2008 TRANSMISSIONS

Four Wheel Drive (4WD) Systems - Edge & MKX

SPECIFICATIONS

MATERIAL

Item	Specification	Fill Capacity
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A	530 ml (18 oz)[a]
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A	1.15L (2.43 pt)[b]

[a] Power Transfer Unit (PTU)

[b] Rear Drive Unit (RDU)

TORQUE SPECIFICATIONS

Description	N.m	lb-in
4X4 control module nut	7	62

DESCRIPTION AND OPERATION

FOUR WHEEL DRIVE (4WD) SYSTEMS

The All-Wheel Drive (AWD) system consists of the following:

- Power Transfer Unit (PTU)
- Rear driveshaft
- 4X4 control module (coupling device control module) (located behind the RH side instrument panel)
- Rear axle with coupling device

Torque from the engine is transferred through the transaxle to the PTU. This torque is transferred from the driveshaft to the rear axle, which drives the rear halfshafts. The AWD system, referred to as an Active Torque Coupling (ATC) system, is always active and requires no driver input.

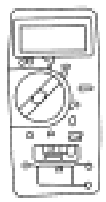
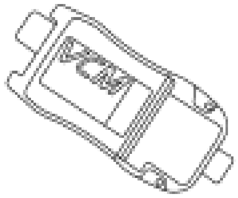
The AWD system continuously monitors vehicle conditions and automatically adjusts the torque distribution between the front and rear wheels. During normal operation, most of the torque is delivered to the front wheels. If wheel slip between the front and rear wheels is detected, or if the vehicle is under heavy acceleration, the AWD system increases torque to the rear wheels to prevent or control wheel slip.

Serviceable components of the PTU are limited to the output shaft seal and flange, intermediate shaft seal and deflector, and the PTU-transaxle compression seal. No internal components are serviced. There should be no need to remove the PTU cover. If any of the internal geared components, bearings, case cover or shafts are worn or damaged, a new PTU must be installed.

DIAGNOSTIC TESTS

FOUR WHEEL DRIVE (4WD) SYSTEMS - ALL WHEEL DRIVE (AWD)

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2574-A	Flex Probe Kit	105-R025C
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

Principles of Operation

The vehicle is equipped with a four wheel drive (4WD) system, **also referred to as active torque control coupling (ATCC) or intelligent torque control coupling (ITCC)** , that is always active and requires no driver input. The system has no mode select switch. The system combines transparent all-surface operation with all wheel drive (AWD), and is capable of handling all road conditions, including street and highway driving as well as off-road and winter driving.

The system continuously monitors vehicle conditions and automatically adjusts the torque distribution between the front and rear wheels. During normal operation, most of the torque is sent to the front wheels. If wheel slip between the front and rear wheels is detected, or if the vehicle is under heavy acceleration (high-throttle position), the AWD system increases torque to the rear wheels to prevent or control wheel slip.

The system consists of a power transfer unit (PTU), 4X4 control module, rear axle and a solenoid-actuated ATCC device. The module varies the torque sent to the rear wheels by controlling the current sent to the clutch located inside the rear axle.

The 4X4 control module also provides the brake system with its current clutch duty cycle and whether or not the brake system may take command of the clutch duty cycle.

NOTE: **The ATCC solenoid is not repairable. If a new component is required, the ATCC solenoid and rear axle are installed as an assembly. Refer to <u>REAR DRIVE AXLE/DIFFERENTIAL</u> article.**

The PTU is a gearbox that attaches to the transaxle. The RH intermediate shaft passes through the PTU and engages the differential side gear as in normal front wheel drive (FWD) applications. The transaxle differential drives the PTU. The PTU then drives the driveshaft at all times. The driveshaft drives one half of the rear axle clutch pack. The other half of the rear axle clutch pack drives the rear axle ring and pinion.

The active, on-demand AWD system uses data from other systems as inputs to the 4X4 control module. The 4X4 control module uses the inputs to determine the appropriate amount of current to send to the ATCC solenoid that delivers the desired torque to the rear wheels. Specific inputs to the 4X4 control module are:

- Accelerator pedal position via the high-speed controller area network (HS-CAN)
- Transaxle range from the PCM via the HS-CAN
- Brake system status from the ABS module via the HS-CAN
- Wheel speed from all 4 wheels from the ABS module via the HS-CAN

4X4 control module outputs are:

- Solid-state clutch (pulse-width modulated signal) to the ATCC solenoid
- Percent of torque transfer commanded signal to the ABS module via the HS-CAN
- Torque request available signal to the ABS module via the HS-CAN

Heat Protection Mode - During very extreme off-road operation, the AWD system utilizes a heat protection mode to protect the active torque control coupling (ATCC) solenoid (part of rear axle) from damage. If the system detects an overheat condition, it enters a locked mode. If the heat in the system continues to rise once in the locked mode, the 4X4 control module disables the ATCC solenoid. Allow the system to cool down at least 10 minutes with the ignition switch in the ON position.

Inspection and Verification

1. Verify the customer concern.
2. Inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical

• Active torque control coupling (ATCC) solenoid (part of rear axle)
• Power transfer unit (PTU)
• Rear drive unit (RDU)
• Halfshafts and CV joints
• Driveshaft and U-joints
• Fluid leaks
• Wheel/tire size and brand
• Matching tire size and brand
• Tire pressure
	• Smart junction box (SJB) fuse(s):
	  ○ 11 (10A)
	  ○ 35 (10A)
	• 4X4 control module
	• Wiring harness
	• Connector(s)
	• Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: **Make sure to use the latest scan tool software release.**

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: **The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.**

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the DTCs and carry out the self-test diagnostics for the 4X4 control module.

9. If the DTCs retrieved are related to the concern, go to the 4X4 Control Module DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **SYMPTOM CHART - FOUR WHEEL DRIVE (4WD) SYSTEMS** table.

DTC Charts

4X4 CONTROL MODULE DTC CHART

DTC	Description	Possible Causes	Source	Action
B1317	Battery Voltage High	• Generator	4X4 Control Module	Go to **Pinpoint Test B** .
B1318	Battery Voltage Low	• Blown fuse (B+) • Intermittent open on power circuit • 4X4 control module connector	4X4 Control Module	CHECK smart junction box (SJB) fuses 11 (10A) and 35 (10A). If fuses are OK, go to **Pinpoint Test B** .
B1342	ECU is Faulted	• Microprocessor or internal memory fault	4X4 Control Module	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new 4X4 control module. REFER to **4X4 CONTROL MODULE**.
B2900	VIN Mismatch	• Incorrect VIN codes received from PCM	4X4 Control Module	CHECK the PCM configuration. REFER to **MODULE CONFIGURATION** article.
P1635	Tire/Axle Out of Acceptable Range	• Incorrect size tire installed on vehicle • Wheel speed sensor failure • Flat or under-inflated tire	4X4 Control Module	Go to **Pinpoint Test G** .
P1824	4-Wheel Drive Clutch Relay Circuit Failure	• Short to ground on active torque control coupling (ATCC) solenoid (part of rear axle) high circuit • 4X4 control module failure	4X4 Control Module	CHECK SJB fuse 11 (10A). If the fuse is OK, go to **Pinpoint Test E** .
P1825	4-Wheel Drive	• 4X4 control	4X4 Control	CHECK SJB fuses 11 (10A)

	Clutch Relay Open Circuit	module harness connector • Open in ATCC solenoid (part of rear axle) low circuit • Open in ATCC solenoid high circuit • Short to ground on ATCC solenoid low circuit • Short to ground on ATCC solenoid high circuit • Open coil inside ATCC solenoid • Short to voltage in ATCC solenoid low circuit • 4X4 control module failure	Module	and 35 (10A). If the fuses are OK, go to **Pinpoint Test E** .
U0100	Lost Communication with ECM/PCM	• Controller area network (CAN) bus fault • No data received by 4X4 control module from PCM	4X4 Control Module	Go to **Pinpoint Test D** .
U0121	Lost Communication with Anti-lock Brake System (ABS) Control Module	• CAN bus fault • No data received by 4X4 control module from ABS control module	4X4 Control Module	Go to **Pinpoint Test D** .
U0155	Lost Communication with Instrument Cluster (IC) Control Module	• High-speed controller area network (HS-CAN) fault • No data received from the IC by the 4X4 control module	4X4 Control Module	REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the lost communication with the IC.
U0401	Invalid Data Received From	• Invalid data	4X4 Control Module	REFER to **INTRODUCTION -**

	ECM/PCM A	received from PCM • Data out of range		**GASOLINE ENGINES** article to diagnose the accelerator position, engine coolant or keep alive memory fault.
U0415	Invalid Data Received From Anti-lock Brake System (ABS) Control Module	• Invalid data received from ABS module • Data out of range	4X4 Control Module	Go to **Pinpoint Test C** .
U2050	No Application Present	• Application software is not present • Application software update failed • 4X4 control module failed	4X4 Control Module	CONFIGURE the 4X4 control module. REFER to **MODULE CONFIGURATION** article to CARRY OUT programmable module installation (PMI). CLEAR the DTCs. RETRIEVE the DTCs and VERIFY successful module configuration. If DTC U2050 is retrieved again, INSTALL a new 4X4 control module. REFER to **4X4 CONTROL MODULE**. REPEAT the self-test.
U2051	One or More Calibration Files Missing/Corrupt	• Calibration software not present • Calibration software update failed • 4X4 control module failed	4X4 Control Module	CONFIGURE the 4X4 control module. REFER to **MODULE CONFIGURATION** article to CARRY OUT PMI. CLEAR the DTCs. RETRIEVE the DTCs and VERIFY successful module configuration. If DTC U2050 is retrieved again, INSTALL a new 4X4 control module. REFER to **4X4 CONTROL MODULE**. REPEAT the self-test.

Symptom Chart - Four Wheel Drive (4WD) System

SYMPTOM CHART - FOUR WHEEL DRIVE (4WD) SYSTEM

Condition	Possible Sources	Action

• The concern is unverifiable; no DTCs present	• The concern description is inaccurate	• CARRY OUT the All Wheel Drive (AWD) System Functional Test. Go to **Pinpoint Test A** .
• The power transfer unit (PTU) makes noise	• Tire inflation pressure • Tire and wheel size	• MAKE SURE all tires and wheels are the same size and brand and the inflation pressures are correct.
	• Fluid level	• FILL with the correct type and amount of lubricant. REFER to **TRANSFER CASE - POWER TRANSFER UNIT (PTU)** article.
	• Internal components	• OPERATE the vehicle in all gears. If there is noise in the transaxle in NEUTRAL, or in some gears and not in others, REMOVE and REPAIR the transaxle. REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article. If there is noise in all gears, INSTALL a new PTU. REFER to **TRANSFER CASE - POWER TRANSFER UNIT (PTU)** article.
• 4X4 control module battery voltage is high or low	• Concern with voltage regulator or generator • Smart junction box (SJB) fuse 11 (10A) • SJB fuse 35 (10A) • Intermittent open power circuit • 4X4 control module internal relay failure	• Go to **Pinpoint Test B** .
• 4X4 control module received no/invalid data from PCM	• Invalid data received from PCM • Data out of range	• REFER to **INTRODUCTION - GASOLINE ENGINES** article to diagnose the accelerator position, engine coolant or keep alive memory fault.
• 4X4 control module received no/invalid data from ABS module	• Invalid data received from the ABS module • Data out of range	• Go to **Pinpoint Test C** .
• High-speed controller	• HS-CAN bus fault	• Go to **Pinpoint Test D** .

area network (HS-CAN) communications bus fault	• PCM fault • ABS fault • Instrument cluster (IC) fault • 4X4 control module	
• Vehicle has no or inadequate torque at rear wheels	• Rear axle	• REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
	• PTU mechanical failure	• REFER to **TRANSFER CASE - POWER TRANSFER UNIT (PTU)** article.

	• Wheels/tires
	• Active torque control coupling (ATCC) solenoid (part of rear axle)
	• SJB fuse(s):
	  • 11 (10A)
	  • 35 (10A)
	• 4X4 control module
		• Go to **Pinpoint Test G** .

	• Circuitry	• Go to **Pinpoint Test E** .
• Vehicle binds in a turn or resists turning/pulsates or shudders in a straight line	• Wheels/tires	• REFER to **WHEELS AND TIRES** article.
	• Brake system	• REFER to **BRAKE SYSTEM - GENERAL INFORMATION** article.
	• Wheel bearings	• REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.
	• Halfshafts	• REFER to **DRIVELINE SYSTEM - GENERAL INFORMATION** article.
	• Wheel speed sensor(s)	• REFER to **VEHICLE DYNAMIC SYSTEMS** article.
	• ABS module	• REFER to **VEHICLE DYNAMIC SYSTEMS** article.
	• 4X4 control module • ATCC solenoid	• Go to **Pinpoint Test F** .

	(part of rear axle) • Circuitry	
• Tire/axle out of acceptable operating range	• Wheels/tires • Wheel speed sensors • ABS module • 4X4 control module	• Go to **Pinpoint Test G** .

Pinpoint Tests

Pinpoint Test A: All Wheel Drive (AWD) System Functional Test

Refer to appropriate SYSTEM WIRING DIAGRAMS article for All Wheel Drive (AWD) schematic and connector information.

Normal Operation

The all wheel drive (AWD) system continuously monitors vehicle conditions and automatically adjusts the torque distribution between the front and rear wheels. During normal operation, most of the torque is delivered to the front wheels. If wheel slip between the front and rear wheels is detected, or if the vehicle is under heavy acceleration, the AWD system increases torque to the rear wheels to prevent or control wheel slip.

This pinpoint test is intended to diagnose the following:

- An AWD system concern without on-demand or continuous DTCs present.

PINPOINT TEST A: AWD SYSTEM FUNCTIONAL TEST

NOTE: **This test must be carried out on a hard surface in an area without traffic.**

NOTE: **Carry out Inspection and Verification as outlined before carrying out this pinpoint test.**

A1 CHECK FOR WRENCH LIGHT PROVE-OUT

- Turn the ignition to the ON position and observe the wrench light.
- **Does the wrench light illuminate for 3 seconds and then turn OFF?**

  YES : Go to A2.

  NO : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article for further diagnosis of the instrument cluster (IC).

A2 CHECK FOR ACTIVE TORQUE CONTROL COUPLING (ATCC) SOLENOID (PART OF REAR AXLE) LOCK

- Drive the vehicle on a dry, hard surface in turns while applying the accelerator pedal.

- **Is driveline wind-up present in turns?**

  YES : With the ignition switch in ON position, allow the ATCC solenoid to cool down for at least 10 minutes and repeat the test. CHECK for wind-up again. If no wind-up is found, go to A3; if still present, go to **Pinpoint Test F** .

  NO : Go to A3.

A3 CHECK FOR VALID ACCELERATOR PEDAL POSITION MONITORING THE ACCELERATOR PEDAL POSITION (AP) PID

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module
- Monitor the AP PID while pressing the accelerator pedal.
- **Does the accelerator pedal position match the AP PID percent value?**

  YES : Go to A4.

  NO : REFER to the INTRODUCTION - GASOLINE ENGINES article to diagnose the accelerator pedal position sensor concern.

A4 CHECK 4X4 CONTROL MODULE WHEEL SPEED SENSOR PIDs

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module
- While driving the vehicle at 48 km/h (30 mph), monitor the following wheel speed sensor PIDs:
  - Left Front Wheel Speed Sensor (LF_WSPD)
  - Left Rear Wheel Speed Sensor (LR_WSPD)
  - Right Front Wheel Speed Sensor (RF_WSPD)
  - Right Rear Wheel Speed Sensor (RR_WSPD)
- **Are all 4 wheel speeds within 3 km/h (1.8 mph) of each other?**

  YES : Go to A5.

  NO : Go to **Pinpoint Test G** .

A5 CHECK VEHICLE ACCELERATION IN A STRAIGHT LINE

- Carry out 3 accelerations from 0-48 km/h (0-30 mph) in a straight line (one each with low, medium and full accelerator pedal application).
- **Does the vehicle pulsate or shudder while accelerating?**

  YES : Go to **Pinpoint Test F** .

  NO : Go to A6.

A6 CHECK VEHICLE TURNING ABILITY

- Drive the vehicle in a fully locked turn, on dry pavement, at 8 km/h (5 mph).
- **Does the vehicle bind in the turn or resist turning?**

  YES : Go to **Pinpoint Test F** .

  NO : Go to A7.

A7 CHECK FOR TORQUE AT REAR WHEELS USING PWM OUTPUT CONTROL COMMAND #1 (CLCH_SOL) ACTIVE COMMAND

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module
- Using the scan tool, command CLCH_SOL to energize the ATCC solenoid to a constant 100% applied.

- Drive the vehicle in a fully locked turn, on dry pavement, at 8 km/h (5 mph).
- **Does the vehicle bind in the turn or resist turning?**

  YES : End the active command. The concern cannot be duplicated at this time. RETURN the vehicle to the customer.

  NO : End the active command. CHECK that the driveshaft rotates when the transaxle is in gear. If yes, go to **Pinpoint Test E** . If no, CHECK the PTU. REFER to **TRANSFER CASE - POWER TRANSFER UNIT (PTU)** article.

Pinpoint Test B: 4X4 Control Module Battery Voltage is High or Low

Refer to appropriate SYSTEM WIRING DIAGRAMS article for All Wheel Drive (AWD) schematic and connector information.

Normal Operation

If the 4X4 control module observes an overpower or underpower voltage condition, DTCs are set and the 4X4 control module may not allow 4WD operation.

- DTC B1317 Battery Voltage High - When the 4X4 control module detects battery voltage greater than 16 volts for at least 10 seconds or ignition run/start voltage greater than 16 volts for at least one second, this DTC is set.
- DTC B1318 Battery Voltage Low - When the 4X4 control module detects battery voltage less than 9 volts for at least 10 seconds or ignition run/start voltage less than 9 volts for at least one second with the engine running at 1,500 RPM or greater, this DTC is set.

This pinpoint test is intended to diagnose the following:

- Fuses
- Charging/battery system
- 4X4 control module
- Wiring, terminals or connectors

PINPOINT TEST B: 4X4 CONTROL MODULE BATTERY VOLTAGE IS HIGH OR LOW

NOTE: **Carry out Inspection and Verification as outlined before carrying out this pinpoint test.**

B1 CHECK FOR HIGH BATTERY VOLTAGE MONITORING THE MODULE SUPPLY VOLTAGE (VBAT_4X4) PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module
- Monitor the battery voltage VBAT_4X4 PID.
- **Is the battery voltage greater than 16 volts?**

YES : REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article for diagnosis of the battery and charging system.

NO : Go to B2.

B2 CHECK FOR LOW VOLTAGE MONITORING THE MODULE SUPPLY VOLTAGE (VBAT_4X4) PID

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module
- Monitor the battery voltage VBAT_4X4 PID.
- **Is the battery voltage less than 9 volts?**

YES : Go to B4.

NO : Go to B3.

B3 CHECK FOR A BLOWN FUSE

- Check the following smart junction box (SJB) fuses:
  - 11 (10A).
  - 35 (10A).
- **Are the fuses open?**

YES : INSTALL a new fuse(s). CLEAR the DTCs. REPEAT the self-test.

NO : Go to B4.

B4 CHECK FOR CORRECT VOLTAGE AT THE BATTERY

- Measure the voltage between the battery positive terminal and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to B5.

NO : REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article for diagnosis of the battery and charging system.

B5 CHECK CIRCUIT GD140 (BK/GN) FOR AN OPEN

- Key in OFF position.
- Disconnect: 4X4 Control Module C281
- Measure the resistance between 4X4 control module C281-15, circuit GD140 (BK/GN), harness side and ground.

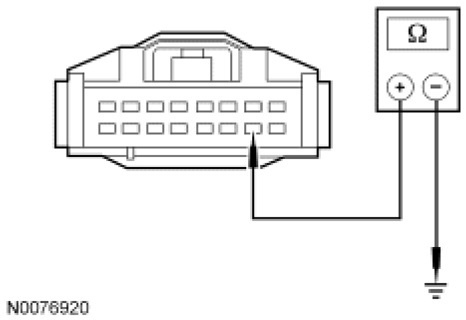


Fig. 1: Checking Circuit GD126 (BK/WH) For An Open
Courtesy of FORD MOTOR CO.

- Repeat this measurement while wiggling the harness.
- **Is the resistance less than 5 ohms?**

  YES : Go to B6.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

B6 CHECK POWER TO THE 4X4 CONTROL MODULE

- Key in ON position.

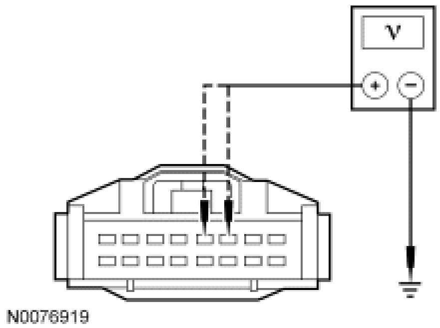


Fig. 2: Checking 4X4 Control Module Power Circuits
Courtesy of FORD MOTOR CO.

- Measure the voltage between 4X4 control module C281-6, circuit SBP11 (BU/RD), harness side and ground; and between 4X4 control module C281-5, circuit CBP35 (YE/GY), harness side and ground.
- **Are the voltages greater than 10 volts?**

  YES : Go to B7.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

B7 CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION

- Disconnect the 4X4 control module.
- Check the harness and component side connectors for:
  - corrosion.
  - pushed-out/bent pins.
- Connect the 4X4 control module and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new 4X4 control module. REFER to **4X4 CONTROL MODULE**. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: 4X4 Control Module Received No/Invalid Data From ABS Module

Refer to appropriate SYSTEM WIRING DIAGRAMS article for All Wheel Drive (AWD) schematic and

connector information.

Normal Operation

The on-demand four wheel drive (4WD) system uses data from other systems as inputs to the 4X4 control module. The 4X4 control module uses the inputs to determine the appropriate duty cycle to send to the active torque control coupling (ATCC) (part of rear axle) solenoid that delivers the desired torque to the rear wheels. Specific inputs to the 4X4 control module are: accelerator pedal position output from the PCM, transmission range from the PCM, brake system status and all 4 wheel speeds from the ABS module. Communication between the 4X4 control module and other modules is obtained through the high-speed controller area network (HS-CAN). If the 4X4 control module loses communication with, or receives invalid data from any of the necessary modules, DTCs are set and the 4X4 control module may not allow 4WD operation.

- DTC U0415 Invalid Data Received from Anti-lock Brake System (ABS) Control Module - When the 4X4 control module receives invalid HS-CAN bus data or invalid wheel speed(s) from the ABS module for more than 30 seconds, this DTC is set.

This pinpoint test is intended to diagnose the following:

- ABS module

PINPOINT TEST C: 4X4 CONTROL MODULE RECEIVED NO/INVALID DATA FROM ABS MODULE

NOTE:	**This test must be carried out on a hard surface in an area without traffic.**

NOTE:	**Carry out Inspection and Verification as outlined before carrying out this pinpoint test.**

C1 CHECK FOR ABS MODULE DTCs

- Key in ON position.
- Carry out the ABS module self-test.
- Review the results of the ABS module self-test.
- **Are any DTCs present?**

  YES : REFER to **VEHICLE DYNAMIC SYSTEMS** article for further diagnosis of the ABS.

  NO : Go to C2.

C2 CHECK WHEEL SPEED SENSORS PIDs

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module
- While driving the vehicle at 32 km/h (20 mph), monitor the following wheel speed sensor PIDs:
  - Left Front Wheel Speed Sensor (LF_WSPD)
  - Left Rear Wheel Speed Sensor (LR_WSPD)
  - Right Front Wheel Speed Sensor (RF_WSPD)
  - Right Rear Wheel Speed Sensor (RR_WSPD)

- **Do the 4 wheel speed sensors match the speedometer and are they within 3 km/h (1.8 mph) of each other?**

  YES : The system is operating correctly at this time. CLEAR the DTCs. REPEAT the self-test.

  NO : REFER to **VEHICLE DYNAMIC SYSTEMS** article for further diagnosis of the ABS.

Pinpoint Test D: High-Speed Controller Area Network (HS-CAN) Communications Bus Fault

Refer to appropriate SYSTEM WIRING DIAGRAMS article for All Wheel Drive (AWD) schematic and connector information.

Normal Operation

The on-demand four wheel drive (4WD) system uses data from other systems as inputs to the 4X4 control module. The 4X4 control module uses the inputs to determine the appropriate duty cycle to send to the active torque control coupling (ATCC) solenoid (part of rear axle) that delivers the desired torque to the rear wheels. Specific inputs to the 4X4 control module are: accelerator pedal position output from the PCM, transmission range from the PCM, brake system status and all 4 wheel speeds from the ABS module. Communication between the 4X4 control module and other modules is obtained through the high-speed controller area network (HS-CAN). If the 4X4 control module loses communication with, or receives invalid data from any of the necessary modules, DTCs are set and the 4X4 control module may not allow 4WD operation.

- DTC U0100 Lost Communication with ECM/PCM - When the 4X4 control module detects a missing HS-CAN bus message from the PCM for at least 5 seconds, this DTC is set.
- DTC U0121 Lost Communication with Anti-lock Brake System (ABS) Control Module - When the 4X4 control module detects a missing HS-CAN bus message from the ABS module for at least 5 seconds, this DTC is set.

This pinpoint test is intended to diagnose the following:

- 4X4 control module
- PCM
- ABS module
- Wiring, terminals or connectors

PINPOINT TEST D: HIGH-SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATIONS BUS FAULT

NOTE:	**Carry out Inspection and Verification as outlined before carrying out this pinpoint test.**

D1 CHECK HS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE 4X4 CONTROL MODULE FOR AN OPEN

- Key in OFF position.

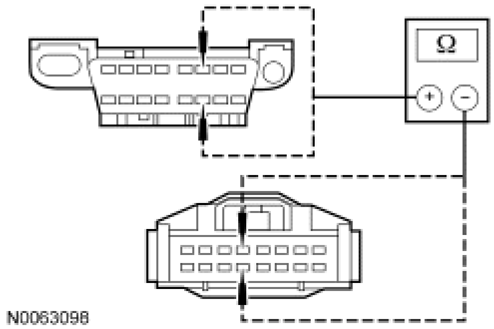


Fig. 3: Checking High Speed Can Circuits Between DLC And 4X4 Control Module For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C281-4, circuit VDB04 (WH/BU), harness side and DLC C251-6, circuit VDB04 (WH/BU), harness side; and between 4X4 control module C281-12, circuit VDB05 (WH), harness side and DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to D2.

  NO : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test. CARRY OUT the Network Test.

D2 CHECK HS-CAN CIRCUITS FOR A SHORT TO GROUND

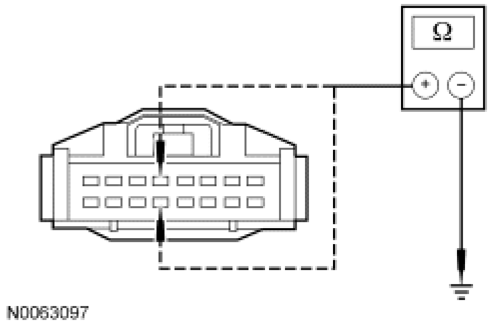


Fig. 4: Checking High Speed CAN Circuits For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C281-4, circuit VDB04 (WH/BU), harness side and ground; and between 4X4 control module C281-12, circuit VDB05 (WH), harness side and ground.
- **Are the resistances greater than 5,000 ohms?**

  YES : Go to D3.

  NO : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test. CARRY OUT the Network Test.

D3 CHECK RESISTANCE BETWEEN HS-CAN CIRCUITS

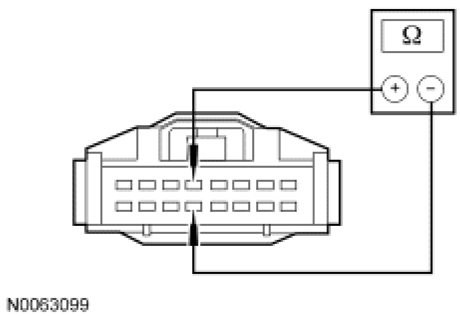


Fig. 5: Checking Resistance Between High Speed CAN Circuits
Courtesy of FORD MOTOR CO.

NOTE:	**The PCM and the instrument cluster (IC) must be connected and operating correctly to obtain the correct resistance between the HS-CAN circuits.**

- Measure the resistance between 4X4 control module C281-4, circuit VDB04 (WH/BU) harness side and 4X4 control module C281-12, circuit VDB05 (WH) harness side.
- **Is the resistance 60 ohms (± 5 ohms)?**

  YES : Go to D4.

  NO : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test. CARRY OUT the Network Test.

D4 CHECK FOR DTCs U0100 AND U0121 SET TOGETHER

- Key in ON position.
- Carry out the 4X4 control module self-test.
- Review the results of the 4X4 control module self-test.
- **Are DTCs U0100 and U0121 set together?**

  YES : REFER to **MODULE COMMUNICATIONS NETWORK** article to continue diagnosis of the communications network.

  NO : Go to D5.

D5 CHECK FOR DTC U0100

- Refer to the results of the 4X4 control module self-test.
- **Is DTC U0100 set?**

  YES : The PCM is not sending any data to the 4X4 control module. REFER to **MODULE COMMUNICATIONS NETWORK** article to for additional PCM diagnosis.

  NO : Go to D6.

D6 CHECK FOR DTC U0121

- Refer to the results of the 4X4 control module self-test.
- **Is DTC U0121 set?**

  YES : The ABS module is not sending any data to the 4X4 control module. REFER to **MODULE COMMUNICATIONS NETWORK** article for additional ABS module diagnosis.

NO : Go to D7.

D7 CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION

- Key in OFF position.
- Disconnect the 4X4 control module.
- Check the harness and component side connectors for:
  - corrosion.
  - pushed-out/bent pins.
- Connect the 4X4 control module and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new 4X4 control module. REFER to **4X4 CONTROL MODULE**. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: Vehicle Has No or Inadequate Torque at Rear Wheels

Refer to appropriate SYSTEM WIRING DIAGRAMS article for All Wheel Drive (AWD) schematic and connector information.

Normal Operation

The on-demand four wheel drive (4WD) system uses data from other systems as inputs to the 4X4 control module. The 4X4 control module uses the inputs to determine the appropriate duty cycle to send to the active torque control coupling (ATCC) solenoid (part of rear axle) that delivers the desired torque to the rear wheels. If the 4X4 control module loses communication with, or receives invalid data from any of the necessary modules, DTCs are set and the 4X4 control module may not allow 4WD operation.

- DTC P1824 4-Wheel Drive Clutch Relay Circuit Failure - When the 4X4 control module detects a short to ground on the ATCC solenoid feedback circuit, this DTC is set.
- DTC P1825 4-Wheel Drive Clutch Relay Open Circuit - When the 4X4 control module detects an open or short to ground on the ATCC solenoid command or feedback circuit for more than 2 seconds, this DTC is set.

This pinpoint test is intended to diagnose the following:

- Tire/axle out of range
- ATCC solenoid (part of rear axle)
- 4X4 control module
- Power transfer unit (PTU)
- Wiring, terminals or connectors

PINPOINT TEST E: VEHICLE HAS NO OR INADEQUATE TORQUE AT REAR WHEELS

NOTE: **Carry out Inspection and Verification as outlined before carrying out this pinpoint test.**

E1 CHECK FOR 4X4 CONTROL MODULE DTCs

- Key in ON position.
- Carry out the 4X4 control module self-test.
- **Are any DTCs received?**

  YES : For DTC P1824 or P1825, go to E5.

  For all other DTCs, REFER to the 4X4 Control Module DTC Chart in this service information.

  NO : Go to E2.

E2 CHECK HIGH-SPEED CONTROLLER AREA NETWORK (HS-CAN) CIRCUITS BETWEEN DATA LINK CONNECTOR (DLC) AND 4X4 CONTROL MODULE FOR AN OPEN

- Key in OFF position.
- Disconnect: 4X4 Control Module C281

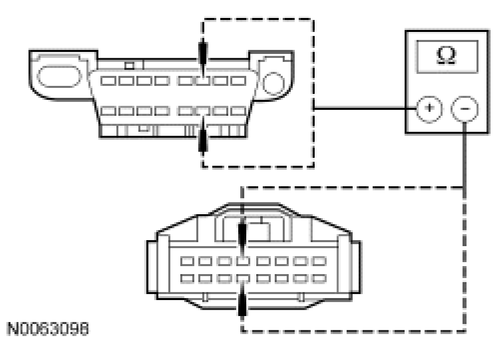


Fig. 6: Checking High Speed Can Circuits Between DLC And 4X4 Control Module For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C281-4, circuit VDB04 (WH/BU), harness side and DLC C251-6, circuit VDB04 (WH/BU), harness side; and between 4X4 control module C281-12, circuit VDB05 (WH), harness side and DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to E3.

  NO : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test. CARRY OUT the Network Test.

E3 CHECK HS-CAN CIRCUITS FOR A SHORT TO GROUND

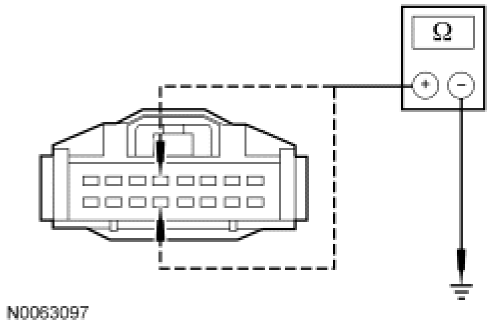


Fig. 7: Checking High Speed CAN Circuits For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C281-4, circuit VDB04 (WH/BU), harness side and ground; and between 4X4 control module C281-12, circuit VDB05 (WH), harness side and ground.
- **Are the resistances greater than 5,000 ohms?**

  YES : Go to E4.

  NO : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test. CARRY OUT the Network Test.

E4 CHECK RESISTANCE BETWEEN HS-CAN CIRCUITS

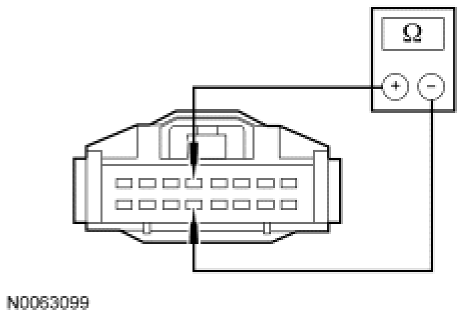


Fig. 8: Checking Resistance Between High Speed CAN Circuits
Courtesy of FORD MOTOR CO.

NOTE:	**The PCM and the instrument cluster (IC) must be connected and operating correctly to obtain the correct resistance between the HS-CAN circuits.**

- Measure the resistance between 4X4 control module C281-4, circuit VDB04 (WH/BU) harness side and 4X4 control module C281-12, circuit VDB05 (WH) harness side.
- **Is the resistance 60 ohms (± 5 ohms)?**

  YES : Go to E5.

  NO : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test. CARRY OUT the Network Test.

E5 CHECK CIRCUITS CCF21 (VT/WH) AND RCF21 (WH/VT) FOR A SHORT TO GROUND WITH ATCC SOLENOID (PART OF REAR AXLE) CONNECTED

- Key in OFF position.
- Disconnect: 4X4 Control Module C281

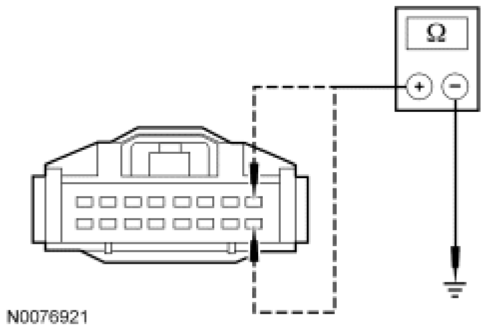


Fig. 9: Checking Circuits CCF21 (VT/WH) & RCF21 (WH/VT) For A Short To Ground With ATC Solenoid Connected
Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C281-8, circuit CCF21 (VT/WH), harness side and ground; and between 4X4 control module C281-16, circuit RCF21 (WH/VT), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to E8.

  NO : Go to E6.

E6 CHECK CIRCUITS CCF21 (VT/WH) AND RCF21 (WH/VT) FOR A SHORT TO GROUND WITH C4004 DISCONNECTED

- Disconnect: ATCC Solenoid Jumper Harness C4004

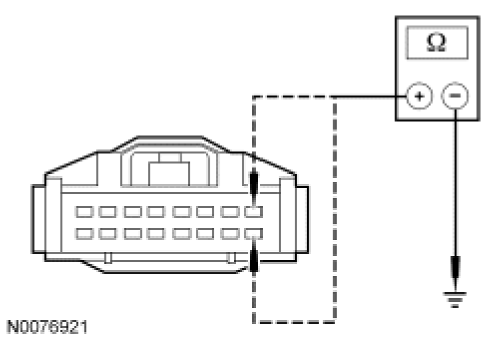


Fig. 10: Checking Circuits CCF21 (VT/WH) & RCF21 (WH/VT) For A Short To Ground With ATC Solenoid Connected
Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C281-8, circuit CCF21 (VT/WH), harness side and ground; and between 4X4 control module C281-16, circuit RCF21 (WH/VT), harness side and

ground.

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to E7.

  NO : REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.

E7 CHECKING THE ATCC SOLENOID JUMPER HARNESS WIRES

NOTE: **The active torque control coupling (ATCC) solenoid jumper harness must be secured to prevent damage to the wiring.**

- Disconnect: ATCC Solenoid C4347
- Inspect the ATCC solenoid jumper harness for damage.
- **Is the ATCC solenoid jumper harness damaged?**

  YES : REPAIR or INSTALL a new ATCC solenoid jumper harness. CLEAR the DTCs. REPEAT the self-test.

  NO : INSTALL a new rear axle assembly. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article. CLEAR the DTCs. REPEAT the self-test.

E8 CHECK CIRCUITS CCF21 (VT/WH) AND RCF21 (WH/VT) FOR AN OPEN WITH ATCC SOLENOID CONNECTED

- Connect: ATCC Solenoid C4347 and ATCC Solenoid Jumper Harness C4004

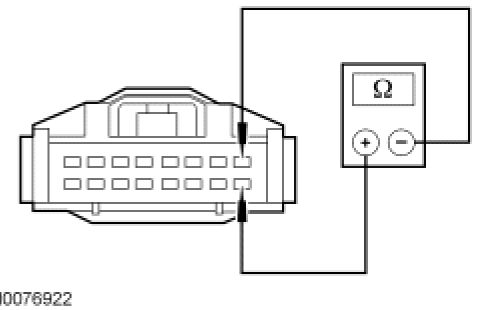


Fig. 11: Checking Circuits CCF21 (VT/WH) & RCF21 (WH/VT) For An Open With ATC Solenoid Connected
Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C281-8, circuit CCF21 (VT/WH), harness side and 4X4 control module C281-16, circuit RCF21 (WH/VT), harness side.
- **Is the resistance less than 10 ohms?**

  YES : Go to E11.

  NO : Go to E9.

E9 CHECK CIRCUITS CCF21 (VT/WH) AND RCF21 (WH/VT) FOR AN OPEN AT C4004

- Disconnect: ATCC Solenoid Jumper Harness C4004

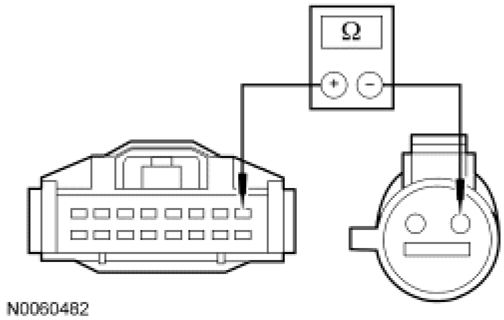


Fig. 12: Measuring Resistance Between 4X4 Control Module C281-8, Circuit CCF21 (VT/WH) & ATCC solenoid jumper harness C4004-1, circuit CCF21 (VT/WH)
Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C281-8, circuit CCF21 (VT/WH), harness side and ATCC solenoid jumper harness C4004-1, circuit CCF21 (VT/WH).
- Repeat this measurement while wiggling the harness.

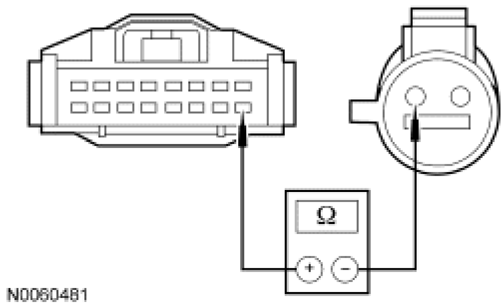


Fig. 13: Measuring Resistance Between 4X4 Control Module C281-16, Circuit RCF21 (WH/VT) & ATCC Solenoid Jumper Harness C4004-2, Circuit RCF21 (WH/VT)
Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C281-16, circuit RCF21 (WH/VT), harness side and ATCC solenoid jumper harness C4004-2, circuit RCF21 (WH/VT), harness side.
- Repeat this measurement while wiggling the harness.
- **Are the resistances less than 5 ohms?**

  YES : Go to E10.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E10 CHECK THE ATCC SOLENOID CIRCUIT FOR AN INTERNAL OPEN

NOTE:	**The active torque control coupling (ATCC) solenoid jumper harness must be secured to prevent damage to the wiring.**

- Disconnect: ATCC Solenoid C4347

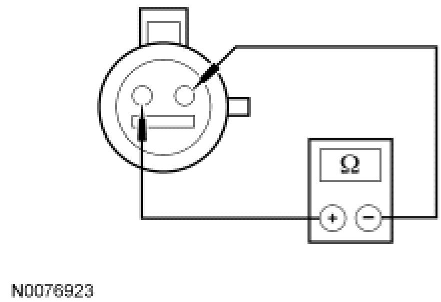


Fig. 14: Checking ATC Solenoid Circuit For An Internal Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between ATCC solenoid C4347-1, circuit CCF21 (VT/WH), component side and ATCC solenoid C4347-2, circuit RCF21 (WH/VT), component side.
- Repeat this measurement while wiggling the harness.
- **Is the resistance less than 10 ohms?**

  YES : REPAIR or INSTALL a new ATCC solenoid jumper harness. CLEAR the DTCs. REPEAT the self-test.

  NO : INSTALL a new rear axle assembly. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article. CLEAR the DTCs. REPEAT the self-test.

E11 CHECK CIRCUIT GD140 (BK/GN) FOR AN OPEN

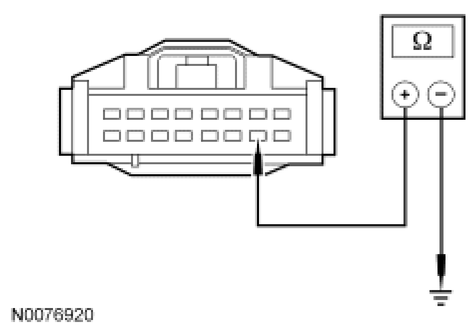


Fig. 15: Checking Circuit GD126 (BK/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C281-15, circuit GD140 (BK/GN), harness side and ground.
- Repeat this measurement while wiggling the harness.
- **Is the resistance less than 5 ohms?**

  YES : Go to E12.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

E12 CHECK THE 4X4 CONTROL MODULE POWER CIRCUITS

- Key in ON position.

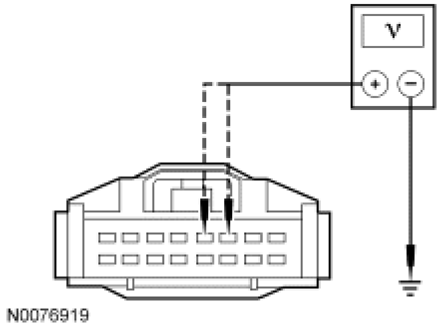


Fig. 16: Checking 4X4 Control Module Power Circuits
Courtesy of FORD MOTOR CO.

- Measure the voltage between 4X4 control module C281-6, circuit SBP11 (BU/RD), harness side and ground; and between 4X4 control module C281-5, circuit CBP35 (YE/GY), harness side and ground.
- **Are the voltages greater than 10 volts?**

  YES : Go to E13.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E13 CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION

- Disconnect: 4X4 Control Module C281
- Check the harness and component side connectors for:
  - corrosion.
  - pushed-out/bent pins.
- Check the ATCC solenoid jumper harness between the 4X4 control module and the ATCC solenoid, located on the rear subframe.
- Connect the 4X4 control module and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new 4X4 control module. REFER to **4X4 CONTROL MODULE**. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: Vehicle Binds in a Turn or Resists Turning/Pulsates or Shudders in a Straight Line

Refer to appropriate SYSTEM WIRING DIAGRAMS article for All Wheel Drive (AWD) schematic and connector information.

Normal Operation

The all wheel drive (AWD) system continuously monitors vehicle conditions and automatically adjusts the torque distribution between the front and rear wheels. During normal operation, most of the torque is sent to the front wheels. If wheel slip between the front and rear wheels is detected or the vehicle is under heavy acceleration, the AWD system increases torque to the rear wheels.

This pinpoint test is intended to diagnose the following:

- Rear axle
- Wheels/tires
- PCM
- ABS module
- 4X4 control module
- Circuitry

PINPOINT TEST F: VEHICLE BINDS IN A TURN OR RESISTS TURNING/PULSATES OR SHUDDERS IN A STRAIGHT LINE

NOTE:	**Carry out Inspection and Verification as outlined before carrying out this pinpoint test.**

F1 CHECK FOR TORQUE AT THE REAR WHEELS

- Key in OFF position.
- Disconnect: Active Torque Control Coupling (ATCC) Solenoid (Part of Rear Axle) C4347
- Drive the vehicle in a straight line on dry pavement.
- **Is a pulsation or shudder still present?**

  YES : REFER to **DRIVELINE SYSTEM - GENERAL INFORMATION** article for additional axle diagnosis.

  NO : Go to F2.

F2 CHECK TO SEE IF THE ATCC SOLENOID IS BEING COMMANDED ON MONITORING 4WD CLUTCH PWM STATUS (4WDCPWMST) PID

- Key in OFF position.
- Connect: ATCC Solenoid C4347
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module
- Monitor the 4WDCPWMST PID.
- Drive the vehicle no faster than 8 km/h (5 mph) in tight turns on dry pavement while monitoring the ATCC solenoid duty cycle.
- **Is the duty cycle greater than 20%?**

  YES : Go to F3.

  NO : Go to **Pinpoint Test G** .

F3 CHECK FOR THE CORRECT WHEEL SPEEDS USING THE WHEEL SPEED SENSORS PIDs

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module

- While driving the vehicle at 48 km/h (30 mph), monitor the following wheel speed sensor PIDs:
  - Left Front Wheel Speed Sensor (LF_WSPD)
  - Left Rear Wheel Speed Sensor (LR_WSPD)
  - Right Front Wheel Speed Sensor (RF_WSPD)
  - Right Rear Wheel Speed Sensor (RR_WSPD)
- **Are all 4 wheel speeds within 3 km/h (1.8 mph) of each other?**

  YES : Go to F4.

  NO : Go to **Pinpoint Test G** .

F4 CHECK FOR VALID ACCELERATOR PEDAL POSITION MONITORING ACCELERATOR PEDAL POSITION (AP) PID

- Key ON, engine OFF (KOEO).
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module
- Monitor AP PID while pressing/releasing the accelerator pedal.
- **Does the accelerator position match the PID percent value?**

  YES : Go to F5.

  NO : REFER to the **INTRODUCTION - GASOLINE ENGINES** article to diagnose the engine control system.

F5 CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION

- Disconnect the 4X4 control module.
- Check the harness and component side connectors for:
  - corrosion.
  - pushed-out/bent pins.
- Check the ATCC solenoid jumper harness between the 4X4 control module and the ATCC solenoid, located on the rear subframe.
- Connect the 4X4 control module and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new 4X4 control module. REFER to **4X4 CONTROL MODULE**. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: Tire/Axle Out of Acceptable Operating Range

Refer to appropriate SYSTEM WIRING DIAGRAMS article for All Wheel Drive (AWD) schematic and connector information.

Normal Operation

The all wheel drive (AWD) system continuously monitors vehicle conditions and automatically adjusts the torque distribution between the front and rear wheels. During normal operation, most of the torque is sent to the front wheels. If wheel slip between the front and rear wheels is detected or the vehicle is under heavy acceleration, the AWD system increases torque to the rear wheels.

- DTC P1635 Tire/Axle Out of Acceptable Range - When the 4X4 control module detects inappropriate mini spare or road wheels/tires (greater than 5% at one wheel) installed, this DTC is set.

This pinpoint test is intended to diagnose the following:

- Wheels/tires
- Wheel speed sensors
- ABS module
- 4X4 control module

PINPOINT TEST G: TIRE/AXLE OUT OF ACCEPTABLE OPERATING RANGE

NOTE:	**This test must be carried out on a hard surface in an area without traffic.**

NOTE:	**Carry out Inspection and Verification as outlined before carrying out this pinpoint test.**

G1 CHECK THE RECENT TIRE USAGE

- Check with customer about recent tire usage or installation.
- **Has a tire been installed on the vehicle recently that was not originally supplied with the vehicle?**

  YES : INFORM the customer to only use tires of the type supplied with the vehicle. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to G2.

G2 CHECK TIRE SIZE AND BRAND

- Check the tire size and the brand of tire.
- **Are all 4 tires the same size and brand?**

  YES : Go to G3.

  NO : INSTALL tires that are the same size and brand. INFORM the customer to only use the same size tires and brand. CLEAR the DTCs. REPEAT the self-test.

G3 CHECK TIRE AIR PRESSURES

- Check the air pressure in all 4 tires.
- **Are all 4 tires at the recommended air pressure?**

  YES : Go to G4.

  NO : ADJUST the tire air pressures. CLEAR the DTCs. REPEAT the self-test. INFORM the customer to maintain the correct tire air pressure.

G4 CHECK FOR CORRECT WHEEL SPEEDS

- Connect the diagnostic tool.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module
- While driving the vehicle at 48 km/h (30 mph), monitor the following wheel speed sensor PIDs:
  - Left Front Wheel Speed Sensor (LF_WSPD)
  - Left Rear Wheel Speed Sensor (LR_WSPD)
  - Right Front Wheel Speed Sensor (RF_WSPD)
  - Right Rear Wheel Speed Sensor (RR_WSPD)
- **Are all 4 wheel speeds within 3 km/h (1.8 mph) of each other?**

  YES : Go to G5.

  NO : The ABS module is sending invalid wheel speed data to the 4X4 control module. REFER to **VEHICLE DYNAMIC SYSTEMS** article for additional ABS module diagnosis.

G5 CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION

- Disconnect: 4X4 Control Module C281
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect the 4X4 control module and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new 4X4 control module. REFER to **4X4 CONTROL MODULE**. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

REMOVAL AND INSTALLATION

4X4 CONTROL MODULE

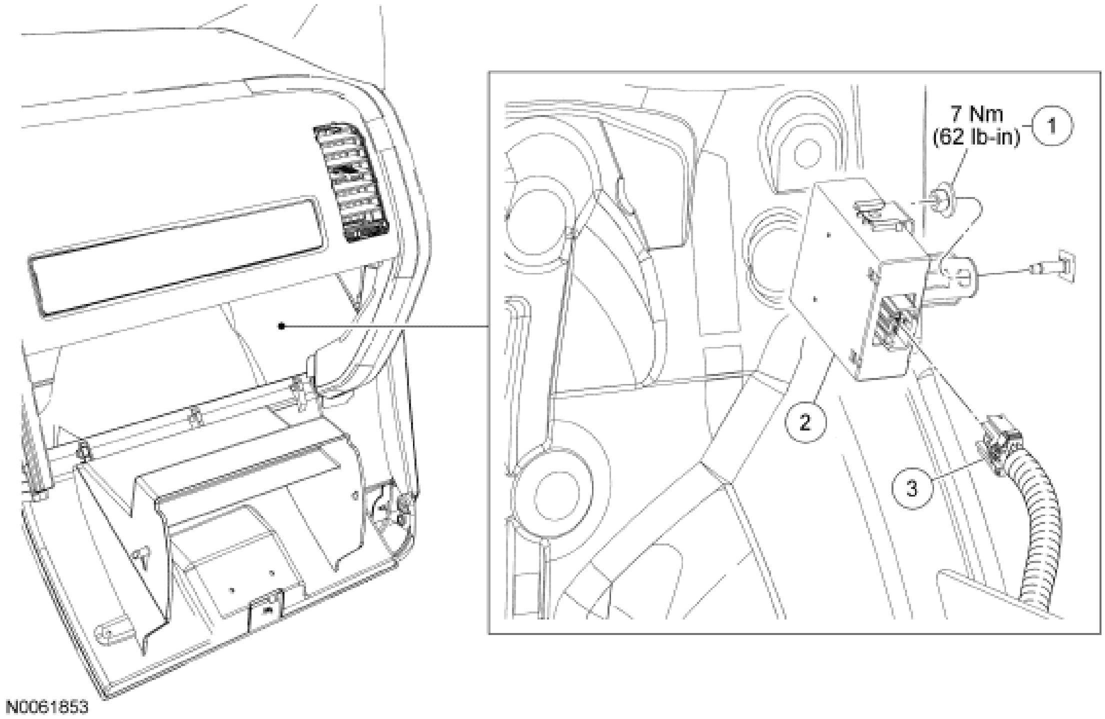


Fig. 17: Exploded View Of 4X4 Control Module With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N621906-S424	4X4 control module nut
2	7E453	4X4 control module and bracket
3	-	Electrical connector (part of 14A005)

REMOVAL AND INSTALLATION

1. From below the RH side instrument panel, remove the hush panel.
2. Disconnect the 4X4 control module harness connector.
3. Remove the 4X4 control module nut.
   - To install, tighten to 7 N.m (62 lb-in).
4. Remove the 4X4 control module and bracket.
5. To install, reverse the removal procedure.

2008 BRAKES

Vehicle Dynamic Systems - Edge & MKX

SPECIFICATIONS

MATERIAL SPECIFICATIONS

Item	Specification	Fill Capacity
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1	803-821 ml (1.69-1.73 pt)

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
ABS module screws	5	-	44
Brake caliper brake tube-to-hydraulic control unit (HCU) fittings	22	16	-
HCU bracket-to-frame bolts	25	18	-
HCU bracket-to-HCU bolt	15	11	-
Master cylinder brake tube-to-HCU fittings	27	20	-
Stability control sensor cluster nuts	9	-	80
Steering wheel rotation sensor bolts	1	-	9
Wheel speed sensor bolts	7	-	62

DESCRIPTION AND OPERATION

ANTI-LOCK CONTROL

ABS With Roll Stability Control (RSC) And Traction Control

The ABS with roll stability control (RSC) and traction control consists of the following components:

- Hydraulic control unit (HCU)
- ABS module (also controls the RSC system and traction control system)
- Stability/traction control switch
- Steering angle sensor module (SASM)
- Stability control sensor cluster (contains the accelerometer[s], roll rate sensor and yaw rate sensor)
- Front wheel speed sensors
- Front wheel speed sensor tone rings (integral to the halfshafts)
- Rear wheel speed sensors
- Rear wheel speed sensor tone rings are:
  - integral to the halfshaft on all wheel drive [AWD] vehicles.
  - integral to the wheel hub and bearing assembly on front wheel drive [FWD] vehicles.

- Brake pressure transducer (integral to the HCU)
- Brake fluid level switch

The ABS prevents wheel lock-up by monitoring the wheel speed sensors and actuating the valves in the HCU which modulates the brake pressure to the brake calipers. By preventing the wheels from locking up, the driver is able to maintain steering control and stop in the shortest possible distance under most conditions. The traction control system utilizes the same components as the ABS to prevent wheel spin and help maintain vehicle control during acceleration. The RSC system utilizes the same components as the ABS and the traction control systems and also monitors the steering wheel rotation sensor and the stability control sensor cluster to assist in stabilizing the vehicle during abrupt maneuvers.

The front wheel speed sensor tone rings are integral to the front halfshafts. Refer to **FRONT DRIVE HALFSHAFTS** article.

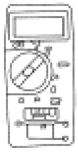
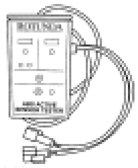
On AWD vehicles, the rear wheel speed sensor tone rings are integral to the rear halfshafts. Refer to **REAR DRIVE HALFSHAFTS** article.

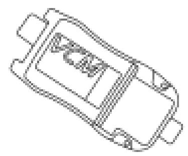
On FWD vehicles, the rear wheel speed sensor tone rings are integral to the wheel hub and bearing assembly. Refer to **REAR SUSPENSION** article.

DIAGNOSTIC TESTS

ANTI-LOCK CONTROL

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2574-A	Flex Probe Kit	105-R025B or equivalent
 ST3030-A	Rotunda Active Wheel Speed Sensor Tester	105-R0110
	Vehicle Communication Module (VCM) and Integrated Diagnostic	

 ST2834-A	System (IDS) software with appropriate hardware, or equivalent scan tool	

Principles of Operation

Standard ABS

The standard ABS module manages anti-lock braking to maintain vehicle control during deceleration.

When the ignition switch is in the RUN position, the ABS module does a preliminary electrical check and, at approximately 20 km/h (12 mph), the hydraulic pump motor is turned on for approximately 1/2 second. During this time a buzzing or humming noise may be heard and a vibration maybe felt in the brake pedal. This is a normal condition. Any malfunction of the ABS disables the stability assist and the ABS warning indicator illuminates. However, the power-assist braking system functions normally.

The ABS module monitors and compares the rotational speed of each wheel. Wheel speeds are measured by the wheel speed sensor, which electrically senses each tooth of the sensor ring as it passes through the magnetic field of the sensor. When the ABS module detects an impending wheel lock, the ABS module commands the hydraulic pump motor on and commands the hydraulic control unit (HCU) to open and close the appropriate solenoid valves to modulate the brake pressure to the individual brake caliper(s). Once the affected wheel(s) return to the desired speed, the ABS module commands the HCU to return the solenoid valves to their normal position and normal base brake operation is restored.

In extreme cold conditions (temperature less than -25°C [-13°F]), the ABS module will briefly operate the hydraulic pump motor when the accelerator is pressed. This is done to warm the brake fluid.

Electronic Brake Distribution (EBD)

On initial application of the brake pedal, full pressure is applied to the rear brakes. The ABS module then uses wheel speed input to calculate an estimated rate of deceleration. Once vehicle deceleration exceeds a predetermined threshold, the ABS module closes the appropriate isolation valves in the Hydraulic Control Unit (HCU) to hold the rear brake pressure constant while allowing the front brake pressure to build. This creates a balanced braking condition between the front and rear wheels and minimizes the chance of rear wheel lockup during hard braking. As the vehicle decelerates, the valves are opened to increase the rear brake pressure in proportion to the front brake pressure.

A slight bump sensation may be felt in the brake pedal when Electronic Brake Distribution (EBD) is active.

If ABS is disabled due to DTCs being present in the ABS module, EBD will continue to function unless the DTCs are for wheel speed sensors or the HCU. When EBD is disabled, the ABS warning indicator and (if equipped) the Electronic Stability Control (ESC) warning indicator will be illuminated.

ABS with Traction Control, Electronic Stability Control (ESC) and Roll Stability Control (RSC)

The ABS module with traction control and roll stability control (RSC) performs the same functions as the standard ABS module. It also performs additional functions specific to traction control and RSC.

Traction Control

When the drive wheels lose traction and begin to spin, with vehicle speed under 100 km/h (62 mph), the ABS module commands the hydraulic pump motor on and commands the HCU to open and close the appropriate solenoid valves to modulate the brake pressure to the brake caliper(s) while simultaneously sending a request to the PCM over the high-speed controller area network (HS-CAN) bus to reduce engine torque to maintain vehicle traction. The PCM accomplishes this by minor incremental timing changes and fewer fuel injector pulses until the ABS module ends the request. The request ends when the driven wheel speed returns to the desired speed. After the vehicle speed exceeds 100 km/h (62 mph), the traction control is accomplished only through the PCM torque control.

Electronic Stability Control (ESC)

The electronic stability control (ESC) system constantly monitors the vehicle motion relative to the intended course. This is done by using sensors to compare the steering input and the yaw rate sensor with that of the actual vehicle motion. The ESC system monitors information from the throttle position (TP) sensor, the steering angle sensor module (SASM) (steering wheel angle and rate of change) and a yaw rate sensor (integral to the stability control sensor cluster) that measures changes in vehicle direction. If the ESC system determines from all these inputs that the vehicle is unable to travel in the intended direction, the system adjusts the brake torque at specific wheels in response to direct measurement of the vehicle motion and reduces engine torque to allow the vehicle to follow the intended course.

When the ESC system activates, any of the following can occur:

- A rumble or grinding sound much like ABS or traction control
- A small deceleration or a reduction in the acceleration of the vehicle
- The ESC indicator flashes
- If the driver's foot is on the brake pedal, a vibration will be felt in the pedal much like ABS

Roll Stability Control (RSC)

The roll stability control (RSC) system constantly monitors the vehicle motion relative to the intended course. This is done by using sensors to compare the steering input and brake application with that of the actual vehicle motion. The system does not activate when the vehicle is traveling in reverse; however, the standard ABS and traction control continue to function as usual. The RSC system monitors information from the wheel speed sensors, the TP sensor, the steering angle sensor module (SASM) (steering wheel angle and rate of change) and a roll-rate sensor (integral to the stability control sensor cluster) that measures changes in vehicle motion. If the RSC system determines from all these inputs that conditions exist for a potential roll-over event, the system adjusts the brake torque at specific wheels in response to direct measurement of the vehicle roll motion and reduces engine torque to make the vehicle more stable. By adjusting brake torque, the system can reduce the cornering forces and, therefore, the total roll moment acting on the vehicle.

When the RSC system activates, any of the following can occur:

- A rumble or grinding sound much like ABS or traction control
- A small deceleration or a reduction in the acceleration of the vehicle
- The RSC indicator flashes
- If the driver's foot is on the brake pedal, a vibration will be felt in the pedal much like ABS
- If the event is severe enough and the driver's foot is not on the brake, the brake pedal will move to apply higher brake forces. A whooshing sound can also be heard from under the instrument panel in an event this severe

Some drivers may notice a slight movement of the brake pedal when the system checks itself. The brake pedal moves when an active test of the brake booster is run. During this test a small amount of pressure is generated at the master cylinder, but no pressure is generated in the brake calipers.

Stability/Traction Control Switch

The stability/traction control switch is hard wired to the instrument cluster module. The instrument cluster module communicates the stability/traction control switch status to the ABS module via the HS-CAN bus.

The stability/traction control switch allows the driver to control use of the stability control/traction assist system. This is independent of the ABS function, which cannot be switched OFF by the driver. The stability control/traction assist system status is indicated by a light in the stability/traction control switch. When the stability/traction control switch is set to OFF, the system is disabled below 60 km/h (37 mph). The system will automatically restore to full functionality every time the vehicle speed exceeds 70 km/h (43 mph) or when the ignition switch is turned to the OFF position and back to the ON position. However, the stability/traction control switch OFF indicator remains illuminated until the switch is pressed. The ABS function continues to work as designed unless the yellow ABS warning indicator is also illuminated. Normal braking function always occurs, unless the red brake warning indicator is illuminated.

Stability Control Sensor Cluster

The stability control sensor cluster consists of the yaw rate sensor, roll-rate sensor, lateral accelerometer and longitudinal accelerometer. The lateral accelerometer measures the acceleration which corresponds to the force involved when the vehicle slides sideways. This acceleration has 2 forms. The first is the centrifugal acceleration which is generated when the vehicle travels around in a circle. The second is the acceleration due to gravity. On level ground there is no contribution from this acceleration. However, if the vehicle is parked sideways on a bank or incline, the sensor measures some lateral acceleration due to gravity even though the vehicle is not moving.

The longitudinal accelerometer measures the acceleration corresponding to the force involved when the vehicle moves forward and rearward in the horizontal plane, along the centerline of the front and rear wheels.

The yaw rate sensor measures the relative vehicle motion about the vertical axis through its center of gravity.

The roll-rate sensor measures the rate of rotation along the front to rear horizontal axis.

Steering Angle Sensor Module (SASM)

The steering angle sensor module (SASM) measures the rate of rotation of the steering wheel by monitoring the steering wheel rotation ring as it passes through the sensor gap. The SASM uses the HS-CAN bus to transmit information to the ABS module about whether the steering wheel is being turned left or right and how far it is being turned.

ABS Module Configuration

A new ABS module must be configured after installation. Refer to Programmable Module Installation in **MODULE CONFIGURATION** article. If installing a new ABS module with RSC, the module must also be calibrated.

ABS Module Calibration

NOTE: The installation of a new stability control sensor cluster does not require ABS module calibration.

The ABS module must be calibrated if any of the following is occurring or have occurred:

- A new ABS module has been installed.
- A new HCU has been installed.
- A new steering wheel rotation sensor has been installed.
- The ABS warning indicator in the instrument cluster flashes once every 2 seconds.

Follow the scan tool directions for ABS module calibration. The ABS module should be configured before it is calibrated. Calibration is required for the ABS module to learn the "at rest" or "zero" position of the stability control components. If a DTC is set for any stability control component, the DTC must be cleared before carrying out the calibration procedure. The ESC warning indicator will flash after clearing the DTCs that are associated with the stability control system. If a DTC is retrieved after calibration, refer to the **ABS MODULE DTC CHART** .

Stability Control Sensor Cluster Calibration

When a new stability control sensor cluster is installed, the cluster must be calibrated. Follow the scan tool instructions for the calibration procedure. When carrying out the cluster calibration, the vehicle must be on a level surface, must not be moving and the ignition switch must be in the RUN position.

Inspection And Verification

1. Verify the customer concern by applying the brakes under different conditions.
2. Verify the base brake system operates correctly by pressing and releasing the brake pedal with the ignition switch in the OFF position. If the stoplamps do not operate correctly, refer to **EXTERIOR LIGHTING** article. If the stoplamps operate correctly, proceed to the next step.
3. Verify the base brake system operates correctly. If any concerns are present, address them before continuing with any ABS concerns. Refer to **BRAKE SYSTEM - GENERAL INFORMATION** article. If the base brake system operates correctly, proceed to the next step.

4. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical

• Base brake system
• Brake booster vacuum hose
• Brake fluid level
• Hydraulic control unit (HCU)
• Steering components, suspension components and tire size
• Steering angle sensor module (SASM)
• Tire pressure
• Tire size or mismatched tires
• Wheel and tire sizes
	• ABS module
	• Battery junction box (BJB) fuse(s):
	  ○ 15 (40A)
	  ○ 50 (10A)
	  ○ 57 (40A)
	  ○ 71 (10A)
	• Brake fluid level switch
	• Brake on/off (BOO) switch
	• Smart junction box (SJB) fuse(s):
	  ○ 34 (5A)
	  ○ 35 (10A)
	• Wiring, terminals or connectors
	• Stability control sensor cluster
	• Stability/traction control switch
	• Wheel speed sensor

5. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

6. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

7. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.

8. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
9. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
10. Clear the continuous DTCs and carry out the self-test diagnostics for the ABS module, the instrument cluster and the steering angle sensor module.
11. If the DTCs retrieved are related to the concern, go to the **ABS MODULE DTC CHART** , the Steering Angle Sensor Module DTC Chart and/or the Instrument Cluster Module DTC Chart. For all other DTCs, refer to the Master DTC Chart in **MULTIFUNCTION ELECTRONIC MODULES** article.
12. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

ABS MODULE DTC CHART

DTC	Description	Source	Action
B1317	Battery Voltage High	ABS Module	**NOTE:** **Battery voltage above 16 volts will cause DTC B1317 to set. Verify battery and charging system condition prior to diagnosing this DTC.** Go to **Pinpoint Test A** .
B1318	Battery Voltage Low	ABS Module	**NOTE:** **Battery voltage below 10 volts will cause DTC B1318 to set. Verify battery and charging system condition prior to diagnosing this DTC.** Go to **Pinpoint Test A** .
B1342	ECU is Faulted	ABS Module	**NOTE:** **If other DTCs are present, REPAIR them before installing a new component.** CLEAR the DTCs. CARRY OUT the ABS module self-test. RETRIEVE the DTCs. If DTC B1342 is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT

			the self-test with the brake pedal not applied.
B211B	Satellite ECU is Faulted	ABS Module	CHECK for water intrusion into stability control sensor cluster connector C3037. REPAIR as necessary. If OK, INSTALL a new sensor cluster. REFER to **Stability Control Sensor Cluster**. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
B2477	Module Configuration Failure	ABS Module	CONFIGURE the ABS module. REFER to **MODULE CONFIGURATION** article. CLEAR the DTCs. REPEAT the self-test. If DTC B2477 is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. REPEAT the self-test.
C1095	ABS Hydraulic Pump Motor Circuit Failure	ABS Module	Go to **Pinpoint Test B** .
C1096	ABS Hydraulic Pump Motor Circuit Open	ABS Module	Go to **Pinpoint Test B** .
C1115	ABS Power Relay Output Short Circuit to Battery	ABS Module	**NOTE:** **If other DTCs are present, REPAIR them before installing a new component.** CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs.If DTC C1115 is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1140	Hydraulic Base Brake Failure	ABS Module	The ABS module receives brake fluid level information from the instrument cluster over the high-speed controller area network (HS-CAN) bus. The instrument cluster receives the brake fluid information from the smart junction box (SJB) over the medium-speed controller area network (MS-CAN) bus. This DTC indicates that a low fluid level condition exists or there is an issue with the brake fluid level switch, wiring, instrument cluster or HS-CAN bus. If there are other HS-CAN bus DTCs present, REFER to **MODULE**

			COMMUNICATIONS NETWORK article to diagnose the HS-CAN bus. If there are no HS-CAN bus DTCs present, VERIFY that the brake fluid is at the correct level and ADJUST as necessary. If the brake fluid level is OK, REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES** article to diagnose the red brake warning indicator and the brake fluid level switch.
C1145	Speed Wheel Sensor RF Input Circuit Failure	ABS Module	Go to **Pinpoint Test C** .
C1155	Speed Wheel Sensor LF Input Circuit Failure	ABS Module	Go to **Pinpoint Test C** .
C1165	Speed Wheel Sensor RR Input Circuit Failure	ABS Module	Go to **Pinpoint Test C** .
C1175	Speed Wheel Sensor LR Input Circuit Failure	ABS Module	Go to **Pinpoint Test C** .
C1185	ABS Power Relay Output Circuit Failure	ABS Module	**NOTE:** **If other DTCs are present, REPAIR them before installing a new component.** CLEAR all DTCs. RETRIEVE DTCs. If DTC C1185 is retrieve again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1194	ABS Outlet Valve Coil LF Circuit Failure	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If C1194 is retrieved again along with one or more other ABS valve coil DTCs, go to **Pinpoint Test A** . If **only** DTC C1194 is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
			CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT

C1198	ABS Inlet Valve Coil LF Circuit Failure	ABS Module	at least one ABS stop. RETRIEVE the DTCs. If C1198 is retrieved again along with one or more other ABS valve coil DTCs, go to **Pinpoint Test A** . If **only** DTC C1198 is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1210	ABS Outlet Valve Coil RF Circuit Failure	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If C1210 is retrieved again along with one or more other ABS valve coil DTCs, go to **Pinpoint Test A** . If **only** DTC C1210 is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1214	ABS Inlet Valve Coil RF Circuit Failure	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If C1214 is retrieved again along with one or more other ABS valve coil DTCs, go to **Pinpoint Test A** . If **only** DTC C1214 is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1222	Speed Wheel Mismatch	ABS Module	Go to **Pinpoint Test D** .
C1233	Speed Wheel LF Input Signal Missing	ABS Module	Go to **Pinpoint Test D** .
C1234	Speed Wheel RF Input Signal Missing	ABS Module	Go to **Pinpoint Test D** .
C1235	Speed Wheel RR Input Signal Missing	ABS Module	Go to **Pinpoint Test D** .
C1236	Speed Wheel LR Input Signal Missing	ABS Module	Go to **Pinpoint Test D** .

C1242	ABS Outlet Valve Coil LR Circuit Failure	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If C1242 is retrieved again along with one or more other ABS valve coil DTCs, go to **Pinpoint Test A** . If **only** DTC C1242 is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1246	ABS Outlet Valve Coil RR Circuit Failure	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If C1246 is retrieved again along with one or more other ABS valve coil DTCs, go to **Pinpoint Test A** . If **only** DTC C1246 is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1250	ABS Inlet Valve Coil LR Circuit Failure	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If C1250 is retrieved again along with one or more other ABS valve coil DTCs, go to **Pinpoint Test A** . If **only** DTC C1250 is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1254	ABS Inlet Valve Coil RR Circuit Failure	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If C1254 is retrieved again along with one or more other ABS valve coil DTCs, go to **Pinpoint Test A** . If **only** DTC C1254 is retrieved again, INSTALL a new ABS module. REFER to

			Anti-Lock Brake System (ABS) Module. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1278	Steering Wheel Angle 1 and 2 Signal Faulted	ABS Module	Go to **Pinpoint Test E** .
C1279	Yaw Rate Sensor Circuit Failure	ABS Module	Go to **Pinpoint Test F** .
C1280	Yaw Rate Sensor Signal Fault	ABS Module	Go to **Pinpoint Test F** .
C1281	Lateral Accelerometer Circuit Failure	ABS Module	Go to **Pinpoint Test F** .
C1282	Lateral Accelerometer Signal Fault	ABS Module	Go to **Pinpoint Test F** .
C1288	Brake Pressure Transducer Main/Primary Input Circuit Failure	ABS Module	Go to **Pinpoint Test G** .
C1329	ABS Outlet Valve Coil RF Circuit Excessive Temperature	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If the DTC is retrieved again, INSTALL a new HCU. REFER to **Hydraulic Control Unit (HCU)**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1330	ABS Outlet Valve Coil LR Circuit Excessive Temperature	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If the DTC is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1331	ABS Outlet Valve Coil RR Circuit Excessive Temperature	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If the DTC is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT

			the self-test with the brake pedal not applied.
C1332	ABS Outlet Valve Coil LF Circuit Excessive Temperature	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If the DTC is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1333	ABS Inlet Valve Coil LR Circuit Excessive Temperature	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If the DTC is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1334	ABS Inlet Valve Coil LF Circuit Excessive Temperature	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If the DTC is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1335	ABS Inlet Valve Coil RF Circuit Excessive Temperature	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If the DTC is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1336	ABS Inlet Valve Coil RR Circuit Excessive	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If the DTC is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**.

	Temperature		CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1404	Traction Control Valve Rear Circuit Failure	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If C1404 is retrieved again along with one or more other ABS valve coil DTCs, go to **Pinpoint Test A** . If **only** DTC C1404 is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1410	Traction Control Valve LF Circuit Failure	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If C1410 is retrieved again along with one or more other ABS valve coil DTCs, go to **Pinpoint Test A** . If **only** DTC C1410 is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1446	Brake Switch Circuit Failure	ABS Module	Go to **Pinpoint Test H** .
C1516	Roll Rate Sensor Signal Fault	ABS Module	Go to **Pinpoint Test F** .
C1517	Roll Rate Sensor Circuit Fault	ABS Module	Go to **Pinpoint Test F** .
C1527	Traction Control Rear Valve Circuit Excessive Temperature	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If the DTC is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
			CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs.

C1528	Traction Control LF Valve Circuit Excessive Temperature	ABS Module	If the DTC is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1530	Dynamic Stability Control RF Valve Circuit Excessive Temperature	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If the DTC is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1531	Dynamic Stability Control LF Valve Circuit Excessive Temperature	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If the DTC is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1730	Reference Voltage Out of Range (+5 V)	ABS Module	If any other DTCs are present, REPAIR those DTCs first. CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE DTCs. If the DTC is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1957	Dynamic Stability Control Valve RF Circuit Failure	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If C1957 is retrieved again along with one or more other ABS valve coil DTCs, go to **Pinpoint Test A** . If **only** DTC C1957 is retrieved again, INSTALL a new ABS module. REFER to

			Anti-Lock Brake System (ABS) Module. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1958	Stability Assist Control Valve LF Circuit Failure	ABS Module	CLEAR all DTCs. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE the DTCs. If C1958 is retrieved again along with one or more other ABS valve coil DTCs, go to **Pinpoint Test A** . If **only** DTC C1958 is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.
C1963	Stability Control Inhibit Warning	ABS Module	**NOTE:** **REPAIR all other DTCs prior to diagnosing this DTC.** This DTC is for information only. CLEAR all DTCs. INSPECT the stability control sensor cluster mounting surface for damage and foreign material. REPAIR or CLEAN as necessary. INSPECT the stability control sensor cluster for correct installation. REFER to **Stability Control Sensor Cluster**.
C1991	Module Calibration Failure	ABS Module	**NOTE:** **If other DTCs are present, REPAIR them before diagnosing DTC C1991.** Go to **Pinpoint Test I** .
C2769	Longitudinal Acceleration Sensor Electrical Failure	ABS Module	Go to **Pinpoint Test F** .
C2770	Longitudinal Acceleration Sensor Plausibility Failure	ABS Module	Go to **Pinpoint Test F** .
U0073	Control Module Communication Bus Off	ABS Module	REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the HS-CAN bus.
U0115	Lost Communication with ECM/PCM - Secondary	ABS Module	REPAIR all other DTCs first. If DTC U0115 is still present, REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the HS-CAN bus.
			REPAIR all other DTCs first. If DTC U0126

U0126	Lost Communication with Steering Angle Sensor Module	ABS Module	is still present, REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the HS-CAN bus.
U0155	Lost Communication with Instrument Panel Cluster	ABS Module	REPAIR all other DTCs first. If DTC U0155 is still present, REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the HS-CAN bus.
U1901	CAN Network #2 Comm Bus Fault - Receive Error	ABS Module	**NOTE:** **If other DTCs are present, REPAIR them before diagnosing DTC U1901.** Go to **Pinpoint Test J** .
U2050	No Application Present	ABS Module	CONFIGURE the ABS module. REFER to **MODULE CONFIGURATION** article. CLEAR the DTCs. RETRIEVE the DTCs and VERIFY successful module configuration. If DTC U2050 is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CLEAR the DTC. REPEAT the self-test.
U2051	One or More Calibration Files Missing or Corrupt	ABS Module	CALIBRATE the ABS module, follow the directions on the scan tool. CLEAR the DTCs. CARRY OUT the ABS module self-test. RETRIEVE and RECORD any DTCs. If DTC U2051 is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CLEAR the DTC. REPEAT the self-test.

STEERING ANGLE SENSOR MODULE (SASM) DTC CHART

DTC	Description	Source	Action
B1317	Battery Voltage High	Steering Angle Sensor Module (SASM)	**NOTE:** **Battery voltage above 16 volts will cause DTC B1317 to set. Verify battery and charging system condition prior to diagnosing this DTC.** Go to **Pinpoint Test L** .
B1318	Battery Voltage Low	SASM	**NOTE:** **Battery voltage below 10 volts will cause DTC B1318 to set. Verify battery and charging system condition prior to diagnosing this DTC.** Go to **Pinpoint Test L** .

B1342	ECU is Faulted	SASM	**NOTE:** **If other DTCs are present, REPAIR them before installing a new component.** CLEAR the DTCs. CARRY OUT the SASM self-test. RETRIEVE the DTCs. If DTC B1342 is retrieved again, INSTALL a new SASM. REFER to **Steering Angle Sensor Module (SASM)**. CLEAR the DTCs. REPEAT the self-test.
U0155	Lost Communication with Instrument Panel Cluster	SASM	REPAIR all other DTCs first. If DTC U0155 is still present, REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the HS-CAN bus.
U2050	No Application Present	SASM	CONFIGURE the SASM. REFER to Programmable Module Installation in **MODULE CONFIGURATION** article. CLEAR the DTCs. CARRY OUT the SASM self-test. If DTC U2050 is retrieved again, INSTALL a new SASM. REFER to **Steering Angle Sensor Module (SASM)**. CLEAR the DTC. REPEAT the self-test.

INSTRUMENT CLUSTER DTC CHART

DTC	Description	Source	Action
C1093	Traction Control Disable Switch Circuit Failure	Instrument Cluster	Go to **Pinpoint Test K** .
-	All Other Instrument Cluster Module DTCs	Instrument Cluster	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the ABS module	• Fuse • Wiring, terminals or connectors • ABS module	• REFER to **MODULE CONFIGURATION** article to diagnose the no communication concern.
• The red brake warning indicator is always/never	• Wiring, terminals or connectors • Brake fluid level	• RETRIEVE all DTCs and REFER to the **ABS MODULE DTC CHART** . If no DTCs are present, REFER to Diagnosis and Testing in

on	• Instrument cluster • ABS module	**INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES** article.
• The yellow ABS warning indicator is always/never on	• Instrument cluster • Brake fluid level • Wiring, terminals or connectors • ABS module	• RETRIEVE all DTCs and REFER to the **ABS MODULE DTC CHART** . If no DTCs are present, REFER to Diagnosis and Testing in **INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES** article.
• The traction assist indicator is never/always on	• Instrument cluster • Wiring, terminals or connectors • Traction control switch	• RETRIEVE all DTCs and REFER to the **ABS MODULE DTC CHART** . If no DTCs are present, REFER to Diagnosis and Testing in **INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES** article.
• ABS false activation, ABS too sensitive, ABS activates on normal stop	• Front wheel speed sensor tone rings • Chafed wire insulation or pinched wire • Rear wheel speed sensor, excessive variance in air gap between wheel speed sensor and sensor tone ring • Open or shorted wheel speed sensor circuit • Rear wheel speed sensor tone rings • Wheel speed sensor	• INSPECT both front wheel speed sensor tone rings for damaged teeth. INSTALL new as necessary. • INSPECT the wiring harness from the front wheel speed sensor knuckle to the frame and from the rear axle to the frame. REPAIR or INSTALL new as necessary. • INSPECT both rear wheel speed sensor tone rings for damaged teeth. INSTALL new as necessary. • Go to **Pinpoint Test C** . • INSPECT the rear wheel speed sensor tone rings. INSTALL new as necessary. • Go to **Pinpoint Test D** .
• The traction control system cannot be disabled	• Instrument cluster • Circuitry • Traction control switch	• Go to **Pinpoint Test K** .

Pinpoint Tests

Pinpoint Test A: DTCs B1317 and B1318 - Battery Voltage High/Low

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The operating voltage required to operate the ABS module, hydraulic valves and pump motor is between 10 and 16 volts.

Fused ignition voltage is supplied to the ABS module from battery junction box (BJB) fuse 50 (10A) along circuit CBB50 (YE/OG). Fused battery voltage is supplied to the ABS module from BJB fuse 57 (40A) along circuit SBB57 (RD) and BJB fuse 15 (40A) along circuit SBB15 (WH/RD). Ground is provided for the ABS module along circuit GD121 (BK/YE).

- DTC B1317 Battery Voltage High - If the voltage supplied to the ABS module exceeds 16 volts during the ABS module self-test or normal operation, with vehicle speed greater than 5 km/h (3 mph), DTC B1317 will be set.
- DTC B1318 Battery Voltage Low - If the voltage supplied to the ABS module falls below 10 volts during the ABS module self-test or normal operation, with vehicle speed greater than 5 km/h (3 mph), DTC B1318 will be set.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Charging system
- ABS module

PINPOINT TEST A: DTCs B1317 AND B1318 - BATTERY VOLTAGE HIGH/LOW

NOTE:	**Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

A1 CHECK FOR RETURNING DTCs

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Clear ABS Module DTCs
- Enter the following diagnostic mode on the diagnostic tool: Self-Test ABS Module
- Carry out the ABS module self-test. Retrieve and record all ABS module DTCs.
- **Are DTCs B1317 or 1318 present?**

  YES : Go to A2.

  NO : REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to continue diagnosis of the charging system.

A2 CHECK THE BATTERY VOLTAGE

- Measure the voltage between the positive and negative battery terminals with key ON engine OFF (KOEO) and with the engine running.
- **Is the battery voltage between 10 and 13 volts with KOEO and between 13 and 17 volts with the engine running?**

  YES : Go to A3.

  NO : REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to continue diagnosis of the charging system.

A3 CHECK THE ABS HARNESS AND MODULE FOR WATER INTRUSION

NOTE: The battery and battery tray need to be removed to access the ABS module connector.

- Key in OFF position.
- Disconnect: ABS Module C135
- Inspect the ABS module connector and module for water intrusion.
- **Is there any evidence of water entry?**

  YES : CLEAN the connector and dry it with low pressure compressed air. INSPECT for evidence of water entry and REPAIR as necessary. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

  NO : Go to A4.

A4 CHECK THE ABS MODULE POWER CIRCUITS FOR AN OPEN

- Disconnect: BJB Fuse 15 (40A)
- Disconnect: BJB Fuse 50 (10A)
- Disconnect: BJB Fuse 57 (40A)

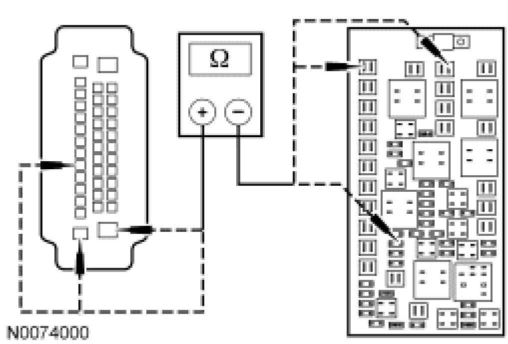


Fig. 1: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between:
  - ABS module C135-1, circuit SBB15 (WH/RD), harness side and BJB fuse 15 (40A), circuit SBB15 (WH/RD), output side.

  - ABS module C135-25, circuit SBB57 (RD), harness side and BJB fuse 57 (40A), circuit SBB57 (RD), output side.
  - ABS module C135-30, circuit CBB50 (YE/OG), harness side and BJB fuse 50 (10A), circuit CBB50 (YE/OG), output side.
- **Are the resistances less than 5 ohms?**

  YES : Go to A5.

  NO : VERIFY BJB fuses 50 (10A), 57 (40A) and 15 (40A) are OK. If OK, REPAIR the affected circuit(s). CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

A5 CHECK THE ABS MODULE GROUND CIRCUITS FOR AN OPEN

- Key in OFF position.

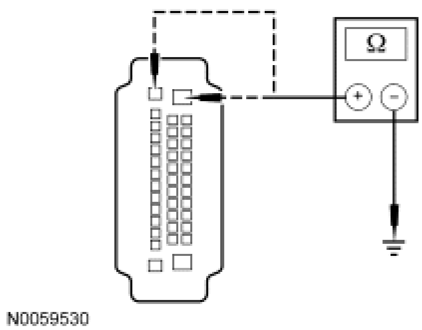


Fig. 2: Measuring Resistance Between Ground & ABS Module C135-13 & C135-38, Circuit GD121 (BK/YE)
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and:
  - ABS module C135-13, circuit GD121 (BK/YE), harness side.
  - ABS module C135-38, circuit GD121 (BK/YE), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to A6.

  NO : REPAIR circuit GD121 (BK/YE). CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

A6 CHECK FOR CORRECT ABS MODULE OPERATION

- Check ABS module C135 for:
  - corrosion.
  - pushed-out pins.
  - spread terminals.
- Connect: ABS C135
- Make sure the ABS connector seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

Pinpoint Test B: DTCs C1095 and C1096 - ABS Hydraulic Pump Motor Circuit Failure/Open

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

Fused battery voltage for hydraulic pump motor operation is supplied to the ABS module from battery junction box (BJB) fuse 15 (40A) along circuit SBB15 (WH/RD). Ground is provided for the ABS module along circuit GD121 (BK/YE).

When the ignition key is turned to the ON position, the ABS module commands the HCU pump on for 100 ms (±6 ms) and is then commanded off. After 6 ms, the ABS module will read the voltage that is being generated by the HCU pump. If the voltage indicates the motor is spinning at less than 500 RPM, there may be a locked motor. If this condition is detected 4 times, DTC C1095 is set. The pump motor is checked for an open circuit 2 seconds after the most recent successful pump motor off command. If the pump motor feedback remains greater than 0.75 volt for more than 50 ms (±6 ms) after these conditions have been met, DTC C1096 is set.

- DTC C1095 ABS Hydraulic Pump Motor Circuit Failure - If a short to voltage or ground is detected, if a locked up pump motor is detected or if there is an internal failure of the ABS module, DTC C1095 will be set.
- DTC C1096 ABS Hydraulic Pump Motor Circuit Open - If a short to voltage, a short to ground or an open is detected or if there is an internal failure of the ABS module, DTC C1095 will be set.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- HCU
- ABS module

PINPOINT TEST B: DTCs C1095 AND C1096 - ABS HYDRAULIC PUMP MOTOR CIRCUIT FAILURE/OPEN

NOTE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

B1 CHECK THE ABS PUMP MOTOR

- Key in ON position.
- **Is the ABS pump motor running all the time?**

  YES : INSTALL a new ABS module and hydraulic control unit (HCU). REFER to **Anti-Lock Brake System (ABS) Module** and **Hydraulic Control Unit (HCU)**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

  NO : Go to B2.

B2 CHECK ABS MODULE PUMP MOTOR OUTPUT COMMAND (PUMP_MTR)

- Enter the following diagnostic mode on the diagnostic tool: DataLogger ABS Module
- Toggle the PUMP_MTR output command ON.
- **Does the ABS pump motor run for approximately 2 seconds?**

  YES : TOGGLE the output command OFF. CLEAR the DTCs. CHECK the yellow ABS warning indicator while driving the vehicle (brakes must not be applied) above 32 km/h (20 mph).

  If the yellow ABS warning indicator does not illuminate, the system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

  If the yellow ABS warning indicator illuminates, RETRIEVE the DTCs.

  If DTC C1096 is retrieved, go to B6.

  If DTC C1095 is retrieved, INSTALL a new HCU. REFER to **Hydraulic Control Unit (HCU)**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

  NO : TOGGLE the output command OFF. Go to B3.

B3 CHECK THE ABS HARNESS AND MODULE FOR WATER INTRUSION

NOTE: **The battery and battery tray need to be removed to access the ABS module connector.**

- Key in OFF position.
- Disconnect: ABS Module C135
- Inspect the ABS module connector and module for water intrusion.
- **Is there any evidence of water entry?**

  YES : CLEAN the connector and dry it with low pressure compressed air. INSPECT for evidence of water entry and REPAIR as necessary. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

  NO : Go to B4.

B4 CHECK CIRCUIT SBB15 (WH/RD) FOR AN OPEN

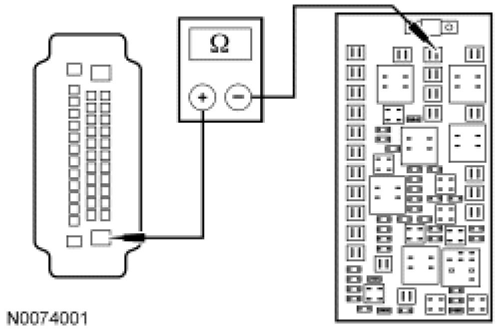


Fig. 3: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between ABS module C135-1, circuit SBB15 (WH/RD), harness side and BJB fuse 15 (40A), circuit SBB15 (WH/RD), output side.
- **Is the resistance less than 5 ohms?**

  YES : Go to B5.

  NO : VERIFY BJB fuse 15 (40A) is OK. If OK, REPAIR circuit SBB15 (WH/RD). CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

B5 CHECK CIRCUIT GD121 (BK/YE) FOR AN OPEN

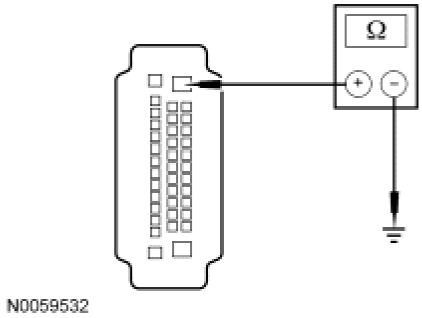


Fig. 4: Measuring Resistance Between ABS Module C135-13, Circuit GD121 (BK/YE), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ABS module C135-13, circuit GD121 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new HCU. REFER to **Hydraulic Control Unit (HCU)**. CLEAR the DTCs. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

  NO : REPAIR circuit GD121 (BK/YE). CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

B6 CHECK FOR CORRECT ABS MODULE OPERATION

- Check ABS module C135 for:

    - corrosion.
    - pushed-out pins.
    - spread terminals.
- Connect: ABS C135
- Make sure the ABS connector seats correctly.
- Clear the DTCs.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

Pinpoint Test C: DTCs C1145, C1155, C1165 and C1175 - Wheel Speed Sensor Input Circuit Failure

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The wheel speed sensors generate a square wave signal that is sent to the ABS module. The wheel speed sensor circuitry connects to the ABS module through 2 wires and a connector at each wheel speed sensor. When the ignition is turned to the RUN position, the ABS module carries out a self-test to determine if the sensors are functional. Voltage is supplied to the active wheel speed sensors from the ABS module. The wheel speed sensor ground is supplied by the ABS module.

Wheel speed sensor DTCs will automatically clear when a successful test drive is carried out. A successful test drive should include speeds above 32 km/h (20 mph) and at least one ABS stop.

DTC Description	Fault Trigger Condition
• DTC C1145 RF Wheel Speed Sensor Input Circuit Failure • DTC C1155 LF Wheel Speed Sensor Input Circuit Failure • DTC C1165 RR Wheel Speed Sensor Input Circuit Failure • DTC C1175 LR Wheel Speed Sensor Input Circuit Failure	If during the ABS module on-demand self test or during normal operation, if the ABS module detects an open, short to ground or voltage or a defective wheel speed sensor input circuit, the appropriate DTC will be set. These DTCs are usually set by a damaged sensor or a circuit fault.

This pinpoint test is intended to diagnose the following:

- Connector water intrusion
- Wiring, terminals or connectors
- Wheel speed sensor tone ring
- Wheel speed sensors
- ABS module

PINPOINT TEST C: DTCs C1145, C1155, C1165 AND C1175 - WHEEL SPEED SENSOR INPUT CIRCUIT FAILURE

NOTE: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

C1 CHECK THE ABS HARNESS AND MODULE FOR WATER INTRUSION

NOTE: The battery and battery tray need to be removed to access the ABS module connector.

- Key in OFF position.
- Disconnect: ABS Module C135
- Inspect the ABS module connector and module for water intrusion.
- **Is there any evidence of water entry?**

  YES : CLEAN the connector and dry it with low pressure compressed air. INSPECT for evidence of water entry and REPAIR as necessary. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

  NO : If the active wheel speed sensor tool is available, go to C2. If the active wheel speed sensor tool is not available, go to C4.

C2 CHECK THE ABS MODULE OUTPUT USING THE SPECIAL TOOL

NOTE: The front wheel speed sensor connectors are located behind the fender splash shields.

- Connect: ABS Module C135
- Disconnect: Suspect Wheel Speed Sensor
- Connect the special tool to the wheel speed sensor connectors.
- Key in ON position.
- Select the correct system polarity on the special tool and turn the special tool power switch to the ON position.
- **Is the module output LED illuminated?**

  YES : Go to C3.

NO : Go to C6.

C3 CHECK THE WHEEL SPEED SENSOR OUTPUT WITH THE SPECIAL TOOL

- Raise the suspect wheel until it can spin freely. Refer to **JACKING AND LIFTING** article.
- While monitoring the special tool, slowly spin the suspect wheel.
- **Is the current level LED illuminated green and do the sensor output LEDs illuminate and flash?**

  YES : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

  NO : If the current level LED is illuminated green and the sensor output LEDs do not illuminate or if the current level LED is illuminated red, INSTALL a new wheel speed sensor. REFER to **Wheel Speed Sensor - Front** or **Wheel Speed Sensor - Rear**. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

  If the current level LED is illuminated green and the sensor output LEDs illuminate green but do not flash, INSPECT the wheel speed sensor tone ring and INSTALL new if necessary. If the tone ring is OK, INSTALL a new wheel speed sensor. REFER to **Wheel Speed Sensor - Front** or **Wheel Speed Sensor - Rear**. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

C4 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR A SHORT TO VOLTAGE

NOTE: Both circuits must be checked for each DTC.

NOTE: The battery must be connected to carry out this test.

NOTE: The front wheel speed sensor connectors are located behind the fender splash shields.

- Disconnect: Suspect Wheel Speed Sensor
- Key in ON position.
- **For DTC C1145** , measure the voltage between ground and:
  - ABS module C135-3, circuit VCA05 (GY/VT), harness side.
  - ABS module C135-4, circuit RCA19 (VT), harness side.
- **For DTC C1155** , measure the voltage between ground and:
  - ABS module C135-27, circuit VCA03 (VT/WH), harness side.
  - ABS module C135-28, circuit RCA17 (YE), harness side.
- **For DTC C1165** , measure the voltage between ground and:
  - ABS module C135-10, circuit RCA20 (BN), harness side.
  - ABS module C135-11, circuit VCA06 (WH/OG), harness side.
- **For DTC C1175** , measure the voltage between ground and:

    - ABS module C135-35, circuit RCA18 (BN/GN), harness side.
    - ABS module C135-36, circuit VCA04 (BU/OG), harness side.
- **Is any voltage present?**

  YES : REPAIR the affected circuit(s). TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

  NO : Go to C5.

C5 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR A SHORT TO GROUND

NOTE: Both circuits must be checked for each DTC.

- Key in OFF position.
- **For DTC C1145** , measure the resistance between ground and:
    - ABS module C135-3, circuit VCA05 (GY/VT), harness side.
    - ABS module C135-4, circuit RCA19 (VT), harness side.
- **For DTC C1155** , measure the resistance between ground and:
    - ABS module C135-27, circuit VCA03 (VT/WH), harness side.
    - ABS module C135-28, circuit RCA17 (YE), harness side.
- **For DTC C1165** , measure the resistance between ground and:
    - ABS module C135-10, circuit RCA20 (BN), harness side.
    - ABS module C135-11, circuit VCA06 (WH/OG), harness side.
- **For DTC C1175** , measure the resistance between ground and:
    - ABS module C135-35, circuit RCA18 (BN/GN), harness side.
    - ABS module C135-36, circuit VCA04 (BU/OG), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to C6.

  NO : REPAIR the affected circuit(s). TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

C6 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR AN OPEN

NOTE: Both circuits must be checked for each DTC.

- Disconnect: ABS Module C135
- Disconnect: Suspect Wheel Speed Sensor
- **For DTC C1145** , measure the resistance between:
    - ABS module C135-3, circuit VCA05 (GY/VT), harness side and RF wheel speed sensor C160-1, circuit VCA05 (GY/VT), harness side.
    - ABS module C135-4, circuit RCA19 (VT), harness side and RF wheel speed sensor C160-2, circuit RCA19 (VT), harness side.
- **For DTC C1155** , measure the resistance between:

  - ABS module C135-27, circuit VCA03 (VT/WH), harness side LF wheel speed sensor C150-2, circuit VCA03 (VT/WH), harness side.
  - ABS module C135-28, circuit RCA17 (YE), harness side LF wheel speed sensor C150-1, circuit RCA17 (YE), harness side.
- **For DTC C1165** , measure the resistance between:
  - ABS module C135-10, circuit RCA20 (BN), harness side and RR wheel speed sensor C426-2, circuit RCA20 (BN), harness side.
  - ABS module C135-11, circuit VCA06 (WH/OG), harness side and RR wheel speed sensor C426-1, circuit VCA06 (WH/OG), harness side.
- **For DTC C1175** , measure the resistance between:
  - ABS module C135-35, circuit RCA18 (BN/GN), harness side and LR wheel speed sensor C440-1, circuit RCA18 (BN/GN), harness side.
  - ABS module C135-36, circuit VCA04 (BU/OG), harness side and LR wheel speed sensor C440-2, circuit VCA04 (BU/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to C7.

  NO : REPAIR the affected circuit(s). TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

C7 CHECK FOR WHEEL SPEED SENSOR CIRCUITS SHORTED TOGETHER

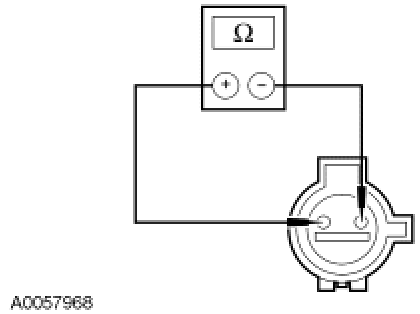


Fig. 5: Checking Circuits For Short
Courtesy of FORD MOTOR CO.

- Measure the resistance between the suspect wheel speed sensor pins, harness side, with the meter in the 10 megaohm range.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to C8.

  NO : REPAIR the affected circuit(s). TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

C8 CHECK THE ABS MODULE OUTPUT

- Connect: ABS Module C135
- Key in ON position.

- Measure the voltage between the suspect wheel speed sensor pins, harness side.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new wheel speed sensor. REFER to **Wheel Speed Sensor - Front** or **Wheel Speed Sensor - Rear**. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

  NO : Go to C9.

C9 CHECK FOR CORRECT ABS MODULE OPERATION

- Key in OFF position.
- Disconnect: ABS C135
- Check the connector for:
  - corrosion.
  - pushed-out pins.
  - spread terminals.
- Connect: ABS C135
- Make sure the ABS connector seats correctly.
- Test drive the vehicle above 32 km/h (20 mph), carry out at least one ABS stop and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

Pinpoint Test D: DTCs C1222, C1233, C1234, C1235 and C1236 - Wheel Speed Sensor Input Signal Missing/Mismatch

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The wheel speed sensors generate a square wave signal that is sent to the ABS module. The wheel speed sensor circuitry connects to the ABS module through 2 wires and a connector at each wheel speed sensor. When the ignition is turned to the RUN position, the ABS module carries out a self-test to determine if the sensors are functional. Voltage is supplied to the active wheel speed sensors from the ABS module. The wheel speed sensor ground is supplied by the ABS module.

Wheel speed sensor DTCs will automatically clear when a successful test drive is carried out. A successful test drive should include speeds above 32 km/h (20 mph) and at least one ABS stop.

DTC Description	Fault Trigger Condition
• DTC C1222 Wheel Speed Mismatch	When the vehicle speed exceeds 20 km/h (12 mph), if the ABS module detects a difference between wheel speed sensor signals, DTC C1222 will be set. DTC C1222 can also be set by damaged tone rings, mismatched wheel and/or tire sizes or driving the vehicle on one or more deflated tires
• DTC C1233 LF Wheel Speed Sensor Signal Fault • DTC C1234 RF Wheel Speed Sensor Signal Fault • DTC C1235 RR Wheel Speed Sensor Signal Fault • DTC C1236 LR Wheel Speed Sensor Signal Fault	When the vehicle speed exceeds 20 km/h (12 mph), if the ABS module does not receive a signal from the wheel speed sensor, the appropriate DTC will be set. These DTCs can also be set by an excessive wheel speed sensor-to-tone ring air gap or a damaged tone ring

This pinpoint test is intended to diagnose the following:

- Mismatched tire sizes
- Wheel speed sensor tone ring
- Wheel speed sensor
- ABS module

PINPOINT TEST D: DTCs C1222, C1233, C1234, C1235 AND C1236 - WHEEL SPEED SENSOR INPUT SIGNAL MISSING/MISMATCH

NOTE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

D1 RETRIEVE ABS MODULE DTCs

- Connect the diagnostic tool.
- Key in ON position.
- Retrieve and record all ABS module DTCs.
- **Are DTCs C1145, C1155, C1165 or C1175 present?**

  YES : Go to **Pinpoint Test C** .

  NO : Go to D2.

D2 CHECK THE ABS HARNESS AND MODULE FOR WATER INTRUSION

NOTE: **The battery and battery tray need to be removed to access the ABS module connector.**

- Key in OFF position.

- Disconnect: ABS Module C135
- Inspect the ABS module connector and module for water intrusion.
- **Is there any evidence of water entry?**

  YES : CLEAN the connector and dry it out with low pressure compressed air. INSPECT for evidence of water entry and repair as necessary. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

  NO : Use the DTCs recorded in the previous step.

  For DTC C1222 Go to D7. For DTCs C1233, C1234, C1235 and C1236, if the active wheel speed sensor tool is available, go to D3. If the active wheel speed sensor tool is not available, go to D6. For all other DTCs, Go to the **ABS MODULE DTC CHART** .

D3 CHECK THE ABS MODULE OUTPUT USING THE SPECIAL TOOL

NOTE: The front wheel speed sensor connectors are located behind the fender splash shields.

- Connect: ABS Module C135
- Disconnect: Suspect Wheel Speed Sensor
- Connect the special tool to the wheel speed sensor connectors.
- Key in ON position.
- Select the correct system polarity on the special tool and turn the special tool power switch to the ON position.
- **Is the module output LED illuminated?**

  YES : Go to D5.

  NO : Go to D4.

D4 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR AN OPEN

NOTE: Both circuits must be checked for each DTC.

- Key in OFF position.
- Disconnect: ABS Module C135
- **For DTC C1233** : measure the resistance between:
  - ABS module C135-27, circuit VCA03 (VT/WH), harness side and LF wheel speed sensor C150-2, circuit VCA03 (VT/WH), harness side.
  - ABS module C135-28, circuit RCA17 (YE), harness side and LF wheel speed sensor C150-1, circuit RCA17 (YE), harness side.
- **For DTC C1234** : measure the resistance between:
  - ABS module C135-3, circuit VCA05 (GY/VT), harness side and RF wheel speed sensor C160-1, circuit VCA05 (GY/VT), harness side.
  - ABS module C135-4, circuit RCA19 (VT), harness side and RF wheel speed sensor C160-2,

circuit RCA19 (VT), harness side.

- **For DTC C1235** : measure the resistance between:
    - ABS module C135-10, circuit RCA20 (BN), harness side and RR wheel speed sensor C426-2, circuit RCA20 (BN), harness side.
    - ABS module C135-11, circuit VCA06 (WH/OG), harness side and RR wheel speed sensor C426-1, circuit VCA06 (WH/OG), harness side.
- **For DTC C1236** : measure the resistance between:
    - ABS module C135-35, circuit RCA18 (BN/GN), harness side and LR wheel speed sensor C440-1, circuit RCA18 (BN/GN), harness side.
    - ABS module C135-36, circuit VCA04 (BU/OG), harness side and LR wheel speed sensor C440-2, circuit VCA04 (BU/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to D8.

  NO : REPAIR the affected circuit(s). TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

D5 CHECK THE WHEEL SPEED SENSOR OUTPUT WITH THE SPECIAL TOOL

- Raise the suspect wheel until it can spin freely. Refer to **JACKING AND LIFTING** article.
- While monitoring the special tool, slowly spin the suspect wheel.
- **Is the current level LED illuminated green and do the sensor output LEDs illuminate and flash?**

  YES : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

  NO : If the current level LED is illuminated green and the sensor output LEDs do not illuminate or if the current level LED is illuminated red, INSTALL a new wheel speed sensor. REFER to **Wheel Speed Sensor - Front** or **Wheel Speed Sensor - Rear**. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

  If the current level LED is illuminated green and the sensor output LEDs illuminate green but do not flash, INSPECT the wheel speed sensor tone ring and INSTALL new if necessary. If the tone ring is OK, INSTALL a new wheel speed sensor. REFER to **Wheel Speed Sensor - Front** or **Wheel Speed Sensor - Rear**. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

D6 CHECK THE WHEEL SPEED SENSOR OUTPUT

NOTE: **The front wheel speed sensor connectors are located behind the fender splash shields.**

NOTE: **The battery must be connected to carry out this test.**

- Connect: ABS Module C135

- Disconnect: Suspect Wheel Speed Sensor

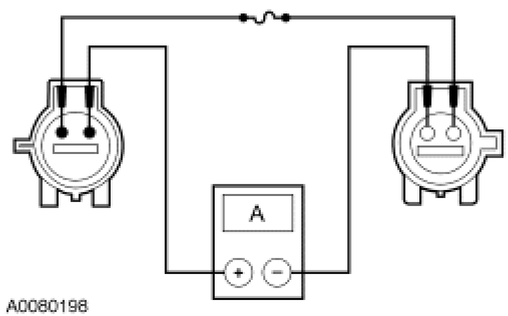


Fig. 6: Checking Wheel Speed Sensor Output
Courtesy of FORD MOTOR CO.

- **For DTC C1233** :
  - connect a fused (5A) jumper wire between LF wheel speed sensor C150-2, circuit VCA03 (VT/WH), harness side and LF wheel speed sensor C150 pin-1, component side.
  - connect the automotive meter between LF wheel speed sensor C150-1, circuit RCA17 (YE), harness side and LF wheel speed sensor C150 pin-2, component side.
- **For DTC C1234** :
  - connect a fused (5A) jumper wire between RF wheel speed sensor C160-1, circuit VCA05 (GN/VT), harness side and RF wheel speed sensor C160 pin-1, component side.
  - connect the automotive meter between RF wheel speed sensor C160-2, circuit RCA19 (VT), harness side and RF wheel speed sensor C160 pin-2, component side.
- **For DTC C1235** :
  - connect a fused (5A) jumper wire between RR wheel speed sensor C426-1, circuit VCA06 (WH/OG), harness side and RR wheel speed sensor C420 pin-1, component side.
  - connect the automotive meter between RR wheel speed sensor C426-2, circuit RCA20 (BN), harness side and RR wheel speed sensor C420 pin-2, component side.
- **For DTC C1236** :
  - connect a fused (5A) jumper wire between LF wheel speed sensor C440-2, circuit VCA04 (BU/OG), harness side and LF wheel speed sensor C440 pin-1, component side.
  - connect the automotive meter between LF wheel speed sensor C440-1, circuit RCA18 (BN/GN), harness side and LF wheel speed sensor C440 pin-2, component side.
- Key in ON position.
- Measure the current while slightly rotating the wheel, using incremental turns.
- **Does the wheel speed sensor output switch between the low state (4 to 8 mA) and the high state (12 to 16 mA)?**

  YES : Go to D7.

  NO : INSTALL a new wheel speed sensor. REFER to **Wheel Speed Sensor - Front** or **Wheel Speed Sensor - Rear**. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

D7 CHECK FOR CORRECT TIRE SIZE AND AIR PRESSURE

- Make sure all tire sizes are correct and matching.
- Make sure all tire pressures are correct.
- Clear the DTCs, drive the vehicle and carry out the self-test.
- **Is DTC C1222 still present?**

  YES : Go to D8.

  NO : The system is operating correctly at this time. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

D8 CHECK THE ABS MODULE ELECTRICAL CONNECTOR

- Key in OFF position.
- Disconnect: ABS C135
- Check the connector for:
  - corrosion.
  - pushed-out pins.
  - spread terminals.
- Connect: ABS C135
- Make sure the ABS connector seats correctly.
- Test drive the vehicle above 32 km/h (20 mph), carry out at least one ABS stop and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop.

Pinpoint Test E: DTC C1278 - Steering Wheel Angle 1 and 2 Circuit Faulted

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The steering angle sensor module (SASM) (also known as the steering angle sensor module) monitors the steering wheel position when the slotted-wheel in the sensor passes through the optical field of the sensor.

Fused ignition voltage is supplied to the SASM from smart junction box (SJB) fuse 34 (5A) along circuit CBP34 (VT/BN). Ground for the sensor is provided along circuit GD115 (BK/GY). The steering wheel angle (in degrees) is sent to the ABS module along the high-speed controller area network (HS-CAN) bus, circuits VDB04 (WH/BU) and VDB05 (WH).

- DTC C1278 Steering Wheel Angle 1 and 2 Circuit Faulted - If during normal operation or the ABS module on-demand self test, the ABS module does not receive the steering wheel rotation sensor input or if the input received does not agree with the input from other sensors, DTC C1278 will be set. Also, a loss of sensor power or ground will cause DTC C1278 to set.

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- SASM

PINPOINT TEST E: DTCs C1277 AND C1278 - STEERING WHEEL ANGLE 1 AND 2 CIRCUIT FAILURE/FAULTED

NOTE:	**Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

NOTE:	**Overtightening of the steering angle sensor module (SASM) fasteners may deform or damage the sensor housing, possibly resulting in faulty operation.**

NOTE:	**Make sure that the SASM is mounted securely to the column with 2 fasteners. A loose sensor or missing fastener may result in incorrect sensor operation. Make sure that the sensor connector is mated securely to the harness connector. Before proceeding with electrical testing, make sure that the vehicle battery is fully charged.**

E1 CARRY OUT THE CALIBRATION PROCEDURE

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: ABS Module Calibration
- Carry out the ABS module calibration procedure following the scan tool directions.
- Test drive the vehicle.
- Retrieve and record any ABS module DTCs.
- **Are any DTCs retrieved or does the calibration procedure indicate a fault?**

  YES : If DTC C1277 or C1278 is retrieved or the calibration procedure indicates a fault, go to E2.

  If any other DTCs are retrieved, go to the **ABS MODULE DTC CHART** .

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

E2 MONITOR THE SASM PID (SWA POS)

- Enter the following diagnostic mode on the diagnostic tool: DataLogger ABS Module
- Monitor the SWA POS PID while rotating the steering wheel clockwise and counterclockwise very slowly.
- **Does the PID move in intervals of 1 degree?**

  YES : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

  NO : Go to E3.

E3 CHECK THE VOLTAGE TO THE SASM

- Key in OFF position.
- Disconnect: SASM C226
- Key in ON position.

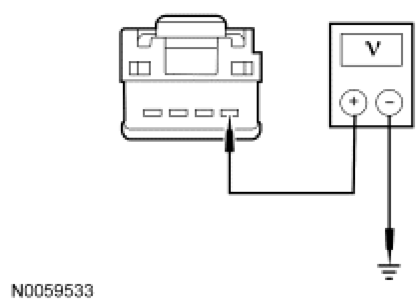


Fig. 7: Measuring Voltage Between Steering Angle Sensor C222-1, CBP34 (VT/BN), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between SASM C226-1, circuit CBP34 (VT/BN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to E4.

  NO : VERIFY SJB fuse 34 (5A) are OK. If OK, REPAIR circuit CBP34 (VT/BN).

  CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

E4 CHECK CIRCUIT GD115 (BK/GY) FOR AN OPEN

- Key in OFF position.

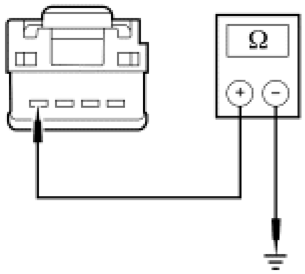


Fig. 8: Measuring Resistance Between Steering Angle Sensor C222-4, GD115 (BK/GY), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between SASM C226-4, circuit GD115 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to E5.

  NO : REPAIR circuit GD115 (BK/GY). CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

E5 CHECK CIRCUITS VDB04 (WH/BU) AND VDB05 (WH) FOR A SHORT TO VOLTAGE

- Key in ON position.

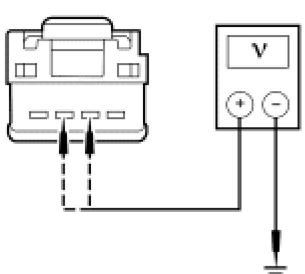


Fig. 9: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and:
  - SASM C226-3, circuit VDB04 (WH/BU), harness side.
  - SASM C226-2, circuit VDB05 (WH), harness side.
- **Are the voltages greater than 6 volts?**

  YES : REPAIR the affected circuit(s). CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

  NO : Go to E6.

E6 CHECK CIRCUITS VDB04 (WH/BU) AND VDB05 (WH) FOR A SHORT TO GROUND

- Key in OFF position.

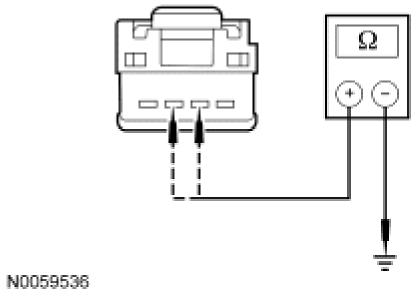


Fig. 10: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and:
  - SASM C226-3, circuit VDB04 (WH/BU), harness side.
  - SASM C226-2, circuit VDB05 (WH), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to E7.

  NO : REPAIR the affected circuit(s). CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

E7 CHECK CIRCUITS VDB04 (WH/BU) AND VDB05 (WH) FOR AN OPEN

NOTE:	**The battery and battery tray need to be removed to access the ABS module connector.**

- Disconnect: ABS Module C135

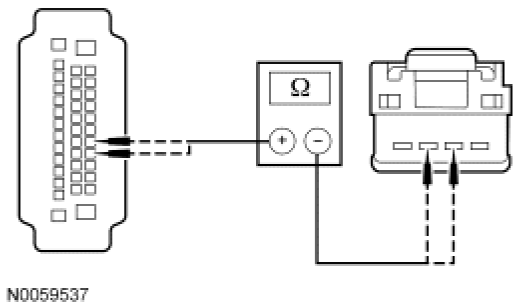


Fig. 11: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between:

- ABS module C135-5, circuit VDB04 (WH/BU), harness side and SASM C226-3, circuit VDB04 (WH/BU), harness side.
- ABS module C135-6, circuit VDB05 (WH), harness side and SASM C226-2, circuit VDB05 (WH), harness side.

- **Are the resistances less than 5 ohms?**

  YES : Go to E8.

  NO : REPAIR the affected circuit(s). CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

E8 CHECK CIRCUITS VDB04 (WH/BU) AND VDB05 (WH) FOR A SHORT TOGETHER

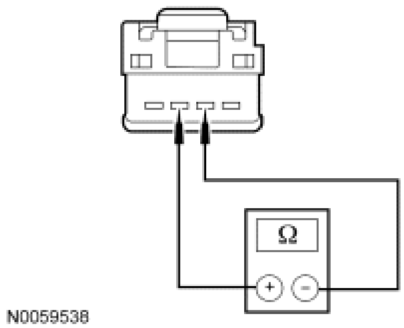


Fig. 12: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between SASM C226-3, circuit VDB04 (WH/BU), harness side and SASM C226-2, circuit VDB05 (WH), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new SASM. REFER to **Steering Angle Sensor Module (SASM)**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

  NO : REPAIR the affected circuit(s). CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

Pinpoint Test F: DTC C1279, C1280, C1281, C1282, C1516, C1517, C2769, C2770 - Stability Control Sensor Cluster Fault

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The accelerometer (lateral and longitudinal) and the yaw rate sensor are contained in the stability control sensor cluster. The sensor cluster measures the vehicle acceleration and yaw rate, then sends the signal along a secondary high-speed controller area network (HS-CAN2) bus to the ABS module, circuits VCA23 (BU/WH) and VCA24 (GN/OG). Fused ignition voltage is supplied to the sensor cluster by smart junction box (SJB) fuse 35 (10A) along circuit CBP35 (YE/GY). Ground for the sensor cluster is provided along circuit GD151 (BK/GN).

DTC Description	Fault Trigger Conditions
• DTC C1279 Yaw Rate Sensor Circuit Failure • DTC C1281 Lateral Accelerometer Circuit Failure • DTC C1517 Roll Rate Sensor Circuit Failure • DTC C2769 Longitudinal Acceleration Sensor Electrical Failure	If, during normal operation or the ABS module on-demand self test the ABS module detects an open circuit, a short to voltage or a short to ground on one or both of the HS-CAN2 bus circuits, the appropriate DTC will be set. Also, a failure of the sensor cluster will cause the appropriate DTC to set.
• DTC C1280 Yaw Rate Sensor Signal Fault • DTC C1282 Lateral Accelerometer Signal Fault • DTC C1516 Roll Rate Sensor Signal Fault • DTC C2770 Longitudinal Acceleration Sensor Plausibility Failure	If, during normal operation the ABS module does not receive the sensor cluster input, or if the input received does not agree with the input from other sensors, the appropriate DTC will be set.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Stability control sensor cluster

PINPOINT TEST F: DTC C1279, C1280, C1281, C1282, C1516, C1517, C2769, C2770 - STABILITY CONTROL SENSOR CLUSTER FAULT

NOTE:	**Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**
NOTE:	**The yaw rate sensor, roll-rate sensor, lateral accelerometer and longitudinal accelerometer are integral to the stability control sensor cluster.**
NOTE:	**Make sure the vehicle is sitting on level ground, at a complete standstill and is not on a hoist before calibrating the stability control sensor cluster.**
NOTE:	**Make sure the vehicle is sitting on level ground, at a complete standstill and is not on a hoist before carrying out this pinpoint test. Any vehicle movement will result in false values for this test.**

F1 CARRY OUT THE CALIBRATION PROCEDURE

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: ABS Module Calibration
- Carry out the ABS module calibration procedure following the scan tool directions.
- Test drive the vehicle.
- Retrieve and record any ABS module DTCs.
- **Are any DTCs retrieved or does the calibration procedure indicate a fault?**

  YES : Go to F2.

  NO : The system is operating correctly. The condition may have been caused by an incomplete or inaccurate stability control sensor cluster calibration.

F2 CHECK THE SENSOR CLUSTER MOUNTING AND MOUNTING SURFACE

NOTE:	**The sensor cluster is located on the RH side of the vehicle, under the rear seat.**

- Key in OFF position.
- Inspect the sensor cluster mounting and make sure that the nuts are fully seated and tightened correctly. Inspect the mounting surface for damage, corrosion or dirt.
- **Were the sensor cluster nuts tightened incorrectly or a significant amount of corrosion or dirt found or the mounting surface damaged?**

  YES : CLEAN and TIGHTEN the nuts to correct specification. CLEAN or REPAIR the mounting surface as necessary. CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test.

  NO : Go to F3.

F3 CHECK THE VOLTAGE TO THE SENSOR CLUSTER

- Disconnect: Stability Control Sensor Cluster C3037
- Key in ON position.

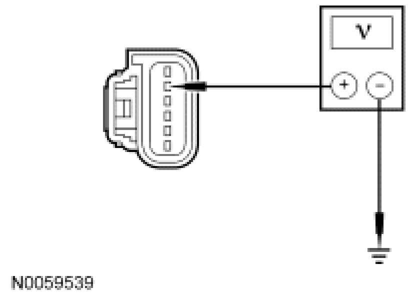


Fig. 13: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the sensor cluster C3037-2, circuit CBP35 (YE/GY), harness side and ground.

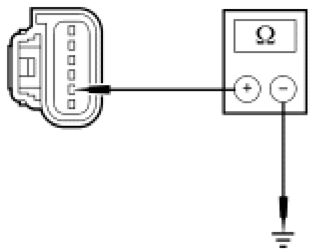
- **Is the voltage greater than 10 volts?**

  YES : Go to F4.

  NO : VERIFY SJB fuse 35 (10A) is OK. If OK, REPAIR circuit CBP35 (YE/GY). CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test.

F4 CHECK CIRCUIT GD151 (BK/GN) FOR AN OPEN

- Key in OFF position.



N0059540

Fig. 14: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the sensor cluster C3037-5, circuit GD151 (BK/GN), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to F5.

  NO : REPAIR circuit GD151 (BK/GN). CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test.

F5 CHECK CIRCUITS VCA23 (BU/WH) AND VCA24 (GN/OG) FOR AN OPEN

NOTE:	**The battery and battery tray need to be removed to access the ABS module connector.**

- Disconnect: ABS Module C135

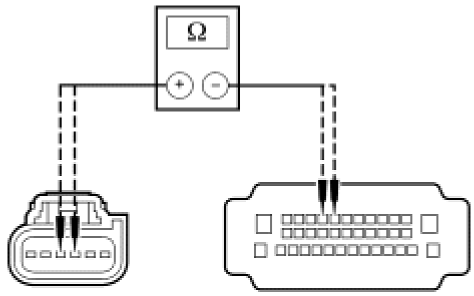


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Fig. 15: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between:
  - ABS module C135-8, circuit VCA23 (BU/WH), harness side and stability control sensor cluster C3037-3, circuit VCA23 (BU/WH), harness side.
  - ABS module C135-9, circuit VCA24 (GN/OG), harness side and stability control sensor cluster C3037-4, circuit VCA24 (GN/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to F6.

  NO : REPAIR the affected circuit(s). CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test.

F6 CHECK CIRCUITS VCA23 (BU/WH) AND VCA24 (GN/OG) FOR A SHORT TO GROUND

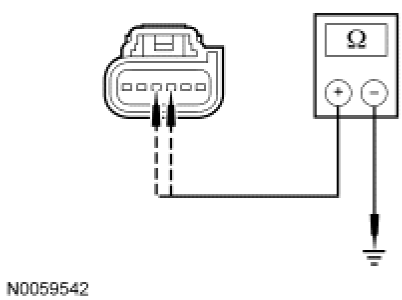

Fig. 16: Measuring Resistance Between Ground & Stability Control Sensor Cluster C3037-3 & C3037-4
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and:
  - stability control sensor cluster C3037-3, circuit VCA23 (BU/WH), harness side.
  - stability control sensor cluster C3037-4, circuit VCA24 (GN/OG), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to F7.

  NO : REPAIR the affected circuit(s). CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test.

F7 CHECK CIRCUITS VCA23 (BU/WH) AND VCA24 (GN/OG) FOR A SHORT TO VOLTAGE

NOTE: The battery must be connected to carry out this test.

- Key in ON position.

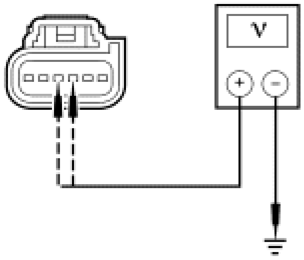

Fig. 17: Measuring Voltage Between Ground & Stability Control Sensor Cluster C3037-3 & C3037-4
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and:
  - stability control sensor cluster C3037-3, circuit VCA23 (BU/WH), harness side.
  - stability control sensor cluster C3037-4, circuit VCA24 (GN/OG), harness side.
- **Is any voltage present?**

  YES : REPAIR the affected circuit(s). CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test.

  NO : INSTALL a new sensor cluster. REFER to **Stability Control Sensor Cluster**. CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test.

Pinpoint Test G: DTC C1288 - Pressure Transducer Main/Primary Input Circuit Failure

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The ABS module monitors the brake pressure transducer in combination with other brake inputs; wheel speed sensors, stoplamp switch from the PCM over the High Speed Controller Area Network (HS-CAN) bus, lateral accelerometer from the sensor cluster. The pressure transducer signal is used by the ABS module for various diagnostic routines as well as to determine system functionality. The pressure transducer is located inside the Hydraulic Control Unit (HCU) and can be monitored via the master cylinder pressure (MC_PRESS) PID. The PID should correlate closely with system hydraulic pressure. When the vehicle is at rest without input from the brake pedal, this PID value should be at or close to 0 kPa (0 psi). However, due to factors such as vehicle age or minor discrepancies in manufacturing, PID readings may have some variability. If the transducer signal reads above 620 kPa (90 psi) when other inputs indicate the system should not be pressurized, DTC C1288 will be set. If the transducer requires service, a new HCU must be installed.

- DTC C1288 Pressure Transducer Main/Primary Input Circuit Failure - If during the ABS module self-test or normal operation the ABS module detects an open, a short to voltage or a short to ground in the transducer, DTC C1288 will be set. Also, if the transducer input does not match the information received from other sources, DTC C1288 will be set.

This pinpoint test is intended to diagnose the following:

- Brake pedal binding
- Air in the brake hydraulic system
- Fluid leak in the brake hydraulic system
- High-speed controller area network (HS-CAN) bus
- Brake on/off (BOO) switch
- HCU

PINPOINT TEST G: DTC C1288 - PRESSURE TRANSDUCER MAIN/PRIMARY INPUT CIRCUIT FAILURE

NOTE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

G1 CHECK FOR ACTIVE DTCs

- Connect the diagnostic tool.
- Key in ON position.
- Using the scan tool, clear the ABS module DTCs.
- Enter the following diagnostic mode on the diagnostic tool: Self-Test ABS Module
- Retrieve and record any ABS module DTCs.
- **Is DTC C1288 present?**

  YES : Go to G2.

  For all other ABS module DTCs, go to the **ABS MODULE DTC CHART** .

  NO : The system is operating correctly at this time. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE and RECORD any DTCs.

G2 CHECK THE MASTER CYLINDER AND PEDAL FOR CORRECT OPERATION

- Press and release the brake pedal.
- **Does the brake pedal smoothly travel to the stop and then return automatically when released?**

  YES : Go to G3.

  NO : INSPECT the brake pedal and master cylinder for obstructions and foreign material that may cause a binding condition. REPAIR or INSTALL new as necessary. CLEAR the DTCs. REPEAT the self-test.

G3 CHECK FOR AIR IN THE BRAKE HYDRAULIC SYSTEM

- Select PARK.
- Start the engine.
- Press and release the brake pedal several times.
- **Does the brake pedal move smoothly and evenly through the length of it's travel?**

YES : Go to G4.

NO : REFER to **BRAKE SYSTEM - GENERAL INFORMATION** article to continue diagnosis of the brake hydraulic system.

G4 CHECK FOR FLUID LEAKS IN THE BRAKE HYDRAULIC SYSTEM

- Visually inspect the brake hydraulic system for brake fluid leaks.
- **Are any leaks found?**

YES : REPAIR as necessary. BLEED the brake system, REFER to **BRAKE SYSTEM - GENERAL INFORMATION** article. CLEAR the DTCs. REPEAT the self-test.

NO : Go to G5.

G5 MONITOR THE ABS MODULE BRAKE ON/OFF (BOO_ABS) PID

- Enter the following diagnostic mode on the diagnostic tool: DataLogger PCM
- Monitor the BOO_ABS PID while pressing and releasing the brake pedal.
- **Does the PID agree with the brake pedal position?**

YES : Go to G7.

NO : Go to G6.

G6 MONITOR THE PCM BRAKE ON/OFF (BOO) PID

- Enter the following diagnostic mode on the diagnostic tool: DataLogger PCM
- Monitor the BOO PID while pressing and releasing the brake pedal.
- **Does the PID agree with the brake pedal position?**

YES : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the HS-CAN bus.

NO : REFER to **EXTERIOR LIGHTING** article to continue diagnosis of the BOO switch.

G7 MONITOR THE ABS MODULE MASTER CYLINDER (MC_PRESS) PRESSURE PID

- Firmly press and release the brake pedal while monitoring the ABS module MC_PRESS PID.
- **Does the PID increase with increased brake pedal pressure and decrease with decreased brake pedal pressure?**

YES : The system is operating correctly at this time. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE and RECORD any DTCs.

NO : INSTALL a new HCU. REFER to **Hydraulic Control Unit (HCU)**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

Pinpoint Test H: DTC C1446 - Brake Switch Circuit Failure

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Vehicle Dynamic Systems for schematic and connector information. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Instrument Cluster for schematic and connector information.

Normal Operation

The ABS module monitors brake pedal position in combination with other brake inputs; wheel speed sensors, brake pressure transducer, lateral accelerometer from the sensor cluster. The pedal position signal is used by the ABS module for various diagnostic routines as well as to determine system functionality. The Brake Pedal Position (BPP) switch is located inside the stoplamp switch and can be monitored via the brake on/off (BOO_ABS) PID and should match the actual brake pedal position. The ABS module receives the BPP switch information from the PCM over the High Speed Controller Area Network (HS-CAN) bus.

- DTC C1446 Brake Switch Circuit Failure - If the brake pedal switch status from the PCM is not received by the ABS module due to a failure of the BPP switch or the HS-CAN bus, the ABS module will set DTC C1446. The ABS module uses a pressure transducer inside the Hydraulic Control Unit (HCU) to verify the brake pedal switch status message from the PCM. When the vehicle is at rest without input from the brake pedal, the pressure transducer value should be at or close to 0 kPa (0 psi). However, due to factors such as vehicle age or minor discrepancies in manufacturing, readings may have some variability.

Possible Causes

- Wiring, terminals or connectors
- BPP switch
- HCU
- ABS module

PINPOINT TEST H: DTC C1446 - BRAKE SWITCH CIRCUIT FAILURE

H1 CHECK THE RED BRAKE WARNING INDICATOR

- Observe the red brake warning indicator while turning the ignition switch from OFF to RUN.
- Key in ON position.
- **Does the indicator illuminate for a short time and then go out?**

  YES : Go to H2.

  NO : If the red brake warning indicator remains illuminated or does not illuminate at all, go to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES** article to diagnose the red brake warning indicator.

H2 CHECK THE ABS MODULE MASTER CYLINDER PRESSURE (MC_PRES) PID

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - ABS Module
- Monitor the MC_PRESS PID **without** pressing the brake pedal.
- **Does the PID display 0 kPa (0 psi)?**

  YES : Go to H3.

  NO : Go to **Pinpoint Test G** .

H3 CHECK FOR COMMUNICATION DTCs

- Review the DTCs retrieved and recorded during Inspection and Verification.
- **Are DTCs U0073 or U0115 present?**

  YES : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the HS-

CAN bus.

NO : Go to H4.

H4 MONITOR THE ABS MODULE BRAKE ON/OFF (BOO) PID

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - ABS Module
- Monitor the BOO PID, while pressing and releasing the brake pedal.
- **Does the PID agree with the brake pedal position?**

  YES : The system is operating correctly at this time. TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. RETRIEVE and RECORD any DTCs.

  NO : Go to H5.

H5 MONITOR THE PCM BRAKE PEDAL POSITION (BOO) PID

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - PCM
- Monitor the BOO PID, while pressing and releasing the brake pedal.
- **Does the PID agree with the brake pedal position?**

  YES : REFER to **MODULE COMMUNICATIONS NETWORK** article to continue diagnosis of the HS-CAN bus.

  NO : REFER to **EXTERIOR LIGHTING** article to continue diagnosis of the stoplamps.

Pinpoint Test I: DTC C1991 - Module Calibration Failure

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The ABS module must be calibrated whenever a component specific to the roll stability control (RSC) system is disconnected or a new component is installed.

- DTC C1991 Module Calibration Failure - If the calibration procedure does not finish or if the ABS module looses the calibration information, DTC C1991 will be set.

This pinpoint test is intended to diagnose the following:

- ABS module
- Stability control sensor cluster
- Steering angle sensor module (SASM)

PINPOINT TEST I: DTC C1991 - MODULE CALIBRATION FAILURE

NOTE:	**The RSC indicator flashes when a system calibration is required. Calibration is required after certain DTCs are cleared.**
NOTE:	**Make sure the vehicle is not on a hoist and is sitting on level ground before**

carrying out ABS module calibration.

I1 CHECK FOR DTCs

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self-Test ABS Module
- Retrieve and record any ABS module DTCs.
- **Are other DTCs retrieved along with C1991?**

  YES : Go to the **ABS MODULE DTC CHART** .

  Some of the pinpoint tests recommend ABS module calibration prior to any further diagnostics. In this case, go to I2.

  NO : Go to I2.

I2 CALIBRATE THE ABS MODULE

- Enter the following diagnostic mode on the diagnostic tool: ABS Module Calibration
- Carry out the ABS module calibration per the scan tool instructions.
- **Does the calibration complete for all of the RSC sensors, and does the RSC indicator stop flashing and turn off?**

  YES : Go to I3.

  NO : Go to I4.

  Some concerns cause the calibration not to complete. If sent here from another pinpoint test, return to that pinpoint test for further diagnostics.

I3 CLEAR DTC C1991

- Enter the following diagnostic mode on the diagnostic tool: Clear ABS Module DTCs
- Using the scan tool, clear the DTC.
- **Does the DTC clear?**

  YES : TEST DRIVE the vehicle above 32 km/h (20 mph) and CARRY OUT at least one ABS stop. REPEAT the self-test.

  If sent here from another pinpoint test, return to that pinpoint test for further diagnostics.

  NO : Go to I4.

I4 MONITOR THE ABS MODULE SASM (SWA POS) PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger ABS Module
- Monitor the SWA POS PID while rotating the steering wheel clockwise and counterclockwise very slowly.
- **Does the PID move in intervals of 1 degree?**

YES : Go to **Pinpoint Test F** .

NO : Go to **Pinpoint Test E** .

Pinpoint Test J: DTC U1901 - CAN Network #2 Communication Bus Fault - Receive Error

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The ABS module communicates with the stability control sensor cluster along the secondary high-speed controller area network (HS-CAN2) bus, circuits VCA23 (BU/WH) and VCA24 (GN/OG).

- DTC U1901 CAN Network #2 Communication Bus Fault - Receive Error - If the ABS module does not receive an expected message from the stability control sensor cluster or the message received does not agree with other sensor inputs, DTC U1901 will be set.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Stability control sensor cluster
- ABS module

PINPOINT TEST J: DTC U1901 - CAN NETWORK #2 COMMUNICATION BUS FAULT- RECEIVE ERROR

NOTE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

J1 CHECK CIRCUITS VCA23 (BU/WH) AND VCA24 (GN/OG) FOR A SHORT TO VOLTAGE

NOTE: **The battery and battery tray need to be removed to access the ABS module connector.**

NOTE: **The battery must be connected to carry out this test.**

- Key in OFF position.
- Disconnect: ABS Module C135
- Disconnect: Stability Control Sensor Cluster C3037
- Key in ON position.

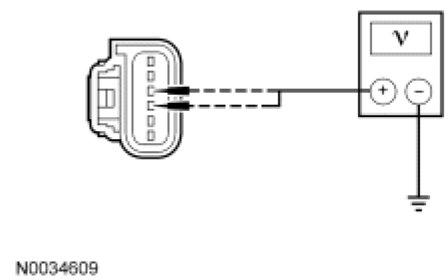

Fig. 18: Checking Circuits For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and:
  - stability control sensor cluster C3037-3, circuit VCA23 (BU/WH), harness side.
  - stability control sensor cluster C3037-4, circuit VCA24 (GN/OG), harness side.
- **Is any voltage present?**

  YES : Go to J2.

  NO : REPAIR the affected circuit(s). CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

J2 CHECK CIRCUITS VCA23 (BU/WH) AND VCA24 (GN/OG) FOR A SHORT TO GROUND

- Key in OFF position.

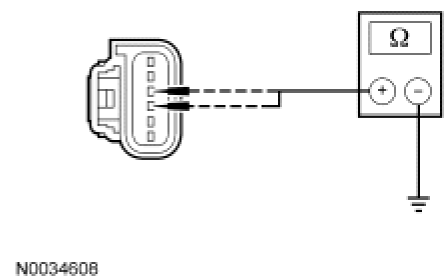

Fig. 19: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and:
  - stability control sensor cluster C3037-3, circuit VCA23 (BU/WH), harness side.
  - stability control sensor cluster C3037-4, circuit VCA24 (GN/OG), harness side.
- **Is the resistances greater than 10,000 ohms?**

  YES : Go to J3.

  NO : REPAIR the affected circuit(s). CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

J3 CHECK CIRCUITS VCA23 (BU/WH) AND VCA24 (GN/OG) FOR AN OPEN

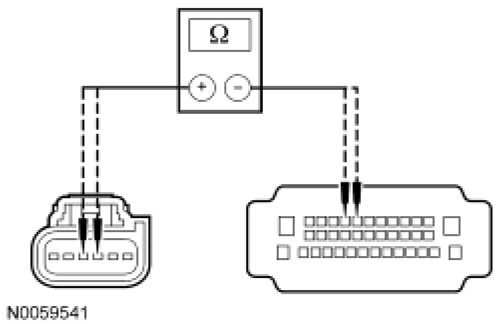

Fig. 20: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between:
  - stability control sensor cluster C3037-3, circuit VCA23 (BU/WH), harness side and ABS module C135-8, circuit VCA23 (BU/WH), harness side.
  - stability control sensor cluster C3037-4, circuit VCA24 (GN/OG), harness side and ABS module C135-9, circuit VCA24 (GN/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to J4.

  NO : REPAIR the affected circuit(s). CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

J4 CHECK CIRCUITS VCA23 (BU/WH) AND VCA24 (GN/OG) FOR A SHORT TOGETHER

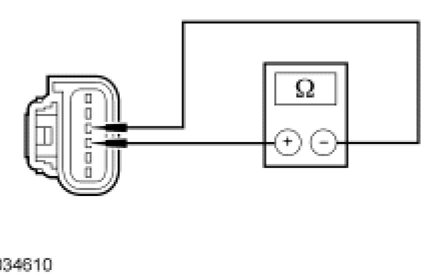

Fig. 21: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between stability control sensor cluster C3037-3, circuit VCA23 (BU/WH), harness side and stability control sensor cluster C3037-4, circuit VCA24 (GN/OG), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to J5.

  NO : REPAIR the affected circuit(s). CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

J5 CHECK THE SENSOR CLUSTER MODULE

- Install a known good sensor cluster. Refer to **Stability Control Sensor Cluster**.
- Connect: ABS Module C135
- Carry out the ABS module self-test. Retrieve and record any ABS module DTCs.
- **Was DTC U1901 retrieved?**

  YES : INSTALL the original sensor cluster. INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied

  NO : Fault corrected. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

Pinpoint Test K: The Traction Control System Cannot Be Disabled

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Instrument Cluster for schematic and connector information.

Normal Operation

The traction control switch is hard wired to the instrument cluster, traction control system status is indicated by an indicator in the instrument cluster. When the driver deactivates the traction assist system, the instrument cluster sends a message to the PCM and the ABS module over the high-speed controller area network (HS-CAN) bus. The traction assist system will remain deactivated until the driver pushes the switch again or until the ignition switch is cycled.

The instrument cluster sends a reference voltage to the stability/traction control switch along circuit CCA15 (YE/GY). When the switch is pressed, the reference voltage is momentarily grounded through the switch along circuit GD116 (BK/VT).

- DTC C1093 Traction Control Disable Switch Circuit Failure - DTC C1093 will be set if the stability/traction control switch is pressed for more than 2 minutes during normal operation, is pressed at all during the instrument cluster on-demand self test or if there is an open circuit, a short to voltage or a short.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Traction control switch
- Instrument cluster

PINPOINT TEST K: THE TRACTION CONTROL SYSTEM CANNOT BE DISABLED

NOTE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

K1 CHECK CIRCUIT CCA15 (YE/GY) FOR VOLTAGE

- Disconnect: Traction Control Switch C2355
- Key in ON position.

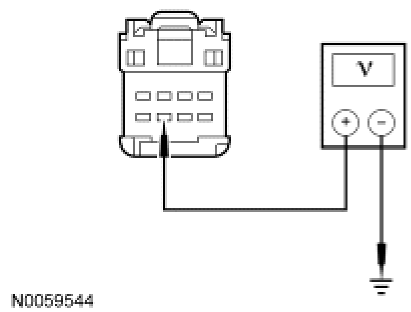

Fig. 22: Measuring Voltage Between Stability/Traction Control Switch C202-7, Circuit CCA15 (YE/GY)
Courtesy of FORD MOTOR CO.

- Measure the voltage between stability/traction control switch C2355-7, circuit CCA15 (YE/GY), harness side.
- **Is the voltage greater than 9.5 volts?**

  YES : Go to K2.

  NO : Go to K4.

K2 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

- Key in OFF position.

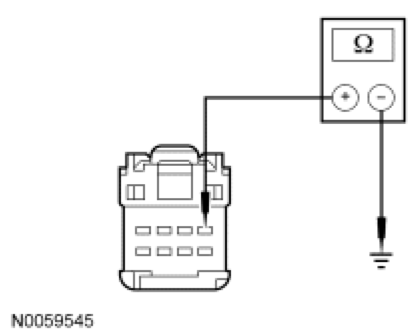

Fig. 23: Measuring Resistance Between Stability/Traction Control Switch C202-1, Circuit GD116 (BK/VT)
Courtesy of FORD MOTOR CO.

- Measure the resistance between stability/traction control switch C2355-1, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to K3.

  NO : REPAIR circuit GD116 (BK/VT). CLEAR the DTCs. TEST the system for normal operation.

K3 ISOLATE THE STABILITY/TRACTION CONTROL SWITCH

- Measure the resistance between stability/traction control switch C2355 pin-7, component side and pin-1, component side while pressing and releasing the switch.
- **Is the resistance less than 5 ohms with the switch pressed and greater than 10,000 ohms with the switch released?**

  YES : Go to K6.

  NO : INSTALL a new stability/traction control switch. REFER to **Stability/Traction Control Switch**. CLEAR the DTCs. TEST the system for normal operation.

K4 CHECK CIRCUIT CCA15 (YE/GY) FOR AN OPEN

- Key in OFF position.
- Disconnect: Instrument Cluster C220

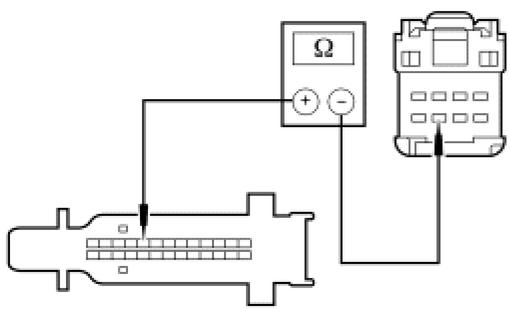

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Fig. 24: Measuring Resistance Between Stability/Traction Control Switch C202-7, CCA15 (YE/GY) & Instrument Cluster C220-22
Courtesy of FORD MOTOR CO.

- Measure the resistance between stability/traction control switch C2355-7, CCA15 (YE/GY), harness side and instrument cluster C220-22, circuit CCA15 (YE/GY), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to K5.

  NO : REPAIR circuit CCA15 (YE/GY). CLEAR the DTCs. TEST the system for normal operation.

K5 CHECK CIRCUIT CCA15 (YE/GY) FOR A SHORT TO VOLTAGE

- Key in ON position.

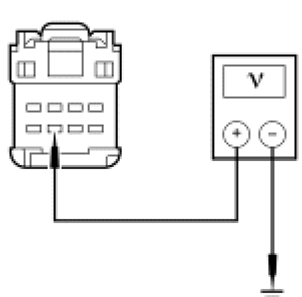

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Fig. 25: Measuring Voltage Between Stability/Traction Control Switch C202-7, CCA15 (YE/GY) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between stability/traction control switch C2355-7, CCA15 (YE/GY), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR circuit CCA15 (YE/GY). CLEAR the DTCs. TEST the system for normal operation.

  NO : Go to K6.

K6 CHECK THE INSTRUMENT CLUSTER ELECTRICAL CONNECTOR

- Check instrument cluster C220 for:
  - corrosion.
  - pushed-out pins.
  - spread terminals.
- Connect: Instrument Cluster C220
- Make sure the instrument cluster connector seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES** article. CLEAR the DTCs. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

Pinpoint Test L: DTCs B1317 and B1318 - Battery Voltage High/Low

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The voltage range required to operate the steering angle sensor module (SASM) is 8-16 volts.

Fused ignition voltage is supplied to the SASM from smart junction box (SJB) fuse 34 (5A) along circuit CBP34 (VT/BN), ground is provided along circuit GD115 (BK/GY). The module communicates with other modules along the high-speed controller area network (HS-CAN) bus, circuits VDB05 (WH) and VDB04 (WH/BU).

- DTC B1317 Battery Voltage High - If the battery voltage is higher than 16 volts for more than 100 ms, DTC B1317 will be set.
- DTC B1318 Battery Voltage Low - If the battery voltage is lower than 8 volts for more than 100 ms,

DTC B1317 will be set.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- SASM
- Charging system

PINPOINT TEST L: DTCs B1317 AND B1318 - BATTERY VOLTAGE HIGH/LOW

NOTE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

L1 CHECK FOR RETURNING DTCs

- Connect the diagnostic tool.
- Key in ON position.
- Carry out the SASM self-test. Retrieve and record all SASM DTCs.
- **Are DTCs B1317 or 1318 present?**

  YES : Go to L2.

  NO : REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to continue diagnosis of the charging system.

L2 CHECK THE BATTERY VOLTAGE

- Measure the voltage between the positive and negative battery terminals with the key ON and the engine OFF (KOEO) and with the engine running.
- **Is the battery voltage between 10 and 13 volts with KOEO and between 13 and 17 volts with the engine running?**

  YES : Go to L3.

  NO : REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to continue diagnosis of the charging system.

L3 CHECK THE VOLTAGE TO THE SASM

- Key in OFF position.
- Disconnect: SASM C222
- Key in ON position.

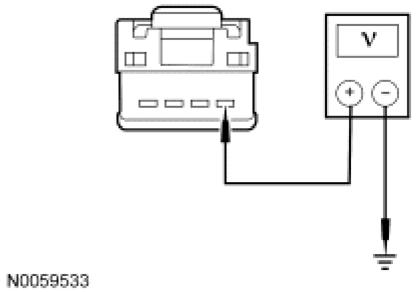


Fig. 26: Measuring Voltage Between Steering Angle Sensor C222-1, CBP34 (VT/BN), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between SASM C222-1, CBP34 (VT/BN), harness side and ground.
- **Is the voltage greater 10 volts?**

  YES : Go to L4.

  NO : VERIFY SJB fuses 34 (5A) is OK. If OK, REPAIR circuit CBP34 (VT/BN). CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

L4 CHECK THE CIRCUIT GD115 (BK/GY) FOR AN OPEN

- Key in OFF position.

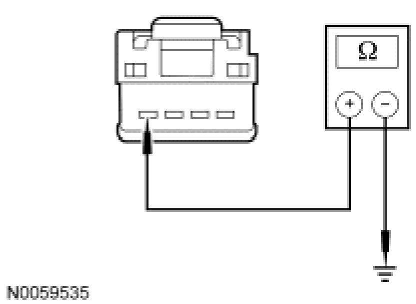


Fig. 27: Measuring Resistance Between Steering Angle Sensor C222-4, GD115 (BK/GY), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between SASM C222-4, GD115 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to L5.

  NO : REPAIR circuit GD115 (BK/GY). CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

L5 CHECK THE ELECTRICAL CONNECTOR SASM

- Check SASM C222 for:

    - corrosion.
    - pushed-out pins.
    - spread terminals.
- Connect: SASM C222
- Make sure the ABS connector seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SASM. REFER to **Steering Angle Sensor Module (SASM)**. CALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

REMOVAL AND INSTALLATION

HYDRAULIC CONTROL UNIT (HCU)

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

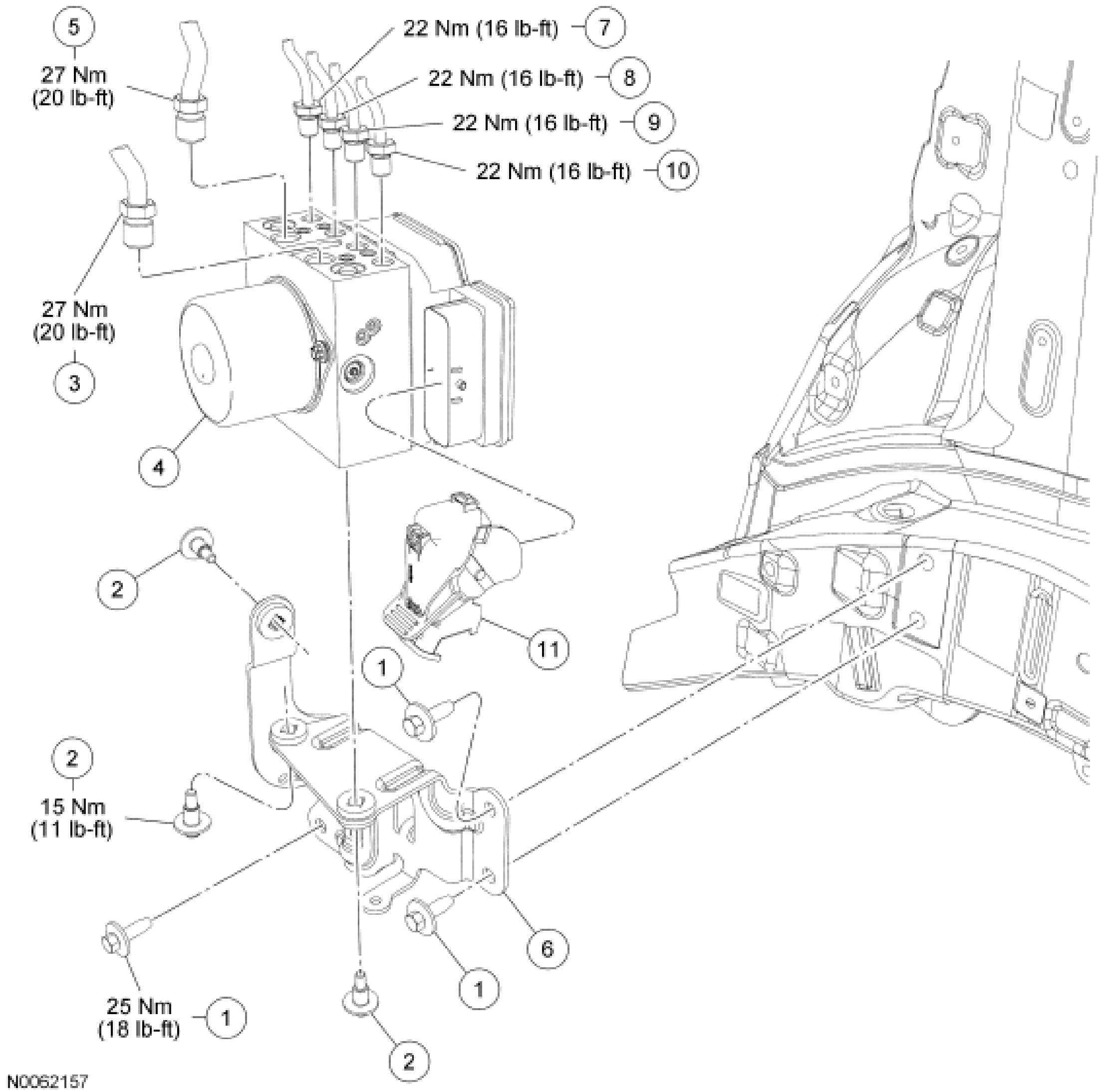


Fig. 28: Exploded View Of Hydraulic Control Unit (HCU) With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W707402	Hydraulic control unit (HCU) bracket-to-frame bolts (3 required)
2	-	HCU bracket-to-HCU bolts (3 required) (part of 2C286)
3	2286	Master cylinder rear brake tube
4	2C286	HCU
5	2A335	Master cylinder front brake tube
6	2C304	HCU bracket
7	2263	RF brake caliper brake tube
8	2C293	RR brake caliper brake tube

9	2C294	LR brake caliper brake tube
10	2264	LF brake caliper brake tube
11	-	ABS module electrical connector (part of 14290)

REMOVAL AND INSTALLATION

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

NOTE: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the air cleaner outlet tube and the air cleaner assembly. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.
2. Remove the battery and battery tray. For additional information, refer to **BATTERY, MOUNTING & CABLES** article.
3. Disconnect the ABS module electrical connector.
4. Disconnect the 6 brake tube fittings.
   - To install, tighten the brake master cylinder tubes to 27 Nm (20 lb-ft).
   - To install, tighten the remaining tubes to 22 Nm (16 lb-ft).
5. Remove the 3 hydraulic control unit (HCU) bracket-to-frame bolts and the HCU.
   - To install, tighten to 25 Nm (18 lb-ft).
6. Remove the 3 HCU bracket-to-HCU bolts and separate the HCU from the bracket.
   - To install, tighten to 15 Nm (11 lb-ft).

   NOTE: Make sure the HCU and ABS module are clean and free of any brake fluid or foreign material before separating the components.

7. To install, reverse the removal procedure.
   - Bleed the brake system. For additional information, refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.

ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

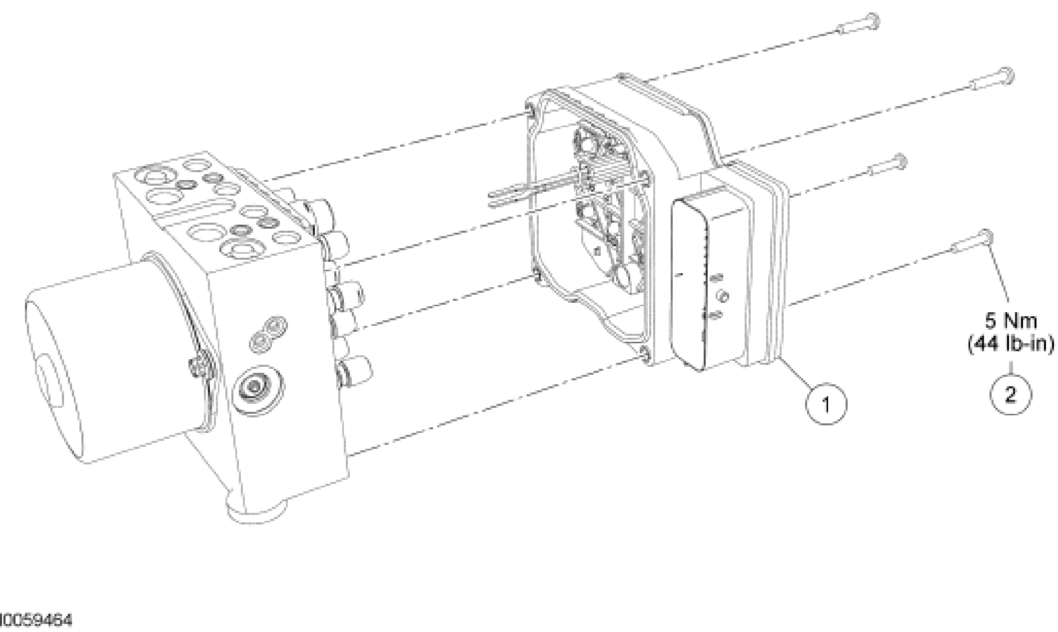


Fig. 29: Exploded View Of Anti-Lock Brake System (ABS) Module With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2C219	ABS module
2	-	ABS module screw (4 required) (part of 2C219)

REMOVAL AND INSTALLATION

NOTE: **Electronic modules are sensitive to electrical charges. The anti-lock brake system (ABS) module can be damaged if exposed to these charges.**

NOTE: **Do not allow any brake fluid or foreign material to enter the mating side of the anti-lock brake system (ABS) module or damage to the solenoids can occur.**

1. Remove the hydraulic control unit (HCU). For additional information, refer to **Hydraulic Control Unit (HCU)**.
2. Remove the 4 ABS module screws and the ABS module.
   - To install, tighten to 5 Nm (44 lb-in).

NOTE: **Visually inspect the ABS module terminals for damage before installation.**

3. To install, reverse the removal procedure.

WHEEL SPEED SENSOR - FRONT

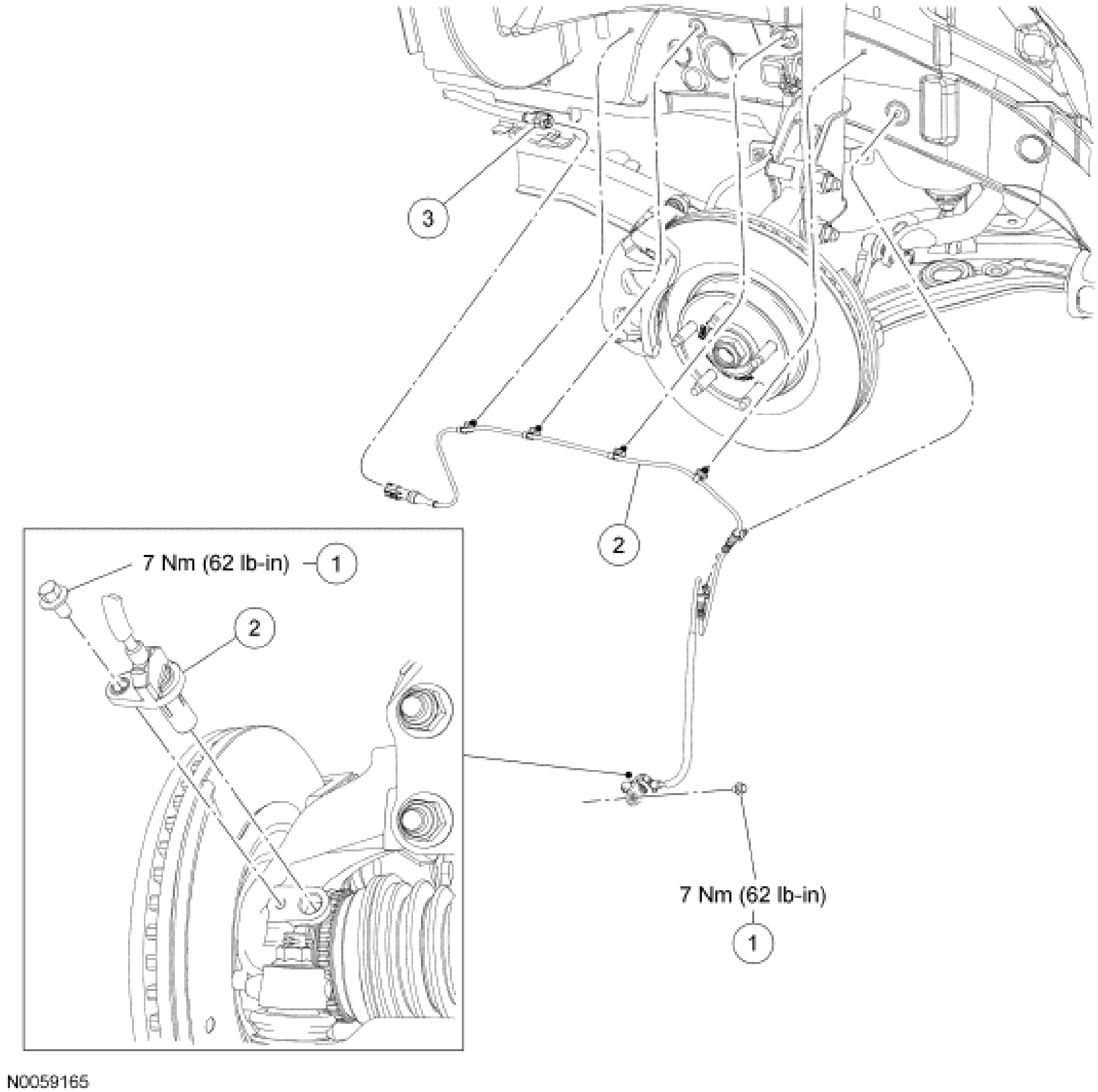


Fig. 30: Exploded View Of Front Wheel Speed Sensor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W500010	Wheel speed sensor bolt
2	2C204 RH/2C205 LH	Wheel speed sensor
3	-	Wheel speed sensor electrical connector (part of 14290)

REMOVAL AND INSTALLATION

1. Remove the wheel and tire. For additional information, refer to **WHEELS & TIRES** article.
2. Remove the retainers and position the fender splash shield aside.
3. Disconnect the wheel speed sensor electrical connector.
4. Disconnect the 6 pushpin fasteners.
5. Remove the front wheel speed sensor bolt and the wheel speed sensor.
    - To install, tighten to 7 Nm (62 lb-in).

NOTE: The wheel speed sensor harness must be routed as shown or damage to the harness during vehicle jounce and rebound can occur.

6. To install, reverse the removal procedure.

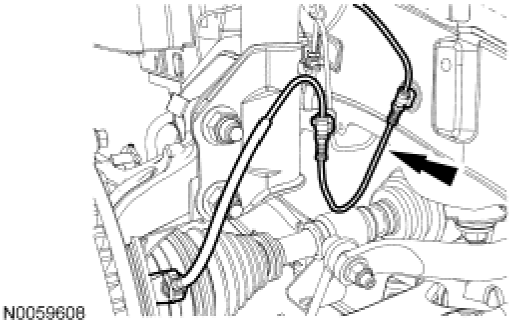


Fig. 31: Identifying Wheel Speed Sensor Harness
Courtesy of FORD MOTOR CO.

WHEEL SPEED SENSOR - REAR

NOTE: All wheel drive (AWD) shown, front wheel drive (FWD) similar.

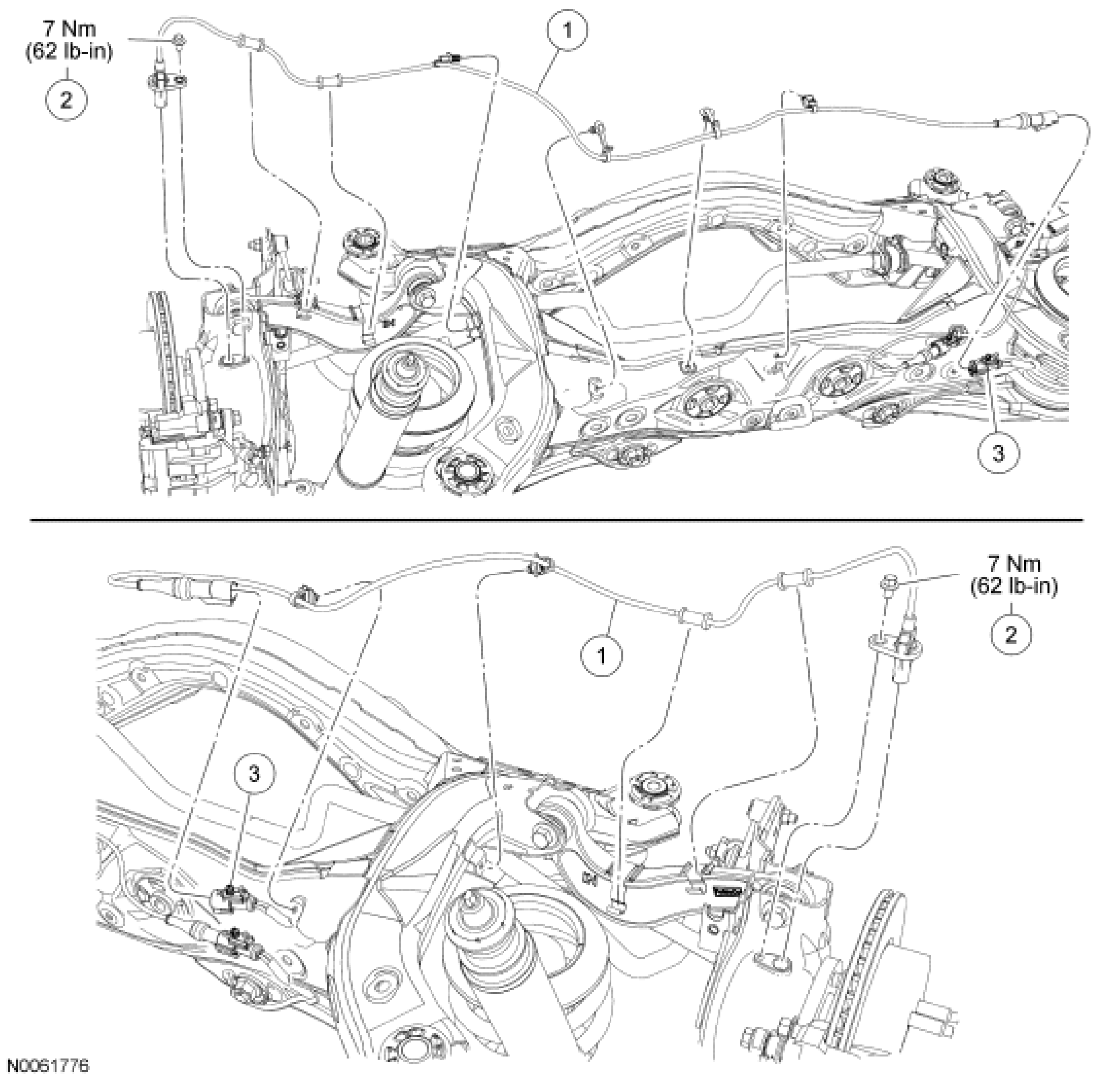


Fig. 32: Exploded View Of Rear Wheel Speed Sensor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2C190	Wheel speed sensor
2	W500010	Wheel speed sensor bolt
3	-	Wheel speed sensor electrical connector (part of 14A005)

REMOVAL AND INSTALLATION

1. Remove the wheel and tire. For additional information, refer to **WHEELS & TIRES** article.
2. Disconnect the wheel speed sensor electrical connector.

NOTE: It is not necessary to remove the harness routing brackets.

3. Disconnect the wheel speed sensor harness from the brackets.
4. Disconnect the pushpin fasteners.
5. Remove the wheel speed sensor bolt and the wheel speed sensor.
    - To install, tighten to 7 Nm (62 lb-in).
6. To install, reverse the removal procedure.

STABILITY CONTROL SENSOR CLUSTER

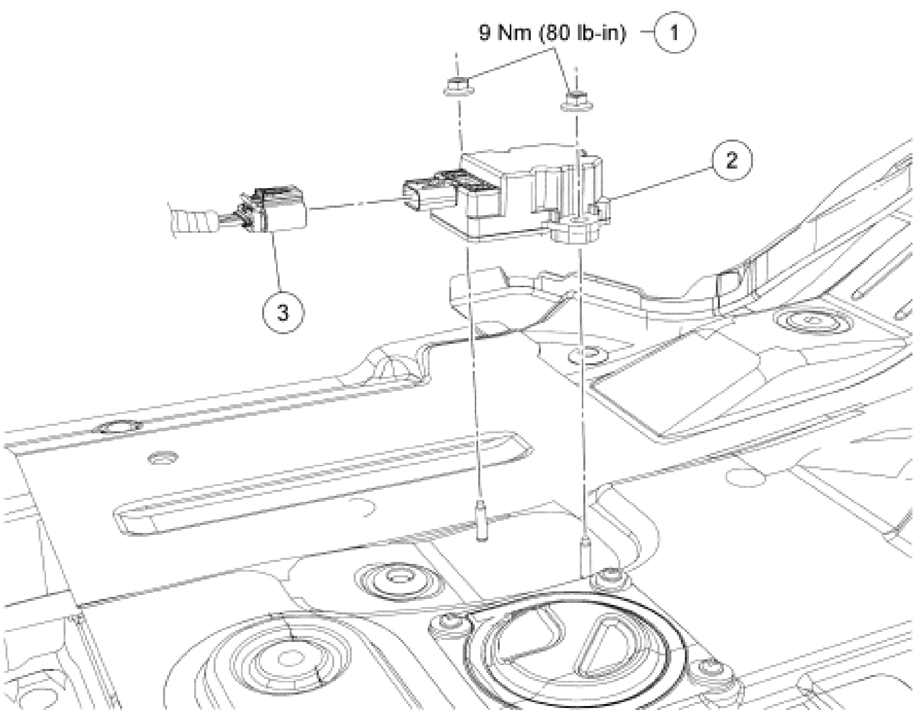


Fig. 33: Exploded View Of Stability Control Sensor Cluster With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W707142	Stability control sensor cluster nuts (2 required)
2	3C187	Stability control sensor cluster
3	-	Stability control sensor cluster electrical connector (part of 14A005)

REMOVAL AND INSTALLATION

NOTE: When installing a new stability control sensor cluster, the sensor cluster must be calibrated. Follow the scan tool directions for the calibration procedures.

NOTE: The sensor is located on the RH side of the vehicle, under the rear seat.

1. Remove the rear seat. For additional information, refer to **SEATING** article.
2. Remove the right rear scuff plate. For additional information, refer to **INTERIOR TRIM & ORNAMENTATION** article.
    - Position the carpet aside.
3. Disconnect the stability control sensor cluster electrical connector.
4. Remove the 2 stability control sensor cluster nuts and the stability control sensor cluster.
    - To install, tighten to 9 Nm (80 lb-in).
5. To install, reverse the removal procedure.

STABILITY/TRACTION CONTROL SWITCH

REMOVAL AND INSTALLATION

NOTE: Edge shown, MKX similar.

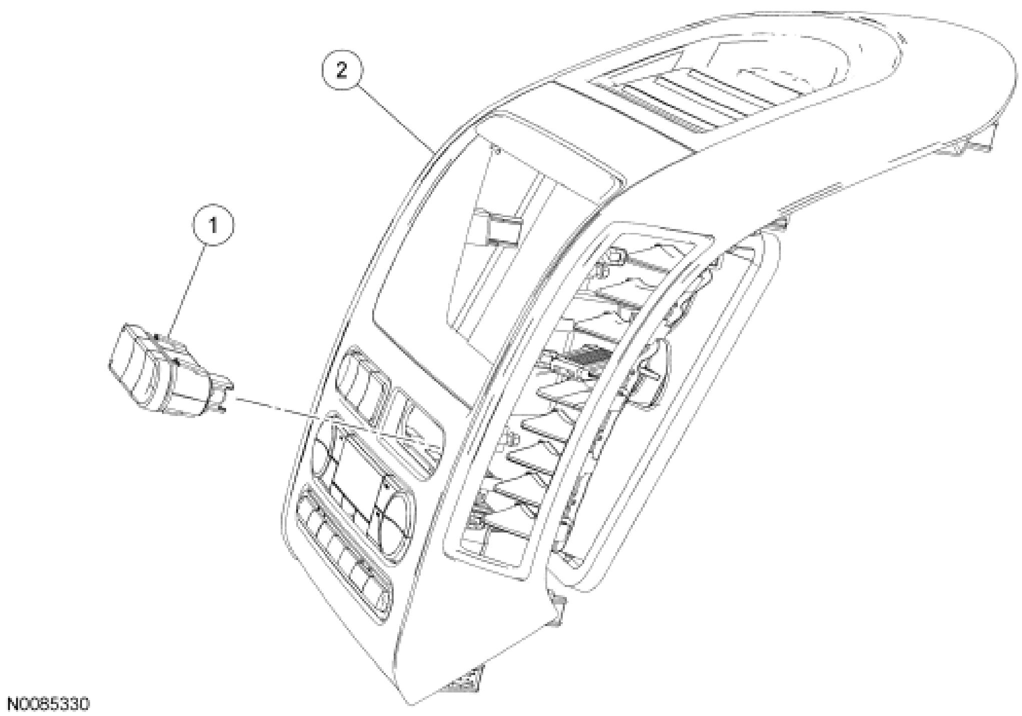


Fig. 34: Identifying Stability/Traction Control Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	13D730	Stability/traction control switch
2	7804302	Instrument panel center finish panel

NOTE: **The ignition switch must be in the OFF position if disconnecting the Passenger Air Bag Deactivation (PAD) indicator electrical connector. Otherwise, a DTC will be set in the Restraints Control Module (RCM) memory and must be cleared before releasing the vehicle.**

1. Turn the ignition OFF and wait at least one minute.
2. Remove the instrument panel center finish panel. For additional information, refer to **INSTRUMENT PANEL & CONSOLE** article.
3. Depress the 4 tabs and remove the stability/traction control switch from the instrument panel center finish panel.

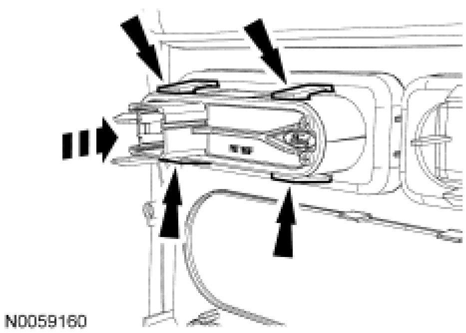
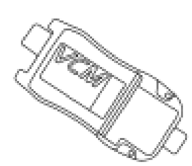


Fig. 35: Depressing Tabs & Removing Stability/Traction Control Switch From Instrument Panel Center Finish Panel
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.

STEERING ANGLE SENSOR MODULE (SASM)

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

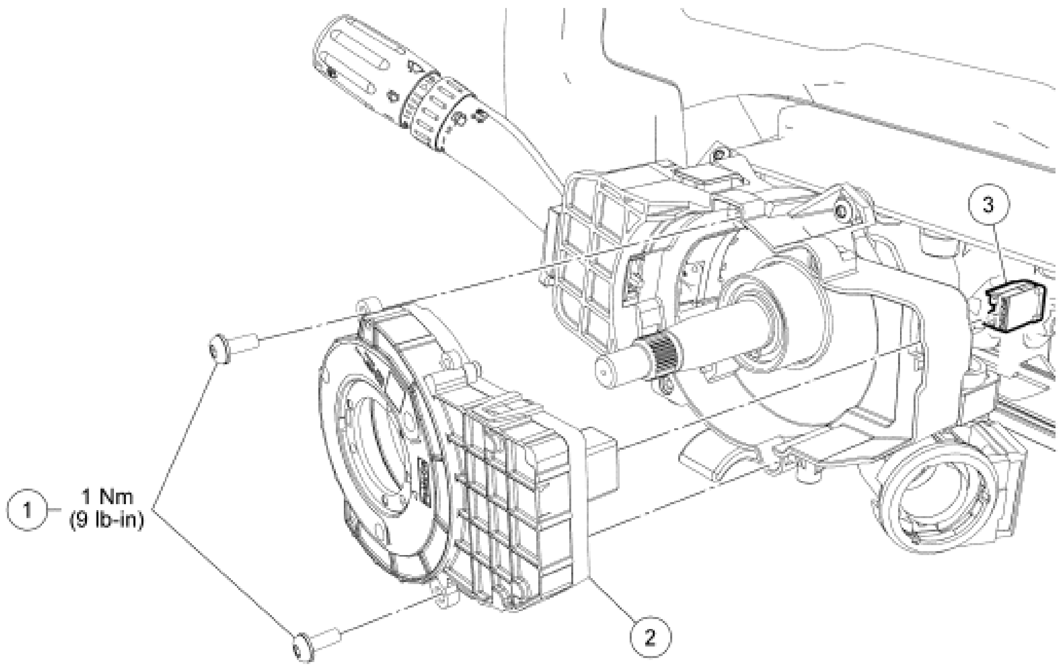


Fig. 36: Exploded View Of Steering Wheel Rotation Sensor With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Steering angle sensor module (SASM) bolts (2 required) (part of 13D774)
2	3F818	SASM
3	-	SASM electrical connector (part of 14401)

REMOVAL

1. Remove the clockspring. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
2. Remove the 2 steering angle sensor module (SASM) bolts.
3. Disconnect the SASM electrical connector and remove the steering wheel rotation sensor.

INSTALLATION

1. If the arrow on the SASM ring and the arrow on the sensor housing are misaligned and/or the straight ahead position of the sensor is not known, follow these steps to align the sensor prior to installing the sensor:
    1. Orient the front wheels in the straight-ahead position.
    2. Connect the SASM electrical connector.

3. Connect the battery negative cable. For additional information, refer to **BATTERY, MOUNTING & CABLES** article.
4. Carefully rotate the sensor clockwise until it stops.
5. Rotate the sensor counter-clockwise 2-1/2 turns.
6. Using the scan tool, read the SASM position PID (SWA POS). The PID should read approximately 0 degrees. If not, repeat the procedure.
7. Disconnect the battery negative cable. For additional information, refer to **BATTERY, MOUNTING & CABLES** article.
8. Disconnect the SASM electrical connector.

NOTE: Slight rotation of the SASM ring is allowed to align the 2 arrows.

2. Make sure the sensor ring arrow is lined up with the SASM housing arrow as shown and position the sensor into the multi-function switch housing.

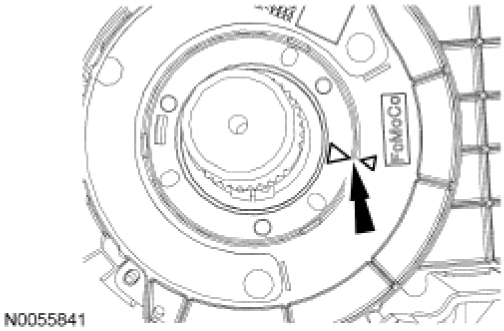


Fig. 37: Making Sure Sensor Ring Arrow Is Lined Up With Absolute Steering Angle Sensor Housing Arrow
Courtesy of FORD MOTOR CO.

3. Connect the SASM electrical connector.
4. Remove the 2 SASM bolts.
   - Tighten to 1 Nm (9 lb-in).
5. Install the clockspring. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
   - If the SASM was aligned using the scan tool, DTCs will be present in the restrains control module (RCM). Using the scan tool, clear the DTCs in the RCM.

2008 ENGINE PERFORMANCE

Acceleration Control - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Accelerator pedal and sensor assembly mounting nuts	7	62

DESCRIPTION AND OPERATION

ACCELERATION CONTROL

The acceleration controls consist of an accelerator pedal and sensor assembly.

The engine management system electronically operates the accelerator of the engine in response to accelerator pedal movements initiated by the driver. In the event of a system failure, the engine management system provides a "limp home" mode which allows the vehicle to be driven with limited performance.

DIAGNOSTIC TESTS

ACCELERATION CONTROL

Refer to the **Introduction - Gasoline Engines** article.

REMOVAL AND INSTALLATION

ACCELERATOR PEDAL AND BRACKET

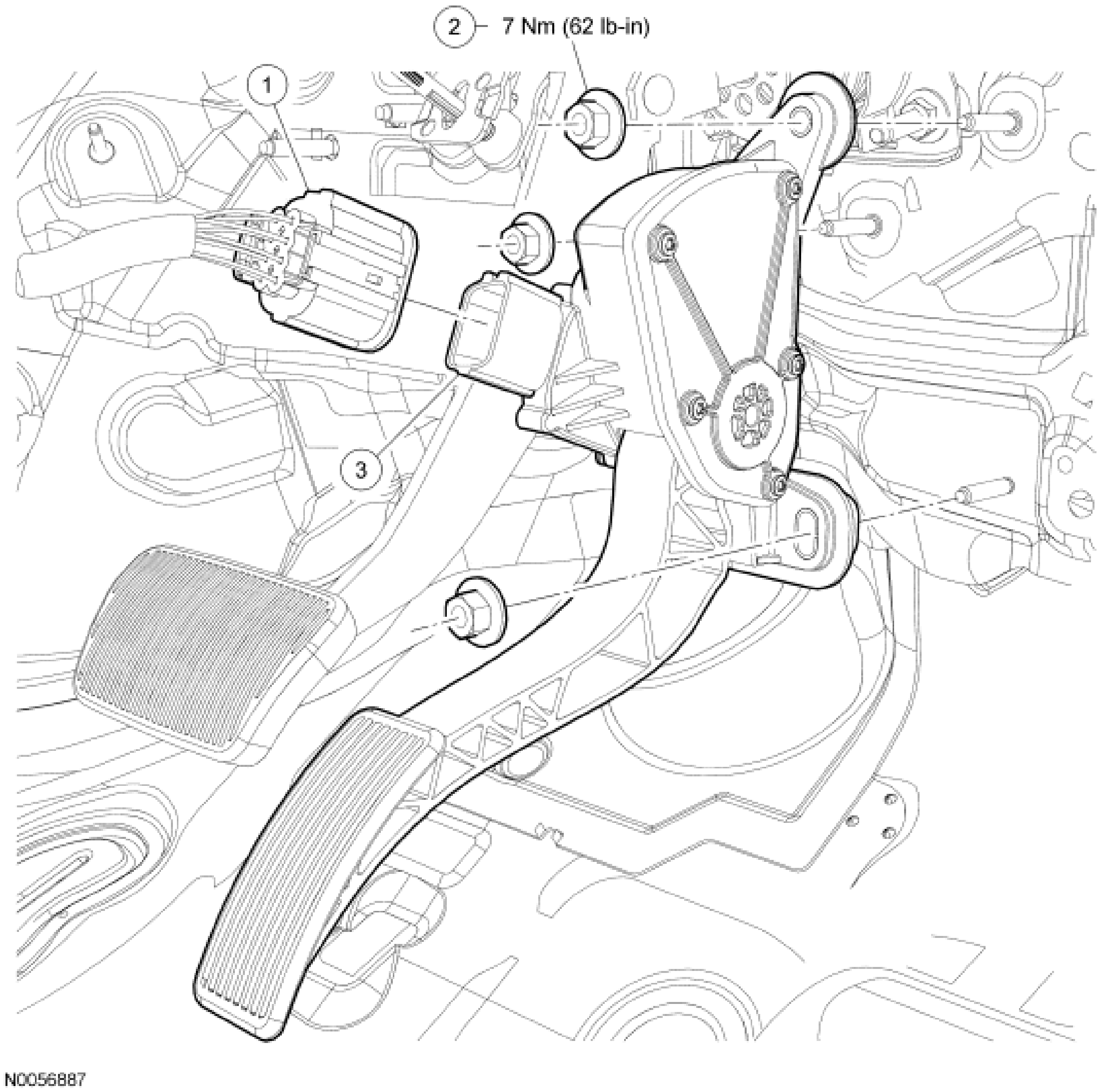


Fig. 1: Exploded View Of Accelerator Pedal & Bracket With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Accelerator pedal sensor electrical connector (part of 14290)
2	90907	Accelerator pedal nut (3 required)
3	9F836	Accelerator pedal and sensor assembly

REMOVAL AND INSTALLATION

NOTE: Release the safety lock tab mechanism on the accelerator pedal sensor electrical connector prior to disconnecting.

1. Disconnect the accelerator pedal sensor electrical connector.
2. Remove the 3 nuts and the accelerator pedal and sensor assembly.
   - To install, tighten to 7 Nm (62 lb-in).
3. To install, reverse the removal procedure.

2008 RESTRAINTS

Supplemental Restraint System - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Front impact severity sensor bolt	11	8	-
Inner floor console support bolts	12	9	-
Manual seat track front cross brace screws	5	-	44
Manual seat track rear cross brace screws	5	-	44
Occupant classification sensor (OCS) weight sensor bolt nuts	33	24	-
Passenger air bag module bolts (Edge)	8	-	71
Passenger air bag module nuts (MKX)	7	-	62
Passenger air bag module support bracket-to-passenger air bag module bolts (MKX)	8	-	71
Passenger air bag module support bracket-to-cross vehicle beam bolts (MKX)	8	-	71
Power seat track front cross brace nuts	20	15	-
Restraints control module (RCM) bolts	12	9	-
Safety belt buckle pretensioner nut	40	30	-
Safety canopy module bolts (all)	9	-	80
Side air bag module bolts	23	17	-
Side impact sensor (B-pillar) bolt	11	8	-
Side impact sensor (C-pillar) bolt	11	8	-

DESCRIPTION AND OPERATION

AIR BAG AND SAFETY BELT PRETENSIONER SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

The air bag supplemental restraint system (SRS) is designed to provide increased collision protection for front seat and second row outboard occupants in addition to that provided by the 3-point safety belt system. Safety belt use is necessary to obtain the best occupant protection and to receive the full advantage of the SRS.

This vehicle contains dual-stage deployment (advanced restraint system) driver and front passenger air bag modules. These vehicles are also equipped with driver and front passenger safety belt retractor pretensioners as well as safety canopies. These canopies deploy from the A-pillar to the C-pillar during a side impact or if a rollover condition is detected. Vehicles with safety canopies are also equipped with seat side air bag modules in the front seats. Seat side air bag modules deploy from the outboard front seat backrest during a side impact. A unique restraints control module (RCM) that detects a potential rollover condition is another standard feature.

In addition, there are 2 front impact severity sensors mounted to the hood latch bracket, 2 first row side impact sensors mounted near the base of the B-pillar and 2 second row impact sensors mounted near the base of the C-pillar. A seat position sensor mounted to the driver seat and a usage detection switch is added to the front driver and passenger outboard buckles.

Vehicles are also equipped with an occupant classification sensor (OCS) system mounted to the front passenger seat track assembly. The weight of any occupant or object on the front passenger seat is electronically communicated to the occupant classification system module (OCSM). The RCM uses this information in determining if the passenger air bag module or passenger seat side air bag module is to be deployed in the event of a deployable collision.

The OCS system includes 4 OCS weight sensor bolts, OCSM and a passenger air bag deactivation (PAD) indicator lamp.

Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) Components

This vehicle is equipped with following SRS components:

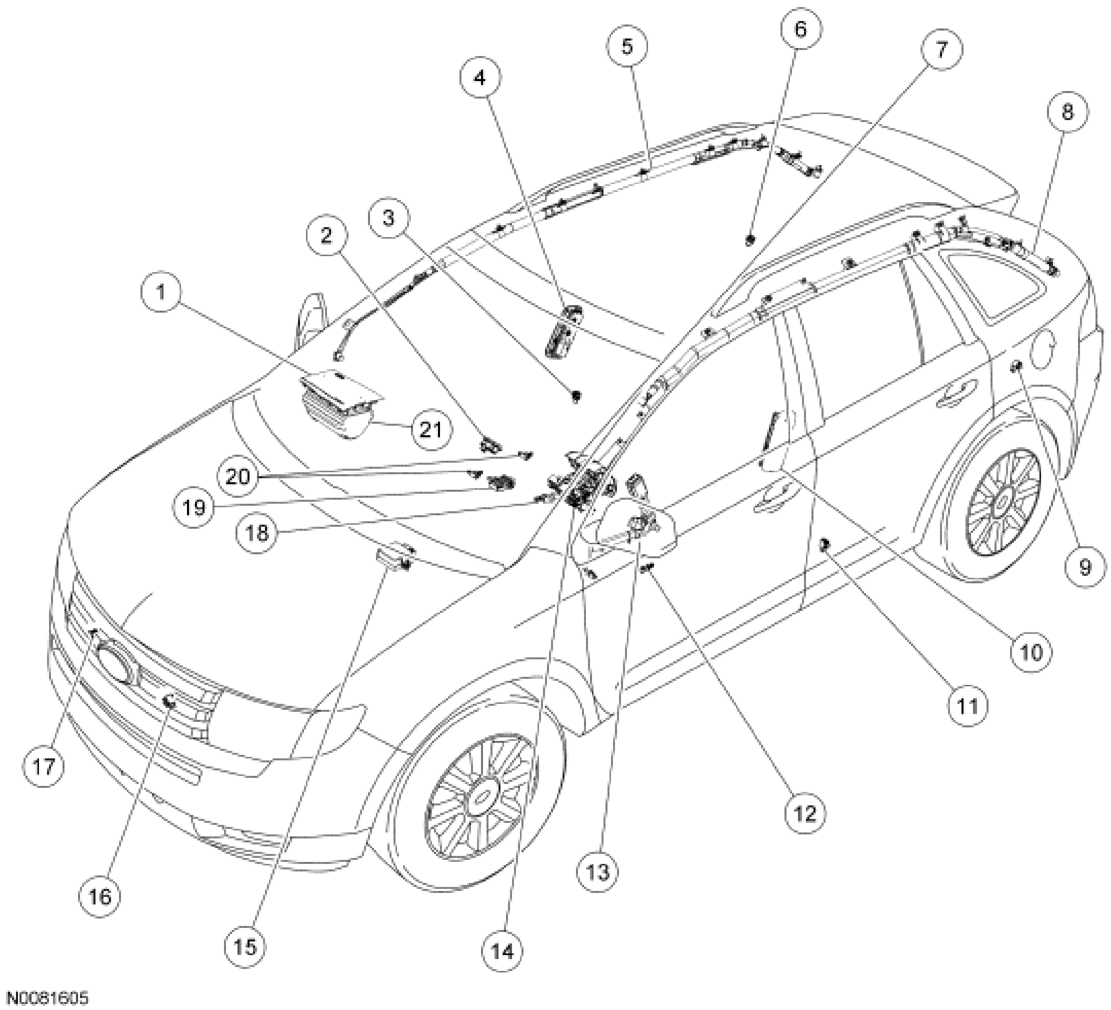


Fig. 1: Identifying Supplemental Restraint System (SRS) Components
Courtesy of FORD MOTOR CO.

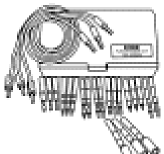
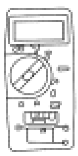
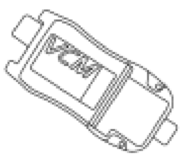
Item	Part Number	Description
1	04338	Passenger air bag cover
2	14B418	Passenger air bag deactivation (PAD) indicator
3	14B345	First row, passenger, side impact sensor
4	611D10	Passenger side air bag module
5	042D94	Passenger side safety canopy module
6	14B345	Second row, passenger, C-pillar side impact sensor
7	043B13	Driver air bag module
8	042D95	Driver side safety canopy module
9	14B345	Second row, driver, C-pillar side impact sensor
10	611D10	Driver side air bag module
11	14B345	First row, driver, side impact sensor
12	14B416	Driver seat track position sensor
13	61203	Driver safety belt buckle (includes safety belt buckle switch)
14	14A664	Clockspring
15	14B321	Restraints control module (RCM)
16	14B006	Driver/center front impact severity sensor
17	14B006	Passenger front impact severity sensor
18	61202	Passenger safety belt buckle (includes safety belt buckle switch)
19	14B422	Occupant classification system module (OCSM)
20	-	Occupant classification weight sensor bolts (2 shown in illustration) (4 required)
21	044A74	Passenger air bag module assembly

DIAGNOSTIC TESTS

AIR BAG AND SAFETY BELT PRETENSIONER SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

Special Tools

Illustration	Tool Name	Tool Number
	Flex Probe Kit	105-R025C or equivalent

 ST2574-A		
 ST1137-A	FLUKE 73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

Principles of Operation

The supplemental restraint system (SRS) consists of a driver and passenger air bag module, safety belt retractor pretensioners and safety canopies (containing an inflator/squib or gas generator and an air bag), impact sensors, a restraints control module (RCM), a clockspring, an air bag warning indicator, occupant classification sensor (OCS) system and a passenger air bag deactivation (PAD) indicator lamp. These components are all interconnected by a wiring harness and powered by the vehicle's battery. The RCM includes a backup power supply. This feature provides sufficient backup power to deploy the SRS in the event that the ignition circuit is lost or damaged during impact. The backup power supply will deplete its stored energy approximately one minute after the battery ground cable is disconnected. If a SRS fault exists, the air bag warning indicator will illuminate and remain illuminated for the rest of the key cycle. In addition to the self-test at start up, the RCM continuously monitors all of its external and internal circuitry for faults.

In a frontal collision, the impact sensors located in the front of the vehicle detect the sudden deceleration and send an electrical signal to the RCM. The RCM uses the information from the impact sensors and the OCS system in the deployment determination. If the RCM determines that deployment is required, the RCM sends voltage and current to the squib(s) causing the solid chemical propellant to undergo a rapid chemical reaction. This controlled reaction produces harmless nitrogen gas that fills the air bag(s)/safety canopies and/or activates the safety belt pretensioners to remove slack from the safety belt(s).

The RCM communicates through the data link connector (DLC) the current and historical DTCs on the high-speed controller area network (HS-CAN). The RCM also communicates over the HS-CAN to the instrument cluster (IC) module, PCM and the occupant classification system module (OCSM).

Air Bag Warning Indicator

The air bag warning indicator:

- is located in the instrument cluster (IC) module.

- lamp and circuitry prove out is a function of the IC module. The IC module will prove out the air bag warning indicator by lighting the air bag warning indicator for 6 seconds and then turn off.
- will flash and/or illuminate based on the message the IC module receives from the RCM.
- will illuminate if the IC module does not receive a message from the RCM.

Air Bag Module Second Stage Deployment Check

Because the driver and passenger front air bags each have 2 deployment stages, it is possible that Stage 1 has deployed and Stage 2 has not.

If a front air bag module has deployed, it is **mandatory** that the front air bag module be remotely deployed using the appropriate air bag disposal procedure.

- For information on driver air bag module and/or passenger air bag module remote deployment, refer to **Pyrotechnic Device Disposal**.

Clockspring

The clockspring:

- is mounted on the steering column, behind the steering wheel.
- allows for continuous electrical connections between the driver air bag module and the restraints control module (RCM) when the steering wheel is turned.

Driver Air Bag Module

The driver air bag module:

- is installed as an assembly.
- is mounted in the center of the steering wheel.
- cannot be interchanged between Edge and MKX vehicles.

High-Speed Controller Area Network (HS-CAN)

This vehicle utilizes a communication system called a high-speed controller area network (HS-CAN). The HS-CAN consists of a twisted pair of wires connected to the following:

- ABS module
- Instrument cluster (IC) module
- PCM
- Transmission control module (TCM)
- Restraints control module (RCM)
- Occupant classification system module (OCSM)
- Air suspension (vehicle dynamics module [VDM]) (if equipped)

- Data link connector (DLC)

The HS-CAN circuits use a bias voltage of approximately 2.5 volts, one is a positive 2.5 volts while the other is a negative 2.5 volts. The HS-CAN also uses 2 terminating resistors, one contained within the PCM, the other in the IC module. The terminating resistors are not serviced separately. The terminating resistors have a value of 120 ohms each, for a normal operating system total of 60 ohms. The HS-CAN may operate with only one terminating resistor and may communicate some messages to some of the control modules with only one circuit functioning. Refer to **MODULE COMMUNICATIONS NETWORK** article.

Impact Sensors

WARNING: **If a vehicle has been in a crash, inspect the restraints control module (RCM) and the impact sensor (if equipped) mounting areas for deformation. If damaged, restore the mounting areas to the original production configuration. A new RCM and sensors must be installed whether or not the air bags have deployed. Failure to follow these instructions may result in serious personal injury or death in a crash.**

For this vehicle line, the supplemental restraint system (SRS) uses 6 satellite sensors in addition to the restraints control module (RCM). The RCM is mounted to the center tunnel beneath the console. All vehicles have 2 front impact severity sensors located in the front-center area of the vehicle, behind the grille mounted on the hood latch bracket. The first row impact sensors are mounted behind the trim panel near the floor on the B-pillar, the second row sensors are located on each C-pillar. Mounting orientation is critical for correct operation of all impact sensors.

Loops/Squibs

All deployable devices contain an initiating device called a squib. The squib is part of the deployment loop. Air bag/safety canopy modules can contain more than one squib, some vehicles may have up to 4 squibs in one air bag module. Squibs are often referred to as loops during the diagnostic process.

Occupant Classification Sensor (OCS) System

The occupant classification sensor (OCS) system is found only on the front passenger seat. The front passenger OCS system is comprised of the following: 4 OCS weight sensor bolts that are mounted to each corner of the seat track and an occupant classification system module (OCSM) which is mounted to the electrical bracket underneath the seat cushion pan. All the components that make up the OCS system are all serviced separately. The weight of any occupant or object on the front passenger seat is electronically communicated to the OCSM. The RCM uses this information in determining if the passenger air bag module or passenger seat side air bag module is to be deployed in the event of a deployable collision.

The OCSM will inform the restraints control module (RCM), via a high-speed controller area network (HS-CAN), of the weight of any occupant or object on the front passenger seat.

The OCSM monitors the OCS system for faults and communicates on-demand and continuous DTCs via the data link connector (DLC) with the use of a scan tool.

The OCS system is also used for operation of the passenger Belt-Minder®. For information on the passenger Belt-Minder® feature, refer to **SAFETY BELT SYSTEM** article. To deactivate or reactivate the passenger Belt-Minder® feature, refer to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES** article or the Owner's Literature.

When the front passenger seat is removed for service, the Zero Seat Weight Test must be carried out after the installation of the front passenger seat. When an OCS system component is installed new, the System Reset must be carried out after the installation of the front passenger seat. The Zero Seat Weight Test and/or System Reset must be carried out only as instructed to do so in the appropriate service information. For information on the Zero Seat Weight Test and/or System Reset, refer to **Occupant Classification Sensor (OCS) System Zero Seat Weight Test** or **Occupant Classification Sensor (OCS) System Reset**.

In the event of a deployable crash, a new passenger seat track with OCS weight sensor bolts must be installed. **DTC B1231 must be cleared before carrying out Occupant Classification Sensor (OCS) System Reset.** Refer to **Occupant Classification Sensor - Manual Seat Track** or **Occupant Classification Sensor - Power Seat Track**.

Passenger Air Bag Deactivation (PAD) Indicator

The passenger air bag deactivation (PAD) indicator is a visual indicator used to inform the front seat occupants of the passenger air bag deactivation state. The PAD indicator is a stand-alone lamp installed into the vehicle instrument panel in a position visible to each front seat occupant.

The restraints control module (RCM) controls the state of the PAD indicator through a direct hardwire connection, based on information provided by the occupant classification sensor (OCS) system. The PAD indicator illuminates to indicate the passenger air bag module is disabled. An exemption to this is when the front passenger seat is determined to be empty and the passenger safety belt is unbuckled, therefore indication of a deactivated passenger air bag module is not necessary. In all other cases, the PAD indicator is unlit when the passenger air bag module is enabled.

When the ignition switch is in the ON position, the PAD indicator prove-out period is initiated by the RCM. The RCM briefly activates the PAD indicator to prove-out the indicator function and verify to the front occupants correct functional operation of the PAD indicator.

When the OCSM detects a fault that causes DTC B2290 and/or B1013 to set on-demand in the OCS system, the OCSM sends a message to the RCM. Upon receiving the fault message from the OCSM, the RCM disables the passenger air bag module, illuminates the PAD indicator indicating the passenger air bag module is disabled and sends a message to the instrument cluster (IC) module to illuminate the air bag warning indicator. The passenger air bag module will remain disabled until the cause for the on-demand DTC has been corrected.

The following table indicates the passenger air bag status and the PAD indicator status based the size of the front outboard passenger occupant.

PASSENGER AIR BAG AND PAD INDICATOR STATUS

Occupant Size	Passenger Safety Belt Buckle Status	Pass. Air Bag Status	PAD Ind. Status
None	Unbuckled	Disabled	Unlit

None	Buckled	Disabled	Lit
Infant or Small Child	Buckled/Unbuckled	Disabled	Lit
Adult Sized	Buckled/Unbuckled	Enabled	Unlit

Passenger Air Bag Module

The passenger air bag module:

- is installed as an assembly.
- is mounted in the passenger side of the instrument panel.
- cannot be interchanged between Edge and MKX vehicles.

Restraints Control Module (RCM)

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **If a vehicle has been in a crash, inspect the restraints control module (RCM) and the impact sensor (if equipped) mounting areas for deformation. If damaged, restore the mounting areas to the original production configuration. A new RCM and sensors must be installed whether or not the air bags have deployed. Failure to follow these instructions may result in serious personal injury or death in a crash.**

NOTE: **Prior to removal of the restraints control module (RCM) module, it is necessary to upload module configuration information to the scan tool. This information needs to be downloaded into the new RCM module once installed. Refer to <u>MODULE CONFIGURATION</u> article. Failure to follow these instructions may result in incorrect operation of the supplemental restraint system (SRS) and may cause system failure.**

NOTE: **When installing a new restraints control module (RCM), always make sure the correct RCM is being installed. If an incorrect RCM is installed, erroneous DTCs will result.**

The RCM carries out the following functions:

- deploys the air bag(s)/safety canopies in the event of a deployable collision.
- activates the safety belt retractor pretensioners to remove slack from the safety belt in the event of a deployable collision.
- monitors the supplemental restraint system (SRS) for faults.

- sends a message to the instrument cluster (IC) module to illuminate the air bag warning indicator if a fault is detected.
- communicates through the data link connector (DLC) the current or historical DTCs.

The RCM monitors the SRS for possible faults. If a fault is detected, the RCM will request illumination of the air bag warning indicator.

When the ignition is cycled (turned OFF and then ON), the IC module will prove out the air bag warning indicator by lighting for 6 seconds and then turn off. If a current SRS fault exists, the RCM requests illumination of the air bag warning indicator and will remain illuminated for the rest of the key cycle. During that same key cycle, some faults that recover (Loss of Communication with the PCM), the RCM will send a request to the IC module to turn the air bag warning indicator off **IF** no other fault is present. The RCM will also communicate the on-demand (current) and continuous (historical) DTCs through the DLC, to the scan tool. If the RCM requests illumination of the air bag warning indicator and the air bag warning indicator does not function, the IC module will automatically activate an audible chime. The chime is a series of 5 sets of 5 tone bursts. If the chime is heard, the SRS and the air bag warning indicator require repair.

The RCM includes a backup power supply. This feature provides sufficient backup power to deploy the air bags in the event that the ignition circuit is lost or damaged during impact. The backup power supply will deplete its stored energy approximately one minute after power and/or ground has been removed from the RCM.

Safety Belt Buckle Switches

As part of the supplemental restraint system (SRS), the driver and front passenger safety belt buckles are equipped with safety belt buckle switches. The safety belt buckle switches indicate to the restraints control module (RCM) whether the safety belts are connected or disconnected. The RCM uses this information in determining the deployment of the dual-stage driver and passenger air bag modules.

Safety Belt Pretensioners

As part of the supplemental restraint system (SRS), the driver and front passenger safety belt retractors are equipped with pretensioners. The safety belt retractor pretensioners remove excess slack from the safety belt webbing. The pretensioners are activated by the restraints control module (RCM) when the module detects a collision exceeding a programmed limit.

Safety Canopy Module

Vehicles are equipped with safety canopies for protection during side impacts or rollovers.

Safety canopies require a specific headliner. The word AIRBAG will appear on the headliner where it meets each B-pillar trim panel.

The safety canopy module:

- is installed as an assembly.
- is mounted above the headliner.

- attaches from the A-pillar frame to the C-pillar frame.
- is standard equipment.
- cannot be interchanged from side-to-side.

Seat Track Position Sensor

The seat track position sensor is mounted to a bracket attached to the inboard side of the driver seat track. The seat track position sensor informs the restraints control module (RCM) of the driver seat position. The RCM uses this information in determining the deployment of the dual-stage driver air bag module.

Side Air Bag Module

NOTE: **References to side air bag modules refer to the seat side air bag module, not to the steering wheel or instrument panel mounted air bag components of the supplemental restraint system (SRS).**

A side air bag module provides protection of the thorax area (between the neck and abdomen) of the body, working in conjunction with the head protection provided by a safety canopy module.

The side air bag module:

- will deploy upon receiving a flow of current from the restraints control module (RCM), initiated by the side impact sensor and internal RCM circuitry.
- is installed as an assembly.
- is mounted in the driver or passenger seat backrest.
- is used in conjunction with a safety canopy module.

Secondary Air Bag Warning (Chime)

The secondary air bag warning, is an audible tone controlled by the instrument cluster (IC) module. If a fault is detected with the air bag warning indicator a DTC will be stored in memory of the IC module. Upon receiving the message from the restraints control module (RCM) that a supplemental restraint system (SRS) fault has been detected, the IC module will sound the secondary air bag warning chime in a pattern of 5 sets of 5 beeps.

Diagnostic Instructions

The symptom chart can be used to help locate supplemental restraint system (SRS) concerns if no DTCs are retrieved and the listed symptoms are observed. Whether or not the listed symptoms are observed, always carry out the following:

1. Run the Self Test to determine what on-demand and continuous memory DTCs are being sensed by the restraints control module (RCM) and occupant classification system module (OCSM).
2. Retrieve all SRS DTCs and fault PIDs stored in the RCM and OCSM memory.
3. If on-demand DTCs are different than continuous memory DTCs, always diagnose the on-demand DTCs first.

A DTC can indicate several concerns. The DTCs are to assist in system diagnosis and are not to be considered definitive. Always refer to the pinpoint test corresponding to the DTC to determine where the concern lies and to repair the concern correctly.

Diagnostic Test Options

Scan tool options:

- Self Test/On-Demand
- Self Test/Continuous Memory and Clear DTCs

Refer to the manufacturer's literature for the scan tool being used for correct scan tool test options.

Self Test/On-Demand

The on-demand Self Test option is used to verify that no electrical concerns exist with the air bag supplemental restraint system (SRS). Upon entering the self-test, the restraints control module (RCM) and the occupant classification system module (OCSM) will make an electrical check of each electrical component in the system. If a concern is detected, a DTC is displayed on the scan tool with a brief description of the DTC. The self-test should always be carried out after any repair to verify that the repair was successful.

To run the on-demand Self Test, follow these steps:

1. Connect the scan tool to the data link connector (DLC).
2. Turn the ignition switch to the ON position.
3. Follow the manufacturer's instructions for the scan tool being used.
4. Select Self-Test.
5. Select RCM or OCSM.
6. The module will run the self-test and display on-demand (reflecting hard system concerns) and continuous memory (historic) DTCs on the scan tool.

Self Test/Continuous Memory and Clear DTCs

During vehicle operation, the restraints control module (RCM) and the occupant classification system module (OCSM) will detect and store on-demand (reflecting hard system concerns) and continuous memory (historic) DTCs. The DTC strategy employed by the RCM incorporates a time-out scheme for determining when a concern exists in the system. This requires a concern may exist for up to one minute in the system before the RCM will detect it. For the RCM to determine that a concern no longer exists, the concern must be absent for up to one minute. The actual detection time-outs vary with each DTC. DTCs can be retrieved with a scan tool using the Self Test option. All DTCs stored in the RCM and OCSM will be displayed on the scan tool along with a brief description of the DTC. If no DTCs are present, the scan tool will display a SYSTEM PASSED message. This option can also be used to clear DTCs from the RCM and OCSM memory, as long as the concern no longer exists.

Once 75 hours of operation have been recorded by the RCM/OCSM since the concern was last detected, all continuous memory DTCs will automatically be removed from memory.

To retrieve or clear DTCs, follow these steps:

1. Connect the scan tool to the data link connector (DLC).
2. Turn the ignition switch to the ON position.
3. Follow the manufacturer's instructions for the scan tool being used.
4. Select Self Test.
5. Select RCM or OCSM (selecting Restraints retrieves DTCs from both modules).

NOTE: **Before proceeding with the clearing operation, make note of the DTCs displayed. Once cleared, continuous DTCs cannot be retrieved.**

6. All DTCs will be displayed on the screen.
7. Clear the DTCs. After clearing the DTCs, cycle the ignition OFF, then ON.
   - Continuous memory DTCs that have been cleared will **not** reoccur as "continuous memory" in the same key cycle. Only new DTCs which were **not** present before clearing can occur as "continuous memory" after clearing.

Occupant Classification Sensor (OCS) System Zero Seat Weight Test

The Zero Seat Weight Test verifies the occupant classification sensor (OCS) measures zero weight for an empty seat. It is necessary to carry out the Zero Seat Weight Test any time the front passenger seat is serviced or removed from the vehicle or as directed in the service information procedures. Refer to **Occupant Classification Sensor (OCS) System Zero Seat Weight Test**.

Occupant Classification Sensor (OCS) System Reset

The System Reset active command resets the zero point of the occupant classification sensor (OCS) system.

The System Reset active command should only be carried out if a new OCS component is installed or as directed by service information .

DataLogger PID/Data

The DataLogger PID/Data option allows the scan tool operator to read the state of several PIDs to aid in diagnosing the system. PIDs are real time measurements of parameters, such as voltages and resistances, calculated by the restraints control module (RCM) or the occupant classification system module (OCSM) and sent to the scan tool for display. Many of the PIDs supported by the modules are calculated periodically and are, therefore, not true real time readings.

To retrieve PIDs, follow these steps:

1. Connect the scan tool to the data link connector (DLC).
2. Turn the ignition switch to the ON position.

3. Follow the manufacturer's instructions for the scan tool being used.
4. Select DataLogger.
5. Select RCM or OCSM.

Active Commands

System Reset

System Reset active command sets the zero set point or rezeros the occupant classification sensor (OCS). Refer to **Occupant Classification Sensor (OCS) System Reset**.

Zero Seat Weight Test

The Zero Seat Weight Test verifies the OCS measures zero weight for an empty seat. Refer to **Occupant Classification Sensor (OCS) System Zero Seat Weight Test**.

Instrument Cluster (IC) Module

These commands allow the technician to verify the operation of instrument cluster (IC) module components and subsystems.

Lamp Fault Codes (LFCs)

This vehicle supports lamp fault codes (LFCs) **only** when the restraints control module (RCM) is in plant mode. A new RCM installed to a vehicle will be in plant mode until:

- programmable module installation (PMI) has been carried out.
- the RCM sees a fault-free supplemental restraint system (SRS) (no DTCs present).

If a LFC is present after completing PMI, a fault is present in the SRS and on-demand DTCs must be retrieved and diagnosed.

Diagnosing Customer Concerns With On-Demand DTCs

NOTE:	**Most supplemental restraint system (SRS) diagnostic procedures will require depowering and repowering of the SRS. Depowering and repowering requires disconnecting of the battery and removal of the restraints control module (RCM) fuse. This reduces the risk of accidental deployment of SRS components while diagnostic procedures are being carried out.**

If the air bag warning indicator is reported ON by the customer when the vehicle comes in for service, connect the scan tool and follow the Diagnostic Instruction procedures in this service information to identify the concern.

Once the DTC is known, read the Normal Operation of the pinpoint test for the DTC involved.

Using the scan tool with the use of PIDs and active command(s) may be of assistance in diagnosing the concern.

- Follow the depowering procedure as directed in **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Determine the location of components involved in creating the DTC.
- Carry out a thorough visual inspection of:
  - components.
  - connectors.
  - splices and wiring harnesses.
  - insulation on conductors.

Diagnosing Customer Concerns With Continuous Memory DTCs

If the air bag warning indicator was reported ON by the customer but is not present when the vehicle comes in for service, follow the Diagnostic Instruction procedures in this service information to identify the intermittent DTC.

Once the DTC is known, read the Normal Operation of the pinpoint test for the DTC involved.

- Follow the depowering procedure as directed in **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Determine the location of components involved in creating the DTC.
- Carry out a thorough visual inspection of:
  - components.
  - connectors.
  - splices and wiring harnesses.
  - insulation on conductors.

Refer to the Possible Causes section of the pinpoint test for the DTC involved, which lists the common concerns that relate to the DTC. Concerns are listed according to priority.

Fault PIDs

There are 2 types of fault PIDs that can be reported by the restraints control module (RCM). The first type, considered conventional, has only one level of fault reporting and identifies a specific concern for a given component and points to a particular diagnostic path, example: DTC B1317 (Battery Voltage High).

The second type uses a process within the software of the controller that maps the byte and bit to name a specific device and fault condition. This process is called Bit-mapping and referred to as fault PIDs in the diagnosis of the vehicle. This type does not identify the specific concern or component on the first level of fault reporting, Example: DTC B2293 (Restraint System - Airbag Fault). DTC B2293 can have up to 28 specific on-demand fault PIDs (areas of concern) associated with this DTC.

Those associated fault PIDs are an extension of the information provided by the DTC and are identified by the same DTC number. A scan tool must be used to view DTCs and their fault PIDs. Once a scan tool has retrieved a DTC, use the scan tool to view the fault PIDs. In the diagnostic path, other types of PIDs are sometimes used to determine the root cause (example: resistance or voltage PIDs).

When viewing of fault PIDs has been carried out, the scan tool can display the PIDs associated with that DTC, including the status or state that exists (on-demand [active] DTC) or existed (continuous memory [historic]) DTC. Refer to the manufacturer instructions for the scan tool being used on how to view fault PIDs.

Prove Out Procedure

Turn the ignition switch from the OFF to the ON position and visually monitor the air bag warning indicator with all supplemental restraint system (SRS) components connected. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an SRS fault is present, the air bag warning indicator will:

- fail to light.
- remain lit continuously.
- flash.

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the restraints control module (RCM) to complete the testing of the SRS. If the air bag warning indicator is inoperative and an SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator will need to be repaired before diagnosis can continue.

Supplemental Restraint System (SRS) Reconnect Checklist

The checklist below should be completed following diagnosis or repair of any air bag system concern:

- All in-seat harness connectors connected?
- All air bag modules connected?
- Occupant classification system module (OCSM) connected?
- All OCS weight sensor bolts connected?
- Safety canopy modules connected?
- Safety belt pretensioner connectors connected?
- All sensors (front and side impact sensors) connected?
- Restraints control module (RCM) connected?
- RCM fuse installed?
- Battery connected?

Air Bag Module Second Stage Deployment Check

Because the driver and passenger front air bags each have 2 deployment stages, it is possible that Stage 1 has deployed and Stage 2 has not.

If a front air bag module has deployed, it is **mandatory** that the front air bag module be remotely deployed using the appropriate air bag disposal procedure to make sure the second stage has been deployed.

- For information on driver or passenger air bag module remote deployment, refer to **Pyrotechnic Device Disposal**.

Glossary

Disconnect the Component

Disconnect the component means to disconnect the component vehicle harness connector, not to remove the component. Do not reconnect a disconnected component unless instructed to do so.

Deactivate the Supplemental Restraint System (SRS)

Deactivate the SRS means to carry out a deactivation procedure. Refer to **Supplemental Restraint System (SRS) Deactivation and Reactivation**.

Depower the SRS

Depower the SRS means to disconnect the battery and remove the restraints control module (RCM) fuse. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

Deployment Loop

The deployment loop is made up of the RCM, deployable device, air bag(s), safety belt pretensioners (safety canopies, deployable steering columns, load limiting retractor, adaptive tether, adaptive vent, if equipped) and associated circuits.

Install a New Component

Install a new component means to remove the existing component and install a new authorized part obtained from Ford Customer Service Division.

Prove Out the SRS

Prove out the SRS means to turn the ignition switch from the OFF to the ON position and visually monitor the air bag warning indicator with all SRS components connected. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an SRS fault is present, the air bag warning indicator will either fail to light or remain lit continuously. The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and an SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator will need to be repaired before diagnosis can continue.

Reactivate the SRS

Reactivate the SRS means to carry out the reactivation procedure. Refer to **Supplemental Restraint System (SRS) Deactivation and Reactivation**.

Reconnect the SRS

Reconnect the SRS means to reconnect all system components. Refer to **Supplemental Restraint System (SRS) Reconnect Checklist**.

Repower the SRS

Repower the SRS means, turn the ignition ON, install the RCM fuse and connect the battery ground cable. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

Secondary Air Bag Warning

The secondary air bag warning is an audible fault format that consists of 5 sets of 5 tone bursts, with each set of 5 tone bursts separated by a 5-second quiet period. One tone burst cycle will consist of one-second ON and one-second OFF. The tone pattern will repeat periodically until the problem and warning light are repaired.

Squib

A squib (igniter) is a device designed to convert electrical energy to the heat energy necessary to deploy a pyrotechnic restraints system device.

Verify the System

Verify the system means to prove out the SRS with all restraint system components in place.

Inspection and Verification

1. Verify the customer concern by checking the air bag warning indicator in the instrument cluster. Prove Out the System. Refer to step 4 under **Repowering Procedure**.
2. Visually inspect for obvious signs of mechanical or electrical damage. Do not disconnect electrical connectors until directed to do so within the pinpoint test.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Damaged restraints control module (RCM) or loose mounting • Damaged front impact severity sensor(s) or loose mounting • Damaged side impact sensor(s) or loose mounting	• Open smart junction box (SJB) fuse 46 (7.5A) • Damaged wiring harness

• Damaged or disconnected passenger air bag deactivation (PAD) indicator • Damaged front passenger seat track assembly • Damaged occupant classification sensor (OCS) weight sensor bolt(s) or loose mounting	• Loose, damaged or corroded connectors • Circuitry open/shorted • Damaged shorting bars • Loose, damaged or pinched passenger seat wire harness

NOTE: The smart junction box (SJB) may also be identified as the generic electronic module (GEM).

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record on-demand and continuous memory DTCs from the RCM and OCSM.
8. If the DTCs retrieved are related to the concern, go to Supplemental Restraint System (SRS) DTC Chart.

For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.

9. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

The DTCs can be retrieved from the restraints control module (RCM) and the occupant classification system module (OCSM) with a scan tool via the data link connector (DLC).

RESTRAINTS CONTROL MODULE (RCM) DTC CHART

DTC[a]	Description	Retrieved From	Action To Take
Continuous lamp	The Air Bag Warning Indicator is Illuminated Continuously	Restraints control module (RCM)	Go to **Pinpoint Test A** .
B1231	Event Threshold Exceeded	RCM	INSTALL a new RCM and impact sensors. REFER to **Inspection and Repair After a Supplemental Restraint System (SRS) Deployment**.
B1317	Battery Voltage High	RCM	CHECK battery voltage; to be below 18 volts. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1318	Battery Voltage Low	RCM	CHECK battery voltage; to be above 8 volts. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1342	ECU (RCM) Is Faulted	RCM	INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**.
B1868	Lamp Air Bag Warning Indicator Circuit Failure	RCM	Go to **Pinpoint Test C** .
B1884	PAD Warning Lamp Circuit Failure	RCM	Go to **Pinpoint Test D** .
B1890	PAD Warning Lamp Circuit Short to Battery	RCM	Go to **Pinpoint Test E** .
B2290	Occupant Classification System Fault	RCM	**NOTE:** **If no on-demand or continuous DTC is present in the OCSM and DTC B2290 is only present in the RCM as a continuous DTC, CLEAR all RCM DTCs and PROVE OUT the system.** **NOTE:** **On-Demand DTC B2290 is reported by the RCM indicating the presence of a fault in the OCS system.**

			Go to **Pinpoint Test F** .
B2292	Restraint System - Seatbelt Pretensioner Fault	RCM	Go to **Pinpoint Test G** .
B2293	Restraint System - Air Bag Fault	RCM	Go to **Pinpoint Test H** .
B2294	Restraint System - Curtain Fault	RCM	Go to **Pinpoint Test I** .
B2295	Restraint System - Side Air Bag Fault	RCM	Go to **Pinpoint Test J** .
B2296	Restraint System - Impact Sensor Fault	RCM	Go to **Pinpoint Test K** .
B2432	Drivers Seat Belt Buckle Switch Circuit Open	RCM	Go to **Pinpoint Test L** .
B2433	Drivers Seat Belt Buckle Switch Circuit Short to Battery	RCM	Go to **Pinpoint Test M** .
B2434	Drivers Seat Belt Buckle Switch Circuit Short to Ground	RCM	Go to **Pinpoint Test N** .
B2435	Drivers Seat Belt Buckle Switch Resistance Out of Range	RCM	Go to **Pinpoint Test O** .
B2436	Passengers Seat Belt Buckle Switch Circuit Open	RCM	Go to **Pinpoint Test P** .
B2437	Passengers Seat Belt Buckle Switch Circuit Short to Battery	RCM	Go to **Pinpoint Test Q** .
B2438	Passengers Seat Belt Buckle Switch Short to Ground	RCM	Go to **Pinpoint Test R** .
B2439	Passengers Seat Belt Buckle Switch Resistance Out of Range	RCM	Go to **Pinpoint Test S** .
B2477	Module Configuration Failure	RCM	**NOTE:** **When installing a new RCM, always make sure the correct RCM is being installed. If an incorrect RCM is installed, erroneous DTCs will result.** INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**.
B2792	Cross Link Between Firing Loops	RCM	Go to **Pinpoint Test T** .
	Incorrect Module Design		INSTALL a new RCM. REFER to

C1414	Level	RCM	**Restraints Control Module (RCM)**.
C1946	Front Driver's Seat Track Position Switch Circuit Open	RCM	Go to **Pinpoint Test V** .
C1947	Front Driver's Seat Track Position Switch Circuit Short to Ground	RCM	Go to **Pinpoint Test W** .
C1948	Front Driver's Seat Track Position Switch Circuit Resistance Out of Range	RCM	Go to **Pinpoint Test X** .
C1982	Front Driver's Seat Track Position Switch Circuit Short to Battery	RCM	Go to **Pinpoint Test Y** .
U0100	Lost Communication With ECM/PCM	RCM	REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the communication concern.
U0154	Lost Communication With Restraints Occupant Classification System Module	RCM	REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the communication concern.
U0401	Invalid Data received From ECM/PCM A	RCM	RETRIEVE PCM DTCs. If DTCs are present in the PCM, REFER to **Introduction - Gasoline Engines** article to diagnose the concern. If DTCs are not present in the PCM and DTC U0401 is present in the RCM as a on-demand DTC, INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**.
U0455	Invalid Data Received From Restraints Occupant Classification System Module	RCM	REPAIR all on-demand OCS DTCs, CLEAR all RCM DTCs and PROVE OUT the system. If no on-demand or continuous DTCs are present in the OCSM and DTC U0455 is only present in the RCM continuous, CLEAR all RCM DTCs and PROVE OUT the system. If no on-demand or continuous DTCs are present in the OCSM and DTC U0455 is present on-demand in the RCM, INSTALL a new OCSM. REFER to **Occupant Classification System Module (OCSM) - Manual Seat Track** or **Occupant Classification System Module**

			(OCSM) - Power Seat Track.
U2050	No Application Present	RCM	INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**.
U2051	One or More Calibration Files Missing/Corrupt	RCM	INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**.

[a] DTC: Retrieved using scan tool.

OCCUPANT CLASSIFICATION SENSOR (OCS) SYSTEM DTC CHART

DTC[a]	Description	Retrieved From	Action To Take
B229B	Occupant Classification System Obstruction	Occupant classification system module (OCSM)	**NOTE:** **If no on-demand or continuous DTC is present in the RCM and DTC B229B is only present in the OCSM as continuous, RESOLVE and CLEAR all OCSM DTCs and PROVE OUT the SRS.** Go to **Pinpoint Test U** .
B1013	Occupant Classification System Calibration Fault	OCSM	Go to **Pinpoint Test Z** .
B1231	Event Threshold Exceeded	OCSM	INSTALL a new passenger seat track assembly with OCS weight sensor bolts. REFER to **SEATING** article and **Inspection and Repair After a Supplemental Restraint System (SRS) Deployment**.
B1317	Battery Voltage High	OCSM	**NOTE:** **If no on-demand or continuous DTC is present in the RCM and DTC B1317 is only present in the OCSM continuous, CLEAR all OCSM DTCs and PROVE OUT the system.** CHECK battery voltage; to be below 18 volts. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1318	Battery Voltage Low	OCSM	**NOTE:** **If no on-demand or continuous DTC is present in the RCM and DTC B1318 is only present in the OCSM continuous, CLEAR all OCSM DTCs and PROVE OUT the system.** CHECK battery voltage; to be above 8 volts. REFER to **CHARGING**

			SYSTEM - GENERAL INFORMATION article.
B1342	ECU (OCSM) is Faulted	OCSM	Go to **Pinpoint Test B** .
B2290	Occupant Classification System Fault	OCSM	Go to **Pinpoint Test F** .
C1941	Zero Seat Weight Test Failure	OCSM	REFER to **Occupant Classification Sensor (OCS) System Zero Seat Weight Test**.
U0100	Lost Communication With ECM/PCM	OCSM	REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the communication concern.
U0151	Lost Communication With Restraints Control Module	OCSM	REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the communication concern.
U2023	Fault Received From External Node	OCSM	DTC is set when a module receives invalid network data from another module with a faulted input. RETRIEVE and REPAIR all non-network DTCs in the other modules on the network. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article for a list of all DTCs.
U2050	No Application Present	OCSM	INSTALL a new OCSM.

[a] DTC: Retrieved using scan tool.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• Air bag warning indicator is illuminated continuously	• Fuse • DTC • Wiring, terminals or connectors • Faulty data link connector (DLC) • Restraint control module (RCM)	• Go to **Pinpoint Test A** .
• Air bag warning indicator	• RCM not	• CARRY OUT programmable module installation (PMI). REFER to **MODULE CONFIGURATION** article. If the air bag warning indicator

flashing at 5 Hz rate	configured	is flashing or has a continuous light after carrying out PMI, REFER to **DTC Charts** to diagnose the concern.
• Audible tone - DTCs retrieved	• SRS fault and air bag warning indicator fault	• REFER to **DTC Charts** .
• No communication with the restraints control module (RCM)	• Fuse • Circuitry • Scan tool • RCM	• REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the no communication concern.
• No communication with the occupant classification system module (OCSM)	• Fuse • Circuitry • Scan tool • OCSM	• REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the no communication concern.

Pinpoint Test - Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

Pinpoint Test A: The Air Bag Warning Indicator is Illuminated Continuously

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

During normal operation, the instrument cluster (IC) module will illuminate the air bag indicator continuously for 6 seconds after the ignition switch is placed to the RUN or ON position. If the supplemental restraint system (SRS) is fault free, the air bag warning indicator will turn off and remain off. If a fault is detected in the SRS, the air bag warning indicator will illuminate and remain illuminated for the rest of the key cycle. The restraints control module (RCM) will communicate to the IC module via the high-speed controller area network (HS-CAN). The IC module will illuminate the air bag indicator based on messaging from the RCM or if there is no communication between the RCM and IC module.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- IC module
- RCM

PINPOINT TEST A: THE AIR BAG WARNING INDICATOR IS ILLUMINATED CONTINUOUSLY

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in**

the accidental deployment of the safety canopy and cause serious personal injury or death.

WARNING: **Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.**

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

A1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Were any continuous memory or on-demand DTCs retrieved?**

  YES : If on-demand or continuous memory DTCs were retrieved, go to the **DTC Charts** for diagnostic direction.

  Do not clear any DTCs until all DTCs have been resolved.

  NO : If the RCM **does** communicate with the scan tool, REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES** article to diagnose the IC module concern.

  If the RCM **does not** communicate with the scan tool, REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the no communication concern.

  Do not clear any DTCs until all DTCs have been resolved.

Pinpoint Test B: DTC B1342 - ECU (OCSM) is Faulted

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The occupant classification sensor (OCS) system is used to classify the front passenger seat occupant in the event of a deployable impact. Refer to **Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)**.

The occupant classification system module (OCSM) monitors internal circuity, hardware and the 4 OCS weight sensor bolts and external circuitry for faults. If the OCSM detects a fault with the internal circuitry, internal hardware, sensor(s) or external circuitry, it will store DTC B1342 in memory and send a message to the restraints control module (RCM). A short to ground on any one of the sensor reference voltage circuits or an open on 3 or more of the sensor reference voltage circuits may set this DTC. The RCM will store DTC B2290 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

Fault PIDs[a]	Description	Fault Trigger Condition
1342_27_OD and 1342_27_CM	Memory Fault	When the OCSM senses a internal hardware failure, a fault will be indicated.
1342_28_OD and 1342_28_CM	Microcontroller Internal Fault	When the OCSM senses a internal failure, a fault will be indicated.
1342_29_OD and 1342_29_CM	Satellite ASIC Fault	When the OCSM senses a internal hardware failure, a fault will be indicated.
1342_30_OD and 1342_30_CM	Power Supply Internal Fault	When the OCSM senses a failure with the internal power supply, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B1342. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B1342.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Incorrectly wired OCS weight sensors
- OCS system component

PINPOINT TEST B: DTC B1342 - ECU IS FAULTED (OCS)

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of**

serious personal injury or death.

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

B1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - OCSM - View and Record All B1342 Fault PIDs
- **Do any OCSM on-demand B1342 fault PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to B2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to B8.

B2 CHECK THE SEAT WIRING AND CONNECTORS

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Carry out a thorough visual inspection of the OCS system wiring, terminals and connectors and the related seat wiring harness and body wiring harness terminals and connectors.
- **Were any wire problems noted?**

  YES : REPAIR the seat connectors and wiring as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to B9.

NO : Using the fault PIDs recorded in step B1, go to the appropriate pinpoint test step.

For 1342_30_OD (Power Supply Internal Fault), go to B3.

For 1342_28_OD (Microcontroller Internal Fault), 1342_29_OD (Satellite ASIC Fault) or 1342_27_OD (Memory Fault), INSTALL a new OCSM. REFER to **Occupant Classification System Module (OCSM) - Manual Seat Track** or **Occupant Classification System Module (OCSM) - Power Seat Track**. Go to B9.

B3 CHECK THE OCS WEIGHT SENSOR BOLT CIRCUITS FOR A SHORT TO GROUND

- Disconnect: OCS Weight Sensor Bolt C3324, C3325, C3330 and C3331
- Disconnect: OCSM C3159

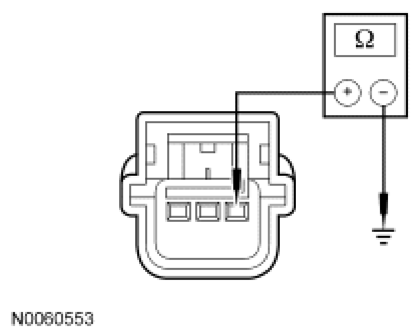


Fig. 2: Measuring Resistance Between OCS Weight Sensor Bolt 1 C3324-1 & Bolt 2 C3325-1, CR140 (YE/GN) & CR141 (BN/YE)
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 1 C3324-1, circuit CR140 (YE/GN), harness side and ground; between OCS weight sensor bolt 2 C3325-1, circuit CR141 (BN/YE), harness side and ground; between OCS weight sensor bolt 3 C3330-1, circuit CR153 (GN/WH), harness side and ground; and between OCS weight sensor bolt 4 C3331-1, circuit CR154 (VT/OG), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to B4.

  NO : REPAIR circuit CR140 (YE/GN), circuit CR141 (BN/YE), circuit CR153 (GN/WH) or circuit CR154 (VT/OG). Go to B9.

B4 CHECK FOR A SHORT BETWEEN THE OCS WEIGHT SENSOR BOLT CIRCUITS

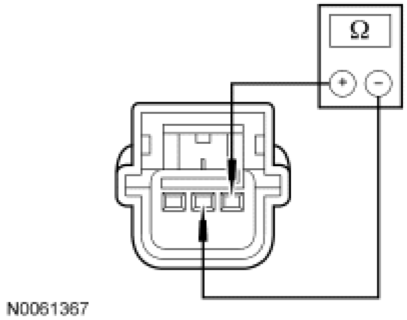


Fig. 3: Measuring Resistance Between OCS Weight Sensor Bolt 1 C3324-1 & Bolt 2 C3325-1, CR140 (YE/GN) & CR141 (BN/YE)
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor:
  - bolt 1 C3324-1, circuit CR140 (YE/GN), harness side and C3324-2, circuit RR140 (GN/OG), harness side; and
  - bolt 2 C3325-1, circuit CR141 (BN/YE), harness side and C3325-2, circuit RR141 (VT/BN), harness side; and
  - bolt 3 C3330-1, circuit CR153 (GN/WH), harness side and C3330-2, circuit RR153 (GY/BU), harness side; and
  - bolt 4 C3331-1, circuit CR154 (VT/OG), harness side and C3331-2, circuit RR154 (VT/WH), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to B5.

  NO : REPAIR circuits CR140 (YE/GN) and RR140 (GN/OG), CR141 (BN/YE) and RR141 (VT/BN), CR153 (GN/WH) and RR153 (GY/BU) or CR154 (VT/OG) and RR154 (VT/WH). Go to B9.

B5 CHECK THE OCS WEIGHT SENSOR BOLT CIRCUITS FOR AN OPEN

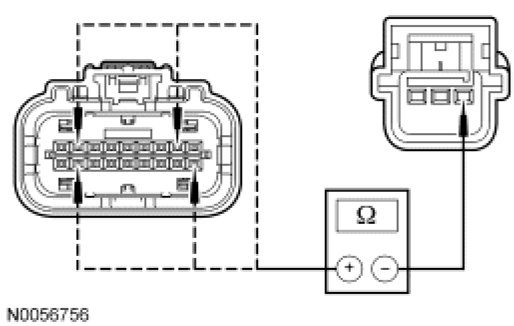


Fig. 4: Measuring Resistance Between OCS Weight Sensor Bolt 1 C3324-1 & Bolt 2 C3325-1, CR140 (YE/GN) & CR141 (BN/YE)
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor:

- bolt 1 C3324-1, circuit CR140 (YE/GN), harness side and OCSM C3159-2, circuit CR140 (YE/GN), harness side; and
- bolt 2 C3325-1, circuit CR141 (BN/YE), harness side and OCSM C3159-10, circuit CR141 (BN/YE), harness side; and
- bolt 3 C3330-1, circuit CR153 (GN/WH), harness side and OCSM C3159-8, circuit CR153 (GN/WH), harness side; and
- bolt 4 C3331-1, circuit CR154 (VT/OG), harness side and OCSM C3159-17, circuit CR154 (VT/OG), harness side.

- **Are the resistances less than 5 ohms?**

  YES : Go to B6.

  NO : REPAIR circuit CR140 (YE/GN), circuit CR141 (BN/YE), circuit CR153 (GN/WH) or circuit CR154 (VT/OG). Go to B9.

B6 CHECK CIRCUITS CR140 (YE/GN), CR141 (BN/YE), CR153 (GN/WH) AND CR154 (VT/OG) FOR A SHORT TO VOLTAGE

- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

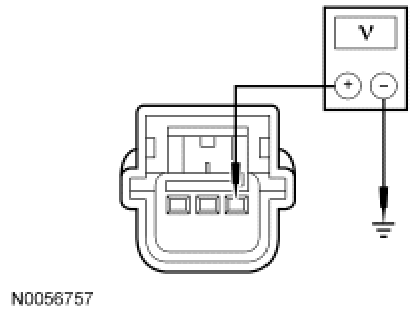


Fig. 5: Measuring Voltage Between OCS Weight Sensor Bolt 1 C3324-1 & Bolt 2 C3325-1, CR140 (YE/GN) & CR141 (BN/YE)
Courtesy of FORD MOTOR CO.

- Measure the voltage between OCS weight sensor:
  - bolt 1 C3324-1, circuit CR140 (YE/GN), harness side and ground; and
  - bolt 2 C3325-1, circuit CR141 (BN/YE), harness side and ground; and
  - bolt 3 C3330-1, circuit CR153 (GN/WH), harness side and ground; and
  - bolt 4 C3331-1, circuit CR154 (VT/OG), harness side and ground.
- **Are the voltages less than 0.2 volt?**

  YES : Go to B7.

  NO : REPAIR circuit CR140 (YE/GN), circuit CR141 (BN/YE), circuit CR153 (GN/WH) or circuit CR154 (VT/OG). Go to B9.

B7 CONFIRM THE OCS MODULE FAULT

NOTE: **Make sure all restraint system sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: OCSM C3159
- Connect: OCS Weight Sensor Bolt Electrical Connectors
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - OCSM - View and Record All B1342 Fault PIDs
  - Refer to PID list in Normal Operation to view B1342 fault PIDs.
- **Do any OCSM on-demand B1342 fault PIDs indicate a fault?**

  YES : INSTALL a new OCSM. REFER to **Occupant Classification System Module (OCSM) - Manual Seat Track** or **Occupant Classification System Module (OCSM) - Power Seat Track**. Go to B9.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of any electrical connector that were disconnected. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to B8.

B8 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Carry out a thorough visual inspection of the OCS system wiring, terminals and connectors and the related seat wiring harness and body wiring harness terminals and connectors.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - OCSM - View and Record All B1342 Fault PIDs
  - Refer to PID list in Normal Operation to view B1342 fault PIDs.
- **Does the original OCSM on-demand DTC B1342 fault PID indicate a fault?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to B2.

  NO : CHECK for causes of intermittent open or short to ground on circuit CR140 (YE/GN), circuit CR141 (BN/YE), circuit CR153 (GN/WH) or circuit CR154 (VT/OG). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS**

components should only be installed when directed to do so in the pinpoint test. REPAIR any intermittent wiring, terminal or connector concerns found. Go to B9.

B9 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

> WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
    - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test C: DTC B1868 - Lamp Air Bag Warning Indicator Circuit Failure

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

During normal operation, the air bag warning indicator will illuminate continuously for approximately 6 seconds and then go out after the ignition switch is placed in the ON position and no air bag fault exists. Control of the air bag warning indicator is a function of the instrument cluster (IC) module based on information it receives from the restraints control module (RCM) over the high-speed controller area network (HS-CAN). The default mode for the air bag warning indicator is on. The RCM sends a message to the IC module to turn the indicator off if no air bag fault exists. If the RCM detects a problem with the supplemental restraints system (SRS) it will send a message to the IC module to turn the air bag warning indicator on.

If the IC module detects a problem with the air bag warning indicator, it will send a fault message to the RCM and the RCM will store DTC B1868 in memory.

- DTC B1868 Lamp Air Bag Warning Indicator Circuit Failure - If the RCM receives a message from the IC module of an air bag warning indicator failure, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- IC module

- RCM

PINPOINT TEST C: DTC B1868 - LAMP AIR BAG WARNING INDICATOR CIRCUIT FAILURE

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: **The SRS must be fully operational and free of faults before releasing the vehicle to the customer.**

C1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was on-demand DTC B1868 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to C2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. CHECK the IC module for

DTCs and REPAIR as needed. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES** article. Go to C4.

C2 CHECK FOR IC MODULE ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - IC Module - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Were any continuous memory or on-demand self test DTCs retrieved?**

  YES : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES** article to diagnosis IC module concerns. Go to C4.

  NO : If the IC module **does** communicate with the scan tool, go to C3.

  If the IC module **does not** communicate with the scan tool, REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the HS-CAN concern. Go to C4.

C3 CHECK THE IC MODULE

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - IC Module - Active Command - All_Lamp
- **Does the air bag warning indicator turn on and off when using the active command?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to C4.

  NO : INSTALL a new IC module. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES** article. Go to C4.

C4 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

  WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test D: DTC B1884 - PAD Warning Lamp Circuit Failure

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and

connector information.

Normal Operation

When the ignition is in the ON position, the passenger air bag deactivation (PAD) indicator prove-out period is initiated by the restraints control module (RCM). The RCM briefly activates the PAD indicator to verify to the occupants correct functional operation of the PAD indicator. Refer to **Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)**.

If the RCM detects an open or short to ground on the PAD indicator circuit, it will store DTC B1884 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC B1884 PAD Warning Lamp Circuit Failure - If the RCM detects an open circuit or short to ground on the PAD indicator circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- PAD indicator
- RCM

PINPOINT TEST D: DTC B1884 - PAD WARNING LAMP CIRCUIT FAILURE

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough**

inspection and verification before proceeding with the pinpoint test.

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: **The SRS must be fully operational and free of faults before releasing the vehicle to the customer.**

D1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was on-demand DTC B1884 retrieved?**

  YES : If the PAD indicator **does** illuminate, go to D2.

  If the PAD indicator **does not** illuminate, go to D4.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to D8.

D2 CHECK CIRCUIT CR116 (GN/WH) FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: PAD Indicator C2355

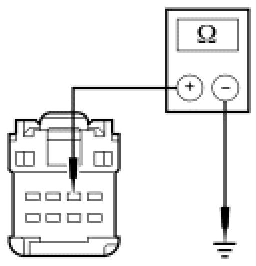


Fig. 6: Measuring Resistance Between PAD Indicator C2355-2, Circuit CR116 (GN/WH) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between PAD indicator C2355-2, circuit CR116 (GN/WH), harness side and ground.
- **Is resistance greater than 10,000 ohms?**

  YES : Go to D7.

  NO : Go to D3.

D3 CHECK THE RCM FOR LOW RESISTANCE

- Disconnect: RCM C310a and C310b

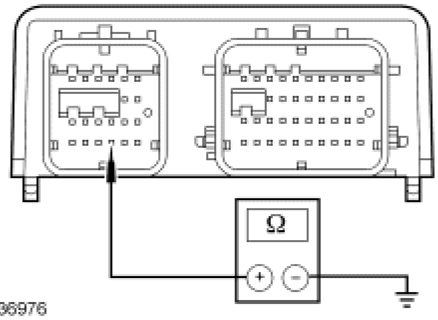


Fig. 7: Checking RCM For Low Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a pin 19, component side and ground.
- **Is resistance greater than 10,000 ohms?**

  YES : REPAIR circuit CR116 (GN/WH). Go to D9.

  NO : Go to D7.

D4 CHECK CIRCUIT CR116 (GN/WH) FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b
- Disconnect: PAD Indicator C2355

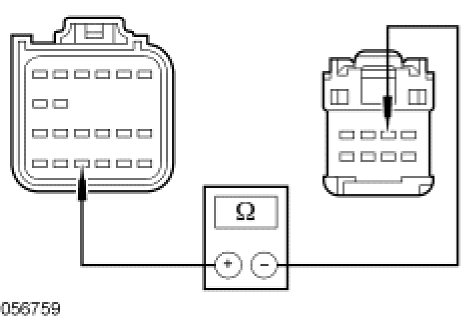


Fig. 8: Measuring Resistance Between PAD Indicator C2355-2, Circuit CR116 (GN/WH) & RCM C310A-19
Courtesy of FORD MOTOR CO.

- Measure the resistance between PAD indicator C2355-2, circuit CR116 (GN/WH), harness side and RCM C310a-19, circuit CR116 (GN/WH), harness side.
- **Is the resistance less than 0.5 ohm?**

  YES : Go to D5.

NO : REPAIR circuit CR116 (GN/WH). Go to D9.

D5 CHECK CIRCUIT CBP46 (WH/BU) FOR AN OPEN

- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

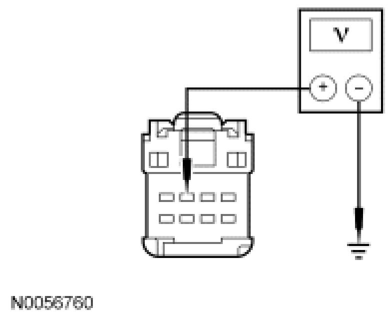


Fig. 9: Measuring Voltage Between PAD Indicator C2355-3, Circuit CBP46 (WH/BU) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between PAD indicator C2355-3, circuit CBP46 (WH/BU), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to D6.

  NO : REPAIR circuit CBP46 (WH/BU). Go to D9.

D6 CHECK THE PAD INDICATOR LAMP

- Key in OFF position.
- Deactivate the SRS. Refer to **Supplemental Restraint System (SRS) Deactivation and Reactivation**.
- Connect: PAD Indicator C2355
- Key in ON position.

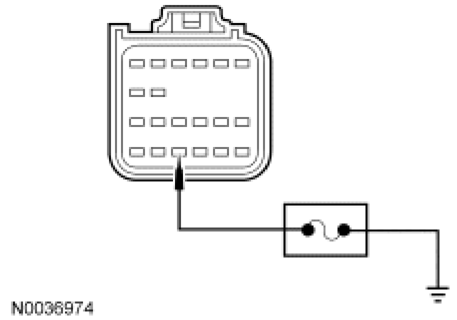


Fig. 10: Checking PAD Indicator Lamp
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between RCM C310a-19, circuit CR116 (GN/WH), harness side and ground.
- **Does the PAD indicator illuminate?**

  YES : Go to D7.

  NO : INSTALL a new PAD indicator. REFER to **Passenger Air Bag Deactivation (PAD) Indicator**. Go to D9.

D7 CONFIRM THE RCM FAULT

NOTE: Make sure all restraint system sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: PAD Indicator C2355 (if previously disconnected)
- Connect: RCM C310a and C310b (if previously disconnected)
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was on-demand DTC B1884 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to D9.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of any electrical connector that were disconnected. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to D8.

D8 CHECK FOR AN INTERMITTENT FAULT

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was on-demand DTC B1884 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to D2.

  NO : CHECK for causes of intermittent open or short to ground on circuit CR116 (GN/WH). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to D9.

D9 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
  - If previously directed to deactivate the SRS, reactivate the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Deactivation and Reactivation**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test E: DTC B1890 - PAD Warning Lamp Circuit Short to Battery

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

When the ignition is in the ON position, the passenger air bag deactivation (PAD) indicator prove-out period is initiated by the restraints control module (RCM). The RCM briefly activates the PAD indicator to verify to the occupants correct functional operation of the PAD indicator. Refer to **Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)**.

If the RCM detects a short to battery on the PAD indicator circuit, it will store DTC B1890 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC B1890 PAD Warning Lamp Circuit Short to Battery - If the RCM detects a short to battery on the PAD indicator circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- PAD indicator
- RCM

PINPOINT TEST E: DTC B1890 - PAD WARNING LAMP CIRCUIT SHORT TO BATTERY

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

E1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was on-demand DTC B1890 retrieved?**

  YES : Go to E2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to E4.

E2 CHECK CIRCUIT CR116 (GN/WH) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and**

Repowering.

- Disconnect: PAD Indicator C2355
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

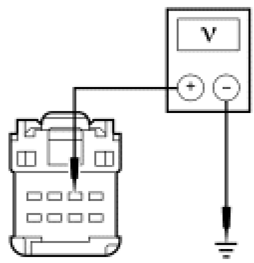


Fig. 11: Measuring Voltage Between PAD Indicator C2355-2, Circuit CR116 (GN/WH) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between PAD indicator C2355-2, circuit CR116 (GN/WH), harness side and ground.
- **Is the voltage less than 0.2 volt?**

  YES : Go to E3.

  NO : REPAIR circuit CR116 (GN/WH). Go to E5.

E3 CHECK THE RCM

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs

NOTE: **DTC B1884 should be retrieved when carrying out the on-demand self**

test due to an open on circuit CR116 (GN/WH). DTC B1890 should not be retrieved at this time.

- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the PAD indicator disconnected, a circuit failure fault would normally be retrieved.
- **Did the PAD warning lamp on-demand DTC change from indicating B1890 to B1884?**

  YES : INSTALL a new PAD indicator. Go to E5.

  NO : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to E5.

E4 CHECK FOR AN INTERMITTENT FAULT

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was on-demand DTC B1890 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to E2.

  NO : CHECK for causes of intermittent short to battery on circuit CR116 (GN/WH). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to E5.

E5 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test F: DTC B2290 - Occupant Classification System Fault

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

NOTE: **DTC B2290 reported by the restraint control module (RCM) is informational only and indicates the presence of a fault in the occupant classification system module (OCSM). Refer to DTC Charts when DTC B2290 is reported by the RCM for diagnostic instructions.**

NOTE: **The following pinpoint test must only be used to diagnose DTC B2290 when reported by the OCSM.**

Normal Operation

The occupant classification sensor (OCS) system is used to classify the front passenger seat occupant in the event of a deployable impact. Refer to **Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)**.

The OCSM monitors the 4 OCS weight sensor bolts and circuity for faults. If the OCSM detects a fault with the sensor(s) or circuitry, it will store DTC B2290 in memory and send a message to the RCM. The RCM will store DTC B2290 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

Fault PIDs[a]	Description	Fault Trigger Condition
2290_0_OD and 2290_0_CM	Passenger Seat OCS Sensor No. 4 Circuit Short to Battery	When the OCSM senses a short to voltage on the OCS weight sensor bolt No. 4 circuits, a fault will be indicated.
2290_1_OD and 2290_1_CM	Passenger Seat OCS Sensor No. 4 Circuit Short to Ground	When the OCSM senses a short to ground on the OCS weight sensor bolt No. 4 circuits, a fault will be indicated.
2290_2_OD and 2290_2_CM	Passenger Seat OCS Sensor No. 4 Comm. Fault/Open	When the OCSM senses a communication fault or open circuits on the OCS weight sensor bolt No. 4, a fault will be indicated.
2290_3_OD and 2290_3_CM	Passenger Seat OCS Sensor No. 4 Internal Fault	When the OCSM senses a internal fault with the OCS weight sensor bolt No. 4, a fault will be indicated.
2290_4_OD and 2290_4_CM	Passenger Seat OCS Sensor No. 3 Circuit Short to Battery	When the OCSM senses a short to voltage on the OCS weight sensor bolt No. 3 circuits, a fault will be indicated.
2290_5_OD and 2290_5_CM	Passenger Seat OCS Sensor No. 3 Circuit Short to Ground	When the OCSM senses a short to ground on the OCS weight sensor bolt No. 3 circuits, a fault will be indicated.
	Passenger Seat OCS Sensor	When the OCSM senses a communication fault or open circuits

2290_6_OD and 2290_6_CM	No. 3 Comm. Fault/Open	on the OCS weight sensor bolt No. 3, a fault will be indicated.
2290_7_OD and 2290_7_CM	Passenger Seat OCS Sensor No. 3 Internal Fault	When the OCSM senses a internal fault with the OCS weight sensor bolt No. 3, a fault will be indicated.
2290_8_OD and 2290_8_CM	Passenger Seat OCS Sensor No.2 Circuit Short to Battery	When the OCSM senses a short to voltage on the OCS weight sensor bolt No. 2 circuits, a fault will be indicated.
2290_9_OD and 2290_9_CM	Passenger Seat OCS Sensor No.2 Circuit Short to Ground	When the OCSM senses a short to ground on the OCS weight sensor bolt No. 2 circuits, a fault will be indicated.
2290_10_OD and 2290_10_CM	Passenger Seat OCS Sensor No.2 Comm. Fault/Open	When the OCSM senses a communication fault or open circuits on the OCS weight sensor bolt No. 2, a fault will be indicated.
2290_11_OD and 2290_11_CM	Passenger Seat OCS Sensor No.2 Internal Fault	When the OCSM senses a internal fault with the OCS weight sensor bolt No. 2, a fault will be indicated.
2290_12_OD and 2290_12_CM	Passenger Seat OCS Sensor No.1 Circuit Short to Battery	When the OCSM senses a short to voltage on the OCS weight sensor bolt No. 1 circuits, a fault will be indicated.
2290_13_OD and 2290_13_CM	Passenger Seat OCS Sensor No.1 Circuit Short to Ground	When the OCSM senses a short to ground on the OCS weight sensor bolt No. 1 circuits, a fault will be indicated.
2290_14_OD and 2290_14_CM	Passenger Seat OCS Sensor No.1 Comm. Fault/Open	When the OCSM senses a communication fault or open circuits on the OCS weight sensor bolt No. 1 circuits, a fault will be indicated.
2290_15_OD and 2290_15_CM	Passenger Seat OCS Sensor No.1 Internal Fault	When the OCSM senses a internal fault with the OCS weight sensor bolt No. 1 circuits, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2290. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2290.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- OCS system component

PINPOINT TEST F: DTC B2290 - OCCUPANT CLASSIFICATION SYSTEM FAULT

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: **The SRS must be fully operational and free of faults before releasing the vehicle to the customer.**

F1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - OCSM - View and Record All B2290 Fault PIDs
  - Refer to PID list in Normal Operation to view B2290 fault PIDs.
- **Do any OCSM on-demand DTC B2290 fault PIDs indicate a fault?**

YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to F2.

NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to F36.

F2 CHECK THE SEAT WIRING AND CONNECTORS

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Carry out a thorough visual inspection of the OCS system wiring, terminals and connectors and the related seat wiring harness and body wiring harness terminals and connectors.
- **Were any problems noted?**

  YES : REPAIR the seat connectors and wiring as needed. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to F37.

  NO : Using the fault PIDs recorded in step F1, go to the appropriate pinpoint test step.

  For 2290_3_OD (Passenger Seat OCS Sensor No. 4 Internal Fault), 2290_7_OD (Passenger Seat OCS Sensor No. 3 Internal Fault), 2290_11_OD (Passenger Seat OCS Sensor No.2 Internal Fault) or 2290_15_OD (Passenger Seat OCS Sensor No.1 Internal Fault), INSTALL a new OCS weight sensor bolt. REFER to **Occupant Classification Sensor - Manual Seat Track** or **Occupant Classification Sensor - Power Seat Track**.

  For 2290_14_OD (Passenger Seat OCS Sensor No.1 Comm. Fault/Open), go to F3.

  For 2290_13_OD (Passenger Seat OCS Sensor No.1 Circuit Short to Ground), go to F7.

  For 2290_12_OD (Passenger Seat OCS Sensor No.1 Circuit Short to Battery), go to F9.

  For 2290_10_OD (Passenger Seat OCS Sensor No.2 Comm. Fault/Open), go to F11.

  For 2290_9_OD (Passenger Seat OCS Sensor No.2 Circuit Short to Ground), go to F15.

  For 2290_8_OD (Passenger Seat OCS Sensor No.2 Circuit Short to Battery), go to F17.

  For 2290_6_OD (Passenger Seat OCS Sensor No. 3 Comm. Fault/Open), go to F19.

  For 2290_5_OD (Passenger Seat OCS Sensor No. 3 Circuit Short to Ground), go to F23.

  For 2290_4_OD (Passenger Seat OCS Sensor No. 3 Circuit Short to Battery), go to F25.

  For 2290_2_OD (Passenger Seat OCS Sensor No. 4 Comm. Fault/Open), go to F27.

  For 2290_1_OD (Passenger Seat OCS Sensor No. 4 Circuit Short to Ground), go to F31.

For 2290_0_OD (Passenger Seat OCS Sensor No. 4 Circuit Short to Battery), go to F33.

F3 CHECK CIRCUITS CR140 (YE/GN), VR211 (WH/BN) AND RR140 (GN/OG) FOR AN OPEN

- Disconnect: OCSM C3159
- Disconnect: OCS Weight Sensor Bolt 1 C3324

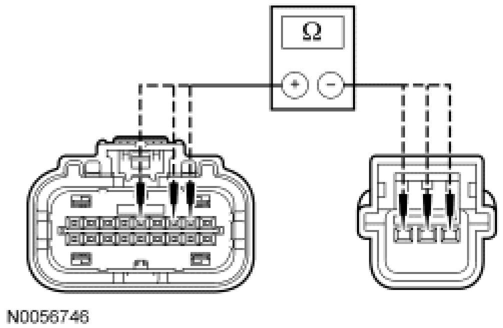


Fig. 12: Measuring Resistance Between OCSM C3159-5, Circuit VR211 (WH/BN) & OCS Weight Sensor Bolt 1 C3324-3
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCSM C3159-5, circuit VR211 (WH/BN), harness side and OCS weight sensor bolt 1 C3324-3, circuit VR211 (WH/BN), harness side; between OCSM C3159-2, circuit CR140 (YE/GN), harness side and OCS weight sensor bolt 1 C3324-1, circuit CR140 (YE/GN), harness side; and between OCSM C3159-5, circuit RR140 (GN/OG), harness side and OCS weight sensor bolt 1 C3324-2, circuit RR140 (GN/OG), harness side.
- **Are the resistances less than 0.5 ohm?**

  YES : Go to F4.

  NO : REPAIR circuit CR140 (YE/GN), circuit VR211 (WH/BN) or circuit RR140 (GN/OG). Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to F37.

F4 CHECK FOR A SHORT BETWEEN CIRCUITS CR140 (YE/GN), VR211 (WH/BN) AND RR140 (GN/OG)

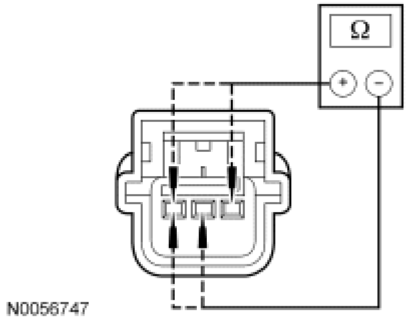


Fig. 13: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 1:
  - C3324-1, circuit CR140 (YE/GN), harness side and C3324-3, circuit VR211 (WH/BN), harness side.
  - C3324-1, circuit CR140 (YE/GN), harness side and C3324-2, circuit RR140 (GN/OG), harness side.
  - C3324-3, circuit VR211 (WH/BN), harness side and C3324-2, circuit RR140 (GN/OG), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to F5.

  NO : REPAIR the affected circuits, circuits CR140 (YE/GN), VR211 (WH/BN) and/or RR140 (GN/OG). Go to F37.

F5 CHECK CIRCUIT VR211 (WH/BN) FOR A SHORT TO VOLTAGE

- Disconnect: Passenger Seat Side Air Bag Module C327
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

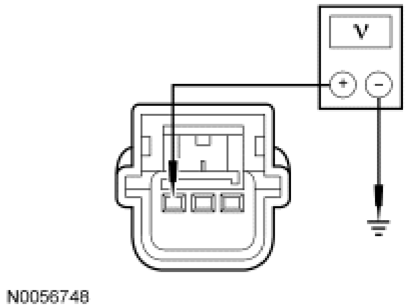


Fig. 14: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between OCS weight sensor bolt 1 C3324-3, circuit VR211 (WH/BN), harness side and ground.
- **Is the voltage less than 0.2 volt?**

  YES : Go to F6.

  NO : REPAIR circuit VR211 (WH/BN). Go to F37.

F6 CHECK CIRCUIT VR211 (WH/BN) FOR A SHORT TO GROUND

- Key in OFF position.

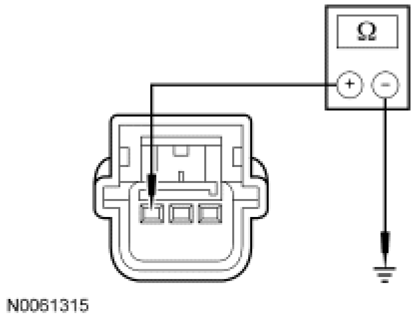


Fig. 15: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 1 C3324-3, circuit VR211 (WH/BN), harness side and ground.
- **Is resistance greater than 10,000 ohms?**

  YES : INSTALL a new OCS weight sensor bolt 1. REFER to **Occupant Classification Sensor - Manual Seat Track** or **Occupant Classification Sensor - Power Seat Track**. Go to F37.

  NO : REPAIR circuit VR211 (WH/BN). Go to F37.

F7 CHECK CIRCUIT VR211 (WH/BN) FOR A SHORT TO GROUND AND A SHORT TO CIRCUIT RR140 (GN/OG)

- Disconnect: OCS Weight Sensor Bolt 1 C3324
- Disconnect: OCSM C3159

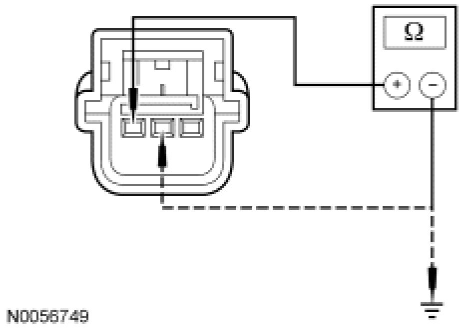


Fig. 16: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 1 C3324-3, circuit VR211 (WH/BN), harness side and ground; and between OCS weight sensor bolt 1 C3324-3, circuit VR211 (WH/BN), harness side and C3324-2, circuit RR140 (GN/OG), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to F8.

  NO : REPAIR circuit VR211 (WH/BN) and/or circuit RR140 (GN/OG). Go to F37.

F8 CHECK CIRCUIT CR140 (YE/GN) FOR AN OPEN

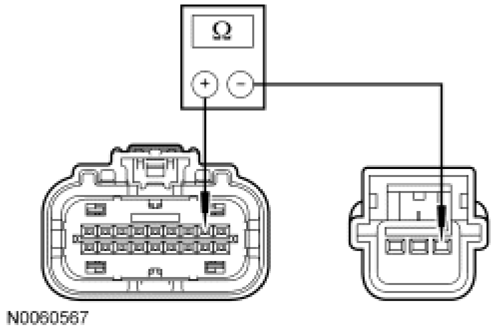


Fig. 17: Measuring Resistance Between OCS Weight Sensor Bolt 1 C3324-1, Circuit CR140 (YE/GN) & OCSM C3159-2
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 1 C3324-1, circuit CR140 (YE/GN), harness side and OCSM C3159-2, circuit CR140 (YE/GN), harness side.
- **Is the resistances less than 5 ohms?**

  YES : Go to F35.

  NO : REPAIR circuit CR140 (YE/GN). Go to F37.

F9 CHECK CIRCUIT RR140 (GN/OG) FOR AN OPEN

- Disconnect: OCS Weight Sensor Bolt 1 C3324

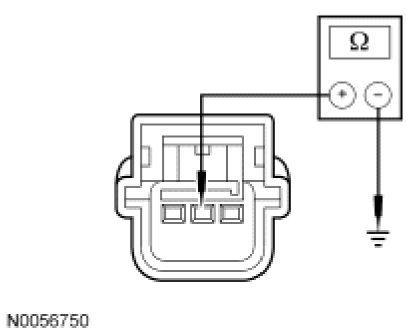


Fig. 18: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 1 C3324-2, circuit RR140 (GN/OG), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to F10.

  NO : REPAIR circuit RR140 (GN/OG). Go to F37.

F10 CHECK CIRCUIT VR211 (WH/BN) FOR A SHORT TO VOLTAGE

- Disconnect: Passenger Seat Side Air Bag Module C327
- Disconnect: OCSM C3159
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint**

System (SRS) Depowering and Repowering.

- Key in ON position.

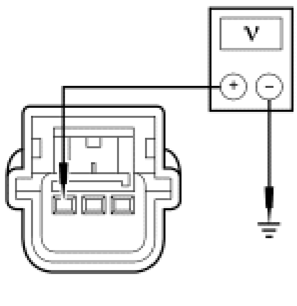


Fig. 19: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between OCS weight sensor bolt 1 C3324-3, circuit VR211 (WH/BN), harness side and ground.
- **Is the voltage less than 0.2 volt?**

  YES : Go to F35.

  NO : REPAIR circuit VR211 (WH/BN). Go to F37.

F11 CHECK CIRCUITS CR141 (BN/YE), VR212 (YE/GN) AND RR141 (VT/BN) FOR AN OPEN

- Disconnect: OCSM C3159
- Disconnect: OCS Weight Sensor Bolt 2 C3325

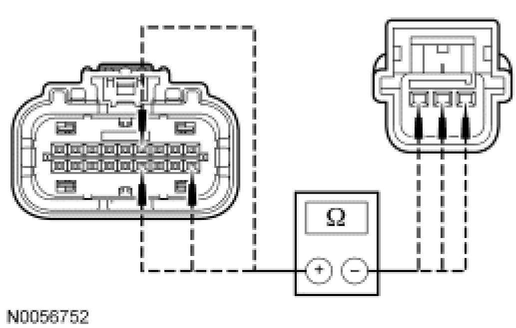


Fig. 20: Measuring Resistance Between OCSM C3159-4, Circuit VR212 (YE/GN) & OCS Sensor 2 C3325-3
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCSM C3159-4, circuit VR212 (YE/GN), harness side and OCS sensor 2 C3325-3, circuit VR212 (YE/GN), harness side; between OCSM C3159-10, circuit CR141 (BN/YE), harness side and OCS sensor 2 C3325-1, circuit CR141 (BN/YE), harness side; and between OCSM C3159-13, circuit RR141 (VT/BN), harness side and OCS sensor 2 C3325-2, circuit RR141 (VT/BN), harness side.
- **Are the resistances less than 0.5 ohm?**

YES : Go to F12.

NO : REPAIR circuit CR141 (BN/YE), circuit VR212 (YE/GN) or circuit RR141 (VT/BN). Go to F37.

F12 CHECK FOR A SHORT BETWEEN CIRCUITS CR141 (BN/YE), VR212 (YE/GN) AND RR141 (VT/BN)

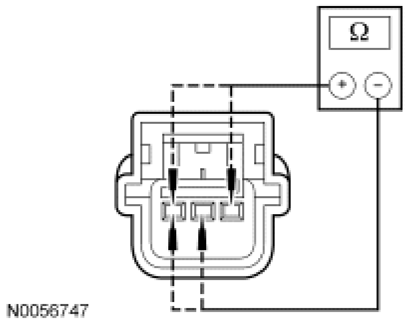


Fig. 21: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 2:
    - C3325-1, circuit CR141 (BN/YE), harness side and C3325-3, circuit VR212 (YE/GN), harness side.
    - C3325-1, circuit CR141 (BN/YE), harness side and C3325-2, circuit RR141 (VT/BN), harness side.
    - C3325-3, circuit VR212 (YE/GN), harness side and C3325-2, circuit RR141 (VT/BN), harness side.
- **Are the resistances greater than 10,0000 ohms?**

  YES : Go to F13.

  NO : REPAIR the affected circuits, circuits CR141 (BN/YE), VR212 (YE/GN) and/or RR141 (VT/BN). Go to F37.

F13 CHECK CIRCUIT VR212 (YE/GN) FOR A SHORT TO VOLTAGE

- Disconnect: Passenger Seat Side Air Bag Module C327
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

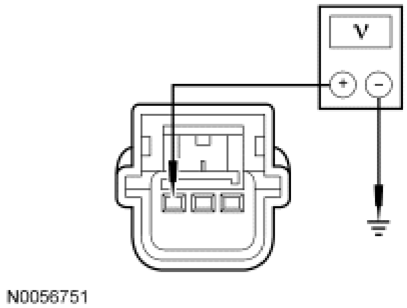


Fig. 22: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between OCS weight sensor bolt 2 C3325-3, circuit VR212 (YE/GN), harness side and ground.
- **Is the voltage less than 0.2 volt?**

YES : Go to F14.

NO : REPAIR circuit VR212 (YE/GN). Go to F37.

F14 CHECK CIRCUIT VR212 (YE/GN) FOR A SHORT TO GROUND

- Key in OFF position.

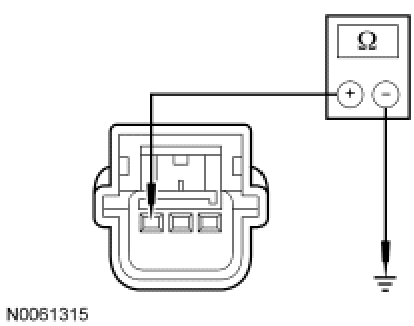


Fig. 23: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 2 C3325-3, circuit VR212 (YE/GN), harness side and ground.
- **Is resistance greater than 10,000 ohms?**

YES : INSTALL a new OCS weight sensor bolt 2. REFER to **Occupant Classification Sensor - Manual Seat Track** or **Occupant Classification Sensor - Power Seat Track**. Go to F37.

NO : REPAIR circuit VR212 (YE/GN). Go to F37.

F15 CHECK CIRCUIT VR212 (YE/GN) FOR A SHORT TO GROUND AND A SHORT TO CIRCUIT RR141 (VT/BN)

- Disconnect: OCS Weight Sensor Bolt 2 C3325
- Disconnect: OCSM C3159

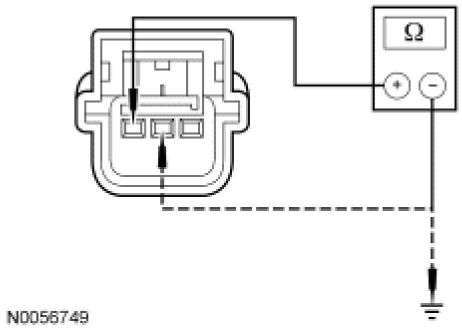


Fig. 24: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 2 C3325-3, circuit VR212 (YE/GN), harness side and ground; and between OCS weight sensor bolt 2 C3325-3, circuit VR212 (YE/GN), harness side and C3325-2, circuit RR141 (VT/BN), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to F16.

  NO : REPAIR circuits VR212 (YE/GN) and RR141 (VT/BN). Go to F37.

F16 CHECK CIRCUIT CR141 (BN/YE) FOR AN OPEN

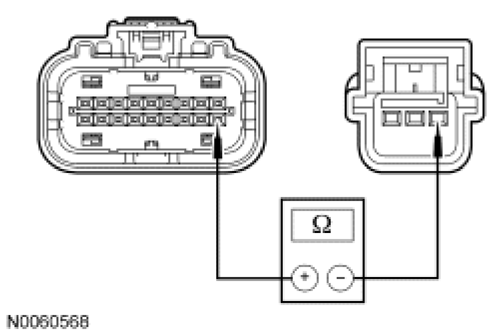


Fig. 25: Measuring Resistance Between OCS Weight Sensor Bolt 2 C3325-1, Circuit CR141 (BN/YE) & OCSM C3159-10
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 2 C3325-1, circuit CR141 (BN/YE), and OCSM C3159-10, circuit CR141 (BN/YE), harness side.
- **Is the resistances less than 5 ohms?**

  YES : Go to F35.

  NO : REPAIR circuit CR141 (BN/YE). Go to F37.

F17 CHECK CIRCUIT RR141 (VT/BN) FOR AN OPEN

- Disconnect: OCS Weight Sensor Bolt 2 C3325

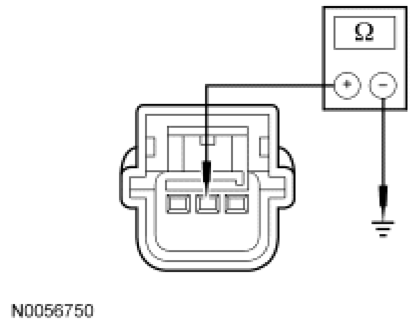


Fig. 26: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 2 C3325-2, circuit RR141 (VT/BN), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to F18.

  NO : REPAIR circuit RR141 (VT/BN). Go to F37.

F18 CHECK CIRCUIT VR212 (YE/GN) FOR A SHORT TO VOLTAGE

- Disconnect: Passenger Seat Side Air Bag Module C327
- Disconnect: OCSM C3159
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

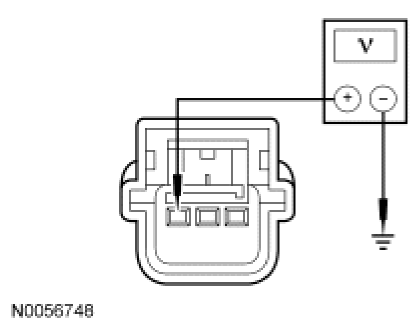


Fig. 27: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between OCS weight sensor bolt 2 C3325-3, circuit VR212 (YE/GN), harness side and ground.
- **Is the voltage less than 0.2 volt?**

  YES : Go to F35.

  NO : REPAIR circuit VR212 (YE/GN). Go to F37.

F19 CHECK CIRCUITS CR153 (GN/WH), VR226 (YE/GY) AND RR153 (GY/BU) FOR AN

OPEN

- Disconnect: OCSM C3159
- Disconnect: OCS Weight Sensor Bolt 3 C3330

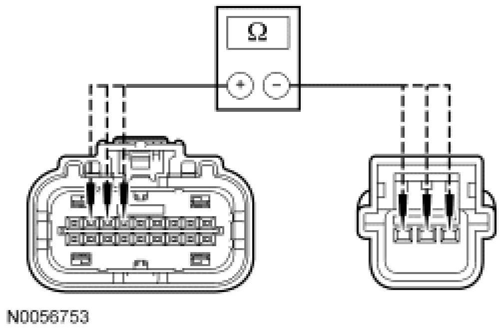


Fig. 28: Measuring Resistance Between OCSM C3159-7, Circuit VR226 (YE/GY) & OCS Weight Sensor Bolt 3 C3330-3
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCSM C3159-7, circuit VR226 (YE/GY), harness side and OCS weight sensor bolt 3 C3330-3, circuit VR226 (YE/GY), harness side; between OCSM C3159-8, circuit CR153 (GN/WH), harness side and OCS sensor 3 C3330-1, circuit CR153 (GN/WH), harness side; and between OCSM C3159-6, circuit RR153 (GY/BU), harness side and OCS sensor 3 C3330-2, circuit RR153 (GY/BU), harness side.
- **Are the resistances less than 0.5 ohm?**

  YES : Go to F20.

  NO : REPAIR circuits CR153 (GN/WH), VR226 (YE/GY) or RR153 (GY/BU). Go to F37.

F20 CHECK FOR A SHORT BETWEEN CIRCUITS CR153 (GN/WH), VR226 (YE/GY) AND RR153 (GY/BU)

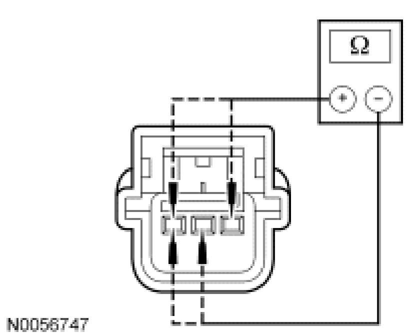


Fig. 29: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 3:
  - C3330-1, circuit CR153 (GN/WH), harness side and C3330-3, circuit VR226 (YE/GY), harness side.

  - C3330-1, circuit CR153 (GN/WH), harness side and C3330-2, circuit RR153 (GY/BU), harness side.
  - C3330-3, circuit VR226 (YE/GY), harness side and C3330-2, circuit RR153 (GY/BU), harness side.
- **Are the resistances greater than 10,0000 ohms?**

  YES : Go to F21.

  NO : REPAIR the affected circuits, circuits CR153 (GN/WH), VR226 (YE/GY) and/or RR153 (GY/BU). Go to F37.

F21 CHECK CIRCUIT VR226 (YE/GY) FOR A SHORT TO VOLTAGE

- Disconnect: Passenger Seat Side Air Bag Module C327
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

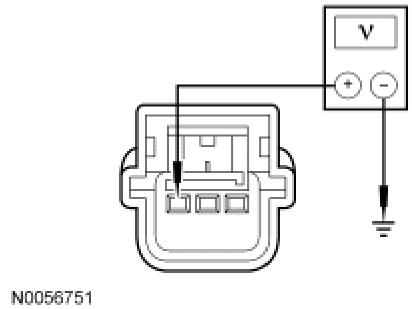


Fig. 30: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between OCS weight sensor bolt 3 C3330-3, circuit VR226 (YE/GY), harness side and ground.
- **Is the voltage less than 0.2 volt?**

  YES : Go to F22.

  NO : REPAIR circuit VR226 (YE/GY). Go to F37.

F22 CHECK CIRCUIT VR226 (YE/GY) FOR A SHORT TO GROUND

- Key in OFF position.

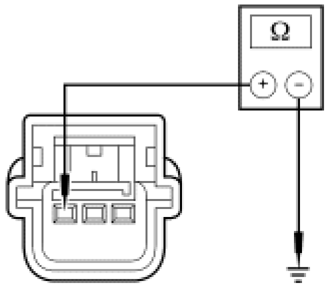


Fig. 31: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 3 C3330-3, circuit VR226 (YE/GY), harness side and ground.
- **Is resistance greater than 10,000 ohms?**

  YES : INSTALL a new OCS weight sensor bolt 3. REFER to **Occupant Classification Sensor - Manual Seat Track** or **Occupant Classification Sensor - Power Seat Track**. Go to F37.

  NO : REPAIR circuit VR226 (YE/GY). Go to F37.

F23 CHECK CIRCUIT VR226 (YE/GY) FOR A SHORT TO GROUND AND A SHORT TO CIRCUIT RR153 (GY/BU)

- Disconnect: OCS Weight Sensor Bolt 3 C3330
- Disconnect: OCSM C3159

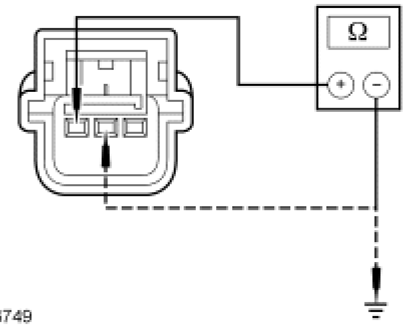


Fig. 32: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 3 C3330-3, circuit VR226 (YE/GY), harness side and ground; and between OCS weight sensor bolt 3 C3330-3, circuit VR226 (YE/GY), harness side and C3291-2, circuit RR153 (GY/BU), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to F24.

  NO : REPAIR circuits VR226 (YE/GY) and/or RR153 (GY/BU). Go to F37.

F24 CHECK CIRCUIT CR153 (GN/WH) FOR AN OPEN

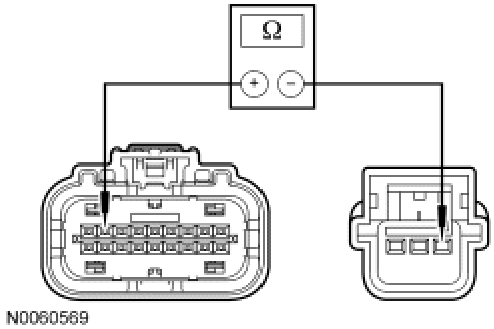


Fig. 33: Measuring Resistance Between OCS Weight Sensor Bolt 3 C3330-1, Circuit CR153 (GN/WH) & OCSM C3159-8
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 3 C3330-1, circuit CR153 (GN/WH), harness side and OCSM C3159-8, circuit CR153 (GN/WH), harness side.
- **Is the resistances less than 5 ohms?**

  YES : Go to F35.

  NO : REPAIR circuit CR153 (GN/WH). Go to F37.

F25 CHECK CIRCUIT RR153 (GY/BU) FOR AN OPEN

- Disconnect: OCS Weight Sensor Bolt 3 C3330

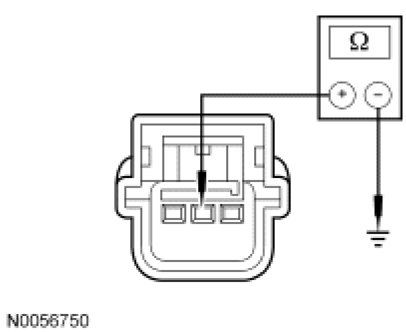


Fig. 34: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 3 C3330-2, circuit RR153 (GY/BU), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to F26.

  NO : REPAIR circuit RR153 (GY/BU). Go to F37.

F26 CHECK CIRCUIT VR226 (YE/GY) FOR A SHORT TO VOLTAGE

- Disconnect: Passenger Seat Side Air Bag Module C327
- Disconnect: OCSM C3159
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint**

System (SRS) Depowering and Repowering.

- Key in ON position.

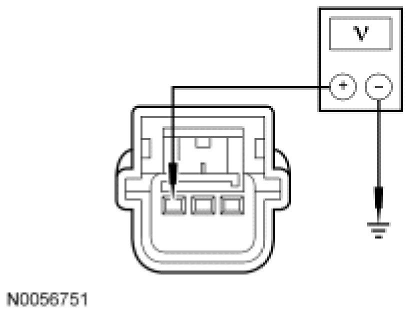


Fig. 35: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between OCS weight sensor bolt 3 C3330-3, circuit VR226 (YE/GY), harness side and ground.
- **Is the voltage less than 0.2 volt?**

  YES : Go to F35.

  NO : REPAIR circuit VR226 (YE/GY). Go to F37.

F27 CHECK CIRCUITS CR154 (VT/OG), VR227 (VT/GN) AND RR154 (VT/WH) FOR AN OPEN

- Disconnect: OCSM C3159
- Disconnect: OCS Weight Sensor Bolt 4 C3331

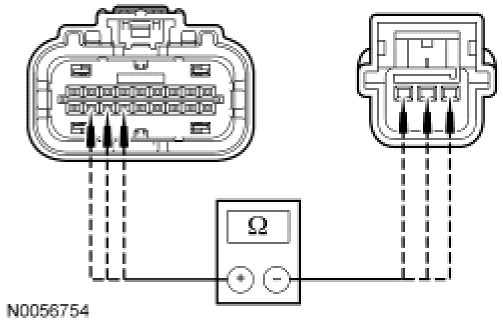


Fig. 36: Measuring Resistance Between OCSM C3159-16, Circuit VR227 (VT/GN) & OCS Weight Sensor Bolt 4 C3331-3
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCSM C3159-16, circuit VR227 (VT/GN), harness side and OCS weight sensor bolt 4 C3331-3, circuit VR227 (VT/GN), harness side; between OCSM C3159-17, circuit CR154 (VT/OG), harness side and OCS sensor 4 C3331-1, circuit CR154 (VT/OG), harness side; and between OCSM C3159-15, circuit RR154 (VT/WH), harness side and OCS sensor 4 C3331-2, circuit RR154 (VT/WH), harness side.

- **Are the resistances less than 0.5 ohm?**

  YES : Go to F28.

  NO : REPAIR circuit CR154 (VT/OG), circuit VR227 (VT/GN) or circuit RR154 (VT/WH). Go to F37.

F28 CHECK FOR A SHORT BETWEEN CIRCUITS CR154 (VT/OG), VR227 (VT/GN) AND RR154 (VT/WH)

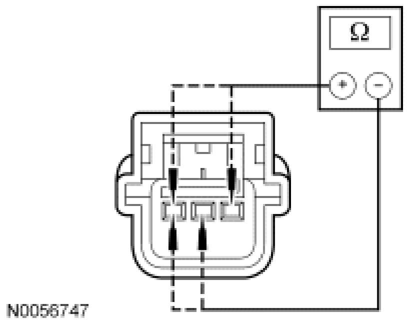


Fig. 37: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 4:
  - C3331-1, circuit CR154 (VT/OG), harness side and C3331-3, circuit VR227 (VT/GN), harness side.
  - C3331-1, circuit CR154 (VT/OG), harness side and C3331-2, circuit RR154 (VT/WH), harness side.
  - C3331-3, circuit VR227 (VT/GN), harness side and C3331-2, circuit RR154 (VT/WH), harness side.
- **Are the resistances greater than 10,0000 ohms?**

  YES : Go to F29.

  NO : REPAIR the affected circuits, circuits CR154 (VT/OG), VR227 (VT/GN) and/or RR154 (VT/WH). Go to F37.

F29 CHECK CIRCUIT VR227 (VT/GN) FOR A SHORT TO VOLTAGE

- Disconnect: Passenger Seat Side Air Bag Module C327
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

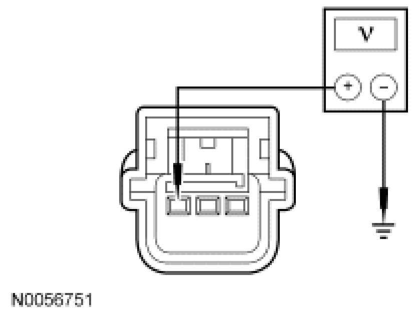


Fig. 38: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between OCS weight sensor bolt 4 C3331-3, circuit VR227 (VT/GN), harness side and ground.
- **Is the voltage less than 0.2 volt?**

  YES : Go to F30.

  NO : REPAIR circuit VR227 (VT/GN). Go to F37.

F30 CHECK CIRCUIT VR227 (VT/GN) FOR A SHORT TO GROUND

- Key in OFF position.

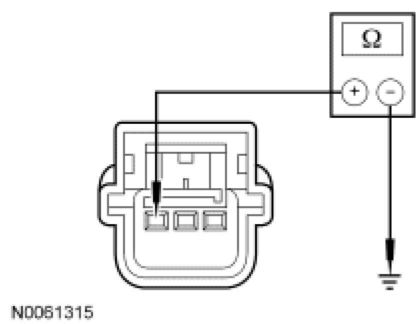


Fig. 39: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 4 C3331-3, circuit VR227 (VT/GN), harness side and ground.
- **Is resistance greater than 10,000 ohms?**

  YES : INSTALL a new OCS weight sensor bolt 4. REFER to **Occupant Classification Sensor - Manual Seat Track** or **Occupant Classification Sensor - Power Seat Track**. Go to F37.

  NO : REPAIR circuit VR227 (VT/GN). Go to F37.

F31 CHECK CIRCUIT VR227 (VT/GN) FOR A SHORT TO GROUND AND A SHORT TO CIRCUIT RR154 (VT/WH)

- Disconnect: OCSM C3159
- Disconnect: OCS Weight Sensor Bolt 4 C3331

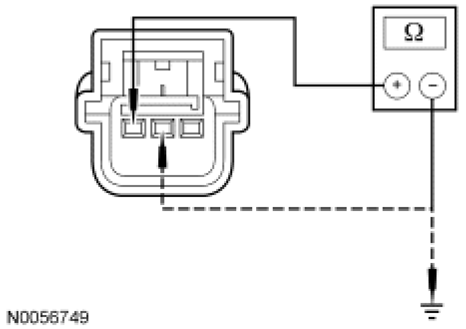


Fig. 40: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 4 C3331-3, circuit VR227 (VT/GN), harness side and ground; and between C3331-3, circuit VR227 (VT/GN), harness side and C3331-2, circuit RR154 (VT/WH), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to F32.

  NO : REPAIR circuits VR227 (VT/GN) and/or RR154 (VT/WH). Go to F37.

F32 CHECK CIRCUIT CR154 (VT/OG) FOR AN OPEN

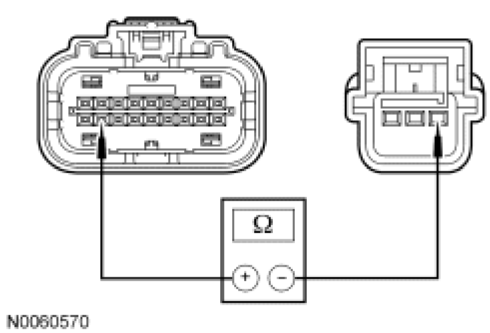


Fig. 41: Measuring Resistance Between OCS Weight Sensor Bolt 4 C3331-1, Circuit CR154 (VT/OG) & OCSM C3159-17
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 4 C3331-1, circuit CR154 (VT/OG), harness side and OCSM C3159-17, circuit CR154 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to F35.

  NO : REPAIR circuit CR154 (VT/OG). Go to F37.

F33 CHECK CIRCUIT RR154 (VT/WH) FOR AN OPEN

- Disconnect: OCS Weight Sensor Bolt 4 C3331

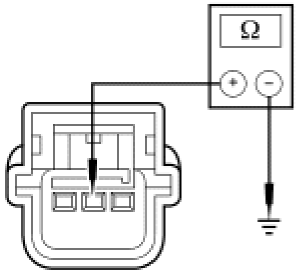


Fig. 42: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCS weight sensor bolt 4 C3331-2, circuit RR154 (VT/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to F34.

  NO : REPAIR circuit RR154 (VT/WH). Go to F37.

F34 CHECK CIRCUIT VR227 (VT/GN) FOR A SHORT TO VOLTAGE

- Disconnect: Passenger Seat Side Air Bag Module C327
- Disconnect: OCSM C3159
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

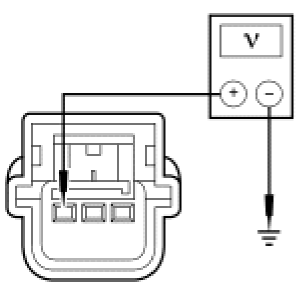


Fig. 43: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between OCS weight sensor bolt 4 C3331-3, circuit VR227 (VT/GN), harness side and ground.
- **Is the voltage less than 0.2 volt?**

  YES : Go to F35.

  NO : REPAIR circuit VR227 (VT/GN). Go to F37.

F35 CONFIRM THE OCS MODULE FAULT

NOTE: **Make sure all restraint system sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: OCSM C3159 (if previously disconnected)
- Connect: Affected OCS Weight Sensor Bolt Electrical Connector(s)
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - OCSM - View and Record All B2290 Fault PIDs
  - Refer to PID list in Normal Operation to view B2290 fault PIDs.
- **Does the original OCSM on-demand DTC B2290 fault PID indicate a fault?**

  YES : INSTALL a new OCSM. REFER to **Occupant Classification System Module (OCSM) - Manual Seat Track** or **Occupant Classification System Module (OCSM) - Power Seat Track**. Go to F37.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of any electrical connector that were disconnected. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to F36.

F36 CHECK FOR AN INTERMITTENT FAULT

- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - OCSM - View and Record All B2290 Fault PIDs
  - Refer to PID list in Normal Operation to view B2290 fault PIDs.
- **Do any OCSM on-demand DTC B2290 fault PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test.

  Using the fault PIDs recorded, go to the appropriate pinpoint test step.

  For 2290_3_OD (Passenger Seat OCS Sensor No. 4 Internal Fault), 2290_7_OD (Passenger Seat OCS Sensor No. 3 Internal Fault), 2290_11_OD (Passenger Seat OCS Sensor No.2 Internal Fault) or 2290_15_OD (Passenger Seat OCS Sensor No.1 Internal Fault), INSTALL a new OCS weight sensor bolt. REFER to **Occupant Classification Sensor - Manual Seat Track** or **Occupant Classification Sensor - Power Seat Track**.

For 2290_14_OD (Passenger Seat OCS Sensor No.1 Comm. Fault/Open), go to F3.

For 2290_13_OD (Passenger Seat OCS Sensor No.1 Circuit Short to Ground), go to F7.

For 2290_12_OD (Passenger Seat OCS Sensor No.1 Circuit Short to Battery), go to F9.

For 2290_10_OD (Passenger Seat OCS Sensor No.2 Comm. Fault/Open), go to F11.

For 2290_9_OD (Passenger Seat OCS Sensor No.2 Circuit Short to Ground), go to F15.

For 2290_8_OD (Passenger Seat OCS Sensor No.2 Circuit Short to Battery), go to F17.

For 2290_6_OD (Passenger Seat OCS Sensor No. 3 Comm. Fault/Open), go to F19.

For 2290_5_OD (Passenger Seat OCS Sensor No. 3 Circuit Short to Ground), go to F23.

For 2290_4_OD (Passenger Seat OCS Sensor No. 3 Circuit Short to Battery), go to F25.

For 2290_2_OD (Passenger Seat OCS Sensor No. 4 Comm. Fault/Open), go to F27.

For 2290_1_OD (Passenger Seat OCS Sensor No. 4 Circuit Short to Ground), go to F31.

For 2290_0_OD (Passenger Seat OCS Sensor No. 4 Circuit Short to Battery), go to F33.

NO : CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to F37.

F37 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

  WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test G: DTC B2292 - Restraint System - Seatbelt Pretensioner Fault

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) continuously monitors the safety belt retractor pretensioner circuits for an acceptable resistance range, unacceptable voltage and shorts to ground. The RCM will set on-demand and store DTC B2292 in memory if any of these conditions are detected to be outside of their respectful range. If the RCM detects a fault, it will send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

As the RCM continuously monitors safety belt retractor pretensioner circuits for resistance, it expects a normal resistance between 1.4 and 3.5 ohms.

If a loop resistance is between 0.9 and 1.4 or between 3.5 and 5 ohms, there exists a strong potential for an intermittent fault, a DTC may or may not set. The RCM will also set an on-demand DTC if the loop resistance is less than 0.9 ohm or greater than 5 ohms.

Fault PIDs[a]	Description	Fault Trigger Condition
2292_24_OD and 2292_24_CM	Pretensioner Circuit Short to Ground, Front Passenger Side	When the RCM senses a short to ground on either of the passenger pretensioner circuits, a fault will be indicated.
2292_25_OD and 2292_25_CM	Pretensioner Circuit Short to Battery, Front Passenger Side	When the RCM senses a short to voltage on either of the passenger pretensioner circuits, a fault will be indicated.
2292_26_OD and 2292_26_CM	Pretensioner Circuit Open, Front Passenger Side	When the RCM measures resistance greater than 5 ohms between the passenger pretensioner circuits, a fault will be indicated.
2292_27_OD and 2292_27_CM	Pretensioner Circuit Resistance Low, Front Passenger Side	When the RCM measures resistance less than 0.9 ohm between the passenger pretensioner circuits, a fault will be indicated.
2292_28_OD and 2292_28_CM	Pretensioner Circuit Short to Ground, Front Driver Side	When the RCM senses a short to ground on either of the driver pretensioner circuits, a fault will be indicated.

2292_29_OD and 2292_29_CM	Pretensioner Circuit Short to Battery, Front Driver Side	When the RCM senses a short to voltage on either of the driver pretensioner circuits, a fault will be indicated.
2292_30_OD and 2292_30_CM	Pretensioner Circuit Open, Front Driver Side	When the RCM measures resistance greater than 5 ohms between the driver pretensioner circuits, a fault will be indicated.
2292_31_OD and 2292_31_CM	Pretensioner Circuit Resistance Low, Front Driver Side	When the RCM measures resistance less than 0.9 ohm between the driver pretensioner circuits, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2292. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2292.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Safety belt retractor pretensioner
- RCM

PINPOINT TEST G: DTC B2292 - RESTRAINT SYSTEM - SEATBELT PRETENSIONER FAULT

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt**

pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: **The SRS must be fully operational and free of faults before releasing the vehicle to the customer.**

G1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2292 Fault PIDs
  - Refer to PID list in Normal Operation to view B2292 fault PIDs.
- **Was on-demand DTC B2292 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test.

  Using the fault PIDs recorded, go to the appropriate pinpoint test step.

  For 2292_31_OD (Pretensioner Circuit Resistance Low, Front Driver Side), go to G2.

  For 2292_30_OD (Pretensioner Circuit Open, Front Driver Side), go to G2.

  For 2292_28_OD (Pretensioner Circuit Short to Ground, Front Driver Side), go to G8.

  For 2292_29_OD (Pretensioner Circuit Short to Battery, Front Driver Side), go to G10.

  For 2292_27_OD (Pretensioner Circuit Resistance Low, Front Passenger Side), go to G11.

  For 2292_26_OD (Pretensioner Circuit Open, Front Passenger Side), go to G11.

  For 2292_24_OD (Pretensioner Circuit Short to Ground, Front Passenger Side), go to G17.

For 2292_25_OD (Pretensioner Circuit Short to Battery, Front Passenger Side), go to G19.

NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time.

Using the fault PIDs recorded, go to the appropriate pinpoint test step.

For 2292_31_CM (Pretensioner Circuit Resistance Low, Front Driver Side), 2292_30_CM (Pretensioner Circuit Open, Front Driver Side), 2292_27_CM (Pretensioner Circuit Resistance Low, Front Passenger Side) or 2292_26_CM (Pretensioner Circuit Open, Front Passenger Side), go to G22.

For 2292_28_CM (Pretensioner Circuit Short to Ground, Front Driver Side) or 2292_24_CM (Pretensioner Circuit Short to Ground, Front Passenger Side), go to G24.

For 2292_29_CM (Pretensioner Circuit Short to Battery, Front Driver Side) or 2292_25_CM (Pretensioner Circuit Short to Battery, Front Passenger Side), go to G25.

G2 CHECK THE DRIVER SAFETY BELT RETRACTOR PRETENSIONER RESISTANCE PID (DR_PTENS)

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM
- Enter the following diagnostic mode on the diagnostic tool: DR_PTENS (Pretensioner Circuit Resistance, Driver Side) Resistance PID
- **Is the resistance PID value between 1.4 and 3.5 ohms**

  YES : Go to G21.

  NO : Go to G3.

G3 CHECK THE DRIVER SAFETY BELT RETRACTOR PRETENSIONER RESISTANCE PID (DR_PTENS) WHILE CARRYING OUT A HARNESS TEST

- Continue monitoring the DR_PTENS (Pretensioner Circuit Resistance, Driver Side) resistance PID while carrying out a harness test of the driver safety belt retractor pretensioner circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness.
- **Does the resistance PID value read between 1.4 and 3.5 ohms while carrying out a harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to G26.

  NO : If the driver safety belt retractor pretensioner resistance PID is less than 1.4 ohms, go to G4.

  If the driver safety belt retractor pretensioner resistance PID is greater than 3.5 ohms, go to G6.

G4 CHECK THE DRIVER SAFETY BELT RETRACTOR PRETENSIONER FOR LOW RESISTANCE FAULT

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Belt Retractor Pretensioner C323
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
    - 2292_30_OD (Pretensioner Circuit Open, Front Driver Side)
    - 2292_31_OD (Pretensioner Circuit Resistance Low, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the driver pretensioner disconnected, an open circuit fault would normally be retrieved.
- **Did the driver safety belt retractor pretensioner on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to G20.

  NO : Go to G5.

G5 CHECK FOR A SHORT BETWEEN DRIVER SAFETY BELT RETRACTOR PRETENSIONER CIRCUITS CR120 (BU/OG) AND RR120 (BN/GN)

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

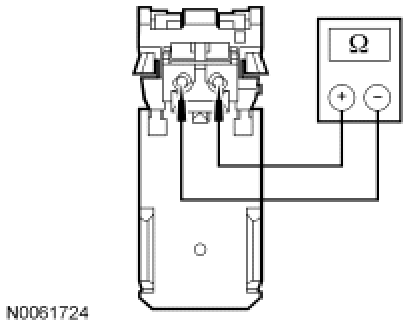


Fig. 44: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver safety belt retractor pretensioner C323-1, circuit CR120 (BU/OG), harness side and C323-2, circuit RR120 (GN/RD), harness side.
- **Is resistance greater than 10,000 ohms?**

  YES : Go to G21.

  NO : REPAIR circuits CR120 (BU/OG) and RR120 (BN/GN). Go to G26.

G6 CHECK THE DRIVER SAFETY BELT RETRACTOR PRETENSIONER FOR AN OPEN

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Belt Retractor Pretensioner C323
- Connect a fused jumper wire between driver safety belt retractor pretensioner C3201-1, circuit CR120 (BU/OG), harness side and C3201-2, circuit RR120 (BN/GN), harness side.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2292_30_OD (Pretensioner Circuit Open, Front Driver Side)
  - 2292_31_OD (Pretensioner Circuit Resistance Low, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the driver pretensioner circuits shorted together, a low resistance fault would normally be retrieved.
- **Did the driver safety belt retractor pretensioner on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**

  YES : Go to G20.

  NO : Go to G7.

G7 CHECK CIRCUITS CR120 (BU/OG) AND RR120 (BN/GN) FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the fused jumper wire from the driver safety belt retractor pretensioner C323.
- Disconnect: RCM C310a and C310b

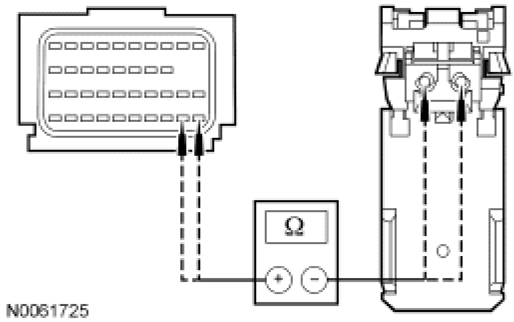


Fig. 45: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-31, circuit CR120 (BU/OG), harness side and driver safety belt retractor pretensioner C323-2, circuit CR120 (BU/OG), harness side; and between RCM C310b-32, circuit RR120 (BN/GN), harness side and driver safety belt retractor pretensioner C323-1, circuit RR120 (GN/RD), harness side.
- **Are resistances less than 0.5 ohm?**

  YES : Go to G21.

  NO : REPAIR circuit CR120 (BU/OG) or circuit RR120 (GN/RD). Go to G26.

G8 CHECK THE DRIVER SAFETY BELT RETRACTOR PRETENSIONER FOR A SHORT TO GROUND

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Belt Retractor Pretensioner C323
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2292_28_OD (Pretensioner Circuit Short to Ground, Front Driver Side)
  - 2292_30_OD (Pretensioner Circuit Open, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the driver pretensioner disconnected, an open circuit fault would normally be retrieved.

- **Did the driver safety belt retractor pretensioner on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to G20.

  NO : Go to G9.

G9 CHECK CIRCUITS CR120 (BU/OG) AND RR120 (GN/RD) FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

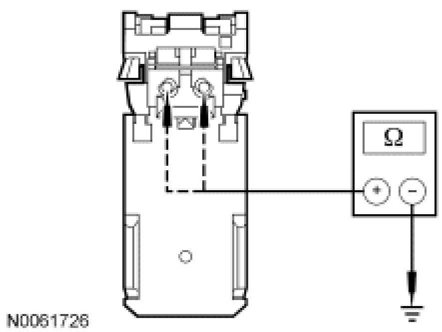


Fig. 46: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver safety belt retractor pretensioner C323-2, circuit CR120 (BU/OG), harness side and ground; and between driver safety belt retractor pretensioner C323-1, circuit RR120 (GN/RD), and ground.
- **Are resistances greater than 10,000 ohms?**

  YES : Go to G21.

  NO : REPAIR circuit CR120 (BU/OG) or circuit RR120 (GN/RD). Go to G26.

G10 CHECK CIRCUITS CR120 (BU/OG) AND RR120 (BN/GN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Belt Retractor Pretensioner C323
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

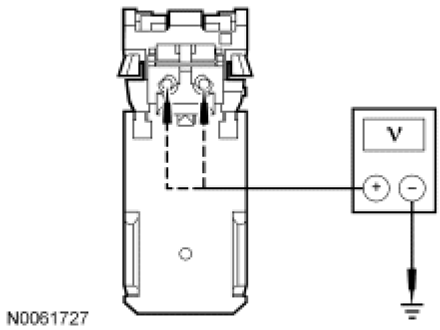


Fig. 47: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver safety belt retractor pretensioner C323-2, circuit CR120 (BU/OG), harness side and ground; and between driver safety belt retractor pretensioner C323-1, circuit RR120 (GN/RD), harness side and ground.
- **Are voltages less than 0.2 volt?**

  YES : Go to G21.

  NO : REPAIR circuit CR120 (BU/OG) or circuit RR120 (BN/GN). Go to G26.

G11 CHECK THE PASSENGER RETRACTOR PRETENSIONER RESISTANCE PID (PS_PTENS)

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM
- Enter the following diagnostic mode on the diagnostic tool: PS_TENS (Pretensioner Circuit Resistance, Passenger Side) Resistance PID
- **Is the resistance PID value between 1.4 and 3.5 ohms?**

  YES : Go to G21.

  NO : Go to G12.

G12 CHECK THE PASSENGER SAFETY BELT RETRACTOR PRETENSIONER RESISTANCE PID (PS_PTENS) WHILE CARRYING OUT A HARNESS TEST

- Continue monitoring the PS_TENS (Pretensioner Circuit Resistance, Passenger Side) resistance PID while carrying out a harness test of the passenger safety belt retractor pretensioner circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness.
- **Does the resistance PID value read between 1.4 and 3.5 ohms while carrying out the harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to G26.

  NO : If the passenger safety belt retractor pretensioner resistance PID is less than 1.4 ohms, go to G13.

  If the passenger safety belt retractor pretensioner resistance PID is greater than 3.5 ohms, go to G15.

G13 CHECK THE PASSENGER SAFETY BELT RETRACTOR PRETENSIONER FOR LOW RESISTANCE FAULT

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Belt Retractor Pretensioner C303
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2292_26_OD (Pretensioner Circuit Open, Front Passenger Side)
  - 2292_27_OD (Pretensioner Circuit Resistance Low, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the passenger pretensioner disconnected, an open circuit fault would normally be retrieved.
- **Did the passenger safety belt retractor pretensioner on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to G21.

  NO : Go to G14.

G14 CHECK FOR A SHORT BETWEEN PASSENGER SAFETY BELT RETRACTOR PRETENSIONER CIRCUITS RR122 (BN) AND CR122 (WH/OG)

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

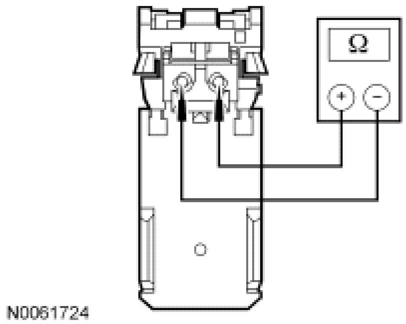


Fig. 48: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger safety belt pretensioner C303-2, circuit CR122 (WH/OG), harness side and C303-1, circuit RR122 (BN), harness side.
- **Is resistance greater than 10,000 ohms?**

  YES : Go to G21.

  NO : REPAIR circuits CR122 (WH/OG) and RR122 (BN). Go to G26.

G15 CHECK THE PASSENGER SAFETY BELT RETRACTOR PRETENSIONER FOR AN OPEN

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Belt Retractor Pretensioner C303
- Connect a fused jumper wire between passenger safety belt retractor pretensioner C303-1, circuit CR122 (WH/OG), harness side and C303-2, circuit RR122 (BN), harness side.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2292_26_OD (Pretensioner Circuit Open, Front Passenger Side)
  - 2292_27_OD (Pretensioner Circuit Resistance Low, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the passenger pretensioner circuits shorted together, a low resistance fault would normally be retrieved.

- **Did the passenger safety belt retractor pretensioner on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**

  YES : Go to G20.

  NO : Go to G16.

G16 CHECK CIRCUITS CR122 (WH/OG) AND RR122 (BN) FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the passenger safety belt retractor pretensioner fused jumper wire.
- Disconnect: RCM C310a and C310b

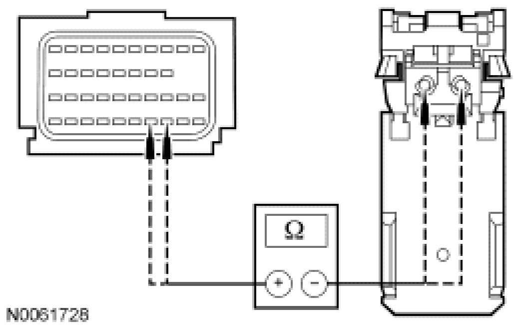


Fig. 49: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-34, circuit RR122 (BN), harness side and passenger safety belt retractor pretensioner C303-1, circuit RR122 (BU/RD), harness side; and between RCM C310b-33, circuit CR122 (WH/OG), harness side and passenger safety belt retractor pretensioner C303-2, circuit CR122 (WH/OG), harness side.
- **Is resistances less than 0.5 ohm?**

  YES : Go to G21.

  NO : REPAIR circuit RR122 (BN) or circuit CR122 (WH/OG). Go to G26.

G17 CHECK THE PASSENGER SAFETY BELT RETRACTOR PRETENSIONER FOR A SHORT TO GROUND

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Belt Retractor Pretensioner C303

- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2292_24_OD (Pretensioner Circuit Short to Ground, Front Passenger Side)
  - 2292_26_OD (Pretensioner Circuit Open, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the passenger pretensioner disconnected, an open circuit fault would normally be retrieved.
- **Did the passenger safety belt retractor pretensioner on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to G20.

  NO : Go to G18.

G18 CHECK CIRCUITS CR122 (WH/OG) AND RR122 (BN) FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

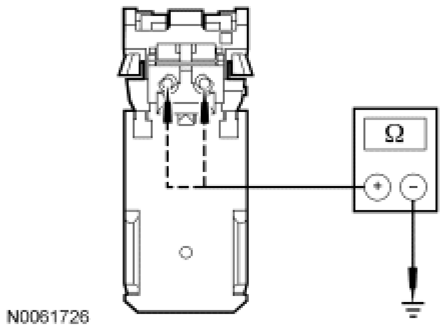


Fig. 50: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger safety belt retractor pretensioner C303-2, circuit CR122 (WH/OG), harness side and ground; and between passenger safety belt retractor pretensioner C303-1, circuit RR122 (BN), harness side and ground.
- **Are resistances greater than 10,000 ohms?**

  YES : Go to G21.

  NO : REPAIR circuit CR122 (WH/OG) or circuit RR122 (BN). Go to G26.

G19 CHECK CIRCUITS RR122 (BN) AND CR122 (WH/OG) FOR A SHORT TO VOLTAGE

- Key in OFF position.

- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Belt Retractor Pretensioner C303
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

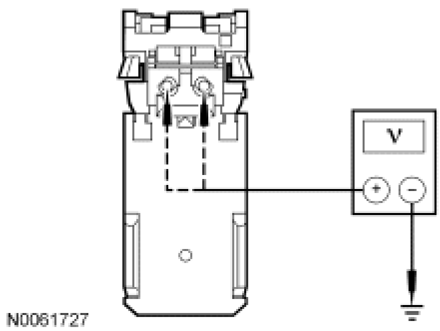


Fig. 51: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger safety belt retractor pretensioner C303-1, circuit RR122 (BN), harness side and ground; and between passenger safety belt retractor pretensioner C303-2, circuit CR122 (WH/OG), harness side and ground.
- **Are voltages less than 0.2 volt?**

  YES : Go to G21.

  NO : REPAIR circuit RR122 (BN) or circuit CR122 (WH/OG). Go to G26.

G20 CONFIRM THE SAFETY BELT RETRACTOR PRETENSIONER FAULT

NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Affected Safety Belt Retractor Pretensioner C323 (Driver) C303 (Passenger)
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record

All B2292 Fault PIDs

- Refer to PID list in Normal Operation to view B2292 fault PIDs.

- **Does the original RCM on-demand DTC B2292 fault PID indicate a fault?**

  YES : INSTALL a new driver or passenger safety belt retractor pretensioner. REFER to **SAFETY BELT SYSTEM** article. Go to G26.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of any electrical connector that were disconnected.

  For 2292_31_CM (Pretensioner Circuit Resistance Low, Front Driver Side), 2292_30_CM (Pretensioner Circuit Open, Front Driver Side), 2292_27_CM (Pretensioner Circuit Resistance Low, Front Passenger Side) or 2292_26_CM (Pretensioner Circuit Open, Front Passenger Side), go to G22.

  For 2292_28_CM (Pretensioner Circuit Short to Ground, Front Driver Side) or 2292_24_CM (Pretensioner Circuit Short to Ground, Front Passenger Side), go to G24.

  For 2292_29_CM (Pretensioner Circuit Short to Battery, Front Driver Side) or 2292_25_CM (Pretensioner Circuit Short to Battery, Front Passenger Side), go to G25.

G21 CONFIRM THE RCM FAULT

NOTE: **Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: All Restraint System Components (if previously disconnected)
- Connect: RCM C310a and C310b (if previously disconnected)
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2292 Fault PIDs
  - Refer to PID list in Normal Operation to view B2292 fault PIDs.
- **Does the original RCM on-demand DTC B2292 fault PID indicate a fault?**

  YES : INSTALL a new RCM and CARRY OUT PMI. REFER to **Restraints Control Module (RCM)**. Go to G26.

NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of any electrical connector that were disconnected.

For 2292_31_CM (Pretensioner Circuit Resistance Low, Front Driver Side), 2292_30_CM (Pretensioner Circuit Open, Front Driver Side), 2292_27_CM (Pretensioner Circuit Resistance Low, Front Passenger Side) or 2292_26_CM (Pretensioner Circuit Open, Front Passenger Side), go to G22.

For 2292_28_CM (Pretensioner Circuit Short to Ground, Front Driver Side) or 2292_24_CM (Pretensioner Circuit Short to Ground, Front Passenger Side), go to G24.

For 2292_29_CM (Pretensioner Circuit Short to Battery, Front Driver Side) or 2292_25_CM (Pretensioner Circuit Short to Battery, Front Passenger Side), go to G25.

G22 CHECK FOR AN INTERMITTENT PRETENSIONER LOW RESISTANCE OR OPEN CIRCUIT FAULT

- If the fault PID was reported for the driver safety belt retractor pretensioner, monitor the following on the scan tool:
  - DR_PTENS (Pretensioner Circuit Resistance, Driver Side) resistance PID.
  - 2292_30_OD (Pretensioner Circuit Open, Front Driver Side) and 2292_31_OD (Pretensioner Circuit Resistance Low, Front Driver Side) on-demand fault PIDs.
- If the fault PID was reported for the passenger safety belt retractor pretensioner, monitor the following on the scan tool:
  - PS_PTENS (Pretensioner Circuit Resistance, Passenger Side) resistance PID.
  - 2292_26_OD (Pretensioner Circuit Open, Front Passenger Side) and 2292_27_OD (Pretensioner Circuit Resistance Low, Front Passenger Side) on-demand fault PIDs.

NOTE: **A resistance PID that reads between 0.9 and 1.4 ohms or between 3.5 and 5 ohms may or may not set an on-demand DTC, yet indicates a strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition.**

- Attempt to recreate the fault by wiggling the connectors (including any inline connectors) and flexing the wire harness.
- **Does any safety belt retractor pretensioner on-demand fault PID indicate a fault is present or is the pretensioner resistance PID less than 1.4 ohms or greater than 3.5 ohms?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to G26.

  NO : Go to G23.

G23 CHECK THE HARNESS AND CONNECTORS

- Key in OFF position.

- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect the affected safety belt retractor pretensioner C323 (driver) or C303 (passenger):
  - inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - inspect wire harness for any damage, pinched, cut or pierced wires.
- **Were any concerns found?**

  YES : REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to G26.

  NO : The fault is not present and cannot be recreated at this time. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** Go to G26.

G24 CHECK FOR AN INTERMITTENT SAFETY BELT RETRACTOR PRETENSIONER CIRCUIT SHORT TO GROUND FAULT

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2292 Fault PIDs
  - Refer to PID list in Normal Operation to view B2292 fault PIDs.
- If the fault PID was reported for the driver safety belt retractor pretensioner, monitor the 2292_28_OD (Pretensioner Circuit Short to Ground, Front Driver Side) on-demand fault PID on the scan tool.
- If the fault PID was reported for the passenger safety belt retractor pretensioner, monitor the 2292_24_OD (Pretensioner Circuit Short to Ground, Front Passenger Side) on-demand fault PID on the scan tool.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
- **Does any safety belt retractor pretensioner on-demand fault PID indicate a fault is present?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to G26.

  NO : The fault is not present and cannot be recreated at this time. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** Go to G26.

G25 CHECK FOR AN INTERMITTENT SAFETY BELT RETRACTOR PRETENSIONER CIRCUIT SHORT TO BATTERY FAULT

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2292 Fault PIDs
  - Refer to PID list in Normal Operation to view B2292 fault PIDs.

- If the fault PID was reported for the driver safety belt retractor pretensioner, monitor the 2292_29_OD (Pretensioner Circuit Short to Battery, Front Driver Side) on-demand fault PID.
- If the fault PID was reported for the passenger safety belt retractor pretensioner, monitor the 2292_25_OD (Pretensioner Circuit Short to Battery, Front Passenger Side) on-demand fault PID.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.
- Attempt to recreate the fault by wiggling the connectors (including any inline connectors) and flexing the wire harness.
- **Does the safety belt retractor pretensioner short to battery on-demand fault PID indicate a fault?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to G26.

  NO : The fault is not present and cannot be recreated at this time. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** Go to G26.

G26 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

> **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test H: DTC B2293 - Restraint System - Air Bag Fault

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) continuously monitors all front air bag module circuits (loop) for an acceptable resistance range, unacceptable voltage and shorts to ground. The RCM will set on-demand and store DTC B2293 in memory if any of these conditions are detected to be outside of their respectful range. If the RCM detects a fault, it will send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

As the RCM continuously monitors all front air bag module circuits for resistance, it expects a normal resistance for the driver air bag module loop 1 and 2, between 1.7 and 4.4 ohms.

The normal expected resistance for the passenger air bag module loop 1 and 2 is between 1.4 and 3.5 ohms.

If a loop resistance for the driver air bag loop 1 or 2 is between 0.9 and 1.7 or between 4.4 and 5 ohms, there exists a strong potential for an intermittent fault, a DTC may or may not set. The RCM will also set an on-demand DTC if the loop resistance is less than 0.9 ohm or greater than 5 ohms.

If a loop resistance for the passenger air bag loop 1 & 2 is between 0.9 and 1.4 or between 3.5 and 5 ohms, there exists a strong potential for an intermittent fault, a DTC may or may not set. The RCM will also set an on-demand DTC if the loop resistance is less than 0.9 ohm or greater than 5 ohms.

Fault PIDs[a]	Description	Fault Trigger Condition
2293_16_OD and 2293_16_CM	Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side	When the RCM measures resistance less than 0.9 ohm between the passenger air bag loop circuits, a fault will be indicated.
2293_17_OD and 2293_17_CM	Air Bag Circuit Open - Loop No. 2, Front Passenger Side	When the RCM measures resistance greater than 5 ohms between the passenger air bag loop circuits, a fault will be indicated.
2293_18_OD and 2293_18_CM	Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side	When the RCM senses a short to voltage on either on the passenger air bag loop circuits, a fault will be indicated.
2293_19_OD and 2293_19_CM	Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side	When the RCM senses a short to ground on either on the passenger air bag loop circuits, a fault will be indicated.
2293_20_OD and 2293_20_CM	Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side	When the RCM measures resistance less than 0.9 ohm between the driver air bag loop circuits, a fault will be indicated.
		When the RCM measures resistance greater than 5 ohms

2293_21_OD and 2293_21_CM	Air Bag Circuit Open - Loop No. 2, Front Driver Side	between the driver air bag loop circuits, a fault will be indicated.
2293_22_OD and 2293_22_CM	Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side	When the RCM senses a short to voltage on either on the driver air bag loop circuits, a fault will be indicated.
2293_23_OD and 2293_23_CM	Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side	When the RCM senses a short to ground on either on the driver air bag loop circuits, a fault will be indicated.
2293_24_OD and 2293_24_CM	Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side	When the RCM measures resistance less than 0.9 ohm between the passenger air bag loop circuits, a fault will be indicated.
2293_25_OD and 2293_25_CM	Air Bag Circuit Open - Loop No. 1, Front Passenger Side	When the RCM measures resistance greater than 5 ohms between the passenger air bag loop circuits, a fault will be indicated.
2293_26_OD and 2293_26_CM	Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side	When the RCM senses a short to voltage on either on the passenger air bag loop circuits, a fault will be indicated.
2293_27_OD and 2293_27_CM	Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side	When the RCM senses a short to ground on either on the passenger air bag loop circuits, a fault will be indicated.
2293_28_OD and 2293_28_CM	Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side	When the RCM measures resistance less than 0.9 ohm between the driver air bag loop circuits, a fault will be indicated.
2293_29_OD and 2293_29_CM	Air Bag Circuit Open - Loop No. 1, Front Driver Side	When the RCM measures resistance greater than 5 ohms between the driver air bag loop circuits, a fault will be indicated.
2293_30_OD and 2293_30_CM	Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side	When the RCM senses a short to voltage on either on the driver air bag loop circuits, a fault will be indicated.
		When the RCM senses a short

2293_31_OD and 2293_31_CM	Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side	to ground on either on the driver air bag loop circuits, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2293. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2293.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Clockspring
- Driver air bag module
- Passenger air bag module
- RCM

PINPOINT TEST H: DTC B2293 - RESTRAINT SYSTEM - AIR BAG FAULT

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: **The SRS must be fully operational and free of faults before releasing the vehicle**

to the customer.

H1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2293 Fault PIDs
  - Refer to PID list in Normal Operation to view B2293 fault PIDs.
- **Do any RCM on-demand DTC B2293 fault PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test.

  Using the fault PIDs recorded, go to the appropriate pinpoint test step.

  For 2293_28_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side), go to H2.

  For 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side), go to H2.

  For 2293_31_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side), go to H10.

  For 2293_30_OD (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side), go to H13.

  For 2293_20_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side), go to H15.

  For 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side), go to H15.

  For 2293_23_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side), go to H23.

  For 2293_22_OD (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side), go to H26.

  For 2293_24_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side), go to H28.

  For 2293_25_OD (Air Bag Circuit Open - Loop No. 1, Front Passenger Side), go to H28.

  For 2293_27_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side), go to H34.

  For 2293_26_OD (Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side), go to H36.

  For 2293_16_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side), go to H37.

For 2293_17_OD (Air Bag Circuit Open - Loop No. 2, Front Passenger Side), go to H37.

For 2293_19_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side), go to H43.

For 2293_18_OD (Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side), go to H45.

NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time.

Using the fault PIDs recorded, go to the appropriate pinpoint test step.

For 2293_28_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side) or 2293_20_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side), go to H50.

For 2293_29_CM (Air Bag Circuit Open - Loop No. 1, Front Driver Side) or 2293_21_CM (Air Bag Circuit Open - Loop No. 2, Front Driver Side), go to H50.

For 2293_31_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side) or 2293_23_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side), go to H51.

For 2293_30_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side) or 2293_22_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side), go to H53.

For 2293_24_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side) or 2293_16_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side), go to H50.

For 2293_25_CM (Air Bag Circuit Open - Loop No. 1, Front Passenger Side) or 2293_17_CM (Air Bag Circuit Open - Loop No. 2, Front Passenger Side), go to H50.

For 2293_27_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side) or 2293_19_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side), go to H52.

For 2293_26_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side) or 2293_18_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side), go to H54.

H2 CHECK THE DRIVER AIR BAG MODULE LOOP 1 RESISTANCE PID (D_ABAGR)

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM
- Enter the following diagnostic mode on the diagnostic tool: D_ABAGR (Driver Air Bag) Resistance PID
- **Is the resistance PID value between 1.7 and 4.4 ohms?**

  YES : Go to H49.

  NO : Go to H3.

H3 CHECK THE DRIVER AIR BAG MODULE LOOP 1 RESISTANCE PID (D_ABAGR) WHILE CARRYING OUT A HARNESS TEST

NOTE: Do not remove the driver air bag module from its mounted position at this time.

- Continue monitoring the D_ABAGR (driver air bag) resistance PID while carrying out a harness test of the driver air bag circuits and accessible connectors (including any inline connectors) by wiggling and flexing the wire harness, connectors and rotating the steering wheel frequently.
- **Does the resistance PID value read between 1.7 and 4.4 ohms while carrying out the harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness or INSTALL a new clockspring as needed. REFER to **Clockspring**. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to H56.

  NO : If the driver air bag module loop 1 resistance PID is less than 1.7 ohms, go to H4.

  If the driver air bag module loop 1 resistance PID is greater than 4.4 ohms, go to H7.

H4 CHECK THE DRIVER AIR BAG MODULE LOOP 1 LOW RESISTANCE FAULT

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_28_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side)
  - 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

YES : Go to H46.

NO : Go to H5.

H5 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUITS FOR LOW RESISTANCE BETWEEN THE CLOCKSPRING AND RCM

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Disconnect: Clockspring C218
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_28_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side)
  - 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module/clockspring disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to H48.

  NO : Go to H6.

H6 CHECK THE RCM FOR LOW RESISTANCE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

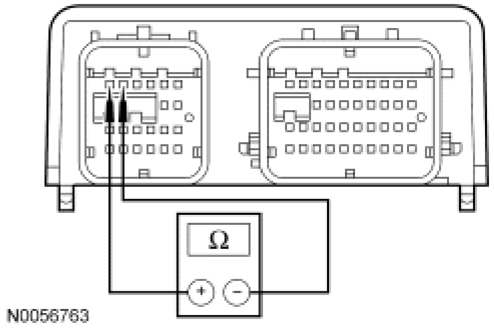


Fig. 52: Measuring Resistance Between RCM C310A Pin 1 & C310A Pin 2, Component Side
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a pin 1 and C310a pin 2, component side.
- **Is resistance greater than 10,000 ohms?**

  YES : REPAIR circuits CR101 (VT/BN) and RR101 (YE/GN). Go to H56.

  NO : Go to H49.

H7 CHECK THE DRIVER AIR BAG MODULE LOOP 1 FOR AN OPEN

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Connect a fused jumper wire between driver air bag module loop 1 electrical connector pin-1, harness side and pin-2, harness side.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_28_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side)
  - 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module loop 1 circuits shorted together, a low resistance fault would normally be retrieved on loop 1. Loop 2 will show an open circuit fault due to the driver air bag being disconnected.
- **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a open circuit to a low resistance fault?**

  YES : Go to H46.

  NO : Go to H8.

H8 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUITS FOR AN OPEN BETWEEN THE CLOCKSPRING AND RCM

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the**

fault.

- Key in OFF position.
- Remove the fused jumper wire from driver air bag module loop 1 electrical connector.
- Disconnect: Clockspring C218
- Connect a fused jumper wire between clockspring C218-1, circuit CR101 (VT/BN), harness side and clockspring C218-9, circuit RR101 (YE/GN), harness side.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_28_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side)
  - 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module loop 1 circuits shorted together, a low resistance fault would normally be retrieved on loop 1. Loop 2 will show an open circuit fault due to the driver air bag being disconnected.
- **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a open circuit to a low resistance fault?**

  YES : Go to H48.

  NO : Go to H9.

H9 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUITS CR101 (VT/BN) AND RR101 (YE/GN) FOR AN OPEN BETWEEN THE CLOCKSPRING AND RCM

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the fused jumper wire from the clockspring connector.
- Disconnect: RCM C310a and C310b

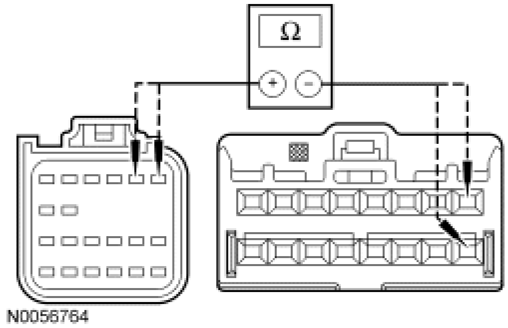


Fig. 53: Measuring Resistance Between RCM C310A-1, Circuit CR101 (VT/BN) & Clockspring C218-1
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a-1, circuit CR101 (VT/BN), harness side and clockspring C218-1, circuit CR101 (VT/BN), harness side; and between RCM C310a-2, circuit RR101 (YE/GN), harness side and clockspring C218-9, circuit RR101 (YE/GN), harness side.
- **Are the resistances less than 0.5 ohm?**

  YES : Go to H49.

  NO : REPAIR circuit CR101 (VT/BN) or circuit RR101 (YE/GN). Go to H56.

H10 CHECK THE DRIVER AIR BAG MODULE LOOP 1 FOR A SHORT TO GROUND

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side)
  - 2293_31_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to H46.

  NO : Go to H11.

H11 CHECK DRIVER AIR BAG MODULE LOOP 1 CIRCUITS FOR A SHORT TO GROUND BETWEEN THE RCM AND CLOCKSPRING

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.

- Disconnect: Clockspring C218
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side)
  - 2293_31_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the clockspring disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to H48.

  NO : Go to H12.

H12 CHECK CIRCUITS CR101 (VT/BN) AND RR101 (YE/GN) FOR A SHORT TO GROUND BETWEEN THE RCM AND CLOCKSPRING

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

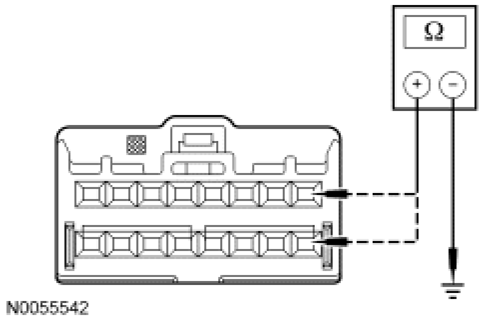


Fig. 54: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between clockspring C218-1, circuit CR101 (VT/BN), harness side and ground; and between clockspring C218-9, circuit RR101 (YE/GN), harness side and ground.
- **Are resistances greater than 10,000 ohms?**

  YES : Go to H49.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR101 (VT/BN) or circuit RR101 (YE/GN). Go to H56.

H13 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUITS FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND CLOCKSPRING

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Disconnect: Clockspring C218
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side)
  - 2293_30_OD (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module/clockspring disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a short to battery to an open circuit fault?**

  YES : Go to H48.

  NO : Go to H14.

H14 CHECK CIRCUITS CR101 (VT/BN) AND RR101 (YE/GN) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND CLOCKSPRING

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

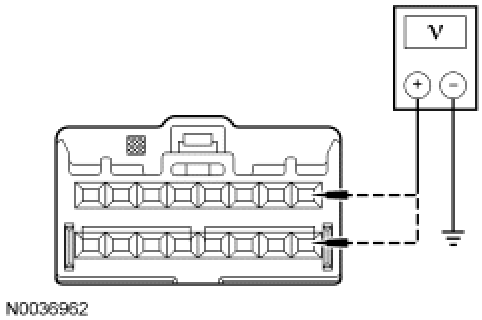


Fig. 55: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between clockspring C218-1, circuit CR101 (VT/BN), harness side and ground; and between clockspring C218-9, circuit RR101 (YE/GN), harness side and ground.
- **Are voltages less than 0.2 volt?**

  YES : Go to H49.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR101 (VT/BN) or circuit RR101 (YE/GN). Go to H56.

H15 CHECK THE DRIVER AIR BAG MODULE LOOP 2 RESISTANCE PID (D_ABAGR2)

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM
- Enter the following diagnostic mode on the diagnostic tool: D_ABAGR2 (Driver Air Bag #2 Resistance) Resistance PID
- **Is the resistance PID value between 1.7 and 4.4 ohms?**

  YES : Go to H49.

  NO : Go to H16.

H16 CHECK THE DRIVER AIR BAG MODULE LOOP 2 RESISTANCE PID (D_ABAGR2) WHILE CARRYING OUT A HARNESS TEST

NOTE:	**Do not remove the driver air bag module from its mounted position at this time.**

- With the driver air bag in its mounted position, continue monitoring the D_ABAGR2 (Driver Air Bag #2 Resistance) resistance PID while carrying out a harness test of the driver air bag circuits and accessible connectors (including any inline connectors), by wiggling and flexing the wire harness, connectors, tilting and rotating the steering wheel frequently.
- **Does the resistance PID value read between 1.7 and 4.4 ohms while carrying out the harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness or INSTALL a new clockspring as needed. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to H56.

NO : If the driver air bag module loop 2 resistance PID is less than 1.7 ohms, go to H17.

If the driver air bag module loop 2 resistance PID is greater than 4.4 ohms, go to H20.

H17 CHECK THE DRIVER AIR BAG MODULE LOOP 2 LOW RESISTANCE FAULT

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_20_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side)
  - 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to H46.

  NO : Go to H18.

H18 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUITS FOR LOW RESISTANCE BETWEEN THE CLOCKSPRING AND RCM

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Disconnect: Clockspring C218
- Key in ON position.

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_20_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side)
  - 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module/clockspring disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to H48.

  NO : Go to H19.

H19 CHECK THE RCM FOR LOW RESISTANCE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

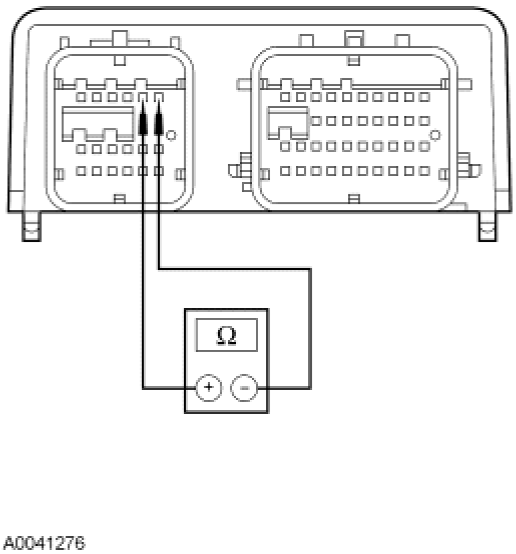


Fig. 56: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a pin 5 and C310a pin 6, component side.

- **Is resistance greater than 10,000 ohms?**

  YES : REPAIR circuits CR102 (BU) and RR102 (WH). Go to H56.

  NO : Go to H49.

H20 CHECK THE DRIVER AIR BAG MODULE LOOP 2 FOR AN OPEN

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Connect a fused jumper wire between driver air bag module loop 2 electrical connector, pin-1, harness side and pin-2, harness side.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_20_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side)
  - 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module loop 2 circuits shorted together, a low resistance fault would normally be retrieved on loop 2. Loop 1 will show an open circuit fault due to the driver air bag being disconnected.
- **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**

  YES : Go to H46.

  NO : Go to H21.

H21 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUITS FOR AN OPEN BETWEEN THE CLOCKSPRING AND RCM

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.

- Remove the fused jumper wire from driver air bag module loop 2 electrical connector.
- Disconnect: Clockspring C218
- Connect a fused jumper wire between clockspring C218-2, circuit CR102 (BU), harness side and clockspring C218-10, circuit RR102 (WH), harness side.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_20_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side)
  - 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module loop 2 circuits shorted together, a low resistance fault would normally be retrieved on loop 2. Loop 1 will show an open circuit fault due to the driver air bag being disconnected.
- **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**

  YES : Go to H48.

  NO : Go to H22.

H22 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUITS CR102 (BU) AND RR102 (WH) FOR AN OPEN BETWEEN THE CLOCKSPRING AND RCM

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the fused jumper wire from the clockspring connector.
- Disconnect: RCM C310a and C310b

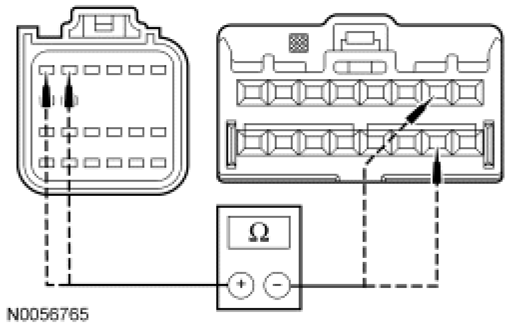


Fig. 57: Measuring Resistance Between RCM C310A-5, Circuit CR102 (BU) & Clockspring C218-2
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a-5, circuit CR102 (BU), harness side and clockspring C218-2, circuit CR102 (BU), harness side; and between RCM C310a-6, circuit RR102 (WH), harness side and clockspring C218-10, circuit RR102 (WH), harness side.

- **Are resistances less than 0.5 ohm?**

  YES : Go to H49.

  NO : REPAIR circuit CR102 (BU) or circuit RR102 (WH). Go to H56.

H23 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUITS FOR A SHORT TO GROUND

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side)
  - 2293_23_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to H46.

  NO : Go to H24.

H24 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUITS FOR A SHORT TO GROUND BETWEEN THE RCM AND CLOCKSPRING

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Disconnect: Clockspring C218
- Key in ON position.

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side)
  - 2293_23_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to H48.

  NO : Go to H25.

H25 CHECK CIRCUITS CR102 (BU) AND RR102 (WH) FOR A SHORT TO GROUND BETWEEN THE RCM AND CLOCKSPRING

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

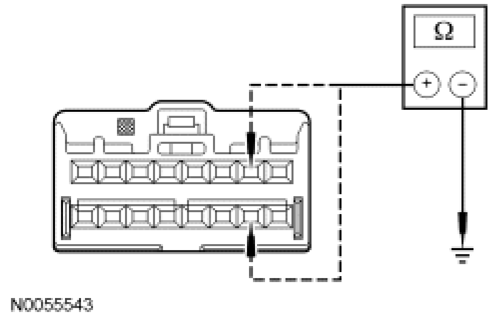


Fig. 58: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between clockspring C218-2, circuit CR102 (BU), harness side and ground; and between clockspring C218-10, circuit RR102 (WH), harness side and ground.
- **Are resistances greater than 10,000 ohms?**

  YES : Go to H49.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR102 (BU) or circuit RR102 (WH). Go to H56.

H26 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUITS FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND CLOCKSPRING

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Disconnect: Clockspring C218
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side)
  - 2293_22_OD (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module/clockspring disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a short to battery to an open circuit fault?**

  YES : Go to H48.

  NO : Go to H27.

H27 CHECK CIRCUITS CR102 (BU) AND RR102 (WH) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND CLOCKSPRING

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

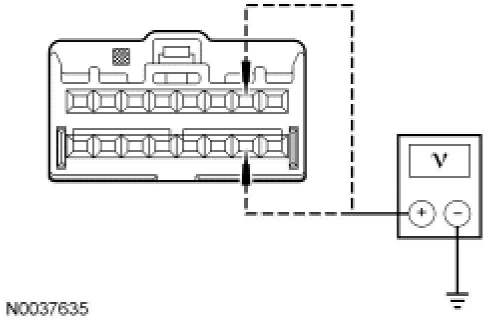


Fig. 59: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between clockspring C218-2, circuit CR102 (BU), harness side and ground; and between clockspring C218-10, circuit RR102 (WH), harness side and ground.
- **Are voltages less than 0.2 volt?**

  YES : Go to H49.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR102 (BU) or circuit RR102 (WH). Go to H56.

H28 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 RESISTANCE PID (P_ABAGR)

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM
- Enter the following diagnostic mode on the diagnostic tool: P_ABAGR (Passenger Air Bag) Resistance PID
- **Is the resistance PID value between 1.4 and 3.5 ohms?**

  YES : Go to H49.

  NO : Go to H29.

H29 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 RESISTANCE PID (P_ABAGR) WHILE CARRYING OUT A HARNESS TEST

NOTE:	**Do not remove the passenger air bag module from its mounted position at this time.**

- With the passenger air bag in its mounted position, continue monitoring the P_ABAGR (Passenger Air Bag) resistance PID while carrying out a harness test of the passenger air bag module circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness.
- **Does the resistance PID value read between 1.4 and 3.5 ohms while carrying out the harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to H56.

NO : If the passenger air bag module loop 1 resistance PID is less than 1.4 ohms, go to H30.

If the passenger air bag module loop 1 resistance PID is greater than 3.5 ohms, go to H32.

H30 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 FOR LOW RESISTANCE FAULT

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256a
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_24_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side)
  - 2293_25_OD (Air Bag Circuit Open - Loop No. 1, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the passenger air bag module loop 1 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to H47.

  NO : Go to H31.

H31 CHECK THE RCM FOR LOW RESISTANCE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

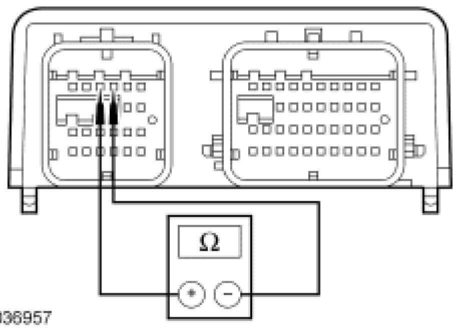


Fig. 60: Checking RCM
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a pin 3 and C310a pin 4, component side.
- **Is resistance greater than 10,000 ohms?**

  YES : REPAIR circuits CR103 (GY/BU) and RR103 (VT/GN). Go to H56.

  NO : Go to H49.

H32 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 FOR AN OPEN

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256a
- Connect a fused jumper wire between passenger air bag module C256a-1, circuit CR103 (GY/BU), harness side and C256a-2, circuit RR103 (VT/GN), harness side.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_24_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side)
  - 2293_25_OD (Air Bag Circuit Open - Loop No. 1, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module loop 1 circuits shorted together, a low resistance fault would normally be retrieved on loop 1. Loop 2 will show an open circuit fault due to the passenger air bag being disconnected.
- **Did the passenger air bag module loop 1 on-demand fault PIDs change from indicating an**

open circuit to a low resistance fault?

YES : Go to H47.

NO : Go to H33.

H33 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 CIRCUITS FOR AN OPEN BETWEEN THE PASSENGER AIR BAG MODULE AND RCM

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

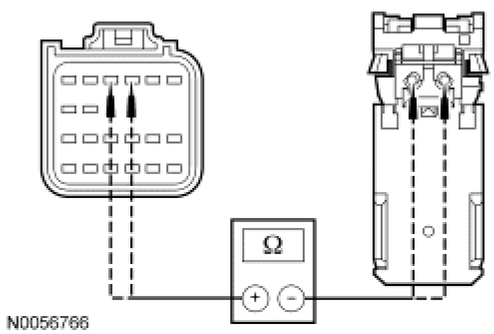


Fig. 61: Measuring Resistance Between RCM C310A-1, Circuit CR103 (GY/BU) & Passenger Air Bag Module C256A-1
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a-1, circuit CR103 (GY/BU), harness side and passenger air bag module C256a-1, circuit CR103 (GY/BU), harness side; and between RCM C310a-2, circuit RR103 (VT/GN), harness side and passenger air bag module C256a-2, circuit RR103 (VT/GN), harness side.
- **Are resistances less than 0.5 ohm?**

  YES : Go to H49.

  NO : REPAIR circuit CR103 (GY/BU) or circuit RR103 (VT/GN). Go to H56.

H34 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 CIRCUITS FOR A SHORT TO GROUND

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256a

- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_25_OD (Air Bag Circuit Open - Loop No. 1, Front Passenger Side)
  - 2293_27_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the passenger air bag module loop 1 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to H47.

  NO : Go to H35.

H35 CHECK CIRCUITS CR103 (GY/BU) AND RR103 (VT/GN) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

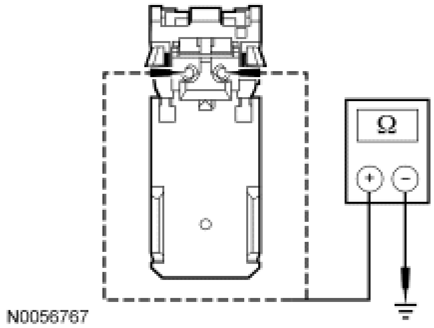


Fig. 62: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger air bag module C256a-1, circuit CR103 (GY/BU), harness side and ground; and between passenger air bag module C256a-2, circuit RR103 (VT/GN), harness side and ground.
- **Are resistances greater than 10,000 ohms?**

  YES : Go to H49.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

REPAIR circuit CR103 (GY/BU) or circuit RR103 (VT/GN). Go to H56.

H36 CHECK CIRCUITS CR103 (GY/BU) AND RR103 (VT/GN) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND PASSENGER AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256a
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

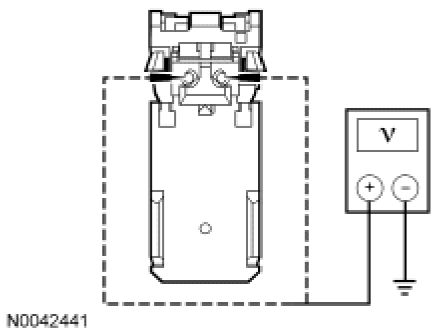


Fig. 63: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger air bag module C256a-1, circuit CR103 (GY/BU), harness side and ground; and between passenger air bag module C256a-2, circuit RR103 (VT/GN), harness side and ground.
- **Are voltages less than 0.2 volt?**

  YES : Go to H49.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR103 (GY/BU) or circuit RR103 (VT/GN). Go to H56.

H37 CHECK THE PASSENGER AIR BAG MODULE LOOP 2 RESISTANCE PID (P_ABAGR2)

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM
- Enter the following diagnostic mode on the diagnostic tool: P_ABAGR2 (Passenger Side Air Bag #2 Resistance) Resistance PID
- **Is the resistance PID value between 1.4 and 3.5 ohms?**

  YES : Go to H49.

  NO : Go to H38.

H38 CHECK THE PASSENGER AIR BAG MODULE LOOP 2 RESISTANCE PID (P_ABAGR2) WHILE CARRYING OUT A HARNESS TEST

NOTE:	**Do not remove the passenger air bag module from its mounted position at this time.**

- With the passenger air bag in its mounted position, continue monitoring the P_ABAGR2 (Passenger Side Air Bag #2 Resistance) resistance PID while carrying out a harness test of the passenger air bag module circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness.
- **Does the resistance PID value read between 1.4 and 3.5 ohms while carrying out the harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to H56.

  NO : If the passenger air bag module loop 2 resistance PID is less than 1.4 ohms, go to H39.

  If the passenger air bag module loop 2 resistance PID is greater than 3.5 ohms, go to H41.

H39 CHECK THE PASSENGER AIR BAG MODULE LOOP 2 FOR LOW RESISTANCE FAULT

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_16_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side)
  - 2293_17_OD (Air Bag Circuit Open - Loop No. 2, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the passenger air bag module loop 2 on-demand fault PIDs change from indicating a low**

resistance to an open circuit fault?

YES : Go to H47.

NO : Go to H40.

H40 CHECK THE RCM FOR LOW RESISTANCE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

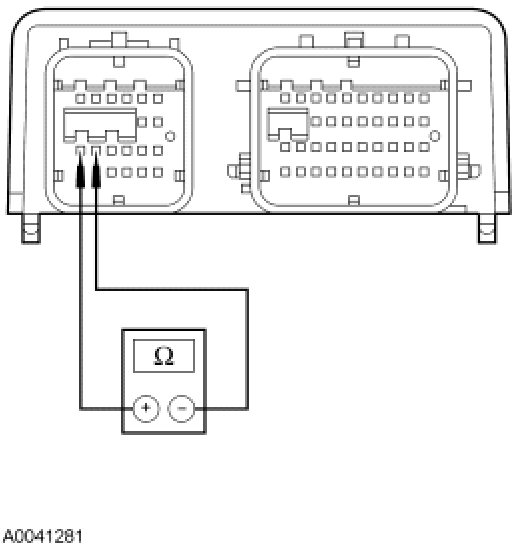


Fig. 64: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a pin 13 and C310a pin 14, component side.
- **Is resistance greater than 10,000 ohms?**

YES : REPAIR circuits CR104 (YE/GY) and RR104 (WH/BU). Go to H56.

NO : Go to H49.

H41 CHECK PASSENGER AIR BAG MODULE LOOP 2 FOR AN OPEN

NOTE:	This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256b
- Connect a fused jumper wire between passenger air bag module C256b-1, circuit CR104 (YE/GY), harness side and C256b-2, circuit RR104 (WH/BU), harness side.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_16_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side)
  - 2293_17_OD (Air Bag Circuit Open - Loop No. 2, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module loop 2 circuits shorted together, a low resistance fault would normally be retrieved on loop 2. Loop 1 will show an open circuit fault due to the passenger air bag module being disconnected.
- **Did the passenger air bag module loop 2 on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**

  YES : Go to H47.

  NO : Go to H42.

H42 CHECK PASSENGER AIR BAG MODULE LOOP 2 CIRCUITS FOR AN OPEN BETWEEN THE PASSENGER AIR BAG MODULE AND RCM

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the fused jumper wire from passenger air bag module C256b.
- Disconnect: RCM C310a and C310b

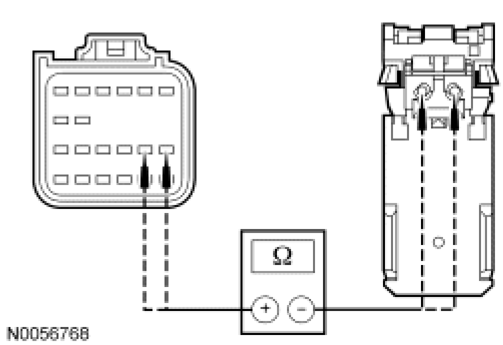


Fig. 65: Measuring Resistance Between RCM C310A-13, Circuit CR104 (YE/GY) & Passenger Air Bag Module C256B-1

Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a-13, circuit CR104 (YE/GY), harness side and passenger air bag module C256b-1, circuit CR104 (YE/GY), harness side; and between RCM C310a-14, circuit RR104 (WH/BU), harness side and passenger air bag module C256b-2, circuit RR104 (WH/BU), harness side.
- **Are resistances less than 0.5 ohm?**

  YES : Go to H49.

  NO : REPAIR circuit CR104 (YE/GY) or circuit RR104 (WH/BU). Go to H56.

H43 CHECK THE PASSENGER AIR BAG MODULE LOOP 2 CIRCUITS FOR A SHORT TO GROUND

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2293_17_OD (Air Bag Circuit Open - Loop No. 2, Front Passenger Side)
  - 2293_19_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the passenger air bag module loop 2 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to H47.

  NO : Go to H44.

H44 CHECK CIRCUITS CR104 (YE/GY) AND RR104 (WH/BU) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

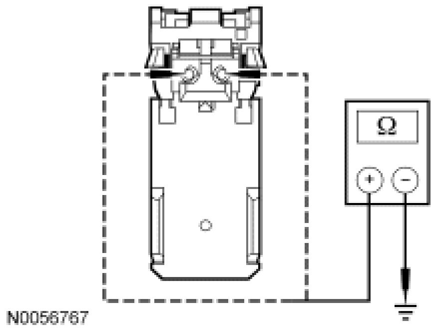


Fig. 66: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger air bag module C256b-1, circuit CR104 (YE/GY), harness side and ground; and between passenger air bag module C256b-2, circuit RR104 (WH/BU), harness side and ground.
- **Are resistances greater than 10,000 ohms?**

  YES : Go to H49.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR104 (YE/GY) or circuit RR104 (WH/BU). Go to H56.

H45 CHECK CIRCUITS CR104 (YE/GY) AND RR104 (WH/BU) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND PASSENGER AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256b
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

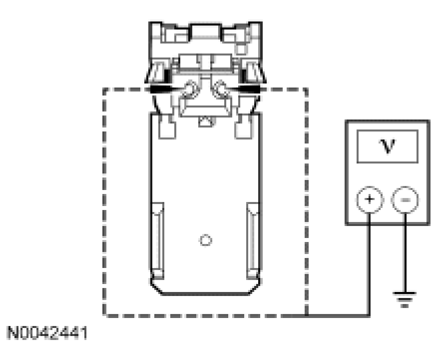


Fig. 67: Measuring Voltage

Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger air bag module C256b-1, circuit CR104 (YE/GY), harness side and ground; and between passenger air bag module C256b-2, circuit RR104 (WH/BU), harness side and ground.
- **Are voltages less than 0.2 volt?**

  YES : Go to H49.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR104 (YE/GY) or circuit RR104 (WH/BU). Go to H56.

H46 CONFIRM THE DRIVER AIR BAG MODULE FAULT

NOTE: Make sure all restraint system components and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Install the driver air bag module. Refer to **Driver Air Bag Module**.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2293 Fault PIDs
  - Refer to PID list in Normal Operation to view B2293 fault PIDs.
- **Does the original RCM on-demand DTC B2293 fault PID indicate a fault?**

  YES : INSTALL a new driver air bag module. REFER to **Driver Air Bag Module**. Go to H56.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of any electrical connector that were disconnected.

  For 2293_28_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side) or 2293_20_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side), go to H50.

  For 2293_29_CM (Air Bag Circuit Open - Loop No. 1, Front Driver Side) or 2293_21_CM (Air Bag Circuit Open - Loop No. 2, Front Driver Side), go to H50.

For 2293_31_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side) or 2293_23_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side), go to H51.

For 2293_30_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side) or 2293_22_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side), go to H53.

H47 CONFIRM THE PASSENGER AIR BAG MODULE FAULT

NOTE: **Make sure all restraint system components and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Passenger Air Bag Module C256a and C256b (if previously disconnected)
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2293 Fault PIDs
  - Refer to PID list in Normal Operation to view B2293 fault PIDs.
- **Does the original RCM on-demand DTC B2293 fault PID indicate a fault?**

  YES : INSTALL a new passenger air bag module. REFER to **Passenger Air Bag Module - Edge** or **Passenger Air Bag Module - MKX**. Go to H56.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of any electrical connector that were disconnected.

  For 2293_24_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side) or 2293_16_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side), go to H50.

  For 2293_25_CM (Air Bag Circuit Open - Loop No. 1, Front Passenger Side) or 2293_17_CM (Air Bag Circuit Open - Loop No. 2, Front Passenger Side), go to H50.

  For 2293_27_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side) or 2293_19_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side), go to H52.

  For 2293_26_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side) or 2293_18_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side), go to H54.

H48 CONFIRM THE CLOCKSPRING FAULT

NOTE: Make sure all restraint system components and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Clockspring C218
- Install the driver air bag module. Refer to **Driver Air Bag Module**.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2293 Fault PIDs
  - Refer to PID list in Normal Operation to view B2293 fault PIDs.
- **Does the original RCM on-demand DTC B2293 fault PID indicate a fault?**

  YES : INSTALL a new clockspring. REFER to **Clockspring**. Go to H56.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of any electrical connector that were disconnected.

  For 2293_28_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side) or 2293_20_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side), go to H50.

  For 2293_29_CM (Air Bag Circuit Open - Loop No. 1, Front Driver Side) or 2293_21_CM (Air Bag Circuit Open - Loop No. 2, Front Driver Side), go to H50.

  For 2293_31_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side) or 2293_23_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side), go to H51.

  For 2293_30_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side) or 2293_22_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side), go to H53.

H49 CONFIRM THE RCM FAULT

NOTE: Make sure all restraint system components and the RCM electrical connectors are connected before carrying out the on-demand self test. If

not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- If previously removed, install the driver air bag module. Refer to **Driver Air Bag Module**.
- Connect: Clockspring C218 (if previously disconnected)
- Connect: Passenger Air Bag Module C256a and C256b (if previously disconnected)
- Connect: RCM C310a and C310b (if previously disconnected)
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2293 Fault PIDs
  - Refer to PID list in Normal Operation to view B2293 fault PIDs.
- **Does the original RCM on-demand DTC B2293 fault PID indicate a fault?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to H56.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of any electrical connector that were disconnected.

  For 2293_28_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side) or 2293_20_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side), go to H50.

  For 2293_29_CM (Air Bag Circuit Open - Loop No. 1, Front Driver Side) or 2293_21_CM (Air Bag Circuit Open - Loop No. 2, Front Driver Side), go to H50.

  For 2293_31_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side) or 2293_23_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side), go to H51.

  For 2293_30_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side) or 2293_22_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side), go to H53.

  For 2293_24_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side) or 2293_16_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side), go to H50.

  For 2293_25_CM (Air Bag Circuit Open - Loop No. 1, Front Passenger Side) or 2293_17_CM (Air Bag Circuit Open - Loop No. 2, Front Passenger Side), go to H50.

For 2293_27_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side) or 2293_19_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side), go to H52.

For 2293_26_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side) or 2293_18_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side), go to H54.

H50 CHECK THE DRIVER OR PASSENGER AIR BAG MODULE FOR AN INTERMITTENT LOW RESISTANCE OR OPEN CIRCUIT FAULT

- If the fault PID was reported for the driver air bag module loop 1 or loop 2, monitor the following on the scan tool:
  - D_ABAGR (Driver Air Bag) resistance PID.
  - D_ABAGR2 (Driver Air Bag #2 Resistance) resistance PID.
  - 2293_28_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side) and 2293_20_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side) on-demand fault PID.
  - 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side) and 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side) on-demand fault PID.
- If the fault PID was reported for the passenger air bag module loop 1 or loop 2, monitor the following on the scan tool:
  - P_ABAGR (Passenger Air Bag) resistance PID.
  - P_ABAGR2 (Passenger Side Air Bag #2 Resistance) resistance PID.
  - 2293_24_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side) and 2293_16_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side) on-demand fault PID.
  - 2293_25_OD (Air Bag Circuit Open - Loop No. 1, Front Passenger Side) and 2293_17_OD (Air Bag Circuit Open - Loop No. 2, Front Passenger Side) on-demand fault PID.

NOTE: **A resistance PID that reads between 0.9 and 1.7 ohms for driver air bag and between 0.9 and 1.4 ohms for passenger air bag or between 4.4 and 5 ohms for driver air bag or between 3.5 and 5 ohms for the passenger air bag may or may not set an on-demand DTC yet indicates a strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition.**

NOTE: **Do not remove the driver or passenger air bag module from its mounted position at this time.**

- With the driver or passenger air bag in its mounted position, attempt to recreate the fault by wiggling connectors (including any inline connectors), and flexing the wire harness, tilting and rotating the steering wheel frequently.
- **Does any driver or passenger air bag on-demand fault PID indicate a fault or is any air bag resistance PID less than 1.7 ohms for driver air bag and less than 1.4 ohms for passenger air bag or greater than 4.4 ohms for driver air bag and greater than 3.5 ohms for passenger air**

bag?

YES : DEPOWER the SRS and REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to H56.

NO : Go to H55.

H51 CHECK THE DRIVER AIR BAG MODULE CIRCUITS FOR AN INTERMITTENT SHORT TO GROUND FAULT

- Monitor the 2293_23_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side) and 2293_31_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side) on-demand fault PIDs.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

NOTE: **Do not remove the driver air bag module from its mounted position at this time.**

- With the driver air bag in its mounted position, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness, tilting and rotating the steering wheel frequently.
- **Does any RCM on-demand B2293 fault PID indicate a fault is present?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to H56.

  NO : Go to H55.

H52 CHECK THE PASSENGER AIR BAG MODULE CIRCUITS FOR AN INTERMITTENT SHORT TO GROUND FAULT

NOTE: **When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.**

- Key in ON position.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.
- Monitor the 2293_27_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side) and 2293_19_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side) on-demand fault PIDs.

NOTE: **Do not remove the passenger air bag module from its mounted position at this time.**

- With the passenger air bag in its mounted position, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
- **Does any RCM on-demand B2293 fault PID indicate a fault is present?**

YES : DEPOWER the SRS and REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to H56.

NO : Go to H55.

H53 CHECK THE DRIVER AIR BAG MODULE CIRCUITS FOR AN INTERMITTENT SHORT TO BATTERY FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.
- Monitor the 2293_30_OD (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side) and 2293_22_OD (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side) on-demand fault PIDs.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness, tilting and rotating the steering wheel frequently.
- **Does any driver air bag module short to battery fault PID indicate a fault?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to H56.

  NO : Go to H55.

H54 CHECK THE PASSENGER AIR BAG MODULE CIRCUITS FOR AN INTERMITTENT SHORT TO VOLTAGE FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.
- Monitor the 2293_26_OD (Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side) and 2293_18_OD (Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side) on-demand fault PIDs.

NOTE: **Do not remove the passenger air bag module from its mounted**

position at this time.

- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
- **Does any passenger air bag module short to battery fault PID indicate a fault?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to H56.

  NO : Go to H55.

H55 CHECK THE HARNESS AND CONNECTORS

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- If the fault PID was reported for the driver air bag:
  - remove the driver air bag module.
  - inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - inspect wire harness for any damage, pinched, cut or pierced wires.
- If the fault PID was reported for the passenger air bag:
  - disconnect the passenger air bag module C256.
  - inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - inspect wire harness for any damage, pinched, cut or pierced wires.
- **Were any concerns found?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to H56.

  NO : The fault is not present and cannot be recreated at this time. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to H56.

H56 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at

this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test I: DTC B2294 - Restraint System - Curtain Fault

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) continuously monitors the driver and passenger safety canopy module circuits (loop) for an acceptable resistance range, unacceptable voltage and shorts to ground. The RCM will set on-demand and store DTC B2294 in memory if any of these conditions are detected to be outside of their respectful range. If the RCM detects a fault, it will send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

As the RCM continuously monitors safety canopy module circuits for resistance, it expects a normal resistance between 1.4 and 3.5 ohms.

If a loop resistance is between 0.9 and 1.4 or between 3.5 and 5 ohms, there exists a strong potential for an intermittent fault, a DTC may or may not set. The RCM will also set an on-demand DTC if the loop resistance is less than 0.9 ohm or greater than 5 ohms.

Fault PIDs[a]	Description	Fault Trigger Condition
2294_24_OD and 2294_24_CM	A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side	When the RCM measures less than 0.9 ohm between the passenger safety canopy circuits, a fault will be indicated.
2294_25_OD and 2294_25_CM	A - B or A - C Pillar Curtain Circuit Open, Passenger Side	When the RCM measures greater than 5 ohms between the passenger safety canopy circuits, a fault will be indicated.
2294_26_OD and 2294_26_CM	A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side	When the RCM senses a short to ground on either on the passenger safety canopy circuits, a fault will be indicated.

2294_27_OD and 2294_27_CM	A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side	When the RCM senses a short to voltage on either on the passenger safety canopy circuits, a fault will be indicated.
2294_28_OD and 2294_28_CM	A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side	When the RCM measures less than 0.9 ohm between the driver safety canopy circuits, a fault will be indicated.
2294_29_OD and 2294_29_CM	A - B or A - C Pillar Curtain Circuit Open, Driver Side	When the RCM measures greater than 5 ohms between the driver safety canopy circuits, a fault will be indicated.
2294_30_OD and 2294_30_CM	A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side	When the RCM senses a short to ground on either on the driver safety canopy circuits, a fault will be indicated.
2294_31_OD and 2294_31_CM	A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side	When the RCM senses a short to voltage on either on the driver safety canopy circuits, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2294. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2294.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Safety canopy module
- RCM

PINPOINT TEST I: DTC B2294 - RESTRAINT SYSTEM - CURTAIN FAULT

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air**

curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

I1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2294 Fault PIDs
  - Refer to PID list in Normal Operation to view B2294 fault PIDs.
- **Do any RCM on-demand DTC B2294 fault PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test.

  Using the fault PIDs recorded, go to the appropriate pinpoint test step.

  For 2294_28_OD (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side), go to I2.

  For 2294_29_OD (A - B or A - C Pillar Curtain Circuit Open, Driver Side), go to I2.

  For 2294_30_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side), go to I9.

  For 2294_31_OD (A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side), go to I11.

  For 2294_24_OD (A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side), go to I12.

  For 2294_25_OD (A - B or A - C Pillar Curtain Circuit Open, Passenger Side), go to I12.

  For 2294_26_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side), go to

I19.

For 2294_27_OD (A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side), go to I21.

NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time.

Using the fault PIDs recorded, go to the appropriate pinpoint test step.

For 2294_28_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side), 2294_24_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side), 2294_29_CM (A - B or A - C Pillar Curtain Circuit Open, Driver Side) or 2294_25_CM (A - B or A - C Pillar Curtain Circuit Open, Passenger Side), go to I24.

For 2294_30_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side) or 2294_26_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side), go to I26.

For 2294_31_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side) or 2294_27_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side), go to I27.

I2 CHECK THE DRIVER SAFETY CANOPY MODULE RESISTANCE PID (DCURTL1)

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM
- Enter the following diagnostic mode on the diagnostic tool: DCURTL1 (Curtain Airbag Driver Loop No.1 Resistance) Resistance PID
- **Is the resistance PID value between 1.4 and 3.5 ohms?**

  YES : Go to I23.

  NO : Go to I3.

I3 CHECK THE DRIVER SAFETY CANOPY MODULE RESISTANCE PID (DCURTL1) WHILE CARRYING OUT A HARNESS TEST

- Continue monitoring the DCURTL1 (Curtain Airbag Driver Loop No.1 Resistance) resistance PID while carrying out a harness test of the driver safety canopy circuits and accessible connectors (including any inline connectors) by wiggling connectors and flexing the wire harness.
- **Does the resistance PID value read between 1.4 and 3.5 ohms while carrying out the harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to I28.

  NO : If the driver safety canopy resistance PID is less than 1.4 ohm, go to I4.

  If the driver safety canopy resistance PID is greater than 3.5 ohms, go to I7.

I4 CHECK THE DRIVER SAFETY CANOPY FOR LOW RESISTANCE FAULT

NOTE: **This pinpoint test step will attempt to change the fault reported by the**

RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Canopy C9018
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2294_28_OD (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side)
  - 2294_29_OD (A - B or A - C Pillar Curtain Circuit Open, Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the driver safety canopy disconnected, an open circuit fault would normally be retrieved.
- **Did the driver safety canopy on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to I22.

  NO : Go to I5.

I5 CHECK FOR A SHORT BETWEEN DRIVER SAFETY CANOPY MODULE CIRCUITS CR109 (BN/BU) AND RR109 (BU/GN)

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

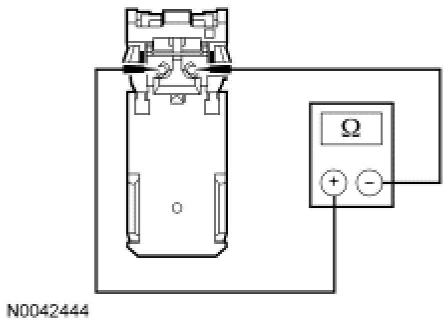


Fig. 68: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver safety canopy C9018-1, circuit CR109 (BN/BU), harness side and C9018-2, circuit RR109 (BU/GN), harness side.

- **Is resistance greater than 10,000 ohms?**

  YES : Go to I23.

  NO : Go to I6.

I6 CHECK THE RCM FOR LOW RESISTANCE

- Disconnect: RCM C310a and C310b

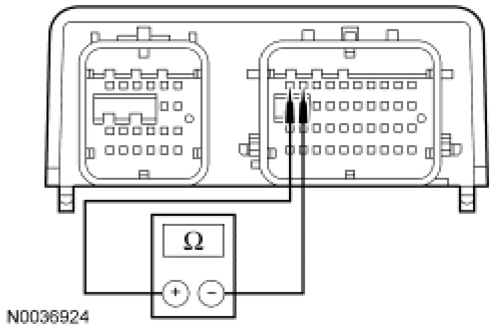


Fig. 69: Checking RCM For Low Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b pin 1, component side, and C310b pin 2, component side.
- **Is resistance greater than 10,000 ohms?**

  YES : REPAIR circuits CR109 (BN/BU) and RR109 (BU/GN). Go to I28.

  NO : Go to I23.

I7 CHECK THE DRIVER SAFETY CANOPY MODULE FOR AN OPEN

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Canopy C9018
- Connect a fused jumper wire between driver safety canopy C9018-1, circuit CR109 (BN/BU), harness side and C9018-2, circuit RR109 (BU/GN), harness side.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2294_28_OD (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side)
  - 2294_29_OD (A - B or A - C Pillar Curtain Circuit Open, Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the driver safety canopy circuits shorted together, a low resistance fault would normally be retrieved.
- **Did the driver safety canopy on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**

  YES : Go to I22.

  NO : Go to I8.

I8 CHECK CIRCUITS CR109 (BN/BU) AND RR109 (BU/GN) FOR AN OPEN BETWEEN THE RCM AND DRIVER SAFETY CANOPY MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the fused jumper wire from the driver safety canopy C9018.
- Disconnect: RCM C310a and C310b

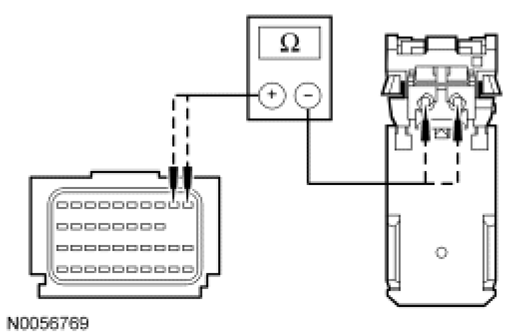


Fig. 70: Measuring Resistance Between RCM C310B-1, Circuit CR109 (BN/BU) & Driver Safety Canopy C9018-1
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-1, circuit CR109 (BN/BU), harness side and driver safety canopy C9018-1, circuit CR109 (BN/BU), harness side; and between RCM C310b-2, circuit RR109 (BU/GN), harness side and driver safety canopy C9018-2, circuit RR109 (BU/GN), harness side.
- **Are resistances less than 0.5 ohm?**

  YES : Go to I23.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR109 (BN/BU) or circuit RR109 (BU/GN). Go to I28.

I9 CHECK THE DRIVER SAFETY CANOPY MODULE FOR A SHORT TO GROUND

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

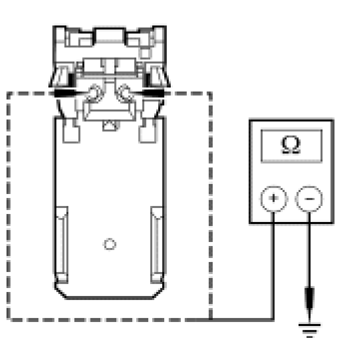
- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Canopy C9018
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2294_29_OD (A - B or A - C Pillar Curtain Circuit Open, Driver Side)
  - 2294_30_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the driver safety canopy disconnected, an open circuit fault would normally be retrieved.
- **Did the driver safety canopy on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to I22.

  NO : Go to I10.

I10 CHECK CIRCUITS CR109 (BN/BU) AND RR109 (BU/GN) FOR A SHORT TO GROUND BETWEEN THE RCM AND DRIVER SAFETY CANOPY MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b



N0056767

Fig. 71: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver safety canopy C9018-1, circuit CR109 (BN/BU), harness side and ground; and between driver safety canopy C9018-2, circuit RR109 (BU/GN), harness side and ground.
- **Are resistances greater than 10,000 ohms?**

  YES : Go to I23.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR109 (BN/BU) or circuit RR109 (BU/GN). Go to I28.

I11 CHECK CIRCUITS CR109 (BN/BU) AND RR109 (BU/GN) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND DRIVER SAFETY CANOPY MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Canopy C9018
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

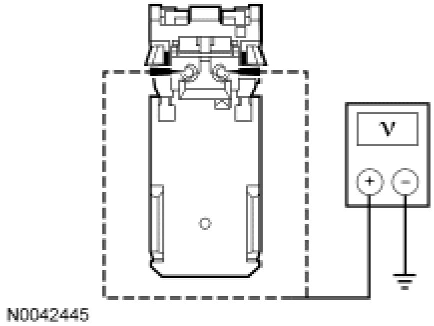


Fig. 72: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver safety canopy C9018-1, circuit CR109 (BN/BU), harness side and ground; and between driver safety canopy C9018-2, circuit RR109 (BU/GN), harness side and ground.
- **Are voltages less than 0.2 volt?**

  YES : Go to I23.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

REPAIR circuit CR109 (BN/BU) or circuit RR109 (BU/GN). Go to I28.

I12 CHECK THE PASSENGER SAFETY CANOPY MODULE RESISTANCE PID

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM
- Enter the following diagnostic mode on the diagnostic tool: PCURTL1 (Curtain Airbag Passenger Loop No.1 Resistance) Resistance PID
- **Is the resistance PID value between 1.4 and 3.5 ohms?**

  YES : Go to I23.

  NO : Go to I13.

I13 CHECK THE PASSENGER SAFETY CANOPY MODULE RESISTANCE PID (PCURTL1) WHILE CARRYING OUT A HARNESS TEST

- Continue monitoring the PCURTL1 (Curtain Airbag Passenger Loop No.1 Resistance) resistance PID while carrying out a harness test of the passenger safety canopy circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness.
- **Does the resistance PID value read between 1.4 and 3.5 ohms while carrying out the harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to I28.

  NO : If the passenger safety canopy resistance PID is less than 1.4 ohm, go to I14.

  If the passenger safety canopy resistance PID is greater than 3.5 ohms, go to I17.

I14 CHECK THE PASSENGER SAFETY CANOPY MODULE FOR LOW RESISTANCE FAULT

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Canopy C9019
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs

- 2294_24_OD (A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side)
- 2294_25_OD (A - B or A - C Pillar Curtain Circuit Open, Passenger Side)

- **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the passenger safety canopy disconnected, an open circuit fault would normally be retrieved.
- **Did the passenger safety canopy on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to I22.

  NO : Go to I15.

I15 CHECK FOR A SHORT BETWEEN PASSENGER SAFETY CANOPY MODULE CIRCUITS CR111 (BN/WH) AND RR111 (YE/VT)

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

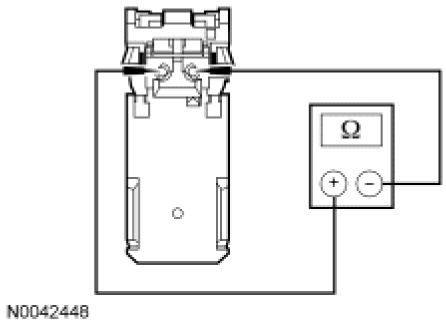


Fig. 73: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger safety canopy module C9019-1, circuit CR111 (BN/WH), harness side and C9019-2, circuit RR111 (YE/VT), harness side.
- **Is resistance greater than 10,000 ohms?**

  YES : Go to I23.

  NO : Go to I16.

I16 CHECK THE RCM FOR LOW RESISTANCE

- Disconnect: RCM C310a and C310b

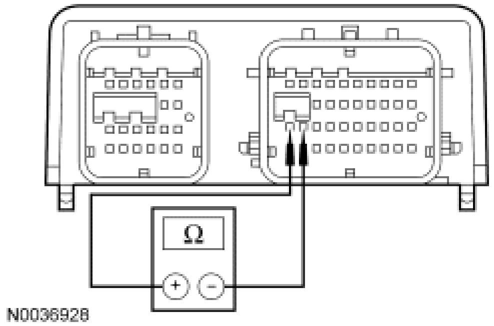


Fig. 74: Checking RCM
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b pin 21, component side, and C310b pin 22, component side.
- **Is resistance greater than 10,000 ohms?**

  YES : REPAIR circuits CR111 (BN/WH) and RR111 (YE/VT). Go to I28.

  NO : Go to I23.

I17 CHECK THE PASSENGER SAFETY CANOPY MODULE FOR AN OPEN

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Canopy C9007
- Connect a fused jumper wire between passenger safety canopy C9019-1, circuit CR111 (BN/WH), harness side and C9019-3, circuit RR111 (YE/VT), harness side.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2294_24_OD (A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side)
  - 2294_25_OD (A - B or A - C Pillar Curtain Circuit Open, Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the passenger safety canopy circuits shorted together, a low resistance fault would normally be retrieved.
- **Did the passenger safety canopy on-demand fault PIDs change from indicating an open**

circuit to a low resistance fault?

YES : Go to I22.

NO : Go to I18.

I18 CHECK CIRCUITS CR111 (BN/WH) AND RR111 (YE/VT) FOR AN OPEN BETWEEN THE RCM AND PASSENGER SAFETY CANOPY MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the fused jumper wire from the passenger safety canopy C9019.
- Disconnect: RCM C310a and C310b

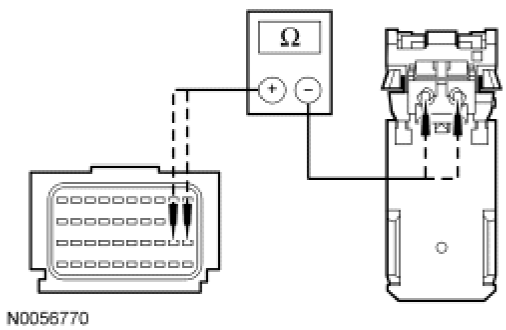


Fig. 75: Measuring Resistance Between RCM C310B-21, Circuit CR111 (BN/WH) & Passenger Safety Canopy Module C9019-1
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-21, circuit CR111 (BN/WH), harness side and passenger safety canopy module C9019-1, circuit CR111 (BN/WH), harness side; and between RCM C310b-22, circuit RR111 (YE/VT), harness side and passenger safety canopy module C9019-2, circuit RR111 (YE/VT), harness side.
- **Are resistances less than 0.5 ohm?**

  YES : Go to I23.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR111 (BN/WH) or circuit RR111 (YE/VT). Go to I28.

I19 CHECK THE PASSENGER SAFETY CANOPY MODULE FOR A SHORT TO GROUND

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.

- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Canopy C9019
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2294_25_OD (A - B or A - C Pillar Curtain Circuit Open, Passenger Side)
  - 2294_26_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the passenger safety canopy disconnected, an open circuit fault would normally be retrieved.
- **Did the passenger safety canopy on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to I22.

  NO : Go to I20.

I20 CHECK CIRCUITS CR111 (BN/WH) AND RR111 (YE/VT) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER SAFETY CANOPY MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

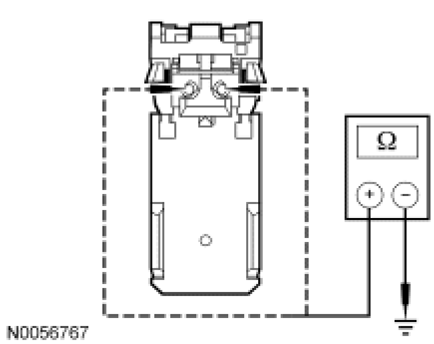


Fig. 76: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger safety canopy C9019-1, circuit CR111 (BN/WH), harness side and ground; and between passenger safety canopy C9019-2, circuit RR111 (YE/VT), harness side and ground.
- **Are resistances greater than 10,000 ohms?**

YES : Go to I23.

NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

REPAIR circuit CR111 (BN/WH) or circuit RR111 (YE/VT). Go to I28.

I21 CHECK CIRCUITS CR111 (BN/WH) AND RR111 (YE/VT) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND PASSENGER SAFETY CANOPY MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Canopy C9019
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

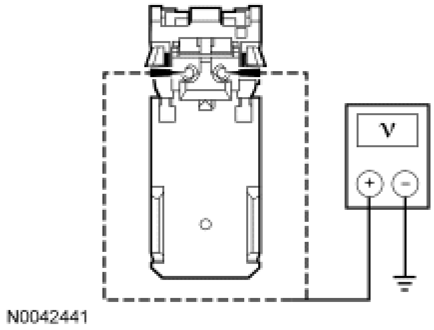


Fig. 77: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger safety canopy C9019-1, circuit CR111 (BN/WH), harness side and ground; and between passenger safety canopy C9019-2, circuit RR111 (YE/VT), harness side and ground.
- **Are voltages less than 0.2 volt?**

YES : Go to I23.

NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

REPAIR circuit CR111 (BN/WH) or circuit RR111 (YE/VT). Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to I28.

I22 CONFIRM THE SAFETY CANOPY MODULE FAULT

NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Affected Safety Canopy C9018 (Driver) C9019 (Passenger)
- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2294 Fault PIDs
  - Refer to PID list in Normal Operation to view B2294 fault PIDs.
- **Does the original RCM on-demand DTC B2294 fault PID indicate a fault?**

  YES : INSTALL a new driver or passenger safety canopy. REFER to **Safety Canopy Module**. Go to I28.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of any electrical connector that were disconnected.

  For 2294_28_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side), 2294_24_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side), 2294_29_CM (A - B or A - C Pillar Curtain Circuit Open, Driver Side) or 2294_25_CM (A - B or A - C Pillar Curtain Circuit Open, Passenger Side), go to I24.

  For 2294_30_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side) or 2294_26_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side), go to I26.

  For 2294_31_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side) or 2294_27_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side), go to I27.

I23 CONFIRM THE RCM FAULT

NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.

- If previously directed to disconnect any SRS component(s):
  - Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
  - Connect all previously disconnected restraint system component(s), including RCM C310a and C310b.
  - Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2294 Fault PIDs
  - Refer to PID list in Normal Operation to view B2294 fault PIDs.
- **Does the original RCM on-demand DTC B2294 fault PID indicate a fault?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to I28.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of any electrical connector that were disconnected.

  For 2294_28_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side), 2294_24_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side), 2294_29_CM (A - B or A - C Pillar Curtain Circuit Open, Driver Side) or 2294_25_CM (A - B or A - C Pillar Curtain Circuit Open, Passenger Side), go to I24.

  For 2294_30_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side) or 2294_26_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side), go to I26.

  For 2294_31_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side) or 2294_27_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side), go to I27.

I24 CHECK FOR AN INTERMITTENT SAFETY CANOPY LOW RESISTANCE OR OPEN CIRCUIT FAULT

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2294 Fault PIDs
  - Refer to PID list in Normal Operation to view B2294 fault PIDs.
- If the fault PID was reported for the driver safety canopy, monitor the DCURTL1 (Curtain Airbag Driver Loop No.1 Resistance) resistance PID on the scan tool.
- If the fault PID was reported for the passenger safety canopy, monitor the PCURTL1 (Curtain Airbag Passenger Loop No.1 Resistance) resistance PID on the scan tool.

NOTE: A resistance PID that reads between 0.9 and 1.4 ohms or between 3.5 and 5 ohms may or may not set an on-demand DTC yet indicates a

strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition.

- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
- **Does any RCM on-demand B2294 fault PID indicate a fault is present or is any safety canopy resistance PID less than 1.4 ohms or greater than 3.5 ohms?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to I28.

  NO : Go to I25.

I25 CHECK HARNESS AND CONNECTORS

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect the affected safety canopy module C9006 (driver) or C9007 (passenger):
  - inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - inspect wire harness for any damage, pinched, cut or pierced wires.
- **Were any concerns found?**

  YES : REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to I28.

  NO : The fault is not present and cannot be recreated at this time. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to I28.

I26 CHECK FOR AN INTERMITTENT SAFETY CANOPY MODULE SHORT TO GROUND FAULT

NOTE: **When monitoring fault and/or resistance PIDs with the scan tool, up to a 2-second delay for the scan tool display to update should be expected.**

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM
- If the fault PID was reported for the driver safety canopy, monitor the 2294_30_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side) fault PID on the scan tool.
- If the fault PID was reported for the passenger safety canopy, monitor the 2294_26_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side) fault PID on the scan tool.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to a 2-second delay for the scan tool display to update.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing

the wire harness.

- **Does any safety canopy on-demand fault PID indicate a fault?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to I28.

  NO : The fault is not present and cannot be recreated at this time. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to I28.

I27 CHECK FOR AN INTERMITTENT SAFETY CANOPY MODULE SHORT TO BATTERY FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- If the fault PID was reported for the driver safety canopy, disconnect the driver safety canopy module C9018.
- If the fault PID was reported for the passenger safety canopy, disconnect the passenger safety canopy module C9019.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to a 2-second delay for the scan tool display to update.
- Monitor the 2294_31_OD (A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side) or 2294_27_OD (A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side) fault PIDs on the scan tool.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
- **Does any safety canopy on-demand fault PID indicate a fault?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to I28.

  NO : The fault is not present and cannot be recreated at this time. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to I28.

I28 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an**

accidental deployment.

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test J: DTC B2295 - Restraint System - Side Air Bag Fault

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

A seat side air bag module provides protection of the thorax area (between the neck and abdomen) of the body, working in conjunction with the head protection provided by a safety canopy module. Refer to **Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)**.

The restraints control module (RCM) continuously monitors the driver and passenger side air bag module circuits (loop) for an acceptable resistance range, unacceptable voltage and shorts to ground. The RCM will set on-demand and store DTC B2295 in memory if any of these conditions are detected to be outside of their respectful range. If the RCM detects a fault, it will send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

As the RCM continuously monitors side air bag module circuits for resistance, it expects a normal resistance between 1.4 and 3.5 ohms.

If a loop resistance is between 0.9 and 1.4 or between 3.5 and 5 ohms, there exists a strong potential for an intermittent fault, a DTC may or may not set. The RCM will also set an on-demand DTC if the loop resistance is less than 0.9 ohm or greater than 5 ohms.

Fault PIDs[a]	Description	Fault Trigger Condition
2295_24_OD and 2295_24_CM	Side Air Bag Circuit Resistance Low, Front Passenger Side	When the RCM measures less than 0.9 ohm between the passenger side air bag module circuits, a fault will be indicated.
		When the RCM measures

2295_25_OD and 2295_25_CM	Side Air Bag Circuit Open, Front Passenger Side	greater than 5 ohms between the passenger side air bag module circuits, a fault will be indicated.
2295_26_OD and 2295_26_CM	Side Air Bag Circuit Short to Ground, Front Passenger Side	When the RCM senses a short to ground on either of the passenger side air bag module circuits, a fault will be indicated.
2295_27_OD and 2295_27_CM	Side Air Bag Circuit Short to Battery, Front Passenger Side	When the RCM senses a short to voltage on either of the passenger side air bag module circuits, a fault will be indicated.
2295_28_OD and 2295_28_CM	Side Air Bag Circuit Resistance Low, Front Driver Side	When the RCM measures less than 0.9 ohm between the driver side air bag module circuits, a fault will be indicated.
2295_29_OD and 2295_29_CM	Side Air Bag Circuit Open, Front Driver Side	When the RCM measures greater than 5 ohms between the driver side air bag module circuits, a fault will be indicated.
2295_30_OD and 2295_30_CM	Side Air Bag Circuit Short to Ground, Front Driver Side	When the RCM senses a short to ground on either on the driver side air bag module circuits, a fault will be indicated.
2295_31_OD and 2295_31_CM	Side Air Bag Circuit Short to Battery, Front Driver Side	When the RCM senses a short to voltage on either on the driver side air bag module circuits, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2295. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2295.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Side air bag module
- RCM

PINPOINT TEST J: DTC B2295 - RESTRAINT SYSTEM - SIDE AIR BAG FAULT

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: **The SRS must be fully operational and free of faults before releasing the vehicle to the customer.**

J1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2295 Fault PIDs
  - Refer to PID list in Normal Operation to view B2295 fault PIDs.
- **Do any RCM on-demand DTC B2295 fault PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test.

  Using the on-demand fault PIDs recorded, go to the appropriate pinpoint test step.

  For 2295_28_OD (Side Air Bag Circuit Resistance Low, Front Driver Side), go to J2.

For 2295_29_OD (Side Air Bag Circuit Open, Front Driver Side), go to J2.

For 2295_30_OD (Side Air Bag Circuit Short to Ground, Front Driver Side), go to J9.

For 2295_31_OD (Side Air Bag Circuit Short to Battery, Front Driver Side), go to J11.

For 2295_24_OD (Side Air Bag Circuit Resistance Low, Front Passenger Side), go to J12.

For 2295_25_OD (Side Air Bag Circuit Open, Front Passenger Side), go to J12.

For 2295_26_OD (Side Air Bag Circuit Short to Ground, Front Passenger Side), go to J19.

For 2295_27_OD (Side Air Bag Circuit Short to Battery, Front Passenger Side), go to J21.

NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time.

Using the fault PIDs recorded, go to the appropriate pinpoint test step.

For 2295_28_CM (Side Air Bag Circuit Resistance Low, Front Driver Side), 2295_24_CM (Side Air Bag Circuit Resistance Low, Front Passenger Side), 2295_29_CM (Side Air Bag Circuit Open, Front Driver Side) or 2295_25_CM (Side Air Bag Circuit Open, Front Passenger Side), go to J24.

For 2295_30_CM (Side Air Bag Circuit Short to Ground, Front Driver Side) or 2295_26_CM (Side Air Bag Circuit Short to Ground, Front Passenger Side), go to J26.

For 2295_31_CM (Side Air Bag Circuit Short to Battery, Front Driver Side) or 2295_27_CM (Side Air Bag Circuit Short to Battery, Front Passenger Side), go to J27.

J2 CHECK THE DRIVER SIDE AIR BAG MODULE RESISTANCE PID (DS_AB)

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM
- Enter the following diagnostic mode on the diagnostic tool: DS_AB (Driver Side Impact Air Bag Resistance) Resistance PID
- **Is the resistance PID value between 1.4 and 3.5 ohms?**

  YES : Go to J23.

  NO : Go to J3.

J3 CHECK THE DRIVER SIDE AIR BAG RESISTANCE PID (DS_AB) WHILE CARRYING OUT A HARNESS TEST

- Continue monitoring the DS_AB (Driver Side Impact Air Bag Resistance) resistance PID while carrying out a harness test of the driver side air bag circuits and accessible connectors (including any inline connectors) by wiggling connectors and flexing the wire harness.
- **Does the resistance PID value read between 1.4 and 3.5 ohms while carrying out the harness test?**

YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to J28.

NO : If the driver side air bag resistance PID is less than 1.4 ohms, go to J4.

If the driver side air bag resistance PID is greater than 3.5 ohms, go to J7.

J4 CHECK THE DRIVER SIDE AIR BAG MODULE FOR LOW RESISTANCE FAULT

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Side Air Bag C328
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2295_28_OD (Side Air Bag Circuit Resistance Low, Front Driver Side)
  - 2295_29_OD (Side Air Bag Circuit Open, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the driver side air bag disconnected, an open circuit fault would normally be retrieved.
- **Did the driver side air bag on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to J22.

  NO : Go to J5.

J5 CHECK FOR A SHORT BETWEEN DRIVER SIDE AIR BAG MODULE CIRCUITS CR105 (GN/BU) AND RR105 (GY/YE)

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

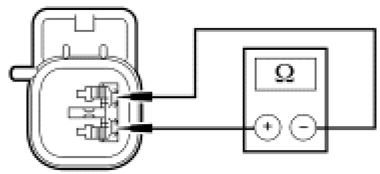


Fig. 78: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver side air bag C328-1, circuit CR105 (GN/BU), harness side and C328-2, circuit RR105 (GY/YE), harness side.
- **Is resistance greater than 10,000 ohms?**

  YES : Go to J22.

  NO : Go to J6.

J6 CHECK THE RCM FOR LOW RESISTANCE

- Disconnect: RCM C310a and C310b

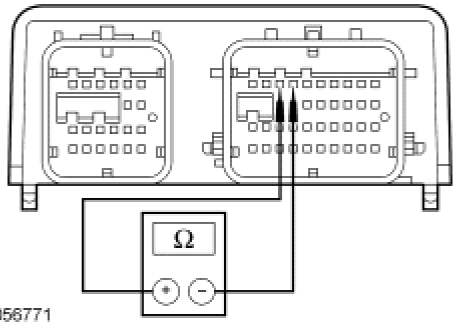


Fig. 79: Measuring Resistance Between RCM C310B Pin 3, Component Side, & C310B Pin 4
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b pin 3, component side, and C310b pin 4, component side.
- **Is resistance greater than 10,000 ohms?**

  YES : REPAIR circuits CR105 (GN/BU) and RR105 (GY/YE). Go to J25.

  NO : Go to J23.

J7 CHECK THE DRIVER SIDE AIR BAG MODULE FOR AN OPEN

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Side Air Bag Module C328
- Connect a fused jumper wire between driver side air bag C328-1, circuit CR110 (GN/BN), harness side and C328-2, circuit RR110 (GY/OG), harness side.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
    - 2295_28_OD (Side Air Bag Circuit Resistance Low, Front Driver Side)
    - 2295_29_OD (Side Air Bag Circuit Open, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the driver side air bag module circuits shorted together, a low resistance fault would normally be retrieved.
- **Did the driver side air bag on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**

  YES : Go to J22.

  NO : Go to J8.

J8 CHECK CIRCUITS CR105 (GN/BU) AND RR105 (GY/YE) FOR AN OPEN BETWEEN THE RCM AND DRIVER SIDE AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the fused jumper wire from the driver side air bag C328.
- Disconnect: RCM C310a and C310b

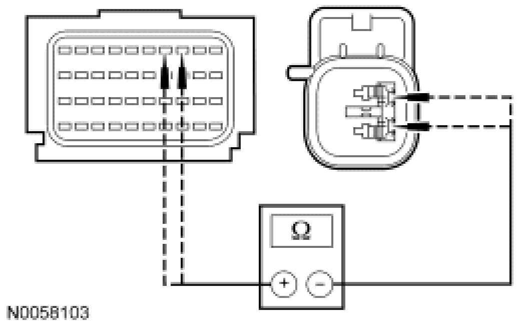


Fig. 80: Measuring Resistance Between RCM C310B-3 & C328-1, Circuit CR110 (GN/BN) & CR105 (GN/BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-3, circuit CR110 (GN/BN), harness side and driver side air bag C328-1, circuit CR105 (GN/BU), harness side; and between RCM C310b-4, circuit RR105 (GY/YE), harness side and driver side air bag C328-2, circuit RR105 (GY/YE), harness side.
- **Are resistances less than 0.5 ohm?**

  YES : Go to J23.

  NO : REPAIR circuit CR105 (GN/BU) or circuit RR105 (GY/YE). Go to J28.

J9 CHECK THE DRIVER SIDE AIR BAG MODULE FOR A SHORT TO GROUND

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Side Air Bag Module C328
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2295_29_OD (Side Air Bag Circuit Open, Front Driver Side)
  - 2295_30_OD (Side Air Bag Circuit Short to Ground, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the driver side air bag module disconnected, an open circuit fault would normally be retrieved.
- **Did the driver side air bag on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to J22.

  NO : Go to J10.

J10 CHECK CIRCUITS CR105 (GN/BU) AND RR105 (GY/YE) FOR A SHORT TO GROUND BETWEEN THE RCM AND DRIVER SIDE AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

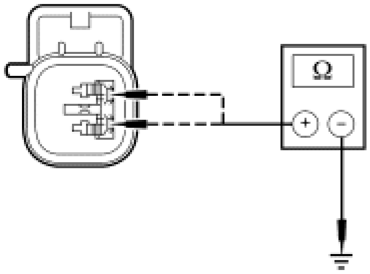


Fig. 81: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver side air bag C328-1, circuit CR105 (GN/BU), harness side and ground; and between driver side air bag C328-2, circuit RR105 (GY/YE), harness side and ground.
- **Is resistance greater than 10,000 ohms?**

  YES : Go to J23.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR105 (GN/BU) or circuit RR105 (GY/YE). Go to J28.

J11 CHECK CIRCUITS CR105 (GN/BU) AND RR105 (GY/YE) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND DRIVER SIDE AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Side Air Bag C328
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

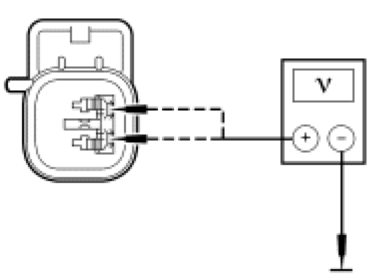


Fig. 82: Measuring Voltage

Courtesy of FORD MOTOR CO.

- Measure the voltage between driver side air bag C328-1, circuit CR105 (GN/BU), harness side and ground; and between driver side air bag C328-2, circuit RR105 (GY/YE), harness side and ground.
- **Are voltages less than 0.2 volt?**

  YES : Go to J23.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR105 (GN/BU) or circuit RR105 (GY/YE). Go to J28.

J12 CHECK THE PASSENGER SIDE AIR BAG MODULE RESISTANCE PID (PS_AB)

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM
- Enter the following diagnostic mode on the diagnostic tool: PS_AB (Passenger Side Impact Air Bag Resistance) Resistance PID
- **Is the resistance PID value between 1.4 and 3.5 ohms?**

  YES : Go to J23.

  NO : Go to J13.

J13 CHECK THE PASSENGER SIDE AIR BAG RESISTANCE PID (PS_AB) WHILE CARRYING OUT A HARNESS TEST

- Continue monitoring the PS_AB (Passenger Side Impact Air Bag Resistance) resistance PID while carrying out a harness test of the passenger side air bag circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness.
- **Does the resistance PID value read between 1.4 and 3.5 ohms while carrying out the harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to J28.

  NO : If the passenger side air bag resistance PID is less than 1.4 ohms, go to J14.

  If the passenger side air bag resistance PID is greater than 3.5 ohms, go to J17.

J14 CHECK THE PASSENGER SIDE AIR BAG MODULE FOR LOW RESISTANCE FAULT

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

- Disconnect: Passenger Side Air Bag C327
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2295_24_OD (Side Air Bag Circuit Resistance Low, Front Passenger Side)
  - 2295_25_OD (Side Air Bag Circuit Open, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the passenger side air bag module disconnected, an open circuit faults would normally be retrieved.
- **Did the passenger side air bag on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to J22.

  NO : Go to J15.

J15 CHECK FOR A SHORT BETWEEN PASSENGER SIDE AIR BAG MODULE CIRCUITS CR106 (VT/GY) AND RR106 (YE/OG)

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

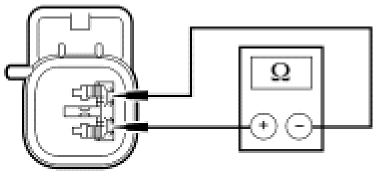


Fig. 83: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger side air bag C327-1, circuit CR106 (VT/GY), harness side and C327-2, circuit RR106 (YE/OG), harness side.
- **Is resistance greater than 10,000 ohms?**

  YES : Go to J23.

  NO : Go to J16.

J16 CHECK THE RCM FOR LOW RESISTANCE

- Disconnect: RCM C310a and C310b

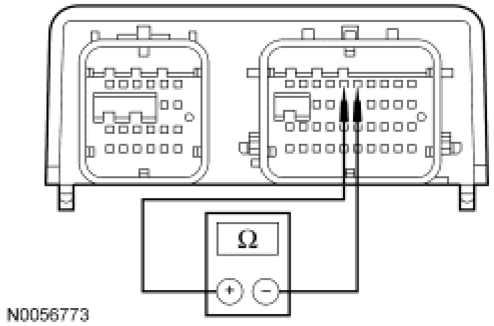


Fig. 84: Measuring Resistance Between RCM C310B Pin 5, Component Side, & C310B Pin 6
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b pin 5, component side, and C310b pin 6, component side.
- **Is resistance greater than 10,000 ohms?**

  YES : REPAIR circuits CR106 (VT/GY) and RR106 (YE/OG). Go to J28.

  NO : Go to J23.

J17 CHECK THE PASSENGER SIDE AIR BAG MODULE FOR AN OPEN

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Side Air Bag C327
- Connect a fused jumper wire between passenger side air bag C327-1, circuit CR106 (VT/GY), harness side and C327-2, circuit RR106 (YE/OG), harness side.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
  - 2295_24_OD (Side Air Bag Circuit Resistance Low, Front Passenger Side)
  - 2295_25_OD (Side Air Bag Circuit Open, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the passenger side air bag circuits shorted together, a low resistance fault would normally be retrieved.
- **Did the passenger side air bag on-demand fault PIDs change from indicating an open circuit**

to a low resistance fault?

YES : Go to J22.

NO : Go to J18.

J18 CHECK CIRCUITS CR106 (VT/GY) AND RR106 (YE/OG) FOR AN OPEN BETWEEN THE RCM AND PASSENGER SIDE AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the fused jumper wire from the passenger side air bag C327.
- Disconnect: RCM C310a and C310b

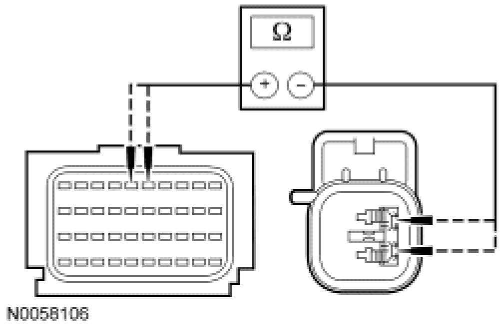


Fig. 85: Measuring Resistance Between RCM C310B-5, Circuit CR106 (VT/GY) & Passenger Side Air Bag Module C327-1
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-5, circuit CR106 (VT/GY), harness side and passenger side air bag module C327-1, circuit CR106 (VT/GY), harness side; and between RCM C310b-6, circuit RR106 (YE/OG), harness side and passenger side air bag module C327-2, circuit RR106 (YE/OG), harness side.
- **Are resistances less than 0.5 ohm?**

YES : Go to J23.

NO : REPAIR circuit CR106 (VT/GY) or circuit RR106 (YE/OG). Go to J28.

J19 CHECK THE PASSENGER SIDE AIR BAG MODULE FOR A SHORT TO GROUND

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Side Air Bag Module C327

- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record the Following Fault PIDs
    - 2295_25_OD (Side Air Bag Circuit Open, Front Passenger Side)
    - 2295_26_OD (Side Air Bag Circuit Short to Ground, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the passenger side air bag module disconnected, an open circuit fault would normally be retrieved.
- **Did the passenger side air bag on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to J22.

  NO : Go to J20.

J20 CHECK CIRCUITS CR106 (VT/GY) AND RR106 (YE/OG) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER SIDE AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

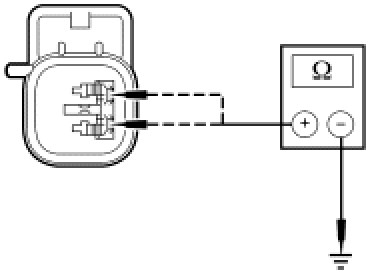


Fig. 86: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger side air bag C327-1, circuit CR106 (VT/GY), harness side and ground; and between passenger side air bag C327-2, circuit RR106 (YE/OG), harness side and ground.
- **Is resistance greater than 10,000 ohms?**

  YES : Go to J23.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

REPAIR circuit CR106 (VT/GY) or circuit RR106 (YE/OG). Go to J28.

J21 CHECK CIRCUITS CR106 (VT/GY) AND RR106 (YE/OG) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND PASSENGER SIDE AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Side Air Bag C327
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

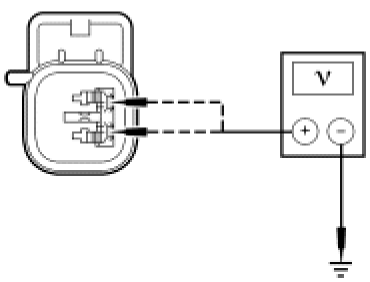


Fig. 87: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger side air bag C327-1, circuit CR106 (VT/GY), harness side and ground; and between passenger side air bag C327-2, circuit RR106 (YE/OG), harness side and ground.
- **Are voltages less than 0.2 volt?**

  YES : Go to J23.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR106 (VT/GY) or circuit RR106 (YE/OG). Go to J28.

J22 CONFIRM THE SIDE AIR BAG MODULE FAULT

NOTE:	**Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and**

Repowering.

- Connect: Affected Side Air Bag C328 (Driver) C3327 (Passenger)
- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2295 Fault PIDs
  - Refer to PID list in Normal Operation to view B2295 fault PIDs.
- **Does the original RCM on-demand DTC B2295 fault PID indicate a fault?**

  YES : REMOVE and INSPECT the seat side air bag module jumper harness, connector terminals for damage. REFER to **Side Air Bag Module**. If a concern is found, REPAIR or INSTALL a new seat jumper harness. Go to J28.

  If a concern was not found, INSTALL a new driver or passenger side air bag module. Go to J28.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of any electrical connector that were disconnected.

  For 2295_28_CM (Side Air Bag Circuit Resistance Low, Front Driver Side), 2295_24_CM (Side Air Bag Circuit Resistance Low, Front Passenger Side), 2295_29_CM (Side Air Bag Circuit Open, Front Driver Side) or 2295_25_CM (Side Air Bag Circuit Open, Front Passenger Side), go to J24.

  For 2295_30_CM (Side Air Bag Circuit Short to Ground, Front Driver Side) or 2295_26_CM (Side Air Bag Circuit Short to Ground, Front Passenger Side), go to J26.

  For 2295_31_CM (Side Air Bag Circuit Short to Battery, Front Driver Side) or 2295_27_CM (Side Air Bag Circuit Short to Battery, Front Passenger Side), go to J27.

J23 CONFIRM THE RCM FAULT

NOTE:	**Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- If previously directed to disconnect any SRS component(s):
  - Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
  - Connect all previously disconnected restraint system component(s), including RCM C310a

and C310b.

    - Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2295 Fault PIDs
    - Refer to PID list in Normal Operation to view B2295 fault PIDs.
- **Does the original RCM on-demand DTC B2295 fault PID indicate a fault?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to J28.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of any electrical connector that were disconnected.

  For 2295_28_CM (Side Air Bag Circuit Resistance Low, Front Driver Side), 2295_24_CM (Side Air Bag Circuit Resistance Low, Front Passenger Side), 2295_29_CM (Side Air Bag Circuit Open, Front Driver Side) or 2295_25_CM (Side Air Bag Circuit Open, Front Passenger Side), go to J24.

  For 2295_30_CM (Side Air Bag Circuit Short to Ground, Front Driver Side) or 2295_26_CM (Side Air Bag Circuit Short to Ground, Front Passenger Side), go to J26.

  For 2295_31_CM (Side Air Bag Circuit Short to Battery, Front Driver Side) or 2295_27_CM (Side Air Bag Circuit Short to Battery, Front Passenger Side), go to J27.

J24 CHECK FOR AN INTERMITTENT SIDE AIR BAG MODULE LOW RESISTANCE OR OPEN CIRCUIT FAULT

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2295 Fault PIDs
    - Refer to PID list in Normal Operation to view B2295 fault PIDs.
- If the fault PID was reported for the driver side air bag module, monitor the DS_AB (Driver Side Impact Air Bag Resistance) resistance PID on the scan tool.
- If the fault PID was reported for the passenger side air bag, monitor the PS_AB (Passenger Side Impact Air Bag Resistance) resistance PID on the scan tool.

NOTE: **A resistance PID that reads between 0.9 and 1.4 ohms or between 3.5 and 5 ohms may or may not set an on-demand DTC yet indicates a strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition.**

- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
- **Does any side air bag on-demand fault PID indicate a fault is present or is the side air bag resistance PID less than 1.4 ohms or greater than 3.5 ohms?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to J28.

  NO : Go to J25.

J25 CHECK THE HARNESS AND CONNECTORS

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect the affected side air bag C328 (driver) C327 (passenger):
  - inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - inspect wire harness for any damage, pinched, cut or pierced wires.
- **Were any concerns found?**

  YES : REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to J28.

  NO : The fault is not present and cannot be recreated at this time. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to J28.

J26 CHECK FOR AN INTERMITTENT SIDE AIR BAG MODULE SHORT TO GROUND FAULT

- If the fault PID was reported for the driver side air bag module, monitor the driver side air bag short to ground on-demand fault PID 2295_30_OD on the scan tool.
- If the fault PID was reported for the passenger side air bag, monitor the passenger side air bag short to ground on-demand fault PID 2295_26_OD on the scan tool.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
- **Does any RCM on-demand B2295 fault PID indicate a fault is present?**

  YES : REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to J28.

  NO : The fault is not present and cannot be recreated at this time. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to J28.

J27 CHECK FOR AN INTERMITTENT SIDE AIR BAG SHORT TO VOLTAGE FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Affected Safety Canopy Module C328 (Driver) C327 (Passenger)
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.
- Monitor the 2295_31_OD (Side Air Bag Circuit Short to Battery, Front Driver Side) or 2295_27_OD (Side Air Bag Circuit Short to Battery, Front Passenger Side) fault PIDs on the scan tool.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
- **Does any RCM on-demand B2295 fault PID indicate a fault is present?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information. Go to J28.

  NO : The fault is not present and cannot be recreated at this time. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to J28.

J28 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test K: DTC B2296 - Restraint System - Impact Sensor Fault

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors all of the impact sensor circuits for faults. If the RCM detects one of the following faults on any of the impact sensor circuits, it will store DTC B2296 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

Fault PIDs[a]	Description	Fault Trigger Condition
2296_3_OD and 2296_3_CM	Driver/Center Front Crash Sensor Circuit Short to Battery	When the RCM senses a short to battery on the driver/center front impact sensor circuits, a fault will be indicated.
2296_5_OD and 2296_5_CM	Driver/Center Front Crash Sensor Communication Fault	When the RCM is unable to communicate (circuit open, short to ground or battery on sensor) with the driver/center front impact sensor, a fault will be indicated.
2296_6_OD and 2296_6_CM	Side Crash Sensor Circuit Short to Battery, Row No.2 Passenger Side	When the RCM senses a short to battery on the passenger second row side impact sensor, a fault will be indicated.
2296_7_OD and 2296_7_CM	Side Crash Sensor Circuit Short to Ground, Row No.2 Passenger Side	When the RCM senses a short to ground on the passenger second row side impact sensor, a fault will be indicated.
2296_8_OD and 2296_8_CM	Side Crash Sensor Communication Fault, Row No.2 Passenger Side	When the RCM is unable to communicate (circuit open, short to ground or battery on sensor) with the passenger second row side impact sensor, a fault will be indicated.
2296_9_OD and 2296_9_CM	Side Crash Sensor Circuit Short to Battery, Row No.2 Driver Side	When the RCM senses a short to battery on the driver second row side impact sensor circuits, a fault will be indicated.
		When the RCM senses a short to ground on the

2296_10_OD and 2296_10_CM	Side Crash Sensor Circuit Short to Ground, Row No.2 Driver Side	driver second row side impact sensor circuits, a fault will be indicated.
2296_11_OD and 2296_11_CM	Side Crash Sensor Communication Fault, Row No.2 Driver Side	When the RCM is unable to communicate (circuit open, short to ground or battery on sensor) with the driver second row side impact sensor, a fault will be indicated.
2296_12_OD and 2296_12_CM	Side Crash Sensor Circuit Short to Battery, Front Passenger Side	When the RCM senses a short to battery on the passenger first row side impact sensor circuits, a fault will be indicated.
2296_13_OD and 2296_13_CM	Side Crash Sensor Circuit Short to Ground, Front Passenger Side	When the RCM senses a short to ground on the passenger first row side impact sensor circuits, a fault will be indicated.
2296_14_OD and 2296_14_CM	Side Crash Sensor Communication Fault, Front Passenger Side	When the RCM is unable to communicate (circuit open, short to ground or battery on sensor) with the passenger first row side impact sensor, a fault will be indicated.
2296_15_OD and 2296_15_CM	Side Crash Sensor Circuit Short to Battery, Front Driver Side	When the RCM senses a short to battery on the driver first row side impact sensor circuits, a fault will be indicated.
2296_16_OD and 2296_16_CM	Side Crash Sensor Circuit Short to Ground, Front Driver Side	When the RCM senses a short to ground on the driver first row side impact sensor circuits, a fault will be indicated.
2296_17_OD and 2296_17_CM	Side Crash Sensor Communication Fault, Front Driver Side	When the RCM is unable to communicate (circuit open, short to ground or battery on sensor) with the driver first row side impact sensor, a fault will be indicated.
2296_18_OD and		When the RCM senses a internal failure with the

2296_18_CM	Driver/Center Front Crash Sensor Internal Fault	driver/center front impact sensor, a fault will be indicated.
2296_19_OD and 2296_19_CM	Driver/Center Front Crash Sensor Mount/Communication Fault	When the RCM is unable to communicate (circuit open, short to ground or battery on sensor) with the driver/center front impact sensor, a fault will be indicated.
2296_24_OD and 2296_24_CM	Side Crash Sensor 2 Internal Fault, Passenger Side	When the RCM senses a internal failure with the passenger second row side impact sensor, a fault will be indicated.
2296_25_OD and 2296_25_CM	Side Crash Sensor Mount or Communication Fault, Row No. 2 Passenger Side	When the RCM is unable to communicate (circuit open, short to ground or battery on sensor) with the passenger second row side impact sensor, a fault will be indicated.
2296_26_OD and 2296_26_CM	Side Crash Sensor 2 Internal Fault, Driver Side	When the RCM senses a internal failure with the driver second row side impact sensor, a fault will be indicated.
2296_27_OD and 2296_27_CM	Side Crash Sensor Mount or Communication Fault, Row No. 2 Driver Side	When the RCM is unable to communicate (circuit open, short to ground or battery on sensor) with the driver second row side impact sensor, a fault will be indicated.
2296_28_OD and 2296_28_CM	Side Crash Sensor Internal Fault, Front Passenger Side	When the RCM senses a internal failure with the passenger first row side impact sensor, a fault will be indicated.
2296_29_OD and 2296_29_CM	Side Crash Sensor Mount or Communication Fault, Front Passenger Side	When the RCM is unable to communicate (circuit open, short to ground or battery on sensor) with the passenger first row side impact sensor, a fault will be indicated.

2296_30_OD and 2296_30_CM	Side Crash Sensor Internal Fault, Front Driver Side	When the RCM senses a internal failure with the driver first row side impact sensor, a fault will be indicated.
2296_31_OD and 2296_31_CM	Side Crash Sensor Mount or Communication Fault, Front Driver Side	When the RCM is unable to communicate (circuit open, short to ground or battery on sensor) with the driver side first row side impact sensor, a fault will be indicated.
2296_55_OD and 2296_55_CM	Passenger Front Crash Sensor Circuit Short to Battery	When the RCM is unable to communicate (circuit open, short to ground or battery on sensor) with the passenger front impact sensor, a fault will be indicated.
2296_56_OD and 2296_56_CM	Passenger Front Crash Sensor Circuit Short to Ground	When the RCM is unable to communicate (circuit open, short to ground or battery on sensor) with the passenger front impact sensor, a fault will be indicated.
2296_57_OD and 2296_57_CM	Passenger Front Crash Sensor Communication Fault	When the RCM is unable to communicate (circuit open, short to ground or battery on sensor) with the passenger front impact sensor, a fault will be indicated.
2296_58_OD and 2296_58_CM	Passenger Front Crash Sensor Internal Fault	When the RCM senses a internal failure with the with the passenger front impact sensor, a fault will be indicated.
2296_59_OD and 2296_59_CM	Passenger Front Crash Sensor Mount/Communication Fault	When the RCM is unable to communicate (circuit open, short to ground or battery on sensor) with the driver/center front impact sensor, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2296. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2296.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Impact sensor
- Incorrect sensor mounting
- RCM

PINPOINT TEST K: DTC B2296 - RESTRAINT SYSTEM - IMPACT SENSOR FAULT

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Do not probe any impact sensor. The impact sensor cannot be tested using a multi-meter.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: **The SRS must be fully operational and free of faults before releasing the vehicle to the customer.**

K1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Do any RCM on-demand DTC B2296 fault PIDs indicate a fault?**

YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test.

Using the fault PIDs recorded, go to the appropriate pinpoint test step.

For 2296_30_OD (Side Crash Sensor Internal Fault, Front Driver Side), INSTALL a new first row driver side impact sensor. REFER to **Side Impact Sensor - B-Pillar**. Go to K34.

For 2296_28_OD (Side Crash Sensor Internal Fault, Front Passenger Side), INSTALL a new first row passenger side impact sensor. REFER to **Side Impact Sensor - B-Pillar**. Go to K34.

For 2296_26_OD (Side Crash Sensor 2 Internal Fault, Driver side), INSTALL a new second row driver side impact sensor. REFER to **Side Impact Sensor - C-Pillar**. Go to K34.

For second row passenger side impact sensor with an internal fault (2296_24_OD (Side Crash Sensor 2 Internal Fault, Passenger side), INSTALL a new second row passenger side impact sensor. REFER to **Side Impact Sensor - C-Pillar**. Go to K34.

For 2296_18_OD (Driver/Center Front Crash Sensor Internal Fault), INSTALL a new driver/center front impact severity sensor. REFER to **Front Impact Severity Sensor**. Go to K34.

For 2296_58_OD (Passenger Front Crash Sensor Internal Fault), INSTALL a new passenger front impact severity sensor. REFER to **Front Impact Severity Sensor**. Go to K34.

For 2296_17_OD (Side Crash Sensor Communication Fault, Front Driver Side)/2296_31_OD (Side Crash Sensor Mount or Communication Fault, Front Driver Side), go to K2.

For 2296_16_OD (Side Crash Sensor Circuit Short to Ground, Front Driver Side), go to K4.

For 2296_15_OD (Side Crash Sensor Circuit Short to Battery, Front Driver Side), go to K6.

For 2296_14_OD (Side Crash Sensor Communication Fault, Front Passenger Side), go to K7.

For 2296_13_OD (Side Crash Sensor Circuit Short to Ground, Front Passenger Side), go to K9.

For 2296_12_OD (Side Crash Sensor Circuit Short to Battery, Front Passenger Side), go to K11.

For 2296_11_OD (Side Crash Sensor Communication Fault, Row No.2 Driver Side), go to K12.

For 2296_10_OD (Side Crash Sensor Circuit Short to Ground, Row No.2 Driver Side), go to K14.

For 2296_9_OD (Side Crash Sensor Circuit Short to Battery, Row No.2 Driver Side), go to K16.

For 2296_8_OD (Side Crash Sensor Communication Fault, Row No.2 Passenger Side), go to K17.

For 2296_7_OD (Side Crash Sensor Circuit Short to Ground, Row No.2 Passenger Side), go to

K19.

For 2296_6_OD (Side Crash Sensor Circuit Short to Battery, Row No.2 Passenger Side), go to K21.

For 2296_5_OD (Driver/Center Front Crash Sensor Communication Fault), go to K22.

For 2296_4_OD (Driver/Center Front Crash Sensor Circuit Short to Ground), go to K24.

For 2296_3_OD (Driver/Center Front Crash Sensor Circuit Short to Battery), go to K26.

For 2296_59_OD (Passenger Front Crash Sensor Mount/Communication Fault), go to K27.

For 2296_56_OD (Passenger Front Crash Sensor Circuit Short to Ground), go to K29.

For 2296_55_OD (Passenger Front Crash Sensor Circuit Short to Battery), go to K31.

NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to K33.

K2 CHECK CIRCUITS VR217 (GY/YE) AND RR131 (VT/GY) FOR AN OPEN BETWEEN THE RCM AND FIRST ROW DRIVER SIDE IMPACT SENSOR

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: First Row Driver Side Impact Sensor C3209
- Disconnect: RCM C310a and C310b

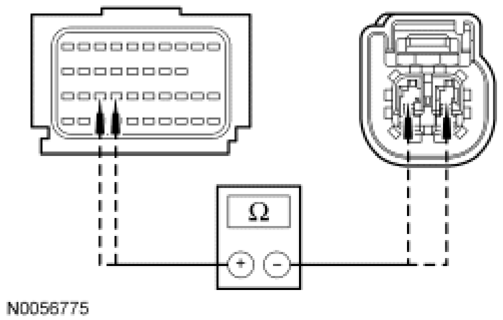


Fig. 88: Measuring Resistance Between RCM C310B-27 & C310B-28, Circuit VR217 (GY/YE) & RR131 (VT/GY)
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-27, circuit VR217 (GY/YE), harness side and first row driver side impact sensor C3209-1, circuit VR217 (GY/YE), harness side; and between RCM C310b-28, circuit RR131 (VT/GY), harness side and first row driver side impact sensor C3209-2, circuit RR131 (VT/GY), harness side.

- **Are resistances less than 0.5 ohm?**

  YES : Go to K3.

  NO : REPAIR circuit VR217 (GY/YE) or circuit RR131 (VT/GY). Go to K34.

K3 CHECK THE FIRST ROW DRIVER SIDE IMPACT SENSOR

- Connect: RCM C310a and C310b
- Install a known good first row driver side impact sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Were any on-demand B2296 fault PIDs for the first row driver side impact sensor indicating a fault?**

  YES : Go to K32.

  NO : Fault corrected. Go to K34.

K4 CHECK CIRCUITS VR217 (GY/YE) AND RR131 (VT/GY) FOR A SHORT TO GROUND BETWEEN THE FIRST ROW DRIVER SIDE IMPACT SENSOR AND RCM

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: First Row Driver Side Impact Sensor C3209
- Disconnect: RCM C310a and C310b

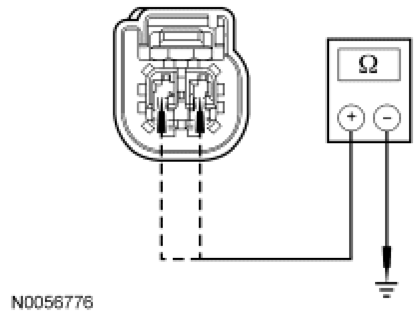


Fig. 89: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between first row driver side impact sensor C3209-2, circuit RR131 (VT/GY), harness side and ground; and between C3209-1, circuit VR217 (GY/YE), harness side and ground.

- **Are resistances greater than 10,000 ohms?**

  YES : Go to K5.

  NO : REPAIR circuit VR217 (GY/YE) or circuit RR131 (VT/GY). Go to K34.

K5 CHECK CIRCUIT VR217 (GY/YE) FOR A SHORT TO CIRCUIT RR131 (VT/GY) BETWEEN THE RCM AND FIRST ROW DRIVER SIDE IMPACT SENSOR

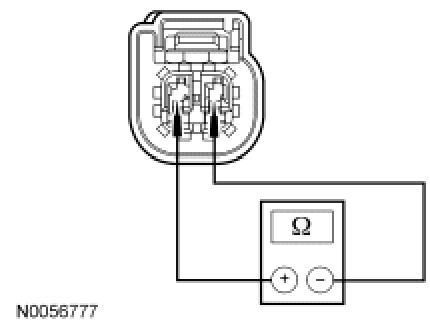


Fig. 90: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between first row driver side impact sensor C3209-1, circuit VR217 (GY/YE), harness side and C3209-2, circuit RR131 (VT/GY), harness side.
- **Is resistance greater than 10,000 ohms?**

  YES : Go to K32.

  NO : REPAIR circuits VR217 (GY/YE) and RR131 (VT/GY). Go to K34.

K6 CHECK CIRCUITS VR217 (GY/YE) AND RR131 (VT/GY) FOR A SHORT TO VOLTAGE BETWEEN THE FIRST ROW DRIVER SIDE IMPACT SENSOR AND RCM

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: First Row Driver Side Impact Sensor C3209
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

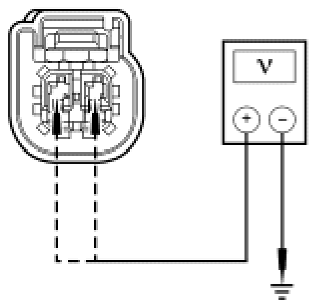


Fig. 91: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between first row driver side impact sensor C3209-2, circuit RR131 (VT/GY), harness side and ground; and between C3209-1, circuit VR217 (GY/YE), harness side and ground.
- **Are voltages less than 0.2 volt?**

  YES : Go to K32.

  NO : REPAIR circuit VR217 (GY/YE) or circuit RR131 (VT/GY). Go to K34.

K7 CHECK CIRCUITS VR218 (YE/OG) AND RR132 (BU/WH) FOR AN OPEN BETWEEN THE RCM AND FIRST ROW PASSENGER SIDE IMPACT SENSOR

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: First Row Passenger Side Impact Sensor C3211
- Disconnect: RCM C310a and C310b

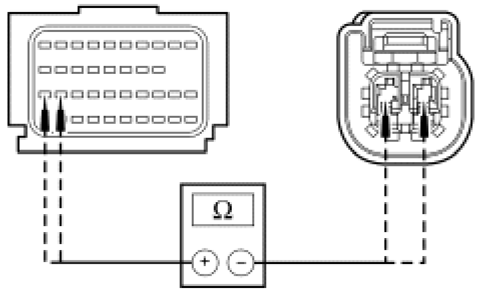


Fig. 92: Measuring Resistance Between RCM C310B-29 & C310B-30, Circuit VR218 (YE/OG) & RR132 (BU/WH)
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-29, circuit VR218 (YE/OG), harness side and first row passenger side impact sensor C3211-1, circuit VR218 (YE/OG), harness side; and between RCM C310b-30, circuit RR132 (BU/WH), harness side and first row passenger side impact sensor C3211-2, circuit RR132 (BU/WH), harness side.
- **Are resistances less than 0.5 ohm?**

YES : Go to K8.

NO : REPAIR circuit VR218 (YE/OG) or circuit RR132 (BU/WH). Go to K34.

K8 CHECK THE FIRST ROW PASSENGER SIDE IMPACT SENSOR

- Connect: RCM C310a and C310b
- Install a known good first row passenger side impact sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
    - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Were any on-demand B2296 fault PIDs for the first row passenger side impact sensor indicating a fault?**

YES : Go to K32.

NO : Fault corrected. Go to K34.

K9 CHECK CIRCUITS VR218 (YE/OG) AND RR132 (BU/WH) FOR A SHORT TO GROUND BETWEEN THE FIRST ROW PASSENGER SIDE IMPACT SENSOR AND RCM

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: First Row Passenger Side Impact Sensor C3211
- Disconnect: RCM C310a and C310b

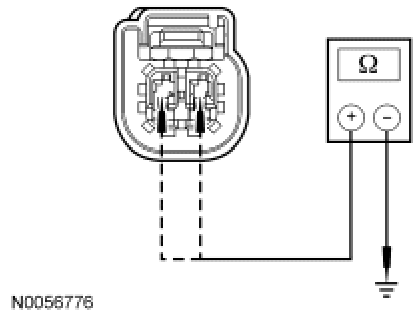


Fig. 93: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between first row passenger side impact sensor C3211-1, circuit VR218 (YE/OG), harness side and ground; and between C3211-2, circuit RR132 (BU/WH), harness side and ground.
- **Are resistances greater than 10,000 ohms?**

YES : Go to K10.

NO : REPAIR circuit VR218 (YE/OG) or circuit RR132 (BU/WH). Go to K34.

K10 CHECK CIRCUIT VR218 (YE/OG) FOR A SHORT TO CIRCUIT RR132 (BU/WH) BETWEEN THE RCM AND FIRST ROW PASSENGER SIDE IMPACT SENSOR

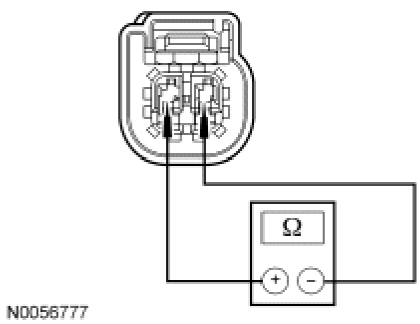


Fig. 94: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between first row passenger side impact sensor C3211-1, circuit VR218 (YE/OG), harness side and C3211-2, circuit RR132 (BU/WH), harness side.
- **Is resistance greater than 10,000 ohms?**

YES : Go to K32.

NO : REPAIR short between circuits VR218 (YE/OG) and RR132 (BU/WH). Go to K34.

K11 CHECK CIRCUITS VR218 (YE/OG) AND RR132 (BU/WH) FOR A SHORT TO VOLTAGE BETWEEN THE FIRST ROW PASSENGER SIDE IMPACT SENSOR AND RCM

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: First Row Passenger Side Impact Sensor C3211
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

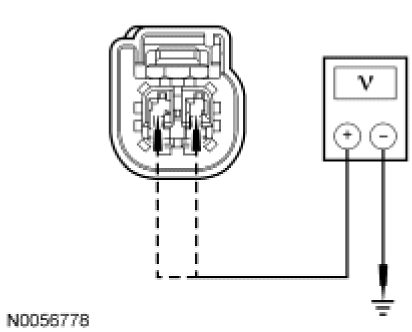


Fig. 95: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between first row passenger side impact sensor C3211-1, circuit VR218 (YE/OG), harness side and ground; and between C3211-2, circuit RR132 (BU/WH), harness side and ground.
- **Are voltages less than 0.2 volt?**

  YES : Go to K32.

  NO : REPAIR circuit VR218 (YE/OG) or circuit RR132 (BU/WH). Go to K34.

K12 CHECK CIRCUITS VR219 (GN/WH) AND RR133 (GY/BN) FOR AN OPEN BETWEEN THE RCM AND SECOND ROW DRIVER SIDE IMPACT SENSOR

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Second Row Driver Side Impact Sensor C3248
- Disconnect: RCM C310a and C310b

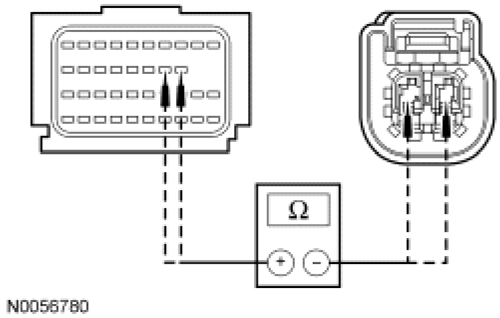


Fig. 96: Measuring Resistance Between RCM C310B-13 & C310B-14, Circuit VR219 (GN/WH) & RR135 (GY/BN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-13, circuit VR219 (GN/WH), harness side and second row driver side impact sensor C3248-1, circuit VR219 (GN/WH), harness side; and between RCM C310b-14, circuit RR135 (GY/BN), harness side and second row driver side impact sensor C3248-2, circuit RR133 (GY/BN), harness side.
- **Are resistances less than 0.5 ohm?**

  YES : Go to K13.

  NO : REPAIR circuit VR219 (GN/WH) or circuit RR133 (GY/BN). Go to K34.

K13 CHECK THE SECOND ROW DRIVER SIDE IMPACT SENSOR

- Connect: RCM C310a and C310b
- Install a known good second row driver side impact sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
    - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Were any on-demand B2296 fault PIDs for the second row driver side impact sensor indicating a fault?**

  YES : Go to K32.

  NO : Fault corrected. Go to K34.

K14 CHECK CIRCUITS VR219 (GN/WH) AND RR133 (GY/BN) FOR A SHORT TO GROUND BETWEEN THE SECOND ROW DRIVER SIDE IMPACT SENSOR AND RCM

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Second Row Driver Side Impact Sensor C3248
- Disconnect: RCM C310a and C310b

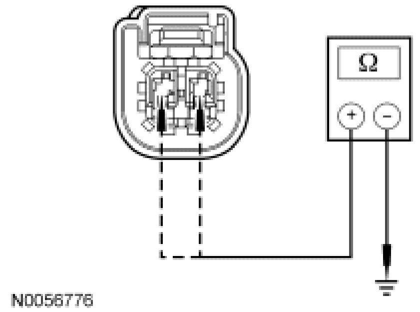


Fig. 97: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between second row driver side impact sensor C3248-1, circuit VR219 (GN/WH), harness side and ground; and between C3248-2, circuit RR133 (GY/BN), harness side and ground.
- **Are resistances greater than 10,000 ohms?**

  YES : Go to K15.

  NO : REPAIR circuit VR219 (GN/WH) or circuit RR133 (GY/BN). Go to K34.

K15 CHECK CIRCUIT VR219 (GN/WH) FOR A SHORT TO CIRCUIT RR133 (GY/BN) BETWEEN THE RCM AND SECOND ROW DRIVER SIDE IMPACT SENSOR

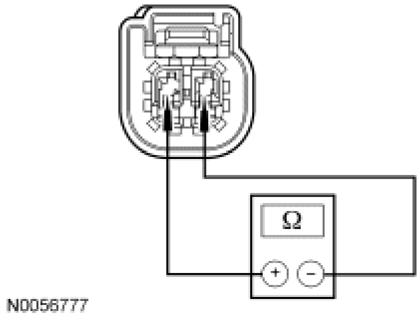


Fig. 98: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between second row driver side impact sensor C3248-1, circuit VR219 (GN/WH), harness side and C3248-2, circuit RR135 (GY/BN), harness side.
- **Is resistance greater than 10,000 ohms?**

  YES : Go to K32.

  NO : REPAIR circuits VR219 (GN/WH) and RR133 (GY/BN). Go to K34.

K16 CHECK CIRCUITS VR219 (GN/WH) AND RR133 (GY/BN) FOR A SHORT TO VOLTAGE BETWEEN THE SECOND ROW DRIVER SIDE IMPACT SENSOR AND RCM

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Second Row Driver Side Impact Sensor C3248
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

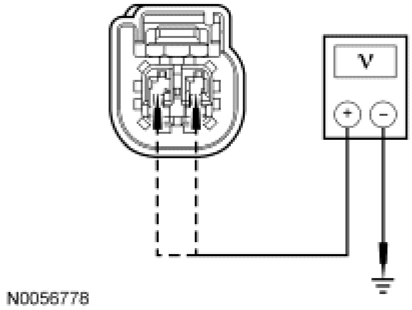


Fig. 99: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between second row driver side impact sensor C3248-1, circuit VR219 (GN/WH), harness side and ground; and between C3248-2, circuit RR133 (GY/BN), harness side and ground.

- **Are voltages less than 0.2 volt?**

  YES : Go to K32.

  NO : REPAIR circuit VR219 (GN/WH) or circuit RR133 (GY/BN). Go to K34.

K17 CHECK CIRCUITS VR220 (VT/OG) AND RR134 (BN/BU) FOR AN OPEN BETWEEN THE RCM AND SECOND ROW PASSENGER SIDE IMPACT SENSOR

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Second Row Passenger Side Impact Sensor C3249
- Disconnect: RCM C310a and C310b

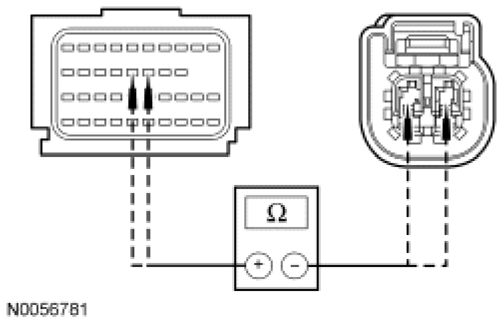


Fig. 100: Measuring Resistance Between RCM C310B-15 & C310B-16, Circuit VR220 (VT/OG) & RR134 (BN/BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-15, circuit VR220 (VT/OG), harness side and second row passenger side impact sensor C3249-1, circuit VR220 (VT/OG), harness side and between RCM C310b-16, circuit RR134 (BN/BU), harness side and second row passenger side impact sensor C3249-2, circuit RR134 (BN/BU), harness side.
- **Are resistances less than 0.5 ohm?**

  YES : Go to K18.

  NO : REPAIR circuit VR220 (VT/OG) or circuit RR134 (BN/BU). Go to K34.

K18 CHECK THE SECOND ROW PASSENGER SIDE IMPACT SENSOR

- Connect: RCM C310a and C310b
- Install a known good second row passenger side impact sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs

- Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Were any on-demand B2296 fault PIDs for the second row passenger side impact sensor indicating a fault?**

  YES : Go to K32.

  NO : Fault corrected. Go to K34.

K19 CHECK CIRCUITS VR220 (VT/OG) AND RR134 (BN/BU) FOR A SHORT TO GROUND BETWEEN THE SECOND ROW PASSENGER SIDE IMPACT SENSOR AND RCM

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Second Row Passenger Side Impact Sensor C3249
- Disconnect: RCM C310a and C310b

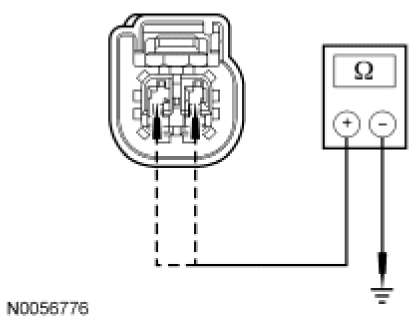


Fig. 101: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between second row passenger side impact sensor C3249-1, circuit VR220 (VT/OG), harness side and ground; and between C3249-2, circuit RR134 (BN/BU), harness side and ground.
- **Are resistances greater than 10,000 ohms?**

  YES : Go to K20.

  NO : REPAIR circuit VR220 (VT/OG) or circuit RR134 (BN/BU). Go to K34.

K20 CHECK CIRCUIT VR220 (VT/OG) FOR A SHORT TO CIRCUIT RR134 (BN/BU) BETWEEN THE RCM AND SECOND ROW PASSENGER SIDE IMPACT SENSOR

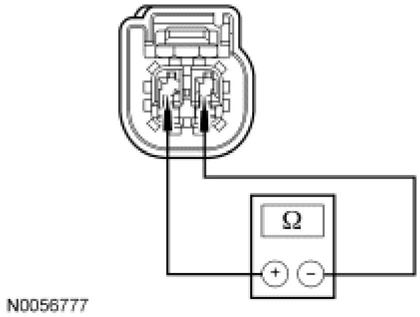


Fig. 102: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between second row passenger side impact sensor C3249-1, circuit VR220 (VT/OG), harness side and C3249-2, circuit RR134 (BN/BU), harness side.
- **Is resistance greater than 10,000 ohms?**

  YES : Go to K32.

  NO : REPAIR circuits VR220 (VT/OG) and RR130 (GN/BU). Go to K34.

K21 CHECK CIRCUITS VR220 (VT/OG) AND RR134 (BN/BU) FOR A SHORT TO VOLTAGE BETWEEN THE SECOND ROW PASSENGER SIDE IMPACT SENSOR AND RCM

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Second Row Passenger Side Impact Sensor C3249
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

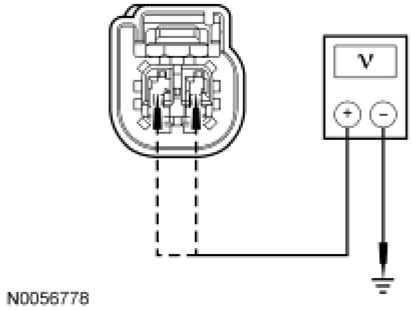


Fig. 103: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between second row passenger side impact sensor C3249-1, circuit VR220 (VT/OG), harness side and ground; and between C3249-2, circuit RR134 (BN/BU), harness side and ground.

- **Are voltages less than 0.2 volt?**

  YES : Go to K32.

  NO : REPAIR circuit VR220 (VT/OG) or circuit RR134 (BN/BU). Go to K34.

K22 CHECK CIRCUITS VR213 (VT/GN) AND RR129 (YE/GY) FOR AN OPEN BETWEEN THE RCM AND DRIVER/CENTER FRONT IMPACT SEVERITY SENSOR

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver/Center Front Impact Severity Sensor C1465
- Disconnect: RCM C310a and C310b

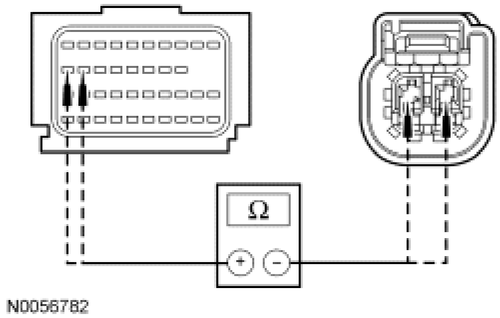


Fig. 104: Measuring Resistance Between RCM C310B-19 & C310B-20, Circuit VR213 (VT/GN) & RR129 (YE/GY)
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-19, circuit VR213 (VT/GN), harness side and driver/center front impact severity sensor C1465-1, circuit VR213 (VT/GN), harness side; and between RCM C310b-20, circuit RR129 (YE/GY), harness side and driver/center front impact severity sensor C1465-2, circuit RR129 (YE/GY), harness side.
- **Are resistances less than 0.5 ohm?**

  YES : Go to K23.

  NO : REPAIR circuit VR213 (VT/GN) or circuit RR129 (YE/GY). Go to K34.

K23 CHECK THE DRIVER/CENTER FRONT IMPACT SEVERITY SENSOR

- Connect: RCM C310a and C310b
- Install a known good driver/center front impact severity sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs

- Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Were any on-demand B2296 fault PIDs for the driver/center front impact severity sensor indicating a fault?**

  YES : Go to K32.

  NO : Fault corrected. Go to K34.

K24 CHECK CIRCUITS VR213 (VT/GN) AND RR129 (YE/GY) FOR A SHORT TO GROUND BETWEEN THE RCM AND DRIVER/CENTER FRONT IMPACT SEVERITY SENSOR

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver/Center Front Impact Severity Sensor C1465
- Disconnect: RCM C310a and C310b

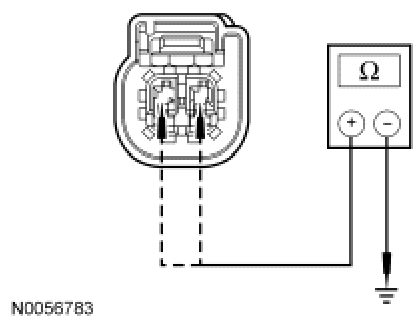


Fig. 105: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver/center front impact severity sensor C1465-1, circuit VR213 (VT/GN), harness side and ground; and between driver/center front impact severity sensor C1465-2, circuit RR129 (YE/GY), harness side and ground.
- **Are resistances greater than 10,000 ohms?**

  YES : Go to K25.

  NO : REPAIR circuit VR213 (VT/GN) or circuit RR129 (YE/GY). Go to K34.

K25 CHECK CIRCUIT VR213 (VT/GN) FOR A SHORT TO CIRCUIT RR129 (YE/GY) BETWEEN THE RCM AND DRIVER/CENTER FRONT IMPACT SEVERITY SENSOR

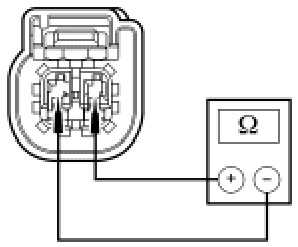


Fig. 106: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver/center front impact severity sensor C1465-1, circuit VR213 (VT/GN), harness side and C1465-2, circuit RR129 (YE/GY), harness side.
- **Is resistance greater than 10,000 ohms?**

  YES : Go to K32.

  NO : REPAIR circuits VR213 (VT/GN) and RR129 (YE/GY). Go to K34.

K26 CHECK CIRCUITS VR213 (VT/GN) AND RR129 (YE/GY) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND DRIVER/CENTER FRONT IMPACT SEVERITY SENSOR

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver/Center Front Impact Severity Sensor C1465
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

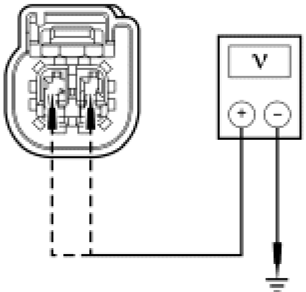


Fig. 107: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver/center front impact severity sensor C1465-1, circuit VR213 (VT/GN), harness side and ground; and between driver/center front impact severity sensor C1465-2, circuit RR129 (YE/GY), harness side and ground.

- **Are voltages less than 0.2 volt?**

  YES : Go to K32.

  NO : REPAIR circuit VR213 (VT/GN) or circuit RR129 (YE/GY). Go to K34.

K27 CHECK CIRCUITS VR214 (WH/BU) AND RR130 (GN/BU) FOR AN OPEN BETWEEN THE RCM AND PASSENGER FRONT IMPACT SEVERITY SENSOR

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Front Impact Severity Sensor C1466
- Disconnect: RCM C310a and C310b

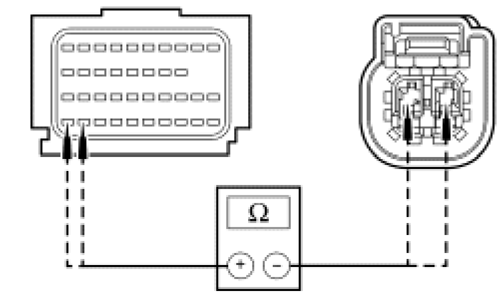


Fig. 108: Measuring Resistance Between RCM C310B-39 & C310B-40, Circuit VR214 (WH/BU) & RR130 (GN/BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-39, circuit VR214 (WH/BU), harness side and driver/center front impact severity sensor C1466-1, circuit VR214 (WH/BU), harness side; and between RCM C310b-40, circuit RR130 (GN/BU), harness side and passenger front impact severity sensor C1466-2, circuit RR130 (GN/BU), harness side.
- **Are resistances less than 0.5 ohm?**

  YES : Go to K28.

  NO : REPAIR circuit VR214 (WH/BU) or circuit RR130 (GN/BU). Go to K34.

K28 CHECK THE PASSENGER FRONT IMPACT SEVERITY SENSOR

- Connect: RCM C310a and C310b
- Install a known good passenger front impact severity sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs

- Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Were any on-demand B2296 fault PIDs for the passenger front impact severity sensor indicating a fault?**

  YES : Go to K32.

  NO : Fault corrected. Go to K34.

K29 CHECK CIRCUITS VR214 (WH/BU) AND RR130 (GN/BU) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER FRONT IMPACT SEVERITY SENSOR

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Front Impact Severity Sensor C1466
- Disconnect: RCM C310a and C310b

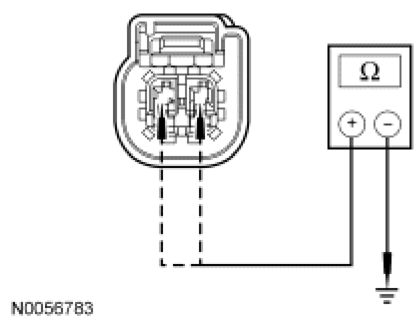


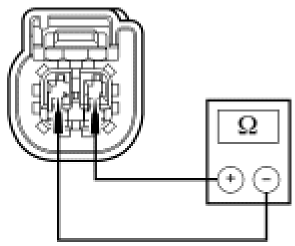
Fig. 109: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger front impact severity sensor C1466-1, circuit VR214 (WH/BU), harness side and ground; and between passenger front impact severity sensor C1466-2, circuit RR130 (GN/BU), harness side and ground.
- **Are resistances greater than 10,000 ohms?**

  YES : Go to K30.

  NO : REPAIR circuit VR214 (WH/BU) or circuit RR130 (GN/BU). Go to K34.

K30 CHECK CIRCUIT VR214 (WH/BU) FOR A SHORT TO CIRCUIT RR130 (GN/BU) BETWEEN THE RCM AND PASSENGER FRONT IMPACT SEVERITY SENSOR



N0056784

Fig. 110: Measuring Resistance
Courtesy of FORD MOTOR CO.

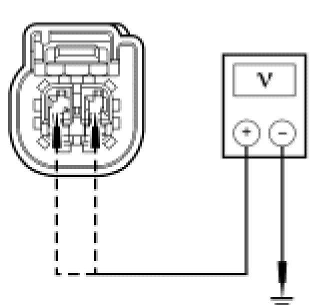
- Measure the resistance between passenger front impact severity sensor C1466-1, circuit VR214 (WH/BU), harness side and C1466-2, circuit RR130 (GN/BU), harness side.
- **Is resistance greater than 10,000 ohms?**

  YES : Go to K32.

  NO : REPAIR circuits VR214 (WH/BU) and RR130 (GN/BU). Go to K34.

K31 CHECK CIRCUITS VR214 (WH/BU) AND RR130 (GN/BU) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND PASSENGER FRONT IMPACT SEVERITY SENSOR

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Front Impact Severity Sensor C1466
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.



N0056785

Fig. 111: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger front impact severity sensor C1466-1, circuit VR214 (WH/BU), harness side and ground; and between passenger front impact severity sensor C1466-2, circuit RR130 (GN/BU), harness side and ground.

- **Are voltages less than 0.2 volt?**

  YES : Go to K32.

  NO : REPAIR circuit VR214 (WH/BU) or circuit RR130 (GN/BU). Go to K34.

K32 CONFIRM THE RCM FAULT

NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Install the original sensor (if known good sensor was installed in a previous step).
- Connect: All Previously Disconnected SRS Components
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Does the original RCM on-demand DTC B2296 fault PID indicate a fault?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to K34.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to K33.

K33 CHECK FOR AN INTERMITTENT FAULT

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Do any on-demand fault DTC B2296 PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is now present. The fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test.

  Using the fault PIDs recorded, go to the appropriate pinpoint test step.

For 2296_30_OD (Side Crash Sensor Internal Fault, Front Driver Side), INSTALL a new first row driver side impact sensor. REFER to **Side Impact Sensor - B-Pillar**. Go to K34.

For 2296_28_OD (Side Crash Sensor Internal Fault, Front Passenger Side), INSTALL a new first row passenger side impact sensor. REFER to **Side Impact Sensor - B-Pillar**. Go to K34.

For 2296_26_OD (Side Crash Sensor 2 Internal Fault, Driver side), INSTALL a new second row driver side impact sensor. REFER to **Side Impact Sensor - C-Pillar**. Go to K34.

For second row passenger side impact sensor with an internal fault (2296_24_OD (Side Crash Sensor 2 Internal Fault, Passenger side), INSTALL a new second row passenger side impact sensor. REFER to **Side Impact Sensor - C-Pillar**. Go to K34.

For 2296_18_OD (Driver/Center Front Crash Sensor Internal Fault), INSTALL a new driver/center front impact severity sensor. REFER to **Front Impact Severity Sensor**. Go to K34.

For 2296_58_OD (Passenger Front Crash Sensor Internal Fault), INSTALL a new passenger front impact severity sensor. REFER to **Front Impact Severity Sensor**. Go to K34.

For 2296_17_OD (Side Crash Sensor Communication Fault, Front Driver Side)/2296_31_OD (Side Crash Sensor Mount or Communication Fault, Front Driver Side), go to K2.

For 2296_16_OD (Side Crash Sensor Circuit Short to Ground, Front Driver Side), go to K4.

For 2296_15_OD (Side Crash Sensor Circuit Short to Battery, Front Driver Side), go to K6.

For 2296_14_OD (Side Crash Sensor Communication Fault, Front Passenger Side), go to K7.

For 2296_13_OD (Side Crash Sensor Circuit Short to Ground, Front Passenger Side), go to K9.

For 2296_12_OD (Side Crash Sensor Circuit Short to Battery, Front Passenger Side), go to K11.

For 2296_11_OD (Side Crash Sensor Communication Fault, Row No.2 Driver Side), go to K12.

For 2296_10_OD (Side Crash Sensor Circuit Short to Ground, Row No.2 Driver Side), go to K14.

For 2296_9_OD (Side Crash Sensor Circuit Short to Battery, Row No.2 Driver Side), go to K16.

For 2296_8_OD (Side Crash Sensor Communication Fault, Row No.2 Passenger Side), go to K17.

For 2296_7_OD (Side Crash Sensor Circuit Short to Ground, Row No.2 Passenger Side), go to K19.

For 2296_6_OD (Side Crash Sensor Circuit Short to Battery, Row No.2 Passenger Side), go to K21.

For 2296_5_OD (Driver/Center Front Crash Sensor Communication Fault), go to K22.

For 2296_4_OD (Driver/Center Front Crash Sensor Circuit Short to Ground), go to K24.

For 2296_3_OD (Driver/Center Front Crash Sensor Circuit Short to Battery), go to K26.

For 2296_59_OD (Passenger Front Crash Sensor Mount/Communication Fault), go to K27.

For 2296_56_OD (Passenger Front Crash Sensor Circuit Short to Ground), go to K29.

For 2296_55_OD (Passenger Front Crash Sensor Circuit Short to Battery), go to K31.

NO : VISUALLY INSPECT the affected impact sensor and mounting surface for damage, corrosion or dirt. INSPECT the wiring, terminals and connectors for damage, corrosion or dirt. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to K34.

K34 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test L: DTC B2432 - Drivers Seat Belt Buckle Switch Circuit Open

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) checks the safety belt buckle switch circuits for faults. If the RCM detects an open circuit fault, it will store DTC B2432 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC B2432 Drivers Seat Belt Buckle Switch Circuit Open - If the RCM detects an open on the driver safety belt buckle circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Driver safety belt buckle switch
- RCM

PINPOINT TEST L: DTC B2432 - DRIVERS SEAT BELT BUCKLE SWITCH CIRCUIT OPEN

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

L1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2432 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to L2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to L6.

L2 CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Belt Buckle Switch C3065
- Connect a fused jumper wire between driver safety belt buckle switch C3065-1, circuit GD143 (BK/VT), harness side and C3065-2, circuit CR201 (BU/OG).
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver safety belt buckle switch circuits shorted together, a short to ground fault would normally be retrieved.
- **Did the driver safety belt buckle switch on-demand DTC change from indicating B2432 to B2434?**

  YES : INSTALL a new driver safety belt buckle. REFER to **SAFETY BELT SYSTEM** article. Go to L7.

  NO : Go to L3.

L3 CHECK CIRCUIT CR201 (BU/OG) FOR AN OPEN BETWEEN THE RCM AND DRIVER SAFETY BELT BUCKLE SWITCH

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

- Remove the fused jumper wire from the driver safety belt buckle switch connector.

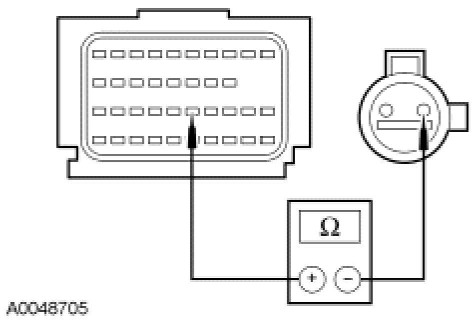


Fig. 112: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-25, circuit CR201 (BU/OG), harness side and driver safety belt buckle switch C3065-2, circuit CR201 (BU/OG), harness side.
- **Is resistance less than 0.5 ohm?**

  YES : Go to L4.

  NO : REPAIR circuit CR201 (BU/OG). Go to L7.

L4 CHECK CIRCUIT GD143 (BK/VT) FOR AN OPEN

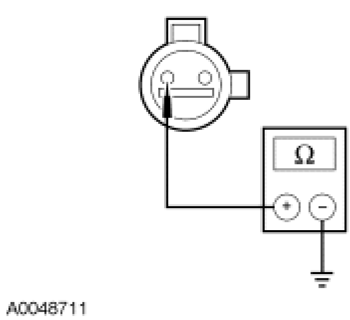


Fig. 113: Measuring Resistance Between Connector And Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver safety belt buckle switch C3065-1, circuit GD143 (BK/VT), harness side and ground.
- **Is resistance less than 0.5 ohm?**

  YES : Go to L5.

  NO : REPAIR circuit GD143 (BK/VT). Go to L7.

L5 CONFIRM THE RCM FAULT

NOTE:	**Make sure all restraint system sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self**

test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Driver Safety Belt Buckle Switch C3065
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2432 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to L7.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to L6.

L6 CHECK FOR AN INTERMITTENT FAULT

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2432 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to L2.

  NO : CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to L7.

L7 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints

- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test M: DTC B2433 - Drivers Seat Belt Buckle Switch Circuit Short to Battery

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) checks the safety belt buckle switch circuits for faults. If the RCM detects a short to voltage fault, it will store DTC B2433 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC B2433 Drivers Seat Belt Buckle Switch Circuit Short to Battery - If the RCM detects a short to battery on the driver safety belt buckle circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Driver safety belt buckle switch
- RCM

PINPOINT TEST M: DTC B2433 - DRIVERS SEAT BELT BUCKLE SWITCH CIRCUIT SHORT TO BATTERY

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor**

pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: **The SRS must be fully operational and free of faults before releasing the vehicle to the customer.**

M1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2433 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to M2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to M4.

M2 CHECK CIRCUIT CR201 (BU/OG) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Seat Side Air Bag Module C3628
- Disconnect: Driver Safety Belt Buckle Switch C3065
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

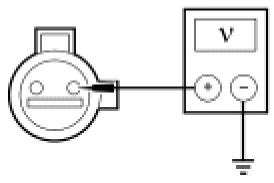


Fig. 114: Measuring Voltage Between connector And Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver safety belt buckle switch C3065-2, circuit CR201 (BU/OG), harness side and ground.
- **Is voltage less than 0.2 volt?**

  YES : Go to M3.

  NO : REPAIR circuit CR201 (BU/OG). Go to M5.

M3 CONFIRM THE RCM FAULT

NOTE: Make sure all restraint system sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Driver Safety Belt Buckle Switch C3065
- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2433 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to M5.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of any electrical connector that were disconnected. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to M4.

M4 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.

- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Seat Side Air Bag Module C328
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2433 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to M2.

  NO : CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to M5.

M5 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test N: DTC B2434 - Drivers Seat Belt Buckle Switch Short to Ground

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors the driver safety belt buckle switch circuits for faults. If the RCM detects a short to ground fault, it will store DTC B2434 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC B2434 Drivers Seat Belt Buckle Switch Circuit Short to Ground - If the RCM detects a short to ground on the driver safety belt buckle circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Driver safety belt buckle switch
- RCM

PINPOINT TEST N: DTC B2434 - DRIVERS SEAT BELT BUCKLE SWITCH SHORT TO GROUND

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: **The SRS must be fully operational and free of faults before releasing the vehicle**

to the customer.

N1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2434 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to N2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to N5.

N2 CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH FOR A SHORT TO GROUND

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Belt Buckle Switch C3065
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver safety belt buckle switch disconnected, a open circuit fault would normally be retrieved.
- **Did the driver safety belt buckle switch on-demand DTC change from indicating B2434 to B2432?**

  YES : INSTALL a new driver safety belt buckle assembly. REFER to **SAFETY BELT SYSTEM** article. Go to N6.

  NO : Go to N3.

N3 CHECK CIRCUIT CR201 (BU/OG) FOR A SHORT TO GROUND BETWEEN THE RCM AND DRIVER SAFETY BELT BUCKLE SWITCH

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

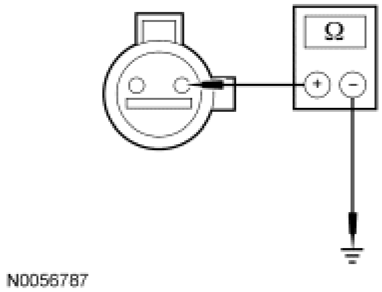


Fig. 115: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver safety belt buckle switch C3065-2, circuit CR201 (BU/OG), harness side and ground.
- **Is resistance greater than 10,000 ohms?**

  YES : Go to N4.

  NO : REPAIR circuit CR201 (BU/OG). Go to N6.

N4 CONFIRM THE RCM FAULT

NOTE: **Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Connect: Driver Safety Belt Buckle Switch C3065
- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2434 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to N6.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to N5.

N5 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs

- **Was RCM on-demand DTC B2434 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to N2.

  NO : CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to N6.

N6 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test O: DTC B2435 - Drivers Seat Belt Buckle Switch Resistance Out of Range

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors the driver safety belt buckle switch circuits for faults. If the RCM detects a current out of range fault, it will store DTC B2435 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC B2435 Drivers Seat Belt Buckle Switch Resistance Out of Range - If the RCM detects a current out of range between buckled and unbuckled on the driver safety belt buckle switch, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

- Driver safety belt buckle and pretensioner assembly
- RCM

PINPOINT TEST O: DTC B2435 - DRIVERS SEAT BELT BUCKLE SWITCH RESISTANCE OUT OF RANGE

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: **The SRS must be fully operational and free of faults before releasing the vehicle to the customer.**

O1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs

- **Was RCM on-demand DTC B2435 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to O2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to O4.

O2 CHECK THE SAFETY BELT BUCKLE SWITCH

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Belt Buckle Switch C3065
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver safety belt buckle switch disconnected, a open circuit fault would normally be retrieved.
- **Did the driver safety belt buckle switch on-demand DTC change from indicating B2435 to B2432?**

  YES : INSTALL a new driver safety belt buckle assembly. REFER to **SAFETY BELT SYSTEM** article. Go to O3.

  NO : Go to O5.

O3 CONFIRM THE RCM FAULT

NOTE:	**Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Driver Safety Belt Buckle Switch C3065
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2435 retrieved?**

YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to O5.

NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to O4.

O4 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect the driver safety belt buckle switch C3065:
  - Inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damage, pinched, cut or pierced wires.
  - Repair any concerns found. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information.
- Connect: All Previously Disconnected Component(s)/Connector(s)
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2435 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to O2.

  NO : CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to O5.

O5 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

> WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test P: DTC B2436 - Passengers Seat Belt Buckle Switch Circuit Open

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) checks the passenger safety belt buckle switch circuits for faults. If the RCM detects an open circuit fault, it will store DTC B2436 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC B2436 Passengers Seat Belt Buckle Switch Circuit Open - If the RCM detects an open on the passenger safety belt buckle circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Passenger safety belt buckle switch
- RCM

PINPOINT TEST P: DTC B2436 - PASSENGERS SEAT BELT BUCKLE SWITCH CIRCUIT OPEN

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

P1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2436 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to P2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to P6.

P2 CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Belt Buckle Switch C3066
- Connect a fused jumper wire between passenger safety belt buckle switch C3066-2, circuit CR203 (GY/VT), harness side and C3066-1, circuit GD143 (BK/VT), harness side.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the passenger safety belt buckle switch circuits shorted together, a short to ground fault would normally be retrieved.
- **Did the passenger safety belt buckle switch on-demand DTC change from indicating B2436 to B2438?**

  YES : INSTALL a new passenger safety belt buckle assembly. REFER to **SAFETY BELT SYSTEM** article. Go to P7.

  NO : Go to P3.

P3 CHECK CIRCUIT CR203 (GY/VT) FOR AN OPEN BETWEEN THE RCM AND PASSENGER SAFETY BELT BUCKLE SWITCH

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the fused jumper wire from the passenger safety belt buckle switch C3066.
- Disconnect: RCM C310a and C310b

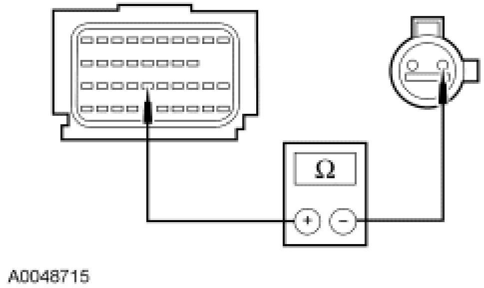


Fig. 116: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-26, circuit CR203 (GY/VT), harness side and the passenger safety belt buckle switch C3066-2, circuit CR203 (GY/VT), harness side.
- **Is resistance less than 0.5 ohm?**

  YES : Go to P4.

  NO : REPAIR circuit CR203 (GY/VT). Go to P7.

P4 CHECK CIRCUIT GD143 (BK/VT) FOR AN OPEN

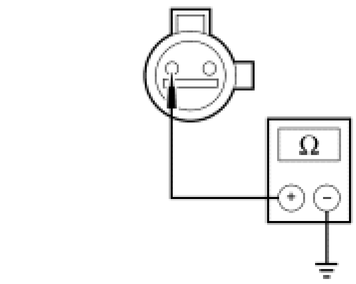


Fig. 117: Measuring Resistance Between Connector And Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger safety belt buckle switch C3066-2, circuit GD143 (BK/VT), harness side and ground.
- **Is resistance less than 0.5 ohm?**

  YES : Go to P5.

  NO : REPAIR circuit GD143 (BK/VT). Go to P7.

P5 CONFIRM THE RCM FAULT

NOTE:	**Make sure all restraint system sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Passenger Safety Belt Buckle Switch C3066
- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2436 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to P7.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to P6.

P6 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2436 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to P2.

  NO : CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to P7.

P7 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test Q: DTC B2437 - Passengers Seat Belt Buckle Switch Circuit Short to Battery

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) checks the passenger safety belt buckle switch circuits for faults. If the RCM detects a short to voltage fault, it will store DTC B2437 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC B2437 Passengers Seat Belt Buckle Switch Circuit Short to Battery - If the RCM detects a short to battery on the passenger safety belt buckle circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Passenger safety belt buckle switch
- RCM

PINPOINT TEST Q: DTC B2437 - PASSENGER'S SEAT BELT BUCKLE SWITCH CIRCUIT SHORT TO BATTERY

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: **The SRS must be fully operational and free of faults before releasing the vehicle to the customer.**

Q1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2437 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to Q2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to Q4.

Q2 CHECK CIRCUIT CR203 (GY/VT) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b
- Disconnect: Passenger Safety Belt Buckle Switch C3066
- Disconnect: Passenger Seat Side Air Bag Module C327
- Disconnect: Passenger Safety Belt Retractor Pretensioner C303
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

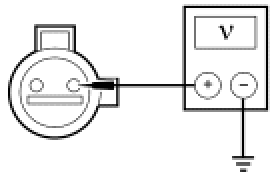


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Fig. 118: Measuring Voltage Between connector And Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger seat belt buckle switch C3066-2, circuit CR203 (GY/VT), harness side and ground.
- **Is voltage less than 0.2 volt?**

  YES : Go to Q3.

  NO : REPAIR circuit CR203 (GY/VT). Go to Q5.

Q3 CONFIRM THE RCM FAULT

NOTE: **Make sure all restraint system sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self**

test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: RCM C310a and C310b
- Connect: Passenger Safety Belt Buckle Switch C3066
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2437 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to Q5.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to Q4.

Q4 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Belt Retractor Pretensioner C303
- Disconnect: Passenger Seat Side Air Bag Module C327
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2437 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to Q2.

  NO : CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to Q5.

Q5 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: Turn the ignition OFF and wait one minute to deplete the

backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test R: DTC B2438 - Passengers Seat Belt Buckle Switch Short to Ground

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors the passenger safety belt buckle switch circuits for faults. If the RCM detects a short to ground fault, it will store DTC B2438 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC B2438 Passenger's Seat Belt Buckle Switch Circuit Short to Ground - If the RCM detects a short to ground on the passenger safety belt buckle circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Passenger safety belt buckle switch
- RCM

PINPOINT TEST R: DTC B2438 - PASSENGERS SEAT BELT BUCKLE SWITCH SHORT TO GROUND

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and**

the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

R1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2438 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to R2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to R5.

R2 CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Belt Buckle Switch C3066
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the passenger safety belt buckle switch disconnected, a open circuit fault would normally be retrieved.
- **Did the passenger safety belt buckle switch on-demand DTC change from indicating B2438 to B2436?**

  YES : INSTALL a new passenger safety belt buckle assembly. REFER to **SAFETY BELT SYSTEM** article. Go to R6.

  NO : Go to R3.

R3 CHECK CIRCUIT CR203 (GY/VT) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER SAFETY BELT BUCKLE SWITCH

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

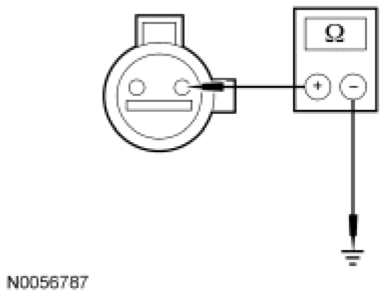

Fig. 119: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat belt buckle switch C3066-2, circuit CR203 (GY/VT), harness side and ground.
- **Is resistance greater than 10,000 ohms?**

  YES : Go to R4.

  NO : REPAIR circuit CR203 (GY/VT). Go to R6.

R4 CONFIRM THE RCM FAULT

NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Connect: Passenger Safety Belt Buckle Switch C3066
- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2438 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to R6.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to R5.

R5 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2438 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to R2.

  NO : CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to R6.

R6 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test S: DTC B2439 - Passengers Seat Belt Buckle Switch Resistance Out of Range

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors the passenger safety belt buckle switch circuits for faults. If the RCM detects a current out of range fault, it will store DTC B2439 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC B2439 Passengers Seat Belt Buckle Switch Resistance Out of Range - If the RCM detects a current out of range between buckled and unbuckled on the passenger safety belt buckle switch, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Passenger safety belt buckle switch
- RCM

PINPOINT TEST S: DTC B2439 - PASSENGERS SEAT BELT BUCKLE SWITCH RESISTANCE OUT OF RANGE

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

S1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2439 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to S2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to S4.

S2 CHECK THE SAFETY BELT BUCKLE SWITCH

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Belt Buckle Switch C3066
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs

- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the passenger safety belt buckle switch disconnected, a open circuit fault would normally be retrieved.
- **Did the passenger safety belt buckle switch on-demand DTC change from indicating B2439 to B2436?**

  YES : INSTALL a new passenger safety belt buckle assembly. REFER to **SAFETY BELT SYSTEM** article. Go to S5.

  NO : Go to S3.

S3 CONFIRM THE RCM FAULT

NOTE: **Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Passenger Safety Belt Buckle Switch C3066
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2439 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to S5.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to S4.

S4 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect the passenger safety belt buckle switch C3066:
  - Inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damage, pinched, cut or pierced wires.
  - Repair any concerns found. Refer to appropriate SYSTEM WIRING DIAGRAMS article, Connector Repair Procedures for schematic and connector information.
- Connect: All Previously Disconnected Component(s)/Connector(s)

- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC B2439 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to S2.

  NO : CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to S5.

S5 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test T: DTC B2792 - Cross Link Between Firing Loops

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors all the deployable devices for a cross link between the circuits of another deployable device. If the RCM detects a short between the circuits of the deployable devices, it will store DTC B2792 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

Fault PIDs[a]	Description	Fault Trigger Condition
2792_8_OD and 2792_8_CM	A-B or A-C pillar Curtain, Passenger Side	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_9_OD and 2792_9_CM	A-B or A-C pillar Curtain, Driver Side	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_12_OD and 2792_12_CM	Side Airbag Passenger	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_13_OD and 2792_13_CM	Side Airbag Driver	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_26_OD and 2792_26_CM	Pretensioner Passenger	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_27_OD and 2792_27_CM	Pretensioner Driver	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_28_OD and 2792_28_CM	Airbag Passenger Front Loop #2	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_29_OD and 2792_29_CM	Airbag Passenger Front Loop #1	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_30_OD and 2792_30_CM	Airbag Driver Front Loop #2	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_31_OD and 2792_31_CM	Airbag Driver Front Loop #1	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2792. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2792.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- RCM

PINPOINT TEST T: DTC B2792 - CROSS LINK BETWEEN FIRING LOOPS

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

T1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record

On-Demand and Continuous Memory DTCs

- Enter the following diagnostic mode on the diagnostic tool: Datalogger - RCM - View and Record All B2792 Fault PIDs
- **Do any RCM on-demand B2792 fault PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to T2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to T4.

T2 CHECK DEPLOYABLE CIRCUITS FOR A CROSS LINK FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b
- Disconnect **ALL of the affected** deployable devices.
- Using the following chart, measure the resistance between the circuits of the affected deployable devices.

DEPLOYABLE DEVICES

Squib/Loop	Connector - Pin	Circuit
Driver air bag module loop 1	• Driver air bag module loop 1 electrical connector • Driver air bag module loop 1 electrical connector	• CR101 (VT/BN) • RR101 (YE/GN)
Driver air bag module loop 2	• Driver air bag module loop 2 electrical connector • Driver air bag module loop 2 electrical	• CR102 (BU) • RR102 (WH)

	connector	
Passenger air bag module loop 1	• C256a-1 • C256a-2	• CR103 (GY/BU) • RR103 (VT/GN)
Passenger air bag module loop 2	• C256b-1 • C256b-2	• CR104 (YE/GY) • RR104 (WH/BU)
Driver side air bag module (seat harness connector)	• C328-1 • C328-2	• CR105 (GN/BN) • RR105 (GY/YE)
Passenger side air bag module (seat harness connector)	• C327-1 • C327-2	• CR106 (VT/GY) • RR106 (YE/OG)
Driver safety canopy module	• C9018-1 • C9018-2	• CR109 (BN/BU) • RR109 (BU/GN)
Passenger safety canopy module	• C9019-1 • C9019-2	• CR111 (BN/WH) • RR111 (YE/VT)
Driver safety belt retractor pretensioner	• C3201-2 • C3201-1	• CR120 (BU/OG) • RR120 (BN/GN)
Passenger safety belt retractor pretensioner	• C3202-2 • C3202-1	• CR122 (WH/OG) • RR122 (BN)

- **Are resistances greater than 10,000 ohms between the affected circuits?**

  YES : Go to T3.

  NO : REPAIR the affected circuits. Go to T5.

T3 CONFIRM THE RCM FAULT

NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Connect: All Previously Disconnected Restraint System Component(s)
- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2792 Fault PIDs
- **Do any RCM on-demand B2792 fault PIDs indicate a fault?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to T5.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to T4.

T4 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- If a cross link fault for driver air bag loop 1 or loop 2 is present continuous, remove the driver air bag module. Refer to **Driver Air Bag Module**.
- If a cross link fault for passenger air bag module loop 1 or loop 2 is present continuous, disconnect the passenger air bag module C256a and C256b.
- If a cross link fault for driver side air bag is present continuous, disconnect the driver side air bag module C328.
- If a cross link fault for passenger side air bag is present continuous, disconnect the passenger side air bag module C327.
- If a cross link fault for driver safety canopy module is present continuous, disconnect the driver safety canopy module C9018.
- If a cross link fault for passenger safety canopy module is present continuous, disconnect the passenger safety canopy module C9019.
- If a cross link fault for driver safety belt retractor pretensioner is present continuous, disconnect the driver safety belt retractor pretensioner C323.
- If a cross link fault for passenger safety belt retractor pretensioner is present continuous, disconnect the passenger safety belt retractor pretensioner C303.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint**

System (SRS) Depowering and Repowering.

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2792 Fault PIDs
- **Do any RCM on-demand B2792 fault PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to T2.

  NO : CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to T5.

T5 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test U: DTC B229B - Occupant Classification System Obstruction

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The occupant classification sensor (OCS) system is used to classify the front passenger seat occupant in the event of a deployable impact. Refer to **Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)**.

The occupant classification system module (OCSM) monitors the 4 OCS weight sensors bolts and circuity for faults. If the OCSM detects an obstruction, an upward force on the passenger seat for 60 seconds, it will store DTC B229B in memory and send a message to the restraints control module (RCM). The RCM will store DTC B2290 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC B229B Occupant Classification System Obstruction - If the OCSM detects a negative force on one or more OCS weight sensor bolt(s) (weight sensors), it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Foreign object placed under or contacting the passenger seat

PINPOINT TEST U: DTC B229B - OCCUPANT CLASSIFICATION SYSTEM OBSTRUCTION

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

U1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM - Retrieve and Record Continuous Memory DTCs
- **Was OCSM on-demand DTC B229B retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to U2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to U4.

U2 INSPECT UNDER THE PASSENGER SEAT FOR FOREIGN OBJECTS AND WIRE HARNESS

- Key in OFF position.
- Position the seat and inspect under and on the sides of the seat for the presence of any foreign objects contacting the under side and side of the passenger seat. Carry out a thorough visual inspection of the passenger seat wire harness at or near the OCS weight sensor bolts and the related seat wiring harness and body wiring harness for correct harness routing.
- **Were any problems noted?**

  YES : REMOVE obstruction and/or REPAIR as necessary. Go to U5.

  NO : Go to U3.

U3 CONFIRM THE OCS MODULE FAULT

- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM - Retrieve and Record Continuous Memory DTCs
- **Was OCSM on-demand DTC B229B retrieved?**

  YES : INSTALL a new OCSM. REFER to **Occupant Classification System Module (OCSM) - Manual Seat Track** or **Occupant Classification System Module (OCSM) - Power Seat Track**. Go to U5.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to U5.

U4 CHECK FOR AN INTERMITTENT FAULT

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM - Retrieve and Record Continuous Memory DTCs
- **Was OCSM on-demand DTC B229B retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to U2.

NO : CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to U5.

U5 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test V: DTC C1946 - Front Driver's Seat Track Position Switch Circuit Open

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors the driver seat track position sensor circuits. If the RCM detects an open circuit, it will store DTC C1946 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC C1946 Front Driver's Seat Track Position Switch Circuit Open - If the RCM detects a open on the driver seat track position sensor circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Driver seat track position sensor
- RCM

PINPOINT TEST V: DTC C1946 - FRONT DRIVER'S SEAT TRACK POSITION SWITCH CIRCUIT

OPEN

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

V1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC C1946 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to V2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to V6.

V2 CHECK THE DRIVER SEAT TRACK POSITION SENSOR

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Seat Track Position Sensor C356
- Connect a fused jumper wire between driver seat track position sensor C356-2, circuit VR215 (YE/VT), harness side and C356-1, circuit GD143 (BK/VT), harness side.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver seat track position sensor circuits shorted together, a short to ground fault would normally be retrieved.
- **Did the driver seat track position switch on-demand DTC change from indicating C1946 to C1947?**

  YES : INSTALL a new driver seat track position sensor. REFER to **Seat Position Sensor**. Go to V7.

  NO : Go to V3.

V3 CHECK CIRCUIT VR215 (YE/VT) FOR AN OPEN BETWEEN THE RCM AND DRIVER SEAT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b
- Remover the fused jumper wire from the driver seat track position sensor C356.

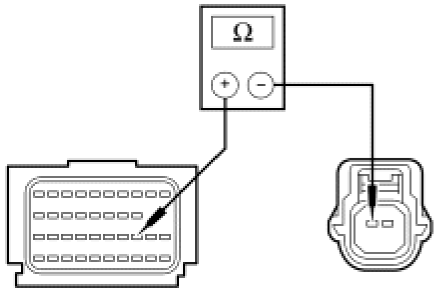

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Fig. 120: Measuring Resistance Between RCM C310B-23, Circuit VR215 (YE/VT) & Driver Seat Track Position Sensor C356-2
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-23, circuit VR215 (YE/VT), harness side and driver seat track position sensor C356-2, circuit VR215 (YE/VT).
- **Is resistance less than 0.5 ohm?**

  YES : Go to V4.

  NO : REPAIR circuit VR215 (YE/VT). Go to V7.

V4 CHECK CIRCUIT GD143 (BK/VT) FOR AN OPEN TO GROUND

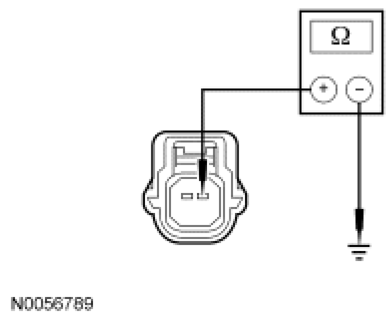

Fig. 121: Measuring Resistance Between Driver Seat Track Position Sensor C356-1, Circuit GD143 (BK/VT) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat track position sensor C356-1, circuit GD143 (BK/VT) and ground.
- **Is resistance less than 0.5 ohm?**

  YES : Go to V5.

  NO : REPAIR circuit GD143 (BK/VT). Go to V7.

V5 CONFIRM THE RCM FAULT

NOTE: **Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Driver Seat Track Position Sensor C356
- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC C1946 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to V7.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to V6.

V6 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Belt Retractor Pretensioner C323
- Disconnect: Driver Side Air Bag Module C328
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC C1946 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to V2.

  NO : CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to V7.

V7 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints

- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test W: DTC C1947 - Front Driver's Seat Track Position Switch Circuit Short to Ground

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors the driver seat track position sensor circuits. If the RCM detects a short to ground, it will store DTC C1947 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC C1947 Front Driver's Seat Track Position Switch Circuit Short to Ground - If the RCM detects a short to ground on the driver seat track position sensor circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Driver seat track position sensor
- RCM

PINPOINT TEST W: DTC C1947 - FRONT DRIVER'S SEAT TRACK POSITION SWITCH CIRCUIT SHORT TO GROUND

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor**

pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: **The SRS must be fully operational and free of faults before releasing the vehicle to the customer.**

W1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC C1947 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to W2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to W5.

W2 CHECK THE SEAT TRACK POSITION SENSOR

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Seat Track Position Sensor C356
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs

- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver seat track position sensor disconnected, an open circuit fault would normally be retrieved.
- **Did the driver seat track position switch on-demand DTC change from indicating C1947 to C1946?**

  YES : INSTALL a new driver seat track position sensor. REFER to **Seat Position Sensor**. Go to W6.

  NO : Go to W3.

W3 CHECK CIRCUIT VR215 (YE/VT) FOR A SHORT TO GROUND BETWEEN THE RCM AND SEAT TRACK POSITION SENSOR

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

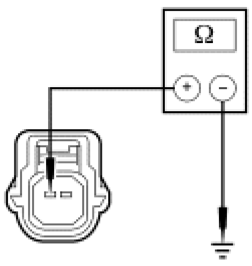

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Fig. 122: Measuring Resistance Between Driver Seat Track Position Sensor C356-2, Circuit VR215 (YE/VT) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat track position sensor C356-2, circuit VR215 (YE/VT) and ground.
- **Is resistance greater than 10,000 ohms?**

  YES : Go to W4.

  NO : REPAIR circuit VR215 (YE/VT). Go to W6.

W4 CONFIRM THE RCM FAULT

NOTE:	**Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Seat Track Position Sensor C356

- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC C1947 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to W6.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to W5.

W5 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Belt Retractor Pretensioner C323
- Disconnect: Driver Side Air Bag Module C3051
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC C1947 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to W2.

  NO : CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to W6.

W6 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at

this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test X: DTC C1948 - Front Driver's Seat Track Position Switch Circuit Resistance Out of Range

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

NOTE: Due to the seat track position sensor being a Hall-effect type sensor, this pinpoint test will be diagnosing a current out of range fault instead of the current DTC definition for a resistance out of range fault.

Normal Operation

The restraints control module (RCM) monitors the driver seat track position sensor circuits. If the RCM detects a current out of range condition, it will store DTC C1948 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC C1948 Front Driver's Seat Track Position Switch Circuit Resistance Out of Range - If the RCM detects a current out of range between forward and rearward on the driver seat track position switch, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Driver seat track position sensor
- RCM

PINPOINT TEST X: DTC C1948 - FRONT DRIVER'S SEAT TRACK POSITION SWITCH CIRCUIT RESISTANCE OUT OF RANGE

WARNING: Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in

the accidental deployment of the safety canopy and cause serious personal injury or death.

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

X1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC C1948 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to X2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to X4.

X2 CHECK THE DRIVER SEAT TRACK POSITION SENSOR

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Seat Track Position Sensor C356
- Connect a fused jumper wire between driver seat track position sensor C356-2, circuit VR215 (YE/VT), harness side and C356-1, circuit GD143 (BK/VT), harness side.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver seat track position sensor circuits shorted together, a short to ground fault would normally be retrieved.
- **Did the driver seat track position sensor on-demand DTC change from indicating C1948 to C1947?**

  YES : INSTALL a new driver seat track position sensor. REFER to **Seat Position Sensor**. Go to X5.

  NO : Go to X3.

X3 CONFIRM THE RCM FAULT

NOTE: **Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Driver Seat Track Position Sensor C356
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC C1948 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to X5.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to X4.

X4 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Belt Retractor Pretensioner C323
- Disconnect: Driver Side Air Bag Module C328
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC C1948 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to X2.

  NO : CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to X5.

X5 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

  WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to**DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test Y: DTC C1982 - Front Driver's Seat Track Position Switch Circuit Short to Battery

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors the driver seat track position sensor circuits. If the RCM detects a short to battery, it will store DTC C1982 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC C1982 Front Driver's Seat Track Position Switch Circuit Short to Battery - If the RCM detects a short to battery on the driver seat track position sensor circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- RCM

PINPOINT TEST Y: C1982 - FRONT DRIVER'S SEAT TRACK POSITION SWITCH CIRCUIT SHORT TO BATTERY

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to**

follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Y1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC C1982 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to Y2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to Y4.

Y2 CHECK CIRCUITS VR215 (YE/VT) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b
- Disconnect: Driver Seat Track Position Sensor C356
- Disconnect: Driver Side Air Bag Module C328
- Disconnect: Driver Safety Belt Retractor Pretensioner C323
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

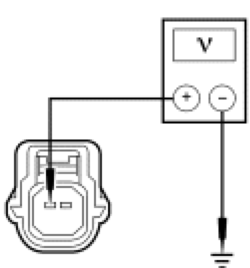

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Fig. 123: Measuring Voltage Between Driver Seat Track Position Sensor C356-2, Circuit VR215 (YE/VT) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat track position sensor C356-2, circuit VR215 (YE/VT), harness side and ground.
- **Is voltage less than 0.2 volt?**

  YES : Go to Y3.

NO : REPAIR circuit VR215 (YE/VT). Go to Y5.

Y3 CONFIRM THE RCM FAULT

NOTE: **Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: RCM C310a and C310b
- Connect: Driver Seat Track Position Sensor C356
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC C1982 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to Y5.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of any electrical connector that were disconnected. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to Y4.

Y4 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Belt Retractor Pretensioner C323
- Disconnect: Driver Side Air Bag Module C328
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM - Retrieve and Record On-Demand and Continuous Memory DTCs
- **Was RCM on-demand DTC C1982 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to Y2.

  NO : CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint**

test. REPAIR any intermittent wiring, terminal or connector concerns found. Go to Y5.

Y5 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

> WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to **DTC Charts** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test Z: DTC B1013 - Occupant Classification Calibration Fault

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Supplemental Restraint System for schematic and connector information.

Normal Operation

The occupant classification sensor (OCS) system is used to classify the front passenger seat occupant in the event of a deployable impact. Refer to **Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)**.

The occupant classification system module (OCSM) monitors the OCS weight sensor bolts for a correct calibration/weight and ID from each sensor. If the OCSM detects an incorrect weight or ID from any of the 4 seat weight sensors, a seat track that is mis-aligned/bent, wire harness connected to the incorrect OCS weight sensor bolt, an unsuccessful system reset or if an OCS system component has been installed new, it will store DTC B1013 in memory and send a message to the restraints control module (RCM) which stores DTC B2290 in memory. The RCM will then send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

This pinpoint test is intended to diagnose the following:

- Wiring of OCS weight sensor bolts
- Wiring, terminals or connectors
- OCS system component installed new

- Passenger seat track
- Misrouted harness
- Seat track mounting and alignment
- Seat track fastener torque

PINPOINT TEST Z: DTC B1013 - OCCUPANT CLASSIFICATION CALIBRATION FAULT

NOTE: Do not install any new OCS system components until directed to do so during the pinpoint test.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: If a new OCS system component has been installed, the OCSM will store DTC B1013, causing the air bag warning indicator to illuminate during the prove out. This DTC will clear after a successful system reset.

Z1 CHECK THE SEAT HARNESS WIRING AND CONNECTORS

- Key in OFF position.
- Carry out a thorough visual inspection of the OCS system harness wiring, terminals and connectors and the related seat wiring harness and body wiring harness terminals and connectors for any damage, misrouting or pulling on any OCS weight sensor bolt.

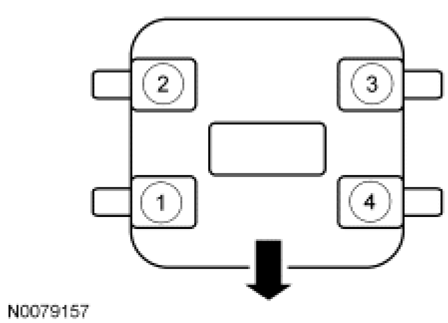


Fig. 124: Identifying OCS System Harness Connector
Courtesy of FORD MOTOR CO.

NOTE: The OCS weight sensor bolts do not have differently keyed connectors. Connecting the incorrect connector to a sensor will cause DTC B1013 to set and may cause other erroneous DTCs to set.

- Using the illustration, identify that the sensors are connected correctly. Refer to appropriate

SYSTEM WIRING DIAGRAMS article for schematic and connector information.

OCS Weight Sensor Bolt Location

- OCS weight sensor bolt 1, located at the front outboard
- OCS weight sensor bolt 2, located at the rear outboard
- OCS weight sensor bolt 3, located at the rear inboard
- OCS weight sensor bolt 4, located at the front inboard

- **Were any wiring or connector concerns noted?**

  YES : REPAIR the seat connectors and wiring as needed. CARRY OUT the OCS system reset. REFER to **Occupant Classification Sensor (OCS) System Reset**. Go to Z3.

  NO : Go to Z2.

Z2 CHECK THE SEAT TRACK

NOTE: Correct seat track alignment on a passenger front manual seat (if equipped) is critical before removing the seat from the vehicle. During seat installation, the inboard and outboard tracks must be in alignment with each other. Failure to follow this instruction may result in an unsuccessful system reset and incorrect operation of the OCS system.

NOTE: Check for a bent or binding power seat track assembly (if equipped). Position the seat in all positions and check for correct operation after installation of the seat into the vehicle. Failure to follow this instruction may result in an unsuccessful system reset and incorrect operation of the OCS system.

NOTE: The passenger seat bolts must be tightened to the correct specifications and in the correct sequence. Failure to follow this instruction may result in an unsuccessful system reset and incorrect operation of the OCS system. Refer to SEATING article Seat Removal and Installation.

- Loosen the 4 seat track to floor mounting bolts.
- Tighten the seat track-to-floor bolts in the following sequence.
  A. Tighten the front inboard seat track-to-floor bolt to 55 Nm (41 lb-ft).
  B. Tighten the front outboard seat track-to-floor bolt to 55 Nm (41 lb-ft).
  C. Tighten the rear inboard seat track-to-floor bolt to 55 Nm (41 lb-ft).
  D. Tighten the rear outboard seat track-to-floor bolt to 55 Nm (41 lb-ft).
- Carry out the OCS system reset. Refer to **Occupant Classification Sensor (OCS) System Reset**.
- **Did the system reset pass?**

  YES : Fault corrected. Go to Z3.

NO : INSTALL a new seat track with OCS weight sensor bolts. REFER to **SEATING** article. Go to Z3.

Z3 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

  WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the Supplemental Restraint System (SRS) DTC Chart for pinpoint test direction.

  NO : CLEAR all RCM and OCSM continuous memory DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

GENERAL PROCEDURES

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEPOWERING AND REPOWERING

Depowering Procedure

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.**

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF.
2. Turn the ignition switch to OFF.
3. At the smart junction box (SJB), located in the LH lower kick panel, remove the lower kick panel fuse cover and the RCM fuse 46 (7.5A) from the SJB. For additional information, refer to the appropriate Wiring service information.
4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.
5. Turn the ignition switch to OFF.

WARNING: **Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.**

See DESCRIPTION AND OPERATION for location of the RCM and impact sensor(s).

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

6. Disconnect the battery ground cable and wait at least one minute. For additional information, refer to **BATTERY, MOUNTING & CABLES** article.

Repowering Procedure

1. Turn the ignition switch from OFF to ON.
2. Install RCM fuse 46 (7.5A) to the SJB and install the lower kick panel fuse cover.

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

3. Connect the battery ground cable.
4. Prove out the SRS as follows:

   Turn the ignition switch from ON to OFF. Wait 10 seconds, then turn the ignition switch back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn OFF. If an air bag SRS fault is present, the air bag warning indicator will:

   - fail to light.

   - remain lit continuously.

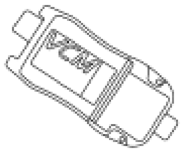
   - flash at a 5 Hz rate (RCM not configured).

   The air bag warning indicator might not light until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

   Clear all continuous DTCs from the RCM and occupant classification system module (OCSM) using a scan tool.

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEACTIVATION AND REACTIVATION

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

Deactivation

WARNING: Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

WARNING: Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

WARNING: **To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.**

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All vehicles

1. Turn all vehicle accessories OFF.
2. Turn the ignition switch to OFF.
3. At the smart junction box (SJB), located in the LH lower kick panel, remove the lower kick panel fuse cover and the RCM fuse 46 (7.5A) from the SJB. For additional information, refer to the appropriate Wiring service information.
4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.
5. Turn the ignition OFF.

WARNING: **Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.**

See <u>DESCRIPTION AND OPERATION</u> for location of the RCM and impact sensor(s).

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

6. Disconnect the battery ground cable and wait at least one minute. For additional information, refer to **BATTERY, MOUNTING & CABLES** article.

NOTE: Repeat this step for both locking pins.

7. Using a 3-mm Allen wrench or a suitable tool through the access hole on the backside of the steering wheel, position the tool against the spring clip and push in, disengaging the clip from the locking pin. With the spring clip disengaged from the locking pin, gently pull back on that side of the driver air bag module to release it from the steering wheel.

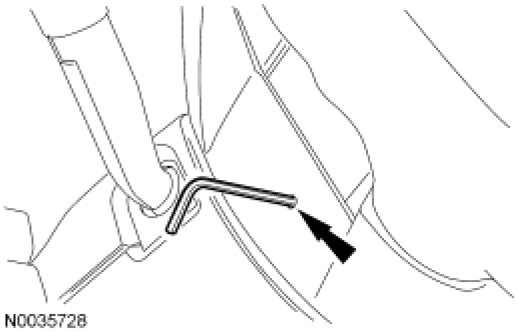


Fig. 125: Locating Allen Wrench
Courtesy of FORD MOTOR CO.

NOTE: Do not pull the driver air bag module electrical connectors out by the locking buttons. Damage to the locking buttons may occur.

8. Using a small screwdriver as shown in illustration, lift up and release the locking buttons on the driver air bag module electrical connectors. With the locking buttons released, remove the electrical connectors and the driver air bag module.

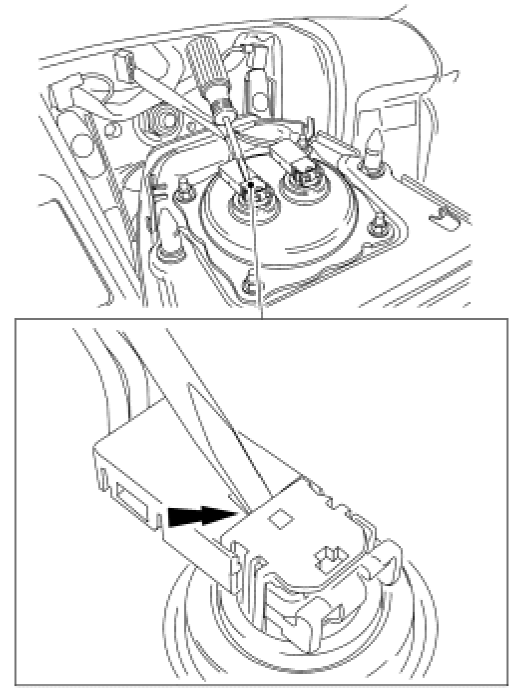


Fig. 126: Releasing Locking Buttons On Driver Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

9. Open and lower the glove compartment door. Then unhook the glove compartment door from the instrument panel.
   - If equipped, detach the glove compartment door dampener.

Edge

10. Remove the 2 passenger air bag module bolts from the cross vehicle beam bracket.

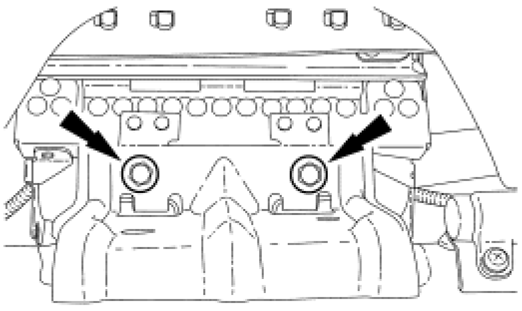


Fig. 127: Locating Passenger Air Bag Module Bolts From Cross Vehicle Beam Bracket
Courtesy of FORD MOTOR CO.

NOTE:	**Do not handle the passenger air bag module by grabbing the edges of the deployment doors. Damage to the air bag module may occur.**

11. Through the glove compartment opening, release the 4 LH side deployment door clips. Then release the foreward-most 5 clips and separate the deployment door and passenger air bag module from the instrument panel.

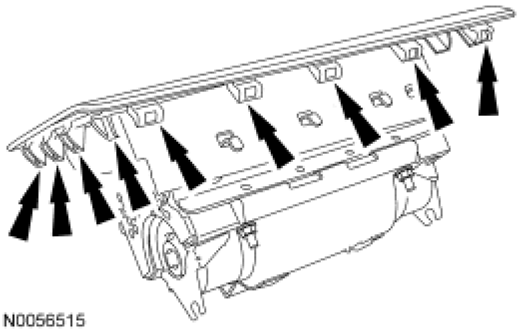


Fig. 128: Locating LH Side Deployment Door Clip
Courtesy of FORD MOTOR CO.

12. Using a small screwdriver as shown in illustration, lift up and release the locking button on the RH passenger air bag module electrical connector.

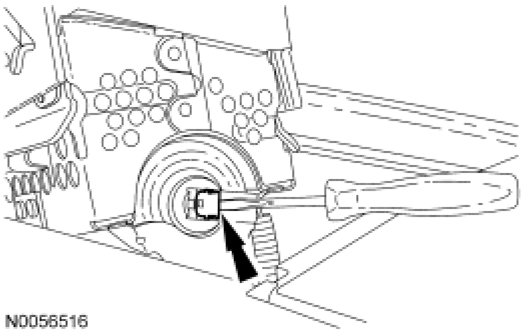


Fig. 129: Releasing Locking Button On RH Passenger Air Bag Module Electrical Connector Using A Small Screwdriver
Courtesy of FORD MOTOR CO.

NOTE: **Do not pull the passenger air bag module electrical connector out by the locking button. Damage to the locking button may occur.**

13. With the RH locking button released, remove the RH electrical connector.
14. Using a small screwdriver as shown in illustration, lift up and release the locking button on the LH passenger air bag module electrical connector.

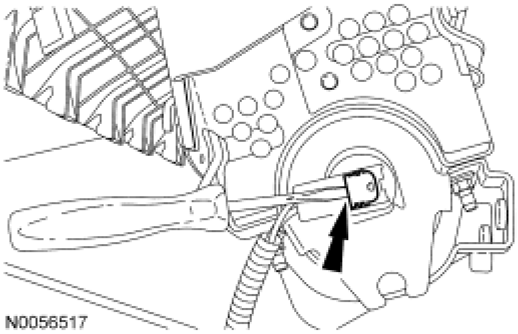


Fig. 130: Releasing Locking Button On LH Passenger Air Bag Module Electrical Connector Using A Small Screwdriver
Courtesy of FORD MOTOR CO.

NOTE: **Do not pull the passenger air bag module electrical connector out by the locking button. Damage to the locking button may occur.**

15. With the LH locking button released, remove the LH electrical connector and remove the passenger air bag module.

    MKX

16. Pull straight out to release the 5 retaining clips and remove the RH instrument panel finish panel.

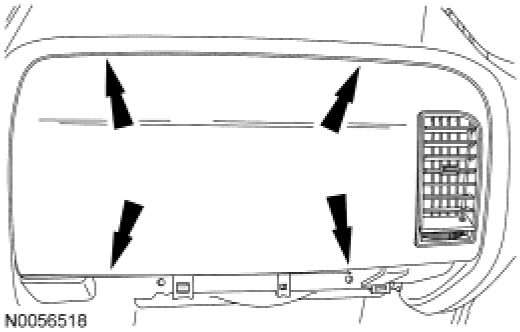


Fig. 131: Locating Retaining Clips On RH I/P Finish Panel
Courtesy of FORD MOTOR CO.

17. Remove the screw for the LH duct assembly bracket from the front of the instrument panel.

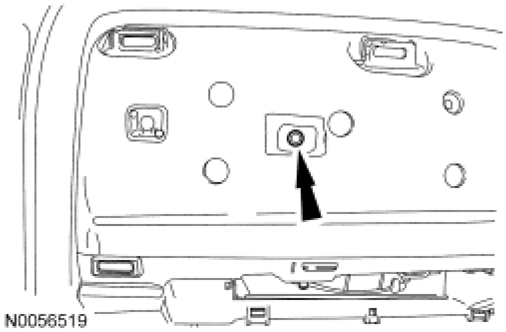


Fig. 132: Locating Screw On LH Duct Assembly Bracket
Courtesy of FORD MOTOR CO.

18. Through the glove compartment opening, remove the screw and the LH duct assembly.

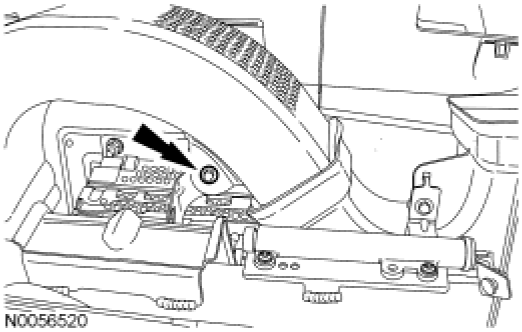


Fig. 133: Locating Screw On LH Duct Assembly
Courtesy of FORD MOTOR CO.

19. Through the glove compartment opening, remove the screw and the RH duct assembly.

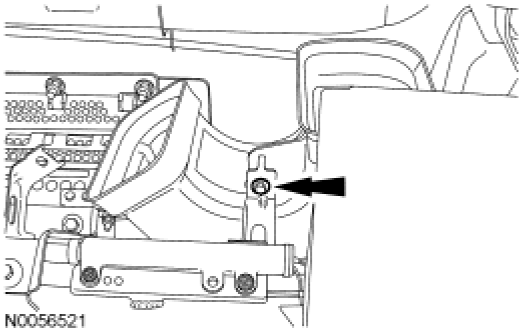


Fig. 134: Locating Screw On RH Duct Assembly
Courtesy of FORD MOTOR CO.

20. Remove the 4 bolts and the passenger air bag module support bracket.

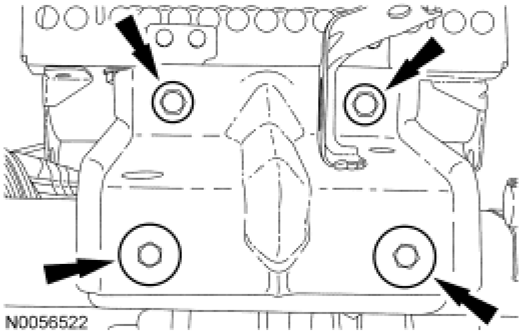


Fig. 135: Locating Bolts On Passenger Air Bag Module Support Bracket
Courtesy of FORD MOTOR CO.

21. Remove the 3 nuts from the passenger air bag module.

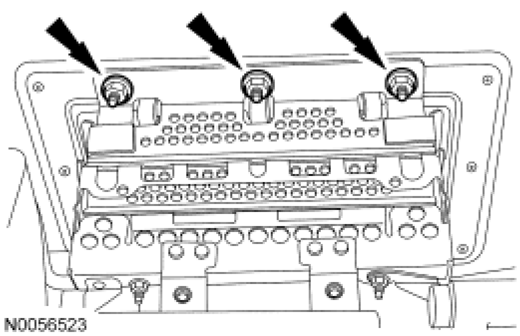


Fig. 136: Locating Nuts On Passenger Air Bag Module
Courtesy of FORD MOTOR CO.

NOTE:	**Do not allow the passenger air bag module to hang from the wiring harness. Damage to the wiring harness and connectors may occur.**

22. Lower the rear of the passenger air bag module off the 3 mounting studs. Move the passenger air bag module rearward to release the 7 hooks from the instrument panel and rest the module on the cross vehicle beam.

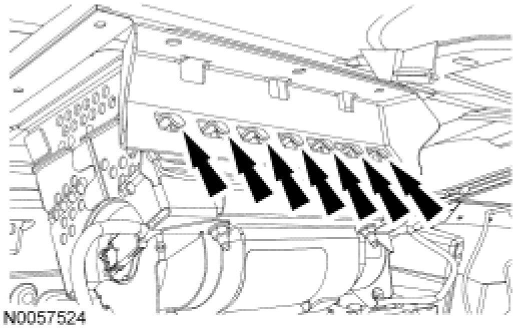


Fig. 137: Identifying Hooks On I/P
Courtesy of FORD MOTOR CO.

23. Using a small screwdriver as shown in illustration, lift up and release the locking button on the LH passenger air bag module electrical connector.

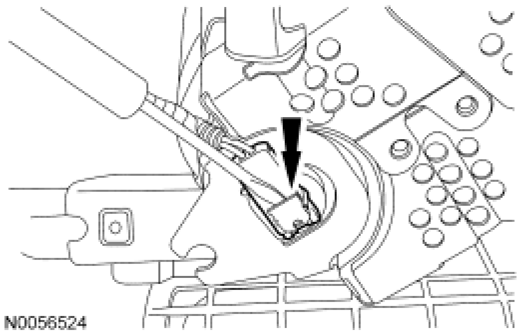


Fig. 138: Releasing Locking Button On LH Passenger Air Bag Module Electrical Connector Using A Small Screwdriver
Courtesy of FORD MOTOR CO.

NOTE:	**Do not pull the passenger air bag module electrical connector out by the locking button. Damage to the locking button may occur.**

24. With the LH locking button released, remove the LH electrical connector from the passenger air bag module.
25. Using a small screwdriver as shown in illustration, lift up and release the locking button on the RH passenger air bag module electrical connector.

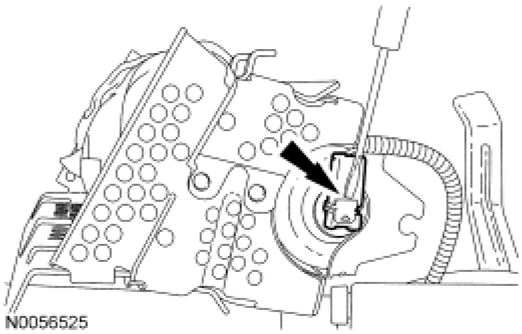


Fig. 139: Releasing Locking Button On RH Passenger Air Bag Module Electrical Connector Using A Small Screwdriver
Courtesy of FORD MOTOR CO.

NOTE:	**Do not pull the passenger air bag module electrical connector out by the locking button. Damage to the locking button may occur.**

26. With the RH locking button released, remove the RH electrical connector. Remove the passenger air bag module from the glove compartment opening.

All vehicles

27. From under the rear of the front passenger seat, slide and disengage the passenger seat side air bag module electrical connector locking clip, and then release the tab and disconnect the passenger seat side air bag module electrical connector.

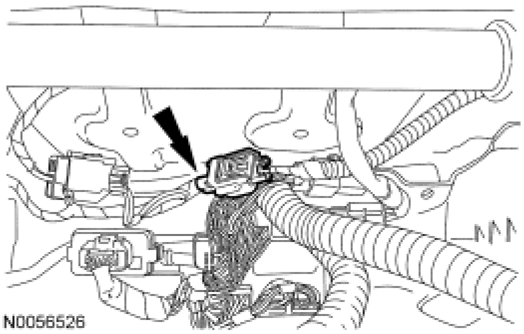


Fig. 140: Identifying Passenger Seat Side Air Bag Module Electrical Connector
Courtesy of FORD MOTOR CO.

28. Remove the passenger side D-pillar trim panel. For additional information, refer to **INTERIOR TRIM & ORNAMENTATION** article.

NOTE: Do not pull the passenger safety canopy module electrical connector out by the locking button. Damage to the locking button may occur.

29. With the locking button released, remove the electrical connector from the passenger safety canopy module.

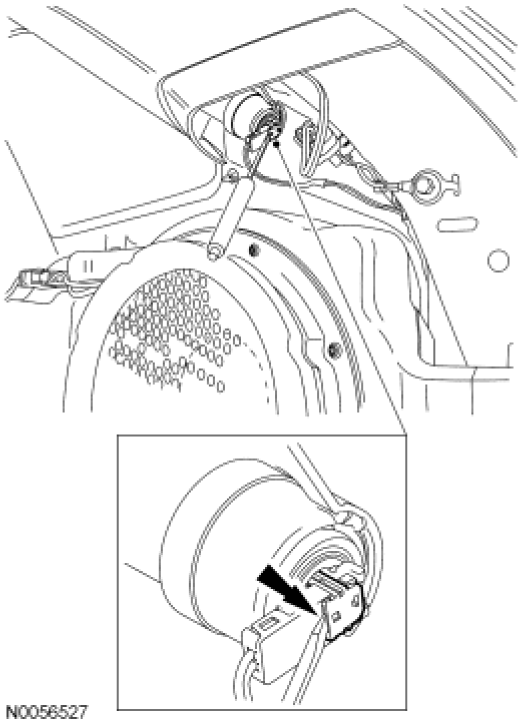


Fig. 141: Locating Electrical Connector From Passenger Safety Canopy Module
Courtesy of FORD MOTOR CO.

30. Remove the driver side D-pillar trim panel. For additional information, refer to **INTERIOR TRIM & ORNAMENTATION** article.

NOTE: Do not pull the driver safety canopy module electrical connector out by the locking button. Damage to the locking button may occur.

31. With the locking button released, remove the electrical connector from the driver safety canopy module.

Fig. 142: Locating Electrical Connector From Driver Safety Canopy Module
Courtesy of FORD MOTOR CO.

32. From under the rear of the driver seat, detach the driver seat side air bag module electrical connector from the seat cushion frame. Then slide and disengage the driver seat side air bag module electrical connector locking clip, and then release the tab and disconnect the driver seat side air bag module electrical connector.

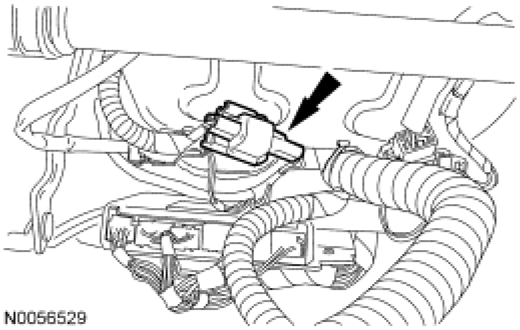


Fig. 143: Identifying Driver Seat Side Air Bag Module Electrical Connector Locking Clip
Courtesy of FORD MOTOR CO.

33. Install RCM fuse 46 (7.5A) to the SJB.
34. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING & CABLES** article.

Reactivation

All vehicles

1. Remove RCM fuse 46 (7.5A) from the SJB.
2. Disconnect the battery ground cable and wait at least one minute.
3. Connect the driver seat side air bag module electrical connector and then slide and engage the seat side air bag electrical connector locking clip. Then attach the driver seat side air bag module electrical connector to the seat cushion frame.

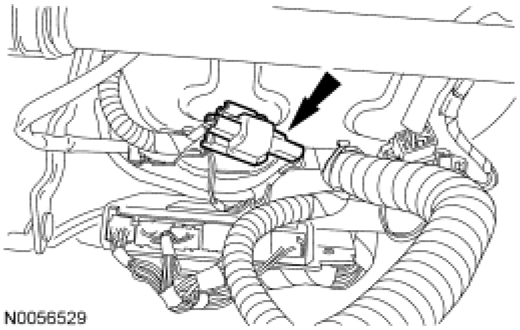


Fig. 144: Identifying Driver Seat Side Air Bag Module Electrical Connector Locking Clip
Courtesy of FORD MOTOR CO.

NOTE:	**Do not install the safety canopy module electrical connector by the locking button. Damage to the locking button may occur.**
NOTE:	**The safety canopy module electrical connector locking button must be in the released position when the connector is being installed or connector damage may occur.**

NOTE: **The safety canopy module electrical connector is unique and cannot be reversed when connected to the safety canopy module. Match the electrical connector key to the keyway in the safety canopy module. Do not force the electrical connector into the safety canopy module. Damage to the connector or component may occur.**

4. With the locking button released, install the driver safety canopy module electrical connector fully into the driver safety canopy module and seat the locking button.

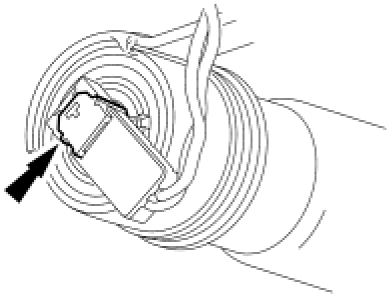


Fig. 145: Identifying Driver Safety Canopy Module Electrical Connector
Courtesy of FORD MOTOR CO.

5. Install the driver side D-pillar trim panel. For additional information, refer to **INTERIOR TRIM & ORNAMENTATION** article.

NOTE: **Do not install the safety canopy module electrical connector by the locking button. Damage to the locking button may occur.**

NOTE: **The safety canopy module electrical connector locking button must be in the released position when the connector is being installed or connector damage may occur.**

NOTE: **The safety canopy module electrical connector is unique and cannot be reversed when connected to the safety canopy module. Match the electrical connector key to the keyway in the safety canopy module. Do not force the electrical connector into the safety canopy module. Damage to the connector or component may occur.**

6. With the locking button released, install the passenger safety canopy module electrical connector fully into the passenger safety canopy module and seat the locking button.

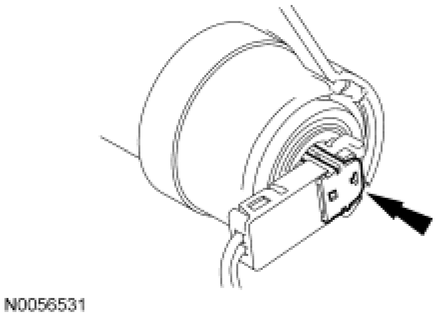


Fig. 146: Identifying Passenger Safety Canopy Module Electrical Connector
Courtesy of FORD MOTOR CO.

7. Install the passenger side D-pillar trim panel. For additional information, refer to **INTERIOR TRIM & ORNAMENTATION** article.
8. Connect the passenger seat side air bag module electrical connector and then slide and engage the seat side air bag electrical connector locking clip.

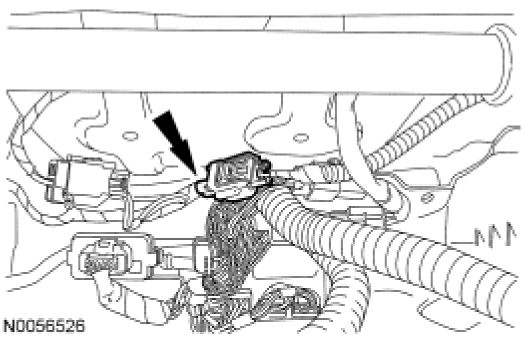


Fig. 147: Identifying Passenger Seat Side Air Bag Module Electrical Connector
Courtesy of FORD MOTOR CO.

MKX

NOTE:	**Do not install the passenger air bag module electrical connectors by the locking buttons. Damage to the locking buttons may occur.**

NOTE:	**The passenger air bag module electrical connector locking buttons must be in the released position when the connector is being installed or connector damage may occur.**

NOTE:	**The passenger air bag module electrical connectors are unique and cannot be reversed when connected to the passenger air bag module. Match the electrical connector key to the keyway in the passenger air bag module. Do not force the electrical connectors into the passenger air bag module. Damage to the connector or component may occur.**

NOTE: RH side shown in illustration, LH side similar.

9. Position the passenger air bag module on the cross vehicle beam. With the locking buttons released, install the 2 passenger air bag module electrical connectors fully into the passenger air bag module and seat the locking buttons.

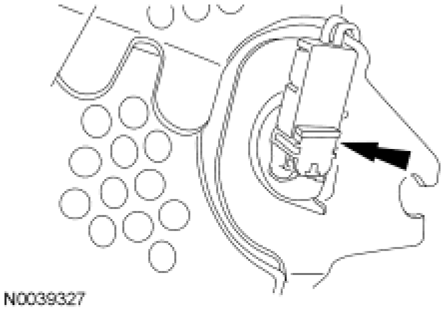


Fig. 148: Locating Passenger Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

NOTE: During the passenger air bag module installation, make sure all 7 of the hooks are fully seated in the instrument panel.

10. Install the passenger air bag module 7 hooks into the instrument panel. Raise the rear of the passenger air bag module onto the 3 mounting studs.

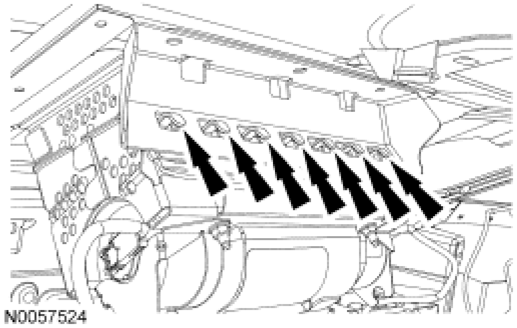


Fig. 149: Identifying Hooks On I/P
Courtesy of FORD MOTOR CO.

11. Install the 3 passenger air bag module nuts.
    - Tighten to 7 Nm (62 lb-in).

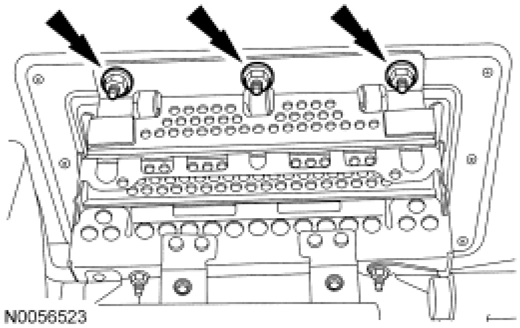


Fig. 150: Locating Nuts On Passenger Air Bag Module
Courtesy of FORD MOTOR CO.

NOTE: To avoid a squeak or rattle condition, install the passenger air bag module bracket and passenger air bag module bolts in this order.

12. Install the passenger air bag module support bracket and the 4 bolts.
    1. Install the passenger air bag module support bracket and 2 bolts to the cross vehicle beam.
        - Tighten to 8 Nm (71 lb-in).
    2. Install the inboard passenger air bag module support bracket-to-passenger air bag module bolt.
        - Tighten to 8 Nm (71 lb-in).
    3. Install the outboard passenger air bag module support bracket-to-passenger air bag module bolt.
        - Tighten to 8 Nm (71 lb-in).

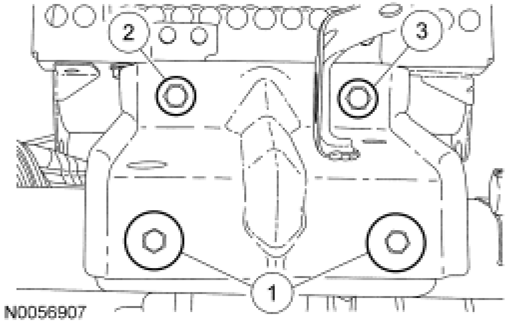


Fig. 151: Installing Passenger Air Bag Module Support Bracket Bolts In Sequence
Courtesy of FORD MOTOR CO.

13. Install the screw and the RH duct assembly.

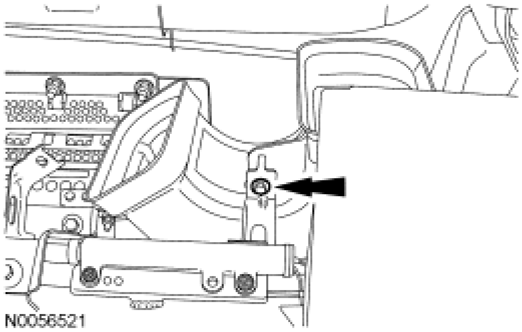


Fig. 152: Locating Screw On RH Duct Assembly
Courtesy of FORD MOTOR CO.

14. Install the screw and the LH duct assembly.

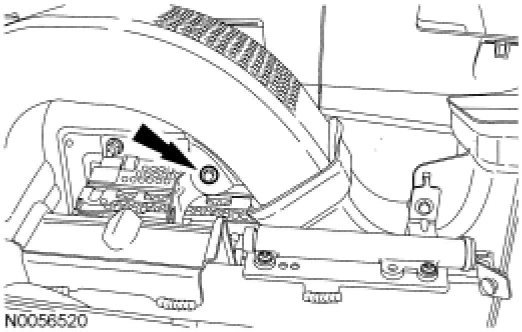


Fig. 153: Locating Screw On LH Duct Assembly
Courtesy of FORD MOTOR CO.

15. Install the screw for the LH duct assembly bracket in the front of the instrument panel.

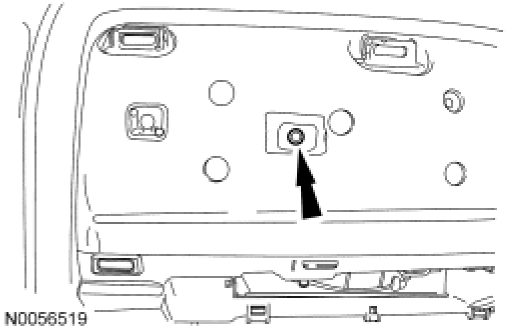


Fig. 154: Locating Screw On LH Duct Assembly Bracket
Courtesy of FORD MOTOR CO.

NOTE: Make sure the RH instrument panel finish panel 5 retaining clips are fully seated in the instrument panel.

16. Install the RH instrument panel finish panel.

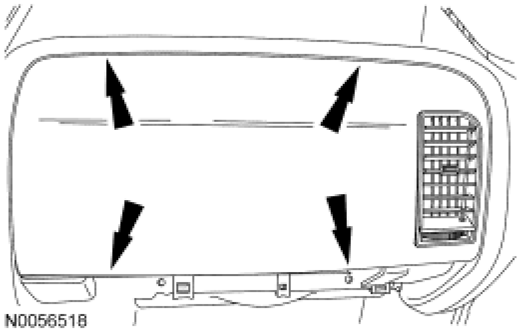


Fig. 155: Locating Retaining Clips On RH I/P Finish Panel
Courtesy of FORD MOTOR CO.

Edge

NOTE:	**Do not install the passenger air bag module electrical connectors by the locking buttons. Damage to the locking buttons may occur.**
NOTE:	**The passenger air bag module electrical connector locking buttons must be in the released position when the connector is being installed or connector damage may occur.**
NOTE:	**The passenger air bag module electrical connectors are unique and cannot be reversed when connected to the passenger air bag module. Match the electrical connector key to the keyway in the passenger air bag module. Do not force the electrical connectors into the passenger air bag module. Damage to the connector or component may occur.**
NOTE:	**RH side shown in illustration, LH side similar.**

17. With the locking buttons released, install the 2 passenger air bag module electrical connectors fully into the passenger air bag module and seat the locking buttons.

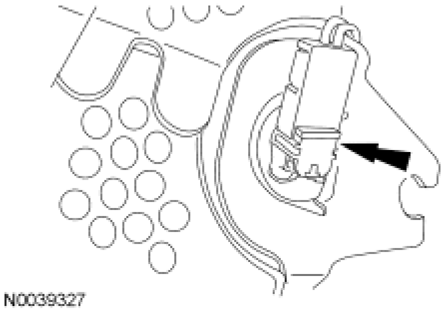


Fig. 156: Locating Passenger Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

NOTE: Do not handle the passenger air bag module by grabbing the edges of the deployment doors. Damage to the air bag module may occur.

NOTE: During air bag module installation, make sure all the deployment door clips are fully seated in the instrument panel.

18. Install the passenger air bag module deployment door rear-most clips into the instrument panel first. Then install the side deployment door clips working around to the forward-most clips seating each of them fully into the instrument panel.

NOTE: To avoid a squeak or rattle condition, install the 2 passenger air bag module bolts in this order.

19. Install the passenger air bag module 2 bolts.
    1. Install the inboard passenger air bag module bolt.
        - Tighten to 8 Nm (71 lb-in).
    2. Install the outboard passenger air bag module bolt.
        - Tighten to 8 Nm (71 lb-in).

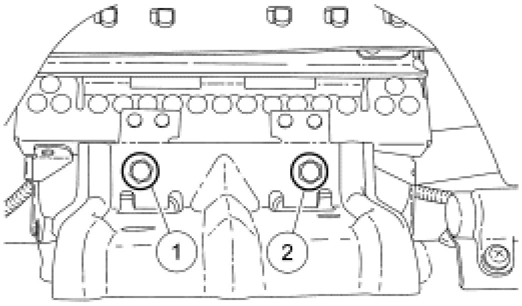


Fig. 157: Installing Passenger Air Bag Module Bolts In Sequence
Courtesy of FORD MOTOR CO.

All vehicles

20. Hook the glove compartment door to the instrument panel. Close the glove compartment door.
    - If equipped, attach the glove compartment door dampener.

NOTE: Do not install the driver air bag module electrical connectors by the locking buttons. Damage to the locking buttons may occur.

NOTE: The driver air bag module electrical connector locking buttons must be in the released position when the connector is being installed or connector damage may occur.

NOTE: The passenger air bag module electrical connectors are unique and cannot be reversed when connected to the passenger air bag module. Match the electrical connector key to the keyway in the passenger air bag module. Do not force the electrical connectors into the passenger air bag module. Damage to the connector or component may occur.

21. With the locking buttons released, install the driver air bag module electrical connectors fully into the driver air bag module and seat the locking buttons.

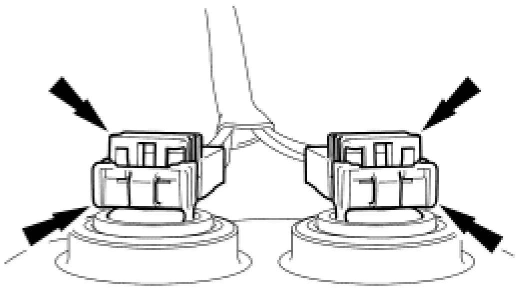


Fig. 158: Locating Driver Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

NOTE: Audible clicks will be heard when both wire clips are seated in the driver air bag module.

22. Align the driver air bag module locking pins to the steering wheel and, while pushing inward, seat the 2 driver air bag module locking pins to the steering wheel wire clips.
    - When the 2 locking pins are seated in place, there should be an even gap between the driver air bag module trim cover and the steering wheel.
23. Turn the ignition switch from OFF to ON.
24. Install RCM fuse 46 (7.5A) to the SJB and install the lower kick panel fuse cover.

WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

25. Connect the battery ground cable.
26. Prove out the SRS as follows:

    Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will:

- fail to light.

- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and an SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator will need to be repaired before diagnosis can continue.

Clear all continuous DTCs from the RCM and occupant classification system module (OCSM) using a scan tool.

INSPECTION AND REPAIR AFTER A SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEPLOYMENT

WARNING: **Remove restraint system diagnostic tools from the vehicle prior to road testing. If tools are not removed, the supplemental restraint system (SRS) device may not deploy in a crash. Failure to follow this instruction may result in serious personal injury or death in a crash and possibly violate vehicle safety standards.**

NOTE: After diagnosing or repairing a Supplemental Restraint System (SRS), the restraint system diagnostic tools (if required) must be removed before operating the vehicle over the road.

NOTE: Deployable devices (such as air bag modules, pretensioners) may deploy alone or in various combinations depending on the impact event.

NOTE: Always refer to the appropriate service information procedures prior to carrying out vehicle repairs affecting the SRS and safety belt system.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

All vehicles

NOTE: Refer to the correct removal and installation procedure for all SRS components being installed.

1. When any deployable device or combination of devices are deployed and/or the Restraints Control Module (RCM) has the DTC B1231 (Event Threshold Exceeded) in memory, the repair of the vehicle SRS is to include the removal of all deployed devices and the installation of new deployable devices, the

removal and installation of new impact sensors, and the removal and installation of a new RCM. DTCs must be cleared from all required modules after repairs are carried out.

Vehicles with Occupant Classification Sensor (OCS) system

NOTE: After installation of new Occupant Classification Sensor (OCS) system components, carry out the Occupant Classification Sensor (OCS) System Reset procedure as instructed in the service information. Refer to the appropriate service information for OCS system removal and installation procedure.

2. When a vehicle has been involved in a collision and the Occupant Classification System Module (OCSM) has DTC B1231 stored in memory, the repair of the OCS system is to include the following procedures for the specified system:
   - For rail-type OCS system, inspect the passenger side floorpan for damage and repair as necessary. Install new OCS system rails.
   - For weight sensor bolt-type OCS system, inspect the passenger side floorpan for damage and repair as necessary. Install a new seat track with OCS system weight sensor bolts. DTC must be cleared from the OCSM before carrying out Occupant Classification Sensor (OCS) System Reset. Do not install a new OCSM unless DTC B1231 cannot be cleared.

   NOTE: Most bladder-type OCSM do not store a DTC B1231 in memory after deployment. The DTC B1231 is stored only by the RCM.

   - For bladder-type OCS system, inspect for damage and repair as necessary. If installation of an OCS system component is required, an OCS system service kit must be installed.

All vehicles

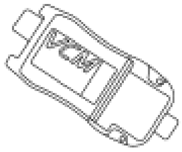
3. When any damage to the impact sensor mounting points or mounting hardware has occurred, repair or install new mounting points and mounting hardware as needed.
4. When the driver air bag module has deployed, a new clockspring must be installed.
5. New driver and/or front passenger safety belt systems (including retractors, buckles and height adjusters) must be installed if the vehicle is involved in a collision that results in deployment of the driver and/or front passenger safety belt pretensioners. For additional information, refer to **SAFETY BELT SYSTEM** article.
6. Inspect the entire vehicle for damage, including the following components:
   - Steering column (deployable column if equipped)
   - Instrument panel knee bolsters and mounting points
   - Instrument panel braces and brackets
   - Instrument panel and mounting points
   - Seats and seat mounting points
   - Safety belts, safety belt buckles and safety belt retractors. For additional information, refer to **SAFETY BELT SYSTEM** article.

- SRS wiring, wiring harnesses and connectors

7. After carrying out the review and inspection of the entire vehicle for damage, repair or install new components as needed.

OCCUPANT CLASSIFICATION SENSOR (OCS) SYSTEM RESET

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

NOTE: If DTC B2290 is retrieved on-demand from the occupant classification system module (OCSM) and restraints control module (RCM):

- **There is a fault with the occupant classification sensor (OCS) weight sensor bolt(s) and/or wiring.**
- **The cause for the DTC must be corrected before carrying out the OCS system reset.**
- **Refer to DTC Charts for diagnostic direction.**
- **The RCM stores DTC B2290 in memory ONLY to identify a problem with the OCS system.**

If DTC B2290 is only present in the RCM and no on-demand or continuous DTC are present in the OCSM, CLEAR all DTCs from the RCM.

1. **Diagnostic Instruction:** The Occupant Classification Sensor (OCS) System Reset procedure **should only** be carried out if instructed to do so by the service information.

   If the concern is with the passenger air bag deactivation (PAD) indicator operation, refer to Passenger Air Bag Deactivation (PAD) Indicator and Occupant Classification Sensor (OCS) System in **DESCRIPTION AND OPERATION** .

   WARNING: **The following precautions must be taken before carrying out the following procedure on the front passenger seat:**

   - **Park the vehicle on level ground.**
   - **Make sure the occupant classification sensor (OCS) system is stabilized at a temperature in the range of 5°C to 48°C (41°F to 118°F) and is not exposed to temperatures outside that range.**
   - **Make sure the front passenger seat is empty and dry.**

- **Make sure the front passenger seat repair is complete and all attached components (head restraint, seat side shield) are correctly installed.**
- **Make sure nothing is placed in the map pockets (if equipped) of the front passenger seat.**
- **Make sure nothing is underneath the front passenger seat.**
- **Make sure no non-factory installed items (seat covers, DVD screens) are on or contacting the front passenger seat. If any non-factory items were installed to the seat, remove the item(s) and communicate to the customer that any alteration/modification to the front passenger seat may affect performance of the OCS system. Refer to the Owner's Literature.**
- **Make sure the seat is correctly installed in the vehicle.**

Failure to follow these instructions may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

NOTE: **Correct seat track alignment of the inboard and outboard seat tracks on a manual seat is critical for a successful system reset. Before removing a front passenger seat equipped with a manual seat track, mark both tracks to indicate correct alignment between the inboard and outboard tracks. Failure to follow this instruction will result in an unsuccessful system reset and incorrect operation of the occupant classification sensor (OCS) system.**

NOTE: **Make sure the occupant classification sensor (OCS) system weight sensor bolt protection brackets are correctly installed to the seat track and that they not contact the cushion side shield, wire harness or any other surrounding parts. Failure to follow this instruction may result in the incorrect operation of the OCS system.**

NOTE: **In the event of a deployable crash and OCSM DTC B1231 is retrieved on-demand, the DTC must be cleared before carrying out the Occupant Classification Sensor (OCS) System Reset.**

NOTE: **If a new OCS system component has been installed, the RCM and OCSM will:**

- **store DTC B1013 and B2290 in memory.**
- **cause the air bag warning indicator to illuminate.**
- **clear after a successful system reset.**

- **the RCM stores DTC B2290 in memory.**

2. Turn the ignition switch to the off position. Wait 10 seconds, then turn the ignition switch back to ON and visually monitor the air bag warning indicator. The air bag warning indicator will light continuously for approximately 6 seconds and then turn OFF. If no SRS DTCs are present **and no new OCS system components were installed** , the air bag warning indicator will remain off. If the SRS indicator illuminates, indicating a fault is present, use a scan tool to retrieve DTCs and refer to **DTC Charts** for diagnostic direction before carrying out the system reset procedure.
3. Cycle the ignition to the OFF position.

NOTE: **The following seat checks must be made before attempting to carry out an occupant classification sensor (OCS) system reset after the seat has been removed and re-installed for any reason:**

- **Make sure the seat is correctly installed in the vehicle.**
- **Make sure the seat has been tightened to specification as identified in the appropriate service information.**
- **Make sure the seat track is correctly aligned (manual seat track).**
- **Make sure the OCS weight sensor bolt harness connections are correct for each sensor at their correct location. Refer to appropriate SYSTEM WIRING DIAGRAMS article for schematic and connector information. Refer to the illustration for correct sensor location on the seat.**

OCS Weight Sensor Bolt Location

- **OCS weight sensor bolt 1, front outboard**
- **OCS weight sensor bolt 2, rear outboard**
- **OCS weight sensor bolt 3, rear inboard**
- **OCS weight sensor bolt 4, front inboard**

4. Position the front passenger seat.
   - Position the seat backrest in the upright (vertical) position.
   - Position the seat in the middle position of seat track travel.
   - Position the seat height to its middle position (power seat only).

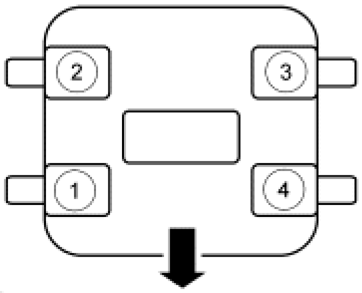


Fig. 159: Identifying OCS System Harness Connector
Courtesy of FORD MOTOR CO.

5. Remove the hysteresis from the front passenger seat by firmly hitting the back of the seat head restraint 3 times.

NOTE: Make sure a minimum 8-second time period has passed after cycling the ignition switch ON before carrying out the System Reset active command.

6. Turn the ignition switch ON, wait 8 seconds and carry out the System Reset using the scan tool.
    - If the system passed, go to **Occupant Classification Sensor (OCS) System Zero Seat Weight Test**.

    NOTE: Do not install any new OCS system components at this time. OCS system components should only be installed when directed to do so.

    - If the system did not pass, **proceed to Step 7.**
7. Carry out the OCSM self-test.
    - If DTCs B2290 and B1013 are retrieved on-demand in the OCSM, refer to **DTC Charts** for diagnostic direction. Carry out diagnostics for DTC B2290 before any other DTCs.
    - If any other DTC is retrieved on-demand in the OCSM, refer to **DTC Charts** for diagnostic direction.
    - If only DTC B1013 is retrieved on-demand in the OCSM, refer to **DTC Charts** for diagnostic direction.

OCCUPANT CLASSIFICATION SENSOR (OCS) SYSTEM ZERO SEAT WEIGHT TEST

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

WARNING: **The following precautions must be taken before carrying out the following procedure on the front passenger seat:**

- **Park the vehicle on level ground.**
- **Make sure the occupant classification sensor (OCS) system is stabilized at a temperature in the range of 5°C to 48°C (41°F to 118°F) and is not exposed to temperatures outside that range.**
- **Make sure the front passenger seat is empty and dry.**
- **Make sure the front passenger seat repair is complete and all attached components (head restraint, seat side shield) are correctly installed.**
- **Make sure nothing is placed in the map pockets (if equipped) of the front passenger seat.**
- **Make sure nothing is underneath the front passenger seat.**
- **Make sure no non-factory installed items (seat covers, DVD screens) are on or contacting the front passenger seat. If any non-factory items were installed to the seat, remove the item(s) and communicate to the customer that any alteration/modification to the front passenger seat may affect performance of the OCS system. Refer to the Owner's Literature.**
- **Make sure the seat is correctly installed in the vehicle.**

Failure to follow these instructions may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

NOTE: Make sure the occupant classification sensor (OCS) weight sensor bolt protection brackets are correctly installed to the seat track and that it does not contact the cushion side shield, wire harness or any other surrounding parts. Failure to follow this instruction may result in the incorrect operation of the OCS system.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: The Zero Seat Weight Test is done with the passenger seat positioned in 2 different positions to make sure that there is nothing to affect the performance and operation of the occupant classification sensor (OCS) system.

NOTE: The Zero Seat Weight Test verifies the OCS system measures zero weight for an empty seat. It is necessary to carry out the Zero Seat Weight Test procedure after a successful System Reset or as directed to do so in the appropriate service information procedures.

NOTE: If the occupant classification system module (OCSM) has any on-demand DTCs except C1941 present, the fault condition(s) must be repaired and the DTCs cleared before carrying out the Zero Seat Weight Test on the front passenger seat. Failure to follow this instruction will result in an unsuccessful Zero Seat Weight Test and the incorrect operation of the OCS system.

WARNING: The following precautions must be taken before carrying out the following procedure on the front passenger seat:

- **Park the vehicle on level ground.**
- **Make sure the occupant classification sensor (OCS) system is stabilized at a temperature in the range of 5°C to 48°C (41°F to 118°F) and is not exposed to temperatures outside that range.**
- **Make sure the front passenger seat is empty and dry.**
- **Make sure the front passenger seat repair is complete and all attached components (head restraint, seat side shield) are correctly installed.**
- **Make sure nothing is placed in the map pockets (if equipped) of the front passenger seat.**
- **Make sure nothing is underneath the front passenger seat.**
- **Make sure no non-factory installed items (seat covers, DVD screens) are on or contacting the front passenger seat. If any non-factory items were installed to the seat, remove the item(s) and communicate to the customer that any alteration/modification to the front passenger seat may affect performance of the OCS system. Refer to the Owner's Literature.**
- **Make sure the seat is correctly installed in the vehicle.**

Failure to follow these instructions may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

1. Make sure the front passenger seat is empty and there is nothing underneath the seat. Remove any items from the seat that were not factory installed and make sure that the seat is correctly installed in the vehicle. For additional information, refer to Occupant Classification Sensor (OCS) System in **Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)**.
2. Position the front passenger seat in the first position.
   - Position the seat backrest in the upright position.
   - Position the seat in the full forward position of seat track travel.
   - Position the seat height to its highest position (power seat only).

WARNING: Remove binding or resistance between all components of the front

passenger seat as directed in the following procedure. Failure to follow this instruction may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

3. Remove hysteresis from the front passenger seat by firmly hitting the back of the seat head restraint 3 times.
4. Turn the ignition to the OFF position.

WARNING: **Make sure nothing is placed on the front passenger seat during the following procedure. Do not press, touch or lay anything on the front passenger seat until the following procedure has been completed. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increase the risk of serious personal injury or death in a crash.**

5. Turn the ignition to the ON position.

NOTE: **Make sure a minimum 8-second time period has passed after cycling the ignition switch ON before carrying out the Zero Seat Weight Test active command.**

6. Carry out the Zero Seat Weight Test using the scan tool.
   - If the system passed, **proceed to Step 7.**
   - If the system did not pass (DTC C1941 Zero Seat Weight Test Failure reported), **proceed to Step 9.**
7. Position the front passenger seat to the second position.
   - Position the seat in the full rearward position of seat track travel.
   - Position the seat height to its lowest position (power seat only).
8. Carry out the Zero Seat Weight Test using the scan tool.
   - If the system passed, repair is complete, **Proceed to Step 10.**
   - If the system did not pass (DTC C1941 Zero Seat Weight Test Failure reported), **proceed to Step 9.**

NOTE: **Check the repair history of the vehicle for any previous repair that required the removal or service of the passenger seat. The repair history may lead to an area of concern.**

9. Inspect the following for causes of a unsuccessful Zero Seat Weight Test.
   - Make sure the front passenger seat is empty and there is nothing underneath the seat. Remove any items from the seat that were not factory installed and make sure that the seat is correctly installed in the vehicle.
   - Make sure the seat wiring harnesses are routed and secured correctly and are not twisted, pinched,

pulling down or pushing up on any seat component. Refer to Seat Cushion Wire Harness Routing - Front Passenger Cushion in the General Procedures portion of **SEATING** article.

- Make sure the OCS weight sensor bolt protection brackets are correctly installed to the seat track and are not contacting the cushion side shield, wire harness or any other surrounding parts.
- Make sure the seat track and backrest frame are not bent, twisted or damaged.
- Move the seat and backrest to all seating positions. Make sure the seat track does not bind or have any resistance when moved to all seating positions. Make sure that there are no obstructions contacting any seat component when the seat is moved to all seating positions.
- Make sure the seat is assembled correctly and all fasteners are tightened to specifications.
    - If a concern was found, repair as necessary, **proceed to Step 1.**
    - If no concern was found, install a new passenger seat track assembly with OCS weight sensor bolts. Refer to **SEATING** article.

10. Prove out the SRS as follows:

    Turn the ignition switch from ON to OFF. Wait 10 seconds, then turn the ignition switch back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will:

    - fail to light.

    - remain lit continuously.

    - flash at a 5 Hz rate (RCM not configured).

    The air bag warning indicator might not light until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

    Repair any unresolved DTCs.

    Clear all continuous DTCs from the RCM and OCSM using a scan tool.

PYROTECHNIC DEVICE DISPOSAL

Disposal of Deployable Devices and Pyrotechnic Devices That are Undeployed/Inoperative

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

NOTE: **All inoperative air bag modules and safety belt pretensioners have been placed on the Mandatory Return List. All discolored or damaged air bag modules must**

be treated the same as any inoperative live air bag being returned.

1. Depower the Supplemental Restraint System (SRS). For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Remove the undeployed/inoperative device. For additional information, refer to the appropriate procedure in this service information or **SAFETY BELT SYSTEM** article.

NOTE: **When installing a new air bag module, a prepaid return postcard is provided with the replacement air bag module. The serial number for the new part and the Vehicle Identification Number (VIN) must be recorded and sent to Ford Motor Company.**

3. If installing a new air bag module, record the necessary information and return the inoperative air bag module to Ford Motor Company.

Disposal of Deployable Devices and Pyrotechnic Devices That Are Deployed

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Remove the deployed device. For additional information, refer to the appropriate procedure in this service information or **SAFETY BELT SYSTEM** article.

NOTE: **If a dual stage driver or passenger air bag module has deployed due to a crash event, the air bag module requires manual deployment to make sure both stages have deployed before scrapping the vehicle or disposing of the air bag module. To determine if a vehicle is equipped with dual stage driver or passenger air bag modules, refer to DESCRIPTION AND OPERATION .**

3. Dispose of the deployed device in the same manner as any other part to be scrapped.

Disposal of Deployable Devices and Pyrotechnic Devices That Require Manual Deployment

1. Safety and environmental concerns require consideration and treatment of restraints system deployable and pyrotechnic devices when disposing of vehicles, deployable devices or pyrotechnic devices. Deploying deployable and pyrotechnic devices before scrapping a vehicle or the device eliminates the potential for hazardous exposures or reactions during processing. If special handling procedures are followed, deployable and pyrotechnic devices can be deployed safely and recycled with the vehicle, shipped separately to a recycling facility or disposed of safely.

NOTE: **To determine the deployable devices a vehicle is equipped with, refer to DESCRIPTION AND OPERATION .**

A vehicle equipped with any of the following deployable devices requires manual deployment of the devices before scrapping the vehicle or component. For additional information, refer to the appropriate portion of this procedure.

- Driver air bag module
- Passenger air bag module
- Seat side air bag modules
- Safety canopy modules
- Side air curtain modules

NOTE: **To determine the pyrotechnic devices a vehicle is equipped with, refer to DESCRIPTION AND OPERATION .**

2. A vehicle equipped with any of the following pyrotechnic devices requires manual deployment of the devices before scrapping the vehicle or component. For additional information, refer to the appropriate portion of this procedure.
   - Safety belt buckle pretensioners
   - Safety belt retractor pretensioners
   - Adaptive load limiting retractors
   - Deployable steering column

NOTE: **To determine if a vehicle is equipped with dual stage driver or passenger air bag modules, refer toDESCRIPTION AND OPERATION .**

3. If a dual stage driver or passenger air bag module has deployed due to a crash event, the air bag module requires manual deployment to make sure both stages have deployed before scrapping the vehicle or disposing of the air bag module. For additional information, refer to Driver Air Bag Module, Passenger Air Bag Module and Seat Side Air Bag Modules - Remote Deployment in this procedure.

Driver Air Bag Module, Passenger Air Bag Module and Seat Side Air Bag Modules - Remote Deployment

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

WARNING: **Always carry or place a live safety canopy, or side air curtain module, with the module and tear seam pointed away from your body. Failure to follow this instruction may result in serious personal injury or death in the**

event of an accidental deployment.

WARNING: **Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.**

NOTE: For air bag modules with multiple loops, all the loops on the air bag module must be deployed.

NOTE: Some driver and passenger front air bags have 2 deployment stages. After a collision it is possible that Stage 1 has deployed and Stage 2 has not.

If a front air bag module has deployed, it is mandatory that the front air bag module be remotely deployed using the appropriate air bag disposal procedure.

NOTE: A typical air bag disposal is shown in illustration that is similar for all vehicles.

All driver, passenger and seat side air bag modules

1. Make a container to house the air bag module for deployment.

   NOTE: The tires must be of sufficient size to accommodate the air bag module.

   - Obtain a tire and wheel assembly and an additional 4 tires (without wheels) of the same size.
   - With the tire and wheel assembly on the bottom, stack the tires.
   - Securely tie all of the tires together.

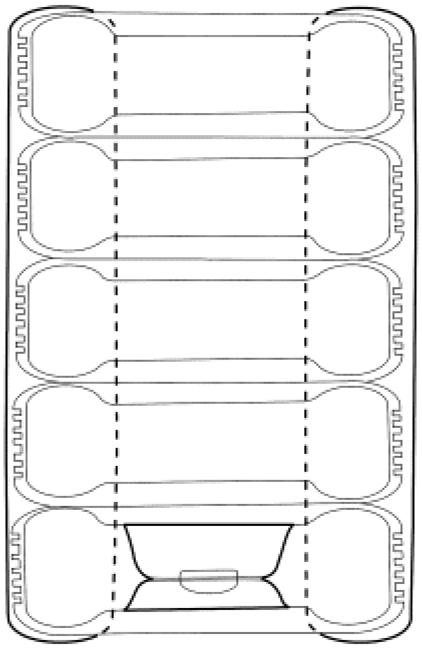


Fig. 160: Placing Air Bag Modules Inside Tire For Deployment
Courtesy of FORD MOTOR CO.

2. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
3. Remove the air bag module. For additional information, refer to the appropriate procedure.

NOTE: If the air bag module does not have a hardwired pigtail, it will be necessary to cut the wires and connector(s) from the vehicle wire harness and reconnect to the air bag module.

4. Cut each of the air bag module wires near the electrical connector that connects to the vehicle wire harness.
5. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

NOTE: Typical driver air bag module with 2 loops shown in illustration, other air bag modules with multiple loops similar.

6. For air bag modules with multiple loops, twist together a wire from each loop then repeat for the remaining wires from each loop.

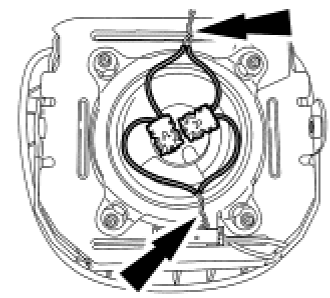


Fig. 161: Locating Air Bag Module Wire Squibs
Courtesy of FORD MOTOR CO.

7. Make a jumper harness to deploy the air bag module.
    - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
    - At one end of the jumper harness, connect the wires together.
8. Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the air bag module or to the twisted-together wires if multiple loops. Use tape or other insulating material to make sure that the leads do not make contact with each other.

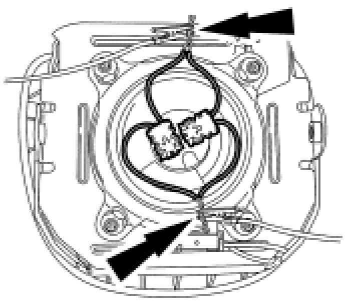


Fig. 162: Connecting Jumper Wires To Squibs
Courtesy of FORD MOTOR CO.

Driver air bag modules

NOTE: Make sure to maintain the connections to the air bag module.

9. With the stack of tires upright and the wheel on the bottom, carefully place the driver air bag module, with the trim cover facing up, on the wheel.

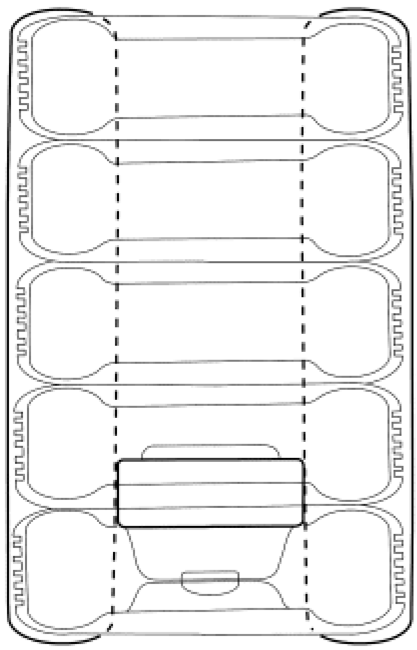
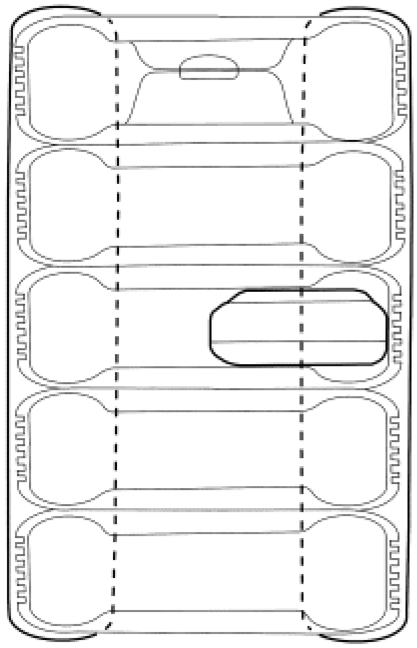


Fig. 163: Placing Driver Air Bag Modules Inside Tires For Deployment
Courtesy of FORD MOTOR CO.

Passenger and seat side air bag modules

NOTE: **Make sure to maintain the connections to the air bag module.**

10. Tip the stack of tires on its side and place the air bag module inside the center tire, making sure that there are 2 tires beneath the tire containing the air bag module and 2 tires (including the tire and wheel assembly) above the tire containing the air bag module.
11. Place the tire stack upright, with the wheel on top.



N0033184

Fig. 164: Identifying Passenger Or Seat Side Air Bag Modules Inside Center Tire
Courtesy of FORD MOTOR CO.

All driver, passenger and seat side air bag modules

12. Remain at least 9.14 m (30 ft) away from the air bag module.
13. From the end of the jumper harness that is not connected to the air bag module, disconnect the 2 wires of the jumper harness from each other.
14. Deploy the air bag module by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.
15. To allow for cooling, wait at least 10 minutes before approaching the deployed air bag module.
16. Dispose of the deployed air bag module in the same manner as any other part to be scrapped.

Safety Belt Buckle Pretensioners, Safety Belt Retractor Pretensioners and Adaptive Load Limiting Safety Belt Retractors - Remote Deployment

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

WARNING: **Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud**

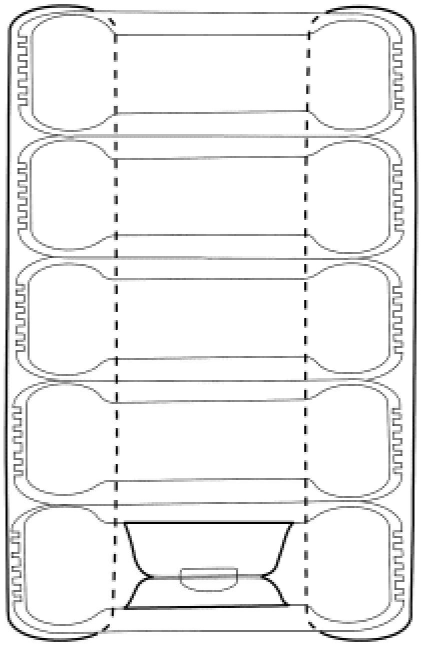
report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.

NOTE: A typical safety belt buckle and retractor disposal is shown in illustration that is similar for all vehicles.

1. Make a container to house the safety belt buckle or retractor for deployment.

    NOTE: The tires must be of sufficient size to accommodate the safety belt buckle or retractor.

    - Obtain a tire and wheel assembly and an additional 4 tires (without wheels) of the same size.
    - With the tire and wheel assembly on the bottom, stack the tires.
    - Securely tie all of the tires together.



N0033182

Fig. 165: Placing Air Bag Modules Inside Tire For Deployment
Courtesy of FORD MOTOR CO.

2. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
3. Remove the safety belt buckle or retractor. For additional information, refer to the appropriate procedure in **SAFETY BELT SYSTEM** article.
    - When deploying a safety belt buckle pretensioner, install a nut and bolt of sufficient length and of

the same diameter as was used to retain it to the seat.

NOTE: If the safety belt buckle or retractor does not have a hardwired pigtail, it will be necessary to cut the wires and connector(s) from the vehicle wire harness and reconnect to the safety belt buckle or retractor.

4. Cut each of the safety belt buckle or retractor wires near the electrical connector that connects to the vehicle wire harness.
5. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.
6. Make a jumper harness to deploy the safety belt buckle or retractor.
    - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
    - At one end of the jumper harness, connect the wires together.

NOTE: Typical safety belt retractor pretensioner shown in illustration, other safety belt buckle pretensioners and load limiting retractors similar.

7. Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the safety belt buckle or retractor. Use tape or other insulating material to make sure that the leads do not make contact with each other.

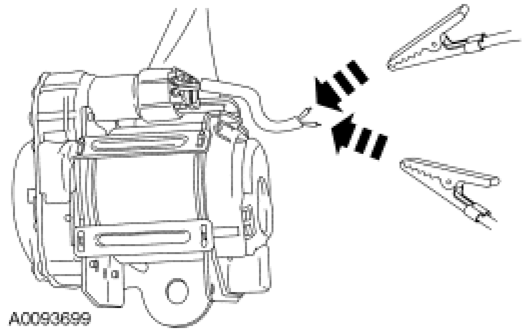
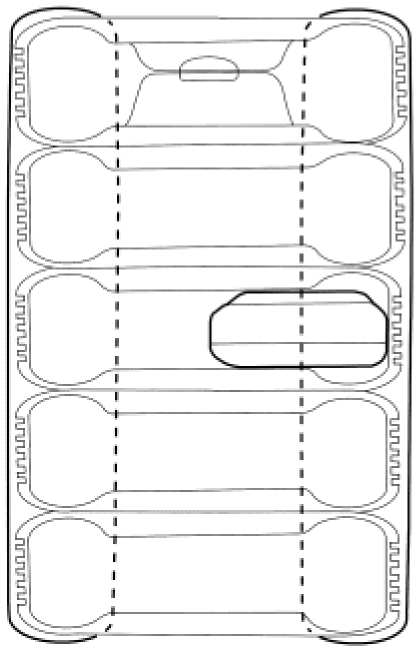


Fig. 166: Attaching Jumper Wires To Safety Belt Retractor Pretensioner
Courtesy of FORD MOTOR CO.

NOTE: Make sure to maintain the connections to the safety belt buckle or retractor.

8. Tip the stack of tires on its side and place the safety belt buckle or retractor inside the center tire, making sure that there are 2 tires beneath the tire containing the safety belt buckle or retractor and 2 tires (including the tire and wheel assembly) above the tire containing the safety belt buckle or retractor.
9. Place the tire stack upright, with the wheel on top.



N0033184

Fig. 167: Identifying Passenger Or Seat Side Air Bag Modules Inside Center Tire
Courtesy of FORD MOTOR CO.

10. Remain at least 9.14 m (30 ft) away from the safety belt buckle or retractor.
11. From the end of the jumper harness that is not connected to the safety belt buckle or retractor, disconnect the 2 wires of the jumper harness from each other.
12. Deploy the safety belt buckle or retractor by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.
13. To allow for cooling, wait at least 10 minutes before approaching the deployed safety belt buckle or retractor.
14. Dispose of the deployed safety belt buckle or retractor in the same manner as any other part to be scrapped.

Safety Belt Buckle Pretensioners, Safety Belt Retractor Pretensioners and Load Limiting Safety Belt Retractors - In-Vehicle Deployment

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

WARNING: **Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud**

report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.

NOTE: **A typical safety belt buckle and retractor disposal is shown in illustration that is similar for all vehicles.**

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Access the safety belt buckle or retractor electrical connectors. For additional information, refer to **SAFETY BELT SYSTEM** article.
3. Cut each of the safety belt buckle or retractor wires, leaving at least 101.6 mm (4 in) to work with.
4. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.
5. Make a jumper harness to deploy the safety belt buckle or retractor.
   - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
   - At one end of the jumper harness, connect the wires together.

   NOTE: **Typical safety belt retractor pretensioner shown in illustration, other safety belt buckle pretensioners and load limiting retractors are similar.**

6. Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the safety belt buckle or retractor. Use tape or other insulating material to make sure that the leads do not make contact with each other.

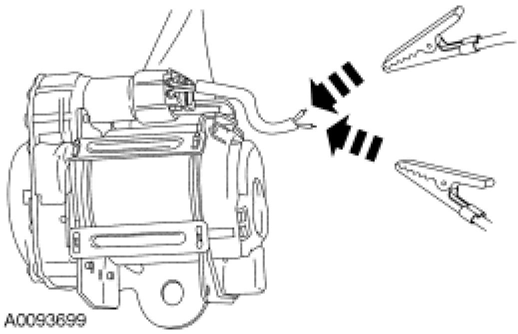


Fig. 168: Attaching Jumper Wires To Safety Belt Retractor Pretensioner
Courtesy of FORD MOTOR CO.

7. Remain at least 9.14 m (30 ft) away from the safety belt buckle or retractor.
8. From the end of the jumper harness that is not connected to the safety belt buckle or retractor, disconnect the 2 wires of the jumper harness from each other.
9. Deploy the safety belt buckle or retractor by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.
10. To allow for cooling, wait at least 10 minutes before approaching the deployed safety belt buckle or retractor.

11. Dispose of the deployed safety belt buckle or retractor in the same manner as any other part to be scrapped.

Safety Canopy Modules and Side Air Curtain Modules - In-Vehicle Deployment

WARNING: **Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.**

NOTE: The safety canopy module deployment for a scrapped vehicle will occur in its installed position in the vehicle.

NOTE: A typical safety canopy module disposal is shown in illustration that is similar for all vehicles.

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Access the safety canopy/side air curtain module electrical connectors. For additional information, refer to the appropriate procedure.
3. Cut each of the safety canopy/side air curtain module wires leaving at least 101.6 mm (4 in) to work with.
4. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

   NOTE: Typical safety canopy/side air curtain module with 2 loops shown in illustration, other safety canopy/side air curtain modules with 2 loops are similar.

5. For safety canopy/side air curtain modules with multiple loops, twist together a wire from each loop then repeat for the remaining wires from each loop.

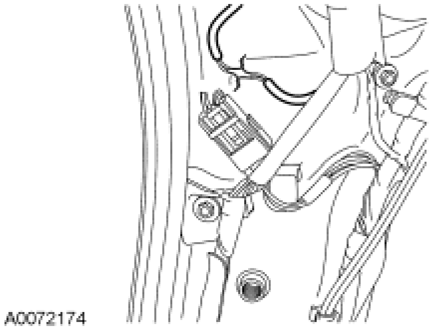


Fig. 169: Identifying Safety Canopy/Side Air Curtain Module Wire Squibs
Courtesy of FORD MOTOR CO.

6. Make a jumper harness to deploy the safety canopy/side air curtain module.
    - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
    - At one end of the jumper harness, connect the wires together.
7. Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the safety canopy/side air curtain module or to the twisted-together wires if multiple loops. Use tape or other insulating material to make sure that the leads do not make contact with each other.

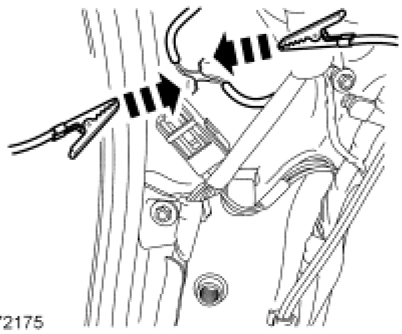


Fig. 170: Connecting Jumper Harness To Twisted Wires
Courtesy of FORD MOTOR CO.

8. From the end of the jumper harness that is not connected to the safety canopy/side air curtain module, disconnect the 2 wires of the jumper harness from each other.
9. Deploy the safety canopy/side air curtain module by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.
10. To allow for cooling, wait at least 10 minutes before approaching the deployed safety canopy/side air curtain module.
11. Dispose of the deployed safety canopy/side air curtain module in the same manner as any other part to be scrapped.

Deployable Steering Column - In-Vehicle Deployment

WARNING: **Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.**

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

NOTE: **It may be necessary to lower or remove the deployable steering column from the instrument panel to access the deployable steering column electrical connector.**

2. Access the deployable steering column electrical connector.

NOTE: If the deployable steering column does not have a hardwired pigtail, it will be necessary to cut the wires and connector(s) from the vehicle wire harness and reconnect to the deployable steering column.

3. Cut each of the deployable steering column wires, leaving at least 101.6 mm (4 in) to work with.
4. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.
5. Make a jumper harness to deploy the deployable steering column.
   - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
   - At one end of the jumper harness, connect the wires together.
6. Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the deployable steering column. Use tape or other insulating material to make sure that the leads do not make contact with each other.

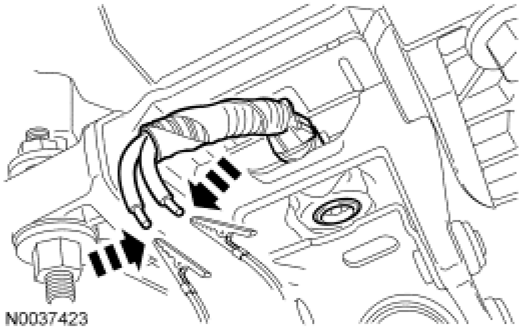


Fig. 171: Connecting Jumper Harness To Wires Of Deployable Steering Column
Courtesy of FORD MOTOR CO.

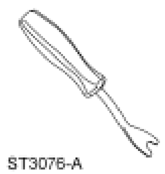
7. Remain at least 9.14 m (30 ft) away from the deployable steering column.
8. From the end of the jumper harness that is not connected to the deployable steering column, disconnect the 2 wires of the jumper harness from each other.
9. Deploy the deployable steering column by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.
10. To allow for cooling, wait at least 10 minutes before approaching the deployed steering column.
11. Dispose of the deployed steering column in the same manner as any other part to be scrapped.

REMOVAL AND INSTALLATION

AIR BAG TRIM COVER - PASSENGER, EDGE

Special Tools

Illustration	Tool Name	Tool Number

	Upholstery Clip Remover	SGT87810 (or equivalent)

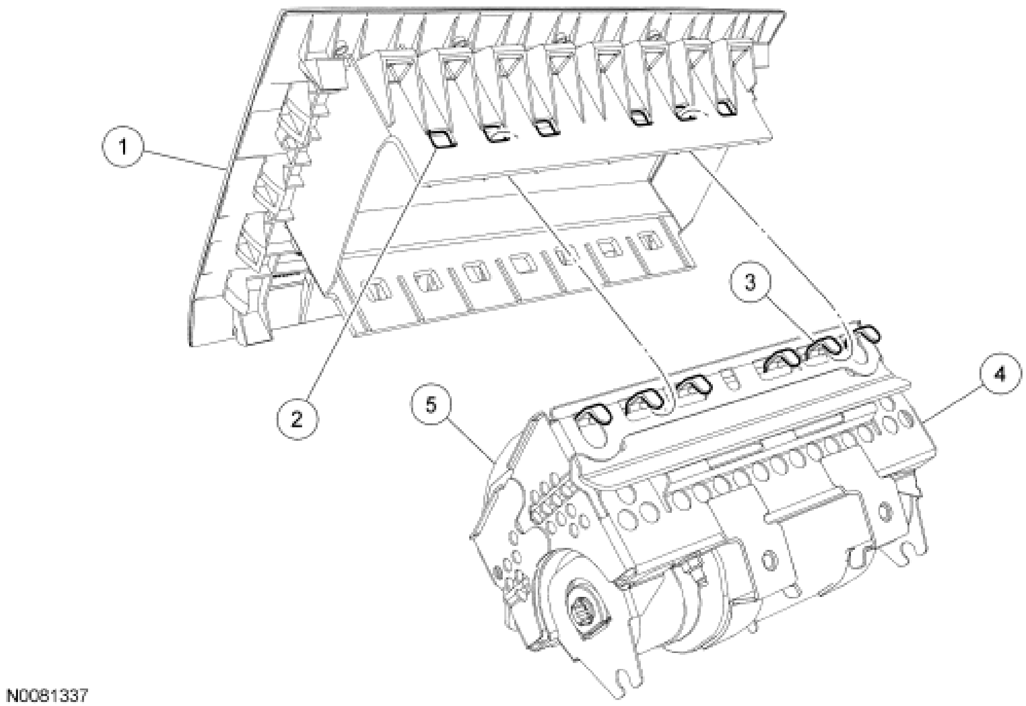


Fig. 172: Identifying Air Bag Trim Cover - Passenger, Edge
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	04338	Passenger air bag cover
2	-	Passenger air bag cover window (part of passenger air bag cover)
3	-	Passenger air bag canister hook (part of canister)
4	-	Passenger air bag canister (part of 044A74)
5	-	Passenger air bag soft pack (part of 044A74)

REMOVAL

WARNING: **Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do**

not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

WARNING: **Do not use any sharp tools to separate the passenger air bag module trim cover from the passenger air bag module canister. Sharp tools may damage the passenger air bag module. Failure to follow this instruction may result in the passenger air bag module deploying incorrectly and increases the risk of serious personal injury or death in a crash.**

WARNING: **Do not unpack or unroll the passenger air bag module soft pack. If the soft pack becomes unpacked or unrolled, install a new passenger air bag module assembly. Failure to follow these instructions may result in the passenger air bag module deploying incorrectly and increases the risk of serious personal injury or death in a crash.**

WARNING: **Do not manipulate or compromise the passenger air bag module hooks during the removal or installation procedure. Failure to follow this instruction may result in the passenger air bag module deploying incorrectly and increases the risk of serious personal injury or death in a crash.**

1. Remove the passenger air bag module. Refer to **Passenger Air Bag Module - Edge** or **Passenger Air Bag Module - MKX**.
2. Place a mark on top of the passenger air bag module canister for correct installation.

WARNING: **Use a non-marring tool to separate the passenger air bag module cover from the passenger air bag module assembly. Sharp tools may damage the passenger air bag module. Failure to follow this instruction may result in the passenger air bag module deploying incorrectly and increases the risk of serious personal injury or death in a crash.**

3. Using an Upholstery Clip Remover or equivalent tool, carefully lift the passenger air bag module cover from the bottom of the air bag module canister, separating the windows from the canister hooks.

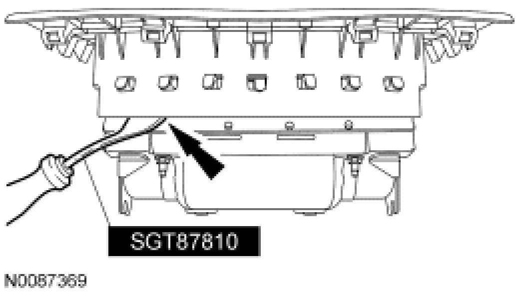


Fig. 173: View Of Passenger Air Bag Module
Courtesy of FORD MOTOR CO.

NOTE: Place an X mark on the old air bag cover to avoid reinstalling.

4. Remove the passenger air bag cover from the canister, separating the top windows from the canister hooks.

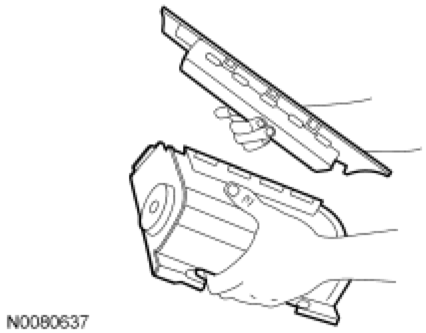


Fig. 174: Identifying Passenger Air Bag Cover
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Place the passenger air bag cover on a clean work surface once it is removed from the shipping package.

WARNING: Carefully inspect the passenger air bag trim cover, canister and soft pack before assembly. If any foreign objects are found, remove them before attaching the passenger air bag trim cover to the canister. If the canister or soft pack is damaged, install a new passenger air bag module assembly. Failure to follow this instruction may result in the passenger air bag module deploying incorrectly, which increases the risk of serious personal injury or death in a crash.

2. Match the number of cover windows to the number of canister hooks before attaching the passenger air bag cover to the canister.
3. Match the top of the passenger air bag cover with the canister mark from the removal procedure.

4. Position the canister onto the passenger air bag cover and engage the bottom hooks into the air bag cover windows.
5. Push the top of the passenger air bag cover to engage the top canister hooks.

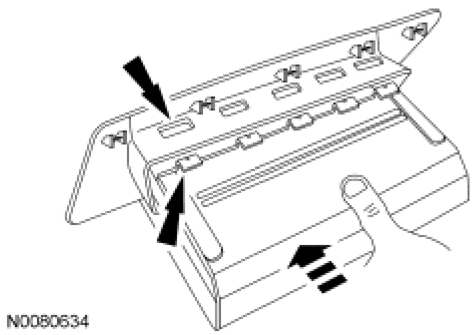


Fig. 175: Pushing Top Of Passenger Air Bag Cover To Engage Top Canister Hooks
Courtesy of FORD MOTOR CO.

6. Inspect the passenger air bag cover windows-to-canister hooks to verify that every window has a hook installed and the sides are not tucked or folded against the air bag canister.

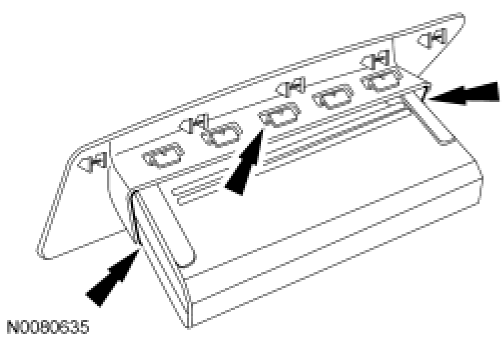


Fig. 176: Inspecting Passenger Air Bag Cover Windows-To-Canister Hooks To Verify Every Window Has A Hook Installed
Courtesy of FORD MOTOR CO.

7. Install the passenger air bag module. Refer to**Passenger Air Bag Module - Edge** or **Passenger Air Bag Module - MKX**.
8.

CLOCKSPRING

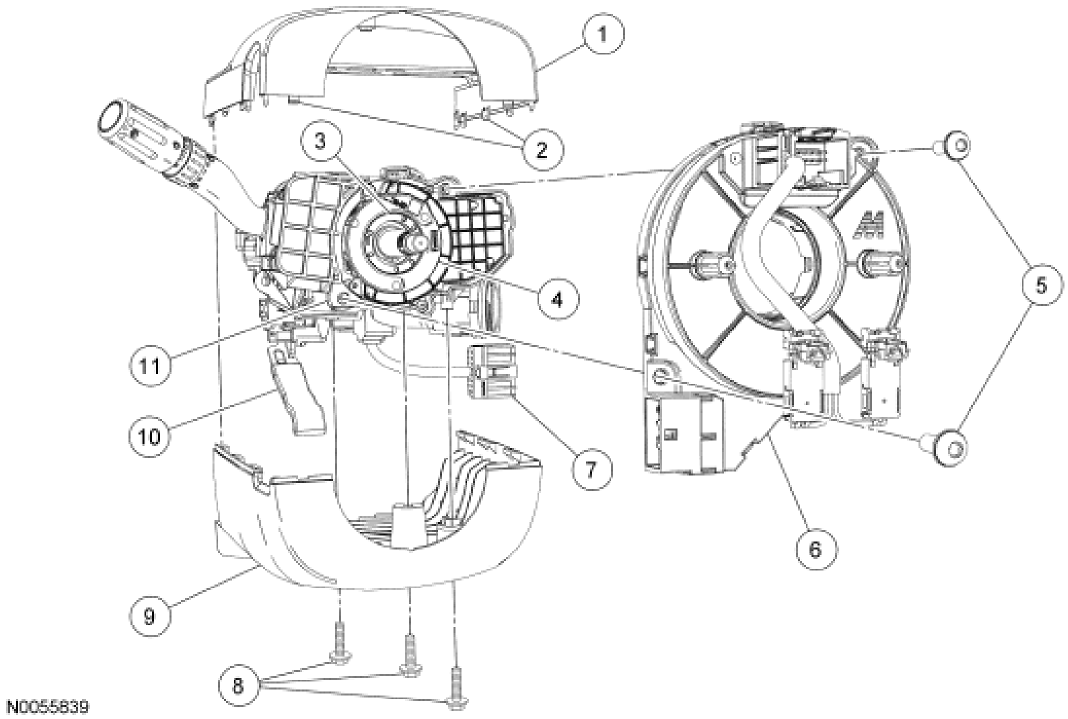


Fig. 177: Exploded View Of Clockspring
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3530A	Upper steering column shroud
2	-	Upper steering column shroud tabs (2 required) (part of 3530)
3	3F818	Steering wheel rotation sensor (if equipped)
4	-	Steering wheel rotation sensor ring (part of 3F818) (if equipped)
5	-	Clockspring screws (2 required) (part of 13K359)
6	14A644	Clockspring
7	-	Clockspring electrical connector (part of 14401)
8	-	Lower steering column shroud screws (3 required) (part of 3530B)
9	3530B	Lower steering column shroud
10	-	Steering column tilt lock/unlock handle
11	-	Multi-function switch housing

REMOVAL

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

1. Remove the driver air bag module. For additional information, refer to **Driver Air Bag Module**.

   NOTE: **Vehicles equipped with a steering wheel rotation sensor and/or adaptive headlamps, do not allow the clockspring rotor to turn from the straight-ahead position after the steering wheel is removed. Failure to follow this instruction may result in component damage and/or system failure.**

   NOTE: **Make sure the road wheels are in the straight-ahead position.**

2. Remove the steering wheel. For additional information, refer to **STEERING COLUMN** article.
3. Tape the clockspring rotor to the steering column shaft to prevent the clockspring rotor from moving out of center.
4. Release the 2 tabs and position the upper steering column shroud upward.
5. Remove the 3 screws and the lower steering column shroud.
6. Disconnect the clockspring electrical connector.
7. Remove the tape from the clockspring rotor to the steering column shaft. Do not allow the clockspring rotor to move from center after tape is removed.

   NOTE: **For vehicles equipped a with steering wheel rotation sensor and/or adaptive headlamps, do not allow the clockspring rotor to turn from the straight-ahead position after the steering wheel is removed. Failure to follow this instruction may result in component damage and/or system failure.**

   NOTE: **For vehicles equipped a with steering wheel rotation sensor and/or adaptive headlamps, after the clockspring has been removed, make sure the arrow on the steering wheel rotation sensor ring is lined up with the arrow on the steering wheel rotation sensor housing as shown in illustration.**

8. Remove the 2 clockspring screws and remove the clockspring.

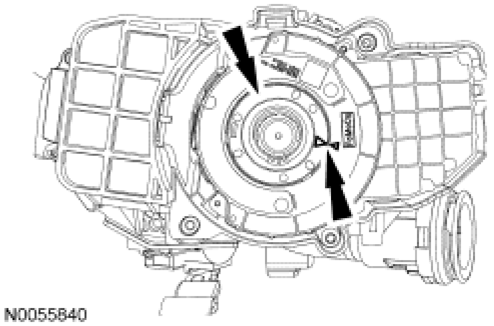


Fig. 178: Locating Clockspring Screws & Clockspring
Courtesy of FORD MOTOR CO.

INSTALLATION

Vehicle repairs reusing the same clockspring

WARNING: **If the clockspring is not correctly centralized, it may fail prematurely. If in doubt, repeat the centralizing procedure. Failure to follow these instructions may increase the risk of serious personal injury or death in a crash.**

NOTE: Make sure the road wheels are in the straight-ahead position. Failure to follow this instruction may result in component damage and/or system failure.

1. If the vehicle's clockspring has rotated out of center, follow these steps to center the clockspring.
    1. Hold the clockspring outer housing stationary.

        NOTE: Overturning will destroy the clockspring. The internal ribbon wire acts as the stop and can be broken from its internal connection.

    2. While turning the rotor counterclockwise, carefully feel for the ribbon wire to run out of length and for a slight resistance. Stop turning at this point.
    3. Turn the clockspring clockwise (approximately 2.25 turns) until the clockspring rotor wiring and connector are in the 12 o'clock position. Clockspring is now centered.
        - Do not allow the rotor to turn from this position.

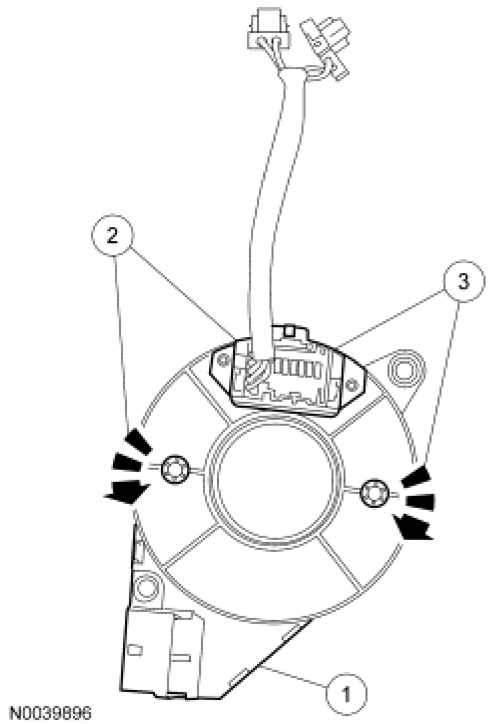


Fig. 179: Centering Clockspring
Courtesy of FORD MOTOR CO.

All vehicles

NOTE:	**Slight rotation of the steering wheel rotation sensor ring is allowed to align the 2 arrows.**

2. Make sure the steering wheel rotation sensor ring arrow is lined up with the steering wheel rotation sensor housing arrow as shown in illustration.

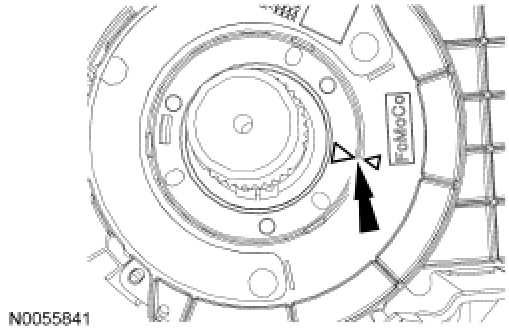


Fig. 180: Making Sure Sensor Ring Arrow Is Lined Up With Absolute Steering Angle Sensor Housing Arrow
Courtesy of FORD MOTOR CO.

NOTE:	**If the clockspring is left unattended by the technician between centralizing**

the clockspring and installing it to the multi-function switch housing, the centralizing procedure must be repeated. Failure to follow this instruction may result in component damage and/or system failure.

NOTE: **For vehicles equipped with a steering wheel rotation sensor and/or adaptive headlamps, slight rotation of the clockspring rotor might be needed to seat the clockspring 3 locator pins into the steering wheel rotation sensor and or adaptive headlamps sensor ring. Very slight rotation is possible on a new clockspring with the sealing key installed.**

NOTE: **Make sure the clockspring is fully seated into the multi-function switch housing before installing the clockspring screws.**

3. Install the clockspring and the 2 screws.

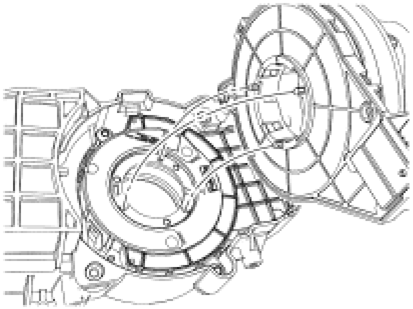


Fig. 181: Installing Clockspring & Screws
Courtesy of FORD MOTOR CO.

4. Connect the clockspring electrical connector.
5. Install the lower steering column shroud and the 3 screws.
6. Attach the upper steering column shroud to the lower steering column shroud.

NOTE: **If not installing a new clockspring, and the vehicle is left unattended by the technician between the installation of the clockspring to the multi-function switch housing and installing the steering wheel, the centralizing procedure can be repeated at this time with the clockspring being installed in the multi-function switch housing. Failure to follow this instruction may result in component damage and/or system failure.**

7. Install the steering wheel. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** article.
   - If a new clockspring is being installed, and after the steering wheel installation, remove the clockspring sealing key.
8. Install the driver air bag module. For additional information, refer to **Driver Air Bag Module**.

DRIVER AIR BAG MODULE

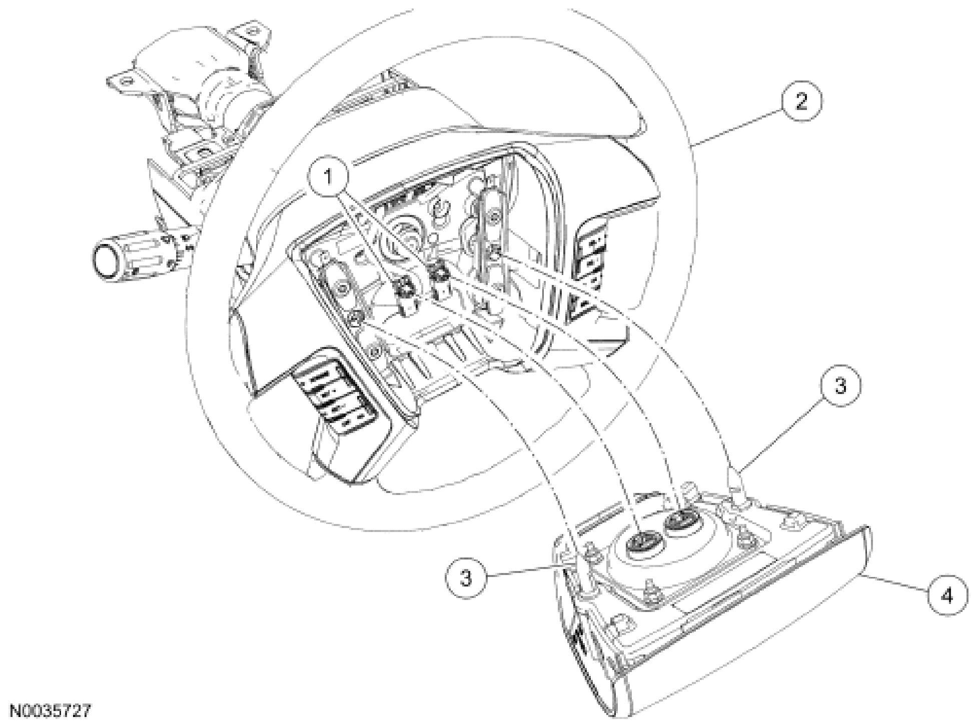


Fig. 182: Exploded View Of Driver Air Bag Module
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Driver air bag module electrical connectors (part of 14A664)
2	3600	Steering wheel
3	-	Driver air bag module locking pins (part of 43B13)
4	43B13	Driver air bag module

REMOVAL

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Do not repaint air bag modules with discolored or damaged trim covers or deployment doors; new air bag modules must be installed. Failure to follow this instruction may result in the air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

NOTE: Repeat this step for both locking pins.

2. Using a 3 mm (0.11 in) Allen wrench or a suitable tool through the access hole on the backside of the steering wheel, position the tool against the spring clip and push in, disengaging the clip from the locking pin. With the spring clip disengaged from the locking pin, gently pull back on that side of the driver air bag module to release it from the steering wheel.

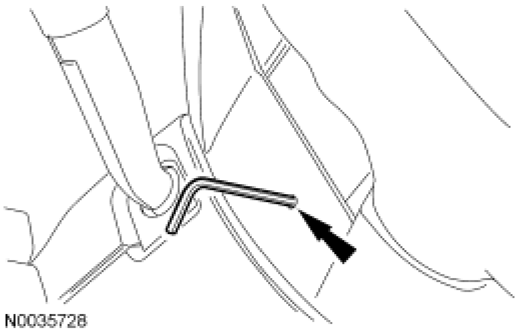


Fig. 183: Locating Allen Wrench
Courtesy of FORD MOTOR CO.

NOTE: Do not pull the driver air bag module electrical connectors out by the locking buttons. Damage to the locking buttons can occur.

3. Using a small screwdriver as shown in illustration, lift up and release the locking buttons on the driver air bag module electrical connectors. With the locking buttons released, remove the electrical connectors and the driver air bag module.

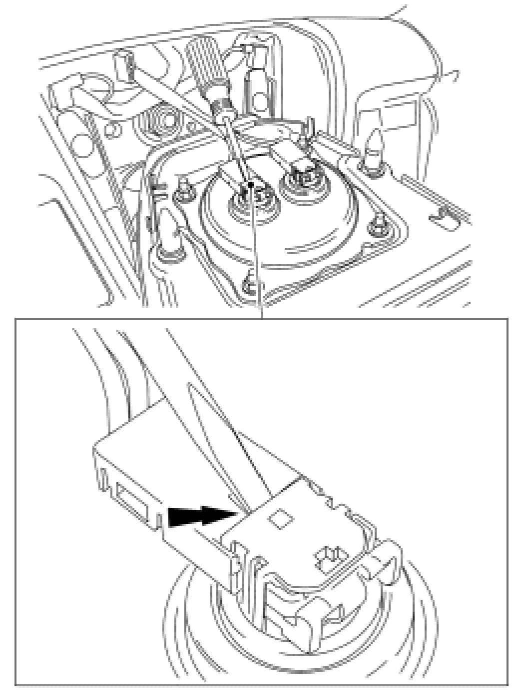


Fig. 184: Releasing Locking Buttons On Driver Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE:	**Do not install the driver air bag module electrical connectors by the locking buttons. Damage to the locking buttons can occur.**

NOTE:	**The driver air bag module electrical connector locking buttons must be in the released position when the connector is being installed or connector damage may occur.**

NOTE:	**The driver air bag module electrical connectors are unique and cannot be reversed when connected to the driver air bag module. Match the electrical connector key to the keyway in the driver air bag module. Do not force the electrical connectors into the driver air bag module. Damage to the connector or component may occur.**

1. With the locking buttons released, install the driver air bag module electrical connectors fully into the driver air bag module and seat the locking buttons.

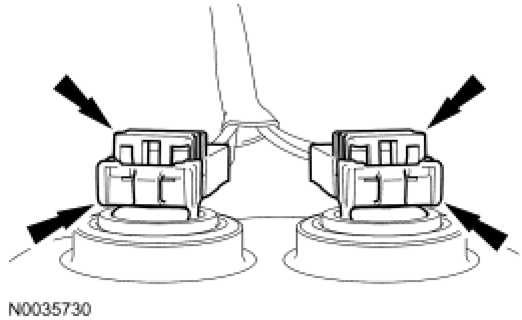


Fig. 185: Locating Driver Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

NOTE: Audible clicks will be heard when both wire clips are seated in the driver air bag module.

2. Align the driver air bag module locking pins to the steering wheel and, while pushing inward, seat the 2 driver air bag module locking pins to the steering wheel wire clips.
   - When the 2 locking pins are seated in place, there should be an even gap between the driver air bag module trim cover and the steering wheel.
3. Repower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

FRONT IMPACT SEVERITY SENSOR

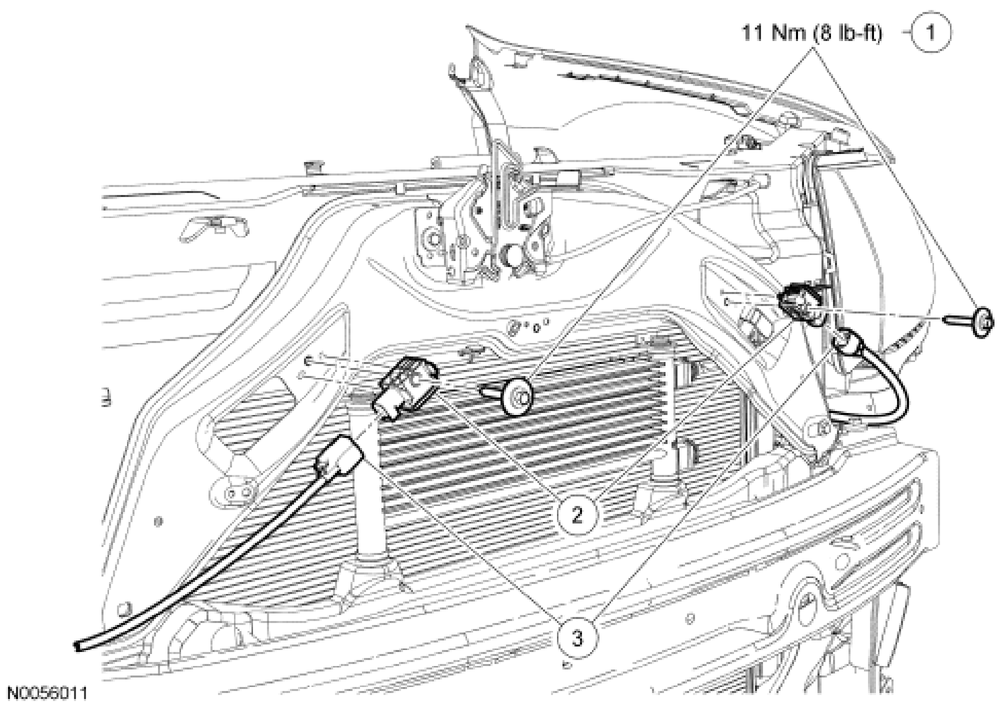


Fig. 186: Exploded View Of Front Impact Severity Sensor With Torque Specification

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W712191	LH and RH front impact severity sensor bolts
2	14B006	LH and RH front impact severity sensors
3	-	LH and RH front impact severity sensor electrical connectors (part of 14290)

WARNING: **If a vehicle has been in a crash, inspect the restraints control module (RCM) and the impact sensor (if equipped) mounting areas for deformation. If damaged, restore the mounting areas to the original production configuration. A new RCM and sensors must be installed whether or not the air bags have deployed. Failure to follow these instructions may result in serious personal injury or death in a crash.**

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Remove the front bumper cover. For additional information, refer to **BUMPERS** article.
3. Disconnect the front impact severity sensor electrical connector.

   WARNING: **Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.**

   NOTE: Make sure the hood latch bracket and front impact severity sensor mating surfaces are clean and free of foreign material.

   NOTE: Note position of the 2 locator tabs on the front impact severity sensor for installation.

4. Remove the bolt and the front impact severity sensor.
   - To install, tighten to 11 Nm (8 lb-ft).
5. To install, reverse the removal procedure.
6. Repower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

OCCUPANT CLASSIFICATION SYSTEM MODULE (OCSM) - MANUAL SEAT TRACK

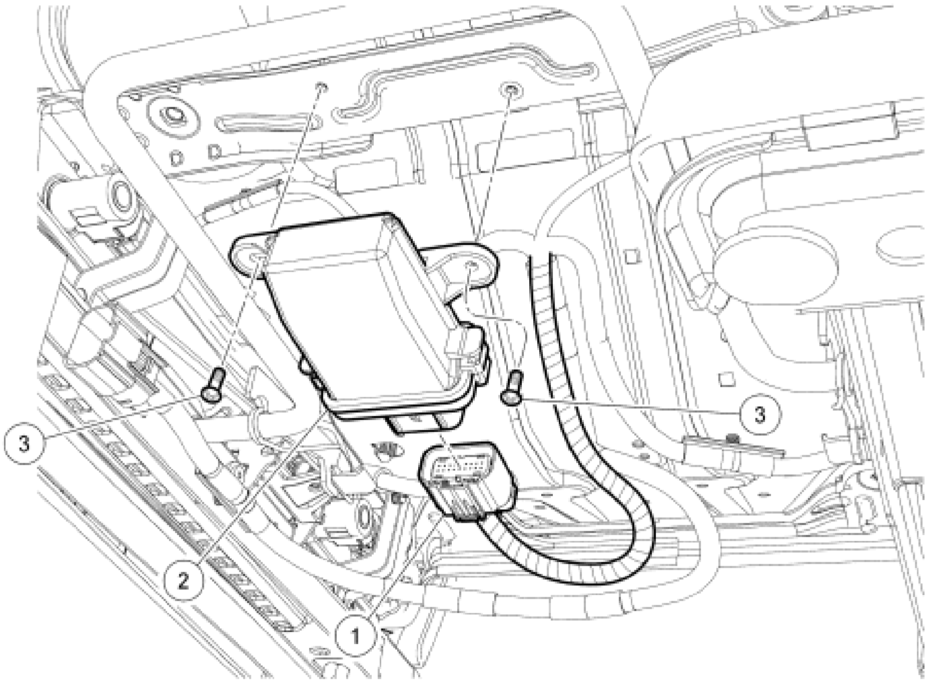


Fig. 187: Exploded View Of Occupant Classification Module - Manual Seat Track
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Occupant classification system module (OCSM) electrical connector (part of 14A698)
2	14B422	OCSM
3	-	OCSM screws

REMOVAL

WARNING: **Use care when handling the front passenger seat and track assembly. Dropping the assembly, placing excessive weight on or sitting on a front passenger seat that is not secured in the vehicle may result in damaged seat components. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.**

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of

faults before releasing the vehicle to the customer.

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Disconnect the occupant classification system module (OCSM) electrical connector.
3. Remove the 2 screws and OCSM.
4. To install, reverse the removal procedure.
5. Install the passenger seat and repower the SRS. **Do not prove out the SRS at this time.** For additional information, refer to **SEATING** article.
6. Carry out the appropriate procedure after installation of an OCSM.
   - If installing the original OCSM, carry out the Zero Seat Weight Test and prove out the SRS. For additional information, refer to **Occupant Classification Sensor (OCS) System Zero Seat Weight Test**.
   - If installing a new OCSM, carry out the System Reset procedure and prove out the SRS. For additional information, refer to **Occupant Classification Sensor (OCS) System Reset**.

OCCUPANT CLASSIFICATION SYSTEM MODULE (OCSM) - POWER SEAT TRACK

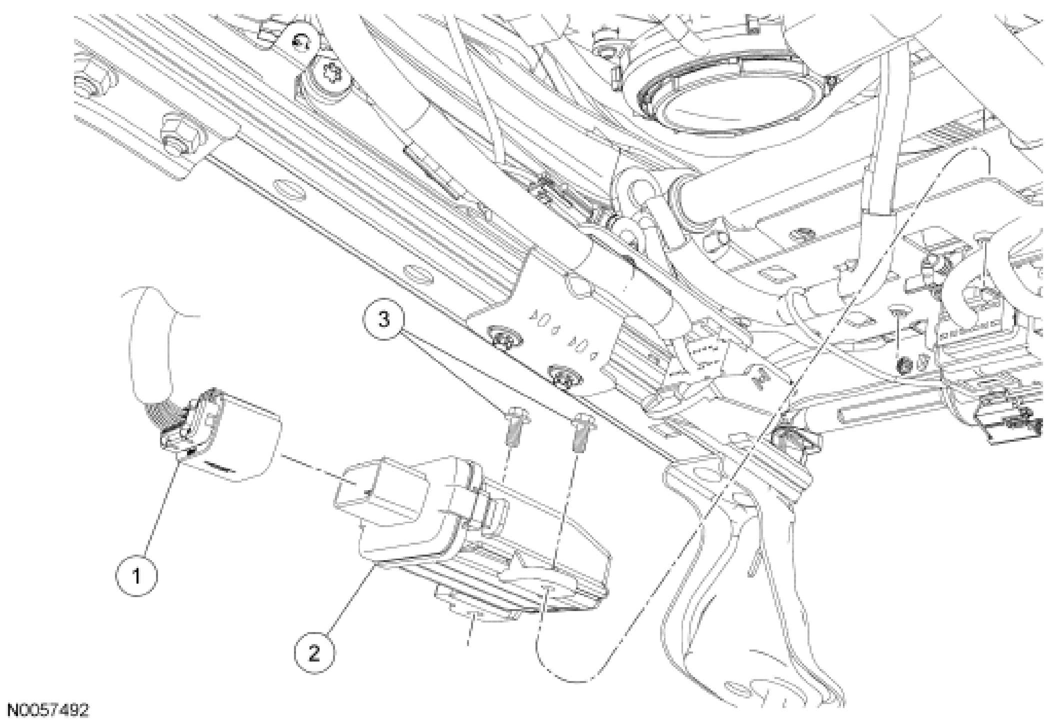


Fig. 188: Exploded View Of Occupant Classification Module - Power Seat Track
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Occupant classification system module (OCSM) electrical connector (part of

		14A698)
2	14B422	OCSM
3	-	OCSM screws

REMOVAL

WARNING: **Use care when handling the front passenger seat and track assembly. Dropping the assembly, placing excessive weight on or sitting on a front passenger seat that is not secured in the vehicle may result in damaged seat components. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.**

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

1. Remove the front passenger seat. For additional information, refer to **SEATING** article.
2. Disconnect the occupant classification system module (OCSM) electrical connector.
3. Remove the 2 screws and OCSM.
4. To install, reverse the removal procedure.
5. Install the front passenger seat. **Do not prove out the SRS at this time.** For additional information, refer to **SEATING** article.
6. Repower the SRS. **Do not prove out the SRS at this time.** For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
7. Carry out the appropriate procedure after installation of an OCSM.
   - If installing the original OCSM, carry out the Zero Seat Weight Test. For additional information, refer to **Occupant Classification Sensor (OCS) System Zero Seat Weight Test**.
   - If installing a new OCSM, carry out the System Reset procedure. For additional information, refer to **Occupant Classification Sensor (OCS) System Reset**.

OCCUPANT CLASSIFICATION SENSOR - MANUAL SEAT TRACK

REMOVAL

WARNING: **Use care when handling the front passenger seat and track assembly. Dropping the assembly, placing excessive weight on or sitting on a front passenger seat that is not secured in the vehicle may result in damaged seat components. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.**

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

NOTE: **Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.**

All occupant classification sensor (OCS) weight sensor bolt(s)

1. Remove the manual seat track. For additional information, refer to **SEATING** article.

    NOTE: **After marking the seat track rails, do not change the position of the seat track.**

2. Mark the position of both seat track rails.

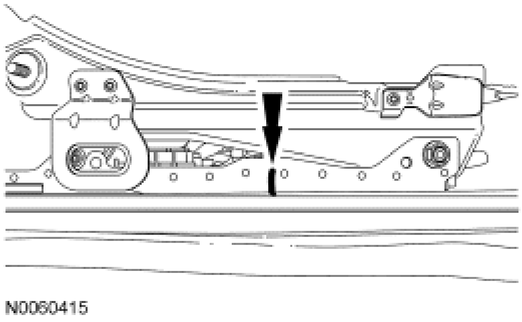


Fig. 189: Marking Position Of Both Seat Track Rails
Courtesy of FORD MOTOR CO.

Inboard OCS weight sensor bolt(s)

3. Remove the nut and safety belt buckle.

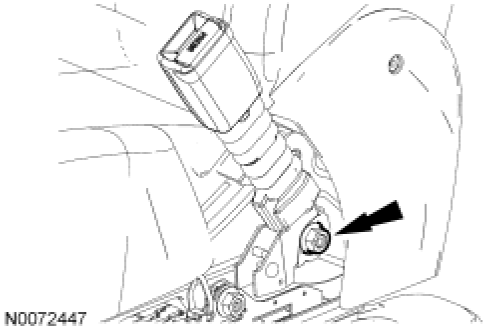


Fig. 190: Identifying Nut And Safety Belt Buckle

Courtesy of FORD MOTOR CO.

All OCS weight sensor bolt(s)

NOTE: **Outboard front cross brace screws shown in illustration, inboard similar.**

4. On the side with the affected OCS I-bolt(s), remove the 2 front cross brace screws.

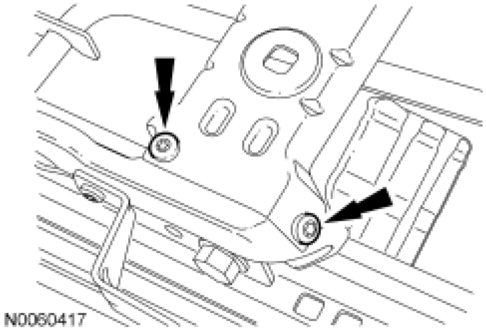


Fig. 191: Identifying Front Cross Brace Screws
Courtesy of FORD MOTOR CO.

5. On the side with the affected OCS weight sensor bolt(s), disengage the seat adjuster handle spring and position it aside.

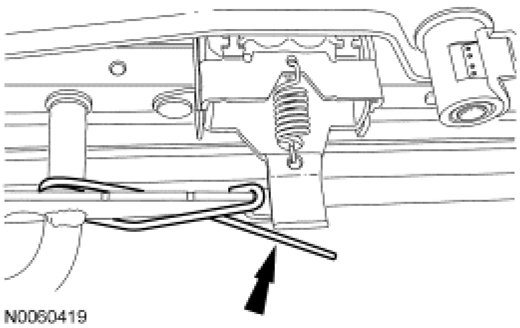


Fig. 192: Identifying Seat Adjuster Handle Spring
Courtesy of FORD MOTOR CO.

6. Separate the seat adjuster handle from the affected side of the seat track rail with the OCS weight sensor bolt(s).

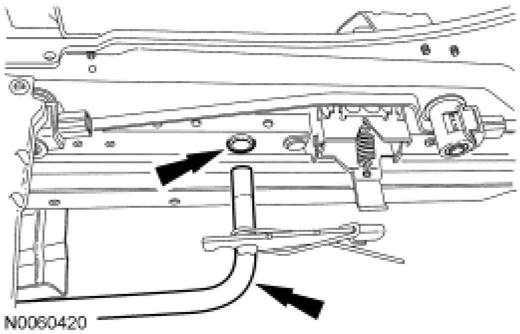


Fig. 193: Identifying Seat Track Rail & OCS Weight Sensor Bolt
Courtesy of FORD MOTOR CO.

NOTE: Outboard rear cross brace screws shown in illustration, inboard similar.

7. On the side with the affected OCS weight sensor bolt(s), remove the 2 rear cross brace screws.

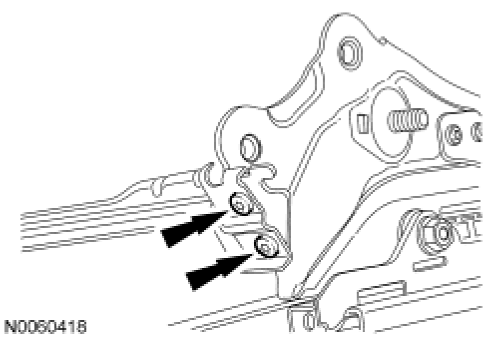


Fig. 194: Identifying Rear Cross Brace Screws
Courtesy of FORD MOTOR CO.

NOTE: If any occupant classification sensor (OCS) weight sensor bolt nuts are removed, new OCS weight sensor bolt nuts must be installed.

8. Remove and discard the 2 OCS weight sensor bolt nuts from the affected side of the seat track rail with the OCS weight sensor bolt(s).

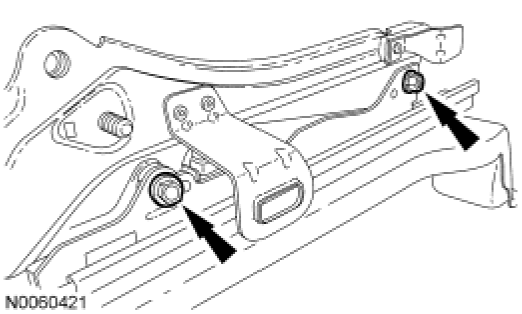


Fig. 195: Identifying OCS Weight Sensor Bolt Nuts

Courtesy of FORD MOTOR CO.

9. Remove the side plate with the OCS weight sensor bolt(s) from the seat track rail.

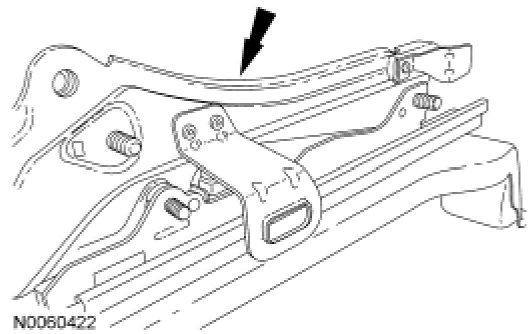


Fig. 196: Identifying Side Plate
Courtesy of FORD MOTOR CO.

NOTE:	**Do not overtighten the side plate with the occupant classification sensor (OCS) weight sensor bolts to the bench or table. Tighten only enough to compress the spring washer. Overtightening may damage the side plate or OCS weight sensor bolts.**

10. Using a suitable tool, clamp the side plate to a bench or table to compress the spring washer on the affected OCS weight sensor bolt as shown in illustration.

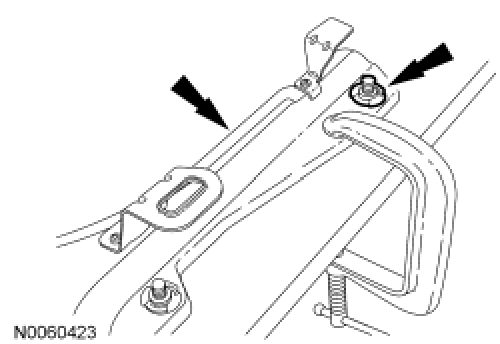


Fig. 197: Clamping Side Plate To A Bench Or Table Using A Suitable Tool
Courtesy of FORD MOTOR CO.

NOTE:	**Note the position of the OCS weight sensor bolt, spring washer and retaining clip for installation.**

11. Remove and discard the retaining clip from the affected OCS weight sensor bolt.

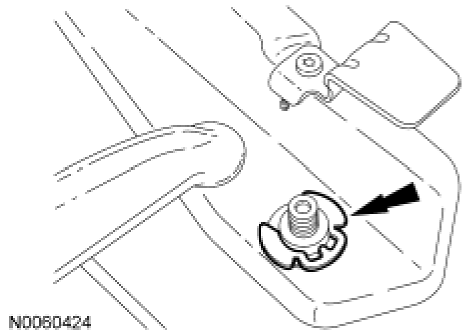


Fig. 198: Identifying Retaining Clip From Affected OCS Weight Sensor Bolt
Courtesy of FORD MOTOR CO.

12. Release the clamp and remove the OCS weight sensor bolt and spring washer from the side plate.

INSTALLATION

All OCS weight sensor bolt(s)

NOTE: **Do not overtighten the side plate with the occupant classification sensor (OCS) weight sensor bolts to the bench or table. Tighten only enough to compress the spring washer. Overtightening may damage the side plate or OCS weight sensor bolts.**

1. Position the spring washer and OCS weight sensor bolt in the side plate. Then clamp the side plate to a bench or table to compress the OCS weight sensor bolt spring washer.

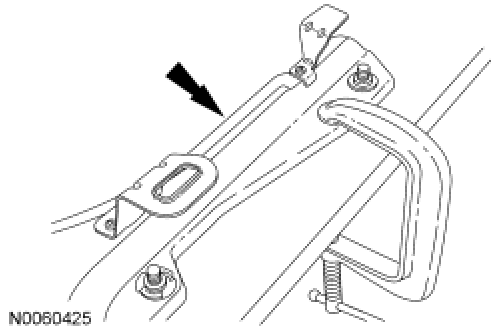


Fig. 199: Clamping Side Plate To A Bench Or Table Using A Suitable Tool
Courtesy of FORD MOTOR CO.

NOTE: **Make sure the OCS weight sensor bolt retaining clip is seated fully in the OCS weight sensor bolt groove underneath the OCS weight sensor O-ring seal.**

2. Install the 2 new OCS weight sensor bolt retaining clips in the OCS weight sensor groove underneath the O-ring seal.

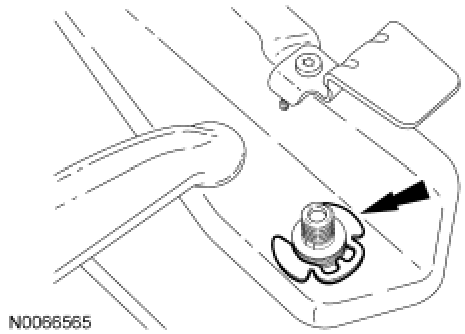


Fig. 200: Identifying Retaining Clip From Affected OCS Weight Sensor Bolt
Courtesy of FORD MOTOR CO.

3. Unclamp the side plate with the installed OCS weight sensor bolt from the bench or table.

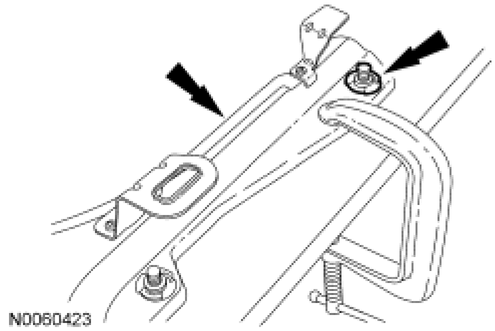


Fig. 201: Clamping Side Plate To A Bench Or Table Using A Suitable Tool
Courtesy of FORD MOTOR CO.

NOTE:	**Slight rotational adjustment of the OCS weight sensors bolts may be necessary to install the OCS weight sensor bolts and side plate to the seat track rail.**

4. Install the side plate and OCS weight sensor bolts to the seat track rail.

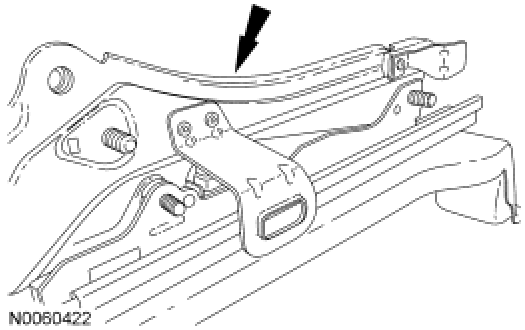


Fig. 202: Identifying Side Plate
Courtesy of FORD MOTOR CO.

NOTE: When installing the side plate to the seat track rail, 2 new OCS weight sensor nuts must be installed.

5. Install the 2 new OCS weight sensor bolt nuts to the seat track rail.
   - Tighten to 33 Nm (24 lb-ft).

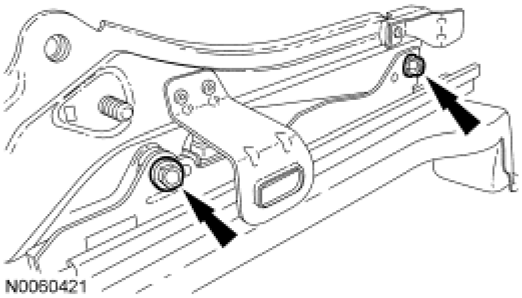


Fig. 203: Identifying OCS Weight Sensor Bolt Nuts
Courtesy of FORD MOTOR CO.

6. Install the seat adjuster handle to the seat track rail.

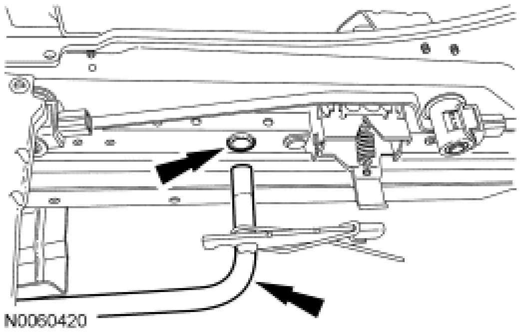


Fig. 204: Identifying Seat Track Rail & OCS Weight Sensor Bolt
Courtesy of FORD MOTOR CO.

7. Engage the seat adjuster handle spring.

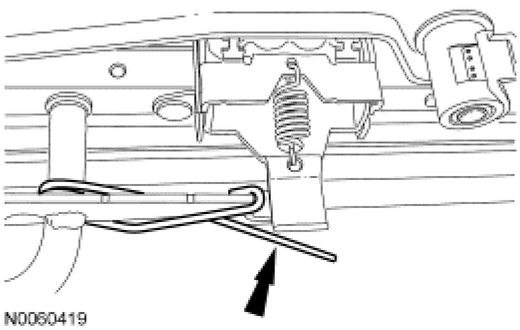


Fig. 205: Identifying Seat Adjuster Handle Spring

Courtesy of FORD MOTOR CO.

8. Install the 2 rear cross brace screws.
    - Tighten to 5 Nm (44 lb-in).

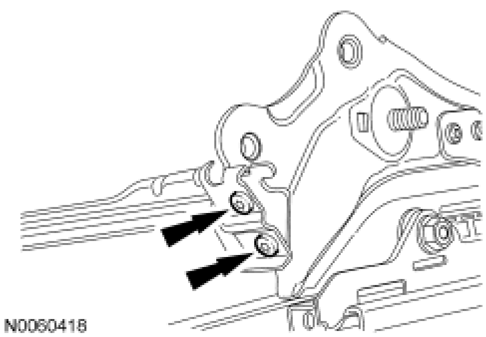


Fig. 206: Identifying Rear Cross Brace Screws
Courtesy of FORD MOTOR CO.

9. Install the 2 front cross brace screws.
    - Tighten to 5 Nm (44 lb-in).

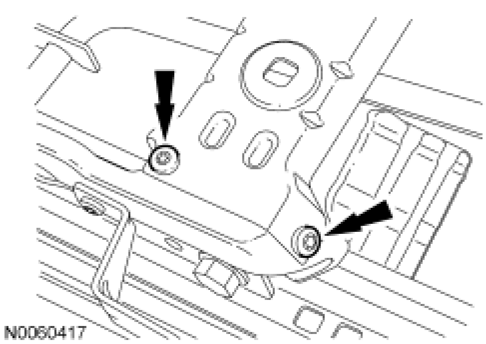


Fig. 207: Identifying Front Cross Brace Screws
Courtesy of FORD MOTOR CO.

Inboard OCS weight sensor bolt(s)

10. Install the nut and safety belt buckle.
    - Tighten to 40 Nm (30 lb-ft).

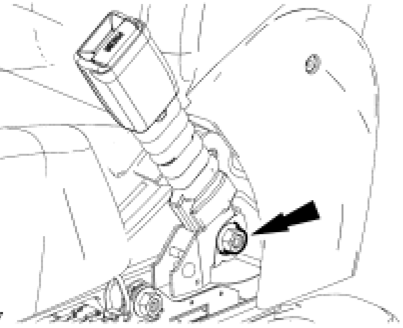


Fig. 208: Identifying Safety Belt Buckle Bolt
Courtesy of FORD MOTOR CO.

All OCS weight sensor bolt(s)

11. Install the manual seat track. For additional information, refer to **SEATING** article.
12. Install the passenger seat and repower the SRS. **Do not prove out the SRS at this time.** For additional information, refer to **SEATING** article.
13. Carry out the appropriate procedure after installation of an OCS system component.
    - If installing the original OCS system component, carry out the Zero Seat Weight Test and prove out the SRS. For additional information, refer to **Occupant Classification Sensor (OCS) System Zero Seat Weight Test**.
    - If installing a new OCS system component, carry out the System Reset procedure and prove out the SRS. For additional information, refer to **Occupant Classification Sensor (OCS) System Reset**.

OCCUPANT CLASSIFICATION SENSOR - POWER SEAT TRACK

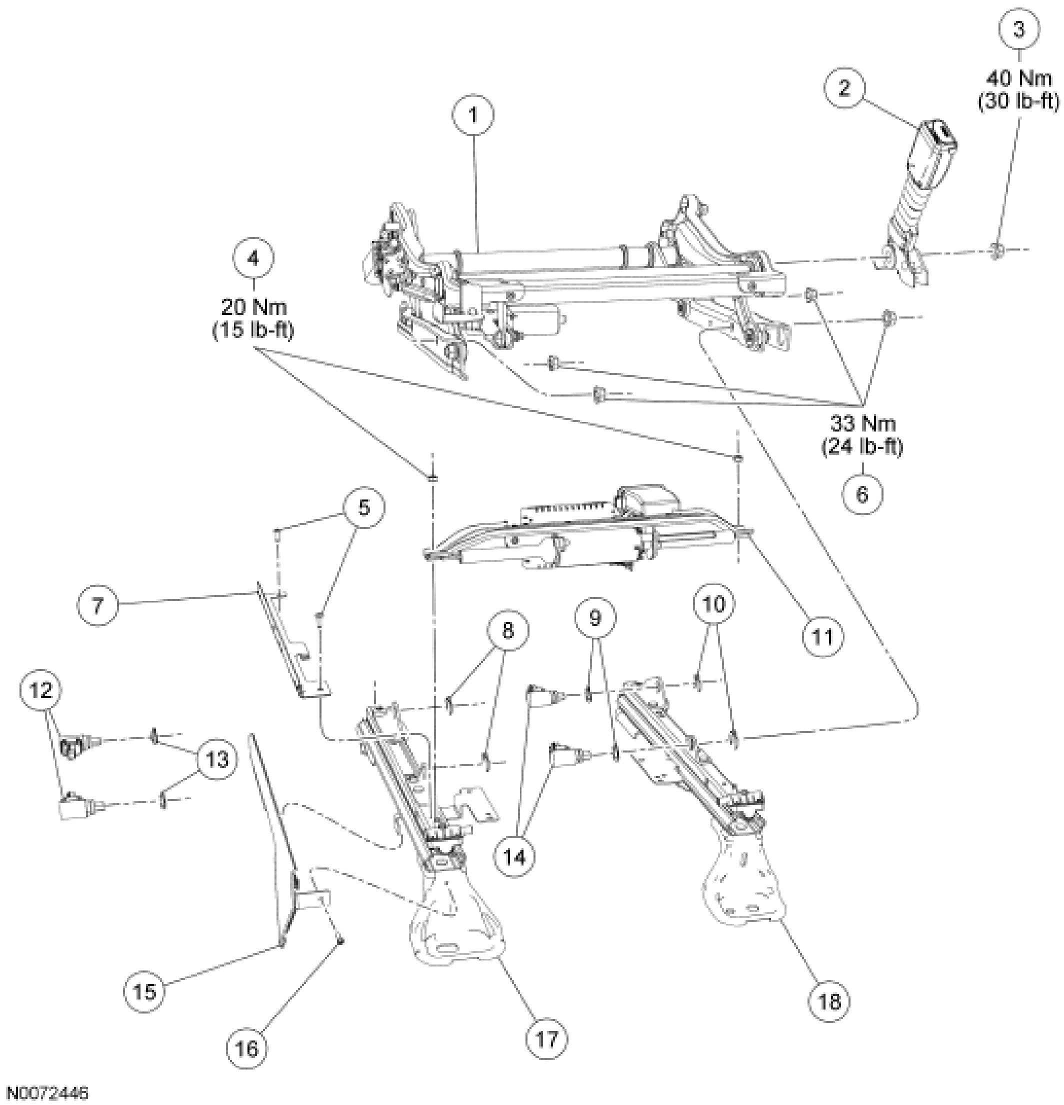


Fig. 209: Identifying Power Seat Track With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	61710	Power seat track assembly
2	61202	Safety belt buckle
3	-	Safety belt buckle nut (part of 61202)
4	-	Seat track front cross brace nuts (2 required) (part of 61710)
5	-	Occupant classification sensor (OCS) weight sensor bolt protection bracket screws (2 required) (part of 61710)
6	-	OCS weight sensor bolt nuts (4 required) (part of 61710)

7	-	OCS weight sensor bolt protection bracket (part of 61710)
8	-	Outboard seat track rail OCS weight sensor bolt retaining clips (2 required) (part of 61710)
9	-	Inboard seat track rail OCS weight sensor bolt spring washers (2 required) (part of 61710)
10	-	Inboard seat track rail OCS weight sensor bolt retaining clips (2 required) (part of 61710)
11	-	Seat track front cross brace (part of 61710)
12	-	Outboard seat track rail OCS weight sensor bolts (2 required) (part of 61710)
13	-	Outboard seat track rail OCS weight sensor bolt spring washers (2 required) (part of 61710)
14	-	Inboard seat track rail OCS weight sensor bolts (2 required) (part of 61710)
15	-	Outboard seat track riser cover shield (part of 61710)
16	-	Outboard seat track riser cover shield retainer (part of 61710)
17	-	Outboard seat track rail (part of 61710)
18	-	Inboard seat track rail (part of 61710)

REMOVAL

WARNING: **Use care when handling the front passenger seat and track assembly. Dropping the assembly, placing excessive weight on or sitting on a front passenger seat that is not secured in the vehicle may result in damaged seat components. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.**

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

NOTE: **Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.**

All occupant classification sensor (OCS) weight sensor bolt(s)

1. Remove the power seat track. For additional information, refer to **SEATING** article.

NOTE: **Inboard seat track rail shown in illustration, outboard similar.**

NOTE: **After marking the seat track rails, do not change the position of the seat track.**

2. Mark the position of both seat track rails.

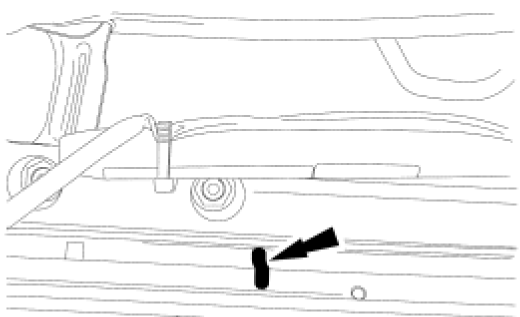


Fig. 210: Marking Position Of Both Seat Track Rails
Courtesy of FORD MOTOR CO.

Inboard OCS weight sensor bolt(s)

3. Remove the nut and safety belt buckle.

Outboard OCS weight sensor bolt(s)

4. Remove the front retainer and outboard seat track riser cover shield.
5. Remove the 2 retainers and occupant classification sensor (OCS) weight sensor bolt protection bracket.

All OCS weight sensor bolt(s)

6. On the side with the affected OCS weight sensor bolt(s), remove the nut from the seat track front cross brace.

NOTE: **If any OCS weight sensor bolt nuts are removed, new OCS weight sensor bolt nuts must be installed.**

7. Remove and discard the 2 OCS weight sensor bolt nuts from the affected side of the seat track rail with the OCS weight sensor(s).

NOTE: **Outboard side shown in illustration, inboard similar.**

8. Separate the front seat track motor cable from the affected seat track rail. Then remove the side plate with the OCS weight sensor bolts from the seat track rail.

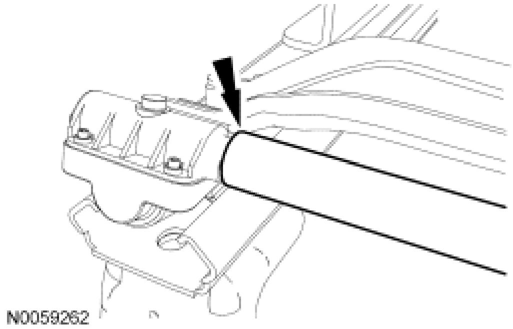


Fig. 211: Identifying Front Seat Track Motor Cable
Courtesy of FORD MOTOR CO.

NOTE: Do not overtighten the side plate with the occupant classification sensor (OCS) weight sensor bolts to the bench or table. Tighten only enough to compress the spring washer. Overtightening may damage the side plate or OCS weight sensor bolts.

9. Using a suitable tool, clamp the side plate to a bench or table to compress the spring washer on the affected OCS weight sensor bolt as shown in illustration.

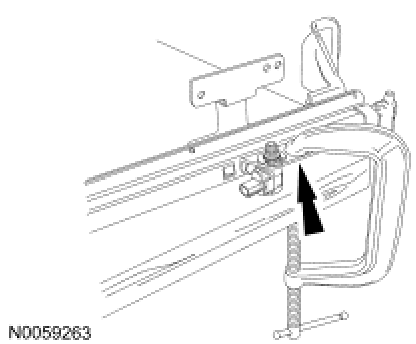


Fig. 212: Clamping Side Plate To A Bench Or Table To Compress Spring Washer On Affected OCS Weight Sensor Bolt
Courtesy of FORD MOTOR CO.

NOTE: Note the position of the OCS weight sensor bolt, spring washer and retaining clip for installation.

10. Remove and discard the retaining clip from the affected OCS weight sensor bolt.

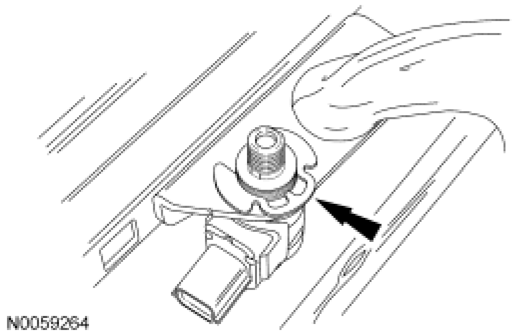


Fig. 213: Identifying Retaining Clip From Affected OCS Weight Sensor Bolt
Courtesy of FORD MOTOR CO.

11. Release the clamp and remove the OCS weight sensor bolt and spring washer from the side plate.

INSTALLATION

All OCS weight sensor bolt(s)

NOTE: Do not overtighten the side plate with the occupant classification sensor (OCS) weight sensor bolts to the bench or table. Tighten only enough to compress the spring washer. Overtightening may damage the side plate or OCS weight sensor bolts.

1. Position the spring washer and OCS weight sensor bolt in the side plate. Then clamp the side plate to a bench or table to compress the OCS weight sensor bolt spring washer.

NOTE: Make sure the OCS weight sensor bolt retaining clip is seated fully in the OCS weight sensor bolt groove underneath the OCS weight sensor O-ring seal.

2. Install the OCS weight sensor bolt retaining clip.

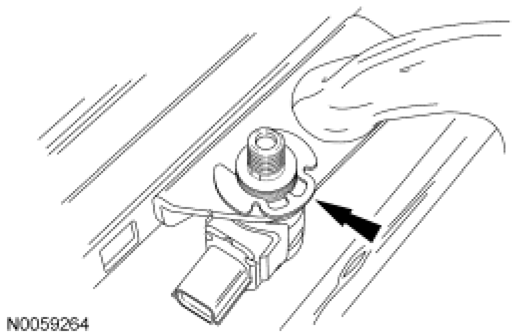


Fig. 214: Identifying Retaining Clip From Affected OCS Weight Sensor Bolt
Courtesy of FORD MOTOR CO.

3. Remove the clamp and side plate from the bench or table.

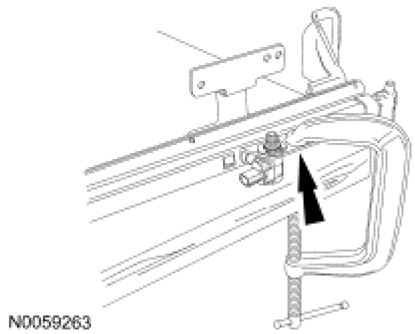


Fig. 215: Clamping Side Plate To A Bench Or Table To Compress Spring Washer On Affected OCS Weight Sensor Bolt
Courtesy of FORD MOTOR CO.

NOTE: **Slight rotational adjustment of the front seat track motor cable and OCS weight sensor bolts may be necessary to install the OCS weight sensor bolts and side plate to the seat track rail.**

4. Install the front seat track motor cable to the seat track rail. Then install the side plate with the OCS weight sensor bolts to the seat track rail.

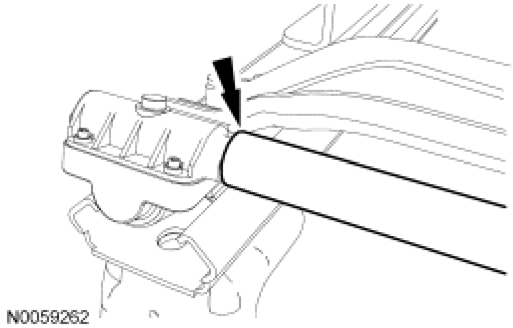


Fig. 216: Identifying Front Seat Track Motor Cable
Courtesy of FORD MOTOR CO.

NOTE: **When installing the side plate to the seat track rail, 2 new OCS weight sensor nuts must be installed.**

5. Install the 2 new OCS weight sensor bolt nuts to the seat track rail.
   - Tighten to 33 Nm (24 lb-ft).

NOTE: **Outboard side shown in illustration, inboard similar.**

6. Install the nut to the seat track front cross brace.
   - Tighten to 20 Nm (15 lb-ft).

Outboard OCS weight sensor bolt(s)

7. Install the 2 retainers and OCS weight sensor bolt protection bracket.
8. Install the front retainer and outboard seat track riser cover shield.

Inboard OCS weight sensor bolt(s)

9. Install the nut and safety belt buckle.
   - Tighten to 40 Nm (30 lb-ft).

All OCS weight sensor bolt(s)

10. Install the power seat track. For additional information, refer to **SEATING** article.
11. Install the passenger seat and repower the SRS. **Do not prove out the SRS at this time.** For additional information, refer to **SEATING** article.
12. Carry out the appropriate procedure after installation of an OCS system component.
    - If installing the original OCS system component, carry out the Zero Seat Weight Test and prove out the SRS. For additional information, refer to **Occupant Classification Sensor (OCS) System Zero Seat Weight Test**.
    - If installing a new OCS system component, carry out the System Reset procedure and prove out the SRS. For additional information, refer to **Occupant Classification Sensor (OCS) System Reset**n.

PASSENGER AIR BAG DEACTIVATION (PAD) INDICATOR

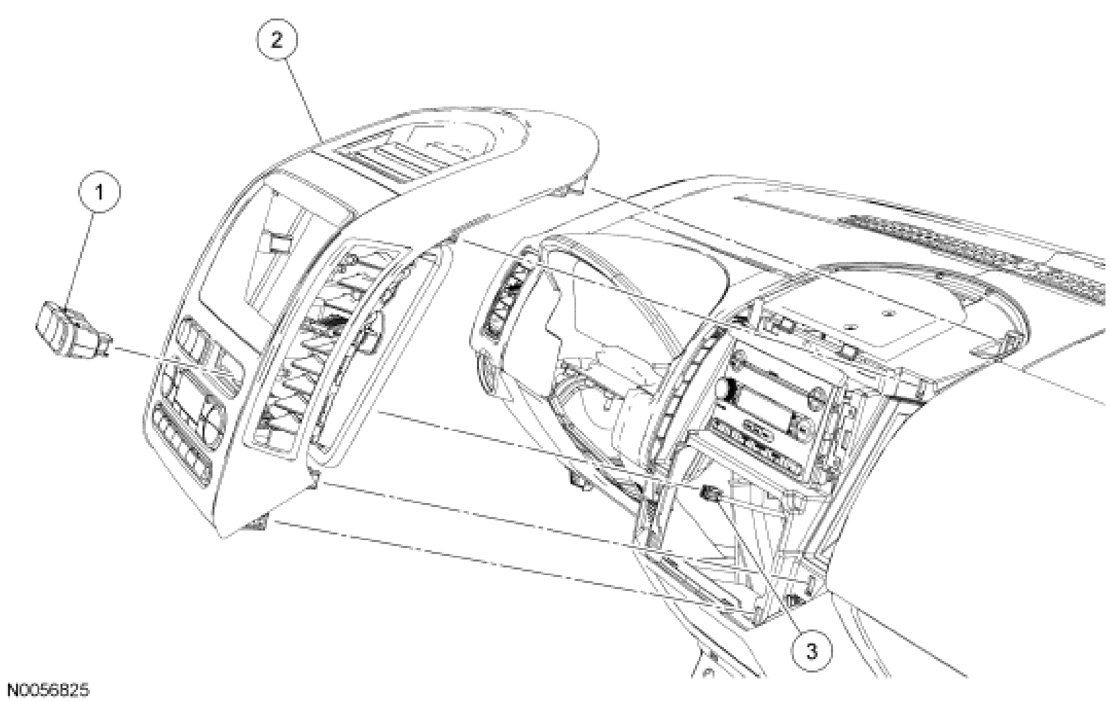


Fig. 217: Exploded View Of Passenger Air Bag Deactivation (PAD) Indicator - Edge
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	13D730	Passenger airbag deactivation (PAD) indicator
2	04302	Instrument panel (I/P) center finish panel
3	-	Passenger airbag deactivation indicator electrical connector (part of 14401)

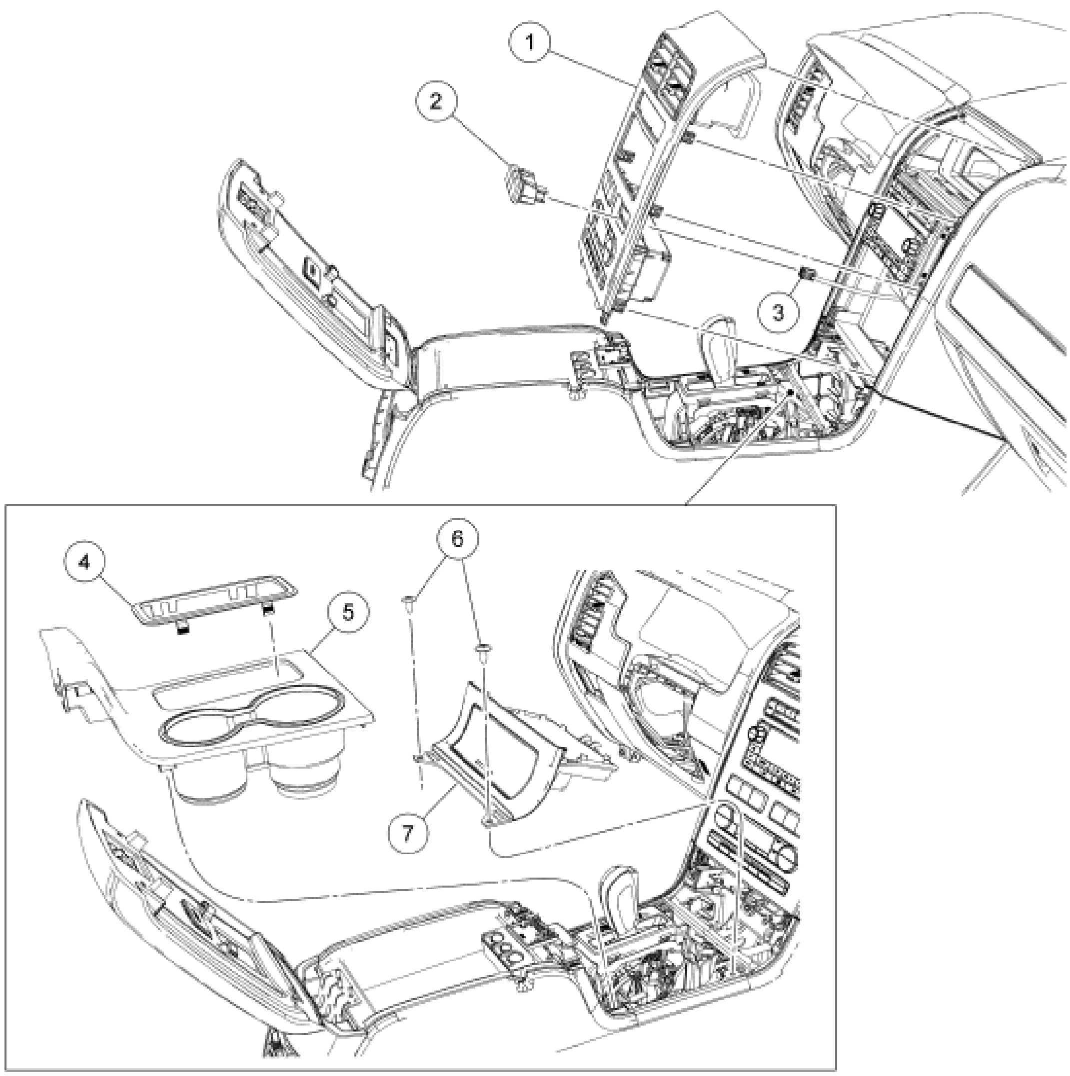


Fig. 218: Exploded View Of Passenger Air Bag Deactivation (PAD) Indicator - MKX
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	04302	Instrument panel center finish panel
2	13D730	Passenger air bag deactivation (PAD) indicator

3	-	PAD indicator electrical connector (part of 14401)
4	7E391	Console shifter bezel
5	045A76	Center finish console panel
6	W706092	Instrument panel power point/storage bin retainers
7	047A04	Instrument panel power point/storage bin

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: The passenger air bag deactivation (PAD) indicator is part of the hazard switch/traction control switch assembly.

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Remove the console shifter bezel (MKX only).
3. Remove the center finish console panel (MKX only).
4. Remove the 2 retainers from the power point/storage bin (MKX only).
5. Pull and release the instrument panel center finish panel.
6. Disconnect the PAD indicator electrical connector.
7. Release the 4 tabs (2 upper and 2 lower) on the PAD indicator and remove it from the instrument panel center finish panel.

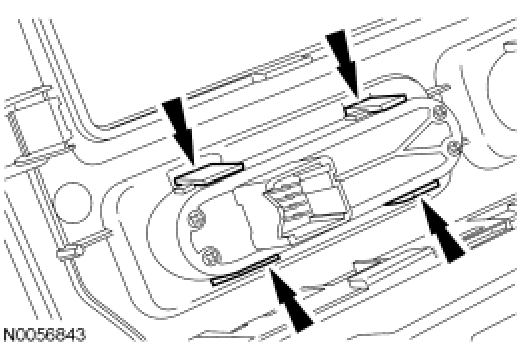


Fig. 219: Locating Tabs On Passenger Air Bag Deactivation Indicator
Courtesy of FORD MOTOR CO.

8. To install, reverse the removal procedure.
9. Repower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

PASSENGER AIR BAG MODULE - EDGE

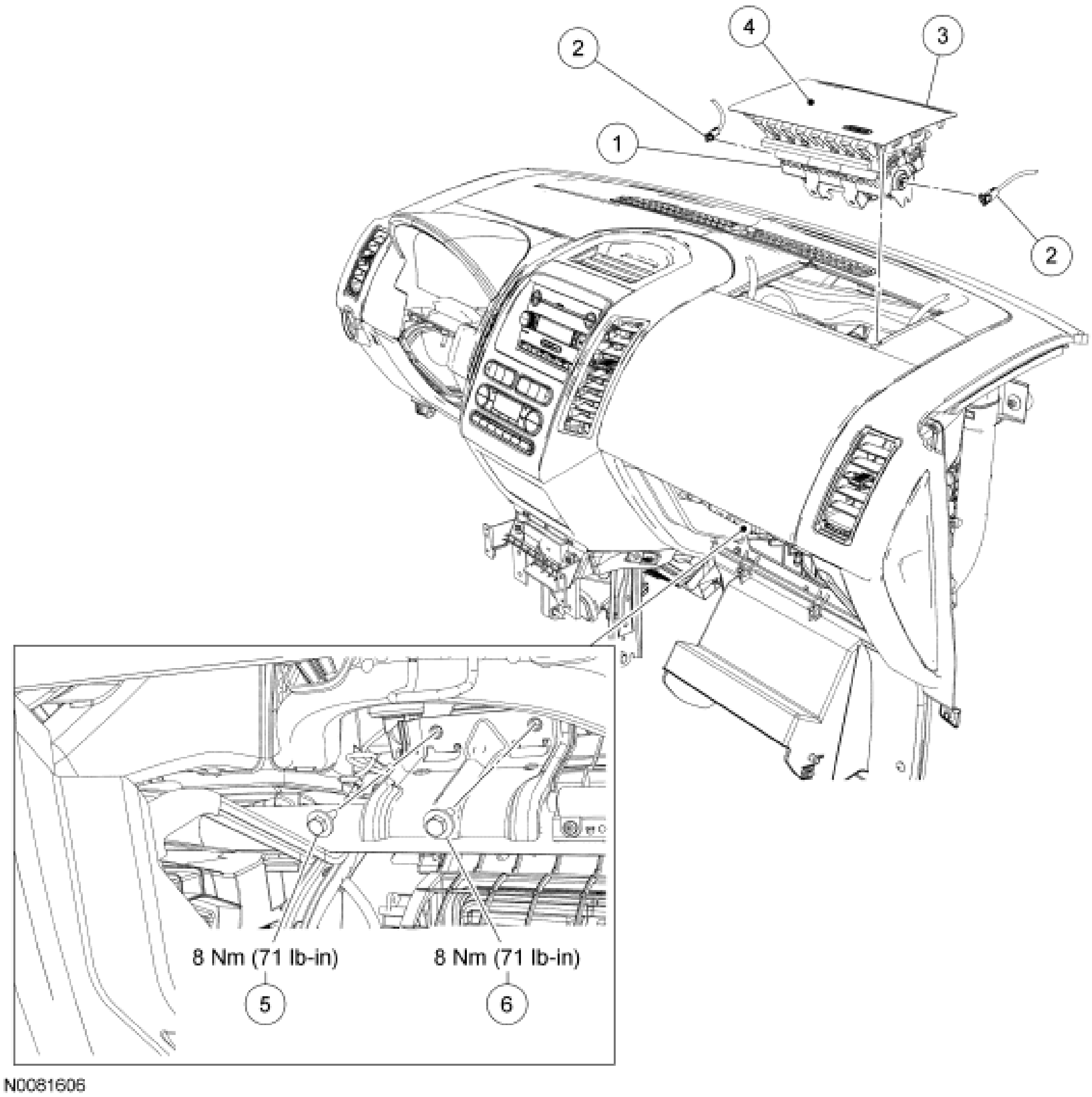


Fig. 220: Identifying Passenger Air Bag Module - Edge With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	044A74	Passenger air bag module assembly
2	-	Passenger air bag module electrical connectors (part of 14401)
3	-	Passenger air bag cover clips (part of 04338)
4	04338	Passenger air bag cover
5	W505422	Passenger air bag module inboard bolt
6	W505422	Passenger air bag module outboard bolt

REMOVAL

WARNING: **Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: Do no install a new passenger air bag module assembly due to a damaged or discolored passenger air bag cover. The passenger air bag cover can be serviced separately from the passenger air bag module assembly. For additional information, refer to Air Bag Trim Cover - Passenger, Edge.

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Open and lower the glove compartment door.
   - If equipped, detach the glove compartment door dampener.
3. Remove the 2 passenger air bag module bolts from the cross-car beam bracket.

   NOTE: Do not handle the passenger air bag module by grabbing the edges of the deployment doors. Damage to the air bag module may occur.

4. Through the glove compartment opening, release the LH side passenger air bag cover clips. Then release the foreward-most passenger air bag cover clips and separate the passenger air bag cover and passenger air bag module from the instrument panel.
5. Using a small screwdriver as shown in illustration, lift up and release the locking button on the RH passenger air bag module electrical connector.

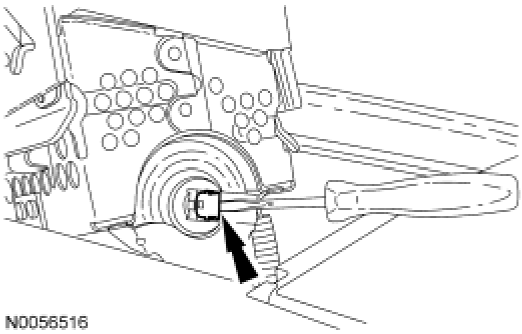


Fig. 221: Releasing Locking Button On RH Passenger Air Bag Module Electrical Connector Using A Small Screwdriver
Courtesy of FORD MOTOR CO.

NOTE: **Do not pull the passenger air bag module electrical connector out by the locking button. Damage to the locking button may occur.**

6. With the RH locking button released, remove the RH electrical connector.
7. Using a small screwdriver as shown in illustration, lift up and release the locking button on the LH passenger air bag module electrical connector.

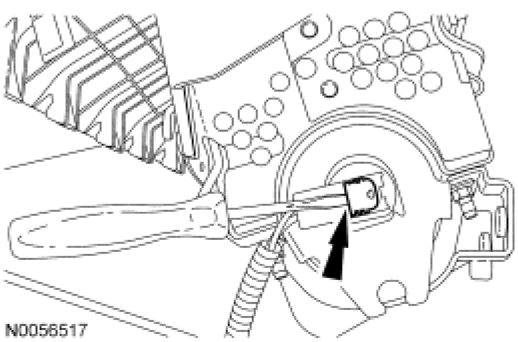


Fig. 222: Releasing Locking Button On LH Passenger Air Bag Module Electrical Connector Using A Small Screwdriver
Courtesy of FORD MOTOR CO.

NOTE: **Do not pull the passenger air bag module electrical connector out by the locking button. Damage to the locking button may occur.**

8. With the LH locking button released, remove the LH electrical connector and remove the passenger air bag module.

INSTALLATION

NOTE: **Do not install the passenger air bag module electrical connectors by the locking buttons. Damage to the locking buttons may occur.**

NOTE: The passenger air bag module electrical connector locking buttons must be in the released position when the connector is being installed or connector damage may occur.

NOTE: The passenger air bag module electrical connectors are unique and cannot be reversed when connected to the passenger air bag module. Match the electrical connector key to the keyway in the passenger air bag module. Do not force the electrical connectors into the passenger air bag module. Damage to the connector or component may occur.

NOTE: RH shown in illustration, LH similar.

1. With the locking buttons released, install the 2 passenger air bag module electrical connectors fully into the passenger air bag module and seat the locking buttons.

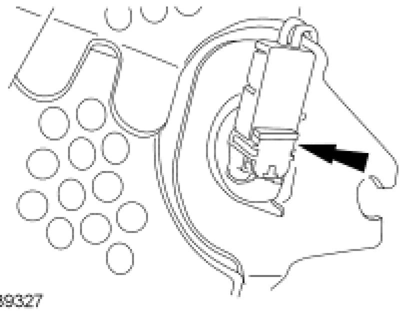


Fig. 223: Locating Passenger Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

NOTE: Do not handle the passenger air bag module by grabbing the edges of the passenger air bag cover. Damage to the air bag module may occur.

NOTE: During passenger air bag module installation, make sure all the passenger air bag cover clips are fully seated in the instrument panel.

2. Install the passenger air bag module passenger air bag cover rear-most clips into the instrument panel first. Then install the side passenger air bag cover clips working around to the forward-most clips seating each of them fully into the instrument panel.

NOTE: To avoid a squeak or rattle condition, install the 2 passenger air bag module bolts in this order.

3. Install the passenger air bag module bolts.
   1. Install the inboard passenger air bag module bolt.
      - Tighten to 8 Nm (71 lb-in).

2. Install the outboard passenger air bag module bolt.
   - Tighten to 8 Nm (71 lb-in).

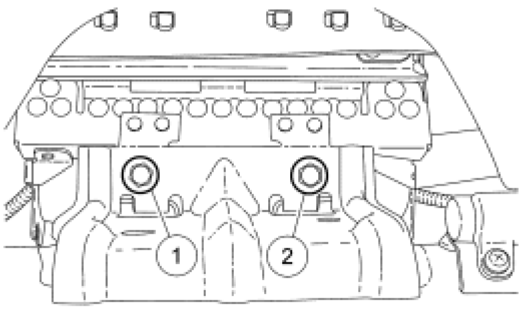


Fig. 224: Installing Passenger Air Bag Module Bolts In Sequence
Courtesy of FORD MOTOR CO.

4. Close the glove compartment door.
   - If equipped, attach the glove compartment door dampener.
5. Repower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

PASSENGER AIR BAG MODULE - MKX

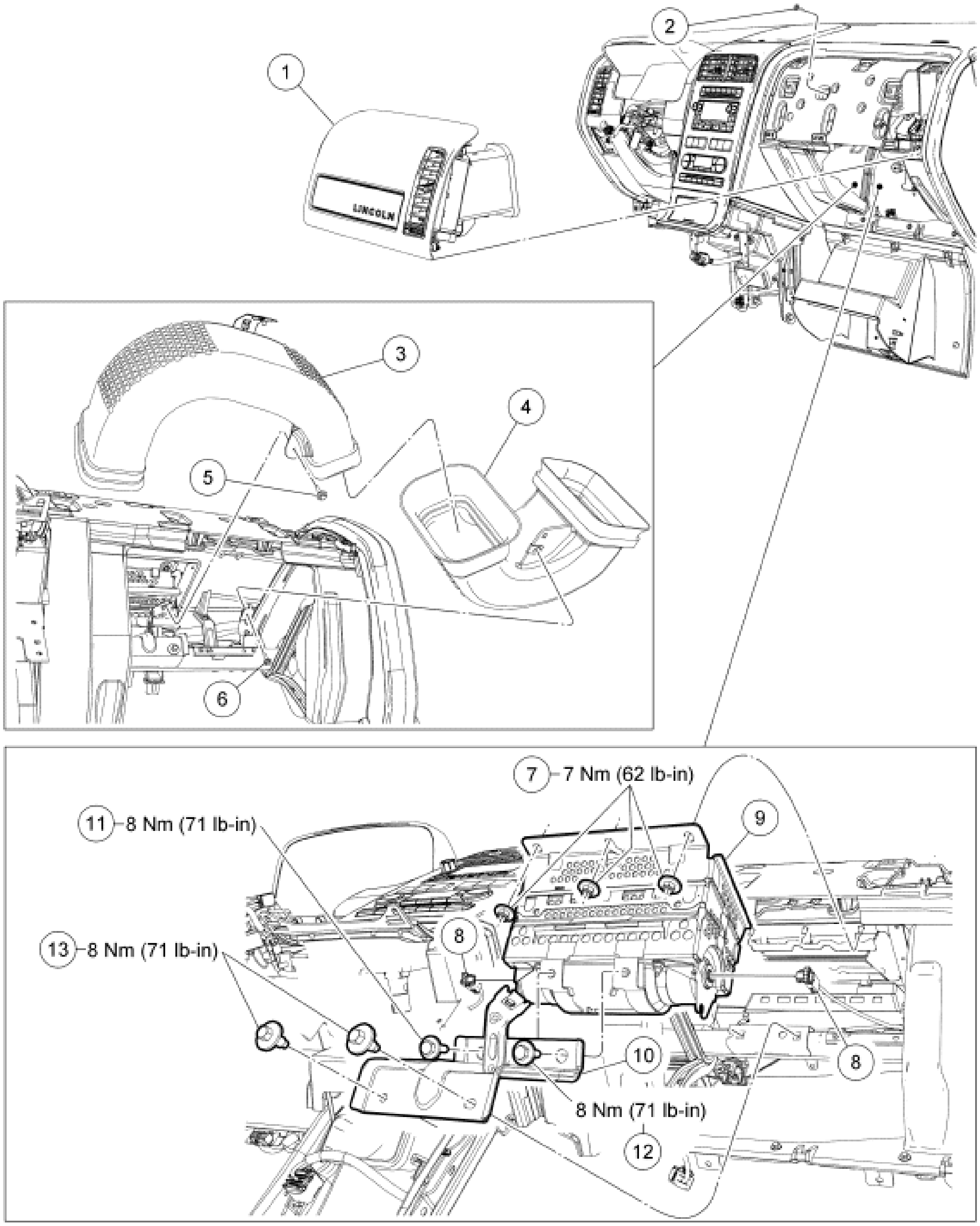


Fig. 225: Exploded View Of Passenger Air Bag Module With Torque Specifications - MKX
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	04338	RH instrument panel finish panel
2	W707628	LH duct assembly bracket screw

3	19B680	LH duct assembly
4	19B680	RH duct assembly
5	W707628	LH duct assembly screw
6	W707628	RH duct assembly screw
7	W701014	Passenger air bag module nuts
8	-	Passenger air bag module electrical connectors part of 14401)
9	044A74	Passenger air bag module
10	-	Passenger air bag module support bracket
11	W505422	Inboard passenger air bag module-to-support bracket bolt
12	W505422	Outboard passenger air bag module-to-support bracket bolt
13	W503922	Passenger air bag module bracket-to-cross vehicle beam bolts

REMOVAL

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Open and lower the glove compartment door. Then unhook the glove compartment door from the instrument panel.
   - If equipped, detach the glove compartment door dampener.

3. Pull straight out to release the 5 retaining clips and remove the RH instrument panel finish panel.
4. Remove the screw from the LH duct assembly bracket from the front of the instrument panel.

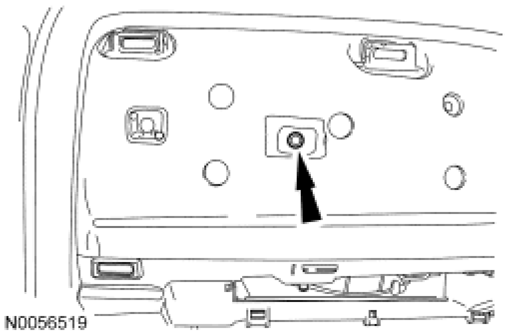


Fig. 226: Locating Screw On LH Duct Assembly Bracket
Courtesy of FORD MOTOR CO.

5. Through the glove compartment opening, remove the screw and the LH duct assembly.

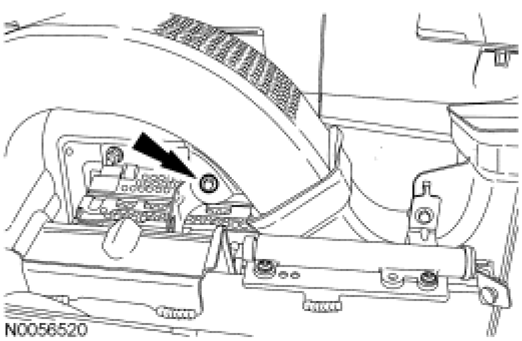


Fig. 227: Locating Screw On LH Duct Assembly
Courtesy of FORD MOTOR CO.

6. Through the glove compartment opening, remove the screw and the RH duct assembly.

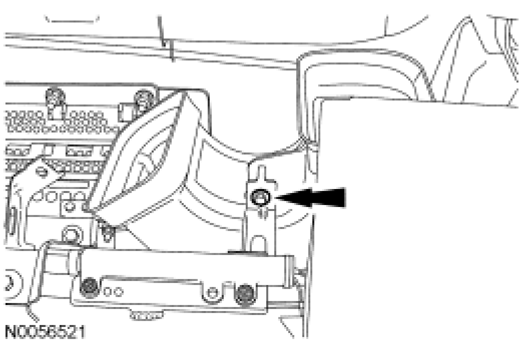


Fig. 228: Locating Screw On RH Duct Assembly
Courtesy of FORD MOTOR CO.

7. Remove the 4 bolts and the passenger air bag module support bracket.

8. Remove the 3 nuts from the passenger air bag module.

NOTE: Do not allow the passenger air bag module to hang from the wiring harness. Damage to the wiring harness and connectors may occur.

9. Lower the rear of the passenger air bag module off the 3 mounting studs. Move the passenger air bag module rearward to release the 7 hooks from the instrument panel and rest the module on the cross vehicle beam.

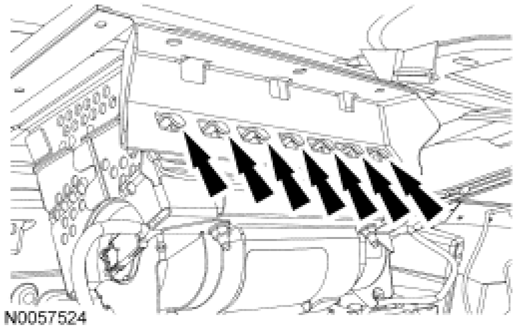


Fig. 229: Identifying Hooks On I/P
Courtesy of FORD MOTOR CO.

10. Using a small screwdriver as shown in illustration, lift up and release the locking button on the LH passenger air bag module electrical connector.

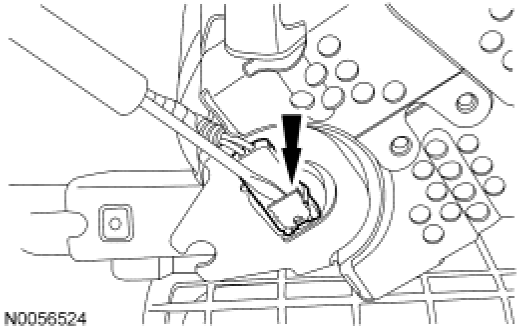


Fig. 230: Releasing Locking Button On LH Passenger Air Bag Module Electrical Connector Using A Small Screwdriver
Courtesy of FORD MOTOR CO.

NOTE: Do not pull the passenger air bag module electrical connector out by the locking button. Damage to the locking button may occur.

11. With the LH locking button released, remove the LH electrical connector from the passenger air bag module.
12. Using a small screwdriver as shown in illustration, lift up and release the locking button on the RH passenger air bag module electrical connector.

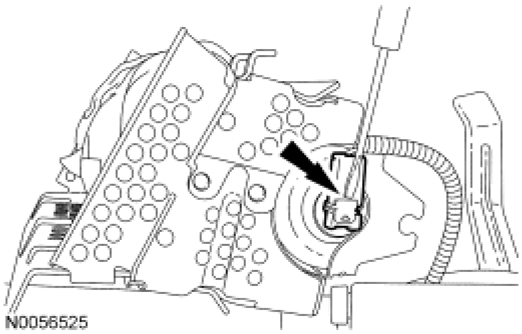


Fig. 231: Releasing Locking Button On RH Passenger Air Bag Module Electrical Connector Using A Small Screwdriver
Courtesy of FORD MOTOR CO.

NOTE: **Do not pull the passenger air bag module electrical connector out by the locking button. Damage to the locking button may occur.**

13. With the RH locking button released, remove the RH electrical connector. Remove the passenger air bag module from the glove compartment opening.

INSTALLATION

NOTE: **Do not install the passenger air bag module electrical connectors by the locking buttons. Damage to the locking buttons may occur.**

NOTE: **The passenger air bag module electrical connector locking buttons must be in the released position when the connector is being installed or connector damage may occur.**

NOTE: **The passenger air bag module electrical connectors are unique and cannot be reversed when connected to the passenger air bag module. Match the electrical connector key to the keyway in the passenger air bag module. Do not force the electrical connectors into the passenger air bag module. Damage to the connector or component may occur.**

NOTE: **RH shown in illustration, LH similar.**

1. Position the passenger air bag module on the cross vehicle beam. With the locking buttons released, install the 2 passenger air bag module electrical connectors fully into the passenger air bag module and seat the locking buttons.

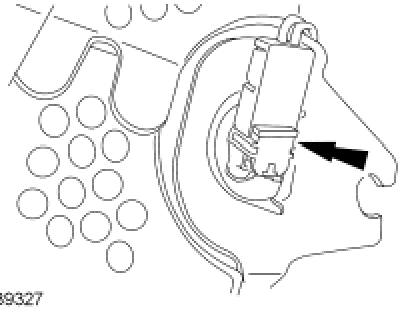


Fig. 232: Locating Passenger Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

NOTE: During the passenger air bag module installation, make sure all 7 of the module hooks are fully seated in the instrument panel.

2. Install the passenger air bag module 7 hooks into the instrument panel. Raise the rear of the passenger air bag module onto the 3 mounting studs.

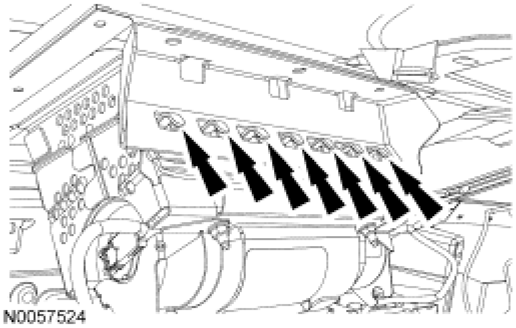


Fig. 233: Identifying Hooks On I/P
Courtesy of FORD MOTOR CO.

3. Install the 3 passenger air bag module nuts.
   - Tighten to 7 Nm (62 lb-in).

NOTE: To avoid a squeak or rattle condition, install the passenger air bag module bracket and passenger air bag module bolts in this order.

4. Install the passenger air bag module support bracket.
   1. Install the passenger air bag module support bracket and 2 bolts to the cross vehicle beam.
      - Tighten to 8 Nm (71 lb-in).
   2. Install the inboard passenger air bag module support bracket-to-passenger air bag module bolt.
      - Tighten to 8 Nm (71 lb-in).
   3. Install the outboard passenger air bag module support bracket-to-passenger air bag module bolt.
      - Tighten to 8 Nm (71 lb-in).

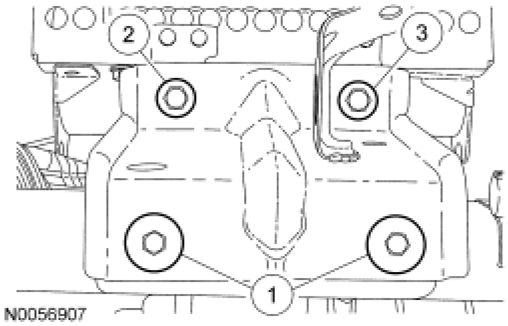


Fig. 234: Installing Passenger Air Bag Module Support Bracket Bolts In Sequence
Courtesy of FORD MOTOR CO.

5. Install the screw and the RH duct assembly.
6. Install the screw and the LH duct assembly.
7. Install the screw for the LH duct assembly bracket in the front of the instrument panel.

NOTE: Make sure the RH instrument panel finish panel 5 retaining clips are fully seated in the instrument panel.

8. Install the RH instrument panel finish panel.
9. Install and close the glove compartment door.
   - If equipped, attach the glove compartment door dampener.
10. Repower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

RESTRAINTS CONTROL MODULE (RCM)

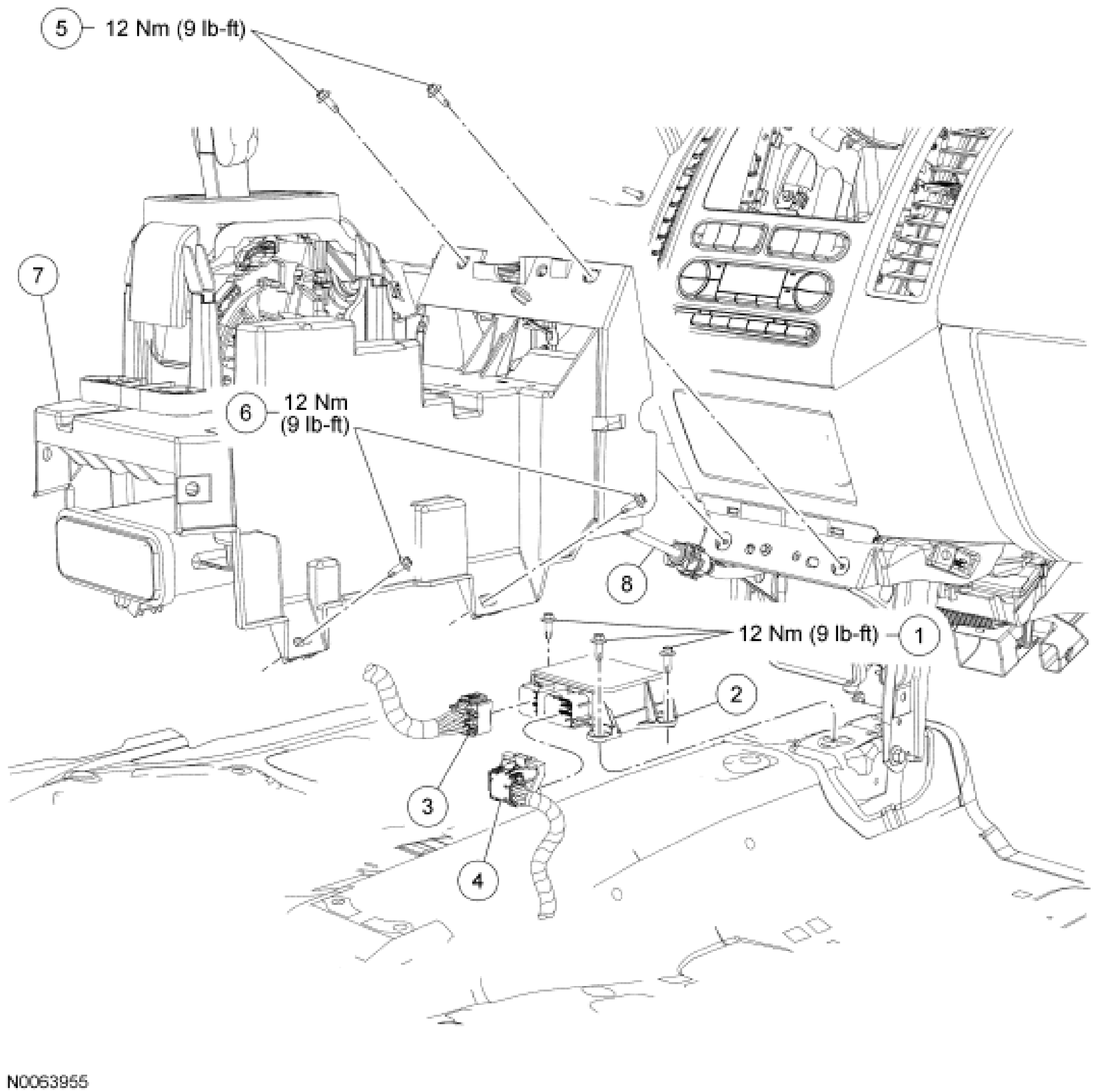


Fig. 235: Exploded View Of Restraints Control Module (RCM) With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W707935	Restraints control module (RCM) bolts
2	14B321	RCM
3	-	RCM small connector (part of 14401)
4	-	RCM large connector (part of 14A005)
5	W707935	Inner floor console support-to-instrument panel bolts (2 required)
6	W505157	Inner floor console support bolts (4 required)
7	45B34	Inner floor console support
8	7E395	Selector lever cable

REMOVAL

WARNING: **If a vehicle has been in a crash, inspect the restraints control module (RCM) and the impact sensor (if equipped) mounting areas for deformation. If damaged, restore the mounting areas to the original production configuration. A new RCM and sensors must be installed whether or not the air bags have deployed. Failure to follow these instructions may result in serious personal injury or death in a crash.**

NOTE: When installing a new restraints control module (RCM), it is necessary to carry out programmable module installation (PMI). For additional information, refer to MODULE CONFIGURATION article. Failure to follow this instruction may result in system failure.

NOTE: When installing a new restraints control module (RCM), always make sure the correct RCM is being installed. If an incorrect RCM is installed, erroneous DTCs will result.

NOTE: The air bag warning indicator illuminates when the correct RCM fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. If installing a new RCM, carry out the steps necessary to prepare for programmable module installation (PMI). For additional information, refer to **MODULE CONFIGURATION** article.
2. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
3. Remove the floor console. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
4. Disconnect the selector lever cable from the ball stud located on the shifter and remove the cable from the retaining clips.

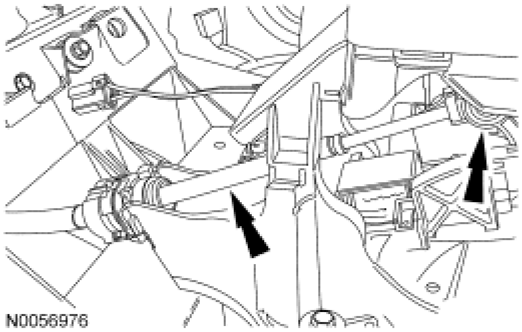


Fig. 236: Locating Shift Cable From Ball Stud On Shifter
Courtesy of FORD MOTOR CO.

5. Remove the 4 bolts (2 each side) from the inner floor console support.
6. Remove the bolts from the inner floor console support-to-instrument panel.
7. Disconnect the electrical connectors from the front inner floor console support.
8. Remove the inner floor console support.
9. Press to release the locking tab and disconnect the small RCM electrical connector.

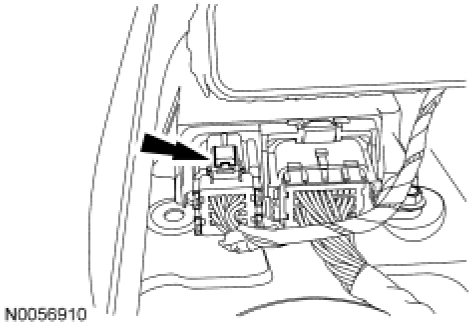


Fig. 237: Locating Locking Tab On Small RCM Electrical Connector
Courtesy of FORD MOTOR CO.

10. Disconnect the large RCM electrical connector.
    1. Pinch the thumb tab and pivot the connector position assurance lever all the way back until it stops.
    2. Pull out and disconnect the RCM electrical connector.

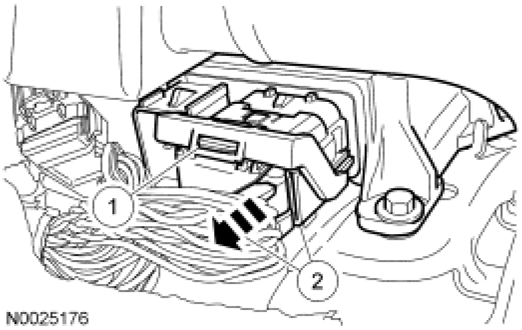


Fig. 238: Disconnecting RCM Electrical Connector
Courtesy of FORD MOTOR CO.

11. Remove the 3 bolts and RCM.

INSTALLATION

WARNING: **Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.**

1. Install the RCM and the 3 bolts.
   - Tighten to 12 Nm (9 lb-ft).
2. Make sure the large RCM connector position assurance lever is in the full release position before attempting to connect the connector.

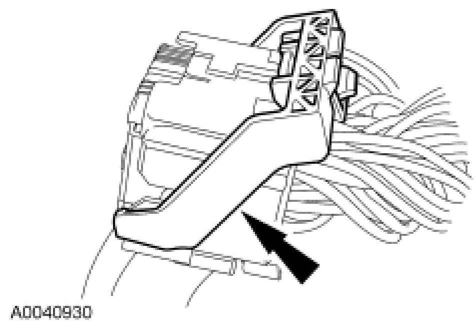


Fig. 239: View Of Connector Position Assurance Lever
Courtesy of FORD MOTOR CO.

NOTE: Placing the large restraints control module (RCM) electrical wiring connector into the RCM on an angle, may cause bad electrical connections and damaged components.

3. Position the large RCM electrical connector into the RCM.

NOTE: Do not push the connector to the point where the lever pivots and seats itself. Light pressure is needed to get the connector into position on the restraints control module (RCM), before using the lever to fully seat the connector. Failure to follow these instructions may cause component or connector damage.

   - With the large RCM electrical connector uniformly aligned to the RCM, lightly push in until a subtle audible click is heard and slight resistance is felt.

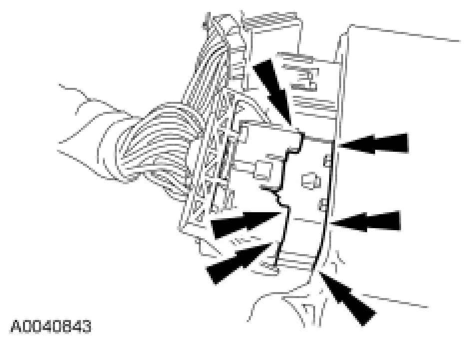


Fig. 240: Large RCM Electrical Wiring Connector
Courtesy of FORD MOTOR CO.

4. Connect the large RCM electrical connector.
    - Using the connector position assurance lever, pivot it toward the RCM, drawing the connector into the RCM.
        - Make sure the thumb tab is engaged to the retainer on the RCM and locked in place.

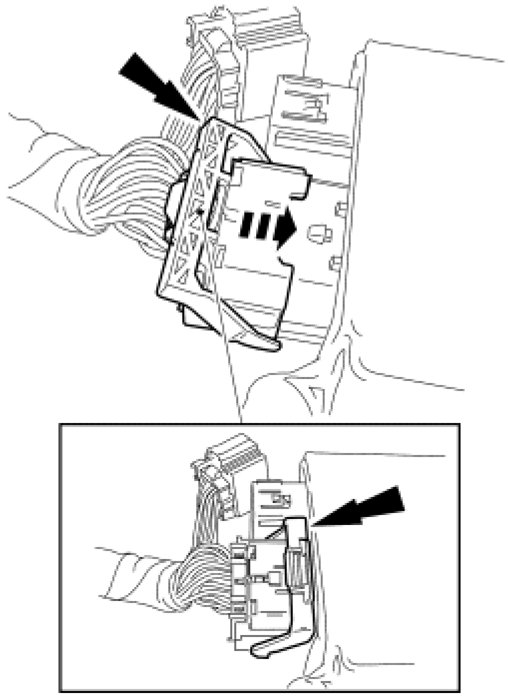


Fig. 241: Locating RCM Electrical Connector
Courtesy of FORD MOTOR CO.

5. Connect the small RCM electrical connector.
6. Install the inner floor console support.
7. Install the 4 bolts (2 each side) to the inner floor console support.
    - Tighten to 12 Nm (9 lb-ft).
8. Install the screws to the inner floor console support bracket-to-floor instrument panel.
    - Tighten to 12 Nm (9 lb-ft).
9. Install the selector lever cable in the selector lever housing.

NOTE:	**When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click in place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable end to make sure that the cable end is correctly installed.**

10. Connect the selector lever cable end to the floor shifter.
11. Attach the electrical connectors to the front inner floor console support bracket.
12. Install the floor console. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
13. Repower the SRS. **Do not prove out the SRS at this time.** For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
14. When installing a new RCM, carry out the steps necessary to complete PMI. For additional information, refer to **MODULE CONFIGURATION** article.
15. Prove out the SRS as follows:

    Turn the ignition switch from ON to OFF. Wait 10 seconds, then turn the ignition switch back to ON and visually monitor the air bag indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn OFF. If an air bag SRS fault is present, the air bag indicator will:

    - fail to light.

    - remain lit continuously.

    - flash at a 5 Hz rate (RCM not configured).

    The air bag warning indicator might not light until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

    Clear all continuous DTCs from the RCM and occupant classification system module (OCSM) using a scan tool.

SAFETY CANOPY MODULE

NOTE: **RH shown in illustration, LH similar.**

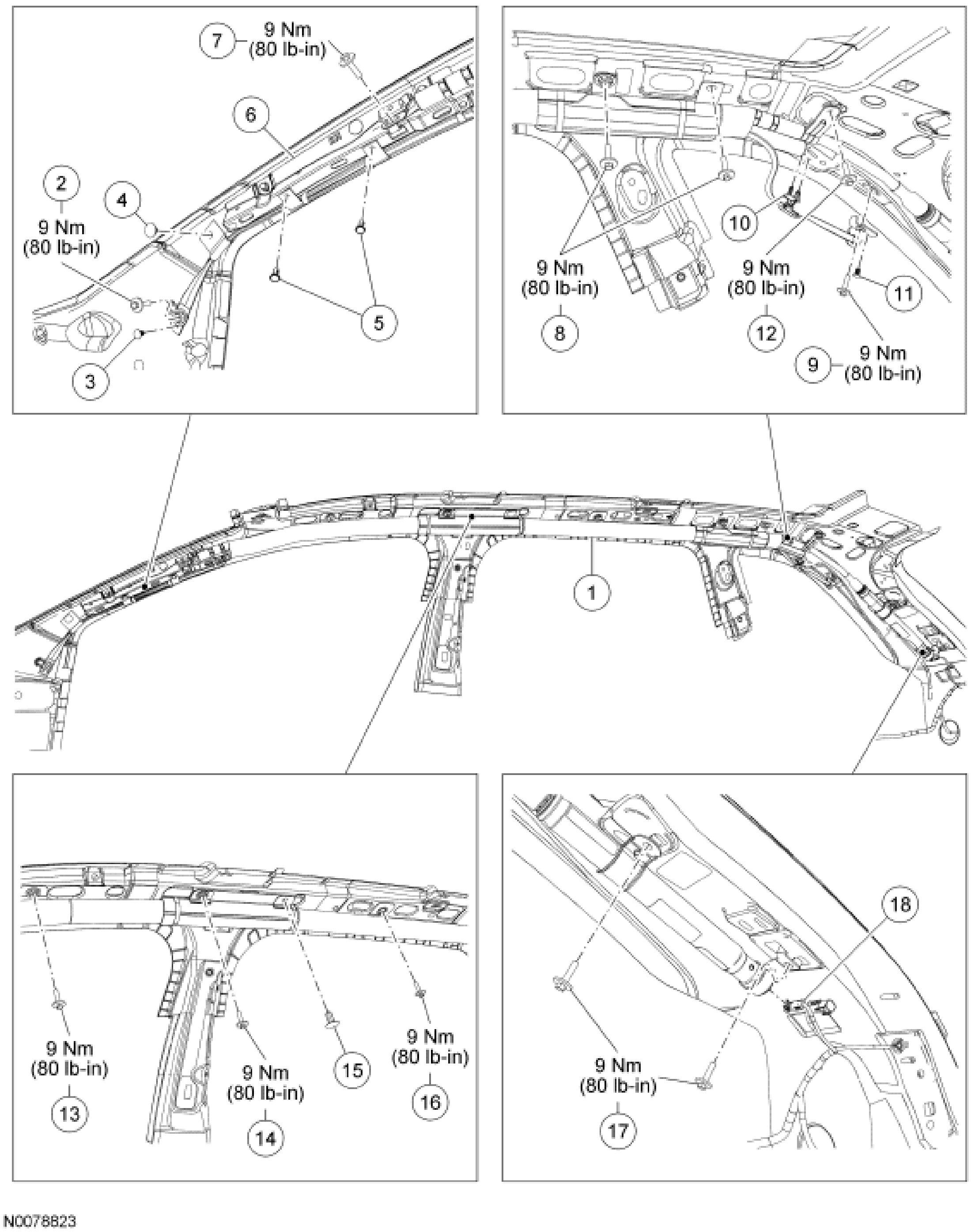


Fig. 242: Identifying Safety Canopy Module With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	042D94 RH/042D95 LH	Safety canopy module
2	W713437	Safety canopy module front tether cord anchor bolt

3	-	Safety canopy module front tether cord anchor pin-type retainer (part of 042D94)
4	-	Safety canopy module front tether cord A-pillar routing pin-type retainer (part of 042D94)
5	-	Safety canopy module front tether cord A-pillar trim bracket routing pin-type retainers (2 required) (part of 042D94)
6	-	A-pillar trim bracket
7	W713437	Safety canopy module A-pillar trim bracket bolt
8	W713437	Safety canopy module C-pillar bolts (2 required)
9	W713437	Safety canopy module rear tether cord anchor bracket bolt
10	-	Safety canopy module rear tether cord routing clip pin-type retainer (part of 042D94)
11	-	Safety canopy module rear tether cord anchor bracket pin-type retainer (part of 042D94)
12	W713437	Safety canopy module D-pillar bolt
13	W713437	Safety canopy module front door opening bolt
14	W713437	Safety canopy module B-pillar bolt
15	-	Safety canopy module B-pillar pin-type retainer (part of 042D94)
16	W713437	Safety canopy module rear door opening bolt
17	W713437	Safety canopy module rear bolts (2 required)
18	-	Safety canopy module electrical connector (part of 14A005)

REMOVAL

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Always carry or place a live safety canopy, or side air curtain module, with the module and tear seam pointed away from your body. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

WARNING: Anytime the safety canopy or side air curtain module has deployed, a new headliner and new A-, B-, C- and D-pillar upper trim panels and attaching hardware must be installed. Remove any other damaged components and hardware and install new components and hardware as needed. Failure to follow these instructions may result in the safety canopy or side air curtain module deploying incorrectly and increases the risk of serious personal injury or death in a crash.

WARNING: When installing a new headliner on a vehicle equipped with safety canopy or side air curtain modules, make sure the headliner has the word AIRBAG on the headliner where it meets each B-pillar trim panel. Otherwise, you have the wrong headliner. Failure to follow this instruction may result in the safety canopy or side air curtain module not deploying or deploying incorrectly, increasing the risk of personal injury or death in a crash.

WARNING: Before installing a safety canopy or side air curtain module, inspect the roofline for any damage. If necessary, the sheet metal must be reworked to its original condition and structural integrity. Install new fasteners if damaged and remove foreign material. Failure to follow these instructions may result in the safety canopy or side air curtain deploying incorrectly, which increases the risk of serious personal injury or death in a crash.

WARNING: Inspect a safety canopy or side air curtain module before installation. If the module is damaged, the cover has separated or the safety canopy/side air curtain material has been exposed, install a new module. Do not attempt to repair the module. Failure to follow these instructions may result in the safety canopy or side air curtain deploying incorrectly, which increases the risk of serious personal injury or death in a crash.

WARNING: Do not obstruct or place objects in the deployment path of the safety canopy or side air curtain module. Failure to follow this instruction may result in the safety canopy or side air curtain module deploying incorrectly and increases the risk of serious personal injury or death in a crash.

WARNING: Never put any type of fastener or tie strap around any part of a safety canopy module, side air curtain module or interior trim panel. This will prevent the safety canopy or side air curtain module from deploying correctly. Failure to follow this instruction may increase the risk of serious personal injury or death in a crash.

WARNING: Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of

serious personal injury or death.

WARNING: **Always use new torque-prevailing type J-nuts when installing the safety canopy in the vehicle. Use of these J-nuts is mandatory to reduce the risk of loss of fastener effectiveness. Failure to follow this instruction may result in the safety canopy module deploying incorrectly and increases the risk of serious personal injury or death in a crash.**

NOTE: The air bag warning indictor illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

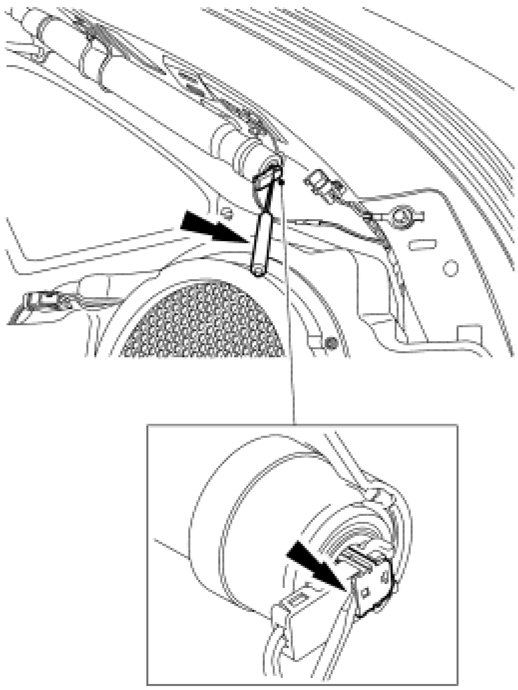
NOTE: The supplemental restraints system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Remove the headliner. For additional information, refer to **INTERIOR TRIM & ORNAMENTATION** article.

   NOTE: Do not pull the safety canopy module electrical connector out by the locking button. Damage to the locking button can occur.

3. Using a small screwdriver as shown in illustration, lift up and release the locking button on the safety canopy module electrical connector. With the locking button released, remove the electrical connector.



N0059226

Fig. 243: Releasing Locking Button On Safety Canopy Module Electrical Connector Using A Small Screwdriver
Courtesy of FORD MOTOR CO.

NOTE: Note the pin-type retainer on the safety canopy module front tether cord to the A-pillar sheet metal for installation.

4. Remove the anchor bolt, then detach the pin-type retainer and the front tether cord anchor from the A-pillar.
5. Remove the safety canopy module front tether cord routing pin-type retainer from the A-pillar sheet metal.
6. Detach the 2 safety canopy module front tether cord A-pillar trim bracket routing pin-type retainers from the A-pillar trim bracket.
7. Remove the safety canopy module A-pillar trim bracket bolt.
8. Remove the safety canopy module front door opening bolt.

NOTE: Note the position and the routing of the safety canopy module rear tether cord and routing clip pin-type retainer for installation.

9. Detach the safety canopy module rear tether cord routing clip pin-type retainer from the upper D-pillar sheet metal.

NOTE: Note the position of the safety canopy module rear tether anchor bracket hook and pin-type retainer in the D-pillar sheet metal.

10. Remove the bolt, then detach the pin-type retainer and remove the safety canopy module rear tether anchor bracket from the D-pillar sheet metal.
11. Remove the safety canopy module rear door opening bolt.
12. Remove the 2 safety canopy module bolts near the C-pillar.
13. Remove the safety canopy module D-pillar bolt.
14. Remove the 2 safety canopy module rear bolts.
15. Remove the safety canopy module bolt near the B-pillar.
16. Remove the safety canopy module B-pillar pin-type retainer.
17. Move the safety canopy module forward to release the rear bracket hook from the sheet metal and remove the safety canopy module.

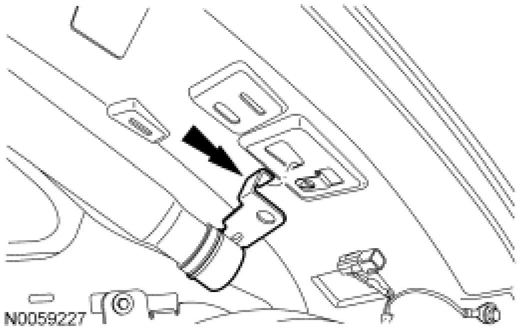


Fig. 244: Moving Safety Canopy Module Forward To Release Rear Bracket Hook From Sheet Metal
Courtesy of FORD MOTOR CO.

INSTALLATION

WARNING: **Before installing a safety canopy or side air curtain module, inspect the roofline for any damage. If necessary, the sheet metal must be reworked to its original condition and structural integrity. Install new fasteners if damaged and remove foreign material. Failure to follow these instructions may result in the safety canopy or side air curtain deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

WARNING: **Inspect a safety canopy or side air curtain module before installation. If the module is damaged, the cover has separated or the safety canopy/side air curtain material has been exposed, install a new module. Do not attempt to repair the module. Failure to follow these instructions may result in the safety canopy or side air curtain deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

WARNING: **Never put any type of fastener or tie strap around any part of a safety canopy module, side air curtain module or interior trim panel. This will prevent the safety canopy or side air curtain module from deploying**

correctly. Failure to follow this instruction may increase the risk of serious personal injury or death in a crash.

WARNING: **Always use new torque-prevailing type J-nuts when installing the safety canopy in the vehicle. Use of these J-nuts is mandatory to reduce the risk of loss of fastener effectiveness. Failure to follow this instruction may result in the safety canopy module deploying incorrectly and increases the risk of serious personal injury or death in a crash.**

1. Discard the 2 front J-nuts and install new.

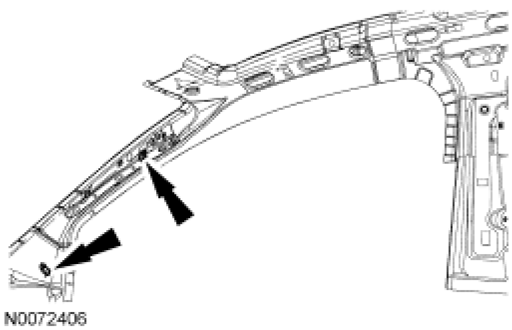


Fig. 245: Identifying 2 Front J-nuts
Courtesy of FORD MOTOR CO.

2. Discard the 2 rear J-nuts and install new.

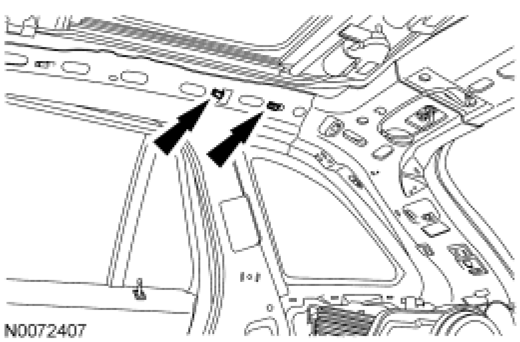


Fig. 246: Identifying 2 Rear J-nuts
Courtesy of FORD MOTOR CO.

3. Position the safety canopy module by moving it rearward, installing the rear bracket hook in the sheet metal.

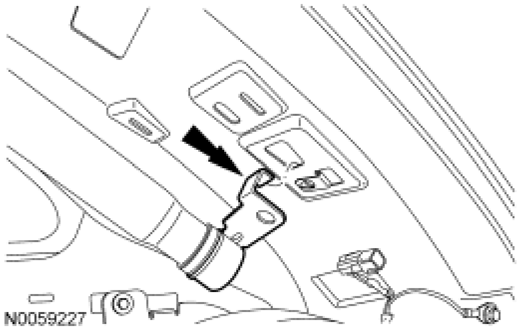


Fig. 247: Moving Safety Canopy Module Forward To Release Rear Bracket Hook From Sheet Metal
Courtesy of FORD MOTOR CO.

4. Install the safety canopy module B-pillar pin-type retainer.
5. Install the front tether cord anchor pin-type retainer.
6. Install the safety canopy module front tether cord routing pin-type retainer to the A-pillar sheet metal.
7. Attach the 2 safety canopy module front tether cord A-pillar trim bracket routing pin-type retainers to the A-pillar trim bracket.
8. Install the safety canopy module rear tether anchor bracket to the D-pillar sheet metal and attach the pin-type retainer.
9. Attach the safety canopy module rear tether cord routing clip pin-type retainer to the upper D-pillar sheet metal.

NOTE: Make sure that all safety canopy module bolt holes line up with all J-nuts.

10. Install the safety canopy module D-pillar bolt.
    - Tighten to 9 Nm (80 lb-in).
11. Install the safety canopy module A-pillar trim bracket bolt.
    - Tighten to 9 Nm (80 lb-in).
12. Install the safety canopy module bolt near the B-pillar.
    - Tighten to 9 Nm (80 lb-in).
13. Install the 2 safety canopy module rear bolts.
    - Tighten to 9 Nm (80 lb-in).
14. Install the 2 safety canopy module bolts near the C-pillar.
    - Tighten to 9 Nm (80 lb-in).
15. Install the safety canopy module rear door opening bolt.
    - Tighten to 9 Nm (80 lb-in).
16. Install the safety canopy module rear tether cord anchor bracket bolt.
    - Tighten to 9 Nm (80 lb-in).
17. Install the safety canopy module front door opening bolt.
    - Tighten to 9 Nm (80 lb-in).

18. Install the safety canopy module front tether cord anchor bolt.
    - Tighten to 9 Nm (80 lb-in).

NOTE: **Do not install the safety canopy module electrical connector by the locking button. Damage to the locking button may occur.**

NOTE: **The safety canopy module electrical connector locking button must be in the released position when the connector is being installed or connector damage may occur.**

NOTE: **The safety canopy module electrical connector is unique and cannot be reversed when connected to the safety canopy module. Match the electrical connector key to the keyway in the safety canopy module. Do not force the electrical connector into the safety canopy module. Damage to the connector or component may occur.**

19. With the locking button released, install the safety canopy module electrical connector fully into the safety canopy module and seat the locking button.

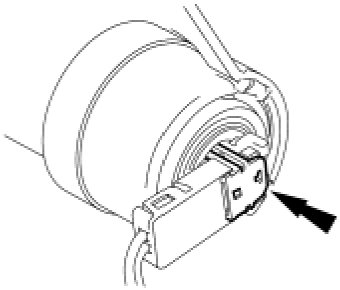


Fig. 248: Identifying Passenger Safety Canopy Module Electrical Connector
Courtesy of FORD MOTOR CO.

20. Install the headliner. For additional information, refer to **INTERIOR TRIM & ORNAMENTATION** article.
21. Repower the SRS For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

SEAT POSITION SENSOR

NOTE: **Power seat shown in illustration, manual similar.**

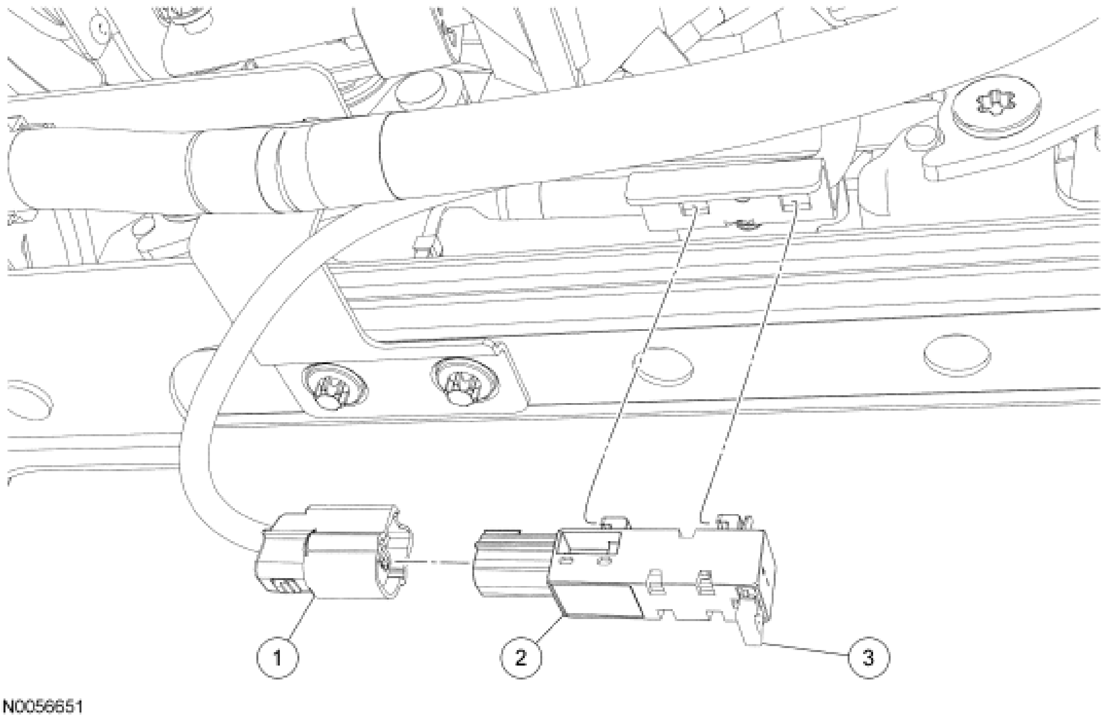


Fig. 249: Exploded View Of Seat Position Sensor
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Seat position sensor electrical connector (part of 14A699)
2	14B416	Seat position sensor
3	-	Seat position sensor retaining clip (part of 14B416)

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

All seats

1. Remove the driver seat. For additional information, refer to **SEATING** article.
2. Disconnect the seat position sensor electrical connector.

   Power seats

3. Detach the wire harness routing pin-type retainer from the seat position sensor bracket.

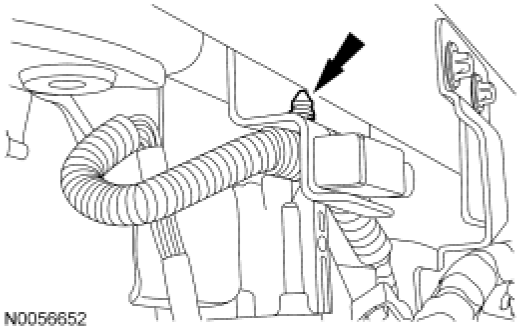


Fig. 250: Locating Wire Harness Routing Pin-Type Retainer From Seat Position Sensor Bracket
Courtesy of FORD MOTOR CO.

All seats

4. Push apart then inward to release the seat position sensor locking clip.

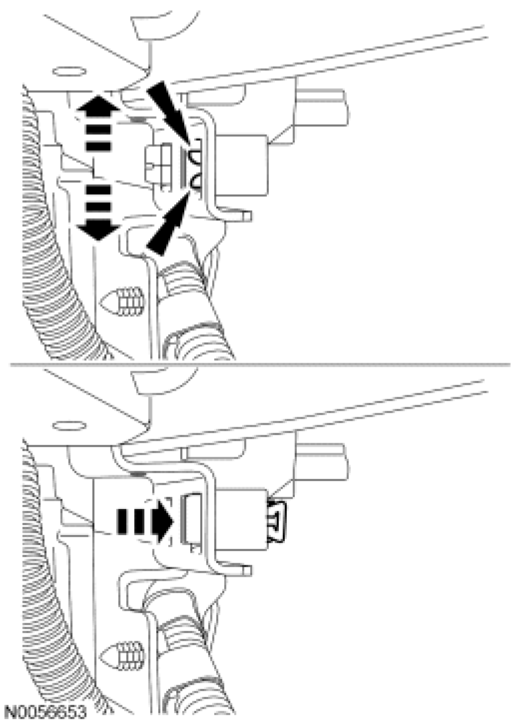


Fig. 251: Pushing Apart Then Inward To Release Seat Position Sensor Locking Clip
Courtesy of FORD MOTOR CO.

5. Slide the seat position sensor rearward to release the 2 hooks from the bracket. Then remove the seat position sensor.
6. To install, reverse the removal procedure.
7. Repower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

SIDE AIR BAG MODULE

NOTE: Passenger shown in illustration, driver similar.

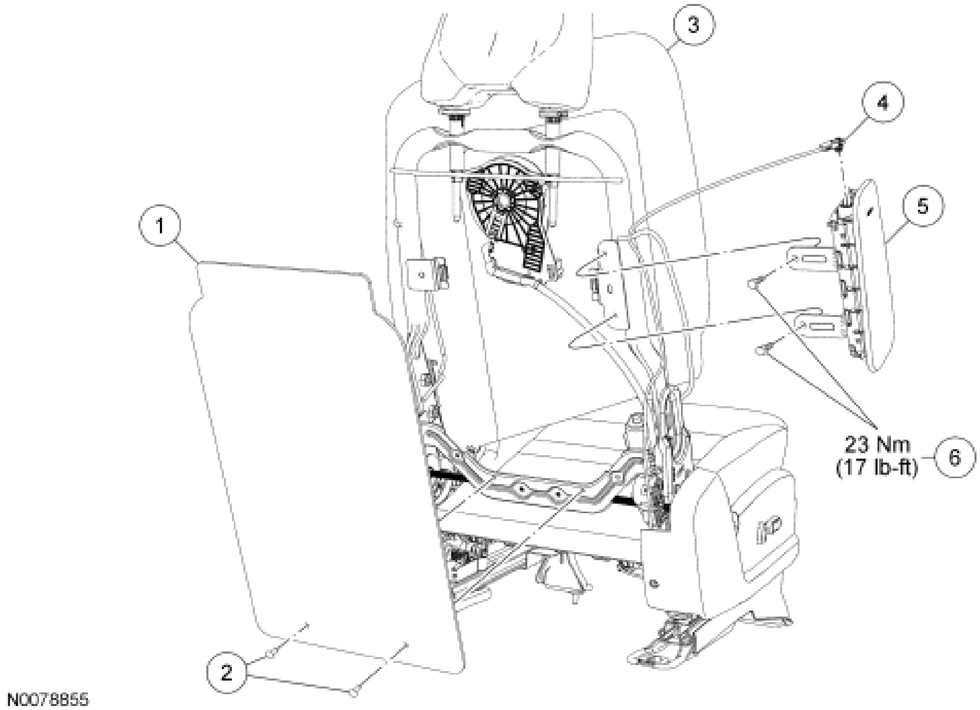


Fig. 252: Identifying Side Air Bag Module With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	60508	Seat backrest trim cover rear panel reinforcement board
2	-	Seat backrest trim cover rear panel reinforcement board pin-type retainers
3	64416/64810	Seat backrest trim cover and foam pad
4	-	Side air bag module electrical connector (part of 14K155)
5	611D10 RH/611D11 LH	Side air bag module
6	W506021	Side air bag module bolts (2 required)

REMOVAL

WARNING: Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

WARNING: Always carry or place a live air bag module with the air bag and

deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

NOTE: If a side air bag deployment took place, a new side air bag module and bolts must be installed. The side air bag module bracket on the seat back frame should be inspected and installed new if necessary.

NOTE: When installing a new side air bag after deployment, refer to SEATING article for additional information.

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. Position the affected seat and backrest fully up and forward.
2. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
3. Release the seat backrest trim cover rear panel lower J-clip. Then, release the 2 seat backrest trim cover rear panel side J-clips.

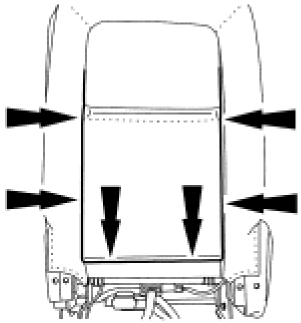


Fig. 253: Identifying Backrest Trim Cover J-Clips
Courtesy of FORD MOTOR CO.

NOTE: **The reinforcement board and seat backrest trim cover rear panel can be positioned aside with the reinforcement board still inside the seat backrest trim cover rear panel.**

4. Detach the 2 pin-type retainers and position aside the seat backrest trim cover rear panel and reinforcement board.
5. Through the rear of the seat remove and discard the 2 side air bag module bolts. Then, separate the side air bag module from the seat backrest.

NOTE: **Do not pull the side air bag module electrical connector out by the locking button. Damage to the locking button may occur.**

6. Using a small screwdriver as shown in illustration, lift up and release the locking button on the side air bag module electrical connector. With the locking button released, remove the electrical connector and the side air bag module.

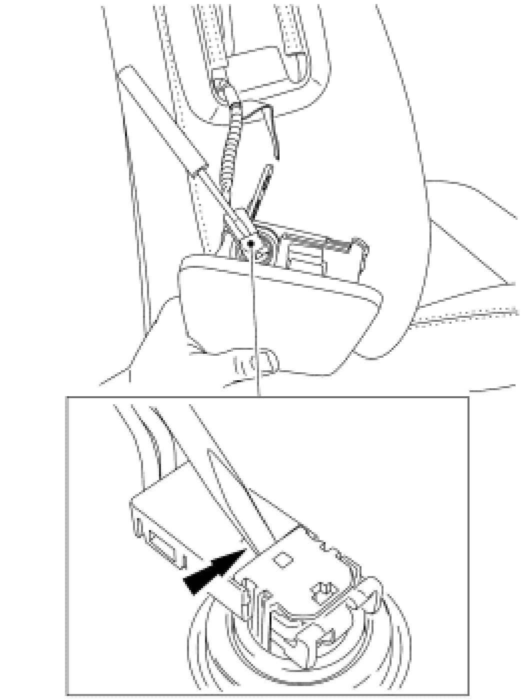


Fig. 254: Lifting Up & Releasing Locking Button On Side Air Bag Module Electrical Connector Using A Small Screwdriver
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE:	**Do not install the side air bag module electrical connector by the locking button. Damage to the locking button may occur.**

NOTE:	**The side air bag module electrical connector locking button must be in the released position when the connector is being installed or connector damage may occur.**

NOTE:	**The side air bag module electrical connector is unique and cannot be reversed when connected to the side air bag module. Match the electrical connector key to the keyway in the side air bag module. Do not force the electrical connector into the side air bag module. Damage to the connector or component may occur.**

1. With the locking button released, install the side air bag module electrical connector fully into the side air bag module and seat the locking button.

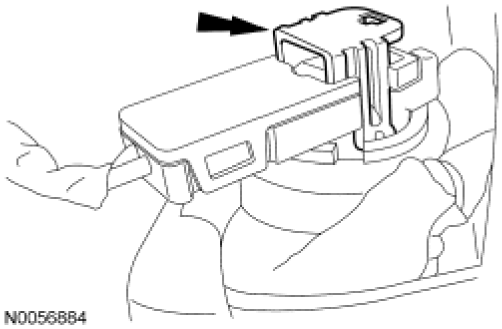


Fig. 255: Identifying Side Air Bag Module Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: Make sure the side air bag module wiring harness is not pinched between the side air bag module and the backrest frame. Damage to wire harness may occur.

NOTE: When installing the side air bag module, new bolts must be installed.

2. Position the side air bag module in the seat backrest and install the 2 new bolts.
   - Tighten to 23 Nm (17 lb-ft).
3. Position the seat backrest trim cover rear panel and attach the 2 pin-type retainers.
4. Attach the 2 seat backrest cover rear side J-clips. Then attach the seat backrest cover rear lower J-clip.
5. Repower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

SIDE IMPACT SENSOR - B-PILLAR

NOTE: RH shown in illustration, LH similar.

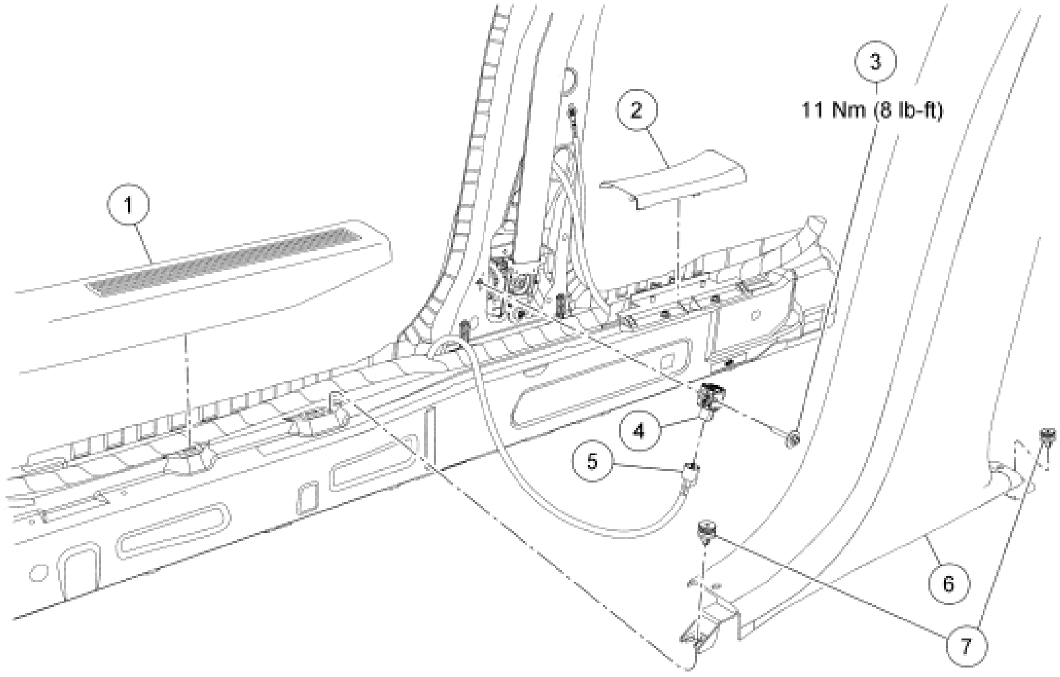


Fig. 256: Exploded View Of Side Impact Sensor - B-Pillar With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	13208	Front door scuff plate
2	13228	Rear door scuff plate
3	W712191	Side impact sensor retaining bolt
4	14B345	Side impact sensor
5	-	Side impact sensor electrical connector (part of 14A005)
6	24356	Lower B-pillar trim panel
7	-	Lower B-pillar trim panel retainers (part of 24356)

WARNING: **If a vehicle has been in a crash, inspect the restraints control module (RCM) and the impact sensor (if equipped) mounting areas for deformation. If damaged, restore the mounting areas to the original production configuration. A new RCM and sensors must be installed whether or not the air bags have deployed. Failure to follow these instructions may result in serious personal injury or death in a crash.**

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Position the front seat forward.
2. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
3. Remove the front door scuff plate.
   - Pull up to release the 5 retaining clips.
4. Remove the rear door scuff plate.
   - Pull up to release the 2 retaining clips.
5. Detach the 2 retainers and remove the lower B-pillar trim panel.

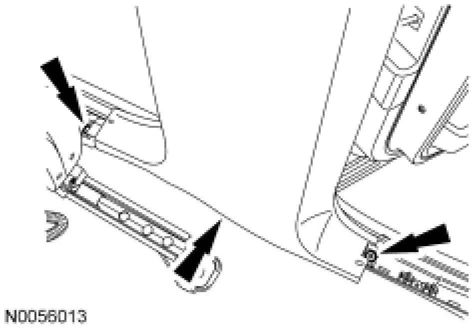


Fig. 257: Identifying Clips & Lower B-Pillar Trim Panel
Courtesy of FORD MOTOR CO.

6. Disconnect the side impact sensor electrical connector.

WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

NOTE: Make sure the B-pillar and side impact sensor mating surfaces are clean and free of foreign material.

NOTE: Note the position of the side impact sensor locating tabs for installation.

7. Remove the bolt and the side impact sensor.
   - To install, tighten to 11 Nm (8 lb-ft).
8. To install, reverse the removal procedure.
9. Repower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

SIDE IMPACT SENSOR - C-PILLAR

NOTE: **RH shown in illustration, LH similar.**

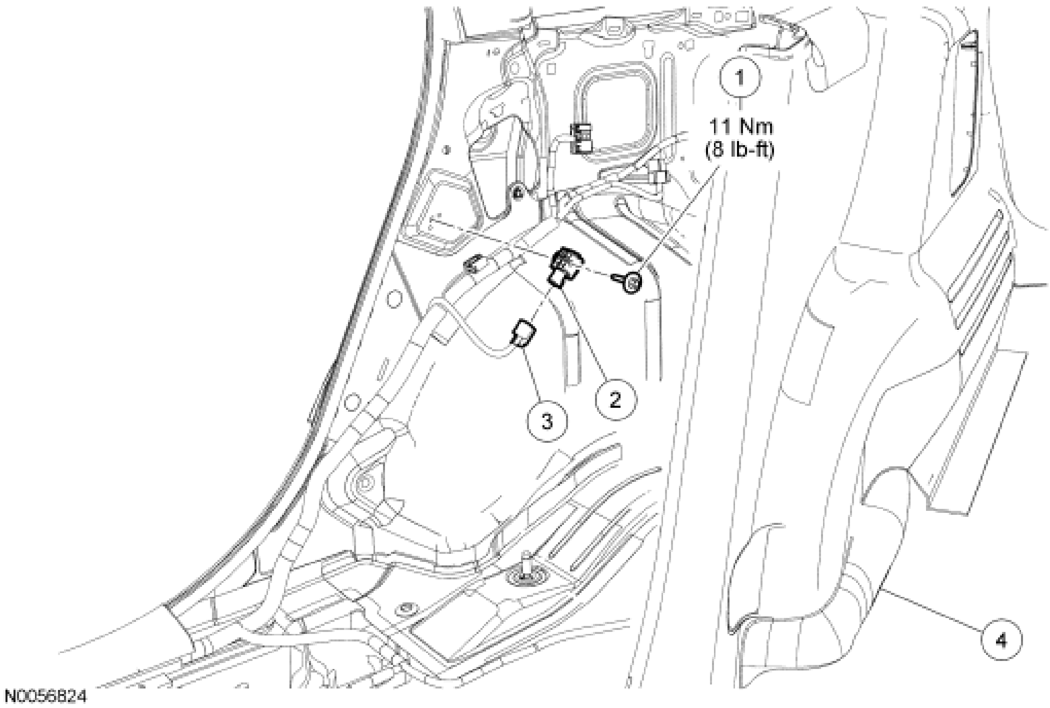


Fig. 258: Exploded View Of Side Impact Sensor - C-Pillar With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W712191	Side impact sensor bolt
2	14B345	Side impact sensor
3	-	Side impact sensor electrical connector (part of 14A005)
4	31012	Quarter trim panel

WARNING: **If a vehicle has been in a crash, inspect the restraints control module (RCM) and the impact sensor (if equipped) mounting areas for deformation. If damaged, restore the mounting areas to the original production configuration. A new RCM and sensors must be installed whether or not the air bags have deployed. Failure to follow these instructions may result in serious personal injury or death in a crash.**

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Fold down the rear seat backrest.
2. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
3. Position aside the quarter trim panel.
   - Pull out on the quarter trim panel at the C-pillar to release the retaining clip to access the C-pillar side impact sensor.

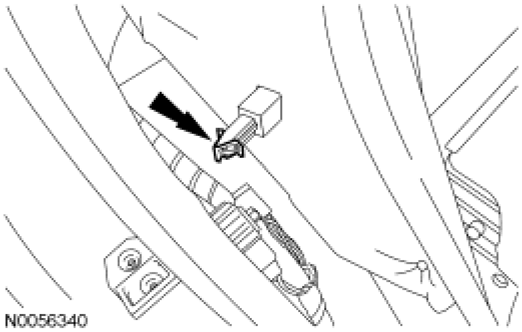


Fig. 259: Pulling Out On Quarter Trim Panel At C-Pillar
Courtesy of FORD MOTOR CO.

4. Disconnect the side impact sensor electrical connector.

   NOTE: Note the position of the 2 side impact sensor locating tabs for installation.

   NOTE: Make sure the C-pillar and side impact sensor mating surfaces are clean and free of foreign material.

5. Remove the bolt and the side impact sensor.
   - To install, tighten to 11 Nm (8 lb-ft).

     WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

6. To install, reverse the removal procedure.
7. Repower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

2008 TRANSMISSIONS

Automatic Transaxle/Transmission External Controls - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	N.m	lb-ft	lb-in
Air cleaner assembly bolt	11	8	-
Air cleaner assembly outlet hose clamp	5	-	44
Manual control lever nut	18	13	-
Selector lever bolts	12	9	-
Selector lever cable bracket bolts	12	9	-
Selector lever cable grommet nuts	10	-	89
Selector lever knob screws	2	-	18

DESCRIPTION AND OPERATION

EXTERNAL CONTROLS

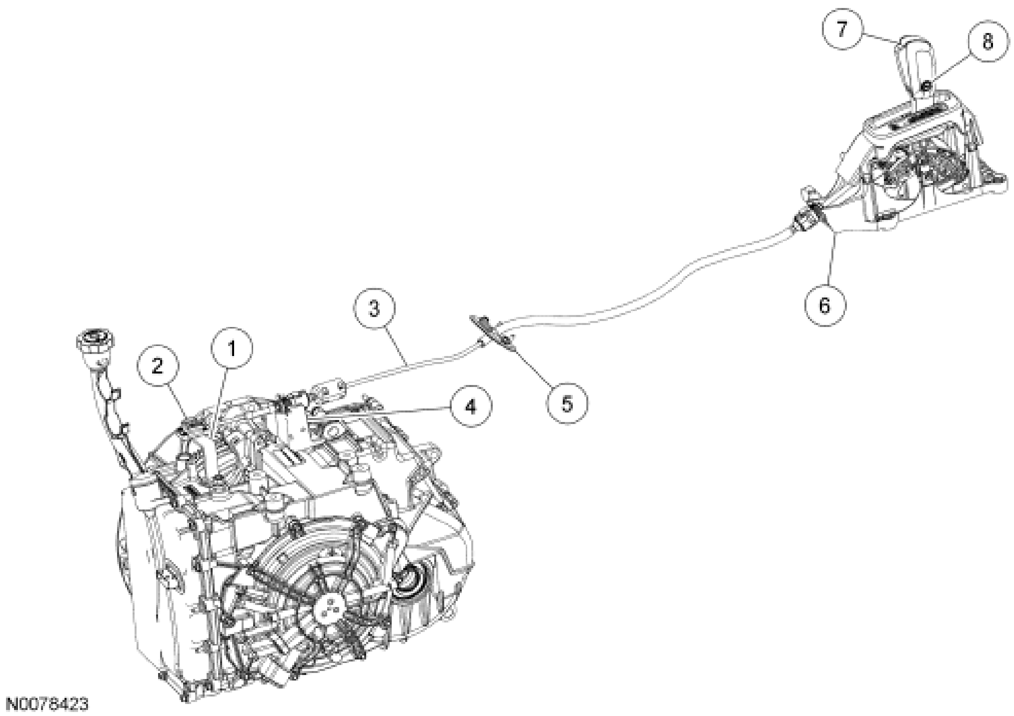


Fig. 1: Identifying External Controls
Courtesy of FORD MOTOR CO.

Item	Part Number	Description

1	7A257	Manual control lever
2	-	Adjuster locking tab (part of 7E395)
3	7E395	Selector lever cable
4	7B229	Selector lever cable bracket
5	-	Selector lever cable grommet (part of 7E395)
6	7K004	Selector lever assembly
7	7L010	Selector lever knob
8	-	Transmission control (TC)/overdrive (O/D) cancel switch (part of 7L010)

The transaxle selector lever linkage consists of:

- a selector lever cable that connects the transaxle manual control lever to the selector lever assembly.
- a brake shift interlock actuator (BSIA) that is integral to the selector lever assembly.
- a transmission control (TC) switch that turns off the operation of 6th gear.

The selector lever assembly:

- locks the transaxle selector lever in the PARK position when the ignition switch is in the LOCK position.
- requires the transaxle selector lever to be in the PARK position to turn the ignition switch to the LOCK position.

Range Selection

This transaxle has 5 range positions: P, R, N, D and L.

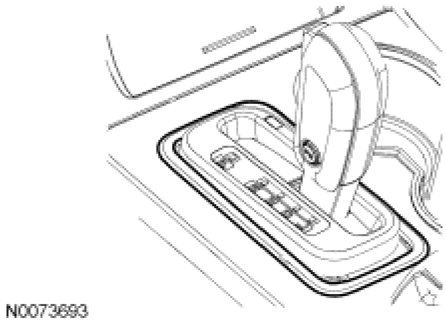


Fig. 2: Identifying 5 Range Positions
Courtesy of FORD MOTOR CO.

Park

In the PARK position:

- there is no powerflow through the transaxle.

- the parking pawl locks the final drive.
- the engine may be started.
- the ignition key may be removed.

Reverse

In the REVERSE position:

- the vehicle may be operated in a rearward direction, at a reduced gear ratio.
- engine braking will occur.

Neutral

In the NEUTRAL position:

- there is no powerflow through the transaxle.
- the output shaft is not held and is free to turn.
- the engine may be started.

Drive Position With Overdrive (O/D)

DRIVE is the normal position for most forward driving.

DRIVE provides:

- automatic shifts - 1st through 6th gears.
- apply and release of the torque converter clutch (TCC).
- maximum fuel economy during normal operation.

Manual L Position

This position provides:

- maximum engine braking.
- downshifts to the lowest available gear for the current vehicle speed.

Manual L position allows for 1st gear when the vehicle reaches slower speeds.

Drive with Grade Assist - Transmission Control (TC) Switch

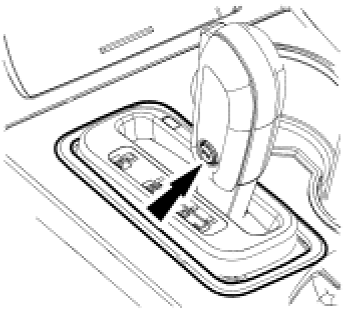


Fig. 3: Identifying Overdrive Switch
Courtesy of FORD MOTOR CO.

Drive with overdrive (O/D) cancel and grade assist is activated when the TC switch is pressed. The TC switch is located on the selector lever knob. When the TC switch is pressed, the 6th gear or O/D upshift is prevented or the transaxle shifts down to 5th gear. The TC switch is meant to be used when driving conditions cause excessive shifting from 6th to other gears such as hilly terrain, mountainous areas or when engine braking is required.

O/D Cancel

- O/D is cancelled.
- The transaxle operates in gears 1 through 5.
- The O/D OFF lamp illuminates on the instrument cluster.

Grade Assist

- Improves vehicle handling in hilly terrain or mountainous areas by providing engine braking and extending lower gear operation on uphill climbs.
- Additional engine braking is provided through the automatic transaxle shift strategy which reacts to vehicle inputs (vehicle acceleration, accelerator pedal, brake pedal and vehicle speed).
- The transaxle will select gears that will provide the engine braking desired, based on the vehicle inputs, this will increase engine RPM during engine braking.

It is recommended to return to DRIVE mode on flat terrain to provide the best fuel economy and transaxle function. The transaxle returns to O/D when the TC switch is pressed again or anytime the key is turned OFF.

Gear Availability

MANUAL LEVER POSITION	TRANSAXLE GEAR OPERATION	DESCRIPTION
P	Park	Forward or reverse gears available. Final drive is held to the transaxle case.
R	Reverse	Transaxle allows reverse only.
N	Neutral	Forward or reverse gears not available. Final drive moves freely.
D	1 ⇆ 2 ⇆ 3 ⇆ 4 ⇆ 5 ⇆ 6	6 forward gears are available. Gears are dependent on vehicle speed and throttle position with coast braking.
D (O/D cancelled)	1 ⇆ 2 ⇆ 3 ⇆ 4 ⇆ 5 ← 6	1st through 5th gears are available. Transaxle shifts to 5th gear if button is pressed when the transaxle is in 6th gear. Transaxle provides engine braking.
L	$\boxed{1}$ ← 2 ← 3 ← 4 ← 5 ← 6	1st gear hold with engine braking, the transaxle downshifts to 1st gear when L is selected above a calibrated speed under minimum to moderate accelerator pedal position.

N0080201

Fig. 4: Identifying Gear Availability
Courtesy of FORD MOTOR CO.

Brake Shift Interlock

The brake shift interlock system consist of the:

- BSIA.
- ignition switch.
- brake pedal position (BPP) switch powered by fuse 71 (10A).
- transmission range (TR) sensor.
- instrument cluster (IC).
- fuse 5 (10A).
- smart junction box (SJB).

When the ignition switch is in RUN/START, the solenoid inhibits the selector lever movement (from the PARK position) if the brake pedal is not depressed.

Inputs to SJB	Output from SJB

• Fuse(s):
  ○ 5 (10A)
  ○ 71 (10A)
• Brake pedal position (BPP) switch
	Brake shift interlock actuator (BSIA)

• Ignition switch position (RUN/START) • Transmission range (TR) sensor (PARK) • Instrument cluster (IC) -	

Brake Shift Interlock Operation

The BSIA inhibits the selector lever movement from the PARK position by mechanically blocking the detent pawl of the selector lever mechanism. When the brake pedal is depressed (BPP switch closed) with the ignition key in the RUN/START position and the transmission in PARK, the BSIA is energized by the SJB, this allows the selector lever to be moved out of the PARK position.

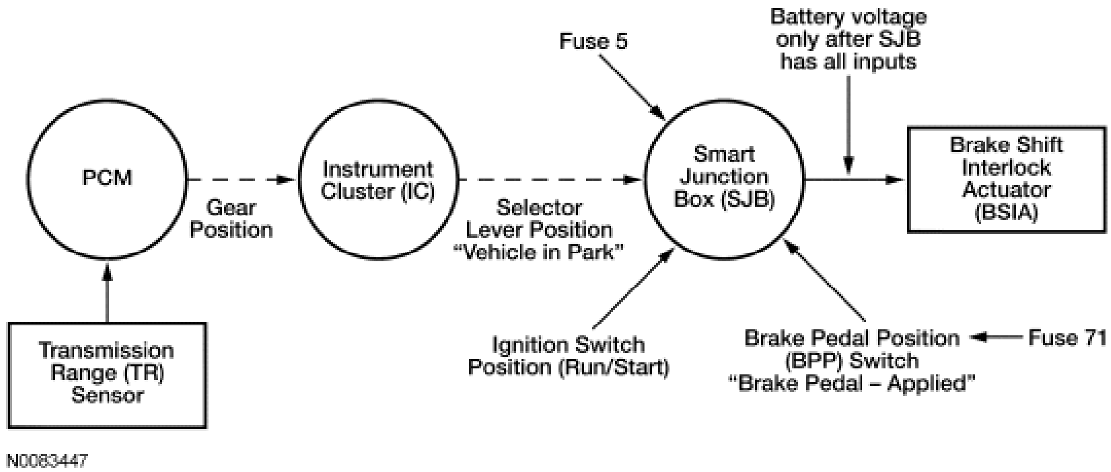


Fig. 5: Identifying Brake Shift Interlock Operation
Courtesy of FORD MOTOR CO.

Proper Operation Requirements

Three requirements for the selector lever to be moved from the PARK position are:

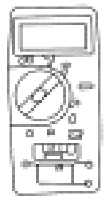
- Ignition switch in the RUN/START position
- TR sensor in the PARK position
- BPP switch closed (brakes applied - brake lamps on)

DIAGNOSTIC TESTS

EXTERNAL CONTROLS

SPECIAL TOOLS

Illustration	Tool Name	Tool Number

 ST1137-A	73 III Digital Multimeter	105-R0057 or equivalent
 ST2574-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	-

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom. Go to **SYMPTOM CHART - EXTERNAL CONTROLS** table or Go to **SYMPTOM CHART - NOISE, VIBRATION AND HARSHNESS (NVH)** table.

VISUAL INSPECTION CHART

Mechanical	Electrical

• Transmission selector lever cable
• Manual control lever
• Selector lever or selector lever knob
• Selector lever slider bunching or binding
	• Fuse
	• Smart junction box (SJB) fuse(s):
	    ○ 5 (10A)
	    ○ 71 (10A)
	• Connections
	• Wiring harness
	• Brake pedal position (BPP) switch
	• Brake shift interlock actuator (BSIA)
	• Transmission control (TC) switch

DTC CHART

DTC	Component	Description	Condition	Symptom	Action
B2572	Brake Shift Interlock	Brake Shift Interlock Output Circuit Failure	The associated circuitry connected to the smart junction box	Brake shift interlock is inoperative or	Go to **Pinpoint Test A** .

			(SJB) or fuse, or the SJB itself may have an issue causing a brake shift interlock concern.	does not operate correctly.	
B2573	Brake Shift Interlock	Brake Shift Interlock Output Circuit Short to Ground	The associated circuitry connected to the SJB or fuse, or the SJB itself may have an issue causing a brake shift interlock concern.	Brake shift interlock is inoperative or does not operate correctly.	Go to **Pinpoint Test A** .

Symptom Chart - External Controls

SYMPTOM CHART - EXTERNAL CONTROLS

Condition	**Possible Sources**	**Action**
• Brake shift interlock system does not release/lock correctly	• Circuitry open/shorted • Fuse(s) • Brake pedal position (BPP) switch	• Go to **Pinpoint Test A** .
• Brake shift interlock system does not release/lock correctly	• Brake shift interlock actuator (BSIA) damaged	• INSTALL a new selector lever assembly. REFER to **SELECTOR LEVER**.
-	• Transmission range (TR) sensor	• DIAGNOSE and REPAIR all TR sensor DTCs. REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article.
• Transmission control (TC)/overdrive (O/D) cancel switch does not operate correctly	• Instrument cluster (IC) • Circuitry open/shorted • PCM • TC switch	• Go to **Pinpoint Test B** .
• Selector lever linkage is out of correct gear relationship	• Selector lever linkage out of adjustment	• REFER to **SELECTOR LEVER CABLE ADJUSTMENT**.
-	• Manual control lever not aligned correctly on the sensor (flat	• REMOVE the manual control lever nut and CHECK the alignment of the manual control lever.

	surfaces do not line up)	
-	• Loose selector lever cable bracket	• CHECK the selector lever cable bracket. TIGHTEN as necessary.

Symptom Chart - Noise, Vibration and Harshness (NVH)

NOTE: **Noise, vibration and harshness (NVH) symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.**

SYMPTOM CHART - NOISE, VIBRATION AND HARSHNESS (NVH)

Condition	Possible Sources	Action
• Vibration - a high frequency (20-80 Hz) that is felt through the seat or selector lever. Changes with engine speed	• Selector lever cable incorrectly routed, grounded out or loose	• CHECK the selector lever cable. REPAIR as necessary.

Electrical Connectors

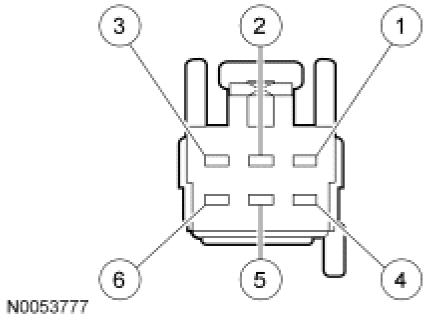


Fig. 6: Selector Lever Harness Connector C3245 (vehicle harness side)
Courtesy of FORD MOTOR CO.

Pin Number	Circuit	Circuit Function
1	CET53 (BU/OG)	Brake shift interlock actuator (BSIA) solenoid power circuit
2	CDC41 (WH/BN)	Park position signal to ignition switch
3	VLN37 (BU/WH)	Power to PRNDL bulb
4	GD140 (BK/GN)	Ground

5	CET34 (BN/GN)	Transmission control (TC) switch signal
6	CBP30 (YE/BU)	TC switch power circuit

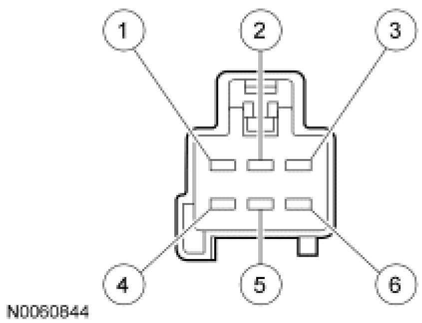


Fig. 7: Selector Lever Harness Connector C3245 (component side)
Courtesy of FORD MOTOR CO.

Pin Number	Circuit	Circuit Function
1	CET53 (OG)	Brake shift interlock actuator (BSIA) solenoid power circuit
2	CDC41 (RD)	Park position signal to ignition switch
3	VLN37 (BU)	Power to PRNDL bulb
4	GD140 (BK)	Ground
5	CET34 (WH)	Transmission control (TC) switch signal
6	CBP30 (BN)	TC switch power circuit

Pinpoint Tests

Refer to appropriate SYSTEM WIRING DIAGRAM article for Transmission Controls schematic and connector information.

Refer to appropriate SYSTEM WIRING DIAGRAM article for Shift Interlock schematic and connector information.

PINPOINT TEST A: THE BRAKE SHIFT INTERLOCK SYSTEM DOES NOT RELEASE/LOCK CORRECTLY

A1 TEST THE BRAKE LIGHTS

- Apply the brake pedal and view the brake lights.
- **Do the brake lights illuminate?**

  YES : Go to A2.

  NO : REFER to **EXTERIOR LIGHTING** article.

A2 TEST SMART JUNCTION BOX (SJB) FUSE 5 (10A)

- Key in OFF position.
- Check fuse: SJB 5 (10A)

- **Is the resistance less than 5 ohms?**

  YES : Go to A3.

  NO : INSTALL a new fuse. Go to A3.

A3 TEST BRAKE SHIFT INTERLOCK ACTUATOR (BSIA) POWER CIRCUIT

- Disconnect: Selector Lever Harness C3245
- Key in ON position.

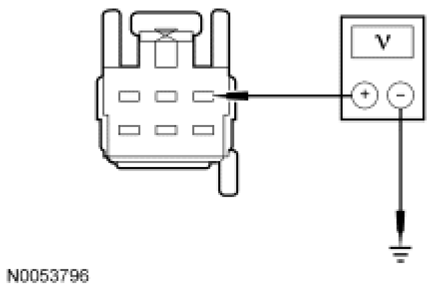


Fig. 8: Measuring Voltage Between Selector Lever Harness Connector C3245-1, Circuit CET53 (BU/OG) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between selector lever harness C3245-1, circuit CET53 (BU/OG) and ground, while applying the brake pedal.
- **Is the voltage greater than 10 volts?**

  YES : Go to A6.

  NO : Go to A4.

A4 TEST THE BSIA POWER CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280C

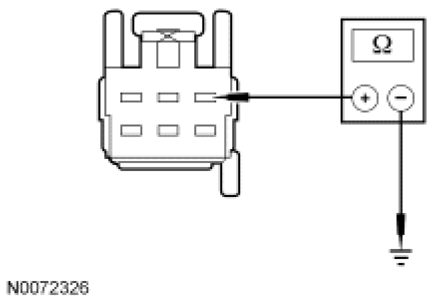


Fig. 9: Measuring Resistance Between Selector Lever Harness C3245-1, Circuit CET53 (BU/OG) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between selector lever harness C3245-1, circuit CET53 (BU/OG) and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to A5.

  NO : REPAIR circuit CET53 (BU/OG) for a short to ground. TEST the system for normal operation.

A5 TEST THE BSIA POWER CIRCUIT FOR AN OPEN

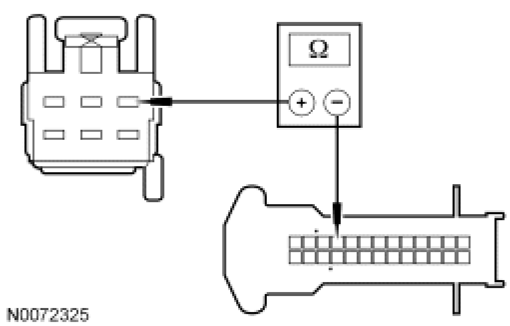


Fig. 10: Measuring Resistance Between Selector Lever Harness C3245-1, CET53 (BU/OG) & SJB C2280C-23
Courtesy of FORD MOTOR CO.

- Measure the resistance between selector lever harness C3245-1, circuit CET53 (BU/OG) and SJB C2280C-23, circuit CET53 (BU/OG).
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new SJB. TEST the system for normal operation.

  NO : REPAIR circuit CET53 (BU/OG) for an open.

A6 TEST BSIA GROUND CIRCUIT

- Key in OFF position.

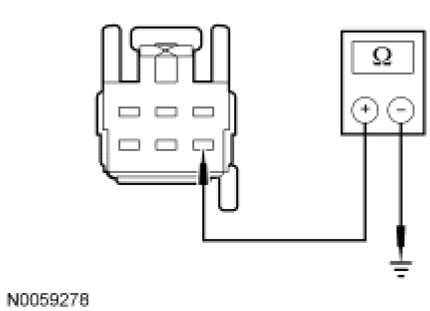


Fig. 11: Measuring Resistance Between Floor Selector Lever Harness Connector C3245-4, GD112 (BK/GN) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between floor selector lever harness connector C3245-4, circuit GD112

(BK/GN) and ground.

- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new selector lever. REFER to **SELECTOR LEVER**.

  NO : REPAIR circuit GD112 (BK/GN). TEST the system for normal operation.

PINPOINT TEST B: TRANSMISSION CONTROL (TC)/OVERDRIVE (O/D) CANCEL SWITCH DOES NOT OPERATE CORRECTLY

B1 TEST THE INSTRUMENT CLUSTER (IC)

- Connect the diagnostic tool.
- Using the scan tool, monitor the TCS PID while cycling the transmission control (TC) (O/D cancel) switch.
- **Does the TCS PID cycle from depressed to not depressed?**

  YES : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

  NO : Go to B2.

B2 CHECK SMART JUNCTION BOX (SJB) FUSE 71 (10A)

- Key in OFF position.
- Check fuse: SJB 71 (10A)
- **Is the resistance less than 5 ohms?**

  YES : Go to B3.

  NO : Go to B4.

B3 TEST THE TC (O/D CANCEL) SWITCH POWER CIRCUIT FOR AN OPEN

- Disconnect: Selector Lever Harness C3245
- Disconnect: SJB Fuse 71 (10A)

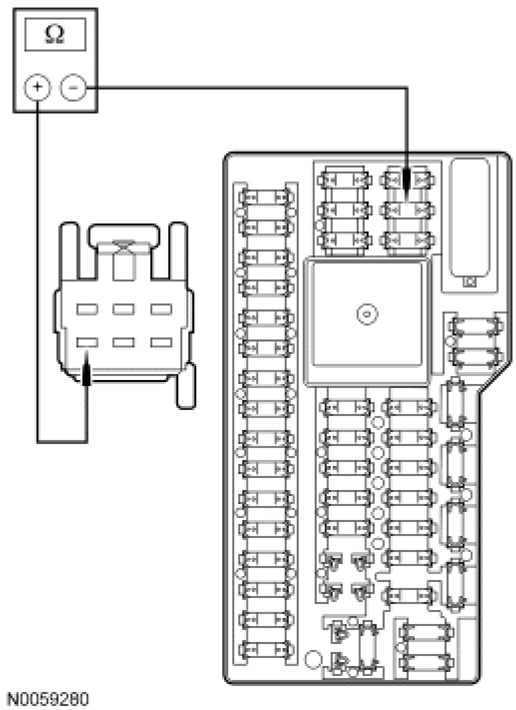


Fig. 12: Measuring Resistance Between Selector Lever Harness Connector C3245-6, Circuit CBP30 (YE/BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between selector lever harness C3245-6, circuit CBP30 (YE/BU) and the output side of SJB fuse 71 (10A).
- **Is the resistance less than 5 ohms?**

  YES : Go to B5.

  NO : REPAIR the circuit CBP30 (YE/BU) for an open. RECONNECT all components. TEST the system for normal operation.

B4 TEST THE TC (O/D CANCEL) SWITCH POWER CIRCUIT FOR A SHORT TO GROUND

- Disconnect: Selector Lever Harness C3245
- Disconnect: SJB Fuse 71 (10A)

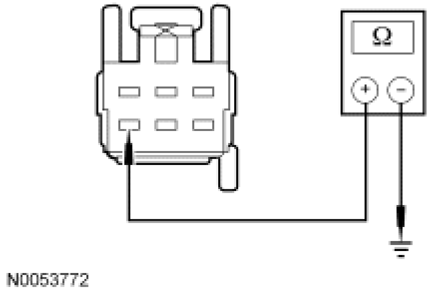


Fig. 13: Measuring Resistance Between Selector Lever Harness Connector C3245-6, CBP30

(YE/BU) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between selector lever harness C3245-6, circuit CBP30 (YE/BU) and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to B6.

  NO : REPAIR circuit CBP30 (YE/BU) for a short to ground. RECONNECT all components. TEST the system for normal operation.

B5 TEST THE TC (O/D CANCEL) SWITCH SIGNAL CIRCUIT FOR AN OPEN

- Disconnect: PCM C175b

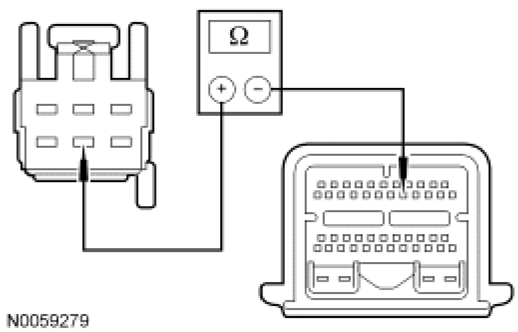


Fig. 14: Measuring Resistance Between Selector Lever Harness Connector C3245-5, Circuit CET34 (BN/GN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between selector lever harness C3245-5, circuit CET34 (BN/GN) and PCM C175b-16, circuit CET34 (BN/GN).
- **Is the resistance less than 5 ohms?**

  YES : Go to B7.

  NO : REPAIR circuit CET34 (BN/GN) for an open. RECONNECT all components. TEST the system for normal operation.

B6 TEST THE TC (O/D CANCEL) SWITCH SIGNAL CIRCUIT FOR A SHORT TO GROUND

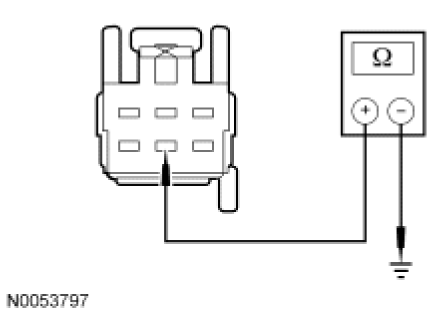


Fig. 15: Measuring Resistance Between Selector Lever Harness Connector C3245-5, CET34

(BN/GN) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between selector lever harness C3245-5, circuit CET34 (BN/GN) and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to B7.

  NO : REPAIR circuit CET34 (BN/GN) for a short to ground. TEST the system for normal operation.

B7 TEST THE TC (O/D CANCEL) SWITCH

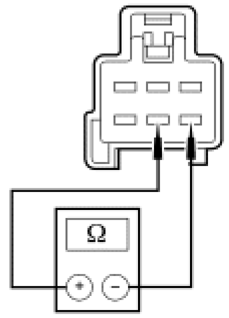


Fig. 16: Measuring Resistance Between Selector Lever Connector C3245-5 & C3245-6, Component Side
Courtesy of FORD MOTOR CO.

- Measure the resistance between selector lever C3245-5 and C3245-6, component side, while cycling the TC (O/D cancel) switch.
- **Is the resistance less than 5 ohms when pressed and greater than 10,000 ohms when released?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

  NO : INSPECT the selector lever wiring harness for damage and repair as necessary. If the selector lever wiring harness is not damaged, INSTALL a new selector lever knob. REFER to **SELECTOR LEVER KNOB**. TEST the system for normal operation.

GENERAL PROCEDURES

BRAKE SHIFT INTERLOCK OVERRIDE

NOTE:	**If it is necessary to use the override procedure to move the selector lever out of the PARK position, it is possible that a fuse has blown and the brake lights are not operational. Before driving the vehicle, verify that the brake lights are working.** **This vehicle is equipped with a brake shift interlock feature that prevents the selector lever from being moved out of PARK when the ignition is in the ON**

position unless the brake pedal is depressed.

If the selector lever cannot be moved out of the PARK position when the ignition is in the ON position and the brake pedal is depressed:

1. Apply the parking brake and remove the ignition key.

NOTE: Relief located at the front of the access panel.

2. Remove the override cap.

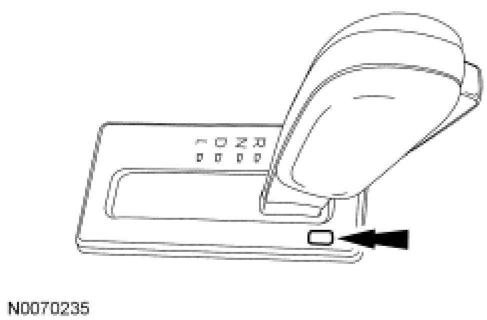


Fig. 17: Identifying Override Cap
Courtesy of FORD MOTOR CO.

3. Using a suitable tool, depress the brake shift interlock override mechanism on the selector lever, apply the brake, depress the button on the selector lever and move the selector lever into NEUTRAL.

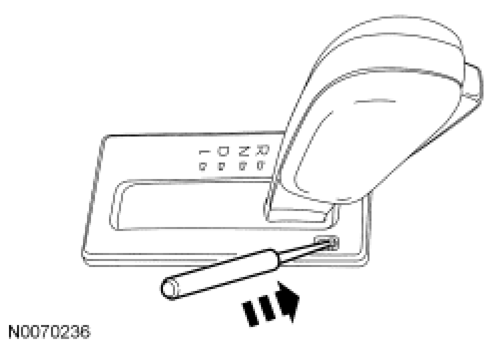


Fig. 18: Depressing The Brake Shift Interlock Override Mechanism
Courtesy of FORD MOTOR CO.

4. Start the vehicle.
5. To install, reverse the procedure.

SELECTOR LEVER CABLE ADJUSTMENT

1. Disconnect the selector lever cable end from the manual control lever.

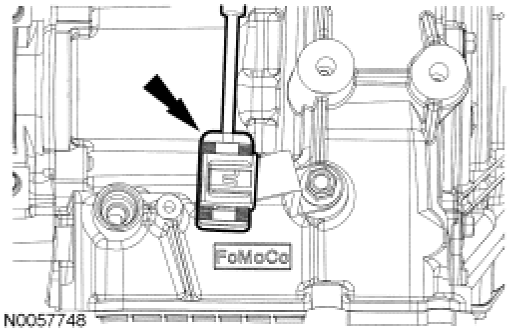


Fig. 19: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

2. Place the manual control lever in DRIVE.
    1. Rotate the manual control lever clockwise until it stops.
    2. Rotate the manual control lever counterclockwise one detent.

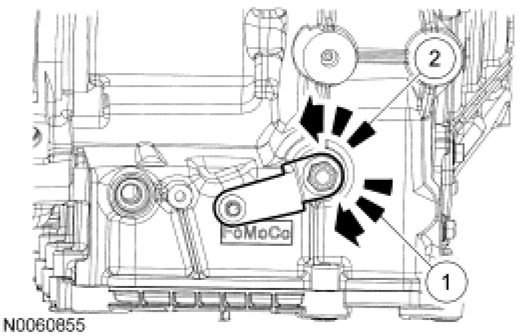


Fig. 20: Rotating Manual Control Lever Clockwise & Counterclockwise
Courtesy of FORD MOTOR CO.

3. Place the selector lever in DRIVE.

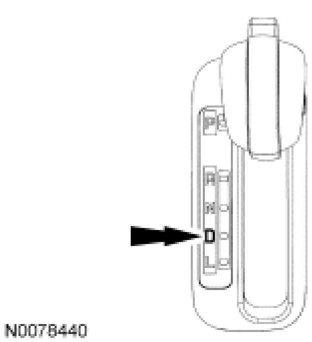


Fig. 21: Placing Selector Lever In Drive
Courtesy of FORD MOTOR CO.

4. Unlock the adjuster.

1. Pry the latch up.
2. Push the lock tab to slide it over.

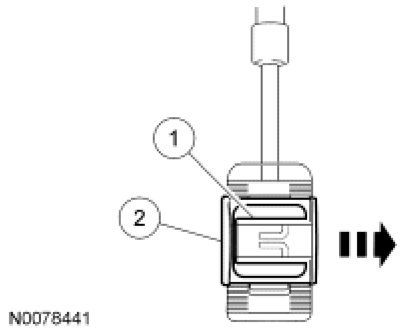


Fig. 22: Pushing Lock Tab To Slide It Over
Courtesy of FORD MOTOR CO.

5. Slide the selector lever cable end forward or backward to align it with the manual control lever.

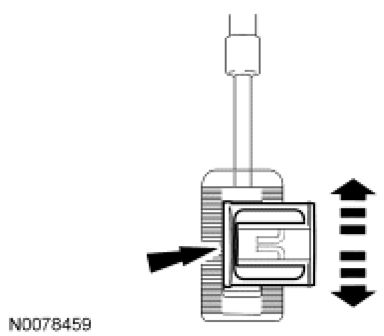


Fig. 23: Sliding Cable End Forward Or Backward To Align It With Manual Control Lever
Courtesy of FORD MOTOR CO.

6. With the adjuster locking tab released, connect the selector lever cable end to the manual control lever.

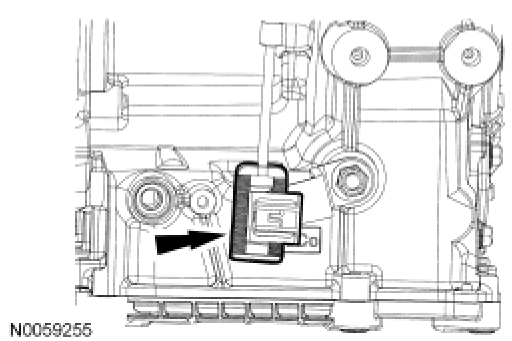


Fig. 24: Connecting Selector Lever Cable End To Manual Lever
Courtesy of FORD MOTOR CO.

7. Slide the release tab back to lock the adjuster.

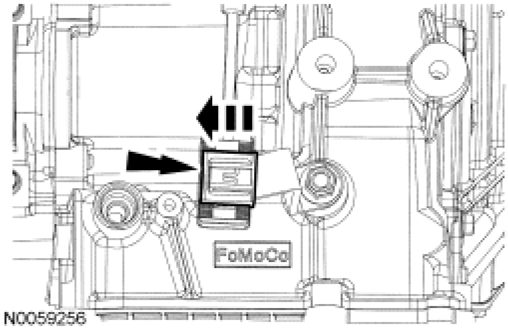


Fig. 25: Sliding Release Tab Back To Lock Adjuster
Courtesy of FORD MOTOR CO.

8. Verify that the vehicle starts in PARK and NEUTRAL only and that the reverse lamps illuminate in REVERSE.

REMOVAL AND INSTALLATION

SELECTOR LEVER CABLE

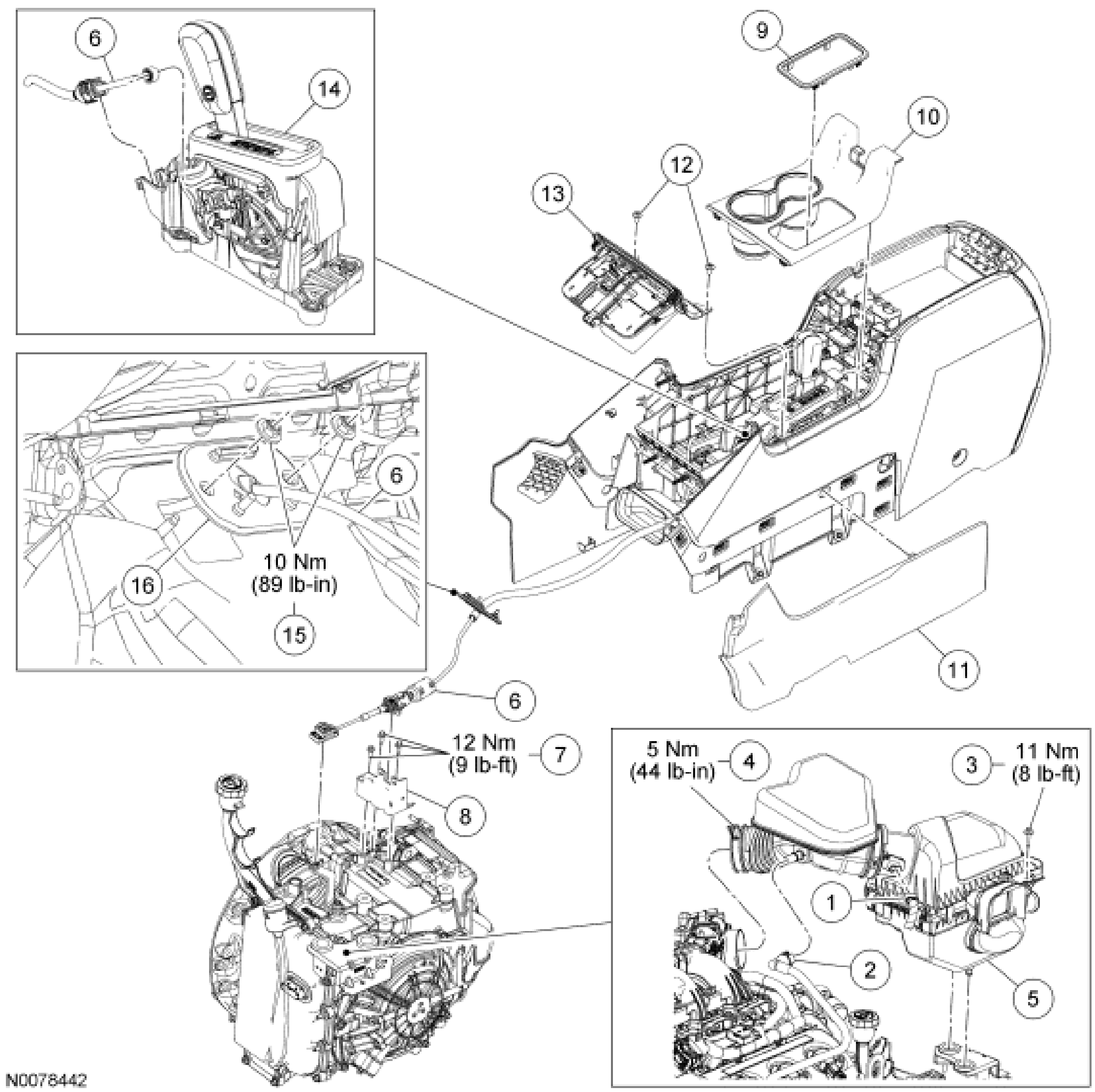


Fig. 26: Identifying Selector Lever Cable With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Mass air flow (MAF) sensor electrical connector
2	6758	Engine vent tube
3	N606678	Air cleaner assembly bolt
4	9C632	Air cleaner outlet tube clamp
5	9C662	Air cleaner assembly
6	7E395	Selector lever cable
7	W500213	Selector lever cable bracket bolts
8	7B229	Selector lever cable bracket
9	78061A16	Selector lever trim ring (MKX only)

10	78045A76	Center console trim cover
11	78045A06	Center console side cover
12	W706092	Power outlet trim cover fasteners
13	78047A04	Power outlet trim cover
14	7K004	Selector lever assembly
15	W707142	Selector lever cable floor grommet nuts
16	57809	Selector lever cable floor grommet

REMOVAL

All vehicles

1. Disconnect the mass air flow (MAF) sensor electrical connector and the wiring harness fastener from the air cleaner assembly.

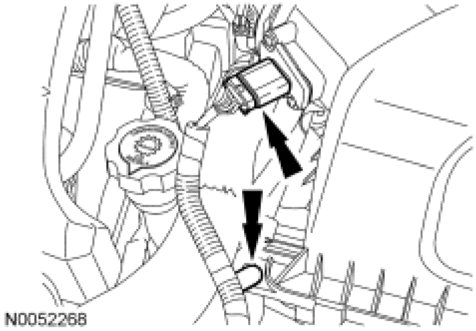


Fig. 27: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

2. Disconnect the brake booster vacuum hose from the air cleaner outlet pipe.

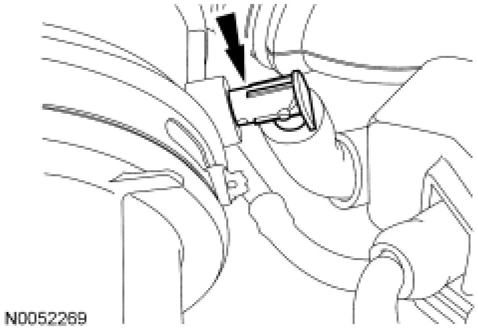


Fig. 28: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

3. Disconnect the engine breather from the air cleaner assembly.

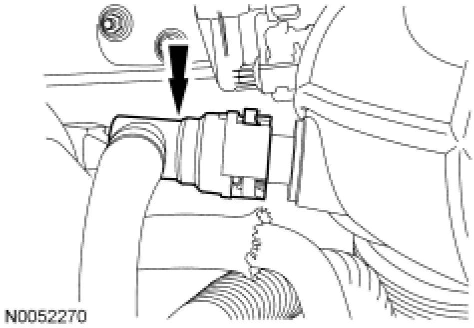


Fig. 29: Locating Engine Breather
Courtesy of FORD MOTOR CO.

4. Remove the air cleaner assembly bracket bolt.

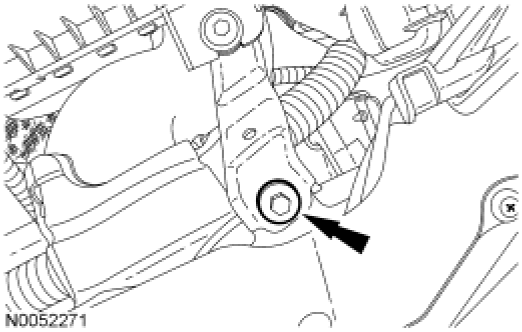


Fig. 30: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

5. Loosen the air cleaner outlet pipe clamp at the throttle body and remove the air cleaner and air cleaner outlet pipe assembly.

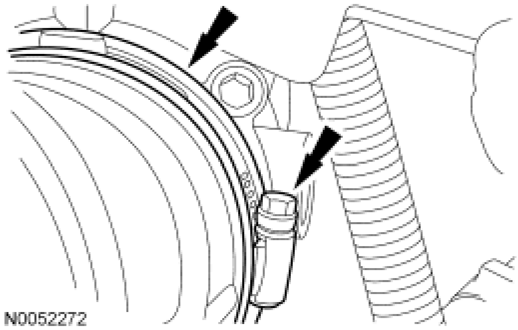


Fig. 31: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

6. Disconnect the selector lever cable end from the manual control lever.

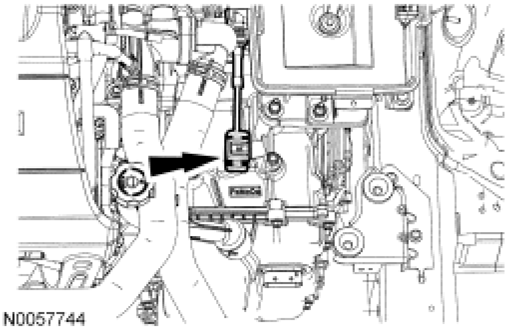


Fig. 32: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

7. Release the 2 tabs, remove the selector lever cable from the selector lever cable bracket and position the cable aside.

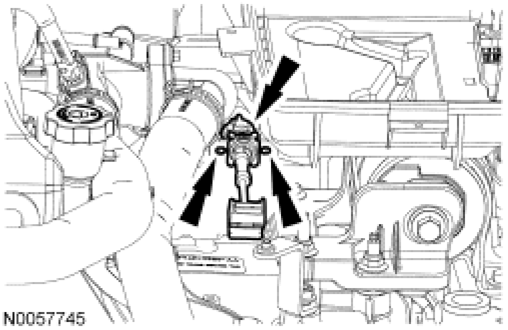


Fig. 33: Locating Selector Lever Cable Bracket & Tabs
Courtesy of FORD MOTOR CO.

8. Remove the 3 bolts and the selector lever cable bracket.

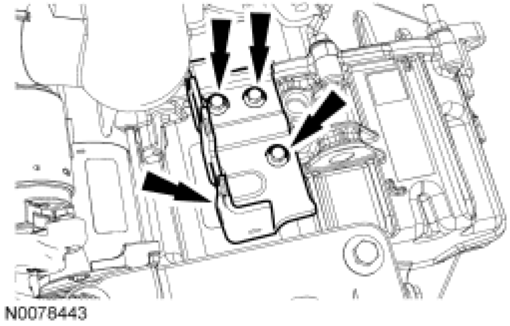


Fig. 34: Identifying Selector Lever Cable Bracket
Courtesy of FORD MOTOR CO.

MKX only

9. Using a suitable tool, remove the selector lever trim ring.

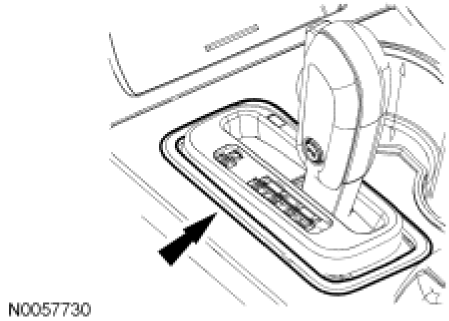


Fig. 35: Locating Selector Lever Trim Ring
Courtesy of FORD MOTOR CO.

All vehicles

10. Lift the armrest. Using a suitable tool, remove the center console trim cover.

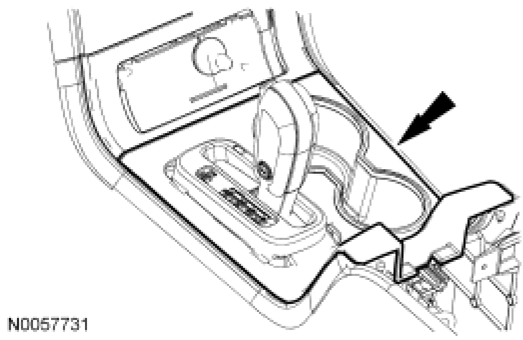


Fig. 36: Identifying Center Console Trim Cover
Courtesy of FORD MOTOR CO.

11. Remove the 2 fasteners and position aside the power outlet trim cover.

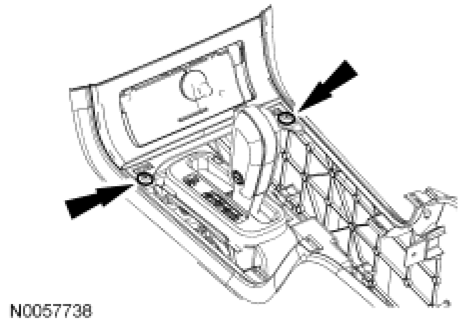


Fig. 37: Identifying Fasteners On Power Outlet Trim Cover
Courtesy of FORD MOTOR CO.

12. Remove the selector lever cable end from the selector lever.

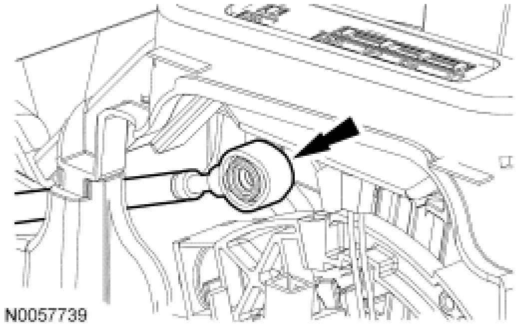


Fig. 38: Identifying Selector Lever Cable End From Selector Lever
Courtesy of FORD MOTOR CO.

13. Release the 2 tabs and remove the selector lever cable from the selector lever housing.

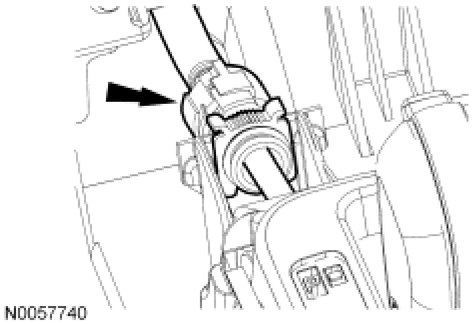


Fig. 39: Locating Selector Lever Cable On Selector Lever Housing
Courtesy of FORD MOTOR CO.

14. Remove the center console side cover.

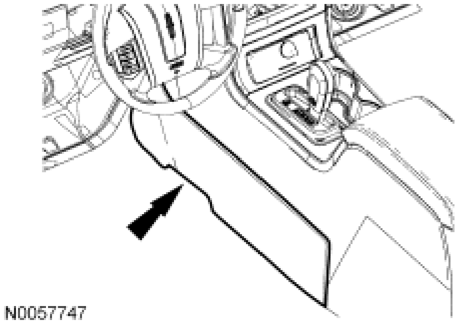


Fig. 40: Identifying Center Console Side Cover
Courtesy of FORD MOTOR CO.

15. Remove the 2 nuts from the grommet, route the selector lever cable from the engine compartment through the floor and remove the selector lever cable from the passenger compartment.

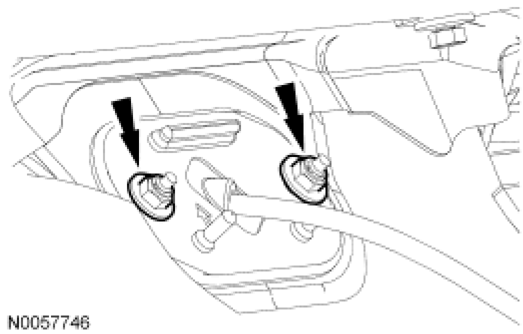


Fig. 41: Identifying Grommet Nuts
Courtesy of FORD MOTOR CO.

INSTALLATION

All vehicles

1. Install the selector lever cable, position the grommet in place and install the 2 nuts.
    - Tighten to 10 N.m (89 lb-in).

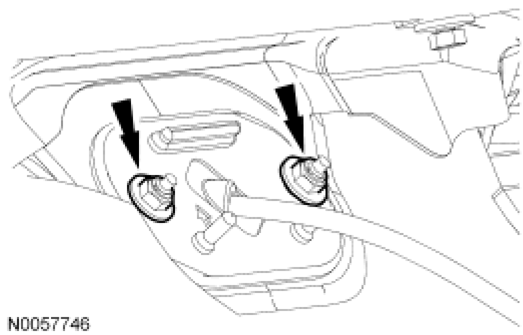


Fig. 42: Identifying Grommet Nuts
Courtesy of FORD MOTOR CO.

2. Install the center console side cover.

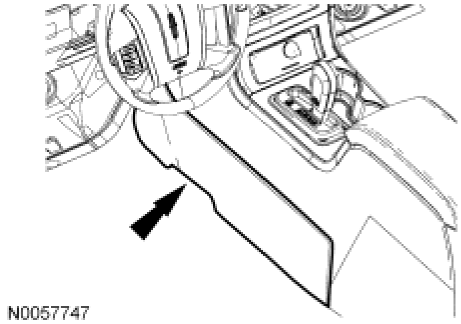


Fig. 43: Identifying Center Console Side Cover
Courtesy of FORD MOTOR CO.

NOTE: **When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the selector lever cable end is snapped onto the ball stud. Press the selector lever cable into the selector lever cable bracket and listen for the cable to click in place. Pull back on the selector lever cable to make sure that it is locked into the selector lever cable bracket. Also make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable end to make sure that the selector lever cable end is correctly installed.**

3. Install the selector lever cable in the selector lever housing.

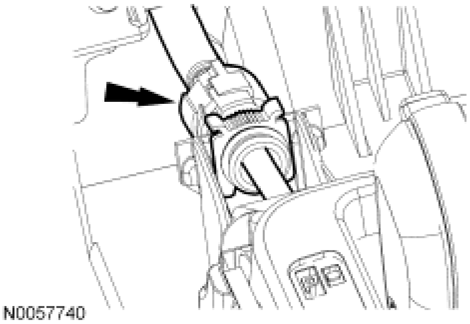


Fig. 44: Locating Selector Lever Cable On Selector Lever Housing
Courtesy of FORD MOTOR CO.

4. Place the selector lever in REVERSE.

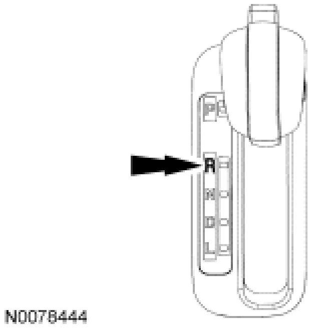


Fig. 45: Identifying REVERSE
Courtesy of FORD MOTOR CO.

5. Install the selector lever cable end on the selector lever.

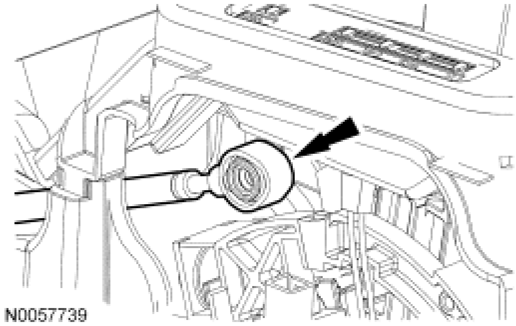


Fig. 46: Identifying Selector Lever Cable End From Selector Lever
Courtesy of FORD MOTOR CO.

6. Place the selector lever in DRIVE.

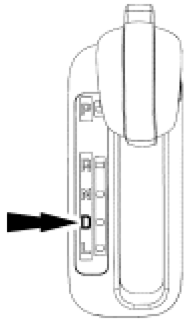


Fig. 47: Placing Selector Lever In Drive
Courtesy of FORD MOTOR CO.

7. Position the power outlet trim cover in place and install the 2 fasteners.

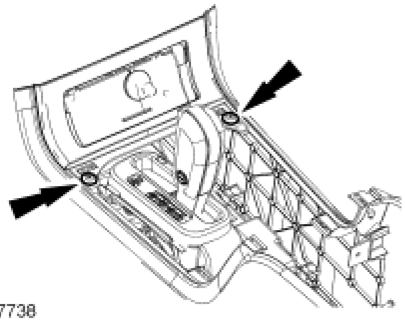


Fig. 48: Identifying Fasteners On Power Outlet Trim Cover
Courtesy of FORD MOTOR CO.

8. Install the center console trim cover.

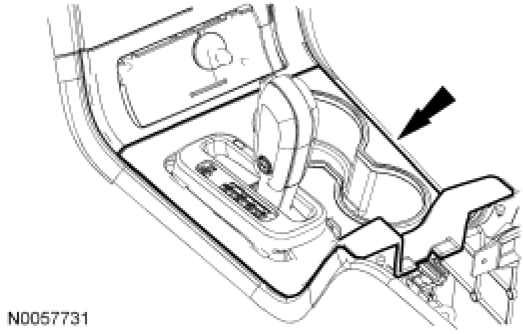


Fig. 49: Identifying Center Console Trim Cover
Courtesy of FORD MOTOR CO.

MKX only

9. Install the selector lever trim ring.

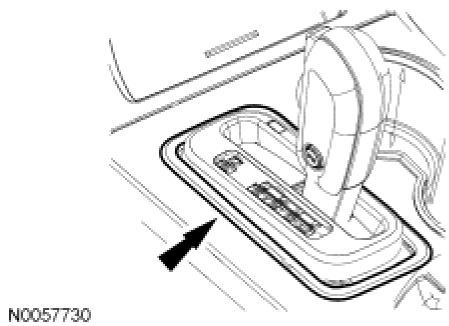


Fig. 50: Locating Selector Lever Trim Ring
Courtesy of FORD MOTOR CO.

All vehicles

10. Position the selector lever cable bracket in place and install the 3 bolts.
    - Tighten to 12 N.m (9 lb-ft).

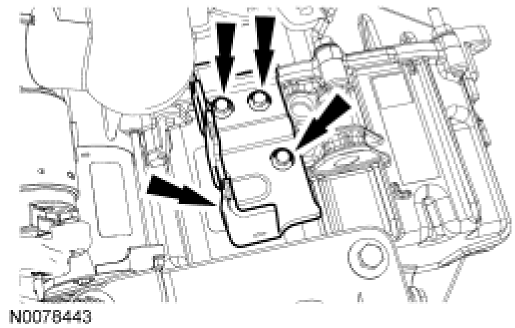


Fig. 51: Identifying Selector Lever Cable Bracket
Courtesy of FORD MOTOR CO.

11. Install the selector lever cable in the selector lever cable bracket.

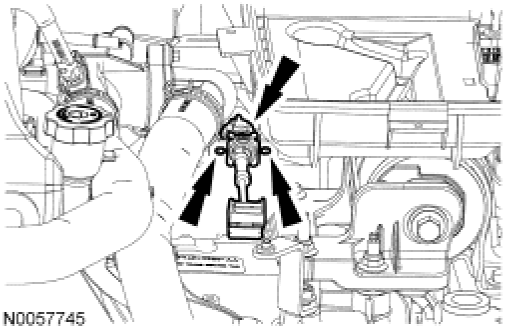


Fig. 52: Locating Selector Lever Cable Bracket & Tabs
Courtesy of FORD MOTOR CO.

12. Place the manual control lever in DRIVE.
    1. Rotate the manual control lever clockwise until it stops.
    2. Rotate the manual control lever counterclockwise one detent.

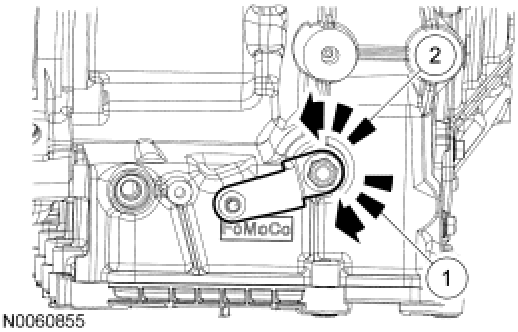


Fig. 53: Rotating Manual Control Lever Clockwise & Counterclockwise
Courtesy of FORD MOTOR CO.

13. Unlock the adjuster.
    1. Pry the latch up.
    2. Push the lock tab to slide it over.

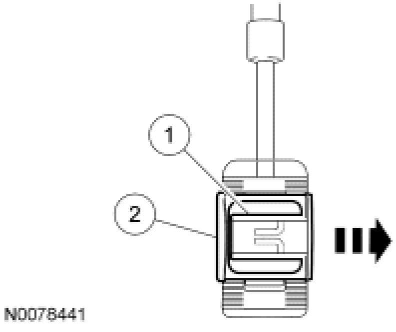


Fig. 54: Pushing Lock Tab To Slide It Over
Courtesy of FORD MOTOR CO.

14. Slide the selector lever cable end forward or backward to align it with the manual control lever.

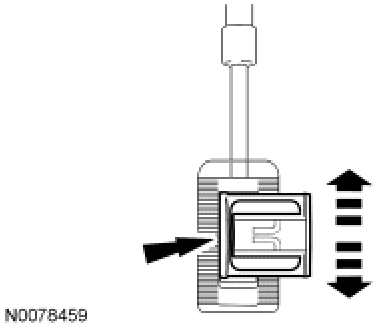


Fig. 55: Sliding Cable End Forward Or Backward To Align It With Manual Control Lever
Courtesy of FORD MOTOR CO.

15. With the adjuster locking tab released, connect the selector lever cable end to the manual control lever.

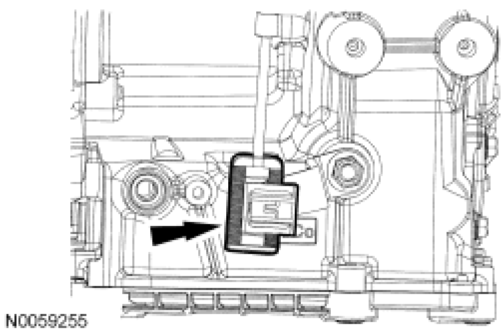


Fig. 56: Connecting Selector Lever Cable End To Manual Lever
Courtesy of FORD MOTOR CO.

16. Slide the release tab back to lock the adjuster.

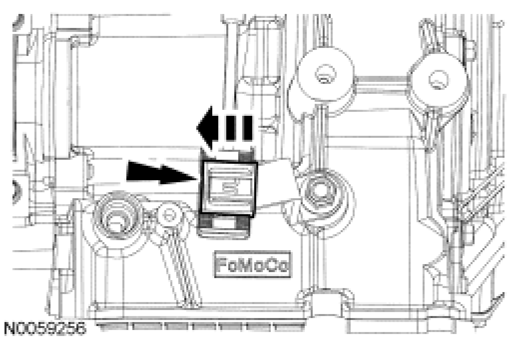


Fig. 57: Sliding Release Tab Back To Lock Adjuster
Courtesy of FORD MOTOR CO.

17. Connect the selector lever cable on the manual control lever.

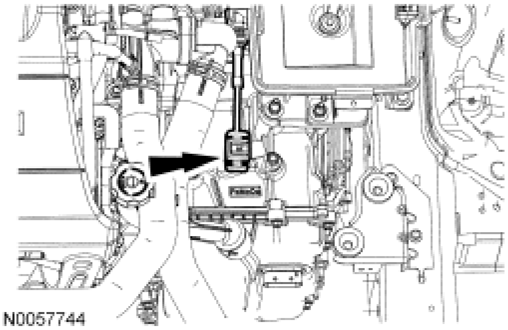


Fig. 58: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

18. Position the air cleaner assembly in place and install the bolt.
    - Tighten to 11 N.m (8 lb-ft).

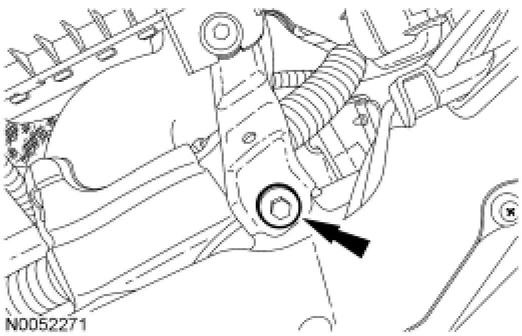


Fig. 59: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

19. Tighten the air cleaner outlet pipe clamp at the throttle body.
    - Tighten to 5 N.m (44 lb-in).

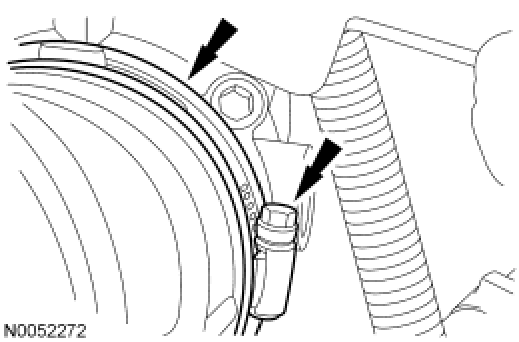


Fig. 60: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

20. Connect the engine breather to the air cleaner assembly.

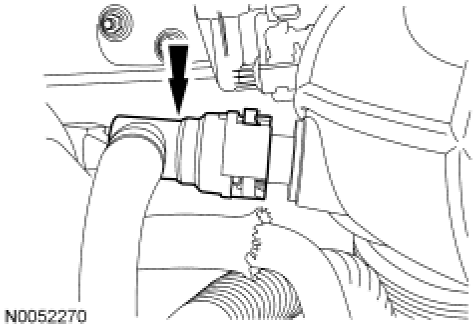


Fig. 61: Locating Engine Breather
Courtesy of FORD MOTOR CO.

21. Connect the brake booster vacuum hose to the air cleaner assembly.

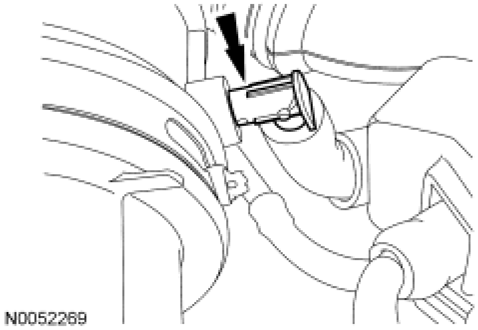


Fig. 62: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

22. Connect the MAF sensor electrical connector and connect the electrical harness fastener.

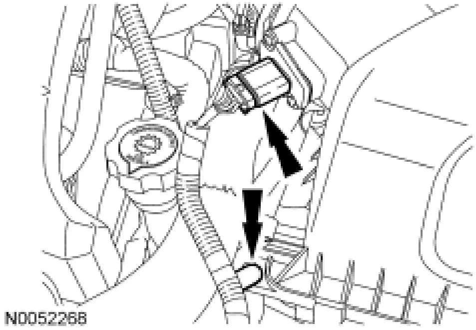


Fig. 63: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

23. Verify that the vehicle starts in PARK and NEUTRAL only and that the reverse lamps illuminate in REVERSE.

SELECTOR LEVER

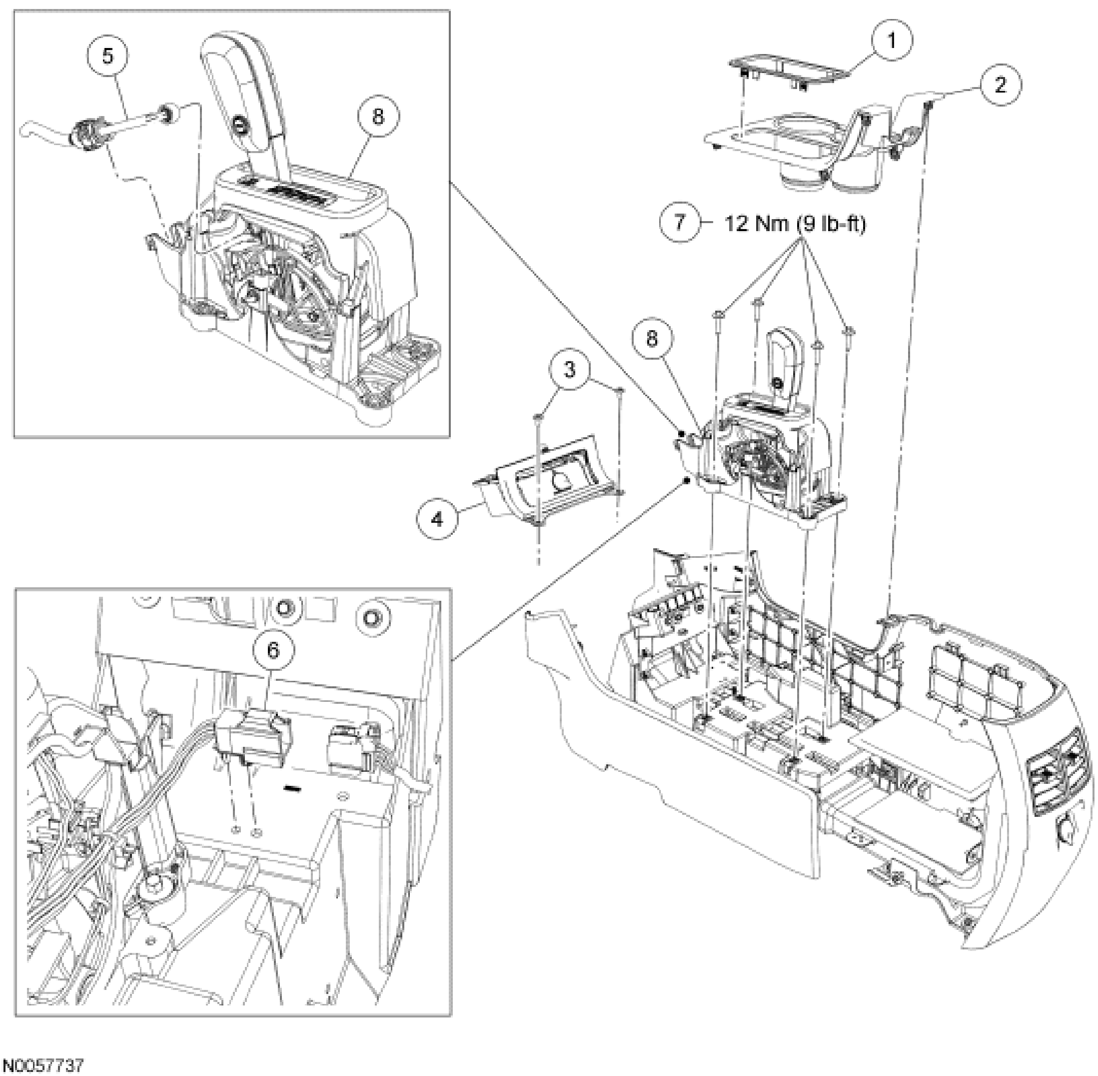


Fig. 64: Exploded View Of Selector Lever Components With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	78061A16	Selector lever trim ring (MKX only)
2	78045A76	Center console trim cover
3	W706092	Power outlet trim cover fasteners
4	78047A04	Power outlet trim cover
5	7E395	Selector lever cable
6	14A459	Selector lever electrical connector
7	N606678	Selector lever bolts
8	7K004	Selector lever

REMOVAL

MKX only

1. Using a suitable tool, remove the selector lever trim ring.

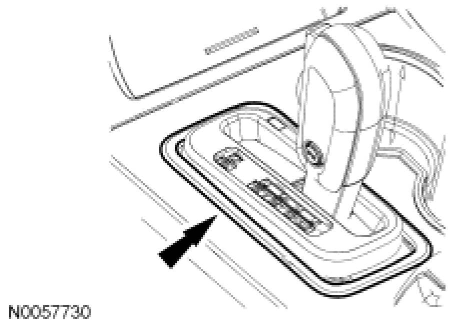


Fig. 65: Locating Selector Lever Trim Ring
Courtesy of FORD MOTOR CO.

All vehicles

2. Lift the armrest. Using a suitable tool, remove the center console trim cover.

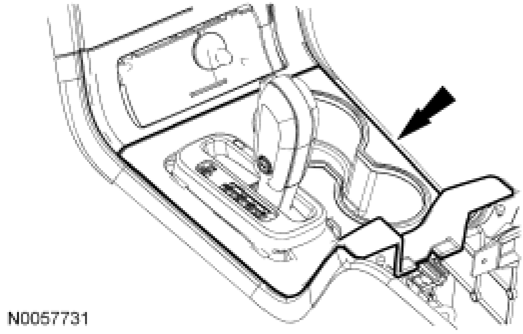


Fig. 66: Identifying Center Console Trim Cover
Courtesy of FORD MOTOR CO.

3. Remove the 2 fasteners and position aside the power outlet trim cover.

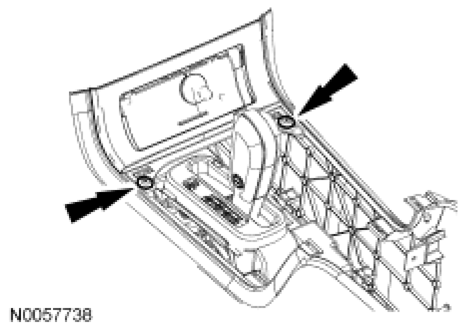


Fig. 67: Identifying Fasteners On Power Outlet Trim Cover
Courtesy of FORD MOTOR CO.

4. Remove the selector lever cable end from the selector lever.

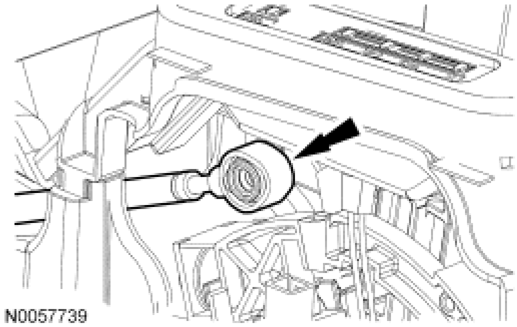


Fig. 68: Identifying Selector Lever Cable End From Selector Lever
Courtesy of FORD MOTOR CO.

5. Release the 2 tabs and remove the selector lever cable from the selector lever housing.

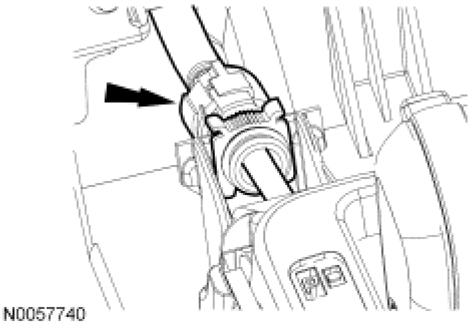


Fig. 69: Locating Selector Lever Cable On Selector Lever Housing
Courtesy of FORD MOTOR CO.

6. Disconnect the selector lever electrical connector.

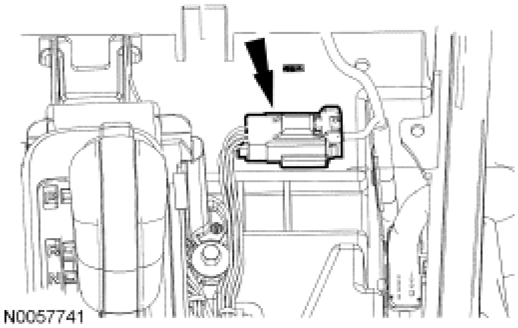
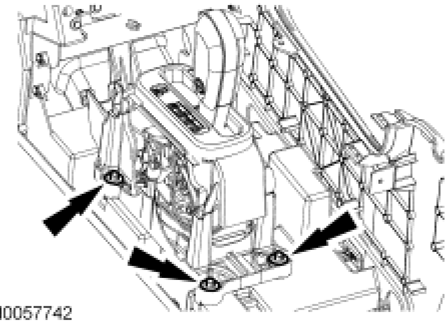


Fig. 70: Locating Selector Lever Electrical Connector
Courtesy of FORD MOTOR CO.

7. Remove the bolts and the selector lever.



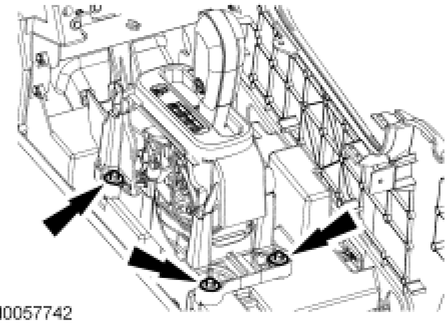
N0057742

Fig. 71: Locating Selector Lever Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

All vehicles

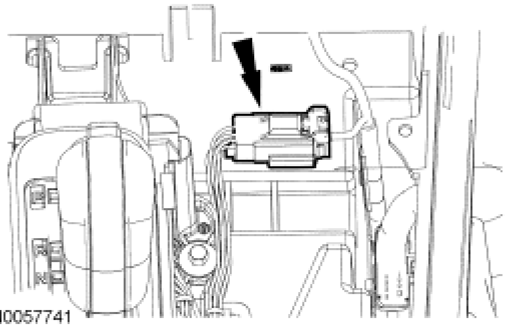
1. Install the selector lever and the bolts.
    - Tighten to 12 N.m (9 lb-ft).



N0057742

Fig. 72: Locating Selector Lever Bolts
Courtesy of FORD MOTOR CO.

2. Connect the selector lever electrical connector.



N0057741

Fig. 73: Locating Selector Lever Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: **When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the selector lever cable end is snapped onto the ball stud. Press the selector lever cable into the selector lever cable bracket and listen for the cable to click in place. Pull back on the selector lever cable to make sure that it is locked into the selector lever cable bracket. Also make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable end to make sure that the selector lever cable end is correctly installed.**

3. Install the selector lever cable in the selector lever housing.

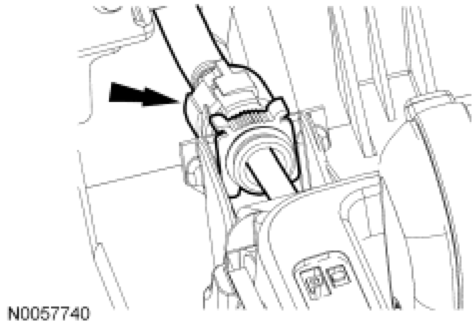


Fig. 74: Locating Selector Lever Cable On Selector Lever Housing
Courtesy of FORD MOTOR CO.

4. Place the selector lever in REVERSE.

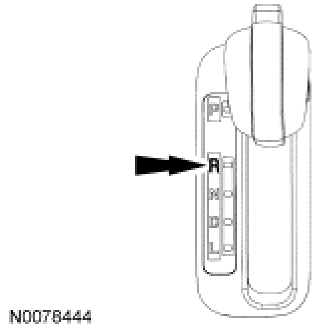


Fig. 75: Identifying REVERSE
Courtesy of FORD MOTOR CO.

5. Disconnect the selector lever cable end from the manual control lever.

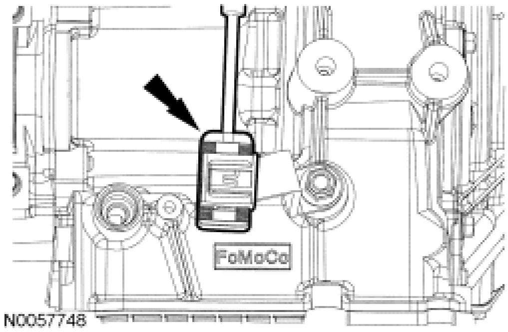


Fig. 76: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

6. Install the selector lever cable end on the selector lever.

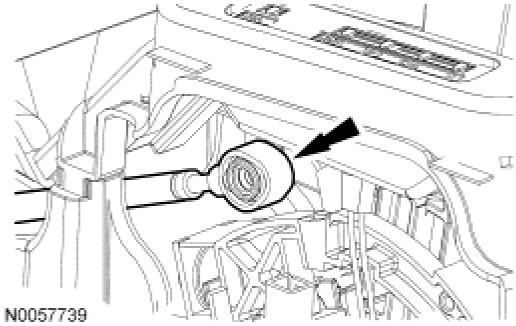


Fig. 77: Identifying Selector Lever Cable End From Selector Lever
Courtesy of FORD MOTOR CO.

7. Place the selector lever in DRIVE.

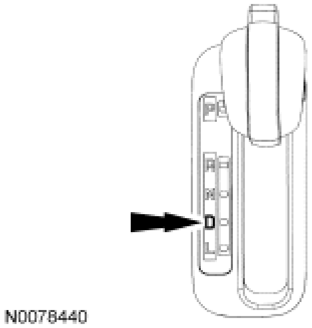


Fig. 78: Placing Selector Lever In Drive
Courtesy of FORD MOTOR CO.

8. Position the power outlet trim cover in place and install the 2 fasteners.

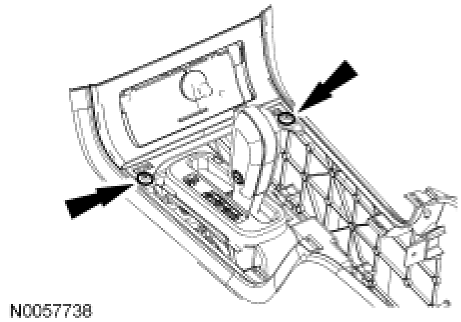


Fig. 79: Identifying Fasteners On Power Outlet Trim Cover
Courtesy of FORD MOTOR CO.

9. Install the center console trim cover.

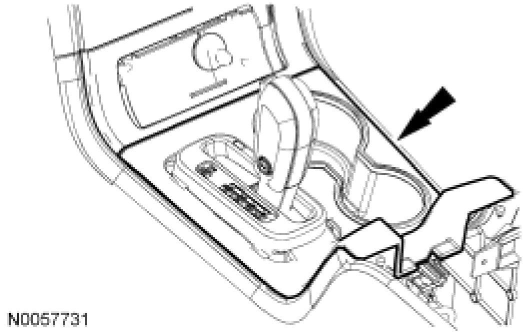


Fig. 80: Identifying Center Console Trim Cover
Courtesy of FORD MOTOR CO.

MKX only

10. Install the selector lever trim ring.

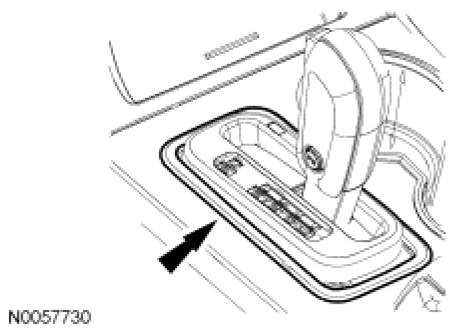


Fig. 81: Locating Selector Lever Trim Ring
Courtesy of FORD MOTOR CO.

All vehicles

11. Place the manual control lever in DRIVE.
    1. Rotate the manual control lever clockwise until it stops.
    2. Rotate the manual control lever counterclockwise one detent.

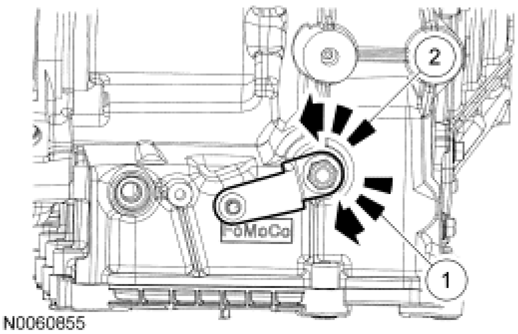


Fig. 82: Rotating Manual Control Lever Clockwise & Counterclockwise
Courtesy of FORD MOTOR CO.

12. Unlock the adjuster.
    1. Pry the latch up.
    2. Push the lock tab to slide it over.

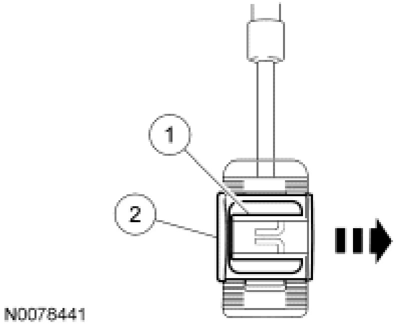


Fig. 83: Pushing Lock Tab To Slide It Over
Courtesy of FORD MOTOR CO.

13. Slide the selector lever cable end forward or backward to align it with the manual control lever.

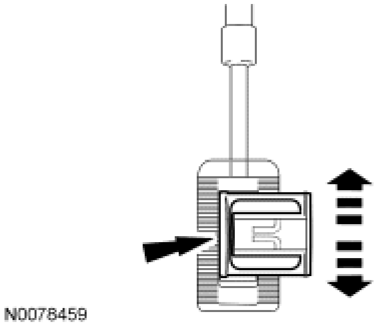


Fig. 84: Sliding Cable End Forward Or Backward To Align It With Manual Control Lever
Courtesy of FORD MOTOR CO.

14. With the adjuster locking tab released, connect the selector lever cable end to the manual control lever.

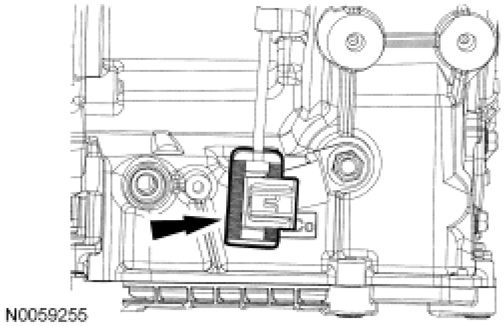


Fig. 85: Connecting Selector Lever Cable End To Manual Lever
Courtesy of FORD MOTOR CO.

15. Slide the release tab back to lock the adjuster.

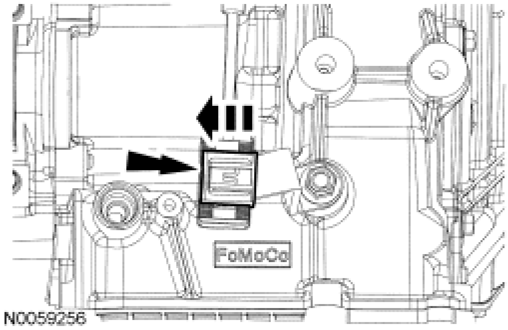


Fig. 86: Sliding Release Tab Back To Lock Adjuster
Courtesy of FORD MOTOR CO.

16. Verify that the vehicle starts in PARK and NEUTRAL only and that the reverse lamps illuminate in REVERSE.

SELECTOR LEVER KNOB

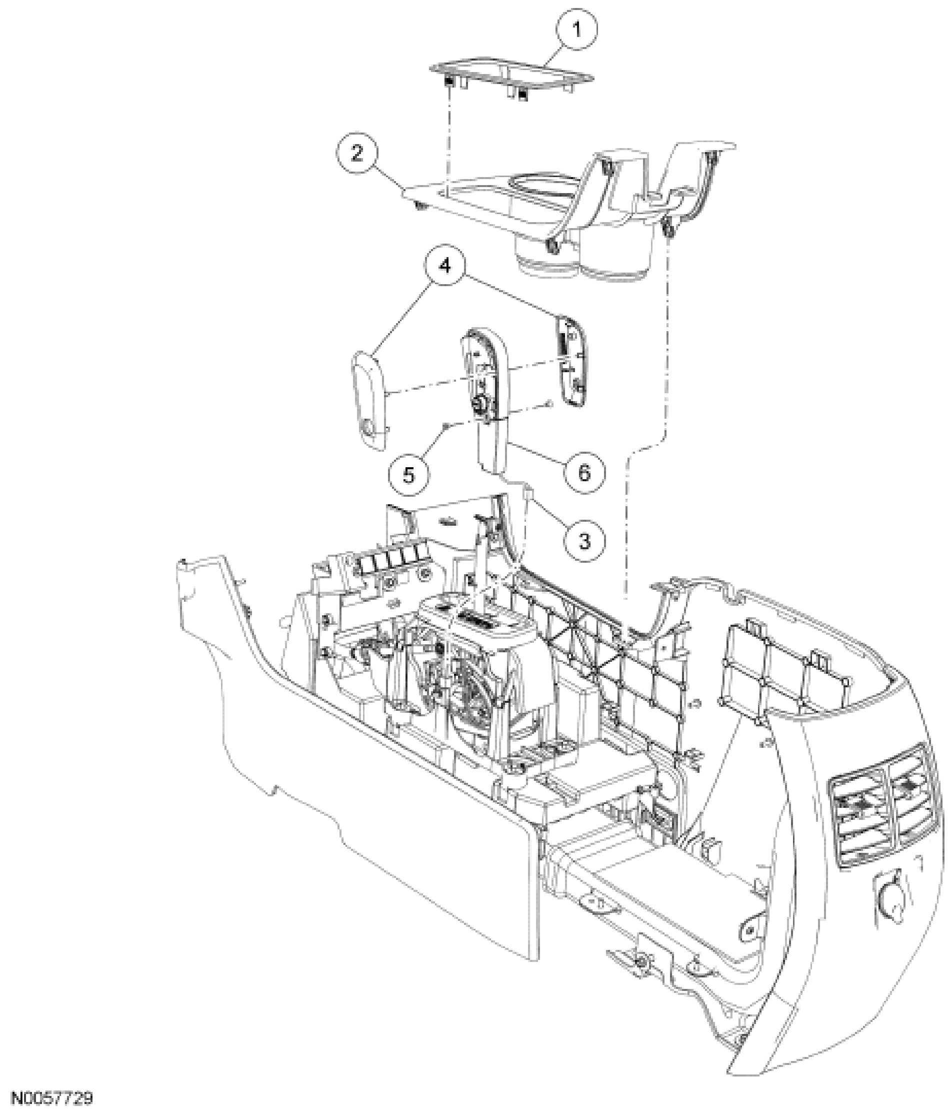


Fig. 87: Exploded View Of Selector Lever Knob & Center Console Trim Cover
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	78061A16	Selector lever trim ring (MKX only)
2	78045A76	Center console trim cover
3	7C453	Transmission control (TC) switch electrical connector
4	-	Selector lever knob trim covers (part of 7L010)
5	W790088	Selector lever knob screw (2 required)
6	7L010	Selector lever knob

REMOVAL

MKX only

1. Using a suitable tool, remove the selector lever trim ring.

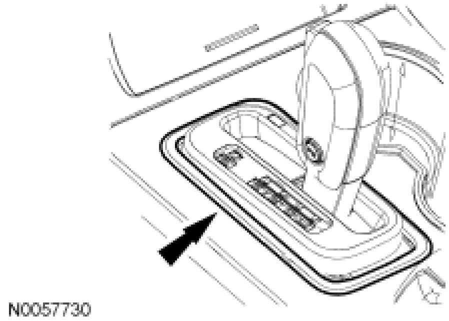


Fig. 88: Locating Selector Lever Trim Ring
Courtesy of FORD MOTOR CO.

All vehicles

2. Lift the armrest. Using a suitable tool, remove the center console trim cover.

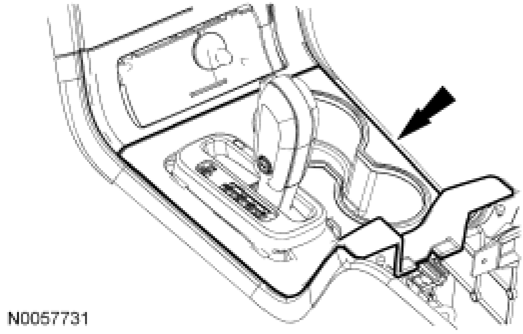


Fig. 89: Identifying Center Console Trim Cover
Courtesy of FORD MOTOR CO.

NOTE: Center console side trim cover removed for clarity.

3. Disconnect the transmission control (TC) switch electrical connector.

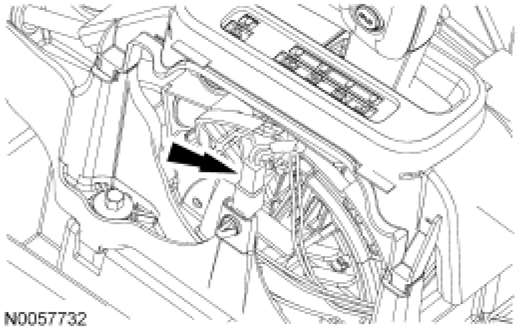


Fig. 90: Locating Transmission Control (TC) Switch Electrical Connector
Courtesy of FORD MOTOR CO.

4. Remove and discard the selector lever knob trim covers by carefully prying out on the bottom front corners, and then pry out on the top front corner and remove the covers.

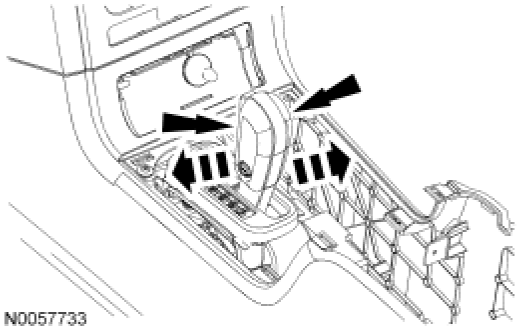


Fig. 91: Removing Selector Lever Knob Trim Covers By Carefully Prying Out On Bottom Front Corners
Courtesy of FORD MOTOR CO.

NOTE: Inspect the knob body for damage. Install a new knob body if necessary.

5. Remove and discard the 2 selector lever knob screws. Remove the selector lever knob while routing the TC switch electrical connector harness out of the selector lever.

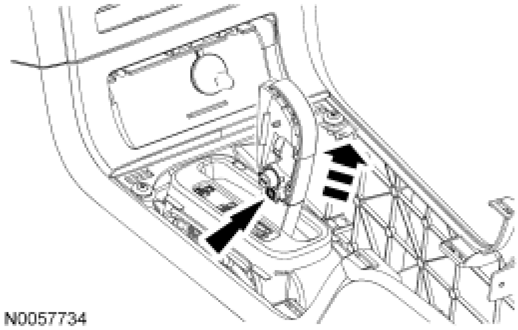


Fig. 92: Removing Selector Lever Knob While Routing TC Switch Electrical Connector Harness Out Of Selector Lever

Courtesy of FORD MOTOR CO.

INSTALLATION

All vehicles

1. Route the TC switch electrical connector harness through the selector lever and install the shift knob and 2 new screws. Loosely install both screws before tightening.
   - Tighten to 2 N.m (18 lb-in).

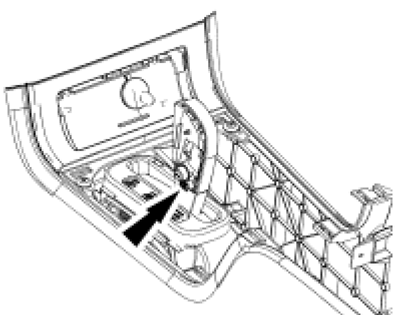


Fig. 93: Routing TC Switch Electrical Connector Harness Through Selector Lever
Courtesy of FORD MOTOR CO.

NOTE: Be sure that the selector lever knob bezel is correctly installed on the selector lever knob.

2. Install new selector lever knob trim covers.

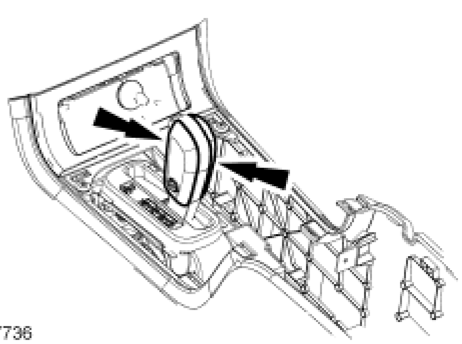


Fig. 94: Identifying Selector Lever Knob Trim Covers
Courtesy of FORD MOTOR CO.

EDGE only

3. Route the TC switch electrical connector wires behind the selector lever bezel light bulb wires.
   1. TC switch electrical connector wires
   2. Selector lever light bulb wires

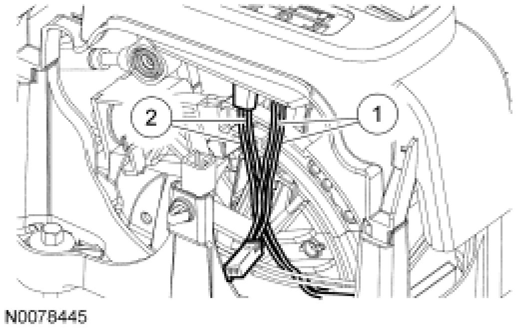


Fig. 95: Identifying Selector Lever Light Bulb Wires
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: **Center console side trim cover removed for clarity.**

4. Connect the TC switch electrical connector.

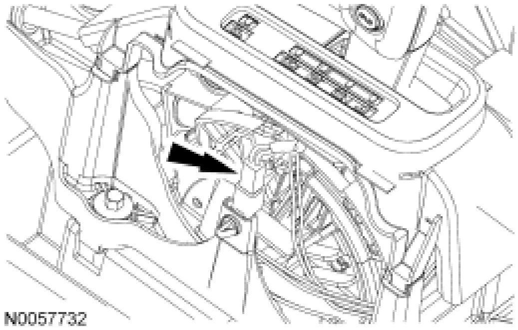


Fig. 96: Locating Transmission Control (TC) Switch Electrical Connector
Courtesy of FORD MOTOR CO.

5. Install the center console trim cover.

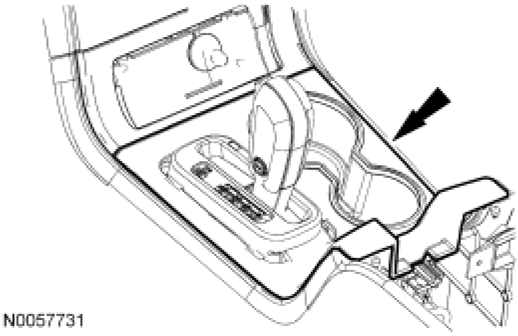


Fig. 97: Identifying Center Console Trim Cover
Courtesy of FORD MOTOR CO.

MKX only

6. Install the selector lever trim ring.

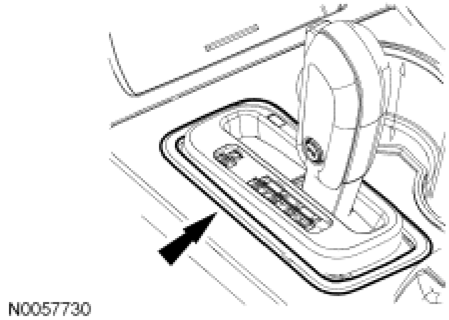


Fig. 98: Locating Selector Lever Trim Ring
Courtesy of FORD MOTOR CO.

2008 TRANSMISSIONS

Transaxle/Transmission Cooling - Edge & MKX

SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Fluid	
MERCON® V, MERCON® SP, Motorcraft Premium Automatic Transmission Fluid, Motorcraft Continuously Variable Chain Type Transmission Fluid and FNR5 transmission fluid are not interchangeable transmission fluids. The use of any transmission fluid other than what is recommended for the transaxle will cause transaxle damage. Refer to the material specification for the correct transmission fluid. The transmission fluid should be changed every 96,560 km (60,000 mi) regardless of normal or special operating conditions.	
CAUTION: Do not use water-based cleaners to clean or flush the transmission fluid cooler tubes or transaxle damage will occur. Mineral spirits can be used to clean the transmission fluid cooler tubes, providing the transmission fluid cooler tubes are flushed with clean transmission fluid and blown dry with shop air. Use only clean transmission fluid designated for this transaxle and torque converter being serviced.	

MATERIAL SPECIFICATIONS

Item	Specification	Fill Capacity
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V	9.5L (10 qt)

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Air cleaner bolt	11	8	-
Air cleaner outlet pipe clamp	5	-	44
Battery tray bolts	10	-	89
Transmission fluid cooler bracket bolts	10	-	89
Transmission fluid cooler thermal bypass valve	9	-	80
Transmission fluid cooler tube bolts	9	-	80
Transmission fluid cooler tube fittings	25	18	-

DESCRIPTION AND OPERATION

TRANSAXLE COOLING

The transmission fluid cooling system consists of the following:

- Oil-to-air transmission fluid cooler
- Transmission fluid cooler tube assembly
- Transmission fluid cooler thermal bypass valve
- Transmission fluid cooler outlet tube
- Transmission fluid cooler return tube

These vehicles are equipped with an external transmission fluid cooler. The transmission fluid cooler is mounted in front of the engine radiator. The transmission fluid cooling system also consists of a transmission fluid cooler thermal bypass valve which is mounted on the transaxle main control cover. When the transmission fluid is below normal operating temperature, transmission fluid travels from the transaxle to the transmission fluid cooler thermal bypass valve then back to the transaxle. When the transmission fluid is at or above normal operating temperature, the transmission fluid cooler thermal bypass valve opens allowing transmission fluid to travel from the transaxle through the transmission fluid cooler then back to the transaxle. The transmission fluid cooler transfers heat from the transmission fluid to the outside air.

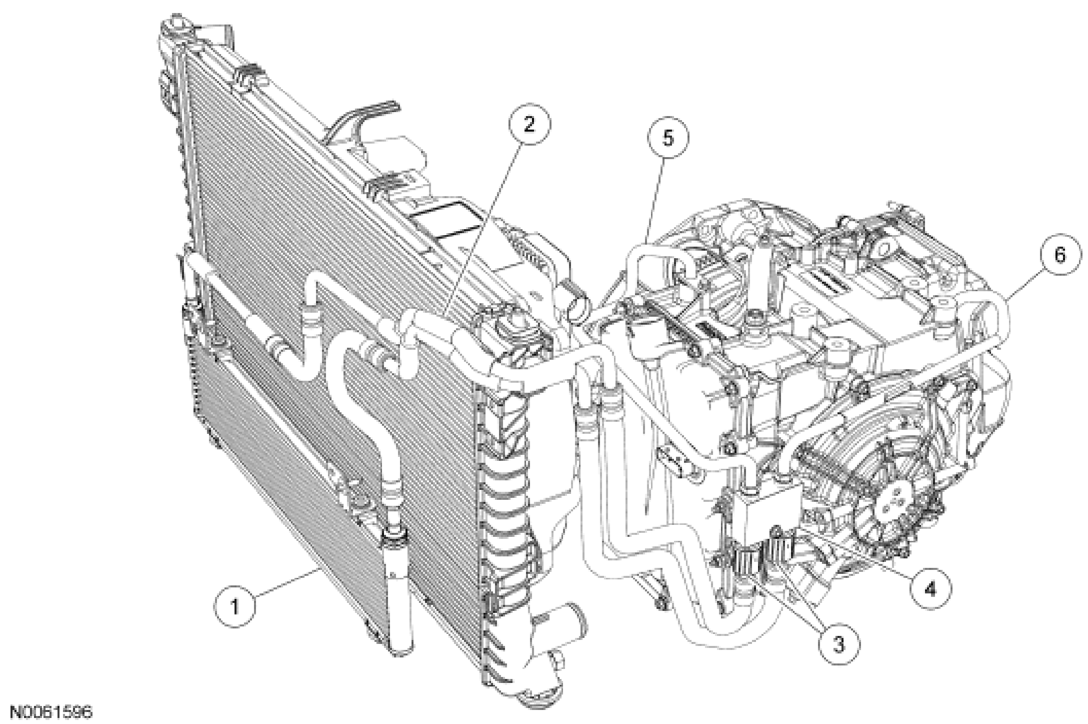


Fig. 1: Identifying Transaxle Cooling System
Courtesy of FORD MOTOR CO.

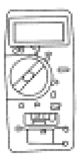
Item	Part Number	Description
1	-	Transmission fluid cooler
2	-	Transmission fluid cooler tube assembly
3	-	Transmission fluid cooler tube secondary latches
4	-	Transmission fluid cooler thermal bypass

		valve
5	-	Transmission fluid cooler outlet tube
6	-	Transmission fluid cooler return tube

DIAGNOSTIC TESTS

TRANSAXLE COOLING

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST1137-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

MATERIAL

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Inspection and Verification

1. Verify the customer concern by operating the vehicle to duplicate the condition.
2. If the inspection reveals obvious concern(s) that can be readily identified, repair as necessary.
3. Install new components if a transmission fluid leak is found in any of the transaxle cooling components.
4. If the concern(s) remains after the inspection, determine the symptom(s). Go to **Symptom Chart - Transaxle Cooling** or Go to **Symptom Chart - Noise, Vibration and Harshness (NVH)**.

Symptom Chart - Transaxle Cooling

Symptom Chart - Transaxle Cooling

Condition	Possible Sources	Action
• Transaxle overheating	• Clogged transmission fluid cooler or transmission fluid cooler tubes • Bent or crushed transmission fluid cooler tubes • Transmission fluid	• INSPECT the transmission fluid cooler, transmission fluid cooler tubes and transmission fluid cooler thermal bypass valve for damage or plugging. INSTALL new components as necessary.

	cooler thermal bypass valve stuck closed	
	• System leaks	• INSPECT transmission fluid cooler and transmission fluid cooler tubes for leaks. SERVICE as required.
	• Internal transaxle concerns	• REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article.

Symptom Chart - Noise, Vibration and Harshness (NVH)

NOTE: Noise, vibration and harshness (NVH) symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.

Symptom Chart - Noise, Vibration and Harshness (NVH)

Condition	Possible Sources	Action
• Vibration - a high frequency (20-80 Hz) that is felt through the seat or gear shifter. Changes with engine speed	• Transmission fluid cooler tubes grounded	• CHECK the transmission fluid cooler tubes. REPAIR as necessary.

Check Transmission Fluid Level and Condition (All Vehicles)

CAUTION: The vehicle should not be driven if the transmission fluid level indicator shows the transmission fluid below the minimum transmission fluid level mark or internal failure could result.

If the vehicle has been operated for an extended period of time, at highway speeds, in city traffic, in hot weather or while pulling a trailer, the transmission fluid needs to cool down to obtain an accurate reading.

The transmission fluid level reading on the transmission fluid level indicator will differ depending on operating and ambient temperatures. The correct reading should be within the normal operating temperature range.

Transmission Fluid Level Check

NOTE: **The transmission fluid should be checked at normal operating temperature 80°C-93°C (175°F-200°F) on a level surface. Normal operating temperature can be reached after approximately 32 km (20 mi) of driving and can be checked using the scan tool.**

Under normal circumstances the transmission fluid level should be checked during normal maintenance. If the transaxle starts to slip, shifts slowly or shows signs of transmission fluid leaking, the transmission fluid level should be checked.

1. With the transaxle in PARK, the engine at idle, foot pressed on the brake, move the selector lever through each gear and allow engagement of each gear. Place the selector lever in the PARK position.
2. Wipe the transmission fluid level indicator cap and remove the transmission fluid level indicator.
3. Wipe the transmission fluid level indicator with a clean cloth.
4. Install the transmission fluid level indicator back in the transmission fluid filler tube until it is fully seated, then remove the indicator. The transmission fluid level should be within the normal operating range.

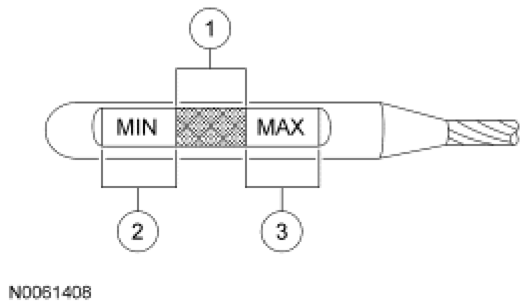


Fig. 2: Identifying Transmission Fluid Indicator
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Correct transmission fluid level at operating temperature 80°C-93°C (175°F-200°F)
2	-	Low transmission fluid level
3	-	High transmission fluid level

High Transmission Fluid Level

A transmission fluid level that is too high may cause the transmission fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of transmission fluid from the vent tube and possible transaxle malfunction and/or damage. If an overfill reading is indicated, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article.

Low Transmission Fluid Level

A low transmission fluid level could result in poor transaxle engagement, slipping, malfunction and/or damage. This could also indicate a leak in one of the transaxle seals or gaskets.

Adding Transmission Fluid

CAUTION: MERCON® V, MERCON® SP, Motorcraft Premium Automatic Transmission Fluid, Motorcraft Continuously Variable Chain Type Transmission Fluid and FNR5 Transmission Fluid are not interchangeable transmission fluids. The use of any fluid other than what is recommended for this transaxle will cause transaxle damage.

If transmission fluid needs to be added, add transmission fluid in 0.25L (1/2 pt) increments through the transmission fluid level indicator tube. Do not overfill the transmission fluid. For transmission fluid type, refer to the **MATERIAL** specification chart.

Transmission Fluid Condition Check

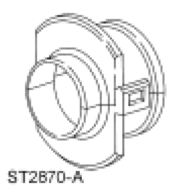
1. Check the transmission fluid level.
2. Observe the color and the odor. The color under normal circumstances should be a dark red color, not brown or black or have a burnt odor.
3. Hold the transmission fluid level indicator over a white facial tissue and allow the transmission fluid to drip onto the facial tissue and examine the stain.
4. If evidence of solid material is found, the transmission fluid pan should be removed for further inspection.
5. If transmission fluid contamination or transaxle failure is confirmed by the sediment in the bottom of the transmission fluid pan, repair the transaxle and clean the transmission fluid cooler tubes and the transmission fluid cooler.
6. If the transaxle is to be overhauled or if installing a new transaxle, the transmission fluid cooler must be backflushed. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article.

REMOVAL AND INSTALLATION

TRANSMISSION FLUID COOLER

SPECIAL TOOLS

Illustration	Tool Name	Tool Number

	Disconnect Tool, Transmission Cooler Line	307-569

MATERIAL

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

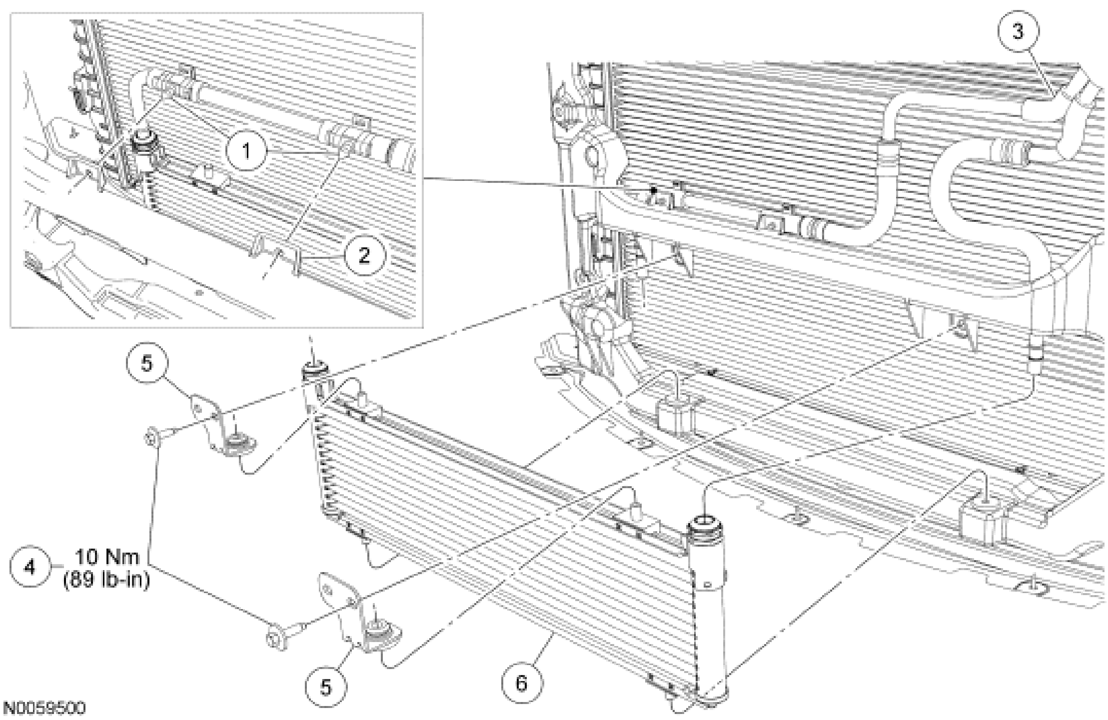


Fig. 3: Exploded View Of Transmission Fluid Cooler With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Transmission fluid cooler tube fasteners
2	-	Radiator support
3	-	Transmission fluid cooler tube assembly
4	-	Transmission fluid cooler mounting bracket bolts
5	-	Transmission fluid cooler mounting brackets
6	-	Transmission fluid cooler

REMOVAL

CAUTION: MERCON® V, MERCON® SP, Motorcraft Premium Automatic Transmission Fluid, Motorcraft Continuously Variable Chain Type Transmission Fluid and FNR5 Transmission Fluid are not interchangeable transmission fluids. The use of any transmission fluid other than what is recommended for this transaxle will cause transaxle damage.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the front bumper cover. For additional information, refer to **BUMPERS** article.
3. Disconnect the 2 transmission fluid cooler tube fasteners from the radiator support.

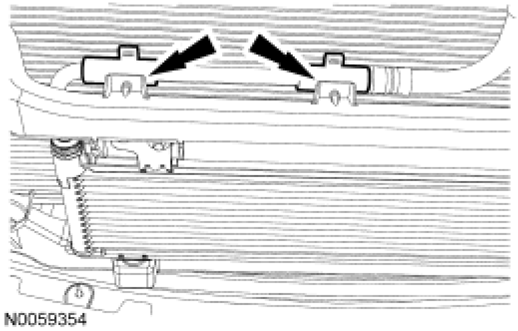


Fig. 4: Locating Transmission Fluid Cooler Tube Fasteners On Radiator Support
Courtesy of FORD MOTOR CO.

4. Remove the secondary latches from the transmission fluid cooler.

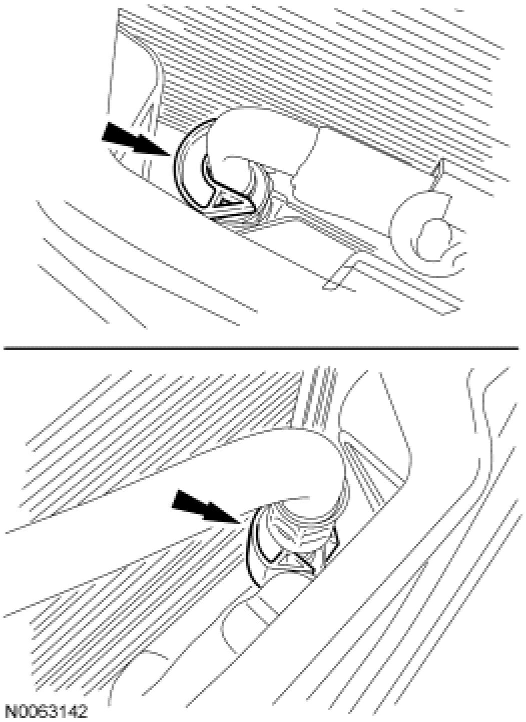


Fig. 5: Locating Secondary Latches On Transmission Fluid Cooler
Courtesy of FORD MOTOR CO.

5. Using the special tool, disconnect the transmission fluid cooler tubes from the transmission fluid cooler.

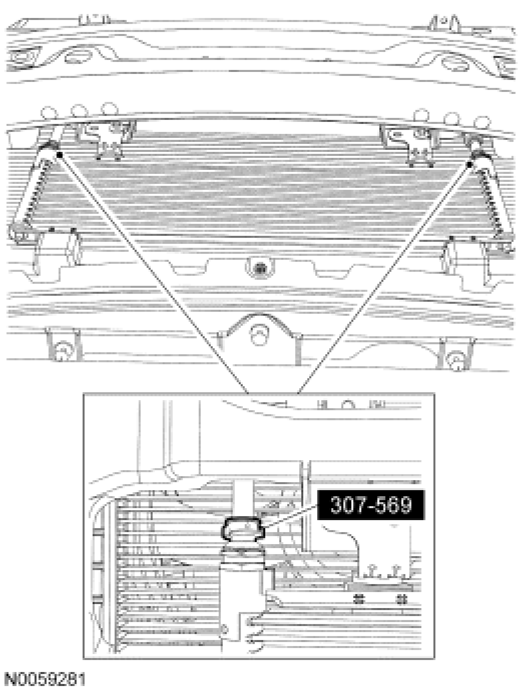


Fig. 6: Disconnecting Transmission Fluid Cooler Tubes From Transmission Fluid Cooler Using

Special Tool (307-569)
Courtesy of FORD MOTOR CO.

6. Remove the 2 bolts and the 2 transmission fluid cooler support brackets.

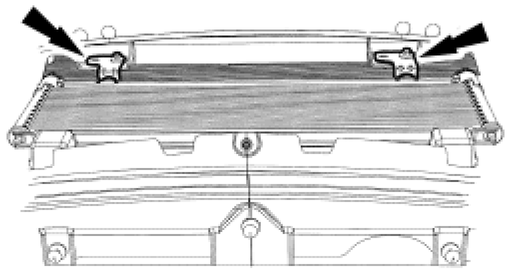


Fig. 7: Locating Transmission Fluid Cooler Support Brackets & Bolts
Courtesy of FORD MOTOR CO.

7. Remove the transmission fluid cooler.

INSTALLATION

1. Position the transmission fluid cooler in place.
2. Install the 2 transmission fluid cooler support brackets and the 2 bolts.
   - Tighten to 10 Nm (89 lb-in).

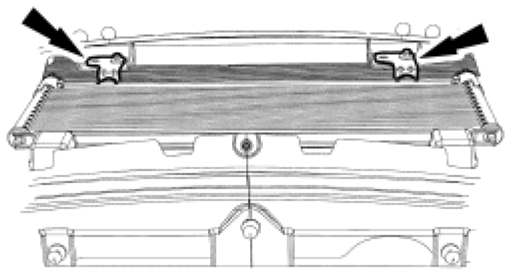


Fig. 8: Locating Transmission Fluid Cooler Support Brackets & Bolts
Courtesy of FORD MOTOR CO.

3. Connect the transmission fluid cooler tubes to the transmission fluid cooler.

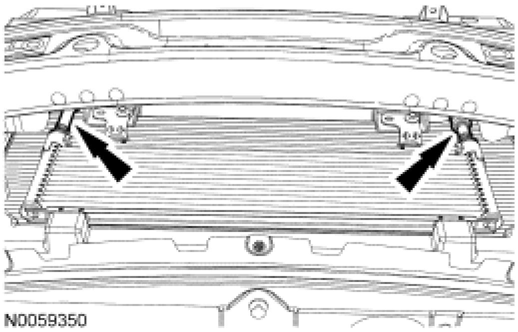


Fig. 9: Locating Transmission Fluid Cooler Tubes On Transmission Fluid Cooler
Courtesy of FORD MOTOR CO.

4. Install the secondary latches on the transmission fluid cooler.

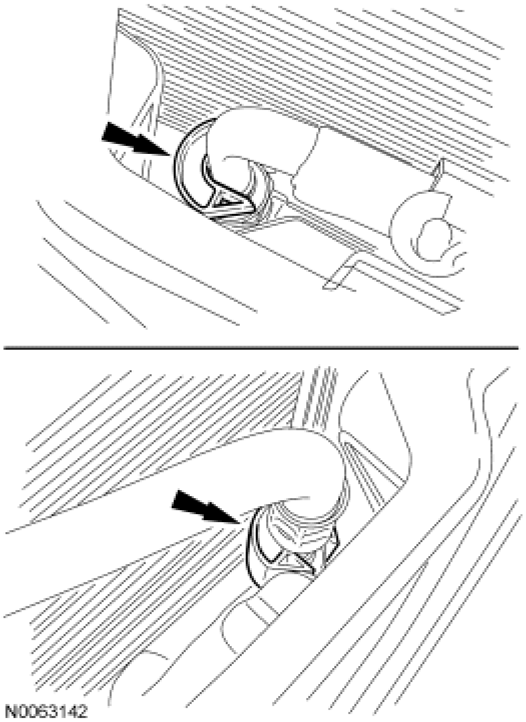


Fig. 10: Locating Secondary Latches On Transmission Fluid Cooler
Courtesy of FORD MOTOR CO.

5. Connect the transmission fluid cooler tube fasteners to the radiator support.

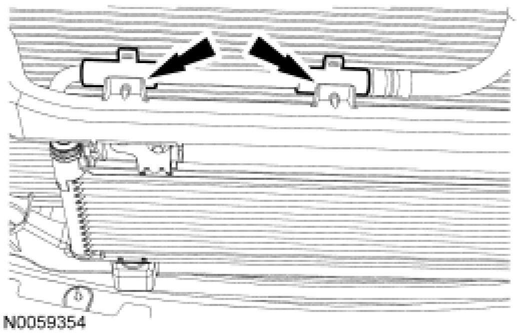
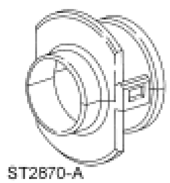


Fig. 11: Locating Transmission Fluid Cooler Tube Fasteners On Radiator Support
Courtesy of FORD MOTOR CO.

6. Install the front bumper cover. For additional information, refer to **BUMPERS** article.
7. Check the transmission fluid level and add transmission fluid as necessary.

TRANSMISSION FLUID COOLER TUBES

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
	Disconnect Tool, Transmission Cooler Line	307-569

MATERIAL

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

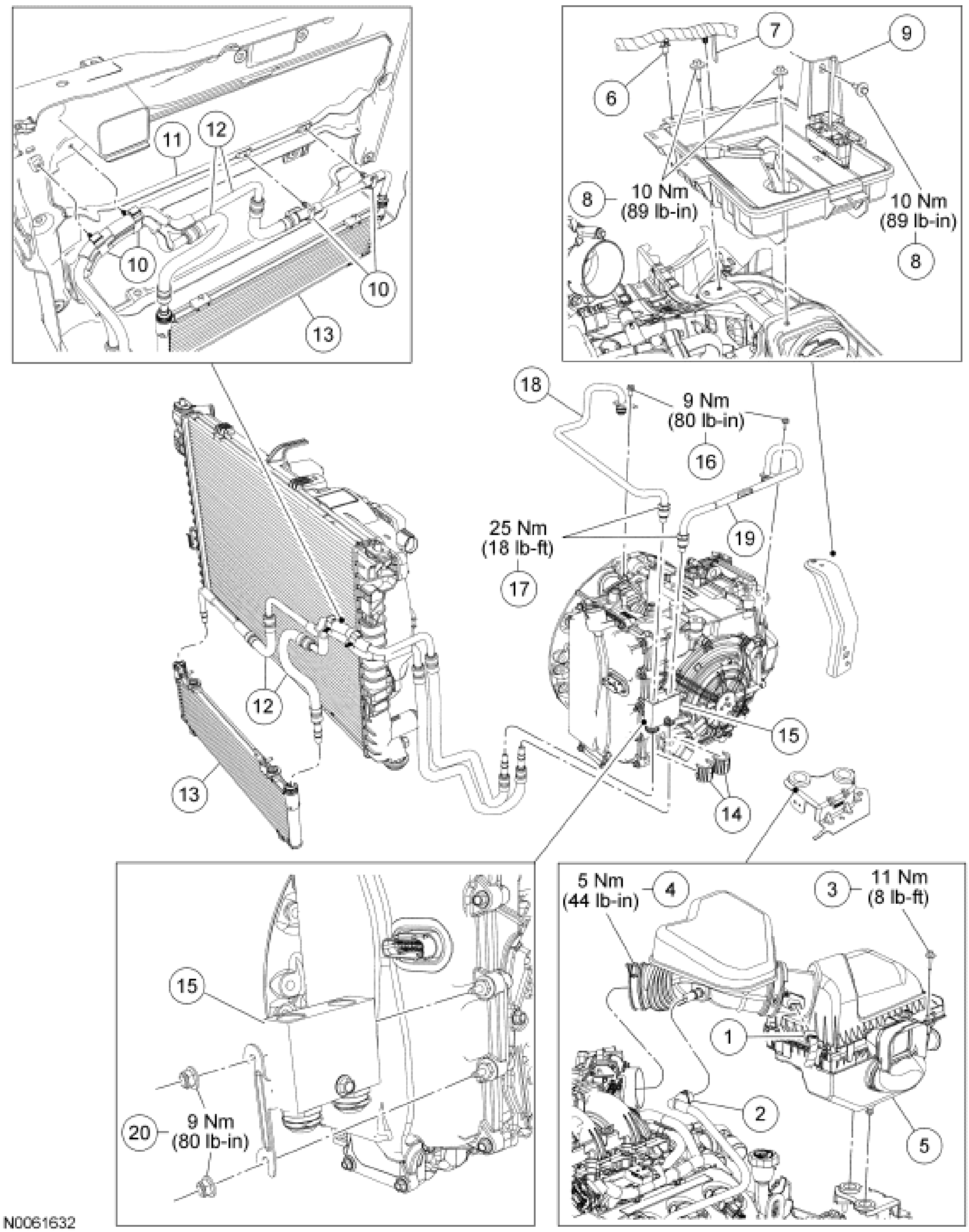


Fig. 12: Exploded View Of Transmission Fluid Cooler Tubes With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Electrical connector - mass air flow (MAF) sensor
2	-	Tube assembly - crankcase vent

3	-	Bolt - air cleaner bracket
4	-	Clamp - air cleaner outlet pipe
5	-	Air cleaner assembly
6	-	Fastener - wiring harness
7	-	Fastener - wiring harness
8	-	Bolts - battery tray
9	-	Battery tray
10	-	Transmission fluid cooler tube fasteners
11	-	Radiator support
12	-	Transmission fluid cooler tube assembly
13	-	Transmission fluid cooler
14	-	Transmission fluid cooler tube secondary latches
15	-	Transmission fluid cooler thermal bypass valve
16	-	Transmission fluid cooler tube bolts
17	-	Transmission fluid cooler tube fittings
18	-	Transmission fluid cooler outlet tube
19	-	Transmission fluid cooler return tube
20	-	Transmission fluid cooler thermal bypass valve nuts

REMOVAL

CAUTION: MERCON® V, MERCON® SP, Motorcraft Premium Automatic Transmission Fluid, Motorcraft Continuously Variable Chain Type Transmission Fluid and FNR5 Transmission Fluid are not interchangeable transmission fluids. The use of any transmission fluid other than what is recommended for this transaxle will cause transaxle damage.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the front bumper cover. For additional information, refer to **BUMPERS** article.
3. Disconnect the mass air flow (MAF) sensor electrical connector and the wiring harness fastener from the air cleaner assembly.

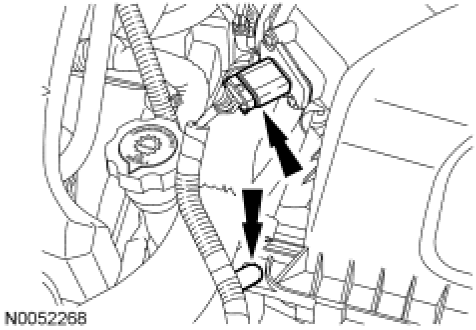


Fig. 13: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

4. Disconnect the brake booster vacuum hose from the air cleaner outlet pipe.

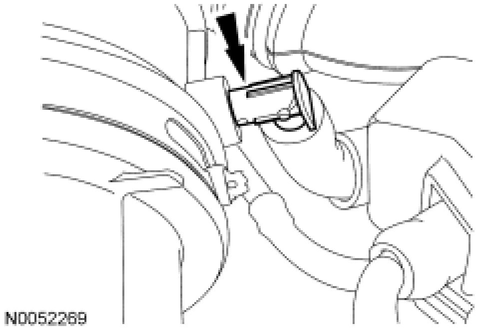


Fig. 14: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

5. Disconnect the engine breather from the air cleaner assembly.

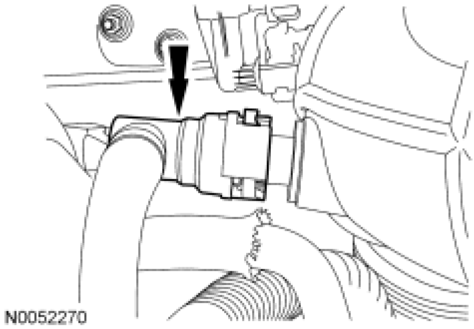


Fig. 15: Locating Engine Breather
Courtesy of FORD MOTOR CO.

6. Remove the air cleaner assembly bracket bolt.

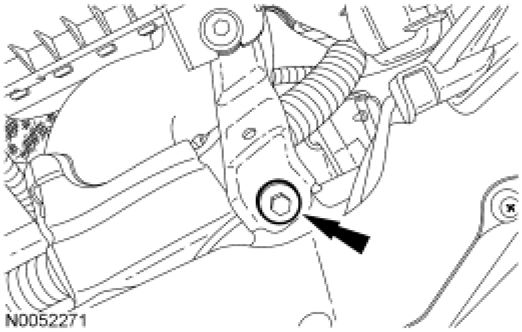


Fig. 16: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

7. Loosen the air cleaner outlet pipe clamp at the throttle body and remove the air cleaner and air cleaner outlet pipe assembly.

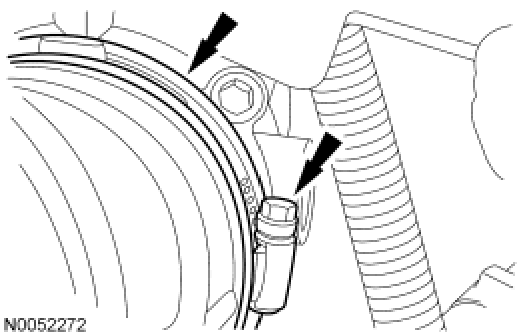


Fig. 17: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

8. Remove the battery. For additional information, refer to **BATTERY, MOUNTING & CABLES** article.
9. Remove the battery tray.
   1. Disconnect the wiring harness fasteners.
   2. Remove the 3 bolts and the battery tray.

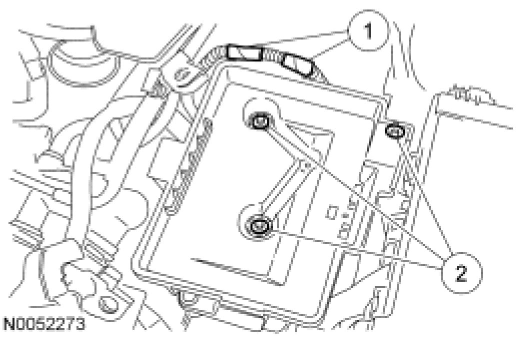


Fig. 18: Identifying Wiring Harness Fasteners, Battery Tray & Bolts
Courtesy of FORD MOTOR CO.

10. Disconnect the transmission fluid cooler tube fasteners from the radiator support.

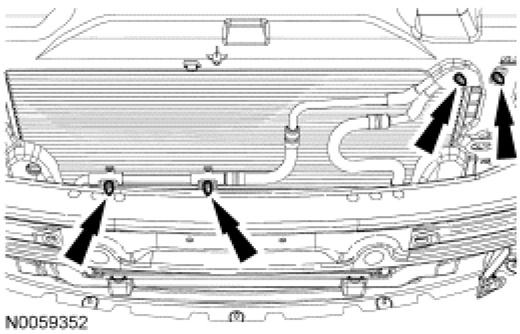


Fig. 19: Locating Transmission Fluid Cooler Tube Fasteners On Radiator Support
Courtesy of FORD MOTOR CO.

11. Remove the secondary latches from the transmission fluid cooler.

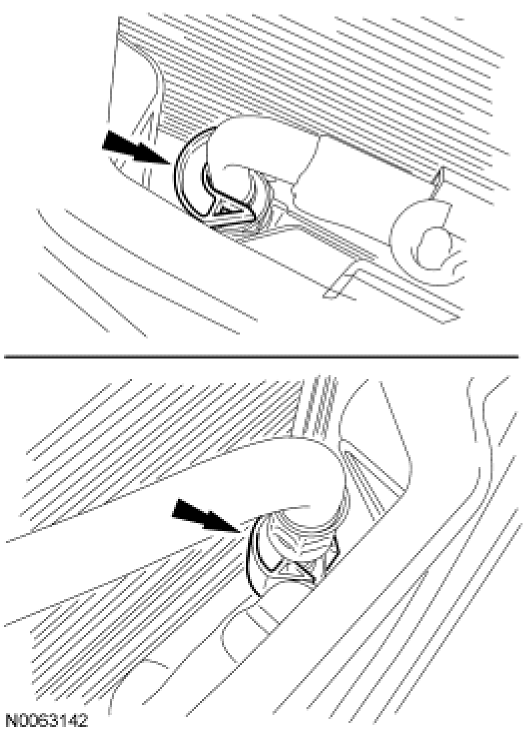


Fig. 20: Locating Secondary Latches On Transmission Fluid Cooler
Courtesy of FORD MOTOR CO.

12. Using the special tool, disconnect the transmission fluid cooler tubes from the transmission fluid cooler.

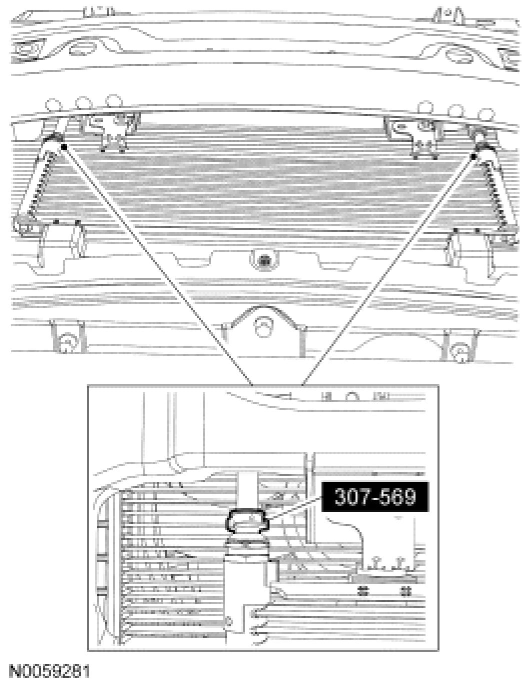


Fig. 21: Disconnecting Transmission Fluid Cooler Tubes From Transmission Fluid Cooler Using Special Tool (307-569)
Courtesy of FORD MOTOR CO.

13. Remove the 2 secondary latches from the transmission fluid cooler tubes at the transmission fluid cooler thermal bypass valve.

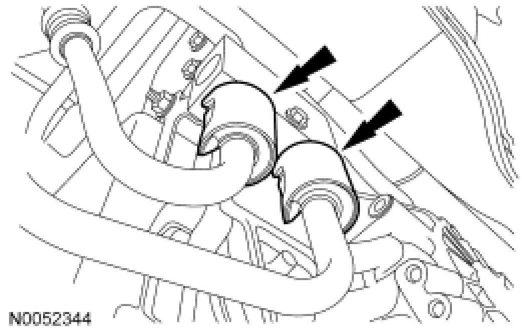


Fig. 22: Locating Secondary Latches On Transmission Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

14. Using the special tool, disconnect the transmission fluid cooler tubes from the transmission fluid cooler thermal bypass valve.

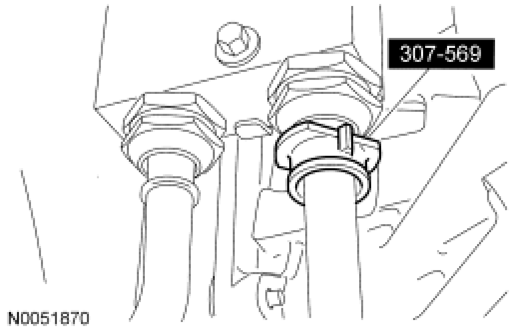


Fig. 23: Disconnecting Transmission Cooling Tubes Using Special Tool (307-569)
Courtesy of FORD MOTOR CO.

NOTE: RH side shown, LH side similar.

15. Pull up on the tabs on both sides of the radiator support, position the radiator back and remove the transmission fluid cooler tubes from the cooling module.

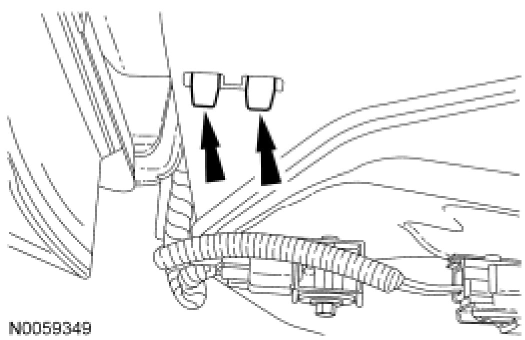


Fig. 24: Locating Tabs On Both Sides Of Radiator Support
Courtesy of FORD MOTOR CO.

16. Remove and discard the 2 transmission fluid cooler tube bolts.

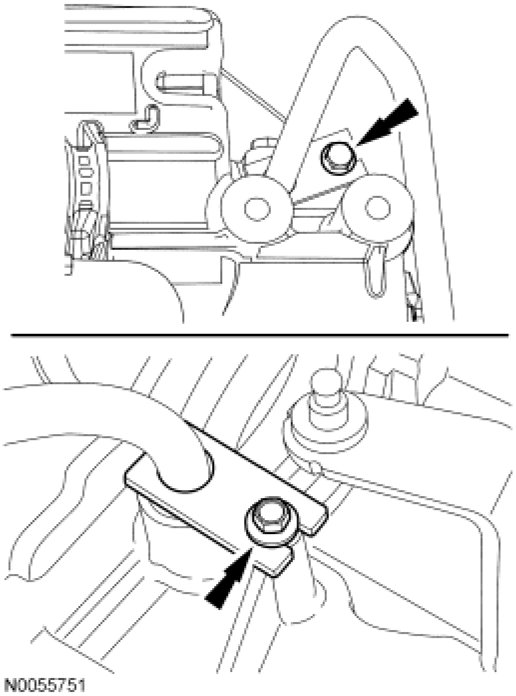


Fig. 25: Identifying Transmission Fluid Cooler Tube Bolts
Courtesy of FORD MOTOR CO.

17. Inspect the transaxle case to be sure that the transmission fluid cooler tube seals and backing rings were removed with the transmission fluid cooler tubes and are not stuck in the transaxle case. If the transmission fluid cooler tube seals or backing rings are stuck in the transaxle case, remove the seals and backing rings.

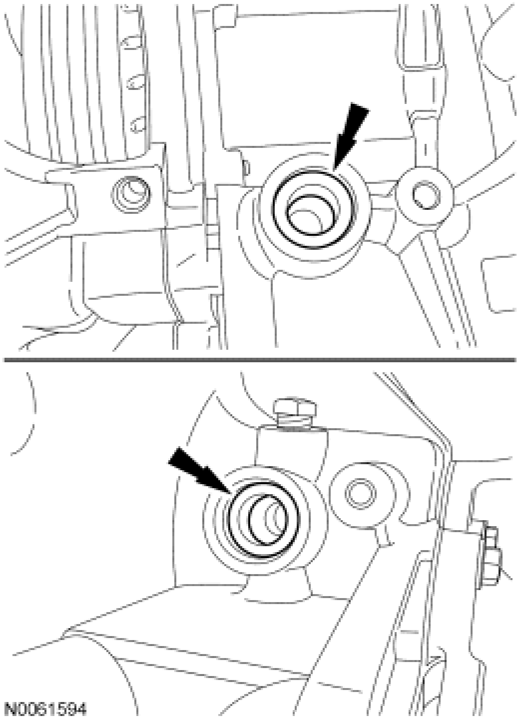


Fig. 26: Locating Transmission Fluid Cooler Tube Seals & Backing Rings
Courtesy of FORD MOTOR CO.

18. Loosen the 2 fluid cooler tube fittings and remove the 2 fluid cooler tubes from the transmission fluid cooler thermal bypass valve and the transaxle.

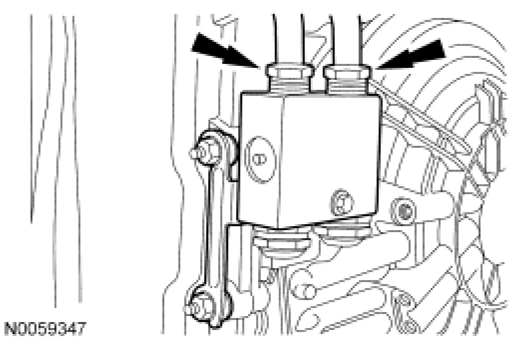


Fig. 27: Locating Fluid Cooler Tube Fittings
Courtesy of FORD MOTOR CO.

19. Remove the 2 nuts and the transmission fluid cooler thermal bypass valve.

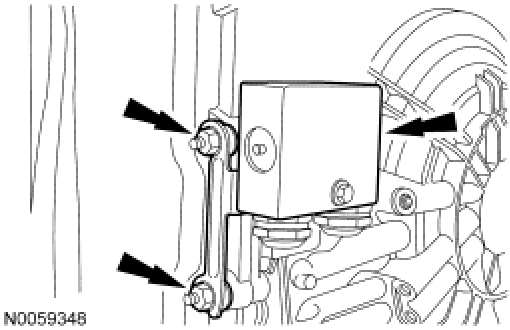


Fig. 28: Locating Thermal Bypass Valve & Nuts
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Position the transmission fluid cooler thermal bypass valve in place and install the 2 nuts.
   - Tighten to 9 Nm (80 lb-in).

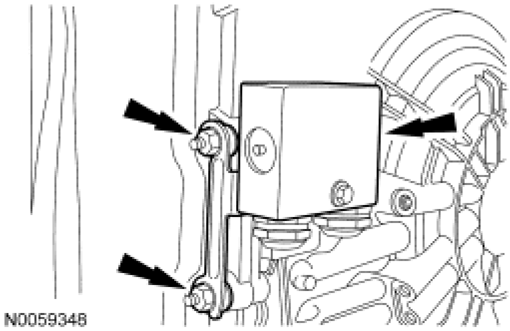


Fig. 29: Locating Thermal Bypass Valve & Nuts
Courtesy of FORD MOTOR CO.

2. Inspect the transmission fluid cooler tube backing rings and seals for damage and install new backing rings or seals if necessary. Lubricate the transmission fluid cooler tube seals with clean transmission fluid and install the backing rings and seals on the transmission fluid cooler tubes.

Item	Part Number	Description
1	7D285	Seal
2	7J324	Backing ring

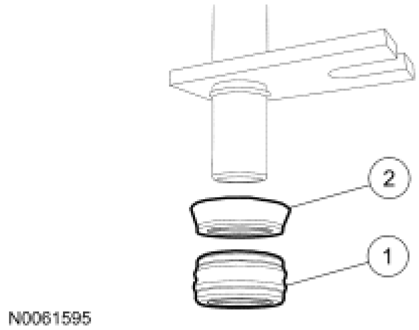


Fig. 30: Identifying Transmission Fluid Cooler Tube Backing Ring & Seal
Courtesy of FORD MOTOR CO.

3. Position the 2 transmission fluid cooler tubes on the transaxle and tighten the 2 transmission fluid cooler tube fittings.
    - Tighten to 25 Nm (18 lb-ft).

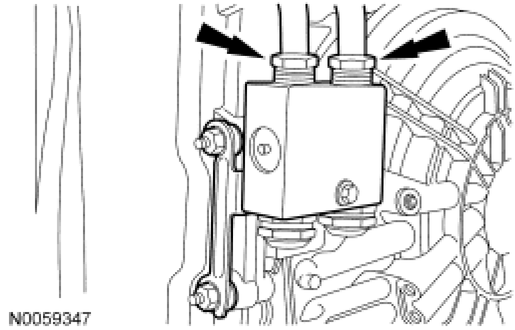


Fig. 31: Locating Fluid Cooler Tube Fittings
Courtesy of FORD MOTOR CO.

4. Install 2 new transmission fluid cooler tube bolts.
    - Tighten to 9 Nm (80 lb-in).

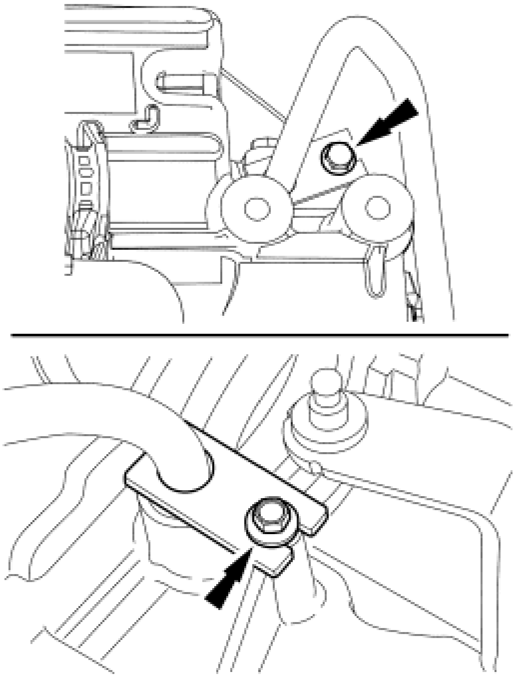


Fig. 32: Identifying Transmission Fluid Cooler Tube Bolts
Courtesy of FORD MOTOR CO.

NOTE: RH side shown, LH side similar.

5. Route the transmission fluid cooler tubes through the cooling module and fasten the upper radiator brackets to the radiator support through the cooling module.

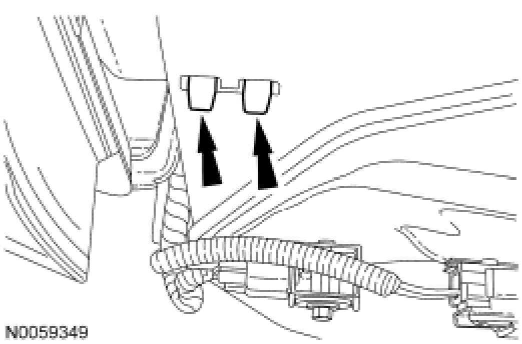


Fig. 33: Locating Tabs On Both Sides Of Radiator Support
Courtesy of FORD MOTOR CO.

6. Install the transmission fluid cooler tubes in the transmission fluid cooler thermal bypass valve.

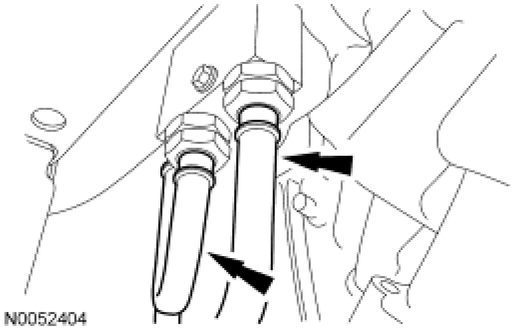


Fig. 34: Locating Transmission Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

7. Install the 2 secondary latches on the transmission fluid cooler tubes at the transmission fluid cooler thermal bypass valve.

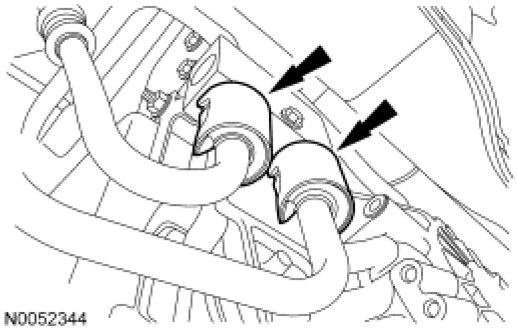


Fig. 35: Locating Secondary Latches On Transmission Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

8. Connect the transmission fluid cooler tubes to the transmission fluid cooler.

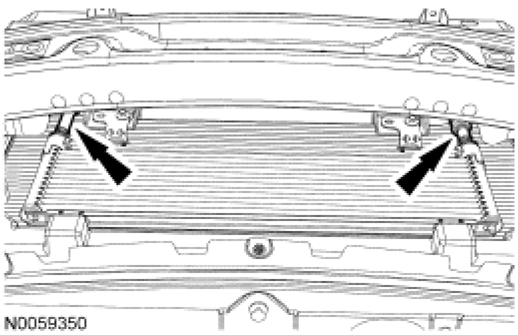


Fig. 36: Locating Transmission Fluid Cooler Tubes On Transmission Fluid Cooler
Courtesy of FORD MOTOR CO.

9. Install the secondary latches on the transmission fluid cooler.

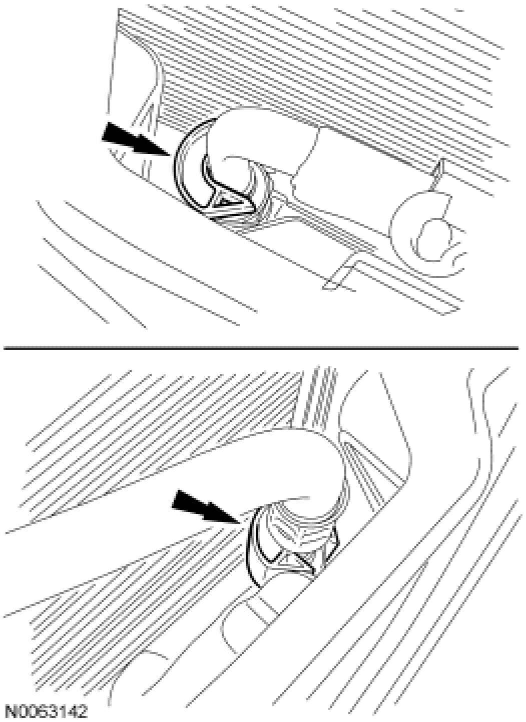


Fig. 37: Locating Secondary Latches On Transmission Fluid Cooler
Courtesy of FORD MOTOR CO.

10. Connect the transmission fluid cooler tube fasteners to the radiator support.

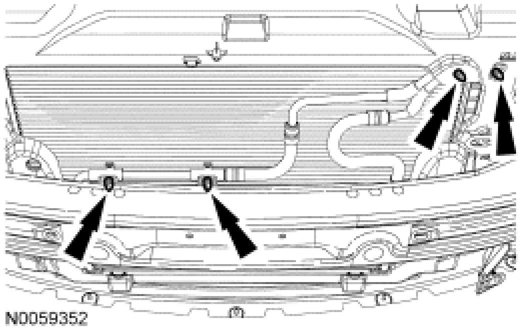


Fig. 38: Locating Transmission Fluid Cooler Tube Fasteners On Radiator Support
Courtesy of FORD MOTOR CO.

11. Install the battery tray.
    1. Install the 3 bolts.
        - Tighten to 10 Nm (89 lb-in).
    2. Connect the wiring harness fasteners to the battery tray.

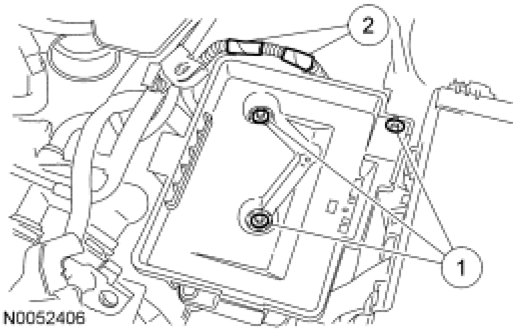


Fig. 39: Identifying Wiring Harness Fasteners, Battery Tray & Bolts
Courtesy of FORD MOTOR CO.

12. Install the battery. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
13. Position the air cleaner assembly in place and install the bolt.
    - Tighten to 11 Nm (8 lb-ft).

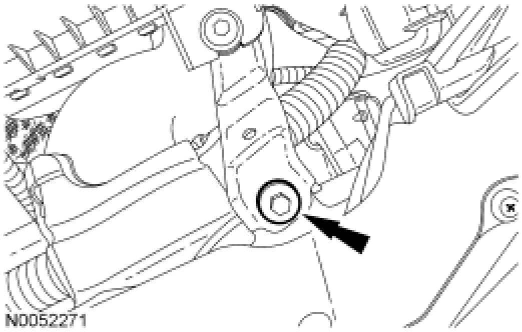


Fig. 40: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

14. Tighten the air cleaner outlet pipe clamp at the throttle body.
    - Tighten to 5 Nm (44 lb-in).

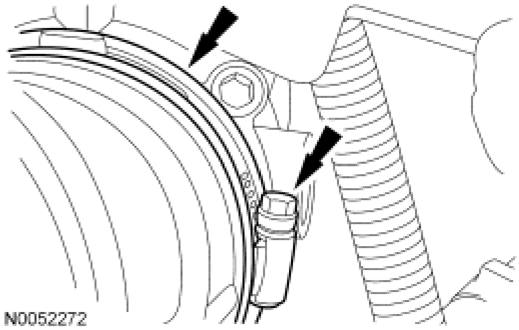


Fig. 41: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

15. Connect the engine breather to the air cleaner assembly.

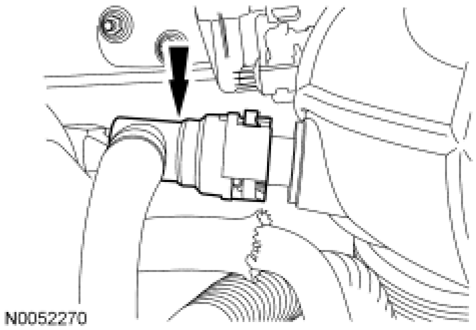


Fig. 42: Locating Engine Breather
Courtesy of FORD MOTOR CO.

16. Connect the brake booster vacuum hose to the air cleaner assembly.

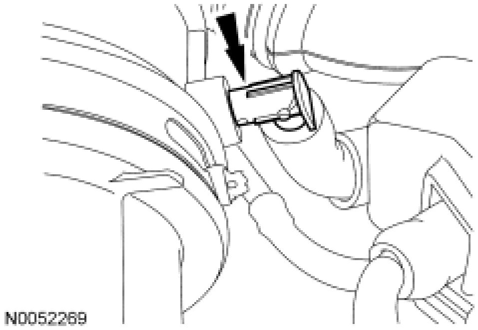


Fig. 43: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

17. Connect the MAF sensor electrical connector and connect the electrical harness fastener.

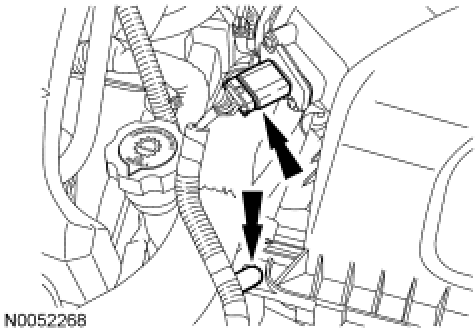


Fig. 44: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

18. Install the front bumper cover. For additional information, refer to **BUMPERS** article.
19. Check the transmission fluid level and add transmission fluid as necessary.

2008 TRANSMISSIONS

Automatic Transaxle/Transmission - Diagnostics, Servicing, & Removal & Installation - 6F50 - Edge & MKX

SPECIFICATIONS

MATERIAL SPECIFICATIONS

Item	Specification	Fill Capacity
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	-	-
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V	9.5L (10 qt)
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B	-

SOLENOID OPERATION CHART

Base Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC (VFS) NL
		SSA (VFS) NL (CB 1, 2, 3, 4)	SSB (VFS) NH (3, 5, R)	SSC (VFS) NL (CB 2, 6)	SSD (VFS) NH (CB L, R/4, 5, 6)	SSE (On/Off) NC	
P	P	Off	On	Off	Off	On	Off
R	R	Off	Off	Off	Off	On	Off
N	N1	Off	On	Off	On	On	Off
	N2	Off	On	Off	Off	Off	Off
	N3	Off	On	Off	Off	On	Off
D	1	On	On	Off	Off[a]	On[b]	Off
	2	On	On	On	On	Off	Off
	3	On	Off	Off	On	Off	Off
	4	On	On	Off	Off	Off	On/Off
	5	Off	Off	Off	Off	Off	On/Off
	6	Off	On	On	Off	Off	On/Off
L	L	On	On	Off	Off[a]	On[b]	Off

CB = Clutch brake
NC = Normally closed
NH = Normally high
NL = Normally low

[a] Turns on above 10 km/h (6 mph).

[b] Turns off above 10 km/h (6 mph).

CLUTCH APPLICATION CHART

Gear	Direct (C 3, 5, R)	Overdrive (C 4, 5, 6)	Forward (CB 1, 2, 3, 4)	Low/ Reverse (CB L, R)	Inter-mediate (CB 2, 6)	One-Way
1st			X	X		X
2nd			X		X	O/R
3rd	X		X			O/R
4th		X	X			O/R
5th	X	X				O/R
6th		X			X	O/R
Reverse	X			X		
CB = Clutch brake O/R = Overrunning						

LINE PRESSURE CHART

Gear	Line
Pressures at Idle[a]	
P	372-413 kPa (54-60 psi)
R	689-724 kPa (100-105 psi)
N	372-413 kPa (54-60 psi)
D	579-600 kPa (84-87 psi)
L	579-600 kPa (84-87 psi)
Pressure at Wide Open Throttle (WOT) Stall[a]	
P	372-413 kPa (54-60 psi)
R	1,724-2,068 kPa (250-300 psi)
N	372-413 kPa (54-60 psi)
D	1,655-1,724 kPa (240-250 psi)
L	1,655-1,724 kPa (240-250 psi)

[a] All pressures are approximate.

STALL SPEED CHART

Engine	Stall Speed
3.5L	2,350-2,650

GEAR RATIO CHART

Gear	Ratio
1st/low	4.484:1
2nd	2.872:1
3rd	1.842:1
4th	1.414:1
5th	1:1
6th	0.742:1
Reverse	2.882:1

SHIFT SPEEDS

Throttle Position	Range	Shift	KM/H	MPH
Light Throttle	D	1-2	14-19	9-12
	D	2-3	24-31	15-19
	D	3-4	32-40	20-25
	D	4-5	45-56	28-35
	D	5-6	63-80	39-50
Medium Throttle	D	1-2	37-47	23-29
	D	2-3	58-71	36-44
	D	3-4	74-93	46-58
	D	4-5	108-135	67-84
	D	5-6	169-211	105-131
Heavy Throttle	D	1-2	55-69	34-43
	D	2-3	84-105	52-65
	D	3-4	127-158	79-98
	D	4-5	167-208	104-129
	D	5-6	179-222	111-138

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Air Cleaner (ACL) assembly bracket bolt	11	-	97
ACL outlet pipe clamp	5	-	44
Battery tray bolts	10	-	89
Catalytic converter nuts	40	30	-
Catalytic converter support bracket bolts	20	-	177
Catalytic converter support bracket nut	40	30	-
Driveshaft bolts	70	52	-
Exhaust Y-pipe assembly clamp	40	30	-
Exhaust Y-pipe assembly nuts	40	30	-
Line pressure tap plug	9	-	80
Lower bumper-to-subframe support nuts	10	-	89
Main control cover bolts[a]	12	-	106
	12	-	106

Main control valve body bolts[a]			
Manual control lever nut	18	-	159
Output Shaft Speed (OSS) sensor bolt	12	-	106
Power steering rack bolts	107	79	-
Power steering rack heat shield bolts	6	-	53
Power Transfer Unit (PTU)-to-transaxle bolts	90	66	-
PTU support bracket bolts	70	52	-
Roll restrictor bolts	90	66	-
Roll restrictor bracket bolts	90	66	-
Roll restrictor heat shield nut	11	-	97
Roll restrictor-to-subframe through bolt	103	76	-
Selector lever cable bracket bolts	12	-	106
Solenoid body bolts[a]	12	-	106
Stabilizer bar bracket bolts	48	35	-
Starter battery terminal	12	-	106
Starter bolts	26	19	-
Starter solenoid terminal	6	-	53
Subframe nuts	150	111	-
Subframe support bracket bolts	103	76	-
Torque converter bolts	55	41	-
Torque converter housing bolts	48	35	-
Transaxle support insulator bolt	55	41	-
Transaxle support insulator bracket nuts	63	46	-
Transaxle support insulator nuts	55	41	-
Transaxle support insulator through bolt	175	129	-
Transmission fluid cooler thermal bypass valve bracket nuts	9	-	80
Transmission fluid cooler tube-to-thermal bypass valve fittings	25	18	-
Transmission fluid cooler tube-to-transaxle case bolts	9	-	80
Transmission fluid drain plug	9	-	80
Transmission fluid filler tube nut	11	-	97
Turbine Shaft Speed (TSS) sensor bolt	12	-	106

[a] Refer to the appropriate procedure.

DIAGNOSTIC TESTS

DIAGNOSTIC STRATEGY

NOTE:	**Do not take shortcuts or assume that critical checks or adjustments have already been made.**

Troubleshooting an electronically controlled automatic transaxle is simplified by using the proven method of diagnosis. One of the most important things to remember is that there is a definite procedure to follow.

Follow the procedures as written to avoid missing critical components or steps.

To correctly diagnose a concern, have the following publications available:

- Appropriate Transaxle articles
- **Introduction - Gasoline Engines** article
- TSBs
- Appropriate SYSTEM WIRING DIAGRAMS article

These publications provide the information required when diagnosing transaxle concerns.

Use the Diagnostic Flow Chart as a guide and follow the steps as indicated.

Preliminary Inspection

- Know and understand the customer's concern.
- Verify the concern by operating the vehicle.
- Check the fluid levels and condition.
- Check for non-factory add-on items.
- Check selector lever linkage for correct adjustment.
- Check TSB messages regarding the concern.

Diagnostics

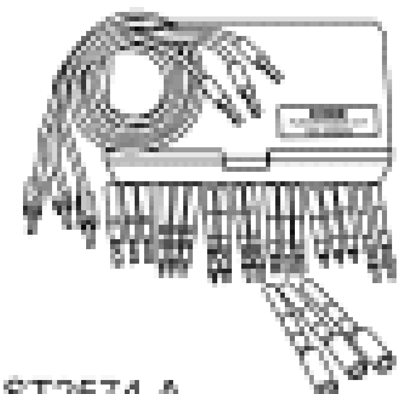
- Carry out On-Board Diagnostic (OBD) procedures Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER).
- Record all DTCs.
- Repair all non-transaxle codes first.
- Repair all transaxle codes second.
- Erase all continuous codes and attempt to repeat them.
- Repair all continuous codes.
- If only pass codes are obtained, refer to **Diagnosis By Symptom** for further information and diagnosis.

Follow the diagnostic sequence to diagnose and repair the concern the first time.

DIAGNOSTIC FLOW CHART

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module	

 ST2574-A	(VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool.	

Prior to carrying out the flow test, the following items should be checked:

- Know and understand the customer concerns.
- Verify the concern by operating the vehicle.
- Check the transmission fluid level and condition.
- Check for non-factory-installed items and verify correct installation.
- Check the selector lever linkage adjustments.
- Check TSB messages for vehicle concerns.
- Carry out both Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) Self Test.
- Record all DTCs.

DIAGNOSTIC FLOW CHART

Test	Result	Action
1) Were any DTCs recorded?	Yes	REPAIR all hard DTCs. FOLLOW the pinpoint tests. REFER to the **Introduction - Gasoline Engines** article first, then this service information, then Go to Step 2.
	No	REFER to **Diagnosis By Symptom**, then Go to Step 5.
2) Are any continuous test memory codes present?	Yes	CLEAR codes and CARRY OUT drive cycle test, then Go to Step 3.
	No	Go to Step 4.

3) Did the continuous test memory codes reappear?	Yes	REPAIR all continuous test memory codes. FOLLOW the pinpoint tests. REFER to the **Introduction - Gasoline Engines** article then the appropriate transmission articles , then this service information, then Go to Step 4.
	No	Go to Step 4.
4) Is the concern repaired?	Yes	CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self test to verify that no DTCs are present. CLEAR memory codes.
	No	REFER to **Diagnosis By Symptom**, then Go to Step 5.
5) Are there any electrical concerns?	Yes	INSTALL the scan tool. CARRY OUT KOEO and KOER tests and drive cycle test with the scan tool, then Go to Step 6.
	No	REFER to the hydraulic and mechanical routine to diagnose and repair the concern, then Go to Step 7.
6) Was the transmission concern corrected when the scan tool was installed?	Yes	REFER to the **Introduction - Gasoline Engines** article, intermittent fault diagnosis and use the scan tool to diagnose cause of concern in the

		processor, vehicle harness or external inputs (sensors or switches).
	No	REFER to the hydraulic and mechanical routine to diagnose the concern, then Go to Step 7.
7) Is the concern repaired?	Yes	CARRY OUT the final quick test to verify that no DTCs are present. CLEAR memory codes.
	No	Concern should have been repaired. GO back through the Diagnostic Flow Chart and review other components that may have contributed to the concern. CHECK and DIAGNOSE those components. Get assistance from other sources.

PRELIMINARY INSPECTION

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

The following items must be checked prior to beginning the diagnostic procedures.

Know and Understand the Concern

In order to correctly diagnose a concern, first understand the customer complaint or condition. Customer contact may be required in order to begin to verify the concern. Understand the conditions as to when the concern occurs. For example:

- Hot or cold vehicle temperature

- Hot or cold ambient temperature
- Vehicle driving conditions
- Vehicle loaded/unloaded

After understanding when and how the concern occurs, proceed to verifying the concern.

Verification of Condition

This article provides information which must be used in both determining the actual cause of customer concerns and carrying out the appropriate procedures.

The following procedures must be used when verifying customer concerns for the transmission.

Determine Customer Concern

NOTE: Some transaxle conditions may cause engine concerns. An electronic pressure control short circuit can cause engine misfiring. The

Torque Converter Clutch (TCC) not disengaging will stall the engine.

Determine customer concerns relative to vehicle use and dependent driving conditions, paying attention to the following items:

- Hot or cold vehicle operating temperature
- Hot or cold ambient temperatures
- Type of terrain
- Vehicle loaded/unloaded
- City/highway driving
- Upshift
- Downshift
- Coasting
- Engagement
- Noise/vibration - check for dependencies, either RPM dependent, vehicle speed dependent, shift dependent, gear dependent, range dependent or temperature dependent.

Check Transmission Fluid Level and Condition

If the vehicle has been operated for an extended period of time at highway speeds, in city traffic, in hot weather or while pulling a trailer, the transmission fluid needs to cool down to obtain an accurate reading.

The transmission fluid level reading on the transmission fluid level indicator will differ depending on operating and ambient temperatures. The correct reading should be within the normal operating temperature range.

Transmission Fluid Level Check

Under normal circumstances, the transmission fluid level should be checked during normal maintenance. If the transaxle starts to slip, shifts slowly or shows signs of transmission fluid leaking, the transmission fluid level should be checked.

1. With the selector lever in PARK, the engine at idle and foot pressed on the brake, move the selector lever through each gear and allow engagement of each gear. Place the selector lever in the PARK position.
2. Wipe the transmission fluid level indicator cap and remove the transmission fluid level indicator.
3. Wipe the transmission fluid level indicator with a clean cloth.
4. Install the transmission fluid level indicator back in the transmission fluid filler tube until it is fully seated, then remove the transmission fluid level indicator. The transmission fluid level should be within the normal operating range.

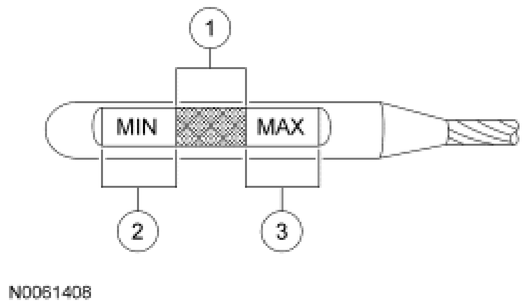


Fig. 1: Identifying Transmission Fluid Indicator
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Correct transmission fluid level at normal operating temperature 80°C-93°C (175°F-200°F)
2	-	Low transmission fluid level
3	-	High transmission fluid level

High Transmission Fluid Level

A transmission fluid level that is too high may cause the transmission fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of transmission fluid from the vent tube and possible transaxle malfunction and/or damage. If an overfill reading is indicated, refer to **Transmission Fluid Drain and Refill**.

Low Transmission Fluid Level

A low transmission fluid level could result in poor transaxle engagement, slipping, malfunction and/or damage. This could also indicate a leak in one of the transaxle seals or gaskets.

Adding Transmission Fluid

NOTE: The use of any other type of transmission fluid than specified could result in transaxle malfunction and/or damage.

If transmission fluid needs to be added, add transmission fluid in 0.25L (1/2 pt) increments through the transmission fluid filler tube. Do not overfill the transmission fluid.

Transmission Fluid Condition Check

1. Check the transmission fluid level.
2. Observe the color and the odor. The color under normal circumstances should be dark reddish, not brown or black or have a burnt odor.
3. Hold the transmission fluid level indicator over a white facial tissue and allow the transmission fluid to drip onto the facial tissue and examine the stain.
4. If evidence of solid material is found, the transmission fluid pan should be removed for further inspection.
5. If the stain is a foamy pink color, this may indicate coolant in the transaxle. The engine cooling system should also be inspected at this time.
6. If transmission fluid contamination or transaxle failure is confirmed by the sediment in the transmission fluid, the transaxle must be disassembled and completely cleaned. This includes the torque converter, cooler bypass valve, coolers and cooler tubes.
7. Carry out diagnostic checks and adjustments, refer to **Diagnosis By Symptom**.

Water in Transmission Fluid

To correctly repair a transmission or transaxle that has had water or coolant introduced into the system, completely disassemble, clean and replace the following parts:

- All internal and external seals
- All friction material; clutches and bands
- Torque converter
- All parts with bonded seals
- All solenoids
- All transmission fluid filters

Prior to installing the transmission or transaxle, the transmission fluid cooler(s), transmission fluid cooler tubes and transmission fluid cooler hoses need to be flushed and cleaned.

ROAD TESTING VEHICLE

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

NOTE: If a new or remanufactured transaxle assembly is being installed or a new solenoid body is installed, the PCM will have to be reflashed with a new

solenoid body strategy and identification data file. The solenoid body strategy drive cycle should also be carried out. Refer to Solenoid Body Strategy.

The Shift Point Road Test and Torque Converter Operation Test provide diagnostic information on shift controls and torque converter operation.

SOLENOID BODY STRATEGY

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Solenoid Body Identification Procedure

1. Using the scan tool, select Powertrain, Transmission and Transmission Solenoid Body Identification from the toolbox icon and follow the instructions displayed on the scan tool.

   The solenoid body identification screen displays solenoid body identification information:

   - Solenoid body identification - 7-digit
   - Solenoid body strategy - 13-digit

     The next screen displays the current solenoid body identification and strategy data file stored in the PCM. If the solenoid body strategy field is blank, the module contains a partial transmission solenoid body strategy. This is due to a corrupt or missing file at the time the programmable parameters were completed.

2. Compare the solenoid body identification and strategy (if available) to the solenoid body service tag or the replacement solenoid body tag located on top of the transaxle case.

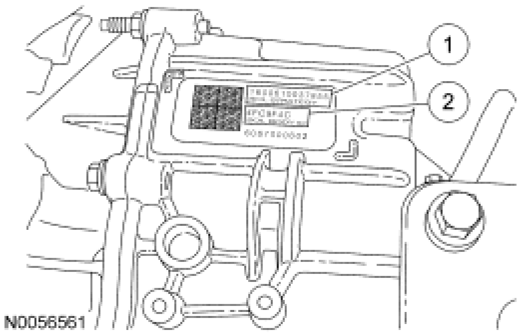


Fig. 2: Original Solenoid Body Service Tag
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Thirteen-digit solenoid body strategy
2	-	Seven-digit solenoid body identification

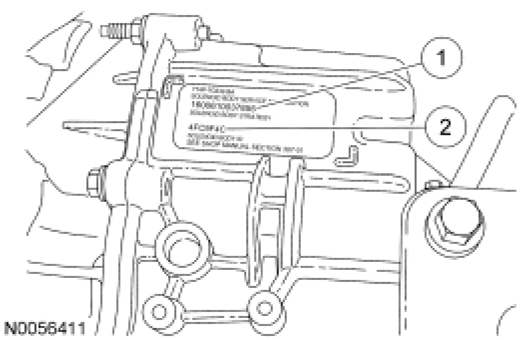


Fig. 3: Replacement Solenoid Body Service Tag
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Thirteen-digit solenoid body strategy
2	-	Seven-digit solenoid body identification

3. If the solenoid body identification and strategy on the scan tool match the solenoid body service tag or replacement tag, then the solenoid body identification and strategy are correct for this transaxle and a solenoid body strategy download is not required. If the solenoid body service tag or replacement tag is missing or damaged so that it is not readable or does not match the identification or strategy on the scan tool, remove the main control cover, refer to **Main Control Cover**.

   The 7-digit identification number and the 13-digit strategy number are stamped on the solenoid body.

   NOTE: **If the solenoid body information does not match the module information, transaxle damage or driveability concerns can occur.**

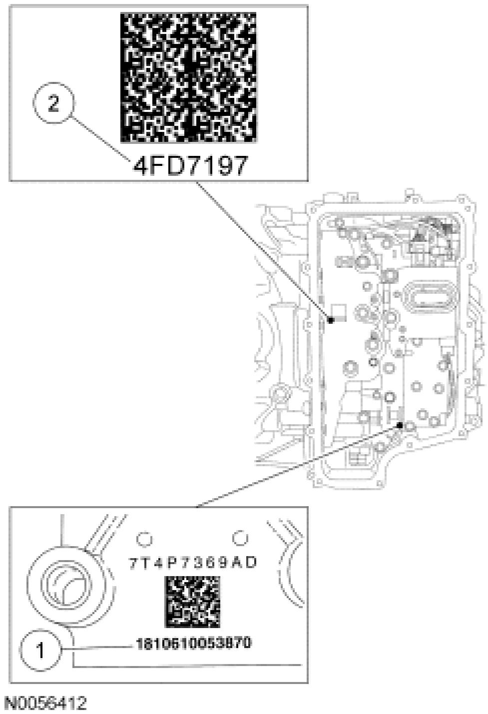


Fig. 4: Solenoid Body Identification Tag
Courtesy of FORD MOTOR CO.

4. Inspect the solenoid body identification and strategy stamped on the solenoid body and compare this to the solenoid body service tag on the transaxle case. If the solenoid body identification and strategy stamped on the solenoid body does not match the solenoid body service tag or if the solenoid body identification and strategy stamped on the solenoid body match the solenoid body service tag on the transaxle case but do not match the solenoid body identification and strategy numbers displayed on the scan tool, a solenoid body strategy data download is required.

Item	Part Number	Description
1	-	Thirteen-digit solenoid body strategy
2	-	Seven-digit solenoid body identification

Solenoid Body Strategy Data Download

1. Using the scan tool, select module programming and programmable parameters under the toolbox icon and select transmission. Follow the instructions displayed on the scan tool.

   There are fields to enter the solenoid body 7-digit identification and 13-digit strategy recorded from the solenoid body.

NOTE: If the solenoid body information is not correct, transaxle damage or driveability concerns can occur.

2. Enter the solenoid body identification and strategy.

   The scan tool will verify that the numbers entered are valid and display a message if the information is not valid.

   The scan tool checks to see if the file is present on the scan tool. If the file is present, the technician may proceed with downloading the file to the PCM. If the file is not present, the scan tool will need to be connected to the Professional Technician Society (PTS) server to download the file onto the scan tool.

3. Verify that the file is present on the scan tool. If the file is present, go to Step 8. If the file is not present, continue with this procedure.
4. Connect the scan tool to the PTS server.

   The screen will display a progress bar when connecting to the network.

5. Follow the instructions on the network to download the strategy file to the scan tool.

   The screen will display a progress bar when downloading the strategy file to the scan tool and display a message if it is downloaded successfully.

6. If the scan tool cannot connect to the PTS server, download the file from www.motorcraft.com.

   If the scan tool cannot download a strategy from the web site, a partial strategy will automatically be downloaded.

7. Reconnect the scan tool to the vehicle.
8. Follow the instructions displayed on the scan tool.
9. If a new solenoid body was installed, compare the 7-digit identification and the 13-digit strategy fields from the solenoid body to the replacement solenoid body tag provided with the solenoid body service kit and place it over the existing identification tag.

   The scan tool will automatically download the strategy file or partial strategy file to the PCM and will display a progress bar while downloading. The scan tool will display a message when it is finished downloading the data that states that the file was downloaded successfully.

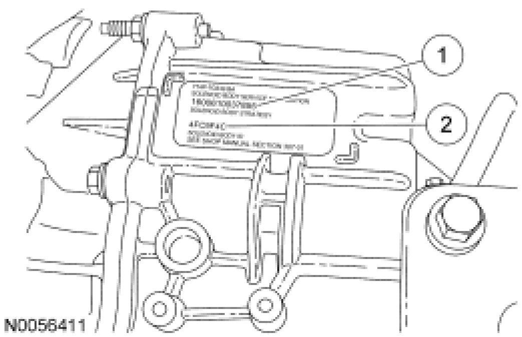


Fig. 5: Replacement Solenoid Body Service Tag

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Thirteen-digit solenoid body strategy
2	-	Seven-digit solenoid body identification

NOTE: If a drive cycle is not completed, the customer may feel erratic shifts and driveability concerns.

10. Test drive the vehicle. Refer to **Solenoid Body Strategy Drive Cycle**.

Solenoid Body Strategy Drive Cycle

Carry out the drive cycle after downloading the solenoid body strategy data file to the PCM.

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

NOTE: The engine and transaxle must be at normal operating temperature.

1. Bring the transaxle to normal operating temperature.
2. With the engine running and the brake applied, move the selector lever through the gears in the following order, pausing in each gear for 4 seconds: N, R, N, D, R, D, N. Repeat this pattern 2 times. If any engagements feel soft or harsh, repeat this procedure.
3. Drive the vehicle and accelerate at a moderate throttle so that the upshifts occur at 2,000 RPM up to 80 km/h (50 mph) and brake moderately to a stop. Repeat this pattern 2 times.
4. Drive the vehicle and accelerate at a moderate throttle so that the upshifts occur at 3,000 RPM up to 80 km/h (50 mph) and brake moderately to a stop. Repeat this pattern 2 times.
5. With the engine running and the brake applied, move the selector lever through the gears in the following order, pausing in each gear for 4 seconds: N, R, N, D, R, D, N. Repeat this pattern 2 times.

SHIFT POINT ROAD TEST

This test verifies that the shift control system is operating correctly.

1. Bring engine and transaxle up to normal operating temperature.
2. Operate vehicle with selector lever in D range.

NOTE: Shift speed ranges are approximate for all applications. For specific applications (engine, axle ratio and application) refer to the Automatic Transmission Specification Issue available from Ford Customer Service Division.

3. Apply minimum throttle and observe speeds at which upshift occurs and torque converter engages using

the shift speeds chart.

SHIFT SPEEDS

Throttle Position	Range	Shift	KM/H	MPH
Light Throttle	D	1-2	14-19	9-12
	D	2-3	24-31	15-19
	D	3-4	32-40	20-25
	D	4-5	45-56	28-35
	D	5-6	63-80	39-50
Medium Throttle	D	1-2	37-47	23-29
	D	2-3	58-71	36-44
	D	3-4	74-93	46-58
	D	4-5	108-135	67-84
	D	5-6	169-211	105-131
Heavy Throttle	D	1-2	55-69	34-43
	D	2-3	84-105	52-65
	D	3-4	127-158	79-98
	D	4-5	167-208	104-129
	D	5-6	179-222	111-138

4. With vehicle speed above 43 km/h (27 mph), press accelerator pedal to floor, Wide Open Throttle (WOT). The transaxle should shift from 4th to 3rd, or 4th to 2nd, depending on the vehicle speed. The Torque Converter Clutch (TCC) should release.
5. With vehicle speed above 56 km/h (35 mph), move the selector lever from D (DRIVE) range to L (LOW) range and remove foot from accelerator pedal. The transaxle should immediately downshift to 2nd gear. When vehicle speed drops below 32 km/h (20 mph), the transaxle should downshift into 4th gear.
6. If the transaxle fails to upshift/downshift or TCC does not apply and release, refer to **Diagnosis By Symptom** for possible causes.

TORQUE CONVERTER DIAGNOSIS

Prior to torque converter installation, all diagnostic procedures must be followed. This is to prevent the unnecessary installation of new or remanufactured torque converters. Only after a complete diagnostic evaluation can the decision be made to install a new or remanufactured torque converter.

Begin with the normal diagnostic procedures as follows:

1. Preliminary Inspection
2. Know and Understand the Customer's Concern
3. Verify the Concern - carry out the Torque Converter Clutch (TCC) Operation Test.
4. Carry out Diagnostic Procedures:
    - Run OBDs. Refer to **Diagnostics**.
        - Repair all non-transmission related DTCs first.
        - Repair all transmission DTCs.

- Rerun OBD to verify repair.
- Carry out Line Pressure Test. Refer to **Special Testing Procedures**.
- Carry out Stall Speed Test. Refer to **Special Testing Procedures**.
- Carry out diagnostic routines. Refer to **Diagnosis By Symptom**.
- Use the index to locate the appropriate routine that best describes the symptom(s). The routine will list all possible components that may cause or contribute to the symptom. Check each component listed, diagnose and repair as required, before installing a new torque converter.

Torque Converter Clutch (TCC) Operation Test

This test verifies that the TCC control system and the torque converter are operating correctly.

1. Carry out Self Test, refer to the tester manual. Check for DTCs.
2. Connect a tachometer to the engine.
3. Bring the engine to normal operating temperature by driving the vehicle at highway speeds for approximately 15 minutes in Overdrive (Circle D) position.
4. If the vehicle stalls in Overdrive (Circle D) at idle with vehicle at a stop, move the selector lever to manual L position. If the vehicle stalls, see torque converter operation concerns, refer to **Diagnosis By Symptom**. Repair as required. If the vehicle does not stall in Overdrive (Circle D), refer to **Diagnosis By Symptom**.

VISUAL INSPECTION

This inspection will identify modifications or additions to the vehicle operating system that may affect diagnosis. Inspect the vehicle for non-Ford factory add-on devices such as:

- Electronic add-on items:
  - A/C
  - generator (alternators)
  - engine turbo
  - cellular telephone
  - cruise control
  - CB radio
  - linear amplifiers
  - backup alarm signal
  - computer
- Vehicle modification:
- These items, if not installed correctly, will affect the PCM or transmission function. Pay particular attention to add-on wiring splices in the PCM harness or transmission wiring harness, abnormal tire size or axle ratio changes.
- Leaks, refer to **Leakage Inspection**.

- Correct linkage adjustments, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.

Selector Lever Linkage Check

If the selector lever linkage is not correctly adjusted, hydraulic leakage can occur at the manual control valve and can cause a delay in engagements and/or slipping while operating. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article for selector lever linkage adjustment.

Check TSBs

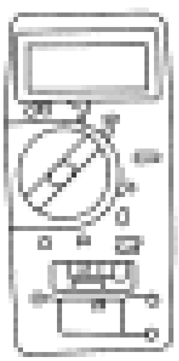
Refer to all TSBs which pertain to the concern and follow the procedure.

Carry Out On-Board Diagnostic (OBD)s Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) Self Test.

After a road test, with the vehicle warm and before disconnecting any connectors, carry out the Self Test using the scan tool. Refer to the **Introduction - Gasoline Engines** article for diagnosis and testing of the powertrain control system.

DIAGNOSTICS

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Digital Multimeter	105-R0057 or equivalent
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

On-Board Diagnostic (OBD) With Scan Tool

NOTE: For detailed instruction and other diagnostic methods using the scan tool or equivalent, refer to the scan tool tester manual and the Introduction - Gasoline Engines article.

These Self-Tests should be used to diagnose the PCM and should be carried out in order.

- Self Test - Key ON Engine OFF (KOEO)
- Self Test - Continuous Memory Codes
- Self Test - Key ON Engine Running (KOER)
- Special Test Modes:
  - Wiggle Test Mode
  - Output Test Mode
- PCM Reset Mode
- Clearing DTCs P1000
- On-Board Diagnostic (OBD) II Drive Cycle
- Other Diagnostic Tool Features

For further information on other diagnostic testing features using the scan tool, refer to the **Introduction - Gasoline Engines** article. Other diagnostic methods include the following.

- PID Access Mode
- Freeze Frame Data Access Mode
- Oxygen Sensor Monitor Mode

OUTPUT STATE CONTROL (OSC) MODE

Description

Output state control allows an off-board diagnostic scan tool direct control of specific transaxle components or functions. Output state control allows the technician to control the main functions or components of the transaxle to help the technician more quickly and easily diagnose the transaxle. For example, output state control may be used to change gears or remain in a specific gear. Output state control may be used to control the operation of the Torque Converter Clutch (TCC) to engage or disengage, or to keep the converter clutch from engaging at all. Output state control may also be used to help carry out solenoid electrical pinpoint tests by turning a solenoid off or on by controlling the actual current to the Variable Force Solenoid (VFS) solenoid.

Procedure

NOTE: Retrieve Continuous Codes and carry out a Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) Self Test before using any output state control. Any DTCs related to the Transmission Range (TR) sensor, the Output Shaft Speed (OSS) sensor or the Turbine Shaft Speed (TSS) sensor must be fixed or the PCM will not allow the output state control to operate.

Output state control is used to test various transaxle components and functions when the vehicle is either in the service bay or being driven on the road. Specific vehicle conditions are required for output state control to control each specific function or component. The following will describe which transaxle functions and components output state control may control and the specific vehicle conditions necessary for its operation.

Service Bay - Vehicle State No. 1

Vehicle state No. 1 is functional ONLY when the key is in the ON position and the vehicle gear selector is in PARK or NEUTRAL with the engine OFF. Vehicle state No. 1 is required when using output state control to carry out electrical pinpoint tests. The following transaxle components may be controlled using output state control in vehicle state No. 1.

- SSA/SS1 - Directs PCM to command Shift Solenoid E (SSE) OFF or ON
- SSD_AMP - Controls the current to Shift Solenoid D (SSD), VFS
- SSC_AMP - Controls the current to Shift Solenoid C (SSC), VFS
- SSB_AMP - Controls the current to Shift Solenoid B (SSB), VFS
- SSA_AMP - Controls the current to Shift Solenoid A (SSA), VFS
- TCC AMP - Controls the current to the TCC VFS
- PCA AMP - Controls the current to the Line Pressure Control (LPC) VFS

The vehicle requirements must be met when sending an output state control value to control each specific component such as the solenoids stated above. If the vehicle requirements are not met when sending the output state control value, an error message may appear. When the error message appears, output state control is cancelled and should be restarted.

After sending the output state control value, if the vehicle requirements are no longer met, the error message will not appear but the output state control value will be cancelled by the PCM. Use the scan tool to monitor the PID that corresponds to each output state control function or component to determine if the PCM is using the output state control value or normal control.

Output state control may be cancelled at any time, using the scan tool, to return the PCM to normal control for a specific output state control function or component. See instructions for specific scan tool.

Service Bay - Vehicle State No. 2

Vehicle state No. 2 is functional ONLY when the engine is running and the vehicle gear selector is in PARK or NEUTRAL with engine speed greater than 1,100 RPM. Vehicle state No. 2 is required when using output state control to carry out a line pressure check. Most, but not all, of the solenoids may be controlled during this vehicle state. It is recommended to use vehicle state No. 1 when using output state control to control the solenoids. The following transaxle function and components may be controlled using output state control in vehicle state No. 2.

- LINEDSD - Output state control function to command line pressure to a desired pressure
- SSD_AMP - Controls the current to SSD, VFS
- SSC_AMP - Controls the current to SSC, VFS
- SSB_AMP - Controls the current to SSB, VFS
- SSA_AMP - Controls the current to SSA, VFS

The vehicle requirements must be met when sending an output state control value to control each specific component such as the solenoids stated above. If the vehicle requirements are not met when sending the output state control value, an error message may appear. When the error message appears, output state control is cancelled and should be restarted.

After sending the output state control value, if the vehicle requirements are no longer met, the error message will not appear but the output state control value will be cancelled by the PCM. Use the scan tool to monitor the PID that corresponds to each output state control function or component to determine if the PCM is using the output state control value or normal control.

Output state control may be cancelled at any time, using the scan tool, to return the PCM to normal control for a specific output state control function or component. See instructions for specific scan tool.

Output state control values for SSA_AMP, SSB_AMP, SSC_AMP, SSD_AMP, PCA AMP and TCC AMP to control the current on the VFS are between zero (0) and one (1) amp. The following are examples.

- 0 - Commands PCM to control current to zero amps
- 0.25 - Commands PCM to control current to 1/4 amp or 250 milli-amps
- 0.50 - Commands PCM to control current to 1/2 amp or 500 milli-amps
- 0.75 - Commands PCM to control current to 3/4 amp or 750 milli-amps
- 1 - Commands PCM to control current to 1 amp or 1,000 milli-amps

Output state control will aid in testing the electronic functions of the PCM, VFS and associated circuitry. Output state control allows the technician to control the PCM commanded current of the VFS and the commanded state of the on/off solenoid. This allows the technician to accurately test the electronic circuitry by comparing the commanded current with the actual current or the on/off state with the actual voltage. Shifting the transmission through the various gears tests the mechanical operation of the VFS. When using output state control to control the VFS current, the technician may measure the circuit current using an inductive pickup or measure the circuit voltage drop to help verify the proper electrical operation of each VFS solenoid.

The output state control values for LINEDSD to command a desired line pressure are between 414 kPa (60 psi) and 1,931 kPa (280 psi). The following are examples.

- 60 psi - Commands PCM to control line pressure to 414 kPa (60 psi)
- 100 psi - Commands PCM to control line pressure to 689 kPa (100 psi)
- 150 psi - Commands PCM to control line pressure to 965 kPa (150 psi)
- 200 psi - Commands PCM to control line pressure to 1,517 kPa (200 psi)

NOTE: Do NOT command line pressure LOWER than 414 kPa (60 psi) or HIGHER than 1,931 kPa (280 psi) or damage to the transaxle can occur.

Output state control allows the technician to control the PCM commanded Line Pressure. This allows the technician to accurately test the electronic pressure control system by comparing the output state control commanded line pressure to the actual line pressure indicated on the pressure gauge. The pressure gauge should be connected to the line pressure tap on the transmission. The PID corresponding to the commanded Line Pressure must be monitored to make sure the PCM is using the output state control value for the commanded Line Pressure. This test will help verify the correct operation of the transmission pump assembly, pump regulator valve and the operation of the LPC solenoid.

Drive Test

Output state control allows control of 3 transmission functions while driving on the road. Each transmission function has a unique set of vehicle operating requirements that the technician is required to meet before the PCM will allow output state control to operate.

- TCC_OSC - Commands the PCM to engage or disengage the TCC
- GEAR_OSC - Commands the PCM to change gears (upshift or down-shift) or remain in a gear
- HRSH_SFT - Commands a slightly higher hydraulic pressure during engagements and upshifts

The vehicle requirements must be met when sending an output state control value to control the specific functions stated above. If the vehicle requirements are not met when sending the output state control value, an error message may appear. When the error message appears, output state control is cancelled and should be restarted.

After sending the output state control value, if the vehicle requirements are no longer met, the error message will not appear but the output state control value will be cancelled by the PCM. Use the scan tool to monitor the PID that corresponds to each output state control function or component to determine if the PCM is using the output state control value or normal control.

Output state control may be cancelled at any time, using the scan tool, to return the PCM to normal control for a specific output state control function or component. See instructions for specific scan tool.

Drive Test - Torque Converter Clutch Control

The output state control values for TCC_OSC to engage or disengage the TCC are as follows:

- 0 - PCM in normal control of TCC and output state control is cancelled
- 1 or OFF - Commands PCM to keep the TCC from engaging
- 2 or ON - Commands PCM to engage the TCC using a normal ramp rate
- 3 or ON - Commands PCM to engage the TCC using a fast ramp rate

Controlling the TCC will assist the technician in testing the operation of the torque converter for engagements and disengagements. Also, the technician may find it easier to evaluate upshifts and downshifts by first using output state control to keep the TCC from engaging.

Vehicle requirements when using TCC_OSC Controlling the TCC.

When sending the TCC_OSC value [1 or OFF], the engine must be running with the transaxle in the DRIVE position and the vehicle speed must be greater than 5 km/h (3 mph).

When sending the TCC_OSC value [2 or 3 or ON], the engine must be running with the selector lever in the DRIVE position, transaxle in 3rd, 4th, 5th or 6th gear, transaxle temperature between 4°C (40°F) and 121°C (250°F), the vehicle speed must be below 24 km/h (15 mph) and engine speed greater than 1,100 RPM with minimal engine load.

Drive Test - Upshift and Downshift Control

NOTE:	**Once output state control has successfully commanded the transmission to shift to the desired output state control gear, the transmission will remain in that gear until output state control commands a different gear or the vehicle conditions are no longer correct.**

The output state control values for GEAR_OSC to control the transaxle gear changes are as follows:

- 0 - PCM in normal shift control and output state control is cancelled
- 1 - Commands PCM to shift to 1st gear - no engine braking
- 2 - Commands PCM to shift to 2nd gear - with engine braking
- 3 - Commands PCM to shift to 3rd gear - with engine braking
- 5 - Commands PCM to shift to 5th gear - with engine braking
- 6 - Commands PCM to shift to 6th gear - with engine braking

Controlling the gear changes will assist the technician in testing the various clutches and bands and whether the transmission is slipping in any particular gear. Output state control will command the PCM to upshift or downshift depending on the output state control gear value the technician selects. The transmission will remain in the output state control gear selected until another output state control gear value is sent or until output state control is cancelled and/or the vehicle conditions for using output state control are no longer met.

Vehicle requirements when using GEAR_OSC Controlling Gear Changes

When sending a GEAR_OSC value, the engine must be running with the selector lever in the DRIVE position, and the vehicle speed must be greater than 5 km/h (3 mph).

Additional vehicle conditions required for upshifts:

- Vehicle speed must be greater then 32 km/h (20 mph) when commanding an upshift to 5th or 6th gear

Additional vehicle conditions required for downshifts:

- Vehicle speed must be less then 32 km/h (20 mph) when commanding a downshift to 1st gear
- Vehicle speed must be less then 64 km/h (40 mph) when commanding a downshift to 2nd gear
- Vehicle speed must be less then 97 km/h (60 mph) when commanding a downshift to 3rd gear
- Vehicle speed must be less then 129 km/h (80 mph) when commanding a downshift to 4th gear
- Vehicle speed must be less then 161 km/h (100 mph) when commanding a downshift to 5th gear

Drive Test - Pressure Added for Engagements and Upshifts

The output state control values for HRSH_SHFT to command a slight or moderate increase in hydraulic pressure to test for firmer engagements and upshifts are as follows:

- 0 or OFF - PCM in normal pressure control for shifts and engagements and output state control is cancelled
- 1 or ON - Commands PCM to moderately increase hydraulic pressure during engagements and upshifts

Setting HRSH_SFT to 1 or ON allows the technician to moderately increase the pressure when performing engagements such as P-R, P-D, N-R, N-D, R-D and when performing automatic upshifts. This can provide additional diagnostic information to help the technician determine whether the electronic pressure control system is providing at least limited control (a normal shift would become firmer). Using output state control to control HRSH_SHFT to 1 or ON should make a softer engagement or shift more normal and an already normal shift or engagement firmer by slightly increasing the pressure. This test should only be used to provide additional diagnostic information and should not be the only scan tool or test to determine a faulty electronic or hydraulic component.

Using Output State Control and Monitoring PIDs

To confirm that the output state control value was sent by the scan tool and the PCM has accepted the output state control command, a corresponding PID for each output state control parameter must be monitored. After SENDING the output state control value, the corresponding PID value should be the same as the output state control value that was sent. Additional PIDs are listed that may be monitored to help the technician accurately diagnose the transaxle.

The following is a list of output state control parameters and their corresponding PIDs:

Output State Control Parameter	Corresponding PID	Additional PIDs
HRSH_SHFT	HRSH_SHFT	

LINEDSD	LINEDSD	PCA, PCA AMP, PCA_F
TCC_OSC	TCC_OSC	TCCRAT, TCCMCMD, TSLIP
GEAR_OSC	GEAR_OSC	SHFT_TYP, GEAR, TRANRAT
SSA_AMP	SSA_AMP	SSPCA, SSPCA_F
SSB_AMP	SSB_AMP	SSPCB, SSPCB_F
SSC_AMP	SSC_AMP	SSPCC, SSPCC_F
SSD_AMP	SSD_AMP	SSPCD, SSPCD_F
PCA AMP	PCA AMP	PCA_F
TCC AMP	TCC AMP	TCCPC, TCCPC_F
SSA/SS1	SSA/SS1	SSA/SS1_F

DIAGNOSTIC PARAMETERS IDENTIFICATION (PID) CHART

Special Tools

Illustration	Tool Name	Tool Number
 ST2574-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

PID Name	PID Description	Units
TCCPC	Commanded pressure for the Torque Converter Clutch (TCC) Variable Force Solenoid (VFS)	Pressure
TCC AMP	Commanded current for the TCC VFS	Amperes
TCCPC_F	Fault status for the TCC VFS	Fault/No Fault
GEAR	Commanded transaxle gear	P, R, N, 1, 2, 3, 4, 5 and 6
GEAR_RAT	Theoretical transaxle gear ratio	Ratio
TRAN_RAT	Actual transaxle gear ratio	Ratio
LINEDSD	Commanded line pressure	Pressure
PCA	Commanded pressure for the Line Pressure Control (LPC) VFS	Pressure
PCA AMP	Commanded current for the LPC VFS	Amperes
PCA_F	Fault status for the LPC VFS	Fault/No Fault

SSPCA	Commanded pressure for the Shift Solenoid A (SSA)/CB1234 VFS	Pressure
SSA_AMP	Commanded current for the SSA/CB1234 VFS	Amperes
SSPCA_F	Fault status for the SSA/CB1234 VFS	Fault/No Fault
SSPCB	Commanded pressure for the Shift Solenoid B (SSB)/C35R VFS	Pressure
SSB_AMP	Commanded current for the SSB/C35R VFS	Amperes
SSPCB_F	Fault status for the SSB/C35R VFS	Fault/No Fault
SSPCC	Commanded pressure for the Shift Solenoid C (SSC)/CB26 VFS	Pressure
SSC_AMP	Commanded current for the SSC/CB26 VFS	Amperes
SSPCC_F	Fault status for the SSC/CB26 VFS	Fault/No Fault
SSPCD	Commanded pressure for the Shift Solenoid D (SSD)/CBLR, C456 VFS	Pressure
SSD_AMP	Commanded current for the SSD/CBLR, C456 VFS	Amperes
SSPCD_F	Fault status for the SSD/CBLR, C456 VFS	Fault/No Fault
SSA/SS1	Commanded state for Shift Solenoid E (SSE)	ON/OFF
SSA/SS1_F	Fault status for SSE	Fault/No Fault
TCC_RAT	Actual speed ratio of torque converter (1.0 = fully engaged)	Ratio
TCC	Commanded torque converter slip (0 = engaged desired)	Ratio
TCC_SLIPACT	Actual difference between engine speed and turbine speed, measured in RPM.	RPM
TSS_SRC	Actual speed of the Turbine Shaft Speed (TSS) Sensor (RPM)	RPM
OSS_SRC	Actual speed of the Output Shaft Speed (OSS) Sensor (RPM)	RPM
TR1	Transmission Range (TR) - Switch 1 actual position	Open/Closed
TR2	TR - Switch 2 actual position	Open/Closed
TR3	TR - Switch 3 actual position	Open/Closed
TR4	TR - Switch 4 actual position	Open/Closed
TCS	Transmission Control Switch (TCS) Position	Depressed/Not Depressed
TFT	Transmission Fluid Temperature (TFT)	Degrees

TRANSAXLE DRIVE CYCLE TEST

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

ST2574-A

NOTE: **Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.**

After carrying out the Self Test, use the following Transaxle Drive Cycle Test for checking continuous codes.

NOTE: **The Transaxle Drive Cycle Test must be followed exactly. Malfunctions must occur 4 times consecutively for shift error DTC to be set and 5 times consecutively for continuous Torque Converter Clutch (TCC) code to set.**

NOTE: **When carrying out the Transaxle Drive Cycle Test, see the solenoid operation chart for correct solenoid operation. Refer to Pinpoint Tests - OSC Equipped Vehicle.**

1. Record and then erase Self Test codes.
2. Warm engine to normal operating temperature.
3. Make sure transmission fluid level is correct.
4. With transaxle in DRIVE, moderately accelerate from stop to 80 km/h (50 mph). This allows the transaxle to shift into 6th gear. Hold speed and throttle opening steady for minimum of 15 seconds.
5. With transaxle in 6th gear and maintaining steady speed and throttle opening, lightly apply and release brake (to operate stoplamps). Then hold speed and throttle steady for additional 5 seconds minimum.
6. Brake to a stop and remain stopped for minimum of 20 seconds.
7. Repeat Steps 4 through 6 at least 5 times.
8. Carry out Self Test and record continuous codes.
    - If DTCs are present, refer to **Diagnostic Trouble Code (DTC) Charts**. Service all non-transaxle DTCs first as they can directly affect the operation of the transaxle. Repeat the Self Test and Road Test to verify the correction. Erase DTCs, carry out drive cycle, and repeat the Self Test after completing service on the DTCs.
    - If the continuous test passes (system pass) and a concern is still present, refer to **Diagnosis By Symptom** in this article check TSBs for diagnostic concern.

After On-Board Diagnostic (OBD)

NOTE: The vehicle wiring harness, PCM and non-transaxle sensors may affect transaxle operations. Service these concerns first.

After the OBD procedures are completed, service all DTCs.

Begin with non-transaxle related DTCs, then service any transaxle related DTCs. Refer to the **Diagnostic Trouble Code (DTC) Charts** for information on Condition and Symptoms. This chart will be helpful in referring to the correct articles(s) and to aid in diagnosing internal transaxle concerns and external non-transaxle inputs. The pinpoint tests are used in diagnosing electrical concerns of the transaxle. Make sure that the vehicle wiring harness and the PCM are diagnosed as well. Refer to the **Introduction - Gasoline Engines** article for diagnosing non-transaxle electronic components. The diagnostic routine hydraulic/mechanical charts will help in diagnosing internal transaxle concerns and external non-transaxle inputs.

Before Pinpoint Tests

NOTE: Prior to entering pinpoint tests, check the PCM wiring harness for correct connections, bent or broken pins, corrosion, loose wires, correct routing, correct seals and their condition. Check the PCM, sensors and actuators for damage. Refer to the Introduction - Gasoline Engines article.

NOTE: If a concern still exists after electrical diagnosis has been carried out, refer to Diagnosis By Symptom.

If DTCs appear while carrying out the OBDs, refer to the **Diagnostic Trouble Code (DTC) Charts** for the appropriate repair procedure. Prior to entering pinpoint tests, refer to any TSBs for transaxle concerns.

DIAGNOSTIC TROUBLE CODE (DTC) CHARTS

Special Tools

Illustration	Tool Name	Tool Number
 ST2574-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

DTC CHART

DTC	Grouping	Component	Description	Condition	Symptom	
P0657	-	Transaxle Solenoid Power Control	Transaxle solenoid power control electrical circuit failure.	Transaxle solenoid power control provides power to all the solenoids. This DTC sets if the transaxle solenoid power control circuit is open.	• No voltage to solenoids. • Defaults to 5th gear. • Only REVERSE and NEUTRAL available. • Will turn on Malfunction Indicator Lamp (MIL).	Go to **Pin**

P0705	P0705, P1702	Transmission Range (TR)	TR sensor circuit failure.	PCM is received an invalid combination of the 4-bit signal from the TR sensor.	• Possible no crank.
					• Only PARK, REVERSE, NEUTRAL and 5th gear available.
					• Harsh engagements.
					• Extremely delayed engagements (until a DTC is set).
					• After a DTC is set and the high side opened.
					  ○ Harsh engagements.
					  ○ Poor performance (due to a 5th gear drive away).
					  ○ No shifts.
					• Will turn on MIL.
						Go to **Pin**

P0706	P0706, P0709	TR Sensor	TR sensor range failure.	TR sensor A circuit range/performance. TR sensor stuck in transition zone (possible wiring, connector or TR sensor issue).	• Possible no crank. • Only PARK, REVERSE, NEUTRAL and 5th gear available. • Harsh engagements.	Go to **Pin**

					• Extremely delayed engagements (until a DTC is set).
					• After a DTC is set and the high side opened.
					  ◦ Harsh engagements.
					  ◦ Poor performance (due to a 5th gear drive away).
					  ◦ No shifts.
					• Will turn on MIL.	

P0708	P0708, P1702	TR Sensor	TR sensor circuit failure.	PCM is received all 4 TR sensor bits open (potential sensor disconnected, wiring, connector or TR sensor issue).	• Possible no crank.
					• Only PARK, REVERSE, NEUTRAL and 5th gear available.
					• Harsh engagements.
					• Extremely delayed engagements (until a DTC is set).
					• After a DTC is set and the high side opened.
					  ◦ Harsh engagements.
					  ◦ Poor performance (due to a 5th gear drive away).
					  ◦ No shifts.
					• Will turn on MIL.
						Go to **Pin**

P0709	P0709 or P0706, P0709	TR Sensor	TR sensor range failure.	TR sensor A circuit range/performance. TR sensor stuck in transition zone (possible wiring, connector or TR sensor	• Possible no crank. • Only PARK, REVERSE, NEUTRAL and 5th gear available.	Go to **Pin**

				issue).	• Harsh engagements.
					• Extremely delayed engagements (until a DTC is set).
					• After a DTC is set and the high side opened.
					  ○ Harsh engagements.
					  ○ Poor performance (due to a 5th gear drive away).
					  ○ No shifts.
					• Will turn on wrench lamp.	

P0710	-	Transmission Fluid Temperature (TFT)	TFT sensor circuit voltage input too low or too high.	• TFT sensor input indicates a short to ground or an open circuit (could be a wiring, connector or sensor issue). • Also see P0712 and P0713.	• Torque Converter Clutch (TCC) and stabilized shift schedule may be enabled sooner after cold start. • Harsh or soft shifts. • Will turn on wrench lamp.	Go to **Pin**
P0710	P0710, P0712	TFT	TFT sensor circuit voltage input too low.	TFT sensor input indicates a short to ground or an open circuit (could be a wiring, connector or sensor issue).	• TCC and stabilized shift schedule may be enabled sooner after cold start. • Harsh or soft shifts. • Will turn on wrench lamp.	Go to **Pin**
P0710	P0710, P0713	TFT	TFT sensor circuit voltage too high.	TFT sensor input indicates a short to ground or an open circuit (could be a wiring, connector or sensor issue).	• TCC and stabilized shift schedule may be enabled sooner after cold start. • Harsh or soft shifts. • Will turn on wrench lamp.	Go to **Pin**
P0711	-	TFT	No change in	PCM has detected no	• TCC and stabilized	Go to **Pin**

			TFT sensor input.	TFT change at low-range or high-range during operation.	shift schedule may be enabled sooner after a cold start. • Harsh or soft shifts. • Will turn on wrench lamp.	
P0712	P0710, P0712	TFT	TFT sensor circuit voltage input too low.	TFT sensor input indicates a short to ground or an open circuit (could be a wiring, connector or sensor issue).	• TCC and stabilized shift schedule may be enabled sooner after cold start. • Harsh or soft shifts. • Will turn on MIL.	Go to **Pin**
P0713	P0710, P0713	TFT	TFT sensor circuit voltage too high.	TFT sensor input indicates a short to ground or an open circuit (could be a wiring, connector or sensor issue).	• TCC and stabilized shift schedule may be enabled sooner after cold start. • Harsh or soft shifts. • Will turn on MIL.	Go to **Pin**
P0715	P0715, P0717	Turbine Shaft Speed (TSS) Sensor	Insufficient input from TSS sensor.	• PCM has detected TSS sensor signal failed to 0 speed when vehicle conditions (mainly output speed) indicate TSS sensor output should be present. • Electrical failures (open, short) of the TSS sensor wiring, connector or a failure of the sensor itself will cause this failure.	• Failure Mode Effects Management action opens transaxle solenoid power control (removes power from all solenoids). ○ Provides PARK, REVERSE, NEUTRAL and 5th gear with maximum line pressure and open TCC available (controlled by the manual lever). • Harsh engagements (due to maximum line pressure).	Go to **Pin**

					- Poor launch performance (due to 5th gear drive away). - Will turn on MIL.	
P0717	P0717 or P0715, P0717	TSS	Insufficient input from TSS sensor.	- PCM has detected TSS sensor signal failed to 0 speed when vehicle conditions (mainly output speed) indicate TSS sensor output should be present. - Electrical failures (open, short) of the TSS sensor wiring, connector or a failure of the TSS sensor itself will cause this failure.	- Failure Mode Effects Management action opens transaxle solenoid power control (removes power from all solenoids). - Provides PARK, REVERSE, NEUTRAL and 5th gear with maximum line pressure and open TCC available (controlled by the manual lever). - Harsh engagements (due to maximum line pressure). - Poor launch performance (due to 5th gear drive away). - Will turn on wrench lamp.	Go to **Pin**
P0718	-	TSS	TSS signal intermittent.	PCM has detected an erratic or no TSS signal.	Will turn on wrench lamp.	Go to **Pin**
P0720	P0720, P0722	Output Shaft Speed (OSS) Sensor	Insufficient input from OSS sensor.	PCM has detected OSS sensor signal failed to 0 speed when vehicle	Failure Mode Effects Management action opens transaxle solenoid power	Go to **Pin**

				conditions (mainly turbine speed) indicate OSS sensor output should be present. • Electrical failures (open, short) of the OSS sensor wiring, connector or a failure of the OSS sensor itself will cause this failure.	control (removes power from all solenoids). ○ provides PARK, REVERSE, NEUTRAL and 5th gear with maximum line pressure and open TCC available (controlled by the manual lever). • Harsh engagements (due to maximum line pressure). • Poor launch performance (due to 5th drive away). • Will turn on MIL.	
P0721	-	OSS	OSS sensor signal noisy.	PCM has detected an erratic or no OSS sensor signal.	Will turn on wrench lamp.	Go to **Pin**
P0722	P0722 or P0720, P0722	OSS	Insufficient input from OSS sensor.	• PCM has detected OSS sensor signal failed to 0 speed when vehicle conditions (mainly turbine speed) indicate OSS output should be present. • Electrical failures (open, short) of the OSS sensor wiring, connector or a failure of the sensor itself will	• Failure Mode Effects Management action opens transaxle solenoid power control (removes power from all solenoids). ○ Provides PARK, REVERSE, NEUTRAL and 5th gear with maximum line pressure and open	Go to **Pin**

				cause this failure.	TCC available (controlled by the manual lever). • Harsh engagements (due to maximum line pressure). • Poor launch performance (due to 5th gear drive away). • Will turn on wrench lamp.	
P0729	P0729, P0734, P0735 or P0729, P0734, P0735, P0766	Overdrive Clutch System Faults (includes non-electrical Shift Solenoid D (SSD) faults, main control valve body and clutch)	SSD stuck off (SSD or main control valve body).	Sixth gear ratio error. SSD stuck off, both low/reverse clutch and overdrive clutch failed off. This code sets for: • Low/reverse clutch/overdrive clutch Variable Force Solenoid (VFS) non-electrical fault. • Low/reverse clutch/overdrive clutch regulator valve stuck in default position. • Low/reverse clutch/overdrive clutch boost valve stuck in default position.	• Customer may notice flares or neutral conditions on shifts into 4th, 5th or 6th gears. • Customer might notice erratic shifting, flares, neutral conditions while the code is being set. • First gear with engine braking. • Fourth, 5th and 6th gears are disabled. • Also might get delayed or no reverse engagement (need low/reverse clutch on to achieve reverse). • Customer might notice high engine speeds (since 3rd gear is the highest available gear). • Will turn on wrench lamp.	Refer to **D**
P072C	-	Low/Reverse	Low/reverse	• Low/reverse	Customer might notice:	Refer to **D**

		Clutch and One-Way Clutch (OWC) Faults (covers just the clutches)	clutch or OWC failed on.	clutch or OWC failed on (transmits torque both directions). • 1st gear is the only available gear with this failure.	• Decelerations on attempted upshifts (since tie-ups occur). • Stuck in 1st gear. • High engine RPM. • Low maximum vehicle speed. • No TCC apply. • Will turn on wrench lamp.	
P072E	P072E, P073A or P072E, P073A, P0757	Direct Clutch System Faults	Shift Solenoid B (SSB) failed on.	The codes: • P072E Stuck in 3rd gear. • P073A Stuck in 5th gear. These codes set together mean SSB is failed on, causing the direct clutch to be stuck on, 3rd and 5th gear are the only available gears. Since the hydraulic controls prevent direct clutch and low/reverse clutch on together in the forward ranges, the solenoid can be isolated from the clutch. These codes set if: • Non-electrical failures where SSB (direct clutch VFS) is stuck on (pressure). • Direct clutch regulator valve stuck in spring compress position.	• Customer may notice a vehicle deceleration on a shift into 2nd, 4th or 6th gears (direct clutch failing to release will cause a tie-up in these gears). • Customer might notice a harsh 1-3 shift. • Customer might notice erratic shifting while the test is confirming direct clutch is failed on. • After a code is stored, all gears but 3rd and 5th gear are disabled. • Since only 3rd and 5th gears are allowed, the customer might notice poor launch performance, lack of shifts and harsh engagements. • Will turn on wrench lamp.	Refer to **D**

P072F	P072F, P073A, P073B or P072F, P073A, P073B, P0767	Overdrive Clutch System Faults (includes non-electrical SSD faults, main control valve body and clutch)	Overdrive clutch failed on (clutch, SSD or main control valve body).	The codes: • P072F stuck in 4th gear. • P073A stuck in 5th gear. • P073B stuck in 6th gear. Set together to indicate the overdrive clutch is failed on. Overdrive clutch failed on, could be due to: • Low/reverse clutch/overdrive clutch VFS (SSD) non-electrical failed stuck on (pressure). • Overdrive clutch stuck on due to mechanical failure. • Low/reverse clutch, overdrive clutch regulator valve stuck in the spring compressed position.	• Customer may notice a vehicle deceleration on a shift into 2nd or 3rd gear (overdrive clutch failing to release will cause a tie-up in 2nd or 3rd gears). • Customer might notice harsh engagements, erratic shifting. • First gear with engine braking, 1st gear without engine braking, 2nd and 3rd gears are disabled. • Poor launch due to 4th gear drive away. • Harsh engagements. • Will turn on wrench lamp.	Refer to **D**
P0733	P0733, P0735 or P0733, P0735, P0756	Direct Clutch System Faults (includes non-electrical SSB faults, valve body and clutch)	Direct clutch failed off.	The codes: • P0733 - 3rd gear ratio error. • P0735 - 5th gear ratio error. Set together if direct clutch is detected failed off. Direct clutch failed off,	• Customer may notice flares or neutral conditions on shifts into 3rd or 5th gears. • PCM will command 3 shifts into 3rd or 5th gear and if the direct clutch is failed off the customer will	Refer to **D**

				could be due to: • Non-electrical failures where SSB (direct clutch VFS) is stuck off (no pressure). • Direct clutch regulator valve stuck in default position. • Direct clutch mechanical failure.	notice flares or neutral conditions that last one second or so. • Third and 5th gear are disabled, customer might notice transmission hangs in 2nd gear on acceleration until customer tips out to closed pedal (done to protect overdrive clutch). • Will turn on wrench lamp.	
P0734	P0729, P0734, P0735 or P0729, P0734, P0735, P0766	Overdrive Clutch System Faults (includes non-electrical SSD faults, valve body and clutch)	SSD stuck off (SSD or valve body).	The codes: • P0734 - 4th gear ratio error. • P0735 - 5th gear ratio error. • P0729 - 6th gear ratio error. Set together mean SSD is stuck off (see P0766 for details).	• Customer may notice flares or neutral conditions on shifts into 4th, 5th or 6th gears. • Customer might notice erratic shifting, flares, neutral conditions while the code is being set. • First gear with engine braking, 4th, 5th and 6th gears are disabled. • Customer might notice high engine speeds (since 3rd gear is highest available gear). • Also might get delayed or no REVERSE engagement (need low/reverse clutch on to achieve reverse). • Will turn on wrench lamp.	Refer to **D**

P0735	P0729, P0734, P0735 or P0729, P0734, P0735, P0766	Overdrive Clutch System Faults (includes non-electrical SSD faults, valve body and clutch)	SSD stuck off (SSD or valve body).	SSD stuck off, both low/reverse clutch and overdrive clutch failed off. This code sets for: • Low/reverse clutch/overdrive clutch VFS non-electrical fault. • Low/reverse clutch/overdrive clutch regulator valve stuck in default position. • Low/reverse clutch/overdrive clutch boost valve stuck in default position. Set together mean SSD is stuck off (see P0766 for details).	• Customer may notice flares or neutral conditions on shifts into 4th, 5th or 6th gears. • Customer might notice erratic shifting, flares, neutral conditions while the code is being set. • 1st gear with engine braking, 4th, 5th and 6th gears are disabled. • Customer might notice high engine speeds (since 3rd gear is highest available gear). • Also might get delayed or no reverse engagement (need low/reverse clutch on to achieve reverse). • Will turn on wrench lamp.	Refer to **D**
P0735	P0733, P0735 or P0733, P0735, P0756	Direct Clutch System Fault (includes non-electrical SSB faults, valve body and clutch)	Direct clutch failed off.	The codes: • P0733 - 3rd gear ratio error. • P0735 - 5th gear ratio error. Set together if direct clutch is detected failed off. Direct clutch failed off, could be due to: • Non-electrical failures where SSB (direct	• Customer may notice flares or neutral conditions on shifts into 3rd or 5th gears. • PCM will command 3 shifts into 3rd or 5th gear and if the direct clutch is failed off the customer will notice flares or neutral conditions that last approximately one second. • Third and 5th gears	Refer to **D**

				clutch VFS) is stuck off (no pressure). • Direct clutch regulator valve stuck in default position. • Direct clutch mechanical failure.	are disabled. • Customer might notice transmission hangs in 2nd gear on acceleration until customer tips out to closed pedal (done to protect the overdrive clutch). • Will turn on wrench lamp.	
P073A	P072F, P073A, P073B or P072F, P073A, P073B, P0767	Overdrive Clutch System Faults (includes non-electrical SSD faults, main control valve body and clutch)	Overdrive clutch failed on (clutch, SSD or main control valve body).	Overdrive clutch failed on, could be due to: • P072F - stuck in 4th gear. • P073A - stuck in 5th gear. • P073B - stuck in 6th gear. Set together to indicate the overdrive clutch is failed on. Overdrive clutch failed on, could be due to: • Low/reverse clutch, overdrive clutch, VFS (SSD) non-electrical failed stuck on (pressure). • Overdrive clutch stuck on due to mechanical failure. • Low/reverse clutch, overdrive clutch regulator valve stuck in the spring compressed	• Customer may notice a vehicle deceleration on a shift into 2nd or 3rd gear (overdrive clutch failing to release will cause a tie-up in 2nd or 3rd gear). • Customer might notice harsh engagements, erratic shifting). • 1st gear with engine braking, 1st gear without engine braking, 2nd and 3rd gears are disabled. • Poor launch due to 4th gear drive away. • Harsh engagements. • Will turn on wrench lamp.	Refer to **D**

				position.		
P073A	P072E, P073A or P072E, P073A, P0757	Direct Clutch System Faults	SSB failed on.	The codes: - P072E - stuck in 3rd gear. - P073A - stuck in 5th gear. These codes set together mean SSB is failed on, causing the direct clutch to be stuck on, 3rd and 5th gear are the only available gears. Since the hydraulic controls prevent direct clutch and low/reverse clutch on together in the forward ranges, the solenoid can be isolated from the clutch. These codes set if: - non-electrical failures where SSB (direct clutch VFS) is stuck on (pressure). - Direct clutch regulator valve stuck in spring compress position.	- Customer may notice a vehicle deceleration on a shift into 2nd, 4th or 6th gears (direct clutch failing to release will cause a tie-up in these gears). - Customer might notice a harsh 1-3 shift. - Customer might notice erratic shifting while the test is confirming direct clutch is failed on. - After a code is stored, all gears but 3rd and 5th are disabled. - Since only 3rd and 5th gears are allowed, the customer might notice poor launch performance, lack of shifts and harsh engagements. - Will turn on wrench lamp.	Refer to **D**
P073B	P072F, P073A, P073B or P072F, P073A, P073B, P0767	Overdrive Clutch System Faults (includes non-electrical SSD faults, valve body and clutch)	Overdrive clutch failed on (clutch, SSD or valve body).	Overdrive clutch failed on, could be due to: - P072F - stuck in 4th gear. - P073A - stuck in 5th gear. - P073B - stuck in 6th gear.	- Customer may notice a vehicle deceleration on a shift into 2nd or 3rd gears (overdrive clutch failing to release will cause a tie-up in 2nd or 3rd gears). - Customer might	Refer to **D**

				Set together to indicate overdrive clutch is failed on. Overdrive clutch failed on, could be due to: • Low/reverse clutch, overdrive clutch, VFS (SSD) non-electrical failed stuck on (pressure). • Overdrive clutch stuck on due to mechanical failure. • Low/reverse clutch/overdrive clutch regulator valve stuck in the spring compressed position.	notice harsh engagements, erratic shifting. • 1st gear with engine braking, 1st gear without engine braking, 2nd and 3rd gears are disabled. • Poor launch due to 4th gear drive away. • Harsh engagements. • Will turn on wrench lamp.	
P0740	P0740, P0743	TCC Solenoid Electrical Faults	TCC circuit is open.	Open circuit in solenoid or wiring.	• TCC failed off - vehicle might run hotter, lose fuel economy. • Will turn on MIL.	Go to **Pin**
P0741	P0741, P1744	TCC System Faults (includes TCC, main control valve body and non-electrical solenoid faults)	TCC failed off.	TCC is mechanically stuck off.	P0741 and P1744 mean the same thing: a non-electrical failure that caused the TCC to fail to apply. This code sets for: • Non-electrical TCC solenoid stuck off. • TCC mechanical failure. • TCC regulator apply valve stuck in TCC release position. • TCC control valve stuck in TCC	Refer to **D**

					release position. • TCC functional failure MIL code. • TCC failed to apply (less than 80 RPM slip error lasting at least 3 seconds when TCC is commanded on) 3 consecutive times. • Will turn on MIL.	
P0742	P0742, P0743	TCC Solenoid Electrical Faults	TCC circuit is shorted to ground.	Short to ground in the solenoid or wiring.	• Failure Mode Effects Management action opens the transaxle solenoid power control, removing power from all solenoids (get PARK, REVERSE, NEUTRAL and 5th gear as the only forward gear with TCC open). • Harsh engagements. • Poor launch performance (due to 5th gear drive away). • No TCC apply. • No shifts. • Will turn on MIL.	Go to **Pin**
P0743	-	TCC Solenoid Electrical Faults	TCC is open, shorted to ground or shorted to voltage.	Open, short to ground or short to power in solenoid or wiring.	• See P0740, P0742 or P0744. • Will turn on wrench lamp.	Go to **Pin**
P0743	P0740, P0743	TCC Solenoid Electrical Faults	TCC circuit is open.	Open circuit in solenoid or wiring.	• TCC failed off - vehicle might run hotter, lose fuel economy. • Will turn on	Go to **Pin**

					wrench lamp.	
P0743	P0742, P0743	TCC Solenoid Electrical Faults	TCC circuit is shorted to ground.	Short to ground in the solenoid or wiring.	• Failure Mode Effects Management action opens the transaxle solenoid power control, removing power from all solenoids (get PARK, REVERSE, NEUTRAL and 5th gear as the only forward gear with TCC open). • Harsh engagements. • Poor launch performance (due to 5th gear drive away). • No TCC apply. • No shifts. • Will turn on wrench lamp.	Go to **Pin**
P0743	P0743, P0744	TCC Solenoid Electrical Faults	TCC is shorted to voltage.	Short to power in the wiring or solenoid.	• TCC failed off - vehicle might run hotter, lose fuel economy. • Will turn on wrench lamp.	Go to **Pin**
P0744	P0743, P0744	TCC Solenoid Electrical Faults	TCC is shorted to voltage.	Short to power in the wiring or solenoid.	• TCC failed off - vehicle might run hotter, lose fuel economy. • Will turn on MIL.	Go to **Pin**
P0748	-	Line Pressure Control (LPC) Solenoid Electrical Faults	LPC is open circuit, shorted to ground or shorted to voltage.	Open, short to ground or short to power in solenoid or wiring.	• See P0960, P0962 and P0963. • Will turn on wrench lamp.	Go to **Pin**
P0748	P0748, P0960	LPC Solenoid Electrical Faults	LPC circuit is open.	Open circuit in solenoid or wiring.	• Failed to maximum line pressure - harsh engagements.	Go to **Pin**

					• Will turn on wrench lamp.	
P0748	P0748, P0962	LPC Solenoid Electrical Faults	LPC circuit is shorted to ground.	Short to ground in the solenoid or wiring.	• Failed to minimum line pressure. • Failure Mode Effects Management action opens the transaxle solenoid power control, removing power from all solenoids (get PARK, REVERSE, NEUTRAL and 5th as the only forward gear with TCC open). • Harsh engagements. • Poor launch performance (due to 5th gear drive away). • No TCC apply. • No shifts. • Will turn on wrench lamp.	Go to **Pin**
P0748	P0748, P0963	LPC Solenoid Electrical Faults	LPC is shorted to voltage.	Short to power in the wiring or solenoid.	• Failed to maximum line pressure - harsh engagements. • Will turn on wrench lamp.	Go to **Pin**
P0750	P0750, P0753	Shift Solenoid A (SSA) Electrical Faults	SSA circuit is open.	Open circuit in solenoid or wiring.	• Forward clutch is failed off - 5th and 6th gears only available forward gears. • Neutral condition or flare when fault occurs. • Poor launch due to 5th gear drive away.	Go to **Pin**

					• Will turn on MIL.	
P0751	P0751, P2700	Forward Clutch System Faults (includes non-electrical SSA faults, valve body and clutch)	Forward clutch failed off.	Forward clutch failed off, could be due to: • Forward clutch VFS (SSA) non-electrical failed stuck off (no pressure). • Forward clutch stuck off due to mechanical failure. • Forward clutch regulator valve stuck in the default position. • Forward clutch boost valve stuck in the default position.	• Customer may notice neutral conditions or flares on downshifts from 5th or 6th gears as the test is determining forward is failed off. • Once a code is stored, all gears with forward on are disabled - leaving 5th and 6th gears as the only forward gears. • Customer might notice erratic shifting, harsh engagements, neutral conditions, flares, poor launch performance (due to 5th gear drive away), harsh reverse engagements. • Will turn on MIL.	Refer to **D**
P0752	P0752, P2700	Forward Clutch System Faults (includes non-electrical SSA faults, valve body and clutch)	Forward clutch failed on.	Forward clutch failed on, could be due to: • Forward clutch VFS (SSA) non-electrical failed stuck on (pressure). • Forward clutch stuck on due to mechanical failure. • Forward clutch regulator valve stuck in the default position.	• Customer may notice a vehicle deceleration on a shift into 5th or 6th (forward clutch failing to release will cause a tie-up in 5th or 6th). • Customer might notice erratic shifting or being stuck in 4th gear while the test is confirming forward clutch is failed on. • After a code is	Refer to **D**

				• Forward clutch regulator valve stuck in the spring compressed position.	stored 5th and 6th are disabled. • Customer might notice higher than normal engine speeds and loss of fuel economy. • Will turn on MIL.	
P0753	-	SSA Electrical Faults	SSA is open, shorted to ground or shorted to voltage.	Open, short to ground or short to power in solenoid or wiring.	• See P0750, P0973, P0974. • Will turn on wrench lamp.	Go to **Pin**
P0753	P0750, P0753	SSA Electrical Faults	SSA circuit is open.	Open circuit in solenoid or wiring.	• Forward clutch is failed off - 5th and 6th only available forward gears. • Neutral condition or flare when fault occurs. • Poor launch due to 5th gear drive away. • Will turn on wrench lamp.	Go to **Pin**
P0753	P0750, P0973	SSA Electrical Faults	SSA circuit is shorted to ground.	Short to ground in the solenoid or wiring.	• Failure Mode Effects Management action opens the transaxle solenoid power control, removing power from all solenoids (get PARK, REVERSE, NEUTRAL and 5th gear as the only forward gear with TCC open). • Harsh engagements. • Poor launch performance (due to 5th gear drive away).	Go to **Pin**

					• No TCC apply. • No shifts. • Will turn on wrench lamp.	
P0753	P0750, P0974	SSA Electrical Faults	SSA is shorted to voltage.	Short to power in the wiring or solenoid.	• Forward clutch is failed off - 5th and 6th gear only available forward gears. • Neutral condition or flare when fault occurs. • Poor launch performance (due to 5th gear drive away). • Will turn on wrench lamp.	Go to **Pin**
P0755	P0755, P0758	SSB Electrical Faults	Open circuit in solenoid or wiring.	SSB circuit is open.	• Direct clutch failed on - only 3rd and 5th gear available. • Harsh engagements. • Poor launch performance (due to 5th gear drive away). • Will turn on MIL.	Go to **Pin**
P0756	P0733, P0735, P0756	Direct Clutch System Fault (includes non-electrical SSB faults, valve body and clutch)	Direct clutch failed off.	Direct clutch failed off, could be due to: • Non-electrical failures where SSB (direct clutch VFS) is stuck off (no pressure). • Direct clutch regulator valve stuck in default position. • Direct clutch mechanical	• Customer may notice flares or neutral conditions on shifts into 3rd or 5th gear. • PCM will command 3 shifts into 3rd or 5th gear, and if direct clutch is failed off the customer will notice flares or neutral conditions that last one second or so.	Refer to **D**

				failure.	3rd and 5th gear are disabled, customer might notice transmission hangs in 2nd on accelerate until customer tips out to closed pedal (done to protect overdrive clutch). - Will turn on MIL.	
P0757	P072E, P073A, P0757	Direct Clutch System Fault (includes non-electrical SSB faults, main control valve body and clutch)	SSB failed on.	SSB (direct clutch VFS) failed on, causing direct clutch failed on. Since the hydraulic controls prevent direct clutch and low/reverse clutch on together in the forward ranges we can isolate the solenoid from the clutch. This code sets if: - Non-electrical failures where SSB (direct clutch VFS) is stuck on (pressure). - Direct clutch regulator valve stuck in spring compress position.	- Customer may notice a vehicle deceleration on a shift into 2nd, 4th or 6th gears (direct clutch failing to release will cause a tie-up in these gears). - Customer might notice a harsh 1-3 shift. - Since only 3rd and 5th gears are allowed customer might notice poor launch performance lack of shifts, harsh engagements. - Will turn on MIL.	Refer to **D**
P0758	-	SSB Electrical Faults	SSB is open, shorted to ground or shorted to voltage.	Open, short to ground or short to power in solenoid or wiring.	- See P0755, P0976, P0977. - Will turn on wrench lamp.	Go to **Pin**
P0758	P0755, P0758	SSB Electrical Faults	Open circuit in solenoid or wiring.	SSB circuit is open.	- Direct clutch failed on - only 3rd and 5th gears available. - Harsh engagements. - Poor launch	Go to **Pin**

					performance (due to 3rd gear drive away). • Will turn on wrench lamp.	
P0758	P0758, P0976	SSB Electrical Faults	SSB circuit is shorted to ground.	Short to ground in the solenoid or wiring.	• Failure Mode Effects Management action opens the transaxle solenoid power control, removing power from all solenoids (get PARK, REVERSE, NEUTRAL and 5th gear as the only forward gear with TCC open). • Harsh engagements. • Poor launch performance (due to 5th gear drive away). • No TCC apply. • No shifts. • Will turn on wrench lamp.	Go to **Pin**
P0758	P0758, P0977	SSB Electrical Faults	SSB is shorted to voltage.	Short to power in the wiring or solenoid.	• Direct clutch failed on - only 3rd and 5th gear available. • Harsh engagements. • Poor launch performance (due to 3rd gear drive away). • Will turn on wrench lamp.	Go to **Pin**
P0760	P0760, P0763	Shift Solenoid C (SSC) Electrical Faults	SSC circuit is open.	Open circuit in solenoid or wiring.	Incorrect gear selection depending on condition mode and manual lever position. See solenoid operation chart.	Go to **Pin**

					• Intermediate clutch is failed off - if fault occurs while in 2nd or 6th gear customer might notice a neutral condition before diagnostics disables 2nd and 6th gear. • Customer might notice erratic, delayed or harsh shifts. • Will turn on MIL.	
P0761	P0761, P2702	Intermediate Clutch System Faults (includes clutch, valve body and non-electrical SSC faults)	Intermediate clutch failed off.	Intermediate clutch failed off, could be due to: • Intermediate clutch VFS SSC non-electrical failed stuck off (no pressure). • Intermediate clutch stuck off due to mechanical failure. • Intermediate clutch regulator valve stuck in the default position.	• Customer may notice neutral conditions or flares on shifts to 2nd or 6th gear as the test is determining intermediate clutch is failed off. • Once a code is stored, all gears with intermediate clutch on are disabled (2nd and 6th gear) leaving 1st gear without engine braking, 1st gear with engine braking, 3rd, 4th and 5th gears. • Customer might notice erratic shifting, neutral conditions, flares, higher engine speeds on highway (due to 6th gear being disabled). • Will turn on MIL.	Refer to **D**
P0762	P0762, P2702	Intermediate Clutch System Faults (includes	Intermediate clutch failed on.	Intermediate clutch failed on, could be due to:	• Customer may notice a vehicle	Refer to **D**

		clutch, valve body and non-electrical SSC faults)		• Intermediate clutch VFS SSC non-electrical failed stuck on (pressure). • Intermediate clutch stuck on due to mechanical failure. • Intermediate clutch regulator valve stuck in the spring compressed position.	deceleration on a shift into 3rd or 5th gears (intermediate clutch failing to release will cause a tie-up in 3rd or 5th gears). • Customer might notice erratic shifting or being stuck in 6th gear while the test is confirming C26 is failed on. • After a code is stored 1st gear with engine braking, 1st gear without engine braking, 3rd, 4th and 5th gears are disabled. • Customer might notice hanging in 2nd on acceleration since 2nd-6th upshifts only occur at closed pedal (due to energy limitations of overdrive clutch), harsh reverse engagements (since low/reverse clutch is not on in 2nd gear). • Will turn on MIL.	
P0763	-	SSC Electrical Faults	SSC is open, shorted to ground or shorted to voltage.	Open, short to ground or short to power in solenoid or wiring.	• See P0760, P0979, P0980. • Will turn on wrench lamp.	Go to **Pin**
P0763	P0760, P0763	SSC Electrical Faults	SSC circuit is open.	Open circuit in solenoid or wiring.	• Intermediate clutch is failed off - if fault occurs while in 2nd or 6th gears, customer might	Go to **Pin**

					notice a neutral condition before diagnostics disables 2nd and 6th gears. • Customer might notice erratic, delayed or harsh shifts. • Will turn on wrench lamp.	
P0763	P0760, P0797	SSC Electrical Faults	SSC circuit is shorted to ground.	Short to ground in the solenoid or wiring.	• Failure Mode Effects Management action opens the transaxle solenoid power control, removing power from all solenoids (get PARK, REVERSE, NEUTRAL and 5th gear as the only forward gear with TCC open). • Harsh engagements. • Poor launch performance (due to 5th gear drive away). • No TCC apply. • No shifts. • Will turn on wrench lamp.	Go to **Pin**
P0763	P0760, P0980	SSC Electrical Faults	SSC is shorted to voltage.	Short to power in the wiring or solenoid.	• Intermediate clutch is failed off - if fault occurs while in 2nd or 6th gear, customer might notice a neutral condition before diagnostics disables 2nd and 6th gear. • Customer might notice erratic,	Go to **Pin**

					delayed or harsh shifts. • Will turn on wrench lamp.	
P0765	P0765, P0768	SSD Electrical Faults	SSD circuit is open.	Open circuit in solenoid or wiring.	• Overdrive clutch failed on, only 4th, 5th and 6th gears available. • Harsh engagements. • Poor launch due to 4th gear drive away. • Will turn on MIL.	Go to **Pin**
P0766	P0729, P0734, P0735, P0766	Overdrive Clutch System Faults (includes non-electrical SSD faults, main control valve body and clutch)	SSD stuck off (SSD or main control valve body).	SSD stuck off, both low/reverse clutch and overdrive clutch failed off. This code sets for: • Low/reverse clutch/overdrive clutch VFS non-electrical fault. • Low/reverse clutch/overdrive clutch regulator valve stuck in default position. • Low/reverse clutch/overdrive clutch boost valve stuck in default position.	• Customer may notice flares or neutral conditions on shifts into 4th, 5th or 6th gears. • Customer might notice erratic shifting, flares, neutral conditions while the code is being set. • 1st gear with engine braking, 4th, 5th and 6th gears are disabled - customer might notice high engine speeds (since 3rd is highest available gear). • Also might get delayed or no reverse engagement (need low/reverse clutch on to achieve reverse). • Will turn on MIL.	Refer to **D**
P0767	P072F, P073A, P073B,	Overdrive Clutch System Faults (includes	Overdrive clutch failed on (clutch, SSD or	Overdrive clutch failed on, could be due to:	• Customer may notice a vehicle deceleration on a	Go to **Pin**

	P0767	non-electrical SSD faults, valve body and clutch)	valve body).	• Low/reverse clutch/overdrive clutch, VFS SSD non-electrical failed stuck on (pressure). • Overdrive clutch stuck on due to mechanical failure. • Low/reverse clutch/overdrive clutch regulator valve stuck in the spring compressed position.	shift into 2nd or 3rd gears (overdrive clutch failing to release will cause a tie-up in 2nd or 3rd gears). • First gear with engine braking, 1st gear without engine braking, 2nd and 3rd gears are disabled. • Poor launch due to 4th gear drive away. • Harsh engagements. • Will turn on MIL.	
P0768	-	SSD Electrical Faults	SSD is open, shorted to ground or shorted to voltage.	Open, short to ground or short to power in solenoid or wiring.	• See P0765, P0982, P0983. • Will turn on wrench lamp.	Go to **Pin**
P0768	P0765, P0768	SSD Electrical Faults	SSD circuit is open.	Open circuit in solenoid or wiring.	• Overdrive clutch failed on, only 4th, 5th and 6th gear available. • Harsh engagements. • Poor launch due to 4th gear drive away. • Will turn on wrench lamp.	Go to **Pin**
P0768	P0765, P0982	SSD Electrical Faults	SSD circuit is shorted to ground.	Short to ground in the solenoid or wiring.	• Failure Mode Effects Management action opens the transaxle solenoid power control, removing power from all solenoids (get PARK, REVERSE,	Go to **Pin**

					NEUTRAL and 5th gear as the only forward gear with TCC open). • Harsh engagements. • Poor launch performance (due to 5th gear drive away). • No TCC apply. • No shifts. • Will turn on wrench lamp.	
P0768	P0765, P0983	SSD Electrical Faults	SSD is shorted to voltage.	Short to power in the wiring or solenoid.	• Overdrive clutch failed on, only 4th, 5th and 6th gears available. • Harsh engagements, poor launch due to 4th gear drive away. • Will turn on wrench lamp.	Go to **Pin**
P0770	P0770, P0773	Shift Solenoid E (SSE) Electrical Faults	SSE circuit failure.	Open, short to ground or short to power in solenoid or wiring.	SSE controls routing SSD pressure to low/reverse clutch or overdrive clutch. For SSE failed off (no pressure): • Customer might notice 4th gear drive away (when 1st gear is commanded). • After it is determined on/off is failed to no pressure then 1st gear with engine braking is disabled. • Customer may notice nothing or	Go to **Pin**

					may notice 2nd gear provided when 1st gear selected in low manual lever range. • Harsh reverse engagements since low/reverse clutch does not apply in neutral or drive in this failure mode. For SSE failed on (pressure): • High side is turned off. • Poor launch performance (due to 5th gear drive away). • Harsh engagements. • No TCC apply. • Will turn on MIL.	
P0771	P0771, P0774	SSE Non-Electrical Faults (SSE and main control valve body)	SSE stuck off.	• The on/off solenoid (SSE) controls the multiplexing of SSD (low/reverse clutch/overdrive clutch VFS). If this solenoid fails off (no pressure), then 1st gear with engine braking is failed to 4th gear. • Also, if clutch select valve 2 sticks in the default position, then 1st gear with engine braking is failed to 4th gear	• If the on/off solenoid (SSE) is failed off or valve 2 is stuck in default position, then the customer will get 4th gear when 1st gear with engine braking is selected. • Customer might notice 4th gear drive way in automatic range since the control system commands 1st gear with engine braking at a stop (turns low/reverse clutch	Refer to **D**

				and reverse is failed to neutral. • It is not necessary to distinguish SSE stuck off from valve 2 stuck default. This code means either: ○ Non-electrical SSE (on/off solenoid) failed off (no pressure). ○ Valve 2 stuck in default position.	on) in case the customer moves the manual lever to reverse. Also, for valve 2 failures, the customer might get a no engagements when selecting reverse. • Will turn on MIL.	
P0772	P0772, P0774	SSE Non-Electrical Faults (SSE and valve body)	SSE stuck on.	• The on/off solenoid (SSE) controls the multiplexing of SSD (low/reverse clutch/overdrive clutch VFS). If this solenoid fails on (pressure) then 1st gear without engine braking, 1st gear with engine braking and 2nd gear are the only available gears. Third gear is failed to 1st gear without engine braking, 4th gear is failed to 1st gear with engine braking, 5th gear is failed to neutral and 6th gear is a tie-up.	• If the on/off solenoid (SSE) is failed on or valve 2 is stuck in spring compressed position, then 1st and 2nd gears are the only available gears. • Customer might notice flares (on shifts into 3rd gear), deceleration (on shifts into 4th gear) or neutral conditions (on shifts into 5th gear). High engine RPM (since 2nd gear is top available gear). • Will turn on MIL.	Refer to **D**

				• Also, if clutch select valve 2 sticks in the spring compressed position the same ratio pattern will occur. This code means either:
				  ○ Non-electrical SSE (on/off solenoid) failed on (pressure).
				  ○ Valve 2 stuck in spring compressed position.		

P0773	P0770, P0773	SSE Electrical Faults	SSE circuit failure.	Open, short to ground or short to power in solenoid or wiring.	SSE controls routing SSD pressure to low/reverse clutch or overdrive clutch. For SSE failed off (no pressure): • Customer might notice 4th gear drive away (when 1st gear commanded). • After it is determined on/off is failed to no pressure then 1st gear with engine braking is disabled. • Customer may notice nothing or may notice 2nd gear provided when 1st gear selected in low manual lever range.	Go to **Pin**

					• Harsh reverse engagements since low/reverse clutch does not apply in neutral or drive in this failure mode. For SSE failed on (pressure): • High side is turned off. • Poor launch performance (due to 5th gear drive away). • Harsh engagements. • No TCC apply. • Will turn on wrench lamp.	
P0774	-	SSE Electrical Faults	SSE stuck on or off.	See P0771 and P0772.	• See P0771 and P0772. • Will turn on wrench lamp.	Go to **Pin**
P0774	P0771, P0774	SSE Non-Electrical Faults (SSE and valve body)	SSE stuck off.	• The on/off solenoid (SSE) controls the multiplexing of SSD (low/reverse clutch/overdrive clutch VFS). If this solenoid fails off (no pressure) then 1st gear with engine braking is failed to 4th. • Also, if clutch select valve 2 sticks in the default position, then 1st gear with engine braking is	• If the on/off solenoid (SSE) is failed off or valve 2 is stuck in default position, then the customer will get 4th gear when 1st gear with engine braking is selected. • Customer might notice 4th gear drive way in automatic range since the control system commands 1st gear with engine braking at a stop (turns	Refer to **D**

				failed to 4th gear and reverse is failed to neutral. • Do not distinguish SSE stuck off from valve 2 stuck default. This code means either: ◦ Non-electrical SSE (on/off solenoid) failed off (no pressure). ◦ Valve 2 stuck in default position.	low/reverse clutch on) in case the customer moves the manual lever to REVERSE. Also, for valve 2 failures the customer might get a no engagements when selecting reverse. • Will turn on wrench lamp.	
P0774	P0772, P0774	SSE Non-Electrical Faults (SSE and valve body)	SSE stuck on.	• The on/off solenoid (SSE) controls the multiplexing of SSD (low/reverse clutch/overdrive clutch VFS). If this solenoid fails on (pressure) then 1st gear without engine braking, 1st gear with engine braking and 2nd gear are the only available gears. 3rd gear is failed to 1st gear without engine braking, 4th gear is failed to 1st gear with engine braking, 5th gear is failed to neutral and 6th gear is a tie-up.	• If the on/off solenoid (SSE) is failed on or valve 2 is stuck in spring compressed position then 1st and 2nd are the only available gears. • Customer might notice flares (on shifts into 3rd gear), deceleration (on shifts into 4th gear) or neutral conditions (shifts into 5th gear). High engine RPM (since 2nd gear is top available gear).	Refer to **D**

				- Also, if clutch select valve 2 sticks in the spring compressed position the same ratio pattern will occur. This code means either: - Non-electrical SSE (on/off solenoid) failed on (pressure). - Valve 2 stuck in spring compressed position. - Will turn on wrench lamp.		
P0960	P0960, P0748	LPC Solenoid Electrical Faults	LPC circuit is open.	Open circuit in solenoid or wiring.	- Failed to maximum line pressure. - Harsh engagements. - Will turn on MIL.	Go to **Pin**
P0962	P0962, P0748	LPC Solenoid Electrical Faults	LPC circuit is shorted to ground.	Short to ground in the solenoid or wiring.	Failed to minimum line pressure: - Failure Mode Effects Management action opens the transaxle solenoid power control removing power from all solenoids (get PARK, REVERSE, NEUTRAL and 5th gear as the only forward gear with TCC open). - Harsh	Go to **Pin**

					engagements. • Poor launch performance (due to 5th gear drive away). • No TCC apply. • No shifts. • Will turn on MIL.	
P0963	P0963, P0748	LPC Solenoid Electrical Faults	LPC is shorted to voltage.	Short to power in the wiring or solenoid.	• Failed to maximum line pressure. • Harsh engagements. • Will turn on MIL.	Go to **Pin**
P0973	P0973, P0753	SSA Electrical Faults	SSA circuit is shorted to ground.	Short to ground in the solenoid or wiring.	• Failure Mode Effects Management action opens the transaxle solenoid power control, removing power from all solenoids (get PARK, REVERSE, NEUTRAL and 5th gear as the only forward gear with TCC open). • Harsh engagements. • Poor launch performance (due to 5th gear drive away). • No TCC apply. • No shifts. • Will turn on MIL.	Go to **Pin**
P0974	P0974, P0753	SSA Electrical Faults	SSA is shorted to voltage.	Short to power in the wiring or solenoid.	• Forward clutch is failed off - 5th and 6th gears only available forward gears. • Neutral condition or flare when fault occurs.	Go to **Pin**

					• Poor launch due to 5th gear drive away • Will turn on MIL.	
P0976	P0976, P0758	SSB Electrical Faults	SSB circuit is shorted to ground.	Short to ground in the solenoid or wiring.	• Failure Mode Effects Management action opens the transaxle solenoid power control, removing power from all solenoids (get PARK, REVERSE, NEUTRAL and 5th gear as the only forward gear with TCC open). • Harsh engagements. • Poor launch performance (due to 5th gear drive away). • No TCC apply. • No shifts. • Will turn on MIL.	Go to **Pin**
P0977	P0977, P0758	SSB Electrical Faults	SSB is shorted to voltage.	Short to power in the wiring or solenoid.	• Direct clutch failed on - only 3rd and 5th gear available. • Harsh engagements. • Poor launch due to 3rd gear drive away. • Will turn on MIL.	Go to **Pin**
P0979	P0979, P0763	SSC Electrical Faults	SSC circuit is shorted to ground.	Short to ground in the solenoid or wiring.	• Failure Mode Effects Management action opens the transaxle solenoid power control, removing power from all solenoids (get PARK, REVERSE,	Go to **Pin**

					NEUTRAL and 5th gear as the only forward gear with TCC open). • Harsh engagements. • Poor launch performance (due to 5th gear drive away). • No TCC apply. • No shifts. • Will turn on MIL.	
P0980	P0980, P0763	SSC Electrical Faults	SSC is shorted to voltage.	Short to power in the wiring or solenoid.	Intermediate clutch is failed off: • If fault occurs while in 2nd or 6th gear, customer might notice a neutral condition before diagnostics disables 2nd and 6th gears. • Customer might notice erratic, delayed or harsh shifts. • Will turn on MIL.	Go to **Pin**
P0982	P0982, P0768	SSD Electrical Faults	SSD circuit is shorted to ground.	Short to ground in the solenoid or wiring.	• Failure Mode Effects Management action opens the transaxle solenoid power control removing power from all solenoids (get PARK, REVERSE, NEUTRAL and 5th as the only forward gear with TCC open), harsh engagements. • Poor launch	Go to **Pin**

					performance (due to 5th gear drive away). • No TCC apply. • No shifts. • Will turn on MIL.	
P0983	P0983, P0768	SSD Electrical Faults	SSD is shorted to voltage.	Short to power in the wiring or solenoid.	• Overdrive clutch failed on, only 4th, 5th and 6th gears available. • Harsh engagements. • Poor launch due to 4th gear drive away. • Will turn on MIL.	Go to **Pin**
P1636	-	ADLR Faults	ADLR chip communication error.	• Lost communication with ADLR solenoid driver. • ADLR is an internal PCM chip that controls the solenoids. The main micro communicates with the ADLR over a serial interface, sending out the desired solenoid state and receiving back a circuit fault status. • If communication is lost with the ADLR, the solenoid states become unknown, so the control system forces the transaxle solenoid power	• Transaxle solenoid power control turned off, providing PARK, REVERSE, NEUTRAL and 5th gear with TCC open and maximum line pressure. • Harsh engagements. • Poor performance launch (due to 5th drive away). • No TCC apply. • No shifts. • Will turn on MIL.	Install a n **ELECTR** **CONTR(**

				control off.		
P163E	-	Transmission Identification Block (solenoid strategy data programmed into the PCM)	Transmission identification version.	• Transmission identification version incorrect (transmission identification version does not match version in PCM calibration). • 7-digit service banding code checksum or total transmission identification block checksum invalid. • Solenoid and Clutch characterization data unavailable. • Failure Mode Effects Management will increase pressure and allow only PARK, REVERSE, NEUTRAL, 1st gear without engine braking and 3rd.	• Failure Mode Effects Management action of limits function to 1st gear without engine braking and 3rd could cause high engine RPM, lack of shifts complaints. • No TCC apply. • Will turn on MIL.	Refer to **S**
P163F	-	Transmission Identification Block (solenoid characterization data programmed into the PCM)	Transmission identification block corrupted, not programmed.	• Transmission identification data not programmed. • Solenoid and Clutch strategy data unavailable. • Failure Mode Effects Management will increase pressure and allow only PARK, REVERSE,	• Failure Mode Effects Management action of limits function to 1st gear without engine braking and 3rd could cause high engine RPM, lack of shifts complaints. • No TCC apply. • Will turn on MIL.	Refer to **S**

				NEUTRAL, 1st gear without engine braking and 3rd.		
P1700	-	Other Main Control Valve Body Faults (stuck valves)	Multiplex manual valve (valve 3).	This DTC is set if the multiplex manual valve sticks in the default position for reverse while the manual valve is in the drive or low position. Neutral will be the default condition in all forward gear ranges with SSE on. Once the PCM sees this fault, the PCM turns off SSE (SSE off) and allows the transaxle to achieve 1st, 2nd, and 3rd gears only.	• Customer might notice neutral conditions when 1st gear with engine braking, 1st gear without engine braking or 2nd are commanded. • Erratic shifting as the OBD isolate the cause of the neutral condition to multiplex manual valve (valve 3). • High engine speeds since 3rd is top available gear, harsh reverse engagements (since low/reverse clutch is not on in drive at low speed with this failure). • Will turn on wrench lamp.	Refer to **D**
P1702	-	TR Sensor Electrical Faults	TR sensor circuit failure.	P1702 - see P0705 and P0708.	• Possible no crank, only PARK, REVERSE, NEUTRAL and 5th gear available, harsh engagements. • Extremely delayed engagements (until a DTC is set). • After a DTC is set and the high side opened - harsh engagements, poor performance (due to a 5th gear drive away), no shifts.	Go to **Pin**

					• Will turn on wrench lamp.	
P1702	P0705, P1702	TR Sensor	TR sensor circuit failure.	PCM is received an invalid combination of the 4-bit signal from the TR sensor (wiring, connector or TR sensor issue).	• Possible no crank, only PARK, REVERSE, NEUTRAL and 5th gear available, harsh engagements. • Extremely delayed engagements (until a DTC is set). • After a DTC is set and the high side opened - harsh engagements, poor performance (due to a 5th gear drive away), no shifts. • Will turn on wrench lamp.	Go to **Pin**
P1702	P0708, P1702	TR Sensor	TR sensor circuit failure.	PCM is received all 4 TR sensor bits open (potential sensor disconnected, wiring, connector or TR sensor issue).	• Possible no crank, only PARK, REVERSE, NEUTRAL and 5th gear available, harsh engagements. • Extremely delayed engagements (until a DTC is set). • After a DTC is set and the high side opened - harsh engagements, poor performance (due to a 5th gear drive away), no shifts. • Will turn on wrench lamp.	Go to **Pin**
P1705	-	TR Sensor	TR sensor.	TR sensor not indicating Park or Neutral during Key ON Engine OFF (KOEO) or Key ON Engine Running (KOER) self-	Carry out KOEO or KOER only.	Go to **Pin**

				test.		
P1711	-	TFT	TFT sensor.	TFT out of self-test range (less than -1°C [30°F] or greater than 105°C [220°F]).	Carry out KOEO or KOER only.	Go to **Pin**
P1744	P0741, P1744	TCC System Faults (includes TCC, main control valve body and non-electrical solenoid faults)	TCC failed off.	TCC is mechanically stuck off.	P0741 and P1744 mean the same thing non-electrical failure that caused the TCC to fail to apply. This code sets for: • Non-electrical TCC solenoid stuck off. • TCC mechanical failure. • TCC regulator apply valve stuck in TCC release position. • TCC control valve stuck in TCC release position. • TCC functional failure MIL code. • TCC failed to apply (less than 80 RPM slip error lasting at least 3 seconds when TCC is commanded on) 3 consecutive times. • Will turn on wrench lamp.	Refer to **D**
P1780	-	Transmission Control Switch (TCS)	TCS.	TCS did not change states during KOER Self Test.	Customer cannot cancel overdrive.	Refer to **A TRANSA EXTERN** article.
P1783	-	Transmission Over Temperature	Transmission over temperature.	Transmission over temperature condition (greater than 135°C [275°F] for at least 5 seconds).	• Torque converter lockup happens earlier than expected. • Will turn on wrench lamp.	Refer to **D**
P1910	-	Reverse Lamp	Reverse lamp	Reverse lamp control	• Reverse lamps do	Refer to **F**

		Control	control.	circuit fault.	not function correctly. • Will turn on wrench lamp.	**LIGHTI**
P2700	-	Forward Clutch System Fault (includes non-electrical SSA faults, main control valve body and forward clutch)	Forward clutch failed on or off.	See P0751 and P0752.	• See P0751 and P0752. • Will turn on wrench lamp.	Refer to **D**
P2700	P0751, P2700	Forward Clutch System Faults (includes non-electrical SSA faults, valve body and clutch)	Forward clutch failed off.	Forward clutch failed off, could be due to: • Forward clutch VFS (SSA) non-electrical failed stuck off (no pressure). • Forward clutch stuck off due to mechanical failure. • Forward clutch regulator valve stuck in the default position. • Forward clutch boost valve stuck in the default position.	• Customer may notice neutral conditions or flares on downshifts from 5th or 6th as the test is determining Forward is failed off. • Once a code is stored, all gears with Forward on are disabled - leaving 5th and 6th as the only Forward gears. • Customer might notice erratic shifting, harsh engagements, neutral conditions, flares, poor launch performance (due to 5th drive away), harsh reverse engagements. • Will turn on wrench lamp.	Refer to **D**
P2700	P0752, P2700	Forward Clutch System Faults (includes non-electrical SSA faults, valve body and	Forward clutch failed on.	Forward clutch failed on, could be due to: • Forward clutch VFS (SSA) non-electrical failed	• Customer may notice a vehicle deceleration on a shift into 5th or 6th gears (forward clutch failing to	Refer to **D**

		clutch)		stuck on (pressure). • Forward clutch stuck on due to mechanical failure. • Forward clutch regulator valve stuck in the default position. • Forward clutch regulator valve stuck in the spring compressed position.	release will cause a tie-up in 5th or 6th gears). • Customer might notice erratic shifting or being stuck in 4th gear while the test is confirming forward clutch is failed on. • After a code is stored 5th and 6th are disabled. Customer might notice higher than normal engine speeds and loss of fuel economy. • Will turn on wrench lamp.	
P2701	-	Direct Clutch System Fault (includes non-electrical SSB faults, valve body and clutch)	Direct clutch failed on.	• Direct clutch failed on due to a mechanical fault. • Due to the hydraulic controls the clutch can be isolated from the solenoid - this failure code means direct clutch is on in 1st gear under conditions where the SSB (direct clutch VFS) cannot cause it to apply.	• Customer may notice a vehicle deceleration on a shift into 2nd, 4th or 6th gear (direct clutch failing to release will cause a tie-up in these gears). • Customer might notice erratic shifting while the test is confirming direct clutch is failed on. • After a code is stored all gears but 3rd and 5th are disabled. • Since only 3rd and 5th gears are allowed the customer might notice: ○ poor launch	Refer to **D**

					performance. ◦ lack of shifts. ◦ harsh engagements. • Will turn on wrench lamp.	
P2702	-	Intermediate Clutch System Faults (includes clutch, valve body and non-electrical SSC faults)	Intermediate clutch failed on or off.	See P0761 and P0762.	• See P0761 and P0762. • Will turn on wrench lamp.	Refer to D
P2702	P0761, P2702	Intermediate Clutch System Faults (includes clutch, valve body and non-electrical SSC faults)	Intermediate clutch failed off.	Intermediate clutch failed off, could be due to: • Intermediate clutch VFS (SSC) non-electrical failed stuck off (no pressure). • Intermediate clutch stuck off due to mechanical failure. • Intermediate clutch regulator valve stuck in the default position.	• Customer may notice neutral conditions or flares on shifts to 2nd or 6th as the test is determining intermediate clutch is failed off. • Once a code is stored, all gears with intermediate clutch on are disabled (2nd and 6th gears) leaving 1st gear without engine braking, 1st gear with engine braking, 3rd, 4th and 5th gears. • Customer might notice erratic shifting, neutral conditions, flares, higher engine speeds on highway (due to 6th gear being disabled). • Will turn on wrench lamp.	Refer to D
P2702	P0762, P2702	Intermediate Clutch System Faults (includes	Intermediate clutch failed on.	Intermediate clutch failed on, could be due to:	• Customer may notice a vehicle deceleration on a	Refer to D

		clutch, valve body and non-electrical SSC faults)		• Intermediate clutch VFS (SSC) non-electrical failed stuck on (pressure). • Intermediate clutch stuck on due to mechanical failure. • Intermediate clutch regulator valve stuck in the spring compressed position.	shift into 3rd or 5th gears (intermediate clutch failing to release will cause a tie-up in 3rd or 5th gears). • Customer might notice erratic shifting or being stuck in 6th gear while the test is confirming C26 is failed on. • After a code is stored 1st gear with engine braking, 1st gear without engine braking, 3rd, 4th and 5th gears are disabled. • Customer might notice hanging in 2nd gear on acceleration since 2nd gear - 6th gear upshifts only occur at closed pedal (due to energy limitations of overdrive clutch), harsh reverse engagements (since low/reverse clutch is not on in 2nd gear). • Will turn on wrench lamp.	
P2703	-	Low/Reverse Clutch and OWC Faults (covers just the clutches)	Low/reverse clutch failed off.	Low/reverse clutch provides engine braking in 1st gear and is required to achieve reverse.	• Low/reverse clutch is only tested for failed off in the low manual lever position. • The customer might notice not getting engine braking in 1st gear	Refer to **D**

					with engine braking, and erratic shifting as the OBDs isolates the fault to low/reverse clutch failed off. • Once a code is stored 2nd gear will be provided in place of 1st in the Low manual lever range. • Customer might also experience delayed or no reverse engagement. • Will turn on wrench lamp.	
P2704	-	Overdrive Clutch System Faults (includes non-electrical SSD faults, valve body and clutch)	Overdrive clutch failed off (clutch fault only).	• Overdrive clutch failed off. • Since SSD (low/reverse clutch/overdrive clutch VFS) is multiplexed we can isolate overdrive clutch failed off mechanical faults (set P2704) from SSD failed to no pressure (sets P0766).	• Customer may notice neutral conditions or flares on shifts into 4th, 5th, or 6th gear. • 4th, 5th and 6th gears are disabled. • Customer might notice erratic shifting, neutral conditions, flares, high engine RPM (since 3rd gear is top available gear). • Will turn on wrench lamp.	Refer to **D**
P2705	-	OWC Faults (covers just the clutches)	OWC failed off.	• OWC holds in 1st gear without engine braking. If the OWC fails off, 1st gear without engine braking is failed to neutral. • First gear with engine braking is	• Customer might notice neutral conditions when 1st gear without engine braking is commanded. • Erratic shifting as the OBD isolates the cause of the neutral condition to	Refer to **D**

				disabled for this failure since low/reverse clutch is not intended to hold power on torque in 1st gear.	the OWC being failed. • Might also notice poor launch performance (due to 2nd gear drive away). • Harsh engagements. • Will turn on wrench lamp.	
P2783	-	Other Main Control Valve Body Faults (stuck valves)	TCC control valve.	• TCC control valve stuck in the apply position. When the TCC is commanded open there will be no flow through the TCC (both apply and release circuits will be exhausted). • Test will run in 3rd or higher (when valve 2 is in the latched position, pointing SSD at overdrive clutch) when the TCC is commanded open. SSE is turned on, if the control valve is stuck this will cause the TCC to apply even though the TCC VFS is off.	• Erratic shifts, vehicle disengages at a stop while in drive or low, early TCC apply. • Will turn on wrench lamp.	Refer to **D**

TRANSAXLE CONNECTOR LAYOUTS

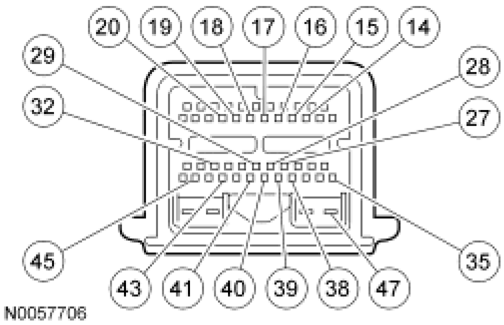


Fig. 6: PCM Transaxle Connector - C175T
Courtesy of FORD MOTOR CO.

Pin Number	Circuit Function
14	Output Shaft Speed (OSS) Sensor Signal
15	Turbine Shaft Speed (TSS) Sensor Signal
16	Transmission Control Switch (TCS)
17	Transmission Range (TR)1
18	TR2
19	TR3
20	Transmission Fluid Temperature (TFT) Sensor Supply
27	Shift Solenoid B (SSB)
28	Shift Solenoid D (SSD)
29	Torque Converter Clutch (TCC) Solenoid
32	TR4
35	Line Pressure Control (LPC)
38	Shift Solenoid E (SSE)
39	Shift Solenoid A (SSA)
40	Shift Solenoid C (SSC)
41	TSS/OSS Power
43	TFT Signal Return
45	TR/TSS/OSS Ground
47	Transaxle Solenoid Power Control Voltage

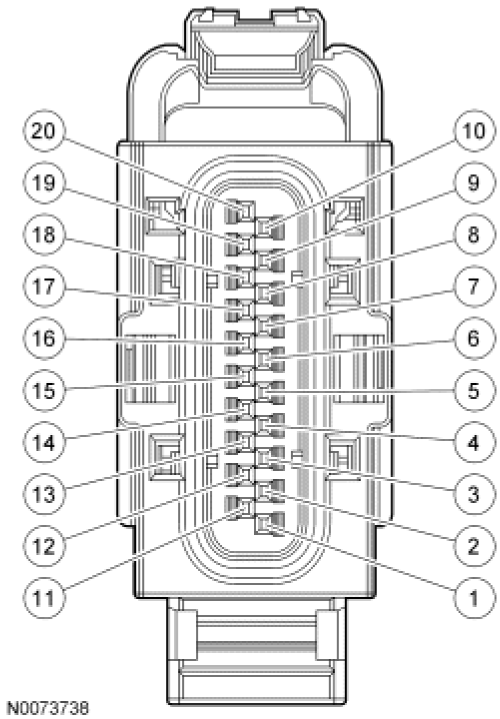


Fig. 7: Transaxle Vehicle Harness Connector - C168
Courtesy of FORD MOTOR CO.

Pin Number	Circuit Function
1	Shift Solenoid E (SSE)
2	Transmission Fluid Temperature (TFT) Sensor Supply
3	TFT Signal Return
4	Transmission Range (TR)1
5	TR2
6	TR3
7	TR4
8	TR Sensor Ground
9	Turbine Shaft Speed (TSS)/Output Shaft Speed (OSS) Sensor Ground
10	OSS Sensor Signal
11	Not Used
12	Shift Solenoid D (SSD)
13	Shift Solenoid A (SSA)
14	Torque Converter Clutch (TCC) Solenoid
15	Transaxle Solenoid Power Control Voltage
16	Shift Solenoid B (SSB)
17	Shift Solenoid C (SSC)
18	Line Pressure Control (LPC)
19	TSS Sensor Signal

20	TSS/OSS Sensor Power Supply

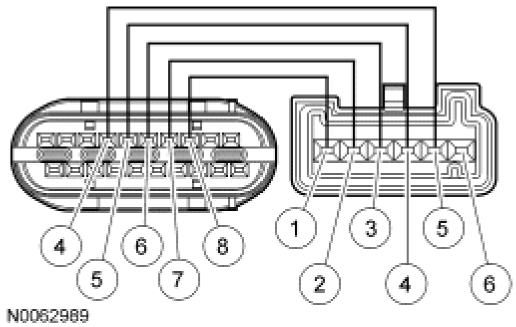


Fig. 8: Solenoid Body-to-Transmission Range (TR) Sensor Internal Circuit Diagram
Courtesy of FORD MOTOR CO.

Solenoid Body Main Connector Pin Number	TR Sensor Pin Number	Circuit Function
4	5	Transmission Range (TR)1
5	4	TR2
6	3	TR3
7	2	TR4
8	1	TR Ground
-	6	Empty

NOTE: **The Output Shaft Speed (OSS) sensor connector is on top of the 20-pin solenoid body connector (next to the Transmission Range (TR) sensor connector).**

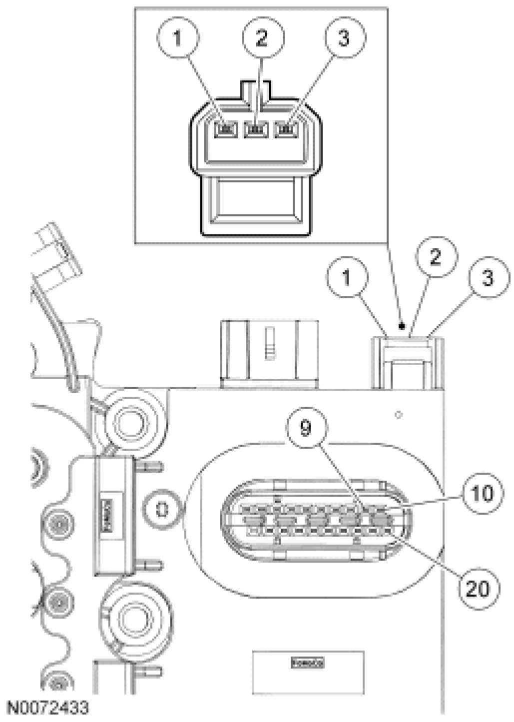


Fig. 9: Solenoid Body-to-Output Shaft Speed (OSS) Sensor Internal Circuit Diagram
Courtesy of FORD MOTOR CO.

Solenoid Body Main Connector Pin Number	OSS Sensor Pin Number	Circuit Function
9	3	Turbine Shaft Speed (TSS)/Output Shaft Speed (OSS) Sensor Ground Circuit
10	1	OSS Sensor Signal
20	2	TSS/OSS Sensor Power Supply

NOTE: **The Turbine Shaft Speed (TSS) sensor connector is below the 20-pin solenoid body connector.**

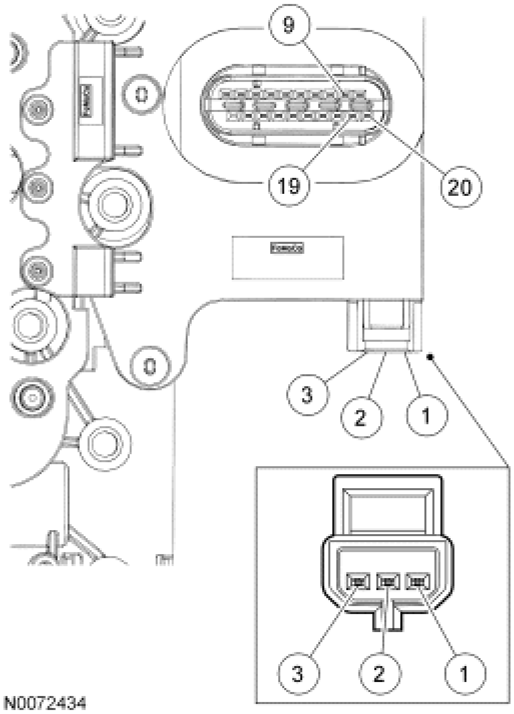


Fig. 10: Solenoid Body-to-Turbine Shaft Speed (TSS) Sensor Internal Circuit Diagram
Courtesy of FORD MOTOR CO.

Solenoid Body Main Connector Pin Number	TSS Sensor Pin Number	Circuit Function
9	1	Turbine Shaft Speed (TSS)/Output Shaft Speed (OSS) Sensor Ground Circuit
19	3	TSS Sensor Signal
20	2	TSS/OSS Sensor Power Supply

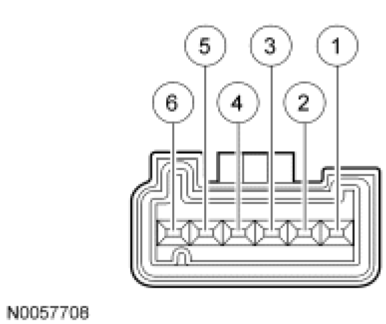


Fig. 11: Digital Transmission Range (TR) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin Number	Circuit Function

1	Transmission Range (TR) Ground
2	TR4
3	TR3
4	TR2
5	TR1
6	Empty

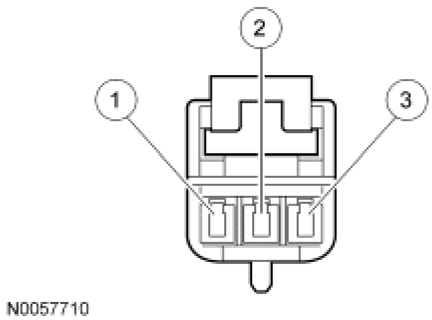


Fig. 12: Turbine Shaft Speed (TSS) Sensor/Output Shaft Speed (OSS) Sensor
Courtesy of FORD MOTOR CO.

Pin Number	Circuit Function
1	Turbine Shaft Speed (TSS) Sensor Ground
2	TSS Power
3	TSS Sensor Signal

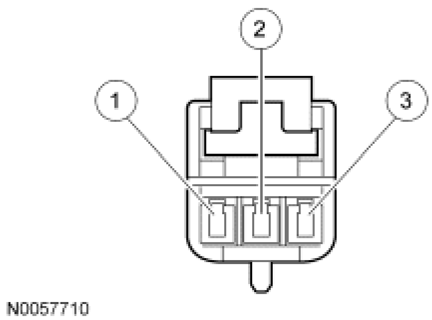
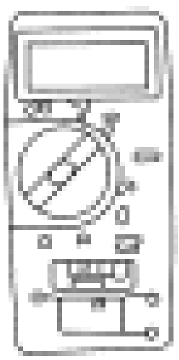


Fig. 13: Turbine Shaft Speed (TSS) Sensor/Output Shaft Speed (OSS) Sensor
Courtesy of FORD MOTOR CO.

Pin Number	Circuit Function
1	Output Shaft Speed (OSS) Sensor Signal
2	OSS Power
3	OSS Sensor Ground

PINPOINT TESTS - OSC EQUIPPED VEHICLE

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Digital Multimeter	105-R0057 or equivalent
 ST2574-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Anytime an electrical connector or solenoid body is disconnected, inspect the connector for terminal condition, corrosion and contamination. Also inspect the connector seal for damage. Clean, repair or install new components as required.

TRANSMISSION RANGE (TR) SENSOR DIAGNOSIS CHART

Selector Position	PID: TR	PID: TR_D			
		TR1	TR2	TR3	TR4
PARK	P/N	0	1	1	0
In Between	REV	0	0	1	0
REVERSE	REV	0	0	1	1
In Between	REV	1	0	1	1
NEUTRAL	NTRL	1	0	1	0
In Between	NTRL	1	0	0	0
Drive	Drive	1	0	0	1
In Between	Drive	0	0	0	1

Low	Low	0	0	0	0

A "In Between" reading could be caused by a selector lever cable or Transmission Range (TR) sensor misaligned or a TR sensor circuit failure of TR1, TR2, TR3 or TR4.

B TR PIDs: 1= Open TR switch, 0 = Closed TR switch.

C VCM Readings: Taken from PCM signal pins for TR1, TR2, TR3 and TR4 to signal return.

Wiggle Test Information for Open/Shorts

A Check TR1, TR2, TR3 and TR4 circuits for an intermittent open with the TR sensor positioned so that suspect circuit is in the closed position and monitor the TR PIDs with the scan tool.

B Check TR1, TR2, TR3 and TR4 circuits for an intermittent short with the TR sensor positioned so that suspect circuit is in the open position and monitor the TR PIDs with the scan tool. To determine the shorted components while observing TR PIDs, unplug the TR and see if the short goes away. If the short is still present, unplug the transaxle harness and see if the short goes away. If the short is still present, then the short is in the PCM or vehicle harness. Remove the suspect circuit(s) wire terminal from the PCM connector. If the short is still present, then the PCM has an internal failure. Otherwise, the failure is in the vehicle harness.

Shift Solenoid Pre-Diagnosis

Use the following shift solenoid operation information when carrying out Pinpoint Test A.

SOLENOID OPERATION CHART

Base Selector Lever Position	PCM Commanded Gear	Shift Solenoid SSA (VFS) NL (CB 1,2,3,4)	SSB (VFS) NH (C 3,5,R)	SSC (VFS) NL (CB 2,6)	SSD (VFS) NH (CB L,R/4,5,6)	SSE (On/Off) NC	TCC (VFS) NL
P	P	Off	On	Off	Off	On	Off
R	R	Off	Off	Off	Off	On	Off
N	N	Off	On	Off	Off[a]	On[a]	Off
D	1	On	On	Off	Off[b]	On[c]	Off
	2	On	On	On	On	Off	Off
	3	On	Off	Off	On	Off	Off
	4	On	On	Off	Off	Off	On/Off
	5	Off	Off	Off	Off	Off	On/Off
	6	Off	On	On	Off	Off	On/Off
L	L	On	On	Off	Off[b]	On[c]	Off

CB = Clutch brake
NC = Normally closed
NH = Normally high
NL = Normally low

[a] Solenoid state will change if vehicle is moving forward with the selector lever in the NEUTRAL position.

[b] Turns on above 10 km/h (6 mph).

[c] Turns off above 10 km/h (6 mph).

Shift Solenoid Failure Mode Chart Failed ON or Failed OFF

Failed ON/OFF due to PCM and/or vehicle wiring concerns and/or solenoid electrically, mechanically or hydraulically stuck ON/OFF.

SHIFT SOLENOID A (SSA)

Gear Commanded	Actual Gears Obtained	
	Failed ON (High Pressure)	Failed OFF (Low Pressure)
R	R	R
D	1, 2, 3, 4	5, 6

SHIFT SOLENOID B (SSB)

Gear Commanded	Actual Gears Obtained	
	Failed ON (Low Pressure)	Failed OFF (High Pressure)
R	N[a]	R
D	1, 2, 4, 6	3, 5

[a] Reverse is available if the solenoid circuit failed causing transaxle solenoid power control solenoid to remove voltage to all solenoids.

SHIFT SOLENOID C (SSC)

Gear Commanded	Actual Gears Obtained	
	Failed ON (High Pressure)	Failed OFF (Low Pressure)
R	R	R
D	2, 6	1, 3, 4, 5

SHIFT SOLENOID D (SSD)

Gear Commanded	Actual Gears Obtained	
	Failed ON (Low Pressure)	Failed OFF (High Pressure)
R	N[a]	R
D	1, 2, 3[b]	4, 5, 6

[a] Reverse is available if the solenoid circuit failed causing transaxle solenoid power control solenoid to remove voltage to all solenoids.

[b] No engine braking.

SHIFT SOLENOID E (SSE)

Gear Commanded	Actual Gears Obtained	
	Failed ON (High Pressure)	Failed OFF (Low Pressure)
R	R	R
D	1, 2	1[a] , 2, 3, 4, 5, 6

[a] No engine braking.

Pinpoint Tests

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Transmission Controls - 6 Speed for schematic and connector information.

PINPOINT TEST A: TRANSAXLE CONTROL SOLENOIDS

NOTE: Refer to the Transaxle Internal Harness Diagram illustration Transaxle Connector Layouts.

NOTE: Refer to the Transaxle Vehicle Harness Connector illustration Transaxle Connector Layouts.

A1 ELECTRONIC DIAGNOSTICS

- Check to make sure the transaxle harness connector is fully seated, terminals are engaged in connector and in good condition before proceeding.
- Connect the diagnostic tool.
- Carry out the Key ON Engine OFF (KOEO) Self Test until continuous DTCs have been displayed.
- Enter the Output Test Mode.
- Select the mode ALL ON. Push START to turn outputs ON. Push STOP to turn outputs OFF.
- **Does vehicle enter Output Test Mode?**

  YES : Go to A2.

  NO : PRESS START. If vehicle does not enter Output Test Mode, REFER to the **Introduction - Gasoline Engines** article.

A2 CHECK THE SOLENOID CIRCUIT FOR AN OPEN

- Key in OFF position.
- Disconnect: Transaxle Vehicle Harness C168
- Use a mirror to inspect both ends of the connector for damage or pushed-out pins, corrosion, loose wires and missing or damaged seals.
- Disconnect: PCM Transaxle Electrical C175T
- Use a mirror to inspect both ends of the connector for damage or pushed-out pins, corrosion, loose wires and missing or damaged seals.
- Measure the resistance of the suspect solenoid circuit between PCM transaxle electrical C175T and

transaxle harness C168 using the following chart.

Shift Solenoid	Transaxle Vehicle Harness C168	PCM Transaxle C175T
Shift Solenoid A (SSA) CET05 (BU/GN)	C168-13	C175T-39
Shift Solenoid B (SSB) CET06 (GN/BN)	C168-16	C175T-27
Shift Solenoid C (SSC) CET07 (GY/OG)	C168-17	C175T-40
Shift Solenoid D (SSD) CET08 (BN/WH)	C168-12	C175T-28
Shift Solenoid E (SSE) CET18 (GY/YE)	C168-1	C175T-38
Line Pressure Control (LPC) CET09 (YE/VT)	C168-18	C175T-35
Torque Converter Clutch (TCC) CET10 (BU/GY)	C168-14	C175T-29

- **Is the resistance less than 5 ohms?**

  YES : Go to A3.

  NO : REPAIR the circuit(s) for an open. RECONNECT all components. TEST the system for normal operation.

A3 CHECK THE SOLENOID CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between transaxle vehicle harness C168 and ground.

Shift Solenoid	Transaxle Vehicle Harness C168	Ground
SSA CET05 (BU/GN)	C168-13	Ground
SSB CET06 (GN/BN)	C168-16	Ground
SSC CET07 (GY/OG)	C168-17	Ground
SSD CET08 (BN/WH)	C168-12	Ground
SSE CET18 (GY/YE)	C168-1	Ground
LPC CET09 (YE/VT)	C168-18	Ground
TCC CET10 (BU/GY)	C168-14	Ground

- **Is the resistance greater than 10,000 ohms?**

  YES : Go to A4.

  NO : REPAIR the circuit(s) for a short to ground. RECONNECT all components. TEST the system for normal operation.

A4 CHECK THE SOLENOID CIRCUIT FOR A SHORT TO POWER

- Measure the voltage between transaxle vehicle harness C168 and ground.

Shift Solenoid	Transaxle Vehicle Harness C168	Ground
SSA CET05 (BU/GN)	C168-13	Ground
SSB CET06 (GN/BN)	C168-16	Ground
SSC CET07 (GY/OG)	C168-17	Ground

SSD CET08 (BN/WH)	C168-12	Ground
SSE CET18 (GY/YE)	C168-1	Ground
LPC CET09 (YE/VT)	C168-18	Ground
TCC CET10 (BU/GY)	C168-14	Ground

- **Is any voltage present?**

  YES : REPAIR the circuit(s) for a short to power. RECONNECT all components. TEST the system for normal operation.

  NO : Go to A5.

A5 CHECK THE RESISTANCE OF THE SOLENOID FIELD CIRCUIT

- Measure the resistance between transaxle solenoid body C168-15, component side and the suspect solenoid pin, component side and compare the value to the specifications in the table below.

Shift Solenoid	Transaxle C168 Component Side	Transaxle C168-15 Component Side
SSA CET05 (BU/GN)	C168-13	C168-15
SSB CET06 (GN/BN)	C168-16	C168-15
SSC CET07 (GY/OG)	C168-17	C168-15
SSD CET08 (BN/WH)	C168-12	C168-15
SSE CET18 (GY/YE)	C168-1	C168-15
LPC CET09 (YE/VT)	C168-18	C168-15
TCC CET10 (BU/GY)	C168-14	C168-15

SOLENOID RESISTANCE VALUES: SSA, SSB, SSC, SSD, TCC AND LPC

Temperature		Resistance (ohms)
°C	°F	
-20 to -10	-4 to 14	3.24-5.13
-10 to 0	14-32	3.43-5.32
0-10	32-50	3.62-5.51
10-20	50-68	3.81-5.70
20-30	68-86	4.00-5.89
30-40	86-104	4.19-6.08
40-50	104-122	4.38-6.27
50-60	122-140	4.57-6.46
60-70	140-158	4.76-6.65
70-80	158-176	4.95-6.83
80-90	176-194	5.13-7.02
90-100	194-212	5.32-7.21

SOLENOID RESISTANCE VALUES: SSE (ON/OFF)

Temperature		

°C	°F	Resistance (ohms)
-20 to -10	-4 to 14	15.45-24.35
-10 to 0	14-32	16.35-25.25
0-10	32-50	17.25-26.15
10-20	50-68	18.15-27.05
20-30	68-86	19.05-27.95
30-40	86-104	19.95-28.85
40-50	104-122	20.85-29.75
50-60	122-140	21.75-30.65
60-70	140-158	22.65-31.54
70-80	158-176	23.54-32.44
80-90	176-194	24.44-33.34
90-100	194-212	25.34-34.24

- **Is the resistance within specifications?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. RECONNECT all components. TEST the system for normal operation.

  NO : REMOVE the main control cover. REFER to **Main Control Cover**. INSPECT the solenoid body for foreign material such as metal shavings on the exposed metal contacts or other components. CLEAR the solenoid body and RECHECK the resistance values. If the resistance values are still out of specification, INSTALL a new solenoid body assembly. REFER to **Solenoid Body Assembly**. RECONNECT all components. TEST the system for normal operation.

PINPOINT TEST B: TFT SENSOR

NOTE: **Refer to the Transaxle Vehicle Harness Connector illustration Transaxle Connector Layouts.**

NOTE: **Refer to the Transaxle Internal Harness Diagram illustration Transaxle Connector Layouts.**

B1 ELECTRONIC DIAGNOSTICS

- Check to make sure transaxle vehicle harness connector C168 is fully seated, terminals are fully engaged in connector and in good condition before proceeding.
- **Have the above items been checked?**

  YES : Go to B2.

  NO : CARRY OUT checks. CLEAR the DTCs. REPEAT the Self Test.

B2 CHECK THE TFT SENSOR CIRCUITS FOR AN OPEN

- Key in OFF position.
- Disconnect: Transaxle Vehicle Harness C168
- Disconnect: PCM Transaxle C175T

- Use a mirror to inspect both ends of the connector for damage or pushed-out pins, corrosion, loose wires and missing or damaged seals.

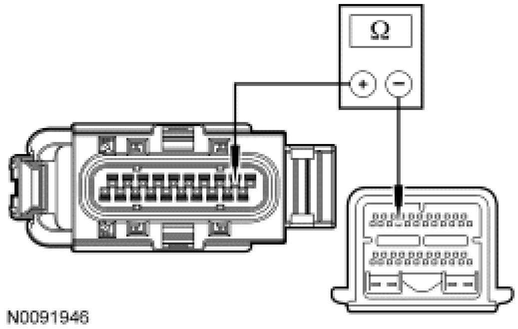


Fig. 14: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between PCM transaxle C175T-20, circuit VET27 (BN/YE) and transaxle vehicle harness C168-2, circuit VET27 (BN/YE).

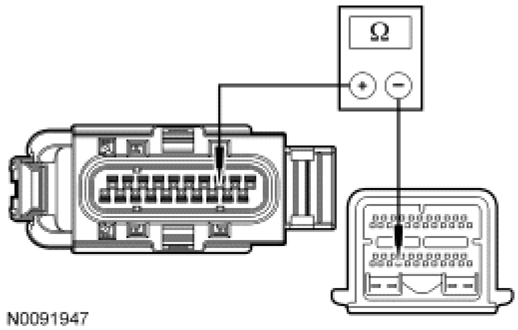


Fig. 15: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between PCM transaxle C175T-43, circuit RE406 (GY/VT) and transaxle vehicle harness C168-3, circuit RE406 (GY/VT).
- **Is the resistance less than 5 ohms?**

  YES : Go to B3.

  NO : REPAIR the circuit(s) for an open. CONNECT all components. TEST the system for normal operation.

B3 CHECK THE TFT SENSOR CIRCUITS FOR A SHORT TO GROUND

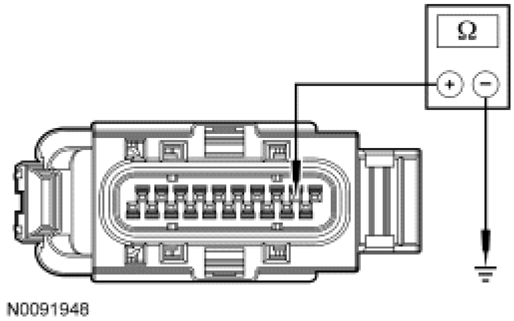


Fig. 16: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between transaxle vehicle harness C168-2, circuit VET27 (BN/YE) and ground.

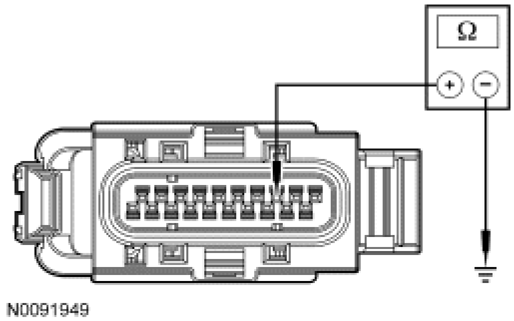


Fig. 17: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between transaxle vehicle harness C168-3, circuit RE406 (GY/VT) and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to B4.

  NO : REPAIR the circuit(s) for a short to ground. CONNECT all components. TEST the system for normal operation.

B4 CHECK THE TFT CIRCUITS FOR A SHORT TO VPWR

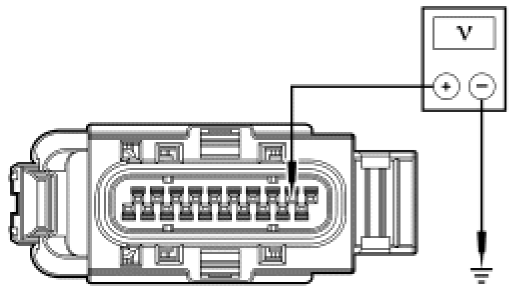


Fig. 18: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between transaxle vehicle harness C168-2, circuit VET27 (BN/YE) and ground.

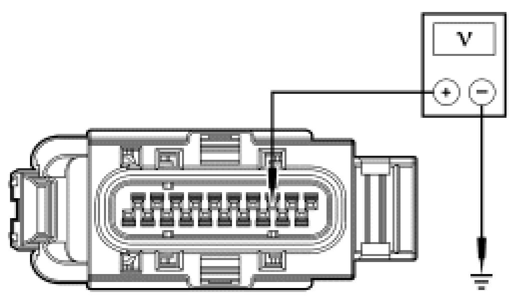


Fig. 19: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between transaxle vehicle harness C168-3, circuit RE406 (GY/VT) and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit(s) for a short to voltage. CONNECT all components. TEST the system for normal operation.

  NO : Go to B5.

B5 CHECK THE RESISTANCE OF THE TFT SENSORS/HARNESS

- Connect: Transaxle Vehicle Harness C168
- **TEST 1.**

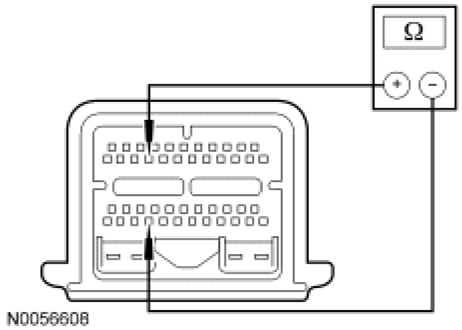


Fig. 20: Measuring Resistance Between PCM Transaxle Electrical Connector C175T Pins 20 & 43, Circuit VET27 (BN/YE) & RE406 (GY/VT)
Courtesy of FORD MOTOR CO.

- Measure and record the resistance between PCM transaxle C175T-20, circuit VET27 (BN/YE) and C175T-43, circuit RE406 (GY/VT).
- Compare the resistance value to the following table ranges:

TRANSMISSION FLUID TEMPERATURE

°C	°F	Resistance (Ohms)
-40 to -20	-40 to -4	1076K-269K
-19 to -1	-3 to 31	309K-91K
0-20	32-68	104K-35K
21-40	69-104	40K-15K
41-70	105-158	17K-4.9K
71-90	159-194	5.6K-2.5K
91-110	195-230	3.0K-1.4K
111-130	231-266	1.7K-0.8K
131-150	267-302	0.97K-0.56K

- **TEST 2.**
- Check for intermittent short or open.
- If the resistance was between 0.8k and 100k ohms, carry out the following test. If the transaxle is warm, allow it to cool. Check the TFT sensor resistance again. Compare the resistance with the initial resistance. The resistance should decrease if the transaxle was heated and should increase if the transaxle was allowed to cool. If correct, then change in the resistance occurs, repeat OBD.
- **Is the resistance in the range?**

  YES : INSTALL a new PCM. CONNECT all components. TEST the system for normal operation.

  NO : INSTALL a new solenoid body. REFER to **Solenoid Body Assembly**. RECONNECT all components. TEST the system for normal operation.

PINPOINT TEST C: TSS AND OSS SENSORS

NOTE: **Refer to the Transaxle Vehicle Harness Connector illustration Transaxle**

Connector Layouts.

NOTE: **Refer to the Transaxle Internal Harness Diagram illustration Transaxle Connector Layouts.**

C1 ELECTRONIC DIAGNOSTICS

- Check to make sure transaxle vehicle harness C168 is fully seated, terminals are engaged in connector and in good condition before proceeding.
- **Have the items above been checked?**

  YES : Go to C2.

  NO : CARRY OUT the checks. CLEAR the DTCs. RERUN the OBD Tests.

C2 ELECTRONIC DIAGNOSTICS

- Connect the diagnostic tool.
- Monitor the speed sensor PIDs while test driving the vehicle.
- **Are the Turbine Shaft Speed (TSS) and Output Shaft Speed (OSS) sensor signals present and consistent?**

  YES : The condition that set the DTC is intermittent and is not currently present. ERASE the codes. RERUN the OBD Tests.

  NO : Go to C3.

C3 CHECK THE TRANSAXLE VEHICLE HARNESS FOR AN OPEN CIRCUIT

- Disconnect: Transaxle Vehicle Harness C168
- Disconnect: PCM Transaxle C175T
- Use a mirror to inspect both ends of the connectors for damage or pushed-out pins, corrosion, loose wires and missing or damaged seals.
- Measure the resistance for the speed sensor circuits between the transaxle vehicle harness C168 and the PCM transaxle C175T.

Speed Sensor Circuit	Transaxle Vehicle Harness C168	PCM Transaxle C175T
TSS/OSS power supply LE111 (VT/GN)	C168-20	C175T-41
TSS/OSS ground RET24 (BN/BU)	C168-9	C175T-45
TSS sensor signal VET33 (WH/OG)	C168-19	C175T-15
OSS sensor signal VET26 (BN/GN)	C168-10	C175T-14

- **Is the resistance less than 5 ohms?**

  YES : Go to C4.

  NO : REPAIR the circuit(s) for an open. CONNECT all components. TEST the system for normal operation.

C4 CHECK THE TRANSAXLE VEHICLE HARNESS FOR A SHORT TO GROUND

- Measure the resistance for the speed sensor circuits between transaxle vehicle harness C168 and

ground.

Speed Sensor Circuit	Transaxle Vehicle Harness C168	Ground
TSS/OSS power supply LE111 (VT/GN)	C168-20	Ground
TSS/OSS ground RET24 (BN/BU)	C168-9	Ground
TSS sensor signal VET33 (WH/OG)	C168-19	Ground
OSS sensor signal VET26 (BN/GN)	C168-10	Ground

- **Is the resistance greater than 10,000 ohms?**

  YES : Go to C5.

  NO : REPAIR the circuit(s) for a short to ground. CONNECT all components. TEST the system for normal operation.

C5 CHECK THE TRANSAXLE VEHICLE HARNESS FOR A SHORT TO VPWR

- Check for voltage from the speed sensor circuits at transaxle vehicle harness C168.

Speed Sensor Circuit	Transaxle Vehicle Harness C168	Ground
TSS/OSS power supply LE111 (VT/GN)	C168-20	Ground
TSS/OSS ground RET24 (BN/BU)	C168-9	Ground
TSS sensor signal VET33 (WH/OG)	C168-19	Ground
OSS sensor signal VET26 (BN/GN)	C168-10	Ground

- **Is any voltage present?**

  YES : REPAIR the circuit(s) for a short to voltage. CONNECT all components. TEST the system for normal operation.

  NO : Go to C6.

C6 CHECK THE SOLENOID BODY FOR AN INTERNAL OPEN CIRCUIT

- Remove the main control cover. Refer to **Main Control Cover**.
- Disconnect: TSS Sensor
- Disconnect: OSS Sensor
- Use a mirror to inspect both ends of the connectors for damage or pushed-out pins, corrosion, loose wires and missing or damaged seals.

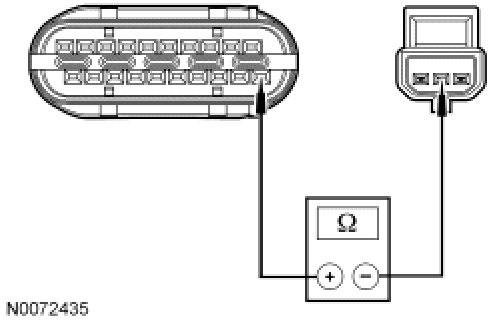


Fig. 21: Measuring Resistance Of Solenoid Body Internal Speed Sensor Power Circuit Between Main Solenoid Body Connector Pin 20 & OSS Sensor Connectors Pin 2
Courtesy of FORD MOTOR CO.

NOTE: The OSS sensor is above the main solenoid body connector next to the Transmission Range (TR) sensor, the TSS sensor connector is below the main solenoid body connector.

- Measure the resistance of the solenoid body internal speed sensor power circuit between the main solenoid body connector pin 20, solenoid body side and the TSS or OSS sensor connectors pin 2, solenoid body side.

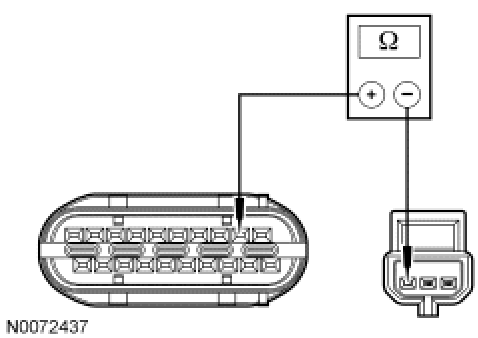


Fig. 22: Measuring Resistance Of Solenoid Body Internal Speed Sensor Power Circuit Between Main Solenoid Body Connector Pin 9 & OSS Sensor Connectors Pin 3
Courtesy of FORD MOTOR CO.

NOTE: The OSS sensor is above the main solenoid body connector next to the TR sensor.

- Measure the resistance of the solenoid body internal speed sensor ground circuit between the main solenoid body connector pin 9, solenoid body side and OSS sensor connector pin 3, solenoid body side.

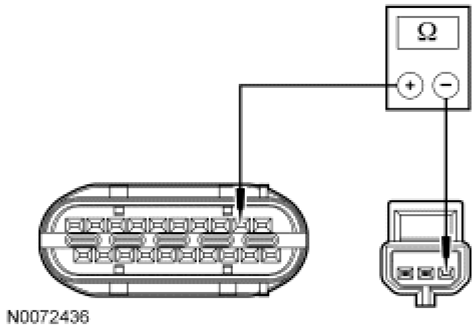


Fig. 23: Measuring Resistance Of Solenoid Body Internal Speed Sensor Power Circuit Between Main Solenoid Body Connector Pin 9 & TSS Sensor Connectors Pin 1
Courtesy of FORD MOTOR CO.

NOTE: The TSS sensor connector is below the main solenoid body connector.

- Measure the resistance of the solenoid body internal speed sensor ground circuit between the main solenoid body connector pin 9, solenoid body side and TSS sensor connector pin 1, solenoid body side.

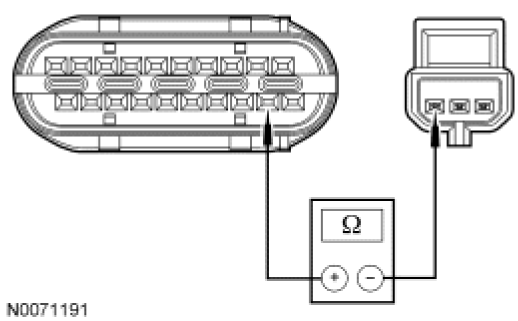


Fig. 24: Measuring Resistance Of Solenoid Body Internal Speed Sensor Power Circuit Between Main Solenoid Body Connector Pin 19 & TSS Sensor Connectors Pin 1
Courtesy of FORD MOTOR CO.

NOTE: The TSS sensor connector is below the main solenoid body connector.

- Measure the resistance of the solenoid body internal circuit for the TSS sensor signal between the main solenoid body connector pin 19, solenoid body side and TSS sensor connector pin 3, solenoid body side.

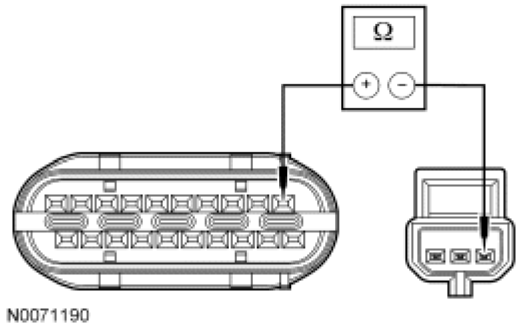


Fig. 25: Measuring Resistance Of Solenoid Body Internal Speed Sensor Power Circuit Between Main Solenoid Body Connector Pin 10 & OSS Sensor Connectors Pin 1
Courtesy of FORD MOTOR CO.

NOTE:	**The OSS sensor is above the main solenoid body connector next to the TR sensor.**

- Measure the resistance of the solenoid body internal circuit for the OSS sensor signal between the main solenoid body connector pin 10, solenoid body side and OSS sensor connector pin 1, solenoid body side.
- **Is the resistance less than 5 ohms?**

  YES : Go to C7.

  NO : INSTALL a new solenoid body. REFER to **Solenoid Body Assembly**. CONNECT all components. TEST the system for normal operation.

C7 CHECK FOR VOLTAGE AT THE SPEED SENSOR CONNECTORS

- Connect: PCM Transaxle C175T
- Connect: Transaxle Vehicle Harness Connector C168
- Key in ON position.

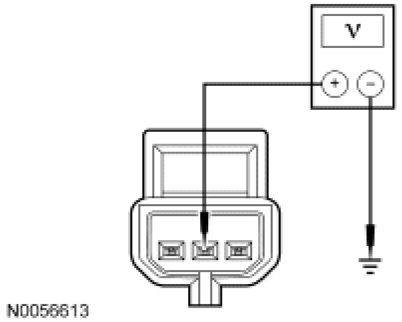


Fig. 26: Measuring Voltage At TSS Sensor Connector Pin 2, Solenoid Body Side Or OSS Sensor Connector Pin 2
Courtesy of FORD MOTOR CO.

- Measure the voltage at TSS sensor connector pin 2, solenoid body side or OSS sensor connector pin 2, solenoid body side.

- **Is the voltage greater than 10 volts?**

  YES : Go to C8.

  NO : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. CONNECT all components. TEST the system for normal operation.

C8 CHECK FOR REFERENCE SIGNAL VOLTAGE AT THE SPEED SENSOR CONNECTORS

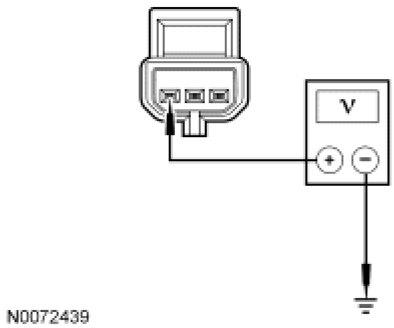


Fig. 27: Measuring Voltage At TSS Sensor Connector Pin 3, Solenoid Body Side
Courtesy of FORD MOTOR CO.

NOTE:	**The TSS sensor connector is below the main solenoid body connector.**

- Measure the voltage at TSS sensor connector pin 3, solenoid body side.

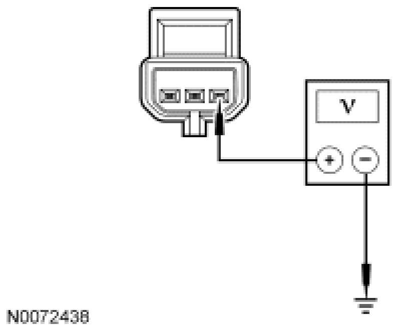


Fig. 28: Measuring Voltage At OSS Sensor Connector Pin 1, Solenoid Body Side
Courtesy of FORD MOTOR CO.

NOTE:	**The OSS sensor is above the main solenoid body connector next to the TR sensor.**

- Measure the voltage at OSS sensor connector pin 1, solenoid body side.
- **Is the voltage between 4.5 and 5.5 volts?**

  YES : Go to C9.

  NO : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. CONNECT all components. TEST the system for normal operation.

C9 CHECK FOR GROUND AT THE SPEED SENSOR CONNECTORS

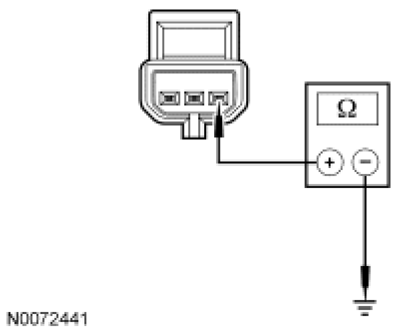


Fig. 29: Measuring Resistance Between TSS Sensor Connector Pin 1, Solenoid Body Side & Ground
Courtesy of FORD MOTOR CO.

NOTE: **The TSS sensor connector is below the main solenoid body connector.**

- Measure the resistance between TSS sensor connector pin 1, solenoid body side and ground.

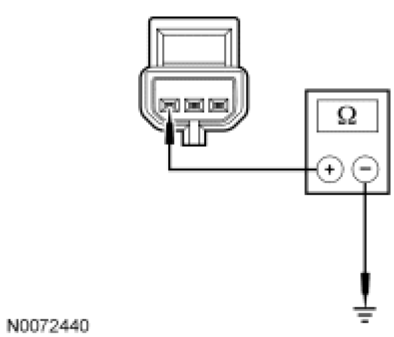


Fig. 30: Measuring Resistance Between OSS Sensor Connector Pin 3, Solenoid Body Side & Ground
Courtesy of FORD MOTOR CO.

NOTE: **The OSS sensor is above the main solenoid body connector next to the TR sensor.**

- Measure the resistance between OSS sensor connector pin 3, solenoid body side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new speed sensor. REFER to **Turbine Shaft Speed (TSS) Sensor** or **Output Shaft Speed (OSS) Sensor**. TEST the system for normal operation. If the condition is still present, INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article.

  NO : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. CONNECT all components. TEST the system for normal operation.

PINPOINT TEST D: TR SENSOR

NOTE: **Refer to the Transmission Range (TR) Sensor Connector illustration Transaxle Connector Layouts.**

NOTE: **Refer to the Transmission Range (TR) Sensor Diagnosis Chart preceding these pinpoint tests.**

D1 VERIFY DTCs

- Key in OFF position.
- Select PARK.
- Carry out the On-Board Diagnostic (OBD) Test. DTCs P0705 and P0708 cannot be set by an incorrectly adjusted selector lever cable.
- **Are only DTCs P0705, P0708 present?**

  YES : Go to D3.

  NO : Go to D2.

D2 VERIFY SELECTOR LEVER CABLE/LINKAGE ADJUSTMENT

- Disconnect the selector lever cable end from the manual control lever.
- Place the transaxle manual control lever in the DRIVE position.
- Select DRIVE.
- Reconnect the selector lever cable/linkage.
- Verify that the selector lever cable/linkage is correctly adjusted. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
- **Is the selector lever cable/linkage correctly adjusted?**

  YES : Go to D3.

  NO : ADJUST the selector lever cable/linkage. REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article. Go to D4.

D3 CHECK THE ELECTRICAL SIGNAL OPERATION

- Select PARK.
- Disconnect: PCM Transaxle C175T
- Disconnect: Transaxle Vehicle Harness C168
- Use a mirror to inspect both ends of the connectors for damaged or pushed-out pins, corrosion, loose wires and missing or damaged seals.
- **Is there damage to the connectors, pins or harness?**

  YES : REPAIR as required. CLEAR DTCs and RERUN On-Board Diagnostic (OBD) Tests.

  NO : Go to D4.

D4 CHECK ELECTRICAL SYSTEM OPERATION TR AND PCM

- Key in OFF position.
- Connect the diagnostic tool.

- Connect: PCM Transaxle C175T
- Connect: Transaxle Vehicle Harness C168
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: TR PIDs: TR, TR1, TR2, TR3, and TR4
- Move the TR selector lever into each gear and stop.
- Observe any of the following PIDs (vehicle-dependent), TR, TR1, TR2, TR3, and TR4 while wiggling harness, tapping on sensor or driving the vehicle.
- Compare the PIDs to the Transmission Range (TR) Sensor Diagnosis Chart.
- **Do the PIDs TR, TR1, TR2, TR3, TR4 match the Transmission Range (TR) Sensor Diagnosis Chart, and do they remain steady when the harness is wiggled, the sensor is tapped on or the vehicle driven?**

  YES : The problem is not in the digital TR sensor system. REFER to **Diagnosis By Symptom** for further diagnosis.

  NO : If the PIDs change when wiggling the harness, tapping on the sensor or driving the vehicle, the problem may be intermittent. Go to D5.

D5 CHECK THE TRANSAXLE VEHICLE TRANSAXLE HARNESS FOR AN OPEN

- Disconnect: PCM Transaxle C175T
- Disconnect: Transaxle Vehicle Harness C168
- Measure the resistance for the TR sensor circuits between the transaxle vehicle harness C168 and the PCM transaxle C175T.

TR Sensor Circuit	Transaxle Vehicle Harness C168	PCM Transaxle C175T
TR-1 VET29 (VT/WH)	C168-4	C175T-17
TR-2 VET30 (YE)	C168-5	C175T-18
TR-3 VET31 (BU/OG)	C168-6	C175T-19
TR-4 VET32 (VT)	C168-7	C175T-32
TR Ground RET24 (BN/BU)	C168-8	C175T-45

- **Is the resistance less than 5 ohms?**

  YES : Go to D6.

  NO : REPAIR the circuit. CONNECT all components. TEST the system for normal operation.

D6 CHECK THE TRANSAXLE VEHICLE HARNESS FOR A SHORT TO GROUND

- Measure the resistance for the TR sensor circuits between the transaxle vehicle harness C168 and ground.

TR Sensor Circuit	Transaxle Vehicle Harness C168	Ground
TR-1 VET29 (VT/WH)	C168-4	Ground
TR-2 VET30 (YE)	C168-5	Ground

TR-3 VET31 (BU/OG)	C168-6	Ground
TR-4 VET32 (VT)	C168-7	Ground
TR Ground RET24 (BN/BU)	C168-8	Ground

- **Are all resistances greater than 10,000 ohms?**

  YES : Go to D7.

  NO : REPAIR shorted circuit(s). RECONNECT all components. TEST the system for normal operation.

D7 CHECK THE TRANSAXLE VEHICLE HARNESS FOR A SHORT TO POWER

- Measure the voltage for the TR sensor circuits between the transaxle vehicle harness C168 and ground.

TR Sensor Circuit	Transaxle Vehicle Harness C168	Ground
TR-1 VET29 (VT/WH)	C168-4	Ground
TR-2 VET30 (YE)	C168-5	Ground
TR-3 VET31 (BU/OG)	C168-6	Ground
TR-4 VET32 (VT)	C168-7	Ground
TR Ground RET24 (BN/BU)	C168-8	Ground

- **Is any voltage present?**

  YES : REPAIR shorted circuit(s). RECONNECT all components. TEST the system for normal operation.

  NO : Go to D8.

D8 CHECK FOR A SHORT BETWEEN TR/PCM INPUT SIGNAL CIRCUITS

- Measure the resistance between TR sensor and PCM Transaxle C175T.

TR Sensor Circuit	PCM Transaxle C175T	Ground
TR-1 VET29 (VT/WH)	C175T-17	Ground
TR-2 VET30 (YE)	C175T-18	Ground
TR-3 VET31 (BU/OG)	C175T-19	Ground
TR-4 VET32 (VT)	C175T-32	Ground
TR Ground RET24 (BN/BU)	C175T-45	Ground

- **Are all resistances greater than 10,000 ohms?**

  YES : Go to D9.

  NO : REPAIR shorts on circuits having less than 10,000 ohms between other TR/PCM input signal circuits. RECONNECT all components. TEST the system for normal operation.

D9 CHECK FOR AN INTERNAL SOLENOID BODY OPEN FOR THE TR SENSOR CIRCUITS

- Remove the main control cover. Refer to **Main Control Cover**.

- Disconnect: TR Sensor Connector
- Use a mirror to inspect both ends of the connector for damage or pushed-out pins, corrosion, loose wires and missing or damaged seals.
- Measure the resistance of the TR sensor circuits between the transaxle vehicle harness connector, component side and the TR sensor connector, solenoid body side.

TR Sensor Circuit	Transaxle Vehicle Harness Connector Pin (Component Side)	TR Sensor Connector Pin (Solenoid Body Side)
TR-1	4	5
TR-2	5	4
TR-3	6	3
TR-4	7	2
TR Ground	8	1

- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new TR sensor. REFER to **Digital Transmission Range (TR) Sensor**. RECONNECT all components. TEST the system for normal operation.

  NO : INSTALL a new solenoid body. REFER to **Solenoid Body Assembly**. RECONNECT all components. TEST the system for normal operation.

PINPOINT TEST E: TRANSAXLE SOLENOID POWER CONTROL CIRCUIT

NOTE: **Refer to the Transaxle Vehicle Harness Connector illustration Transaxle Connector Layouts.**

E1 CHECK FOR VOLTAGE AT THE TRANSAXLE VEHICLE HARNESS C168

- Disconnect: Transaxle Vehicle Harness C168
- Use a mirror to inspect both ends of the connector for damage or pushed-out pins, corrosion, loose wires and missing or damaged seals.
- Key in ON position.

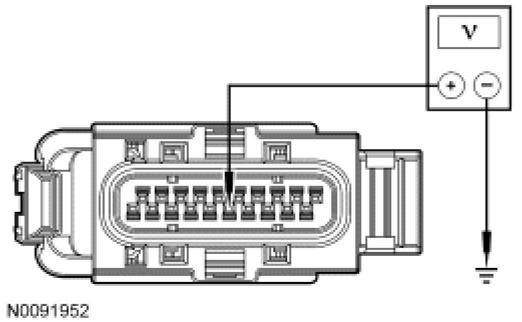


Fig. 31: Measuring Voltage

Courtesy of FORD MOTOR CO.

- Measure the voltage at the transaxle vehicle harness C168-15, circuit CET49 (BN).
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new solenoid body. REFER to **Solenoid Body Assembly**. RECONNECT all components. TEST the system for normal operation.

  NO : Go to E2.

E2 CHECK THE TRANSAXLE SOLENOID POWER CONTROL CIRCUIT FOR AN OPEN

- Key in OFF position.
- Disconnect: PCM Transaxle C175T

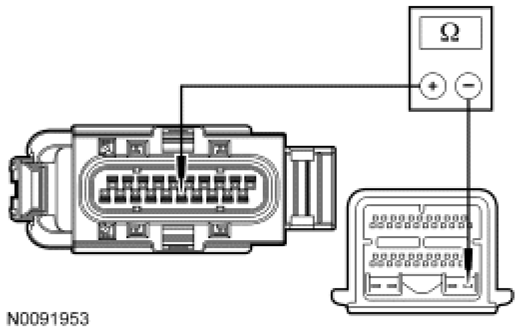


Fig. 32: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM transaxle C175T-47, circuit CET49 (BN) and transaxle vehicle harness C168-15, circuit CET49 (BN).
- **Is the resistance less than 5 ohms?**

  YES : Go to E3.

  NO : REPAIR circuit CET49 (BN) for an open. RECONNECT all components. TEST the system for normal operation.

E3 CHECK THE TRANSAXLE SOLENOID POWER CONTROL CIRCUIT FOR A SHORT TO GROUND

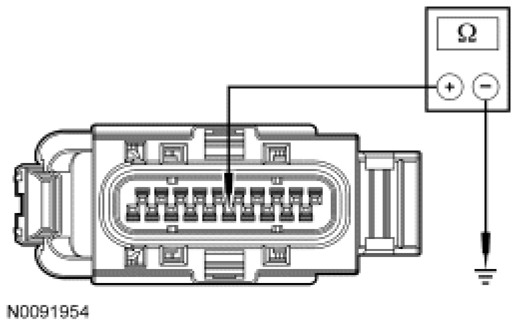


Fig. 33: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the transaxle vehicle harness C168-15, circuit CET49 (BN) and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. RECONNECT all components. TEST the system for normal operation.

  NO : REPAIR circuit CET49 (BN) for a short to ground. RECONNECT all components. TEST the system for normal operation.

SPECIAL TESTING PROCEDURES

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

The special tests are designed to aid the technician in diagnosing the hydraulic and mechanical portions of the transaxle.

Engine Idle Speed Check

Refer to the **Introduction - Gasoline Engines** article for diagnosis and testing of the engine idle speed.

Line Pressure Test

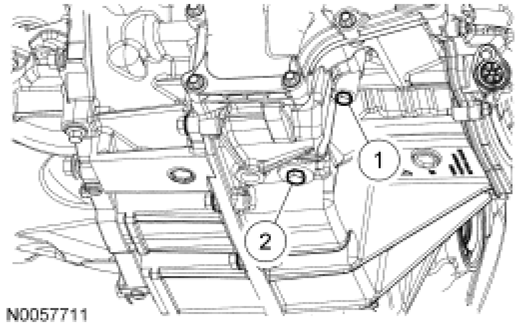


Fig. 34: Identifying Line Pressure Tap & Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Line pressure tap
2	-	Transmission fluid drain plug

NOTE: **Carry out the Line Pressure Test prior to carrying out the Stall Speed Test. If the line pressure is low at stall, do not carry out the Stall Speed Test or further transaxle damage will occur. Do not maintain Wide Open Throttle (WOT) in any transaxle range for more than 5 seconds.**

NOTE: **Do not mistake the transmission fluid drain plug for the line pressure tap plug or the transmission fluid will have to be refilled.**

This test verifies that the line pressure is within specification.

1. Connect a pressure gauge to the line pressure tap.
2. Start the engine and check the line pressures see the line pressure chart to determine if the line pressure is within specification.

LINE PRESSURE CHART

Gear	Line
Pressures at Idle[a]	
P	379-448 kPa (55-65 psi)
R	655-724 kPa (95-105 psi)
N	379-448 kPa (55-65 psi)
D	552-621 kPa (80-90 psi)
L	552-621 kPa (80-90 psi)
Pressure at Wide Open Throttle (WOT) Stall[a]	
P	379-448 kPa (55-65 psi)
R	2,034-2,206 kPa (295-320 psi)
N	379-448 kPa (55-65 psi)
D	1,689-1,758 kPa (245-255 psi)
L	1,689-1,758 kPa (245-255 psi)

[a] All pressures are approximate.

3. If the line pressure is not within specification, go to **Pinpoint Test A** to diagnose the Line Pressure Control (LPC) operation. If LPC operation is OK, see the Line Pressure Diagnosis Chart for line pressure

concern causes.

4. When the pressure tests are completed, install the pressure tap plug.
    - Tighten to 9 Nm (80 lb-in).

LINE PRESSURE DIAGNOSIS CHART

Test Results	Possible Source
HIGH at IDLE - ALL RANGES	Wiring Harnesses Line Pressure Control (LPC) Solenoid Main Regulator Valve
LOW at IDLE - ALL RANGES	Low Fluid Level Fluid Inlet Filter/Seal Main Control Body Cross Leaks Gaskets Pump Separator Plate
LOW in Park ONLY	Valve Body
LOW in Reverse ONLY	Separator Plate Reverse Clutch Valve Body Forward Clutch
LOW in Neutral ONLY	Valve Body
LOW in Overdrive ONLY	Forward Clutch Valve Body
LOW in Drive ONLY	Forward Clutch
LOW in Manual 1st ONLY	Forward Clutch Valve Body

Stall Speed Test

WARNING: **Block all wheels, set the parking brake and firmly apply the service brake to reduce the risk of vehicle movement during this procedure. Failure to follow these instructions may result in serious personal injury.**

NOTE: **Carry out Line Pressure Test prior to carrying out Stall Speed Test. If the line pressure is low at stall, do not carry out Stall Speed Test or further transaxle damage will occur.**

The Stall Speed Test checks:

- Torque Converter Clutch (TCC) operation and installation.
- holding ability of the forward clutch.
- reverse clutch (the low-reverse bands).
- planetary One-Way Clutch (OWC).

- engine driveability concerns.

Conduct this test with the engine coolant and transmission fluid at correct levels and at normal operating temperature.

Apply the parking brake firmly for each Stall Speed Test.

STALL SPEED CHART

Engine	Stall Speed
3.5L	2,350-2,650

1. Connect the scan tool.

   NOTE: If the recorded RPM exceeds the maximum limits, release the accelerator pedal immediately because clutch or band slippage is indicated.

2. In each of the following ranges D, L and R, press the accelerator pedal to the floor and hold it just long enough to let the engine get to WOT. While making this test, do not hold the throttle open for more than 5 seconds at a time.
3. Note the results in each range.
4. After each range, move the selector lever to NEUTRAL and run the engine at 1,000 RPM for about 15 seconds to cool the torque converter before making the next test.
5. Use the Stall Speed Diagnosis Chart for corrective actions.

   NOTE: The stall speed in REVERSE will be lower.

6. If stall speeds were too high, see the Stall Speed Diagnosis Chart. If stall speeds were too low, first check engine idle speed and tune up. If engine is OK, remove torque converter and check TCC for slippage.

STALL SPEED DIAGNOSIS CHART

Range	Possible Source
D, L	Forward Clutch Low/Reverse Clutch Low/One-Way Clutch (OWC)
R	Low/Reverse Clutch Direct Clutch

LEAKAGE INSPECTION

Special Tools

Illustration	Tool Name	Tool Number
	100W/12 Volt DC UV Lamp	164-R0751 or equivalent

 ST1300-A		

Material

Item	Specification
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	-
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

NOTE: **Do not try to stop the fluid leak by increasing the torque beyond specifications. This may cause damage to the case threads.**

Leakage at the transaxle pan-to-case gasket often can be stopped by tightening the attaching bolts to 9 Nm (80 lb-in). If necessary, install a new pan case gasket.

Check the transmission fluid filler tube connection at the transmission case. If leakage is found here, install a new grommet.

Check transmission fluid lines and fittings between the transmission and the cooler in the radiator tank for wear or damage. If leakage cannot be stopped by tightening a transmission fluid tube nut, install new parts. When transmission fluid is found leaking between the case and the cooler line fitting, check for missing or damaged O-ring, then tighten the fitting to maximum specification.

If the leak continues, install a new cooler tube fitting and tighten to specification. The same procedure should be followed for transmission fluid leaks between the radiator cooler and the cooler tube fittings. Refer to **TRANSAXLE/TRANSMISSION COOLING** article.

Check the engine coolant in the radiator. If the transmission fluid is present in the coolant, the cooler in the radiator is probably leaking. The cooler can be further checked for leaks by disconnecting the tubes for the cooler fittings and applying no more than 345 kPa (50 psi) air pressure to the fittings. Remove the coolant recovery cap to relieve the pressure buildup at the exterior of the transmission fluid cooler tank. If the cooler is leaking and/or will not hold pressure, install a new cooler.

If leakage is found at the transaxle range selector lever, install a new seal.

If leakage is found at the transaxle internal harness connector, install a new O-ring.

Fluid Leakage in Torque Converter Area

In diagnosing and correcting fluid leaks in the torque converter area, use the following procedures to locate the exact cause of the leakage. Leakage at the front of the transaxle, as evidenced by fluid around the torque converter housing, may have several sources. By careful observation it is possible, in many instances, to pinpoint the source of the leak before removing the transaxle from the vehicle. The paths which the fluid takes to reach the bottom of the torque converter housing are shown in the illustration. The 5 steps following correspond with the numbers in the illustration.

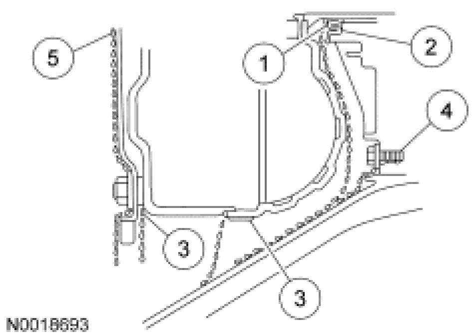


Fig. 35: Identifying Torque Converter Fluid Leakage Area
Courtesy of FORD MOTOR CO.

1. Transmission fluid leaking by the converter hub seal lip will tend to move along the drive hub and onto the back of the torque converter. Except in the case of a total seal failure, transmission fluid leakage by the lip of the seal will be deposited on the inside of the torque converter housing only, near the outside diameter of the housing.
2. Transmission fluid leakage by the outside diameter of the converter impeller hub seal and the case will follow the same path that leaks by the inside diameter of the converter hub seal follow.
3. Transmission fluid leakage from the converter cover weld or the converter-to-flexplate stud weld will appear at outside diameter of torque converter on the back face of the flexplate and in the converter housing only near the flexplate. If a converter-to-flexplate lug, lug weld or converter cover weld leak is suspected, remove the converter and pressure check.
4. Transmission fluid leakage from the bolts inside the converter housing will flow down the back of the torque converter housing. Leakage may be from loose or missing bolts.
5. Engine oil leaks are sometimes incorrectly diagnosed as transaxle converter hub seal leaks. The following areas of possible leakage should also be checked to determine if engine oil leakage is causing the concern.
    1. Leakage at the valve cover gasket may allow engine oil to flow over the torque converter housing or seep down between the torque converter housing and cylinder block causing oil to be present in or at the bottom of the torque converter housing.
    2. Oil galley plug leaks will allow engine oil to flow down the rear face of the cylinder block to the

bottom of the torque converter housing.

3. Leakage at the crankshaft rear oil seal will work back to the flexplate, and then into the torque converter housing.
4. Leakage at oil pressure sensor will allow engine oil to flow down the rear face of the cylinder block to the bottom of the torque converter housing.

Leak Check Test

1. Remove the transmission fluid level indicator and note the color of the transmission fluid. Original factory fill transmission fluid is dyed red to aid in determining if leakage is from the engine or transaxle. Unless a considerable amount of makeup transmission fluid has been added or the transmission fluid has been changed, the red color should assist in pinpointing the leak.
2. Remove the torque converter housing cover. Clean off any transmission fluid from the top and bottom of the torque converter housing, the front of the case and rear face of the engine and oil pan. Clean the torque converter area by washing with a suitable nonflammable solvent and blow dry with compressed air.
3. Wash out the torque converter housing, the front of the flexplate and the converter drain plugs. The torque converter housing may be washed out using cleaning solvent and a squirt-type oil can. Blow all washed areas dry with compressed air.
4. Start and run the engine until the transaxle reaches its normal operating temperature. Observe the back of the cylinder block and top of the torque converter housing for evidence of transmission fluid leakage. Raise the vehicle on a hoist and run the engine at fast idle, then at engine idle, occasionally shifting to the OVERDRIVE and REVERSE ranges to increase pressure within the transaxle. Observe the front of the flexplate, back of the cylinder block (in as far as possible) and inside the torque converter housing and front of the case. Run the engine until transmission fluid leakage is evident and the probable source of leakage can be determined.

Leak Check Test With Black Light

Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda) is used to detect a transmission fluid leak.

1. Add Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye to the transmission fluid. Use one 30.0 mL (1 oz) of dye solution for every 3.8L (4 qt) of transmission fluid.
2. Start and run the engine until the transaxle reaches its normal operating temperature. Observe the back of the cylinder block and top of the torque converter housing for evidence of fluid leakage. Raise the vehicle on a hoist and run the engine at fast idle, then at engine idle, occasionally shifting to the DRIVE and REVERSE ranges to increase pressure within the transaxle. Observe the front of the flexplate, back of the cylinder block (in as far as possible), inside the torque converter housing and the entire case until fluid leakage is evident and the probable source of leakage can be determined.

TRANSMISSION FLUID COOLER

Special Tools

Illustration	Tool Name	Tool Number

	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

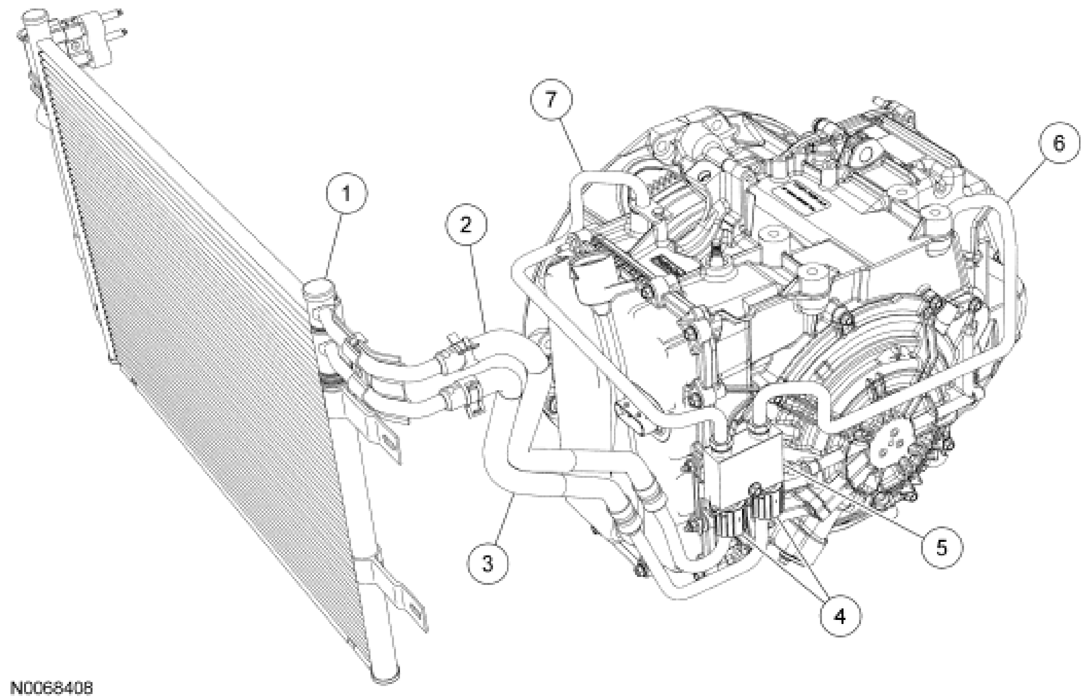


Fig. 36: Transaxle Cooling
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	19712	Transmission fluid cooler
2	7F113	Transmission fluid cooler outlet tube and hose assembly
3	7F112	Transmission fluid cooler inlet tube and hose assembly
4	7J081	Secondary latches
5	7H322	Transmission fluid cooler thermal bypass

		valve
6	7H420	Transmission fluid cooler inlet tube
7	7H420	Transmission fluid cooler outlet tube

When internal wear or damage has occurred in the transaxle, metal particles, clutch plate material or band material may have been carried into the torque converter and transmission fluid cooler. These contaminants are a major cause of recurring transaxle troubles and must be removed from the system before the transaxle is put back into use. Refer to **Transmission Fluid Cooler Backflushing and Cleaning**.

Transmission Fluid Cooler Flow Test

NOTE: The selector lever linkage, selector lever cable adjustment, transmission fluid level and line pressure must be within specification before carrying out this test. Refer to AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS article for selector lever linkage and selector lever cable adjustment and refer to Special Testing Procedures for line pressure test. The transmission fluid must be above 82°C (180°F) for the cooler by-pass to open to carry out this test.

1. Using a scan tool, run the engine to establish the correct transmission fluid temperature of 82°C (180°F).
2. Remove the transmission fluid level indicator from the transmission fluid filler tube.
3. Place funnel in the transmission fluid filler tube.
4. With the vehicle in NEUTRAL, position it on a hoist. Refer to **JACKING & LIFTING** article.
5. Remove the transmission fluid cooler return tube (rear fitting) from the fitting on the transaxle case.
6. Connect one end of a hose to the cooler return tube and route other end of the hose up to a point where it can be inserted into the funnel at the transmission fluid filler tube.
7. Start the engine and run it at idle with the transmission in NEUTRAL position.
8. When transmission fluid flowing from hose is in a steady stream, a liberal amount of transmission fluid should be observed. "Liberal" is described as about 1L (1 qt) delivered in 30 seconds. If a liberal flow is observed, the test is complete.
9. If the flow is not liberal, stop the engine. Disconnect the hose from the cooler return tube and connect it to the converter outlet tube fitting (front fitting) on the transaxle case.
10. Repeat Steps 7 and 8. If flow is now approximately 1L (1 qt) in 30 seconds, refer to **Transmission Fluid Cooler Backflushing and Cleaning**. If the flow is still not approximately 1L (1 qt) in 30 seconds, repair the pump and/or the torque converter.

    If new transmission fluid cooler tubes need to be installed, refer to **TRANSAXLE/TRANSMISSION COOLING** article.

DIAGNOSIS BY SYMPTOM

Special Tools

Illustration	Tool Name	Tool Number

 ST2574-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

The Diagnostic Routines give the technician diagnostic information, direction and suggest possible components, using a symptom as a starting point.

The Diagnostic Routines are divided into 2 categories: Electrical Routines, indicated by 200 series numbers, and Hydraulic/Mechanical Routines, indicated by 300 series numbers. The Electrical Routines list the possible electrical components that could cause or contribute to the symptom described. The Hydraulic/Mechanical Routines list the possible hydraulic or mechanical components that could cause or contribute to the symptom described.

Diagnosis by Symptom Index Directions

1. Using the Symptom Index, select the Concern/Symptom that best describes the condition.
2. See the routine indicated in the Diagnosis By Symptom Index.
3. Always begin diagnosis of a symptom with:
    1. Preliminary inspections.
    2. Verifications of condition.
    3. Checking the fluid levels.
    4. Carry out other test procedures as directed.

    NOTE: **Not all concerns and conditions with electrical components will set a DTC. Be aware that the components listed may still be the cause. Verify correct function of these components prior to proceeding to the Hydraulic/Mechanical Routine listed.**

4. Begin with the Electrical Routine, if indicated. Follow the reference or action required statements. Always carry out the OBD tests as required. Never skip steps. Repair as required. If the concern is still present after electrical diagnosis, then proceed to the Hydraulic/Mechanical Routine listed.
5. The Hydraulic/Mechanical Routines list possible hydraulic or mechanical components that could cause the concern. These components are listed in the removal sequence and by most probable cause. All components listed must be inspected to make sure of correct repair.

Diagnosis by Symptom Index

Title	Routines	
	Electrical[1]	Hydraulic/ Mechanical
Engagement Concerns:		
No Forward	201	301
No Reverse	202	302
Harsh Reverse	203	303
Harsh Forward	204	304
Delayed/Soft Reverse	205	305
Delayed/Soft Forward	206	306
No Forward and No Reverse	207	307
Delayed/Soft Forward and Reverse	209	309
Shift Concerns:		
Some or All Shifts Missing	210	310
Timing - Early/Late	211	311
Timing - Erratic/Hunting	212	312
Soft/Slipping	213	313
Harsh	214	314
No 1st Gear, Engages in Higher Gear	215	315
No 1-2 Shift (Automatic)	220	320
No 2-3 Shift (Automatic)	221	321
No 3-4 Shift (Automatic)	222	322
No 4-5 Shift (Automatic)	223	323
No 5-6 Shift (Automatic)	224	324
No 6-5 Shift (Automatic)	225	325
No 5-4 Shift (Automatic)	226	326
No 4-3 Shift (Automatic)	227	327
No 3-2 Shift (Automatic)	228	328
No 2-1 Shift (Automatic)	229	329
Soft/Slipping 1-2 Shift (Automatic)	230	330
Soft/Slipping 2-3 Shift (Automatic)	231	331
Soft/Slipping 3-4 Shift (Automatic)	232	332
Soft/Slipping 4-5 Shift (Automatic)	233	333
Soft/Slipping 5-6 Shift (Automatic)	234	334
Soft/Slipping 6-5 Shift (Automatic)	235	335
Soft/Slipping 5-4 Shift (Automatic)	236	336
Soft/Slipping 4-3 Shift (Automatic)	237	337
Soft/Slipping 3-2 Shift (Automatic)	238	338
Soft/Slipping 2-1 Shift (Automatic)	239	339
Harsh 1-2 Shift (Automatic)	240	340
Harsh 2-3 Shift (Automatic)	241	341

Harsh 3-4 Shift (Automatic)	242	342
Harsh 4-5 Shift (Automatic)	243	343
Harsh 5-6 Shift (Automatic)	244	344
Harsh 6-5 Shift (Automatic)	245	345
Harsh 5-4 Shift (Automatic)	246	346
Harsh 4-3 Shift (Automatic)	247	347
Harsh 3-2 Shift (Automatic)	248	348
Harsh 2-1 Shift (Automatic)	249	349
Torque Converter Operation Concerns:		
Torque Converter: No Apply	250	350
Torque Converter: Always Applied/Stalls Vehicle	251	351
Torque Converter: Cycling/Shudder/Chatter	252	352
Other Concerns		
Selector Lever Efforts High	261	361
External Leaks	262	362
Vehicle Driveability Concerns	263	363
Noise/Vibration - Forward or Reverse	264	364
Engine Will Not Crank	265	365
No Park Range	266	366
Overheating	267	367

(1) Carry out electrical routine first.

Diagnostic Routines

ENGAGEMENT CONCERN: NO FORWARD

Possible Component		Reference/Action
201 - ELECTRICAL ROUTINE		
Powertrain Control System		
	No electrical concerns	
301 - HYDRAULIC/MECHANICAL ROUTINE		
Transmission Fluid Level		
	Low transmission fluid level	Check transmission fluid level and adjust as necessary. Refer to **Preliminary Inspection**.
	Transmission fluid condition	Carry out transmission fluid condition check. Refer to **Preliminary Inspection**.
Selector Lever Linkage (Internal/External)		
	Damaged or out of adjustment	Inspect for damage. Repair as required. Verify selector lever cable adjustment. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION**

		EXTERNAL CONTROLS article.
Incorrect Pressures		
	Line Pressure Control (LPC) solenoid stuck low	Check pressure at line pressure tap. Carry out Line Pressure Tests and Stall Speed Tests. Refer to **Special Testing Procedures**. See the Line Pressure Chart for specification. If pressures are low, check the following possible components: • Main control valve body • Pump assembly • LPC solenoid
Main Control Valve Body		
	Bolts out of torque specification	Adjust bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect gaskets for damage. Install new as required.
	Manual Control Valve - damaged	Inspect for damage. Install new as required.
Pump Assembly		
	Bolts out of torque specification	Inspect for damage. Install a new pump as required.
	Porosity/cross leaks/ball missing or leaking	Inspect for damage. Install a new pump as required.
	Components - damaged	Inspect for damage. Install a new pump as required.

ENGAGEMENT CONCERN: NO REVERSE

Possible Component		Reference/Action
202 - ELECTRICAL ROUTINE		
Powertrain Control System		
	No electrical concerns	
302 - HYDRAULIC/MECHANICAL ROUTINE		
Transmission Fluid Level		
	Low transmission fluid level	Check transmission fluid level and adjust as necessary. Refer to **Preliminary Inspection**.
	Transmission fluid condition	Carry out transmission fluid condition check. Refer to **Preliminary Inspection**.
Selector Lever Linkage (Internal/External)		
	Damaged or out of adjustment	Inspect for damage. Repair as required. Verify selector lever

		cable adjustment. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
Incorrect Pressures		
	Line Pressure, Line Pressure Control (LPC) Pressure - low	Carry out Line Pressure Tests and Stall Speed Tests. Refer to **Special Testing Procedures**. Check pressure at line pressure tap. See the Line Pressure Chart for specifications. If pressures are low, check the following possible components: • Main control valve body • Pump assembly • Low/reverse clutch assembly • Direct clutch assembly • Shift Solenoid B (SSB), Shift Solenoid D (SSD) and Shift Solenoid E (SSE) solenoids
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gasket and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Manual Control Valve, Springs - stuck, damaged	Inspect for damage. Install new as required.
	Multiplex Valve, Springs - stuck, damaged	Inspect for damage. Install new as required.
	Low/Reverse Clutch Valve, Springs - stuck, damaged	Inspect for damage. Install new as required.
	Direct Clutch Valve, Springs - stuck, damaged	Inspect for damage. Install new as required.
Pump Assembly		
	Bolts out of torque	Inspect for damage. Install a new

	specification	pump as required.
	Porosity/cross leaks, pump assembly leaking, plugged hole	Inspect for damage. Install a new pump as required.
	Components damaged	Inspect for damage. Install a new pump as required.
Low/Reverse Clutch Assembly		
	SSD solenoid stuck low	Inspect for damage. Install a new solenoid body as required. Refer to **Solenoid Body Assembly**.
	Low/Reverse regulator valve stuck	Inspect for damage. Repair as required.
	Seals, Piston, Springs - damaged	Inspect for damage. Repair as required.
	Clearance check out of specification	Inspect for damage. Carry out clearance checks.
	Friction Elements - damaged or worn	Inspect for damage. Repair as required.
Direct Clutch Assembly		
	Seals, Piston, Spring - damaged	Inspect for damage. Repair or install new as required.
	SSB solenoid	Inspect for damage. Install a new solenoid body as required. Refer to **Solenoid Body Assembly**.
	Direct clutch regulator valve	Inspect for damage. Repair or install new as required.
	Clearance check out of specification	Inspect for damage. Carry out clearance checks.
	Friction Elements - damaged, clearance check incorrect	Inspect for damage. Repair as required.

ENGAGEMENT CONCERN: HARSH REVERSE

Possible Component		Reference/Action
203 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Mass Air Flow (MAF) Sensor, Intake Air	Run On-Board Diagnostic (OBD). Refer to the **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test**

	Temperature (IAT) Sensor, Throttle Position (TP) Sensor, Idle Speed Control (ISC), Power Steering Pressure (PSP) Sensor, Engine RPM, Line Pressure Control (LPC) Solenoid, Transmission Fluid Temperature (TFT) sensor, Turbine Shaft Speed (TSS) sensor, Output Shaft Speed (OSS) sensor, Shift Solenoid B (SSB), Shift Solenoid D (SSD) or transaxle solenoid power control circuit open/shorted	**A**, go to **Pinpoint Test B**, go to **Pinpoint Test C** and Go to **Pinpoint Test E**.
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
303 - HYDRAULIC/MECHANICAL ROUTINE		
Incorrect Pressures		
	Line Pressure, LPC Solenoid Pressure - high	Carry out Line Pressure and Stall Speed Tests. Refer to **Special Testing Procedures**. Check pressure at line pressure taps. See the Line Pressure Chart for specifications. If high, check the Main Control Valve Body.
Pump Assembly		
	Bolts out of torque	Inspect for damage.

	specification	Install a new pump as required.
	Porosity/cross leaks, pump assembly leaking, plugged hole	Inspect for damage. Install a new pump as required.
	Components damaged	Inspect for damage. Install a new pump as required.
Main Controls		
	Bolts out of torque specification	Tighten bolts to specification.
	Gasket and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Low/Reverse regulator valve - stuck, damaged	Inspect for damage. Install new as required.
	Low/Reverse boost valve - stuck, damaged	Inspect for damage. Install new as required.
	Direct regulator valve - stuck, damaged	Inspect for damage. Install new as required.
	Direct boost valve - stuck, damaged	Inspect for damage. Install new as required.
	SSB mechanically stuck - high	Install a new solenoid body. Refer to **Solenoid Body Assembly**.
	SSD mechanically stuck - high	Install a new solenoid body. Refer to **Solenoid Body Assembly**.
	Main Regulator Valve - stuck, damaged	Inspect for damage. Install new as required.
Low/Reverse Clutch Assembly		
	SSD solenoid stuck low	Inspect for damage. Install a new solenoid body as required. Refer to **Solenoid Body Assembly**.
	Low/Reverse regulator valve stuck	Inspect for damage. Install a new solenoid body as required.

	Seals, Piston, Springs - damaged	Inspect for damage. Repair as required.
	Clearance check out of specification	Inspect for damage. Carry out clearance checks.
	Friction Elements - damaged or worn	Inspect for damage. Repair as required.
Direct Clutch Assembly		
	Seals, Piston, Spring - damaged	Inspect for damage. Repair or install new as required.
	SSB solenoid stuck	Inspect for damage. Install a new solenoid body as required. Refer to **Solenoid Body Assembly**.
	Direct clutch regulator valve	Inspect for damage. Repair or install new as required.
	Clearance check out of specification	Inspect for damage. Carry out clearance checks.
	Friction Elements - damaged, clearance check incorrect	Inspect for damage. Repair or install new as required.

ENGAGEMENT CONCERN: HARSH FORWARD

Possible Component		Reference/Action
204 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Mass Air Flow (MAF) Sensor, Intake Air Temperature (IAT) Sensor, Throttle Position (TP) Sensor, Idle Speed Control (ISC), Power Steering Pressure (PSP) Sensor, Engine RPM, Line Pressure Control (LPC)	Run On-Board Diagnostic (OBD). Refer to the **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A**, go to **Pinpoint Test B**, go to **Pinpoint Test C** and Go to **Pinpoint Test E**.

	Solenoid, Transmission Fluid Temperature (TFT) sensor, Turbine Shaft Speed (TSS) sensor, Output Shaft Speed (OSS) sensor, Shift Solenoid A (SSA) or transaxle solenoid power control circuit open/shorted	
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
304 - HYDRAULIC/MECHANICAL ROUTINE		
Incorrect Pressures		
	Line Pressure, LPC Pressure - high	Carry out Line Pressure and Stall Speed Tests. Refer to **Special Testing Procedures**. Check pressure at line pressure taps. See the Line Pressure Chart for specifications. If high, check the Main Control Valve Body, Pump Assembly.
Pump Assembly		
	Bolts out of torque specification	Inspect for damage. Install a new pump as required.
	Porosity/cross leaks, pump assembly leaking, plugged hole	Inspect for damage. Install a new pump as required.
	Components damaged	Inspect for damage. Install a new pump as required.
Main Controls		
	Bolts out of torque	Tighten bolts to

	specification	specification.
	Gasket and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Forward Clutch Seal - Leaking Between Valve Body and Case	Inspect for damage. Install new as required.
	Forward clutch regulator valve - stuck, damaged	Inspect for damage. Install new as required.
	Forward clutch boost valve - stuck, damaged	Inspect for damage. Install new as required.
	Main Regulator Valve - stuck, damaged	Inspect for damage. Install new as required.
Forward Clutch Assembly		
	Seals, Piston - worn, damaged	Inspect for damage. Install new as required.
	Friction Elements - damaged	Inspect for damage. Install new as required.
	Wave Spring - damaged	Inspect for damage. Install new as required.

ENGAGEMENT CONCERN: DELAYED/SOFT REVERSE

Possible Component		Reference/Action
205 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Transmission Range (TR) Sensor, Vehicle Wiring Harnesses, PCM, Line Pressure Control (LPC) Solenoid, Transmission Fluid Temperature (TFT) sensor	Run On-Board Diagnostic (OBD). Refer to the **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A**, go to **Pinpoint Test B** and Go to **Pinpoint Test D**.
Solenoid Body		
	Incorrect solenoid	Verify solenoid body strategy data

	body strategy data stored in the PCM	stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
305 - HYDRAULIC/MECHANICAL ROUTINE		
Transmission Fluid Level		
	Low transmission fluid level	Check transmission fluid level and adjust as necessary. Refer to **Preliminary Inspection**.
	Transmission fluid condition	Carry out transmission fluid condition check. Refer to **Preliminary Inspection**.
Selector Lever Linkage (Internal/External)		
	Damaged, out of adjustment	Inspect for damage. Repair as required. Verify selector lever cable adjustment. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
Incorrect Pressures		
	Line Pressure, LPC Pressure - low	Check pressure at line pressure tap. Carry out Line Pressure and Stall Speed Tests. Refer to **Special Testing Procedures**. If pressures are low, check the following possible components: Main Control Valve Body, Pump Assembly, Low/Reverse Clutch Assembly, Direct Clutch Assembly.
Main Controls		
	Solenoid Body Filter Plugged	Inspect for damage. Install a new filter as required.
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Low/Reverse regulator valve - stuck, damaged	Inspect for damage. Install new as required.
	Low/Reverse boost valve - stuck, damaged	Inspect for damage. Install new as required.

	Direct regulator valve - stuck, damaged	Inspect for damage. Install new as required.
	Direct boost valve - stuck, damaged	Inspect for damage. Install new as required.
	Manual Control Valve, Main Regulator Valve, Converter Drain Back Valve, Springs - missing, damaged, misassembled	Inspect for damage. Repair or install new as required.
	Shift Solenoid B (SSB) stuck low	Inspect for damage. Go to **Pinpoint Test A**. Install a new solenoid body as required. Refer to **Solenoid Body Assembly**.
	Shift Solenoid D (SSD) stuck low	Inspect for damage. Install a new solenoid body as required. Refer to **Solenoid Body Assembly**.
Pump Assembly		
	Pump Assembly - worn/cross leaks, leaking	Inspect for damage. Install new as required.
Low/Reverse Clutch Assembly		
	SSD solenoid stuck low	Inspect for damage. Install a new solenoid body as required. Refer to **Solenoid Body Assembly**.
	Low/Reverse regulator valve stuck	Inspect for damage. Install new as required.
	Seals, Piston, Springs - damaged	Inspect for damage. Repair as required.
	Clearance check out of specification	Inspect for damage. Carry out clearance checks.
	Friction Elements - damaged or worn	Inspect for damage. Repair as required.
Direct Clutch Assembly		
	Seals, Piston, Spring - damaged	Inspect for damage. Repair or install new as required.
	SSB solenoid stuck	Inspect for damage. Install a new solenoid body as required. Refer to **Solenoid Body Assembly**.
	Direct clutch regulator valve	Inspect for damage. Repair or install new as required.

	Clearance check out of specification	Inspect for damage. Carry out clearance checks.
	Friction Elements - damaged, clearance check incorrect	Inspect for damage. Repair as required.

ENGAGEMENT CONCERN: DELAYED/SOFT FORWARD

Possible Component		Reference/Action
206 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Transmission Range (TR) Sensor, Vehicle Wiring Harnesses, PCM, Line Pressure Control (LPC) Solenoid, Transmission Fluid Temperature (TFT) sensor, Turbine Shaft Speed (TSS) sensor	Run On-Board Diagnostic (OBD). Refer to the **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A**, go to **Pinpoint Test B**, go to **Pinpoint Test C** and Go to **Pinpoint Test D**.
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
306 - HYDRAULIC/MECHANICAL ROUTINE		
Transmission Fluid Level		
	Low transmission fluid level	Check transmission fluid level and adjust as necessary. Refer to **Preliminary Inspection**.
	Transmission fluid condition	Carry out transmission fluid condition check. Refer to **Preliminary Inspection**.
Selector Lever Linkage		
	Damaged, out of adjustment	Inspect for damage. Repair as required. Verify selector lever cable adjustment. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS**

		article.
Incorrect Pressures		
	Line Pressure, Line Pressure Control (LPC) Pressure - low	Check pressure at line pressure tap. Carry out Line Pressure and Stall Speed Tests. Refer to **Special Testing Procedures**. If pressures are low, check the following possible components: Main Control Valve Body, Pump Assembly, and Forward Clutch.
Main Controls		
	Plugged Solenoid Body Filter	Inspect for damage. Install new as required.
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Forward Clutch Regulator Valve stuck or damaged	Inspect for damage. Install new as required.
	Forward Clutch Boost Valve stuck or damaged	Inspect for damage. Install new as required.
	Main Regulator Valve - stuck, damaged, missing	Inspect for damage. Repair as required.
	LPC solenoid stuck low	Install a new solenoid body. Refer to **Solenoid Body Assembly**.
	SSA stuck low	Install a new solenoid body. Refer to **Solenoid Body Assembly**.
Pump Assembly		
	Bolts out of torque specification	Tighten bolts to specification.
	Worn/cross leaks	Inspect for wear and leaks. Install new as required.
Forward Clutch Assembly		
	Clutch Plates, Seals, Piston - worn, damaged	Inspect clutches, seals and piston for damage. Install new as required.
	Wave Spring - damaged	Inspect for damage. Install new as required.

ENGAGEMENT CONCERN: NO FORWARD AND NO REVERSE

Possible Component		Reference/Action
207 - ELECTRICAL ROUTINE		
	No electrical concerns	
307 - HYDRAULIC/MECHANICAL ROUTINE		
Transmission Fluid Level		
	Low transmission fluid level	Check transmission fluid level and adjust as necessary. Refer to **Preliminary Inspection**.
	Transmission fluid condition	Carry out transmission fluid condition check. Refer to **Preliminary Inspection**.
Halfshaft		
	Splines - worn, damaged	Inspect for damage. Repair as required.
	Shaft - misassembled, incorrect	Inspect for damage. Repair as required.
Selector Lever Linkage (Internal/External)		
	Damaged, out of adjustment	Inspect for damage. Repair as required. Verify selector lever cable adjustment. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
Incorrect Pressures		
	Line Pressure, Line Pressure Control (LPC) Pressure - low	Carry out Line Pressure and Stall Tests. Check pressure at the line pressure tap. See the Line Pressure Chart for specifications. If pressures are low, check the following possible components: Transmission Fluid Filter and Seal Assembly, Main Control, Pump Assembly, Low/Reverse Clutch Assembly, Forward Clutch Assembly.
Transmission Fluid Filter and Seal Assembly		
	Plugged, damaged, not correctly seated	Inspect for damage. Install a new filter and seal assembly.
	Filter, Seal - damaged	Inspect for damage. Install a new filter and seal assembly.
Main Controls		
	Solenoid Body	Inspect for damage. Install a new

	Filter Plugged	filter as required.
	Manual Valve	Inspect for damage. Install new as required.
	Shift Valves	Inspect for damage. Install new as required.
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Main Regulator Valve (only if line pressure is out of specification) - damaged	Inspect for damage. Repair as required.
	Components - damaged, check balls stuck	Inspect for damage. Repair as required.
Pump Assembly		
	Bolts out of torque specification	Tighten bolts to specification.
	Porosity/cross leaks - leaking, plugged hole	Install a new pump assembly.
	Components damaged - Chain, Sprocket or Shaft Broken	Inspect for damage. Install new as required.
Output Shaft		
	Splines - damaged	Inspect for damage. Repair as required.
Other Possible Components		
	Turbine Shaft	Inspect for damage. Repair as required.
	Pump Shaft, Sprockets and Drive Chain	Inspect for damage. Repair as required.
	Flexplate	Inspect for damage. Repair as required.
	Sun Gear and Shell Assemblies	Inspect for damage. Repair as required.
	Planetaries	Inspect for damage. Repair as required.
	Final Drive	Inspect for damage. Repair as

	Assembly	required.

ENGAGEMENT CONCERN: DELAYED/SOFT FORWARD AND REVERSE

Possible Component		Reference/Action
209 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Transmission Range (TR) Sensor, Transmission Fluid Temperature (TFT) Sensor, Turbine Shaft Speed (TSS) Sensor, Line Pressure Control (LPC) Solenoid, Vehicle Wiring Harnesses, PCM	Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A**, go to **Pinpoint Test B**, go to **Pinpoint Test C** and Go to **Pinpoint Test D**.
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
309 - HYDRAULIC/MECHANICAL ROUTINE		
Transmission Fluid Level		
	Low transmission fluid level	Check transmission fluid level and adjust as necessary. Refer to **Preliminary Inspection**.
	Transmission fluid condition	Carry out transmission fluid condition check. Refer to **Preliminary Inspection**.
Selector Lever Linkage (Internal/External)		
	Damaged, out of adjustment	Inspect for damage. Repair as required. Verify selector lever cable adjustment. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
Incorrect Pressures		
	Line Pressure, LPC Pressure - low	Carry out Line Pressure and Stall Speed Tests. Refer to **Special Testing Procedures**. See the Line

		Pressure Chart for specifications. If pressures are low, check the following possible components: Main Control, Pump Assembly and LPC solenoid.
Transmission Fluid Filter and Seal Assembly		
	Plugged, damaged, not correctly seated	Inspect for damage. Install a new filter and seal assembly.
	Filter, Seal - damaged	Inspect for damage. Install a new filter and seal assembly.
Main Controls		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Seals, Manual Valve, Main Regulator Valve - missing, damaged or misassembled	Inspect for damage. Repair or install new as required.
Pump Assembly		
	Bolts out of torque specification	Tighten bolts to specification.
	Worn/cross leaks - leaking	Install a new pump assembly.
	Components damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: SOME OR ALL SHIFTS MISSING

Possible Component		Reference/Action
210 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC), Shift Solenoid D (SSD), Shift Solenoid E	Run On-Board Diagnostic (OBD). Refer to the **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A**, go to **Pinpoint Test C** and Go to **Pinpoint Test D**.

	(SSE), Throttle Position (TP) sensor, Mass Air Flow (MAF) sensor, Output Shaft Speed (OSS) sensor, Turbine Shaft Speed (TSS) sensor, Transmission Range (TR) Sensor, Line Pressure Control (LPC) Solenoid	
310 - HYDRAULIC/MECHANICAL ROUTINE		
Transmission Fluid Level		
	Incorrect transmission fluid level	Check transmission fluid level and adjust as necessary. Refer to **Preliminary Inspection**.
	Transmission fluid condition	Carry out transmission fluid condition check. Refer to **Preliminary Inspection**.
Selector Lever Linkage (Internal/External)		
	Damaged, out of adjustment	Inspect for damage. Repair as required. Verify selector lever cable adjustment. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
Vehicle Speed Input		
	Insufficient, erratic or no input received by the PCM from the OSS sensor	Inspect for damage. Repair as required. Go to **Pinpoint Test C**.
Transmission Fluid Filter and Seal Assembly		
	Plugged, damaged, not correctly seated	Inspect for damage. Install a new filter and seal assembly.
	Filter, Seal - damaged	Inspect for damage. Install a new filter and seal assembly.
Main Controls		
	Regulator and/or Boost Valves - stuck, damaged, misassembled	Inspect for damage. Repair or install new as required.
	Plugged Solenoid Body Filter	Inspect for damage. Install new as required.

End Cover		
	End Cover Gasket - leaking	Inspect for damage. Repair or install new as required.
Planetary Gear Sets		
	Damaged	Inspect for damage. Repair as required.
One-Way Clutch Assembly		
	Damaged	Inspect for damage. Repair as required.
Other Components		
	Clutches	Inspect for damage. Repair as required.
	Output Shafts (Differential)	Inspect for damage. Repair as required.
	Powerflow Components	Inspect for damage. Repair as required.
	Go to Shift Concerns:	See the appropriate shift concern and routine: • Shift Concern: No 1-2, Routine 220/320 • Shift Concern: No 2-3, Routine 221/321 • Shift Concern: No 3-4, Routine 222/322 • Shift Concern: No 4-5, Routine 223/323 • Shift Concern: No 5-6, Routine 224/324 • Shift Concern: No 6-5, Routine 225/325 • Shift Concern: No 5-4, Routine 226/326 • Shift Concern: No 4-3, Routine 227/327 • Shift Concern: No 3-2, Routine 228/328 • Shift Concern: No 2-1, Routine 229/329

SHIFT CONCERNS: TIMING - EARLY/LATE

Possible Component	Reference/Action
211 - ELECTRICAL ROUTINE	

Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC), Shift Solenoid D (SSD), Shift Solenoid E (SSE), Throttle Position (TP) sensor, Mass Air Flow (MAF) sensor, Output Shaft Speed (OSS) sensor, Intake Air Temperature (IAT) sensor, Engine Coolant Temperature (ECT) sensor, Transmission Fluid Temperature (TFT) sensor, Turbine Shaft Speed (TSS) sensor, Internal Wire Harness, Line Pressure Control (LPC) Solenoid	Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A**, go to **Pinpoint Test B** and Go to **Pinpoint Test C**.
		Carry out Shift Point Road Test. Refer to **Shift Point Road Test** and carry out Torque Converter Operation Test. Refer to **Torque Converter Diagnosis**.
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
311 - HYDRAULIC/MECHANICAL ROUTINE		
Other		
	Tire Size	See the specification decal and

		verify vehicle has original equipment. Changes in tire size will affect shift timing.
Transmission Fluid Level		
	Low transmission fluid level	Check transmission fluid level and adjust as necessary. Refer to **Preliminary Inspection**.
	Transmission fluid condition	Carry out transmission fluid condition check. Refer to **Preliminary Inspection**.
Selector Lever Linkage (Internal/External)		
	Damaged, out of adjustment	Inspect for damage. Repair as required. Verify selector lever cable adjustment. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
Main Controls		
	Plugged Solenoid Body Filter	Inspect for damage. Install new as required.
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Valves, Accumulators, Seals, Springs, Clips, Check balls - damaged, missing, misassembled	Inspect for damage. Repair as required. See the appropriate shift concern and routine for further diagnosis: • Shift Concern: Soft/Slipping 1-2, Routine 230/330 • Shift Concern: Soft/Slipping 2-3, Routine 231/331 • Shift Concern: Soft/Slipping 3-4, Routine 232/332 • Shift Concern: Soft/Slipping 4-5, Routine 233/333 • Shift Concern: Soft/Slipping

		5-6, Routine 234/334 • Shift Concern: Soft/Slipping 6-5, Routine 235/335 • Shift Concern: Soft/Slipping 5-4, Routine 236/336 • Shift Concern: Soft/Slipping 4-3, Routine 237/337 • Shift Concern: Soft/Slipping 3-2, Routine 238/338 • Shift Concern: Soft/Slipping 2-1, Routine 239/339
End Cover		
	End Cover Gasket - leaking	Inspect for damage. Repair or install new as required.
Planetary Gear Sets		
	Damaged	Inspect for damage. Repair or install new as required.
One-Way Clutch Assembly		
	Damaged	Inspect for damage. Repair or install new as required.
Other Components		
	Clutches	Inspect for damage. Repair or install new as required.
	Output Shaft (Differential)	Inspect for damage. Repair or install new as required.
	Powerflow Components	Inspect for damage. Repair as required.
Vehicle Speed Input		
	Insufficient, erratic or no input received by the PCM from the OSS or TSS sensors	Inspect for damage. Repair as required. Go to **Pinpoint Test C**.
Transmission Fluid Filter and Seal Assembly		
	Plugged, damaged, not correctly seated	Inspect for damage. Install a new filter and seal assembly.
	Filter, Seal - damaged	Inspect for damage. Install a new filter and seal assembly.

SHIFT CONCERNS: TIMING - ERRATIC/HUNTING

Possible Component		Reference/Action
212 - ELECTRICAL ROUTINE		
Powertrain Control System		

	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Torque Converter Clutch (TCC) and Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC), Shift Solenoid D (SSD), Shift Solenoid E (SSE), Throttle Position (TP) sensor, Output Shaft Speed (OSS) sensor, Engine Coolant Temperature (ECT) sensor, Intake Air Temperature (IAT) sensor, Mass Air Flow (MAF) sensor, Transmission Range (TR) sensor, Transmission Fluid Temperature (TFT) sensor, Turbine Shaft Speed (TSS) sensor	Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A**, go to **Pinpoint Test B**, go to **Pinpoint Test C**, Go to **Pinpoint Test D** and Go to **Pinpoint Test E**.
		Carry out Shift Point Road Test. Refer to **Shift Point Road Test** and carry out Torque Converter Operation Test. Refer to **Torque Converter Diagnosis**.
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
312 - HYDRAULIC/MECHANICAL ROUTINE		
Transmission Fluid Level		
	Low transmission fluid level	Check transmission fluid level and adjust as necessary. Refer to **Preliminary Inspection**.

	Transmission fluid condition	Carry out transmission fluid condition check. Refer to **Preliminary Inspection**.
Selector Lever Linkage (Internal/External)		
	Damaged, out of adjustment	Inspect for damage. Repair as required. Verify selector lever cable adjustment. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
Main Control Valve Body		
	Plugged Solenoid Body Filter	Inspect for damage. Install new as required.
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Valves, Seals, Clips, Check Ball - stuck, damaged, contaminated	Inspect for damage. Repair or install new as required.
End Cover		
	End Cover Gasket - leaking	Inspect for damage. Repair or install new as required.
Vehicle Speed Input		
	Insufficient, erratic or no input received by the PCM from the OSS or TSS sensor	Inspect for damage. Repair as required. Go to **Pinpoint Test C**.
Torque Converter Clutch (TCC)		
		See Torque Converter Cycling (Routine 254/354).
Planetary Gear Sets		
	Damaged	Inspect for damage. Repair as required.
Clutch Assemblies		
	Damaged Clutch Plates, Pistons, Seals, Return Springs	Inspect for damage. Repair or install new as required.
Transmission Fluid Filter and Seal Assembly		

	Plugged, damaged, not correctly seated	Inspect for damage. Install a new filter and seal assembly.
	Filter, Seal - damaged	Inspect for damage. Install a new filter and seal assembly.
For Diagnosis Related to a Specific Shift		
		See the appropriate shift concern and routine for further diagnosis: • Shift Concern: No 1-2, Routine 220/320 • Shift Concern: No 2-3, Routine 221/321 • Shift Concern: No 3-4, Routine 222/322 • Shift Concern: No 4-5, Routine 223/323 • Shift Concern: No 5-6, Routine 224/324 • Shift Concern: No 6-5, Routine 225/325 • Shift Concern: No 5-4, Routine 226/326 • Shift Concern: No 4-3, Routine 227/327 • Shift Concern: No 3-2, Routine 228/328 • Shift Concern: No 2-1, Routine 229/329 • Shift Concern: Soft/Slip 1-2, Routine 230/330 • Shift Concern: Soft/Slip 2-3, Routine 231/331 • Shift Concern: Soft/Slip 3-4, Routine 232/332 • Shift Concern: Soft/Slip 4-5, Routine 233/333 • Shift Concern: Soft/Slip 5-6, Routine 234/334 • Shift Concern: Soft/Slip 6-5, Routine 235/335 • Shift Concern: Soft/Slip 5-4, Routine 236/336 • Shift Concern: Soft/Slip 4-3,

		Routine 237/337 • Shift Concern: Soft/Slip 3-2, Routine 238/338 • Shift Concern: Soft/Slip 2-1, Routine 239/339 • Shift Concern: Harsh 1-2, Routine 240/340 • Shift Concern: Harsh 2-3, Routine 241/341 • Shift Concern: Harsh 3-4, Routine 242/342 • Shift Concern: Harsh 4-5, Routine 243/343 • Shift Concern: Harsh 5-6, Routine 244/344 • Shift Concern: Harsh 6-5, Routine 245/345 • Shift Concern: Harsh 5-4, Routine 246/346 • Shift Concern: Harsh 4-3, Routine 247/347 • Shift Concern: Harsh 3-2, Routine 248/348 • Shift Concern: Harsh 2-1, Routine 249/349

SHIFT CONCERNS: FEEL - SOFT/SLIPPING

Possible Component		Reference/Action
213 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Line Pressure Control (LPC) Solenoid, Mass Air Flow (MAF) sensor, Throttle Position (TP) sensor, Engine Coolant	Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A**, go to **Pinpoint Test B** and Go to **Pinpoint Test C**.

	Temperature (ECT) sensor, Intake Air Temperature (IAT) sensor, Transmission Fluid Temperature (TFT) sensor, Turbine Shaft Speed (TSS) sensor, Output Shaft Speed (OSS) sensor	
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
313 - HYDRAULIC/MECHANICAL ROUTINE		
Transmission Fluid		
	Low transmission fluid level	Check transmission fluid level and adjust as necessary. Refer to **Preliminary Inspection**.
	Transmission fluid condition	Carry out transmission fluid condition check. Refer to **Preliminary Inspection**.
Selector Lever Linkage (Internal/External)		
	Damaged, out of adjustment	Inspect for damage. Repair as required. Verify selector lever cable adjustment. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
Incorrect Pressures		
	Low LPC pressure	Check pressures at line pressure taps. Carry out Line Pressure and Stall Speed Tests. Refer to **Special Testing Procedures**. See the Line Pressure Chart for specification. If pressures are low or all shifts are soft/slipping refer to **Main Control**. If pressures are OK and a specific shift is soft/slipping, see the following chart: • Soft/Slipping Shift 1-2,

		Routine 230/330 • Soft/Slipping Shift 2-3, Routine 231/331 • Soft/Slipping Shift 3-4, Routine 232/332 • Soft/Slipping Shift 4-5, Routine 233/333 • Soft/Slipping Shift 5-6, Routine 234/334 • Soft/Slipping Shift 6-5, Routine 235/335 • Soft/Slipping Shift 5-4, Routine 236/336 • Soft/Slipping Shift 4-3, Routine 237/337 • Soft/Slipping Shift 3-2, Routine 238/338 • Soft/Slipping Shift 2-1, Routine 239/339
Transmission Fluid Filter and Seal Assembly		
	Plugged, damaged, not correctly seated	Inspect for damage. Install a new filter and seal assembly.
	Filter, Seal - damaged	Inspect for damage. Install a new filter and seal assembly.
Main Controls		
	Plugged Solenoid Body Filter	Inspect for damage. Install new as required.
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Sticking or Binding Valves, Check Balls, Clips, Springs - damaged, missing	Inspect for damage. Repair or install new as required.
Pump Assembly		
	Pump Assembly - worn/cross leaks, leaking	Inspect for damage. Install new as required.

SHIFT CONCERNS: FEEL - HARSH

Possible Component		Reference/Action
214 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Line Pressure Control (LPC) Solenoid, Mass Air Flow (MAF) sensor, Throttle Position (TP) sensor, Output Shaft Speed (OSS) sensor, Turbine Shaft Speed (TSS) sensor, Engine Coolant Temperature (ECT) sensor, Intake Air Temperature (IAT) sensor, Power Steering Pressure (PSP) switch, Transmission Fluid Temperature (TFT) sensor, Transmission Range (TR) Sensor, Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC), Shift Solenoid D (SSD) and Shift Solenoid E (SSE)	Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A**, go to **Pinpoint Test B**, go to **Pinpoint Test C** and Go to **Pinpoint Test D**.
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
314 - HYDRAULIC/MECHANICAL ROUTINE		
Transmission Fluid Level		
	Low transmission	Check transmission

	fluid level	fluid level and adjust as necessary. Refer to **Preliminary Inspection**.
	Transmission fluid condition	Carry out transmission fluid condition check. Refer to **Preliminary Inspection**.
Incorrect Pressures		
	High LPC pressure	Check pressure at line pressure tap. Carry out Line Pressure Test. Refer to **Special Testing Procedures**. See the Line Pressure Chart for specifications. If pressures are high or all shifts are harsh, go to Main Control. Refer to **Main Control**. If pressures are OK and a specific shift is harsh. See the appropriate shift routine in the following chart: • Shift 1-2, Routine 240/340 • Shift 2-3, Routine 241/341 • Shift 3-4, Routine 242/342 • Shift 4-5, Routine 243/343 • Shift 5-6, Routine 244/344 • Shift 6-5, Routine

		245/345 • Shift 5-4, Routine 246/346 • Shift 4-3, Routine 247/347 • Shift 3-2, Routine 248/348 • Shift 2-1, Routine 249/349
Main Control Valve Body		
	Plugged Solenoid Body Filter	Inspect for damage. Install new as required.
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Valves, Springs, Clips, Check Balls - stuck, damaged	Inspect for damage. Repair or install new as required.
Pump Assembly		
	Pump Assembly - worn/cross leaks, leaking	Inspect for damage. Install new as required.

SHIFT CONCERNS: NO 1ST GEAR, ENGAGES IN HIGHER GEAR

Possible Component		Reference/Action
215 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC), Shift Solenoid D (SSD), Shift	Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A**, Go to **Pinpoint Test C** and Go to **Pinpoint Test E**.

	Solenoid E (SSE), Output Shaft Speed (OSS) sensor and Turbine Shaft Speed (TSS) sensor, transaxle solenoid power control circuit - no voltage at transaxle connector	Repair as required. Clear codes. Road Test and rerun On-Board Diagnostic (OBD).
315 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Plugged Solenoid Body Filter (SSA Filter Plate)	Inspect for damage. Install new as required.
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Forward Clutch Regulator Valve, Springs, Clips - stuck, damaged, missing, misassembled	Inspect for damage. Repair as required.
	Shift Solenoid - stuck, damaged	Inspect for damage. Go to **Pinpoint Test A**. Repair as required. Activate solenoid using the scan tool. Repair as required.
	For diagnosis related to a specific gear, use the scan tool to select the gear	See the following routines: • Shift 1-2, Routine 220/320 • Shift 2-3, Routine 221/321 • Shift 3-4, Routine 222/322 • Shift 4-5,

		Routine 223/323 • Shift 5-6, Routine 224/324
Mechanical		
	Clutches or Seals - damaged or worn	Inspect for damage. Repair or install new as required.

SHIFT CONCERNS: NO 1-2 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
220 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Shift Solenoid C (SSC) and Transmission Range (TR) Sensor	Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A** and Go to **Pinpoint Test D**.
320 - HYDRAULIC/MECHANICAL ROUTINE		
Incorrect Pressures		
	Line pressure	Check pressure at line pressure tap. Carry out Line Pressure Test. Refer to **Special Testing Procedures**. See the Line Pressure Chart for specifications. If not OK, check Main Control. Refer to **Main Control**.
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Intermediate Regulator Valve,	Inspect for damage. Repair or install new

	Springs, Clips - loose, stuck, missing, misassembled stuck off	as required.
	SSC not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Intermediate Clutch Assembly - Failed Off		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Low/Reverse Clutch Assembly - Failed On		
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - overheated	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring	Inspect for damage.

	Assembly - damaged	Install new as required.
Pump Assembly		
	Worn/cross leaks	Inspect for damage. Install new as required.
	Component damaged	Inspect for damage. Install a new pump assembly as required.
Low One-Way Clutch Assembly		
	Not overrunning, damaged	Inspect for damage. Install new as required.
Planetary Carrier		
	Damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: NO 2-3 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
221 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Shift Solenoid B (SSB) Failed, Shift Solenoid C (SSC) Stuck On and Transmission Range (TR) Sensor	Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A** and Go to **Pinpoint Test D**.
321 - HYDRAULIC/MECHANICAL ROUTINE		
Incorrect Pressures		
	Line pressure	Check pressure at line pressure tap. Carry out Line Pressure Test. Refer to **Special Testing Procedures**. See the Line Pressure Chart for specifications. If not OK, check Main Control. Refer to **Main Control**.

Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, missing, misassembled, stuck off	Inspect for damage. Repair or install new as required.
	Intermediate Regulator and Boost Valves, Springs, Clips - loose, stuck, missing, misassembled, stuck on	Inspect for damage. Repair or install new as required.
	SSB or SSC not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Direct Clutch Assembly - Failed Off		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub -	Inspect for damage.

	damaged	Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Intermediate Clutch Assembly - Failed On		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: NO 3-4 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
222 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Shift Solenoid D (SSD) Failed, Shift Solenoid B (SSB) Stuck On and Transmission Range (TR) Sensor	Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A** and Go to **Pinpoint Test D**.
322 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Overdrive Regulator	Inspect for damage.

	and Boost Valves, Springs, Clips - loose, stuck, missing, misassembled, clutch failed off	Repair or install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, missing, misassembled, clutch failed on	Inspect for damage. Repair or install new as required.
	SSD not functioning correctly, SSB stuck on	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Overdrive Clutch Assembly - Failed Off		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Direct Clutch Assembly - Failed On		
	Seals - damaged	Inspect for damage. Install new as required.

	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: NO 4-5 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
223 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Shift Solenoid B (SSB) Failed, Shift Solenoid A (SSA) Stuck On, Transmission Range (TR) Sensor	Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A** and Go to **Pinpoint Test D**.
Transmission Control Switch (TCS)/Overdrive (O/D) Cancel Switch		
	Switch control circuit open/shorted, switch damaged	Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
323 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck,	Inspect for damage. Repair or install new as required.

	missing, misassembled, clutch failed off	
	Forward Regulator and Boost Valves, Springs, Clips - loose, stuck, missing, misassembled, clutch failed on	Inspect for damage. Repair or install new as required.
	SSB not functioning correctly, SSA stuck on	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Direct Clutch Assembly - Failed Off		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Forward Clutch Assembly - Failed On		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: NO 5-6 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
224 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Shift Solenoid C (SSC) Failed, Shift Solenoid B (SSB) Stuck On, Transmission Range (TR) Sensor	Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A** and Go to **Pinpoint Test D**.
Transmission Control Switch (TCS)/Overdrive (O/D) Cancel Switch		
	Switch control circuit open/shorted, switch damaged	Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
324 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Intermediate Regulator and Boost Valves, Springs, Clips - loose, stuck, missing, misassembled, clutch failed off	Inspect for damage. Repair or install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, missing, misassembled, clutch failed on	Inspect for damage. Repair or install new as required.
	SSC not functioning correctly, SSB stuck on	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body**

		Assembly. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Intermediate Clutch Assembly - Failed Off		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Direct Clutch Assembly - Failed On		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: NO 6-5 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
225 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Shift Solenoid B (SSB) Failed, Shift Solenoid C (SSC) Stuck On, Transmission Range (TR) Sensor	Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A** and Go to **Pinpoint Test D**.
325 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		

	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Intermediate Regulator and Boost Valves, Springs, Clips - loose, stuck, missing, misassembled, clutch failed on	Inspect for damage. Repair or install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, missing, misassembled, clutch failed off	Inspect for damage. Repair or install new as required.
	SSC not functioning correctly, SSB stuck on	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Intermediate Clutch Assembly - Failed On		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as

		required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Direct Clutch Assembly - Failed Off		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: NO 5-4 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
226 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Shift Solenoid A (SSA) Failed, Shift Solenoid B (SSB) Stuck On, Transmission Range (TR) Sensor	Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A** and Go to **Pinpoint Test D**.
326 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Direct Regulator and Boost Valves,	Inspect for damage. Repair or install new

	Springs, Clips - loose, stuck, missing, misassembled, clutch failed on	as required.
	Forward Regulator and Boost Valves, Springs, Clips - loose, stuck, missing, misassembled, clutch failed off	Inspect for damage. Repair or install new as required.
	SSA not functioning correctly, SSB stuck on	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Direct Clutch Assembly - Failed On		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Forward Clutch Assembly - Failed Off		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage.

		Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: NO 4-3 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
227 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Shift Solenoid B (SSB) Failed, Shift Solenoid D (SSD) Stuck On, Transmission Range (TR) Sensor	Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A** and Go to **Pinpoint Test D**.
327 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Overdrive Regulator and Boost Valves, Springs, Clips - loose, stuck, missing, misassembled, clutch failed on	Inspect for damage. Repair or install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, missing, misassembled, clutch	Inspect for damage. Repair or install new as required.

	failed off	
	SSB not functioning correctly, SSD stuck on	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Overdrive Clutch Assembly - Failed On		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Direct Clutch Assembly - Failed Off		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring	Inspect for damage.

	Assembly - damaged	Install new as required.

SHIFT CONCERNS: NO 3-2 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
228 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Shift Solenoid C (SSC) Failed, Shift Solenoid B (SSB) Stuck On, Transmission Range (TR) Sensor	Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A** and Go to **Pinpoint Test D**.
328 - HYDRAULIC/MECHANICAL ROUTINE		
Incorrect Pressures		
	Line pressure	Check pressure at line pressure tap. Carry out Line Pressure Test. Refer to **Special Testing Procedures**. See the Line Pressure Chart for specifications. If not OK, check Main Control Valve Body.
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, missing, misassembled, stuck on	Inspect for damage. Repair or install new as required.
	Intermediate Regulator and Boost Valves, Springs, Clips - loose, stuck,	Inspect for damage. Repair or install new as required.

	missing, misassembled, stuck off	
	SSB or SSC not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Direct Clutch Assembly - Failed On		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Intermediate Clutch Assembly - Failed Off		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as

		required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: NO 2-1 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
229 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Shift Solenoid C (SSC) Stuck On, Transmission Range (TR) Sensor	Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A** and Go to **Pinpoint Test D**.
329 - HYDRAULIC/MECHANICAL ROUTINE		
Incorrect Pressures		
	Line pressure	Check pressure at line pressure tap. Carry out Line Pressure Test. Refer to **Special Testing Procedures**. See the Line Pressure Chart for specifications. If not OK, check Main Control Valve Body.
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Intermediate Regulator Valve, Springs, Clips - loose, stuck, missing, misassembled, stuck on	Inspect for damage. Repair or install new as required.
	SSC not functioning correctly, stuck on	Activate solenoid using scan tool. Refer

		to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Intermediate Clutch Assembly - Failed On		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Low One-Way Clutch Assembly		
	Damaged - Not holding	Inspect for damage. Install new as required.
Planetary Carrier		
	Damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: SOFT/SLIPPING 1-2 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
230 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download

		new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
330 - HYDRAULIC/MECHANICAL ROUTINE		
Incorrect Pressures		
	Line pressure	Check pressure at line pressure tap. Carry out Line Pressure Test. Refer to **Special Testing Procedures**. See the Line Pressure Chart for specifications. If not OK, check Main Control Valve Body.
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Intermediate Regulator Valve, Springs, Clips - loose, stuck, missing, binding, misassembled	Inspect for damage. Repair or install new as required.
	Shift Solenoid C (SSC) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Intermediate Clutch Assembly		

	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Pump Assembly		
	Worn/cross leaks	Inspect for damage. Install new as required.
	Component damaged	Inspect for damage. Install a new pump assembly if required.

SHIFT CONCERNS: SOFT/SLIPPING 2-3 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
231 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
331 - HYDRAULIC/MECHANICAL ROUTINE		
Incorrect Pressures		
	Line pressure	Check pressure at line pressure tap. Carry out Line Pressure Test. Refer to **Special Testing Procedures**. See the Line Pressure Chart for specifications. If

		not OK, check Main Control. Refer to **Main Control**.
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Intermediate Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Multiplex Valve, Springs, Clips - loose, stuck, missing, binding misassembled	Inspect for damage. Repair or install new as required.
	Shift Solenoid B (SSB) or Shift Solenoid C (SSC) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Direct Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.

	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Intermediate Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: SOFT/SLIPPING 3-4 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
232 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
332 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.

	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Overdrive Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Shift Solenoid D (SSD) or Shift Solenoid B (SSB) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Overdrive Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as

		required.
Direct Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: SOFT/SLIPPING 4-5 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
233 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
333 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Forward Regulator	Inspect for damage.

	and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Repair or install new as required.
	Shift Solenoid B (SSB) or Shift Solenoid A (SSA) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Direct Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Forward Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.

	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: SOFT/SLIPPING 5-6 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
234 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
334 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Intermediate Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Shift Solenoid C (SSC) or Shift Solenoid B (SSB) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid

		body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Intermediate Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Direct Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: SOFT/SLIPPING 6-5 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
235 - ELECTRICAL ROUTINE		
Solenoid Body		

	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
335 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Intermediate Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Shift Solenoid C (SSC) or Shift Solenoid B (SSB) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Intermediate Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as

		required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Direct Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: SOFT/SLIPPING 5-4 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
236 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
336 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Bolts out of torque	Tighten bolts to

	specification	specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, missing, misassembled, clutch failed on	Inspect for damage. Repair or install new as required.
	Forward Regulator and Boost Valves, Springs, Clips - loose, stuck, missing, misassembled, clutch failed off	Inspect for damage. Repair or install new as required.
	Shift Solenoid A (SSA) not functioning correctly, Shift Solenoid B (SSB) stuck on	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Direct Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring	Inspect for damage.

	Assembly - damaged	Install new as required.
Forward Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: SOFT/SLIPPING 4-3 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
237 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
337 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Overdrive Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.

	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled, clutch failed off	Inspect for damage. Repair or install new as required.
	Shift Solenoid B (SSB) or Shift Solenoid D (SSD) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Overdrive Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Direct Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged,	Inspect for damage.

	worn	Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: SOFT/SLIPPING 3-2 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
238 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
338 - HYDRAULIC/MECHANICAL ROUTINE		
Incorrect Pressures		
	Line pressure	Check pressure at line pressure tap. Carry out Line Pressure Test. Refer to **Special Testing Procedures**. See the Line Pressure Chart for specifications. If not OK, check Main Control Valve Body.
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing,	Inspect for damage. Repair or install new as required.

	misassembled	
	Intermediate Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Multiplex Valve, Spring, Clip - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Shift Solenoid B (SSB) or Shift Solenoid C (SSC) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Direct Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Intermediate Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as

		required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: SOFT/SLIPPING 2-1 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
239 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
339 - HYDRAULIC/MECHANICAL ROUTINE		
Incorrect Pressures		
	Line pressure	Check pressure at line pressure tap. Carry out Line Pressure Test. Refer to **Special Testing Procedures**. See the Line Pressure Chart for specifications. If not OK, check Main Control Valve Body.
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.

	Intermediate Regulator Valve, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Shift Solenoid C (SSC) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Intermediate Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Low One-Way Clutch Assembly		
	Damaged - not holding	Inspect for damage. Install new as required.
Planetary Carrier		
	Damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: HARSH 1-2 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
240 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
340 - HYDRAULIC/MECHANICAL ROUTINE		
Incorrect Pressures		
	Line pressure	Check pressure at line pressure tap. Carry out Line Pressure Test. Refer to **Special Testing Procedures**. See the Line Pressure Chart for specifications. If not OK, check Main Control Valve Body.
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Intermediate Regulator Valve, Springs, Clips - loose, stuck, missing, binding, misassembled	Inspect for damage. Repair or install new as required.
	Shift Solenoid C (SSC) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body**

		Assembly. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Intermediate Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Pump Assembly		
	Worn/cross leaks	Inspect for damage. Install new as required.
	Component damaged	Inspect for damage, missing ball. Install a new pump assembly if required.

SHIFT CONCERNS: HARSH 2-3 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
241 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
341 - HYDRAULIC/MECHANICAL ROUTINE		
Incorrect Pressures		

	Line pressure	Check pressure at line pressure tap. Carry out Line Pressure Test. Refer to **Special Testing Procedures**. See the Line Pressure Chart for specifications. If not OK, check Main Control Valve Body.
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Intermediate Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Multiplex Valve, Springs, Clips - loose, stuck, missing, binding misassembled	Inspect for damage. Repair or install new as required.
	Shift Solenoid B (SSB) or Shift Solenoid C (SSC) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to

		Solenoid Body Strategy.
Direct Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Intermediate Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: HARSH 3-4 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
242 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to

		Solenoid Body Strategy.
342 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Overdrive Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Shift Solenoid D (SSD) or Shift Solenoid B (SSB) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Overdrive Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as

		required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Direct Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: HARSH 4-5 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
243 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
343 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Direct Regulator and	Inspect for damage.

	Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Repair or install new as required.
	Forward Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Shift Solenoid B (SSB) or Shift Solenoid A (SSA) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Direct Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Forward Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.

	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: HARSH 5-6 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
244 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
344 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Intermediate Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.

	Shift Solenoid C (SSC) or Shift Solenoid B (SSB) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Intermediate Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Direct Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as

		required.

SHIFT CONCERNS: HARSH 6-5 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
245 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
346 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Intermediate Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Shift Solenoid C (SSC) or Shift Solenoid B (SSB) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the

		PCM. Refer to **Solenoid Body Strategy**.
Intermediate Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Direct Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: HARSH 5-4 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
246 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as

		necessary. Refer to **Solenoid Body Strategy**.
346 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, missing, misassembled, clutch failed on	Inspect for damage. Repair or install new as required.
	Forward Regulator and Boost Valves, Springs, Clips - loose, stuck, missing, misassembled, clutch failed off	Inspect for damage. Repair or install new as required.
	Shift Solenoid A (SSA) not functioning correctly, Shift Solenoid B (SSB) stuck on	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Direct Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged,	Inspect for damage.

	worn	Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Forward Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: HARSH 4-3 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
247 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
347 - HYDRAULIC/MECHANICAL ROUTINE		
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.

	Overdrive Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled, clutch failed off	Inspect for damage. Repair or install new as required.
	Shift Solenoid B (SSB) or Shift Solenoid D (SSD) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Overdrive Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Direct Clutch Assembly		
	Seals - damaged	Inspect for damage.

		Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: HARSH 3-2 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
248 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
348 - HYDRAULIC/MECHANICAL ROUTINE		
Incorrect Pressures		
	Line pressure	Check pressure at line pressure tap. Carry out Line Pressure Test. Refer to **Special Testing Procedures**. See the Line Pressure Chart for specifications. If not OK, check Main Control Valve Body.
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off	Inspect for damage. Install new as required.

	location	
	Direct Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Intermediate Regulator and Boost Valves, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Shift Solenoid B (SSB) or Shift Solenoid C (SSC) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Direct Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Intermediate Clutch Assembly		
	Seals - damaged	Inspect for damage.

		Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.

SHIFT CONCERNS: HARSH 2-1 SHIFT (AUTOMATIC)

Possible Component		Reference/Action
249 - ELECTRICAL ROUTINE		
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
349 - HYDRAULIC/MECHANICAL ROUTINE		
Incorrect Pressures		
	Line pressure	Check pressure at line pressure tap. Carry out Line Pressure Test. Refer to **Special Testing Procedures**. See the Line Pressure Chart for specifications. If not OK, check Main Control Valve Body.
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off	Inspect for damage. Install new as required.

	location	
	Intermediate Regulator Valve, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	Shift Solenoid C (SSC) not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Intermediate Clutch Assembly		
	Seals - damaged	Inspect for damage. Install new as required.
	Piston - damaged	Inspect for damage. Install new as required.
	Friction - damaged, worn	Inspect for damage. Install new as required.
	Cylinder Hub - damaged	Inspect for damage. Install new as required.
	Return Spring Assembly - damaged	Inspect for damage. Install new as required.
Low One-Way Clutch Assembly		
	Damaged - not holding	Inspect for damage. Install new as required.
Planetary Carrier		
	Damaged	Inspect for damage. Install new as required.

TORQUE CONVERTER OPERATION CONCERNS: NO APPLY

Possible Component		Reference/Action
250 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Torque Converter Clutch (TCC) Solenoid, Throttle Position (TP) sensor, Transmission Fluid Temperature (TFT) sensor, Turbine Shaft Speed (TSS) sensor, Output Shaft Speed (OSS) sensor and shorted shift solenoid	Carry out Torque Converter Operation Test. Refer to **Torque Converter Diagnosis**. Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A**, go to **Pinpoint Test B** and Go to **Pinpoint Test C**.
350 - HYDRAULIC/MECHANICAL ROUTINE		
Incorrect Pressures		
	Line pressure	Check pressure at line pressure tap. Carry out Line Pressure Test. Refer to **Special Testing Procedures**. See the Line Pressure Chart for specifications. If not OK, check Main Control Valve Body.
Main Control Valve Body		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect for damage. Install new as required.
	TCC Regulator Valve, Springs, Clips - loose, stuck, missing, misassembled	Inspect for damage. Repair or install new as required.
	TCC Control Valve, Springs, Clips - loose, stuck, missing,	Inspect for damage. Repair or install new as required.

	misassembled	
	TCC Solenoid - not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.
Turbine Shaft		
	Seals - damaged, missing	Inspect for damage. Repair as required.
	Holes - missing, plugged	Inspect for damage. Repair as required.
Stator Support Assembly		
	Seals - damaged, missing	Inspect for damage. Repair as required.
	Holes - missing, plugged	Inspect for damage. Repair as required.
Torque Converter Hub Bushing		
	Torque converter hub bushing worn	Inspect the bushing for damage and install a new torque converter as required.
	TCC worn	Install a new torque converter as required.

TORQUE CONVERTER OPERATION CONCERN: ALWAYS APPLIED/STALLS VEHICLE

Possible Component		Reference/Action
251 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Torque Converter Clutch (TCC) Solenoid	Carry out Torque Converter Operation Test. Refer to **Torque Converter Diagnosis**. Run On-Board Diagnostic (OBD). Refer to

		Introduction - Gasoline Engines article for diagnosis. Go to **Pinpoint Test A** using the scan tool. Repair as required. Clear codes. Road Test and rerun On-Board Diagnostic (OBD).
351 - HYDRAULIC/MECHANICAL ROUTINE		
Main Controls		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect gaskets. Repair as required.
	TCC Regulator Valve, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	TCC Control Valve, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	TCC Solenoid - not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the PCM. Refer to **Solenoid Body Strategy**.

TORQUE CONVERTER OPERATION CONCERN: CYCLING/SHUDDER/CHATTER

Possible Component	Reference/Action

252 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Torque Converter Clutch (TCC) Solenoid	Carry out Torque Converter Operation Test. Refer to **Torque Converter Diagnosis**. Run On-Board Diagnostic (OBD). Refer to **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test A** using the scan tool. Repair as required. Clear codes. Road Test and rerun On-Board Diagnostic (OBD).
Solenoid Body		
	Incorrect solenoid body strategy data stored in the PCM	Verify solenoid body strategy data stored in the PCM, download new identification and strategy as necessary. Refer to **Solenoid Body Strategy**.
352 - HYDRAULIC/MECHANICAL ROUTINE		
	Transmission fluid condition	Prior to carrying out this action, make sure all electrical diagnostics have been carried out. Inspect transmission fluid condition. If burnt, drain transmission fluid and converter. Install new transmission fluid and transmission fluid filter assembly. Bring vehicle to normal operating temperature. Carry out Transaxle Drive

		Cycle Test. Carry out On-Board Diagnostic (OBD). If condition still exists, continue diagnostics.
Incorrect Pressures		
	Line pressure	Check pressure at line pressure tap. Carry out Line Pressure Test. Refer to **Special Testing Procedures**. See the Line Pressure Chart for specifications. If not OK, check Main Control. Refer to **Main Control**.
Main Controls		
	Bolts out of torque specification	Tighten bolts to specification.
	Gaskets and Separator Plate - damaged, off location	Inspect gaskets for damage. Repair as required.
	TCC Regulator Valve, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	TCC Control Valve, Springs, Clips - loose, stuck, binding, missing, misassembled	Inspect for damage. Repair or install new as required.
	TCC Solenoid - not functioning correctly	Activate solenoid using scan tool. Refer to **Output State Control (OSC) Mode**. Go to **Pinpoint Test A**. Install a new solenoid body. Refer to **Solenoid Body Assembly**. Download a new solenoid body strategy into the

		PCM. Refer to **Solenoid Body Strategy**.
Turbine Shaft		
	Seals - damaged, missing	Inspect for damage. Install new as required.
Torque Converter		
	Torque converter damaged	Refer to **Torque Converter**.
Stator Support Assembly		
	Stator support assembly - worn, damaged	Inspect for damage. Install new as required.
	Stator support seals - worn, damaged, leaking	Inspect for damage. Install new as required.

OTHER CONCERNS: SELECTOR LEVER EFFORTS HIGH

Possible Component		Reference/Action
261 - ELECTRICAL ROUTINE		
	No electrical concerns	
361 - HYDRAULIC/MECHANICAL ROUTINE		
Selector Lever Linkage (Internal, External)		
	Damaged or out of adjustment	Inspect for damage. Repair as required. Verify selector lever adjustment. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
Manual Control Lever		
	External Retaining Pin - damaged, Nut - loose, Detent Spring - bent, damaged; or Park Mechanism - damaged, incorrect lever used	Inspect for damage. Repair or install new as required.
Main Control Valve Body		
	Manual Valve - stuck	Inspect for damage. Repair or install new as required.
	Bolts out of torque	Tighten bolts to specification.

	specification	
Brake Shift Interlock		
	Mechanically damaged	Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
	Transmission Range (TR) sensor indicating park	Go to **Pinpoint Test D**.

OTHER CONCERNS: EXTERNAL LEAKS

Possible Component		Reference/Action
262 - ELECTRICAL ROUTINE		
	No electrical concerns	
362 - HYDRAULIC/MECHANICAL ROUTINE		
Transmission Fluid Level		
	High transmission fluid level	Check transmission fluid level and adjust as necessary. Refer to **Preliminary Inspection**.
	Transmission fluid condition	Carry out transmission fluid condition check. Refer to **Preliminary Inspection**.
Seals, Gaskets		
	Leaks: Converter, Turbine Shaft Speed (TSS) Sensor, Halfshaft Axles, Gasket/Seal Manual Lever, Fluid Level Indicator, Main Control Cover, Incorrect Hub Seal	Locate source of leak. Repair as required.
Other		
	Leaks: Cooler Fitting, Pressure Taps, Transaxle Connector, Transaxle Pan, Cooler Tubes, Case Porosity, Case Cracked	Locate source of leak. Repair as required.

	Vent - blocked damaged	Check vent for damage or blockage. Repair as required.

OTHER CONCERNS: POOR VEHICLE PERFORMANCE

Possible Component		Reference/Action
263 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Torque Converter Clutch (TCC) Solenoid, Throttle Position (TP) sensor, Output Shaft Speed (OSS) sensor, Mass Air Flow (MAF) sensor, Intake Air Temperature (IAT) Sensor, Internal Wiring Harness	Run On-Board Diagnostic (OBD). Refer to the **Introduction - Gasoline Engines** article for diagnosis. Go to **Pinpoint Test C** using scan tool. Repair as required. Clear codes. Road test and rerun On-Board Diagnostic (OBD). Carry out Shift Point Road Test. Refer to **Shift Point Road Test** and carry out Torque Converter Operation Test. Refer to **Torque Converter Diagnosis**.
363 - HYDRAULIC/MECHANICAL ROUTINE		
Transmission Fluid		
	Low transmission fluid level	Check transmission fluid level and adjust as necessary. Refer to **Preliminary Inspection**.
Verify Correct Shift Scheduling, Engagements, Line Pressures and Stall Speed		
		Go to the appropriate Diagnostic Routines per Index.
Converter Clutch Always Applied		
		Go to Routine 351.

NOTE: **NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.**

OTHER CONCERNS: NOISE/VIBRATION - FORWARD OR REVERSE

Possible Component		Reference/Action
264 - ELECTRICAL ROUTINE		
	No electrical concerns	
364 - HYDRAULIC/MECHANICAL ROUTINE		
For Noises/Vibrations That Change With Engine Speed		
	Converter components	Locate source of disturbance. Repair as required. Transmission fluid level (low) - pump cavitation. Pump assembly.
	Engine Drive Accessories Transmission Fluid Cooler Tubes grounding out Flexplate	
For Noises/Vibrations That Change With Vehicle Speed		
	Engine Mounts - loose or damaged Driveline concerns: • Halfshaft shudder • CV joints • Suspension • Modifications Output/Halfshaft Splines - worn or damaged	Locate source of disturbance and repair as required.
	Turbine Shaft Speed	Inspect for damage.

	(TSS) sensor - incorrectly installed	Repair as required.
Other Noises/Vibrations		
	Main Controls - Valve resonance	Locate source of disturbance and repair as required.
	Selector Lever Cable - vibration, grounding	Locate source of disturbance and repair as required.
	Transmission Fluid Cooler Tubes - grounding	Locate source of disturbance and repair as required.
	ABS	Refer to **VEHICLE DYNAMIC SYSTEMS** article.
	Power Steering Pump	Refer to **POWER STEERING** article.

OTHER CONCERNS: ENGINE WILL NOT CRANK

Possible Component		Reference/Action
265 - ELECTRICAL ROUTINE		
Powertrain Control System		
	Electrical Inputs/Outputs, Vehicle Wiring Harnesses, PCM, Transmission Range (TR) Sensor	Carry out Torque Converter Operation Test. Refer to **Torque Converter Diagnosis**. Run On-Board Diagnostic (OBD). Refer to the **Introduction - Gasoline Engines** article for diagnosis.
365 - HYDRAULIC/MECHANICAL ROUTINE		
Selector Lever Linkage (Internal, External)		
	Damaged or out of adjustment	Inspect for damage. Repair as required. Verify selector lever cable adjustment. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.

OTHER CONCERNS: NO PARK RANGE

Possible Component		Reference/Action
266 - ELECTRICAL ROUTINE		
	No electrical concerns	
366 - HYDRAULIC/MECHANICAL ROUTINE		

Selector Lever Linkage (Internal/External)		
	Damaged or out of adjustment	Inspect for damage. Repair as required. Verify selector lever cable adjustment. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
Park Mechanism		
	Park Brake Pawl, Parking Pawl Return Spring, Park Rod Abutment, Parking Pawl Shaft, Parking Pawl Actuating Rod, Manual Control Lever, Manual Lever Detent Spring - damaged	Inspect for damage. Repair as required.

OTHER CONCERNS: TRANSAXLE OVERHEATING

Possible Component		Reference/Action
267 - ELECTRICAL ROUTINE		
	No electrical concerns	
367 - HYDRAULIC/MECHANICAL ROUTINE		
Transmission Fluid		
	Incorrect transmission fluid level	Check transmission fluid level and adjust as necessary. Refer to **Preliminary Inspection**.
	Transmission fluid condition	Carry out transmission fluid condition check. Refer to **Preliminary Inspection**.
Transmission Fluid Cooler Tubes		
	Damaged, blocked, reversed, leaking	Inspect for damage. Repair as required.
Auxiliary Cooler		
	Damaged, blocked, restricted or	Inspect for damage. Repair as required.

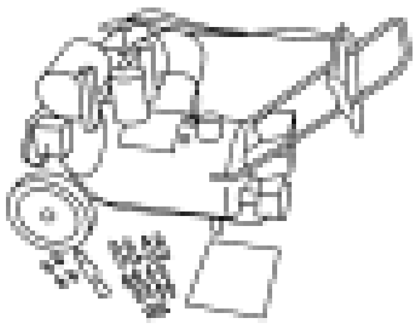
	incorrectly installed	
Vehicle Concerns Causing Engine Overheating		
		Refer to **ENGINE COOLING** article.
Main Control Valve Body		
	Torque Converter Regulator Valve/Spring - stuck, damaged	Inspect for damage. Repair as required.
	Torque Converter Control Valve/Spring - stuck, damaged	Inspect for damage. Repair as required.
Torque Converter Not Applying		
	Seized Converter One-Way Clutch (OWC)	See Routine 250/350. Inspect for damage. Repair as required.
Excessive Towing Loads		
		Check GVW.
Idle or Driveability Concern		
		Refer to the **Introduction - Gasoline Engines** article.
Incorrect Clutch Application or Oil Pressure Control System		
		Carry out line pressure tests. Refer to **Special Testing Procedures** and carry out shift point road test. Refer to **Shift Point Road Test**. Repair as required. See the Line Pressure Chart, and Clutch Application Chart for specifications. Repair as required.

GENERAL PROCEDURES

TRANSMISSION FLUID COOLER BACKFLUSHING AND CLEANING

Special Tools

Illustration	**Tool Name**	**Tool Number**
	Turbo-Tank Heated Cooler Line	222-00004

 ST2971-A	Flusher	

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

NOTE: **Transmission fluid cooler backflushing will be carried out using the Turbo-Tank Heated Cooler Line Flusher. Follow the manufacturer's instructions included with the machine. Test the equipment to make sure that a vigorous fluid flow is present before proceeding.**

1. Check and top off fluid level of the Turbo-Tank Heated Cooler Line Flusher tank with transmission fluid.
2. Allow the fluid in the flusher 15-30 minutes to heat up to 60°C (140°F) before using.
3. Install the line adapters on the transmission fluid cooler tubes.

   NOTE: **The FRONT transmission fluid cooler tube on the thermal bypass valve is the transmission fluid cooler pressure tube.**

4. Attach the flusher's red line to the transmission fluid cooler pressure tube quick disconnect fitting.
5. Attach the flusher's blue line to the transmission fluid cooler return tube quick disconnect fitting.
6. Follow the equipment instructions to purge the transmission fluid cooler tubes and transmission fluid cooler prior to starting the flushing procedure.
7. Allow the transmission fluid cooling system to backflush for 10-15 minutes, then flush the transmission fluid cooler in a normal flow direction for an additional 10-15 minutes.
8. Clean the transaxle mounted fluid cooler tubes and the thermal bypass valve by hand.

TRANSMISSION FLUID DRAIN AND REFILL

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

NOTE: In order to completely clean the torque converter, this procedure needs to be carried out 3 times.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.

   NOTE: If an internal problem is suspected, drain the transmission fluid through a paper filter. A small amount of metal or friction particles may be found from normal wear. If an excessive amount of metal or friction material is present, the transaxle will need to be overhauled.

2. Remove the transmission fluid drain plug and allow the transmission fluid to drain.

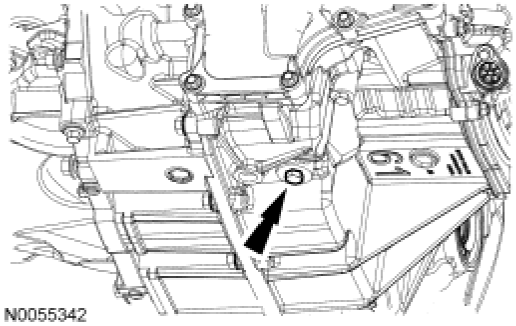


Fig. 37: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

3. Install the transmission fluid drain plug.
   - Tighten to 9 Nm (80 lb-in).

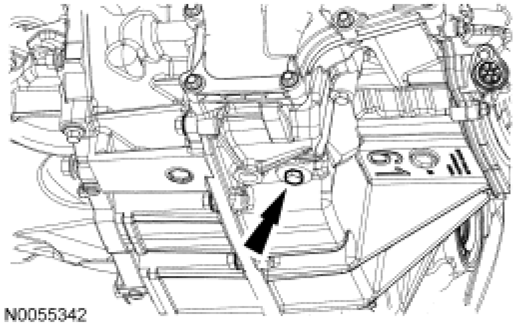


Fig. 38: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

4. Fill the transaxle with clean transmission fluid.

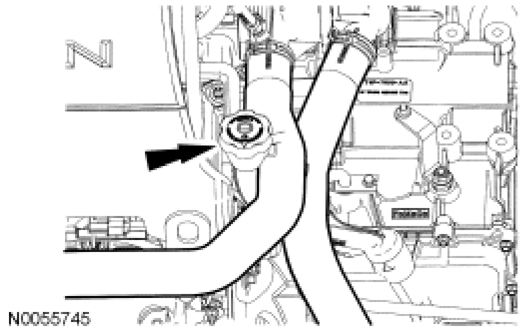


Fig. 39: Filling Transaxle With Clean Transmission Fluid
Courtesy of FORD MOTOR CO.

5. Start the engine and let it run for 3 minutes. Move the range selector lever into each gear position. Repeat Steps 2, 3, 4 and 5 two more times.

   After the transmission fluid has been changed a total of 3 times, check the transmission fluid level for a final time, making sure that the transmission fluid is at the correct level.

TORQUE CONVERTER

1. A new or remanufactured torque converter must be installed if one or more of the following statements is true:
   - A torque converter malfunction has been determined based on complete diagnostic procedures.
   - Converter bolt holes, impeller hub or bushing are damaged.
   - Discoloration (due to overheating).
   - Evidence of transmission assembly or fluid contamination due to the following transmission or converter failure modes:
     - Major metallic failure.
     - Multiple clutches or clutch plate failures.
     - Sufficient component wear which results in metallic contamination.
     - Internal torque converter contamination present. For additional information, refer to **Torque Converter Contamination Inspection**.

TORQUE CONVERTER CONTAMINATION INSPECTION

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

NOTE: **Do not use water-based cleaners or mineral spirits to clean or flush the torque converter or transmission damage will occur. Use only clean automatic transmission fluid designated for the transmission and converter being serviced.**

1. If a new or remanufactured torque converter is not being installed, the following steps must be completed.
2. With the torque converter on a bench, pour a small amount of transmission fluid from the torque converter onto an absorbent white tissue or through a paper filter and examine the transmission fluid.
3. Observe the color and odor of the fluid. The fluid should be red, not brown or black. Odor may indicate an overheating condition such as clutch disc or band failure.
4. Examine the stain on the tissue for evidence of particles of any kind. If particles are present in the transmission fluid, a new torque converter must be installed.
5. If there are no particles or contamination present, drain the remainder of the transmission fluid from the torque converter.
6. Add 1.9L (2 qt) of clean transmission fluid into the converter and agitate by hand.
7. Thoroughly drain the transmission fluid.

IN-VEHICLE SERVICING

MAIN CONTROL

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

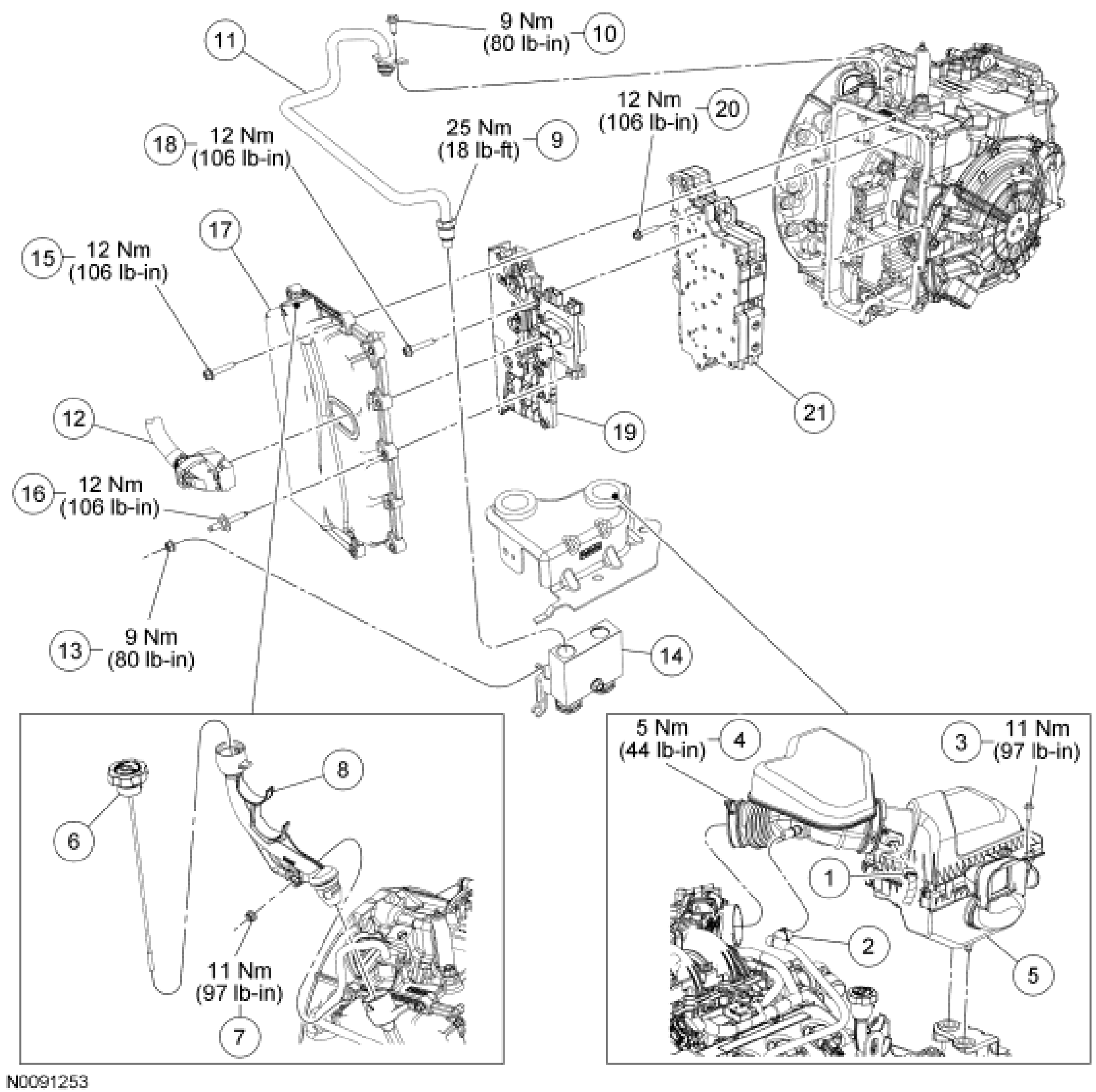


Fig. 40: Main Control & Solenoid Body Components (With Torque Specifications)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Electrical connector - Mass Air Flow (MAF) sensor
2	6758	Tube assembly - crankcase vent
3	N606678	Bolt - Air Cleaner (ACL) bracket
4	9C632	Clamp - ACL outlet pipe
5	9C662	ACL assembly
6	7A020	Transmission fluid level indicator
7	W520101	Transmission fluid filler tube nut
8	7A228	Transmission fluid filler tube
9	-	Nut - transmission fluid cooler tube (part

		of 7H420)
10	W711538	Bolt - transmission fluid cooler tube
11	7H420	Transmission fluid cooler tube
12	7A488	Connector - transaxle harness
13	W520101	Nut - bypass valve
14	7H322	Valve - transaxle fluid cooler bypass
15	7J289	Bolt - solenoid body cover (11 required)
16	W708442	Studbolt - solenoid body cover (3 required)
17	7G004	Cover - solenoid body
18	7J291	Bolt - solenoid body
19	7Z369	Solenoid body
20	7J291	Bolt - valve body
21	7A100	Valve body

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Disconnect the Mass Air Flow (MAF) sensor electrical connector and the wiring harness fastener from the Air Cleaner (ACL) assembly.

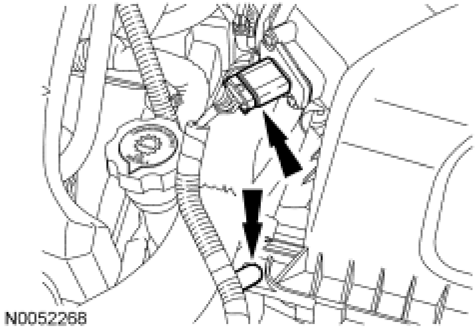


Fig. 41: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

3. Disconnect the brake booster vacuum hose from the ACL outlet pipe.

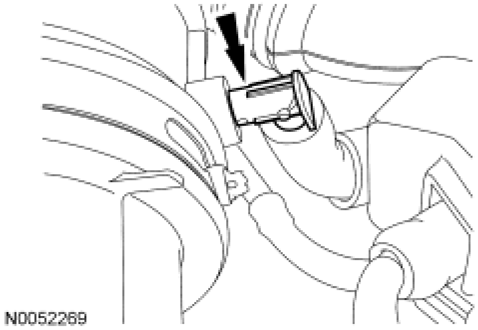


Fig. 42: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

4. Disconnect the engine breather from the ACL assembly.

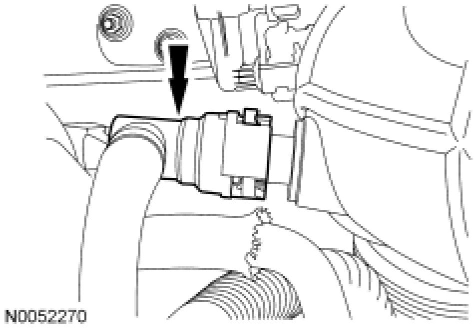


Fig. 43: Locating Engine Breather
Courtesy of FORD MOTOR CO.

5. Remove the ACL assembly bracket bolt.

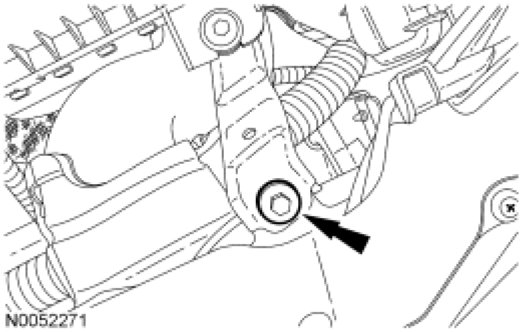


Fig. 44: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

6. Loosen the ACL outlet pipe clamp at the Throttle Body (TB) and remove the ACL and ACL outlet pipe assembly.

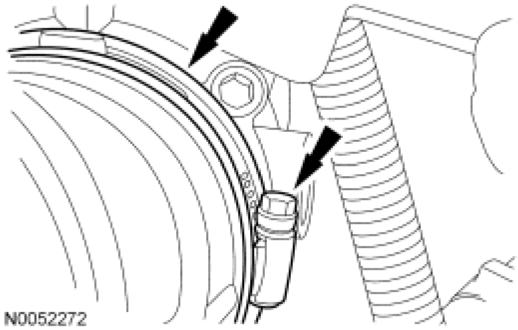


Fig. 45: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

7. Remove the transmission fluid drain plug and allow the transmission fluid to drain.

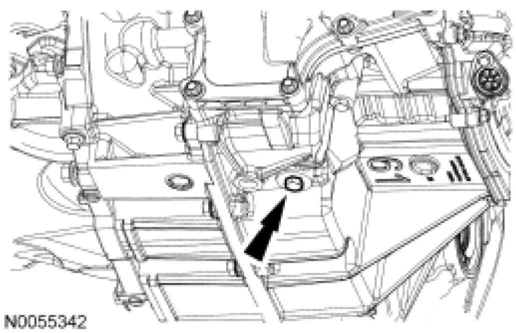


Fig. 46: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

8. Install the transmission fluid drain plug.
   - Tighten to 9 Nm (80 lb-in).

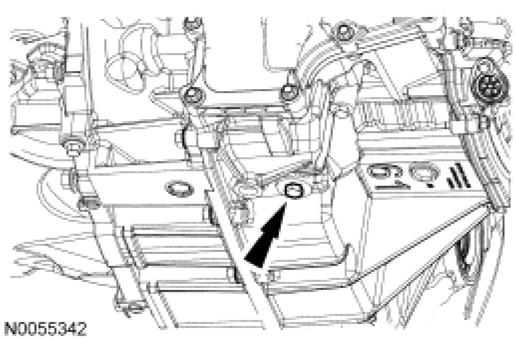


Fig. 47: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses do not need to be removed from the engine.

9. Remove the coolant hoses from the transmission fluid filler tube and position aside.

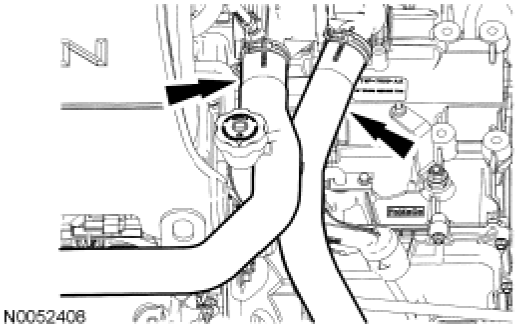


Fig. 48: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

10. Remove the transmission fluid level indicator.

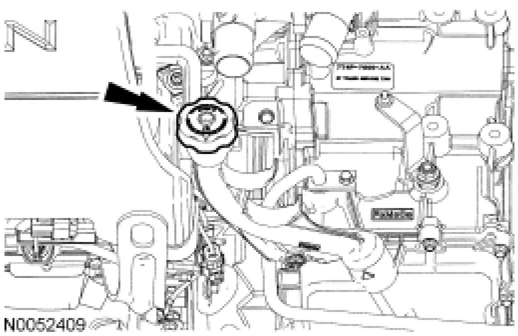


Fig. 49: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

11. Remove the nut, rotate the transmission fluid filler tube counterclockwise 90 degrees and remove the transmission fluid filler tube.

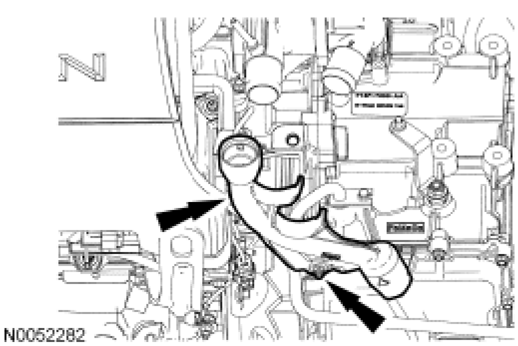


Fig. 50: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

12. Loosen the transmission fluid cooler tube fitting from the thermal bypass valve.

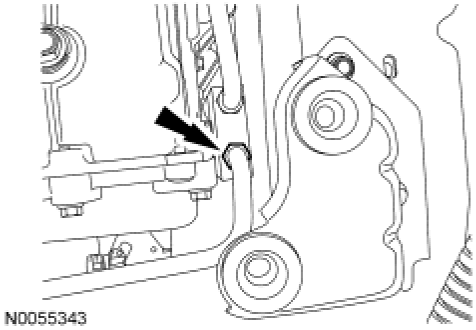


Fig. 51: Identifying Transmission Fluid Cooler Tube Fitting From Thermal Bypass Valve
Courtesy of FORD MOTOR CO.

13. Remove and discard the transmission fluid cooler tube bolt and remove the transmission fluid cooler tube.

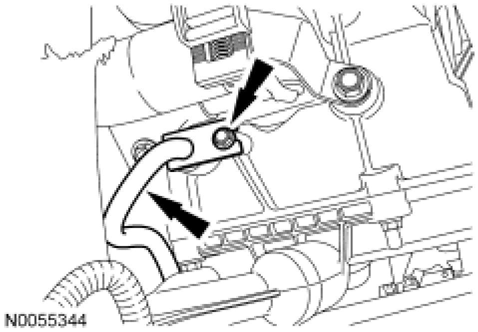


Fig. 52: Identifying Transmission Fluid Cooler Tube Bolt
Courtesy of FORD MOTOR CO.

14. Inspect the transaxle case to make sure that the transmission fluid cooler tube seal and backing ring were removed with the transmission fluid cooler tube and are not stuck in the transaxle case. If the transmission fluid cooler tube seal or backing ring are stuck in the transaxle case, remove the seal and backing ring.

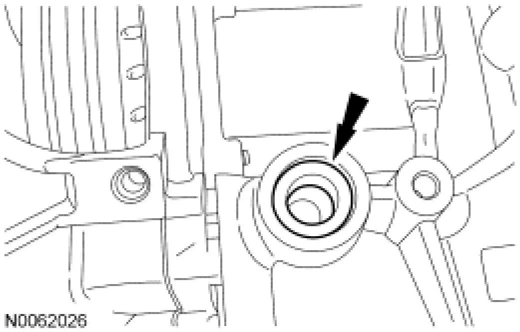


Fig. 53: Identifying Transmission Fluid Cooler Tube Seal
Courtesy of FORD MOTOR CO.

15. Disconnect the transaxle electrical connector.

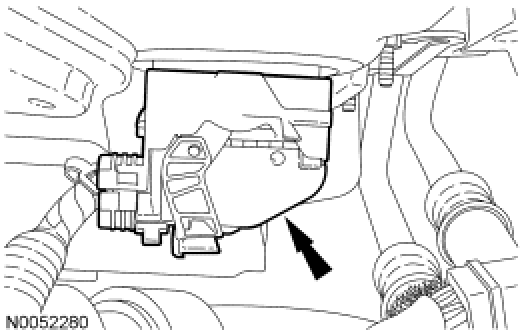


Fig. 54: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

16. Remove the 2 nuts, pull the transmission fluid cooler thermal bypass valve straight up and position it aside.

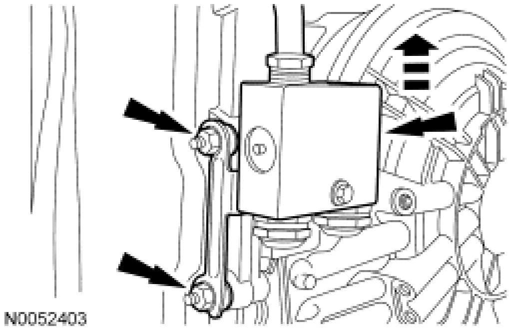


Fig. 55: Removing Nuts & Pulling Transmission Fluid Cooler Thermal Bypass Valve Straight Up
Courtesy of FORD MOTOR CO.

NOTE: Note the location of the studbolts for assembly.

17. Remove the 14 bolts and the main control cover.

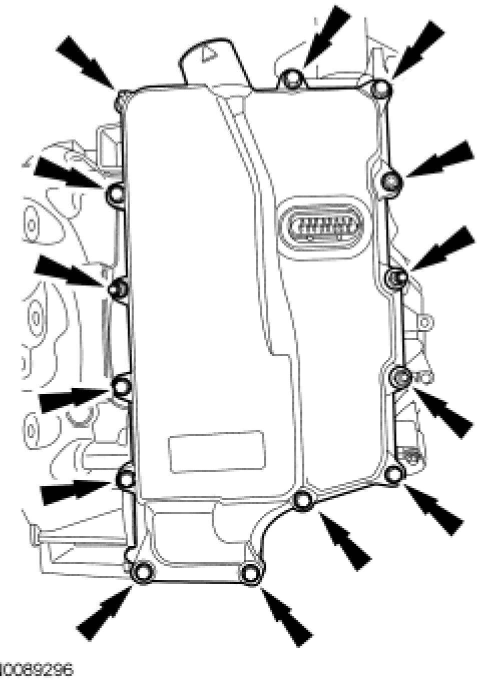


Fig. 56: Main Control Valve Cover Bolts
Courtesy of FORD MOTOR CO.

18. Disconnect the Transmission Range (TR) sensor electrical connector.
    1. Slide the lock over.
    2. Press the tab and disconnect the connector.

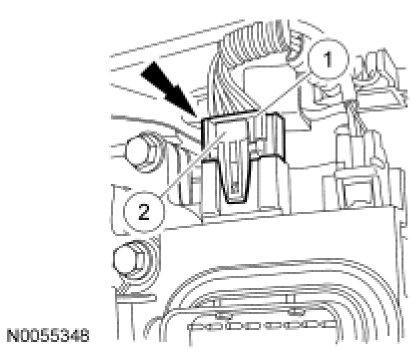


Fig. 57: Pressing Tab & Disconnecting Connector
Courtesy of FORD MOTOR CO.

19. Disconnect the Turbine Shaft Speed (TSS) and Output Shaft Speed (OSS) sensor electrical connectors.

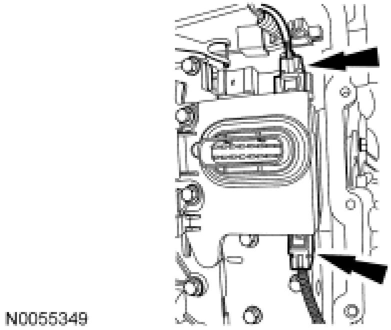


Fig. 58: Locating Turbine Shaft Speed (TSS) & Output Shaft Speed (OSS) Sensor Electrical Connectors
Courtesy of FORD MOTOR CO.

NOTE: The solenoid body should be handled with care, damage to the solenoid body may occur.

NOTE: Note the location of the different length bolts for assembly.

20. Remove the 11 bolts and the solenoid body.

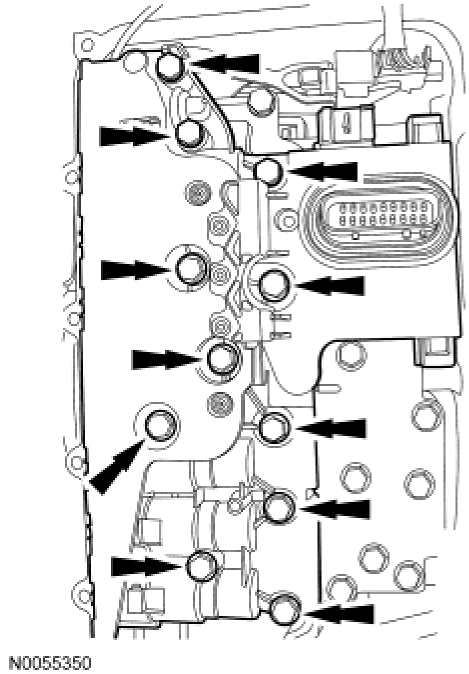


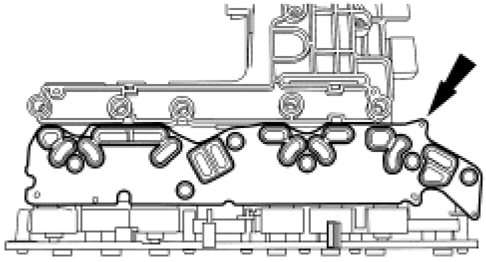
Fig. 59: Locating Solenoid Body Bolts
Courtesy of FORD MOTOR CO.

NOTE: Do not handle the solenoid body in the leadframe area or by the screens of

the solenoid body filter or damage to the solenoid body can occur.

NOTE: **Use care not to break the alignment tabs when installing the solenoid body filter. Damage to the transaxle will occur if the solenoid body is not correctly aligned.**

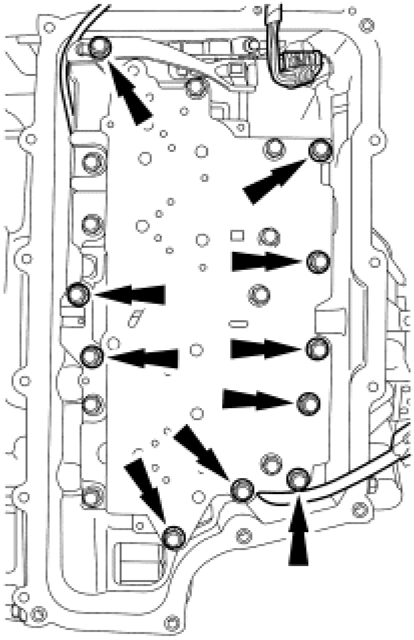
21. Remove the solenoid body filter assembly by pulling it straight up from the alignment tabs. Discard the filter.



N0055016

Fig. 60: Identifying Solenoid Body Filter Assembly
Courtesy of FORD MOTOR CO.

22. Remove the 10 bolts, the TR sensor detent spring and the main control valve body.



N0057465

Fig. 61: Locating Main Control Valve Body Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: **If cleaning of the main control assembly or inspecting the valves, refer to AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50 article. If installing a new main control assembly continue with this procedure.**

NOTE: **Make sure that the manual control lever pin (part of the TR sensor) is correctly installed in the manual control valve.**

1. Position the TSS, OSS and TR sensor wiring harnesses aside and install the main control valve body, the TR sensor detent spring and the 10 bolts. Tighten the bolts in the sequence shown.
   - Tighten to 12 Nm (106 lb-in).

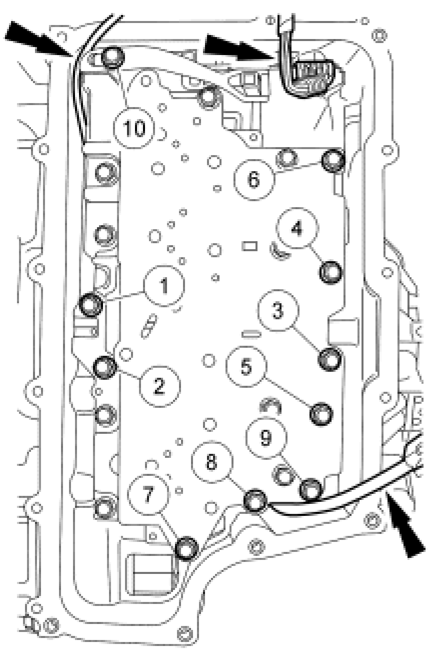


Fig. 62: Main Control Valve Body Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

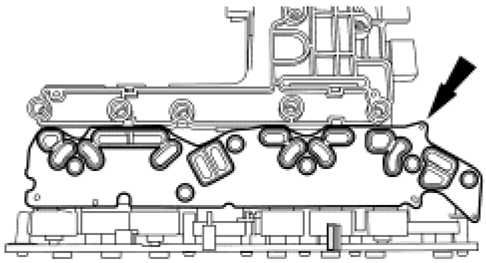
NOTE: **Do not handle the solenoid body in the leadframe area or by the screens of the solenoid body filter or damage to the solenoid body can occur.**

NOTE: **Use care not to break the alignment tabs when installing the solenoid body filter. Damage to the transaxle will occur if the solenoid body is not correctly aligned.**

NOTE: **Make sure that the filter passage areas are clean of foreign material before**

installing the filter. Damage to the transaxle will occur if the filter passages are not clean.

2. Install a new solenoid body filter assembly by pushing it straight down on to the alignment tabs.



N0055016

Fig. 63: Identifying Solenoid Body Filter Assembly
Courtesy of FORD MOTOR CO.

NOTE: Make sure not to pinch the Turbine Shaft Speed (TSS), Output Shaft Speed (OSS) or Transmission Range (TR) sensor wiring harnesses when installing the solenoid body.

NOTE: Install the different length bolts in the locations noted during disassembly.

3. Install the solenoid body and the 11 bolts.
    1. 42 mm (1.65 in) bolt
    2. 63 mm (2.48 in) bolts
    3. 80 mm (3.14 in) bolts
    4. 95 mm (3.74 in) bolts

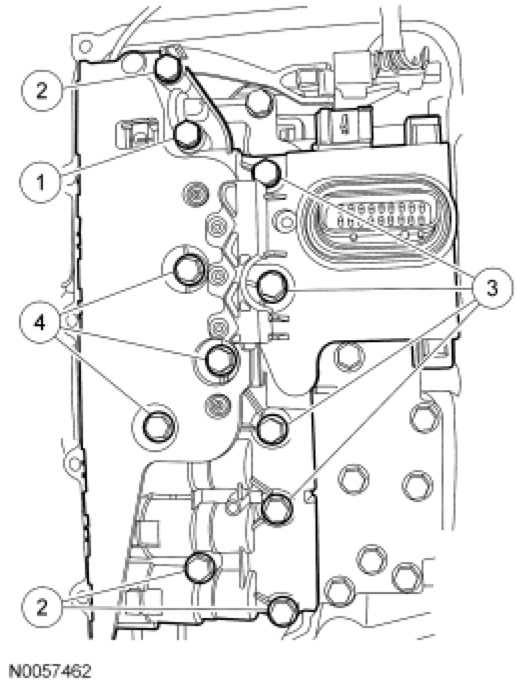
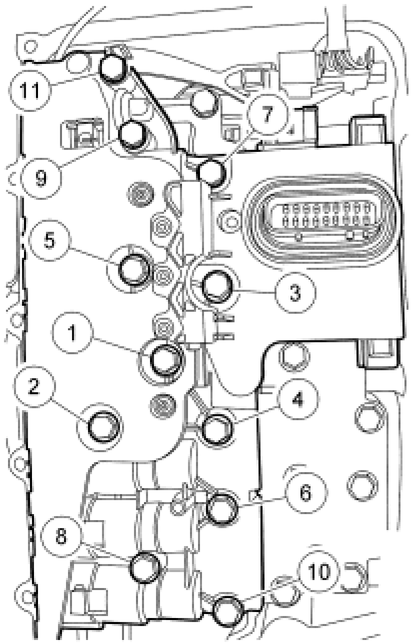


Fig. 64: Locating Solenoid Body Bolts
Courtesy of FORD MOTOR CO.

4. Tighten the solenoid body bolts in the sequence shown.
   - Tighten to 12 Nm (106 lb-in).



N0055351

Fig. 65: Tightening Solenoid Body Bolts In Sequence
Courtesy of FORD MOTOR CO.

5. Route the OSS sensor wiring harness and connect the electrical connector.

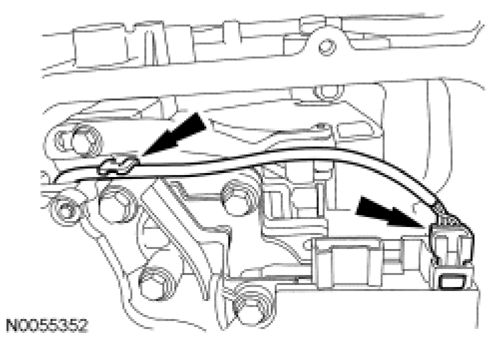


Fig. 66: Locating OSS Sensor Wiring Harness & Electrical Connector
Courtesy of FORD MOTOR CO.

6. Connect the TR sensor electrical connector.
    1. Connect the electrical connector.
    2. Slide the locking tab over.

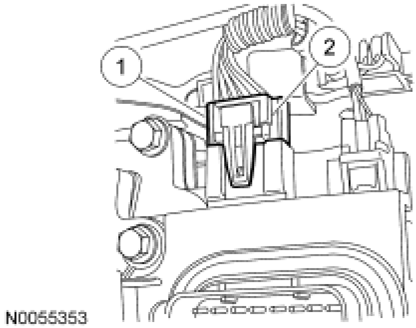


Fig. 67: Identifying TR Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

7. Connect the TSS sensor electrical connector.

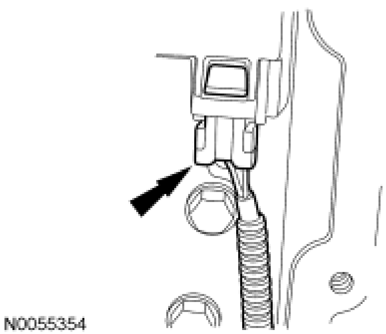


Fig. 68: Identifying TSS Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

8. Inspect the transaxle main control cover seal for damage and install new if necessary.

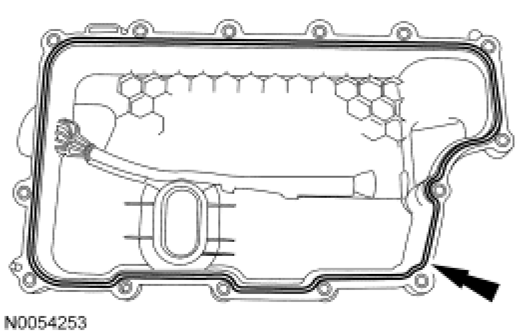


Fig. 69: Inspecting Transaxle Main Control Cover Seal For Damage
Courtesy of FORD MOTOR CO.

NOTE:	**Inspect the 20-pin solenoid body connector seal to make sure that the seal is on the inside of the main control cover or a transmission fluid leak will occur.**

NOTE: Install the studbolts in the locations noted during disassembly.

9. Install the main control cover and loosely install the 14 bolts.
    1. Bolt location
    2. Studbolt location

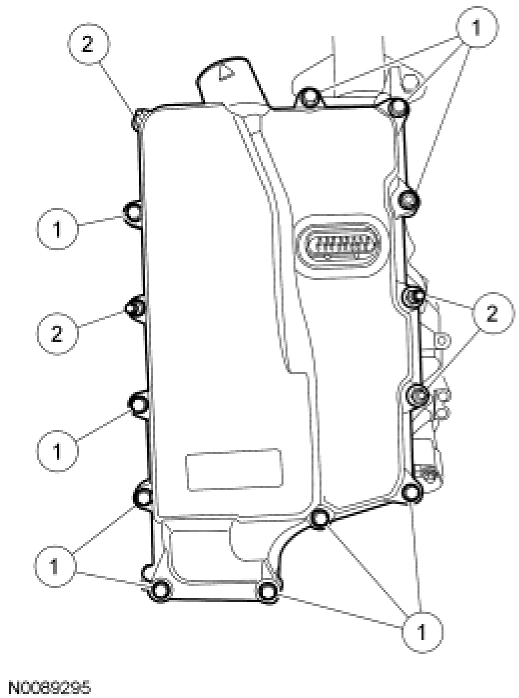


Fig. 70: Main Control Cover Bolts
Courtesy of FORD MOTOR CO.

10. Tighten the main control cover bolts in the sequence shown.
    - Tighten to 12 Nm (106 lb-in).

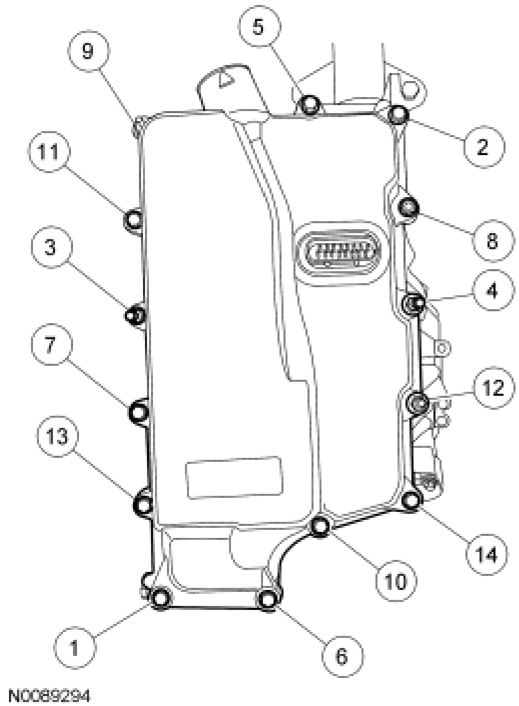


Fig. 71: Main Control Cover Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

11. Position the transmission fluid cooler thermal bypass valve and transmission fluid cooler tube assembly in place and install the 2 transmission fluid cooler tube bracket nuts.
    - Tighten to 9 Nm (80 lb-in).

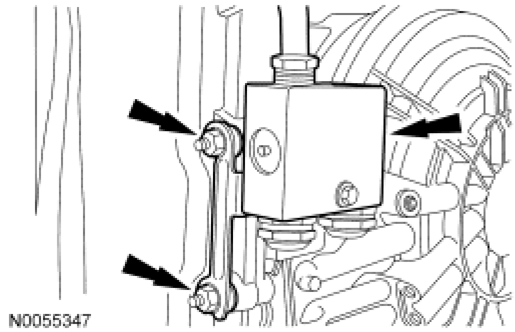


Fig. 72: Identifying Transmission Fluid Cooler Tube Assembly & Nuts
Courtesy of FORD MOTOR CO.

12. Connect the transaxle electrical connector.

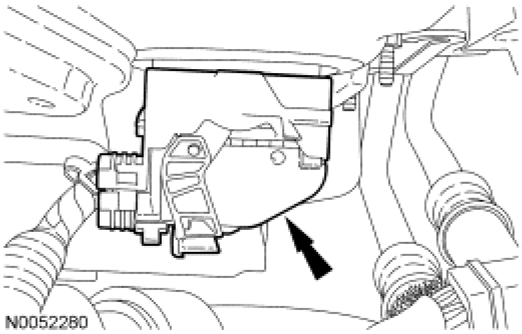


Fig. 73: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

13. Inspect the transmission fluid cooler tube backing ring and seal for damage and install a new backing ring or seal if necessary. Lubricate the transmission fluid cooler tube seal with clean transmission fluid and install the backing ring and seal on the transmission fluid cooler tube.

Item	Part Number	Description
1	7D285	Seal
2	7J324	Backing ring

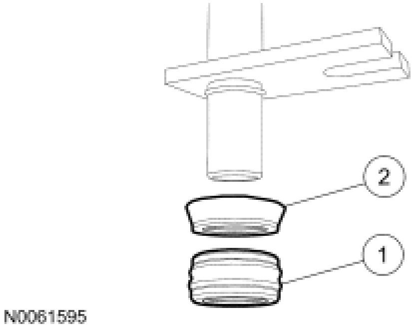


Fig. 74: Identifying Transmission Fluid Cooler Tube Backing Ring & Seal
Courtesy of FORD MOTOR CO.

14. Position the transmission fluid cooler tube in place and install a new bolt.
    - Tighten to 9 Nm (80 lb-in).

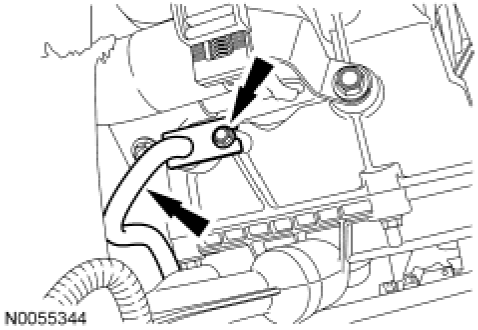


Fig. 75: Identifying Transmission Fluid Cooler Tube Bolt
Courtesy of FORD MOTOR CO.

15. Tighten the transmission fluid cooler tube fitting.
    - Tighten to 25 Nm (18 lb-ft).

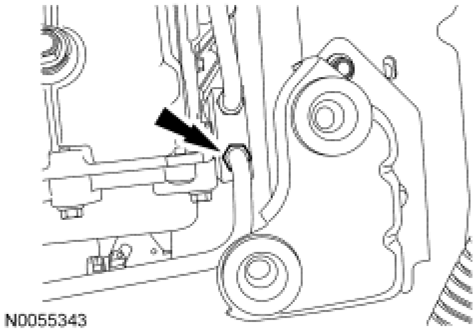


Fig. 76: Identifying Transmission Fluid Cooler Tube Fitting From Thermal Bypass Valve
Courtesy of FORD MOTOR CO.

16. Install the fluid filler tube and the nut.
    - Tighten to 11 Nm (97 lb-in).

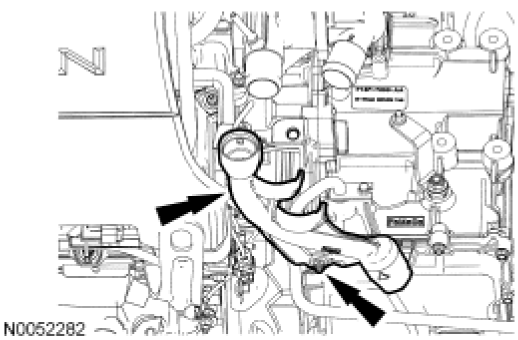


Fig. 77: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

17. Install the transmission fluid level indicator.

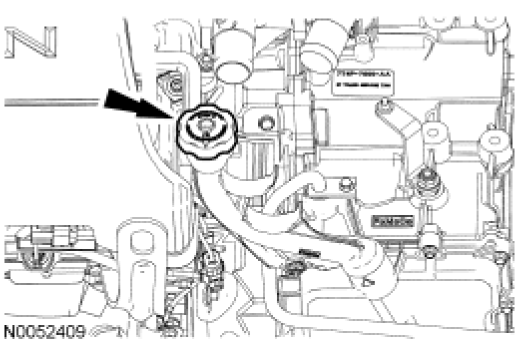


Fig. 78: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

18. Route the coolant hoses in the transmission fluid filler tube.

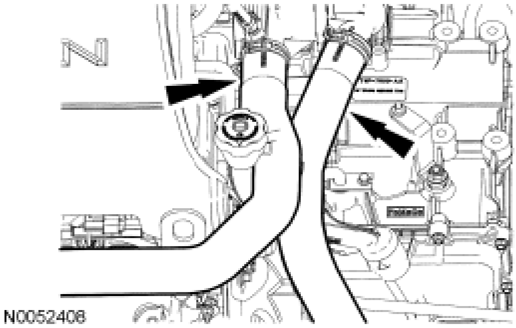


Fig. 79: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

19. Position the ACL assembly in place and install the bolt.
    - Tighten to 11 Nm (97 lb-in).

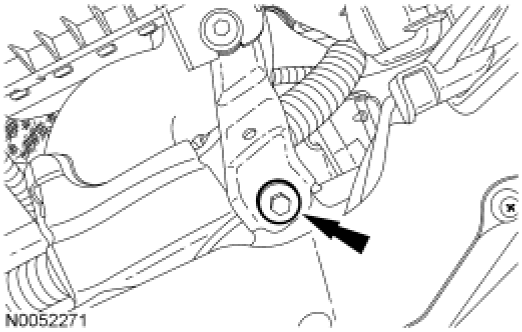


Fig. 80: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

20. Tighten the ACL outlet pipe clamp at the TB.
    - Tighten to 5 Nm (44 lb-in).

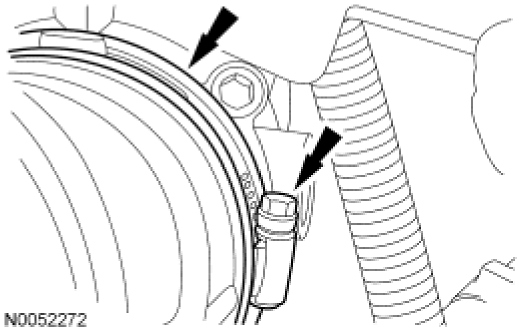


Fig. 81: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

21. Connect the engine breather to the ACL assembly.

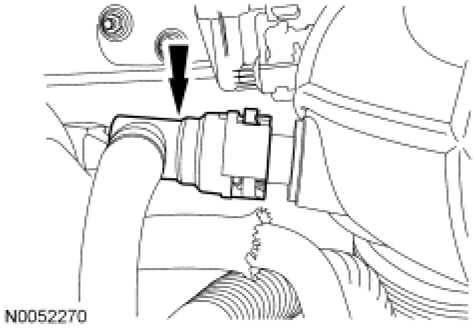


Fig. 82: Locating Engine Breather
Courtesy of FORD MOTOR CO.

22. Connect the brake booster vacuum hose to the ACL assembly.

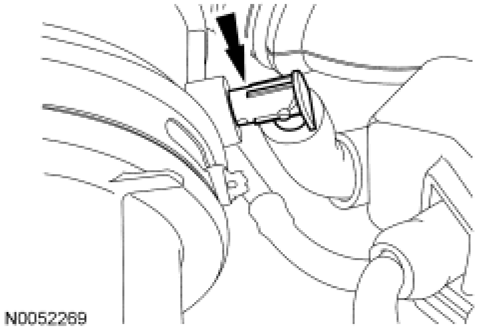


Fig. 83: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

23. Connect the MAF sensor electrical connector and connect the electrical harness fastener.

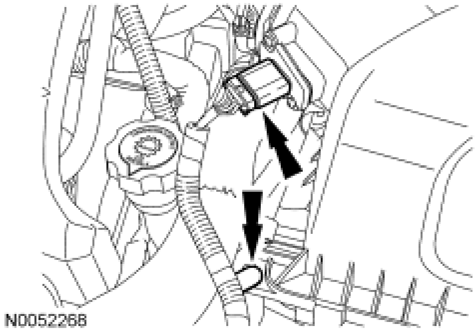


Fig. 84: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

24. Fill with clean transmission fluid to the correct level.

TURBINE SHAFT SPEED (TSS) SENSOR

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Disconnect the Mass Air Flow (MAF) sensor electrical connector and the wiring harness fastener from the Air Cleaner (ACL) assembly.

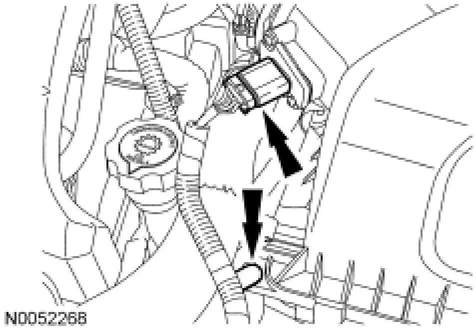


Fig. 85: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

3. Disconnect the brake booster vacuum hose from the ACL outlet pipe.

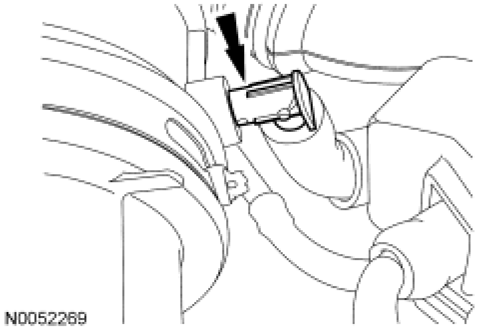


Fig. 86: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

4. Disconnect the engine breather from the ACL assembly.

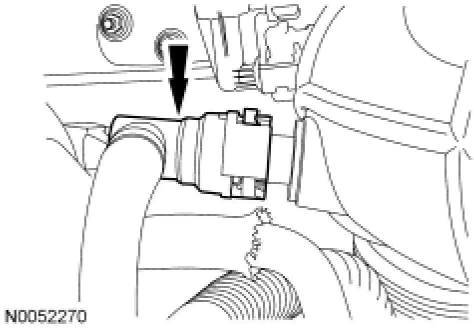


Fig. 87: Locating Engine Breather
Courtesy of FORD MOTOR CO.

5. Remove the ACL assembly bracket bolt.

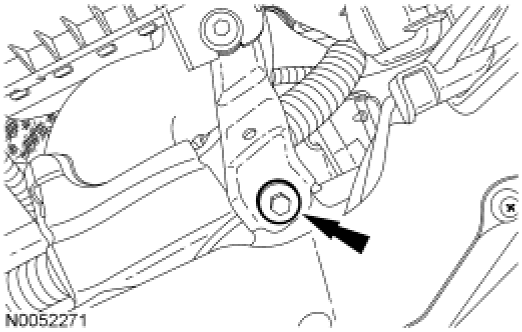


Fig. 88: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

6. Loosen the ACL outlet pipe clamp at the Throttle Body (TB) and remove the ACL and ACL outlet pipe assembly.

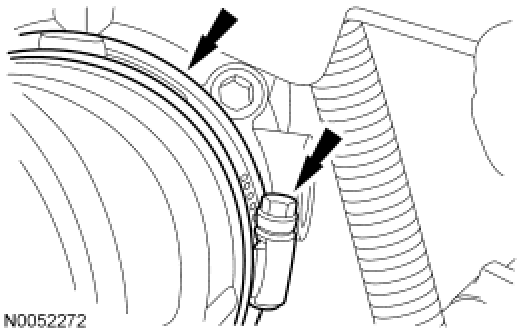


Fig. 89: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

7. Remove the transmission fluid drain plug and allow the transmission fluid to drain.

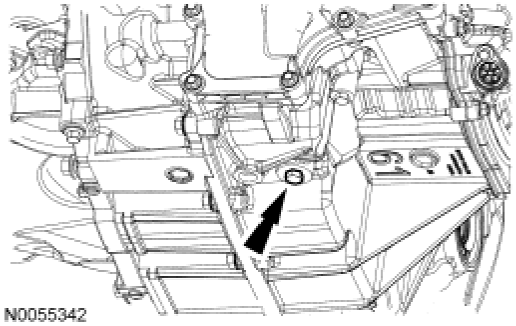


Fig. 90: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

8. Install the transmission fluid drain plug.
    - Tighten to 9 Nm (80 lb-in).

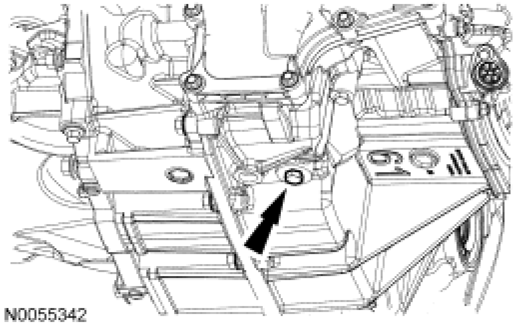


Fig. 91: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses do not need to be removed from the engine.

9. Remove the coolant hoses from the transmission fluid filler tube and position aside.

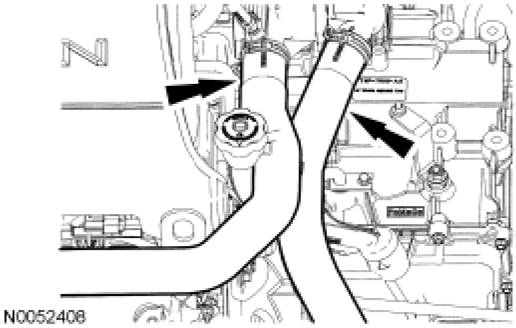


Fig. 92: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

10. Remove the transmission fluid level indicator.

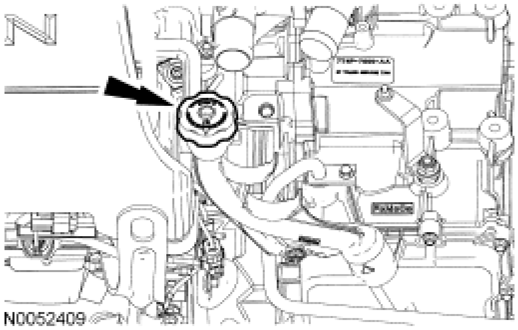


Fig. 93: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

11. Remove the nut, rotate the transmission fluid filler tube counterclockwise 90 degrees and remove the transmission fluid filler tube.

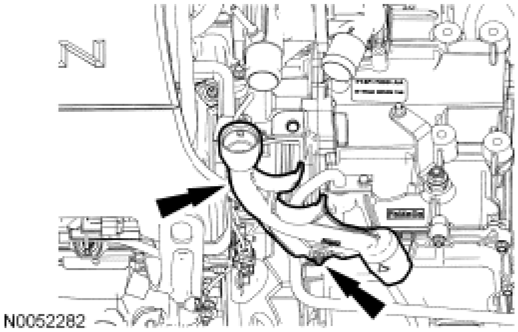


Fig. 94: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

12. Loosen the transmission fluid cooler tube fitting from the thermal bypass valve.

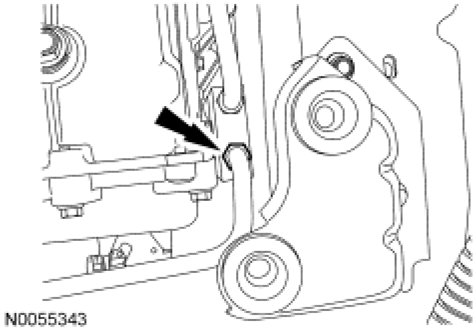


Fig. 95: Identifying Transmission Fluid Cooler Tube Fitting From Thermal Bypass Valve
Courtesy of FORD MOTOR CO.

13. Remove and discard the transmission fluid cooler tube bolt and remove the transmission fluid cooler tube.

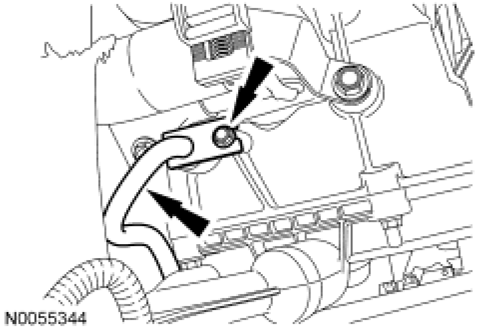


Fig. 96: Identifying Transmission Fluid Cooler Tube Bolt
Courtesy of FORD MOTOR CO.

14. Inspect the transaxle case to make sure that the transmission fluid cooler tube seal and backing ring were removed with the transmission fluid cooler tube and are not stuck in the transaxle case. If the transmission fluid cooler tube seal or backing ring are stuck in the transaxle case, remove the seal and backing ring.

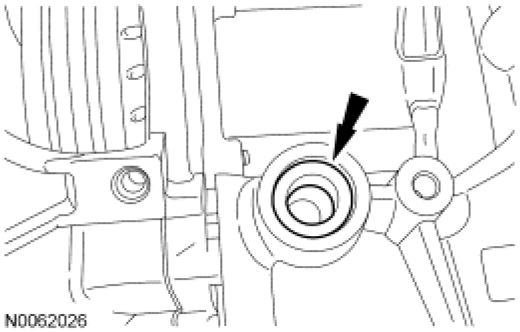


Fig. 97: Identifying Transmission Fluid Cooler Tube Seal
Courtesy of FORD MOTOR CO.

15. Disconnect the transaxle electrical connector.

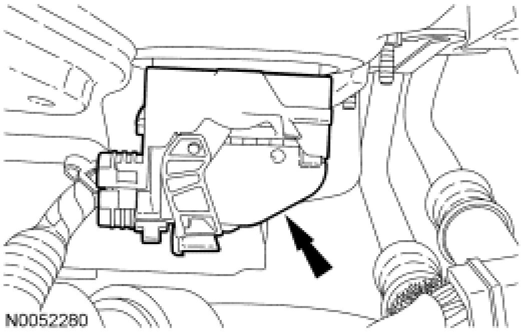


Fig. 98: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

16. Remove the 2 nuts, pull the transmission fluid cooler thermal bypass valve straight up and position it aside.

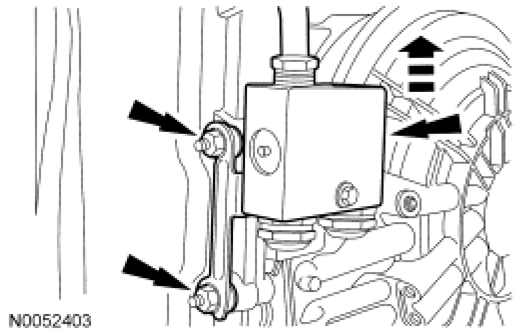


Fig. 99: Removing Nuts & Pulling Transmission Fluid Cooler Thermal Bypass Valve Straight Up
Courtesy of FORD MOTOR CO.

NOTE: Note the location of the stud bolts for assembly.

17. Remove the 14 bolts and the main control cover.

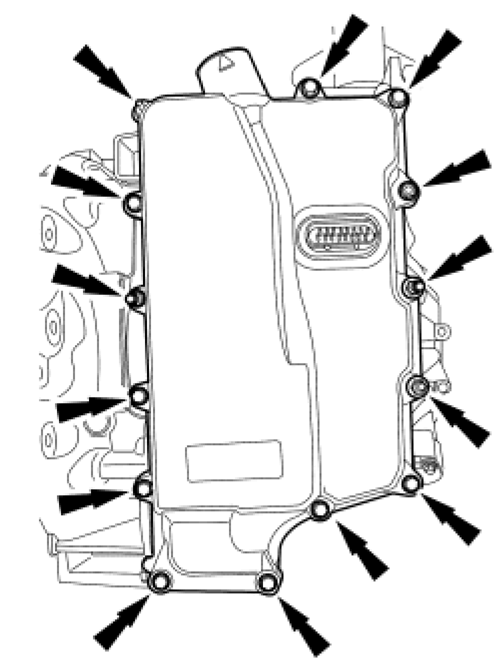


Fig. 100: Main Control Valve Cover Bolts
Courtesy of FORD MOTOR CO.

18. Disconnect the Transmission Range (TR) sensor electrical connector.
    1. Slide the lock over.
    2. Press the tab and disconnect the connector.

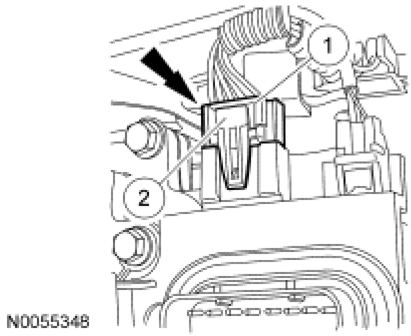


Fig. 101: Pressing Tab & Disconnecting Connector
Courtesy of FORD MOTOR CO.

19. Disconnect the Turbine Shaft Speed (TSS) and Output Shaft Speed (OSS) sensor electrical connectors.

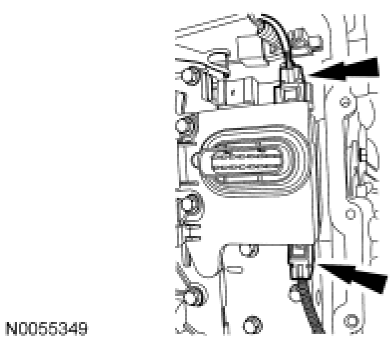
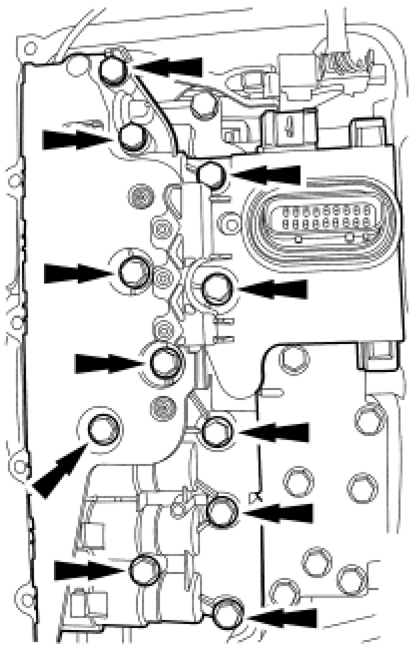


Fig. 102: Locating Turbine Shaft Speed (TSS) & Output Shaft Speed (OSS) Sensor Electrical Connectors
Courtesy of FORD MOTOR CO.

NOTE:	**The solenoid body should be handled with care, damage to the solenoid body may occur.**

NOTE:	**Note the location of the different length bolts for assembly.**

20. Remove the 11 bolts and the solenoid body.



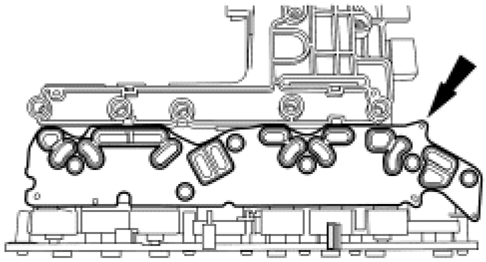
N0055350

Fig. 103: Locating Solenoid Body Bolts
Courtesy of FORD MOTOR CO.

NOTE:	**Do not handle the solenoid body in the leadframe area or by the screens of the solenoid body filter or damage to the solenoid body can occur.**

NOTE:	**Use care not to break the alignment tabs when installing the solenoid body filter. Damage to the transaxle will occur if the solenoid body is not correctly aligned.**

21. Remove the solenoid body filter assembly by pulling it straight up from the alignment tabs. Discard the filter.



N0055016

Fig. 104: Identifying Solenoid Body Filter Assembly
Courtesy of FORD MOTOR CO.

22. Remove the 10 bolts, the TR sensor detent spring and the main control valve body.

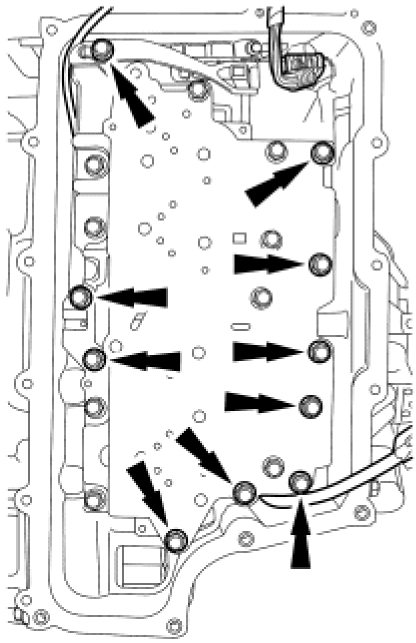


Fig. 105: Locating Main Control Valve Body Bolts
Courtesy of FORD MOTOR CO.

23. Remove the bolt and the TSS sensor.

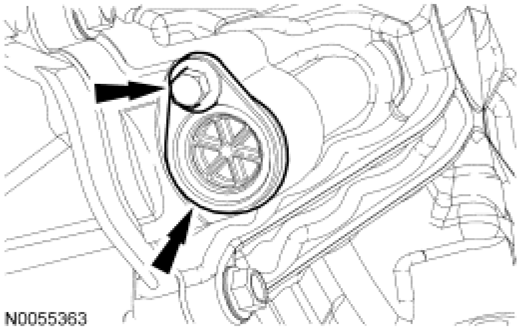


Fig. 106: Identifying TSS Sensor & Bolt
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Route the TSS sensor wiring harness through the cover and the transaxle case.
   - Tighten to 12 Nm (106 lb-in).

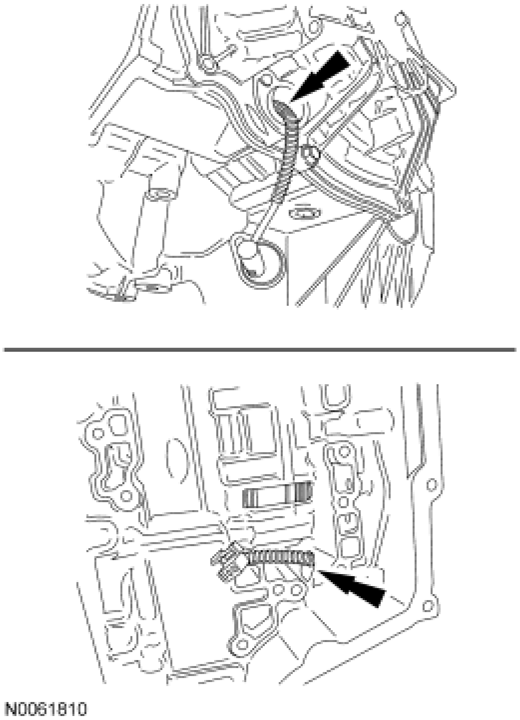


Fig. 107: Routing TSS Sensor Wiring Harness Through Cover & Transaxle Case
Courtesy of FORD MOTOR CO.

2. Install the TSS sensor in the cover and install the bolt.
    - Tighten to 12 Nm (106 lb-in).

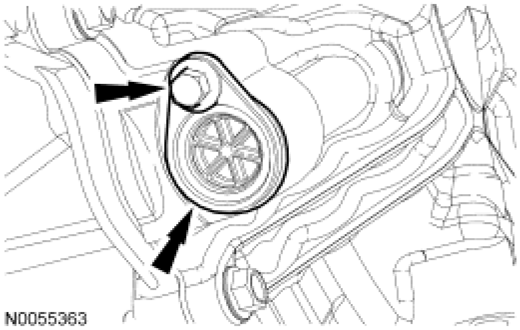


Fig. 108: Identifying TSS Sensor & Bolt
Courtesy of FORD MOTOR CO.

NOTE:	**Make sure that the manual pin (part of the TR sensor) is correctly installed in the manual valve.**

3. Position the TSS, OSS and TR sensor wiring harnesses aside and install the main control valve body.

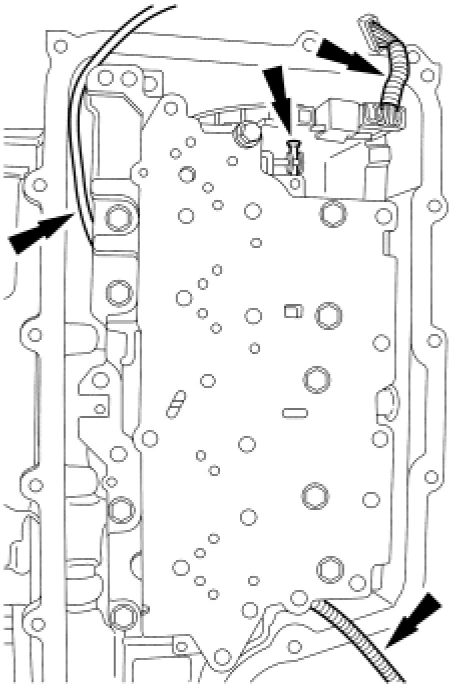


Fig. 109: Locating TSS, OSS & TR Sensor Wiring Harnesses
Courtesy of FORD MOTOR CO.

4. Inspect the manual pin to make sure it is correctly installed in the manual valve. If it is not, pull the valve body off the transaxle case. Correctly install the manual pin in the manual control valve and position the valve body in place.

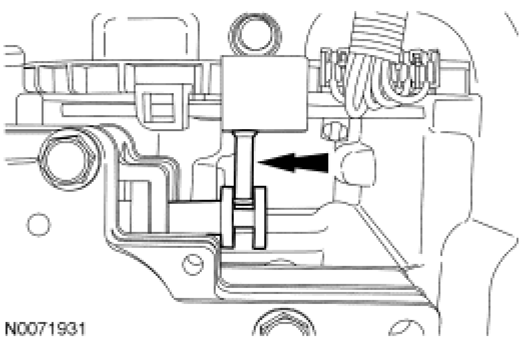
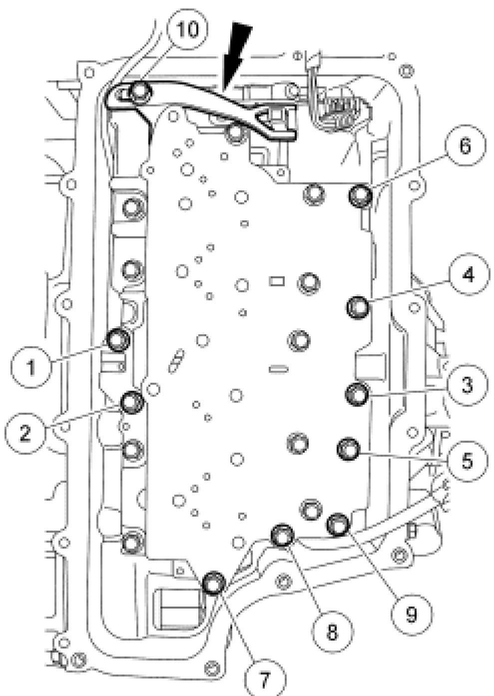


Fig. 110: Identifying Manual Pin
Courtesy of FORD MOTOR CO.

5. Install the TR sensor detent spring and the 10 bolts. Tighten the bolts in the sequence shown.
    - Tighten to 12 Nm (106 lb-in).

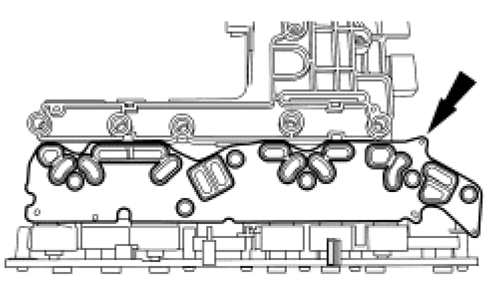


N0071930

Fig. 111: Tightening TR Sensor Detent Spring Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE:	**Do not handle the solenoid body in the leadframe area or by the screens of the solenoid body filter or damage to the solenoid body can occur.**
NOTE:	**Use care not to break the alignment tabs when installing the solenoid body filter. Damage to the transaxle will occur if the solenoid body is not correctly aligned.**
NOTE:	**Make sure that the filter passage areas are clean of foreign material before installing the filter. Damage to the transaxle will occur if the filter passages are not clean.**

6. Install a new solenoid body filter assembly by pushing it straight down on to the alignment tabs.



N0055016

Fig. 112: Identifying Solenoid Body Filter Assembly
Courtesy of FORD MOTOR CO.

NOTE: **Make sure not to pinch the Turbine Shaft Speed (TSS) , Output Shaft Speed (OSS) or Transmission Range (TR) sensor wiring harnesses when installing the solenoid body. Damage to the wiring harness will occur.**

NOTE: **Install the different length bolts in the locations noted during disassembly.**

7. Install the solenoid body and the 11 bolts.
    1. 42 mm (1.65 in) bolt
    2. 63 mm (2.48 in) bolts
    3. 80 mm (3.14 in) bolts
    4. 95 mm (3.74 in) bolts

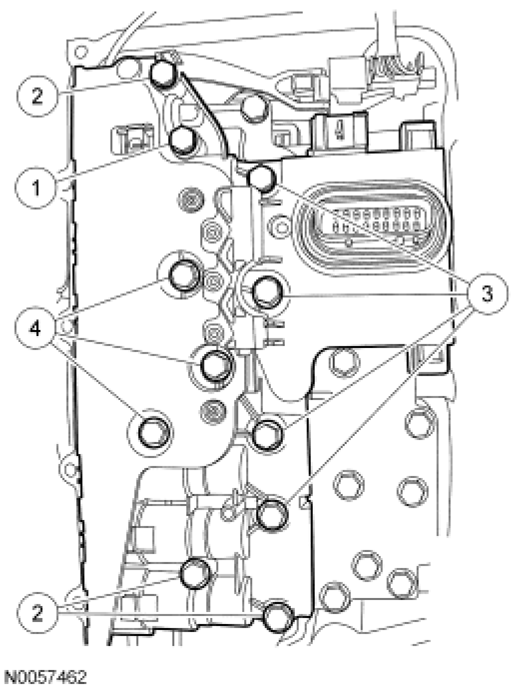


Fig. 113: Locating Solenoid Body Bolts
Courtesy of FORD MOTOR CO.

8. Tighten the solenoid body bolts in the sequence shown.
    - Tighten to 12 Nm (106 lb-in).

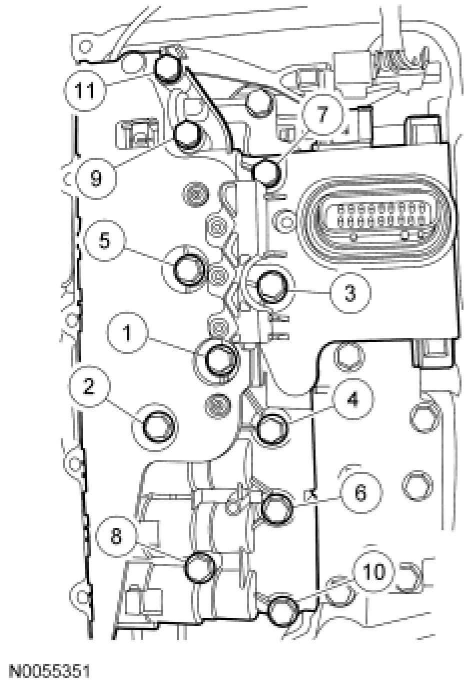


Fig. 114: Tightening Solenoid Body Bolts In Sequence
Courtesy of FORD MOTOR CO.

9. Route the OSS sensor wiring harness and connect the electrical connector.

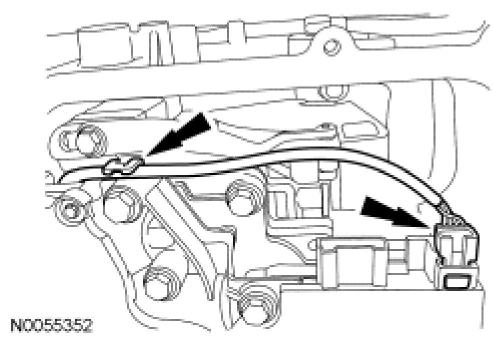


Fig. 115: Locating OSS Sensor Wiring Harness & Electrical Connector
Courtesy of FORD MOTOR CO.

10. Connect the TR sensor electrical connector.
    1. Connect the electrical connector.
    2. Slide the locking tab over.

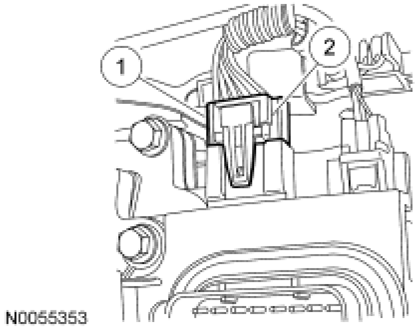


Fig. 116: Identifying TR Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

11. Connect the TSS sensor electrical connector.

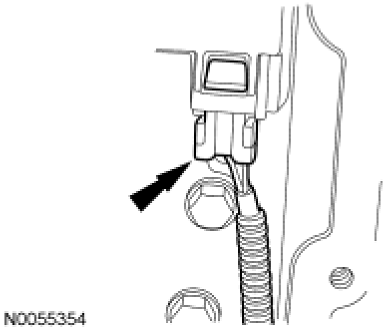


Fig. 117: Identifying TSS Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

12. Inspect the transaxle side cover seal for damage and install new if necessary.

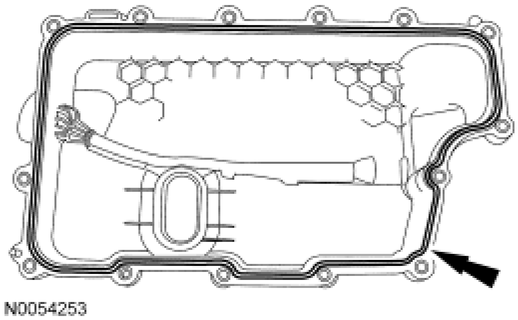


Fig. 118: Inspecting Transaxle Main Control Cover Seal For Damage
Courtesy of FORD MOTOR CO.

NOTE:	**Inspect the 20-pin solenoid body connector seal to make sure that the seal is on the inside of the main control cover or a transmission fluid leak will occur.**

NOTE: Install the studbolts in the locations noted during disassembly.

13. Install the main control cover and install the 14 bolts.
    1. Bolt location
    2. Studbolt location

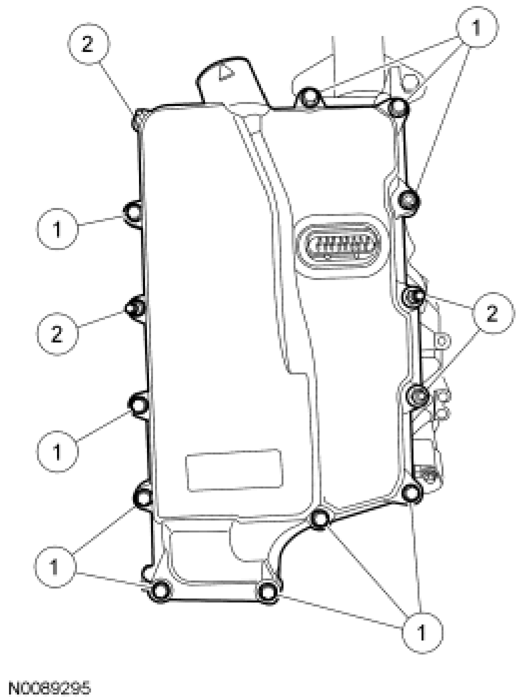


Fig. 119: Main Control Cover Bolts
Courtesy of FORD MOTOR CO.

14. Tighten the main control cover bolts in the sequence shown.
    - Tighten to 12 Nm (106 lb-in).

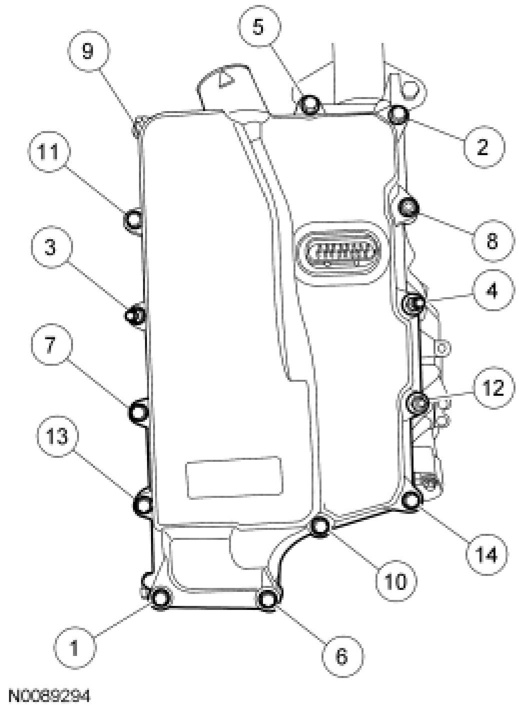


Fig. 120: Main Control Cover Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

15. Position the transmission fluid cooler thermal bypass valve and transmission fluid cooler tube assembly in place and install the 2 transmission fluid cooler line bracket nuts.
    - Tighten to 9 Nm (80 lb-in).

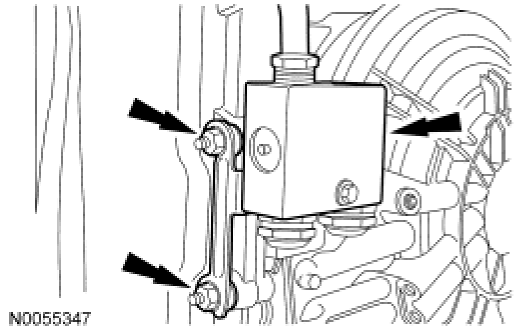


Fig. 121: Identifying Transmission Fluid Cooler Tube Assembly & Nuts
Courtesy of FORD MOTOR CO.

16. Connect the transaxle electrical connector.

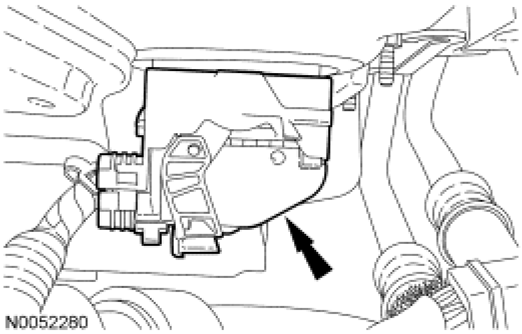


Fig. 122: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

17. Inspect the transmission fluid cooler tube backing ring and seal for damage and install a new backing ring or seal if necessary. Lubricate the transmission fluid cooler tube seal with clean transmission fluid and install the backing ring and seal on the transmission fluid cooler tube.

Item	Part Number	Description
1	7D285	Seal
2	7J324	Backing ring

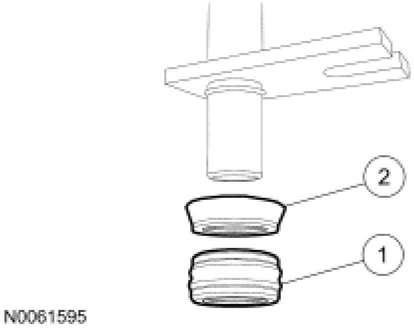


Fig. 123: Identifying Transmission Fluid Cooler Tube Backing Ring & Seal
Courtesy of FORD MOTOR CO.

18. Position the transmission fluid cooler tube in place and install a new bolt.
    - Tighten to 9 Nm (80 lb-in).

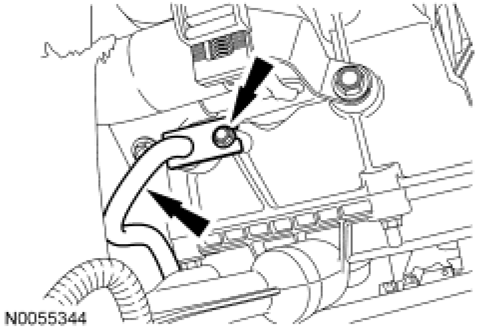


Fig. 124: Identifying Transmission Fluid Cooler Tube Bolt
Courtesy of FORD MOTOR CO.

19. Tighten the transmission fluid cooler tube fitting.
    - Tighten to 25 Nm (18 lb-ft).

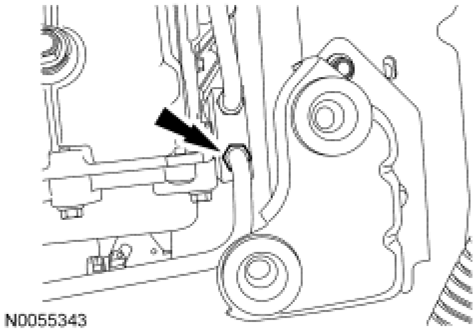


Fig. 125: Identifying Transmission Fluid Cooler Tube Fitting From Thermal Bypass Valve
Courtesy of FORD MOTOR CO.

20. Install the transmission fluid filler tube and the nut.
    - Tighten to 11 Nm (97 lb-in).

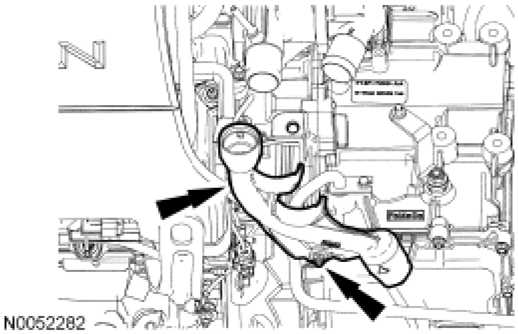


Fig. 126: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

21. Install the transmission fluid level indicator.

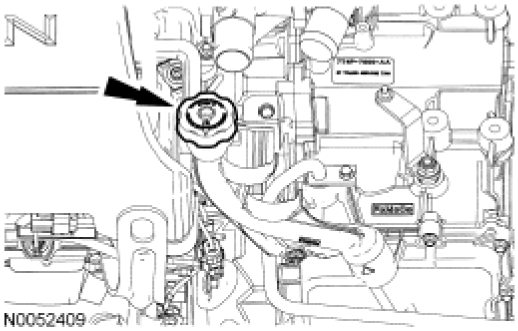


Fig. 127: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

22. Route the coolant hoses in the transmission fluid filler tube.

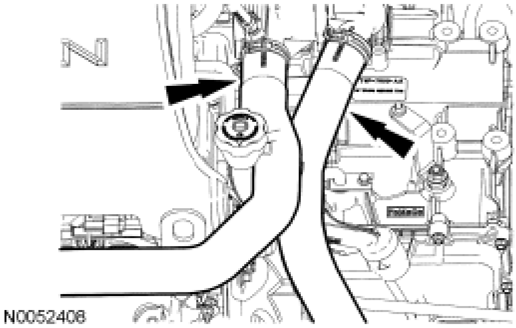


Fig. 128: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

23. Position the ACL assembly in place and install the bolt.
    - Tighten to 11 Nm (97 lb-in).

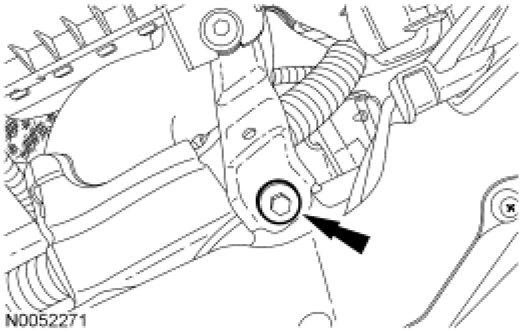


Fig. 129: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

24. Tighten the ACL outlet pipe clamp at the TB.
    - Tighten to 5 Nm (44 lb-in).

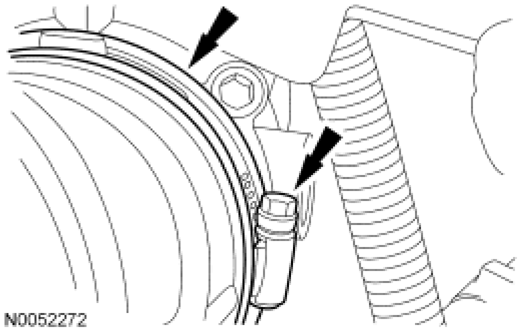
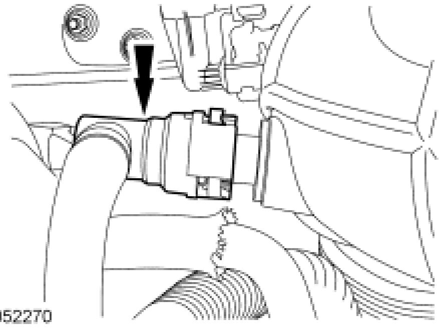


Fig. 130: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

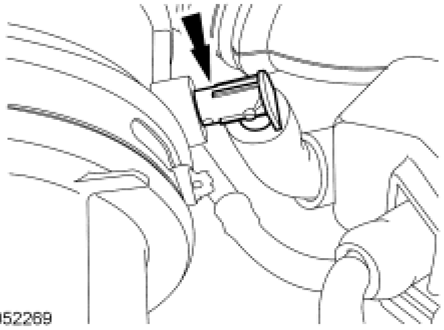
25. Connect the engine breather to the ACL assembly.



N0052270

Fig. 131: Locating Engine Breather
Courtesy of FORD MOTOR CO.

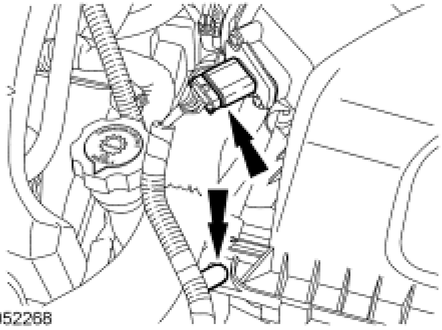
26. Connect the brake booster vacuum hose to the ACL assembly.



N0052269

Fig. 132: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

27. Connect the MAF sensor electrical connector and connect the electrical harness fastener.



N0052268

Fig. 133: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

28. Fill with clean transmission fluid to the correct level.

OUTPUT SHAFT SPEED (OSS) SENSOR

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Disconnect the Mass Air Flow (MAF) sensor electrical connector and the wiring harness fastener from the Air Cleaner (ACL) assembly.

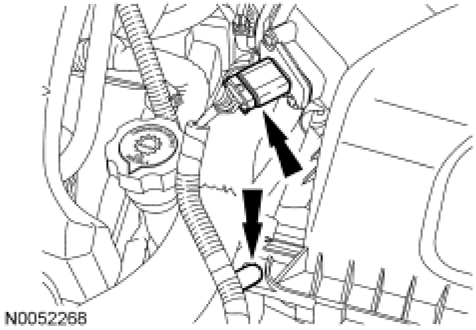


Fig. 134: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

3. Disconnect the brake booster vacuum hose from the ACL outlet pipe.

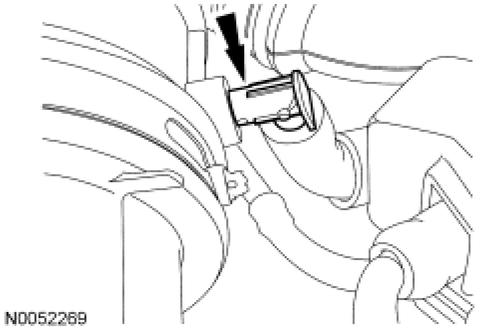


Fig. 135: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

4. Disconnect the engine breather from the ACL assembly.

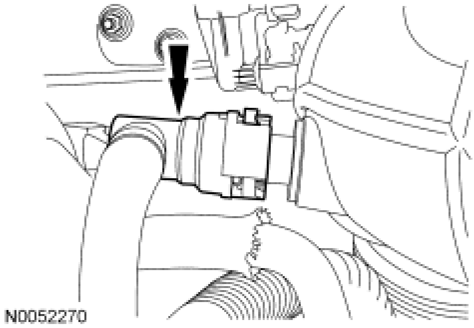


Fig. 136: Locating Engine Breather
Courtesy of FORD MOTOR CO.

5. Remove the ACL assembly bracket bolt.

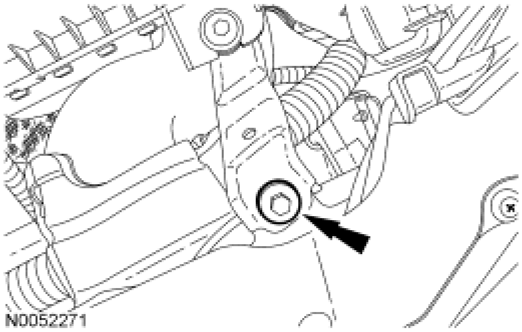


Fig. 137: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

6. Loosen the ACL outlet pipe clamp at the Throttle Body (TB) and remove the ACL and ACL outlet pipe assembly.

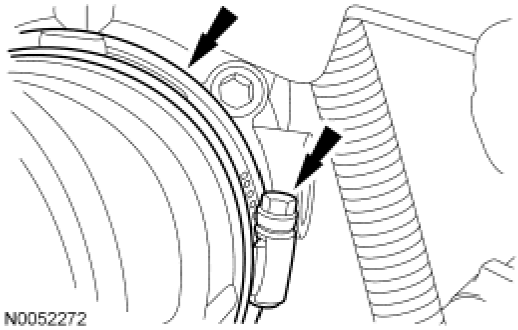


Fig. 138: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

7. Remove the transmission fluid drain plug and allow the transmission fluid to drain.

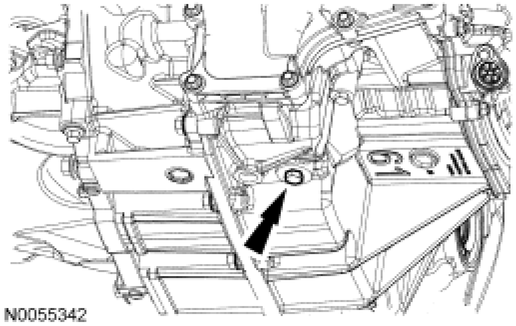


Fig. 139: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

8. Install the transmission fluid drain plug.
   - Tighten to 9 Nm (80 lb-in).

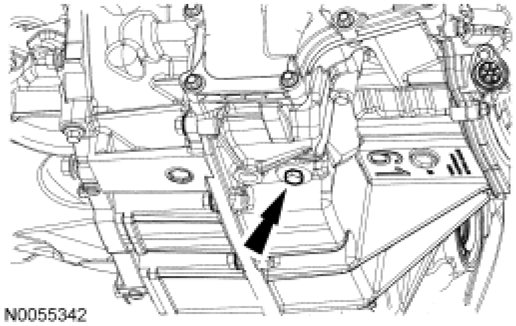


Fig. 140: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses do not need to be removed from the engine.

9. Remove the coolant hoses from the transmission fluid filler tube and position aside.

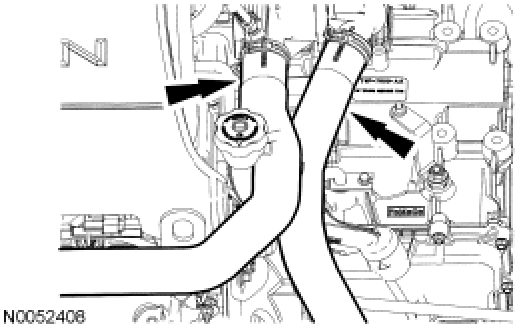


Fig. 141: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

10. Remove the transmission fluid level indicator.

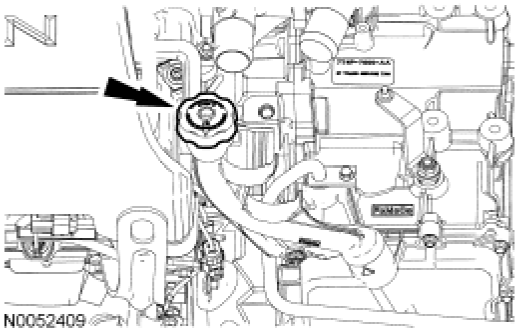


Fig. 142: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

11. Remove the nut, rotate the transmission fluid filler tube counterclockwise 90 degrees and remove the transmission fluid filler tube.

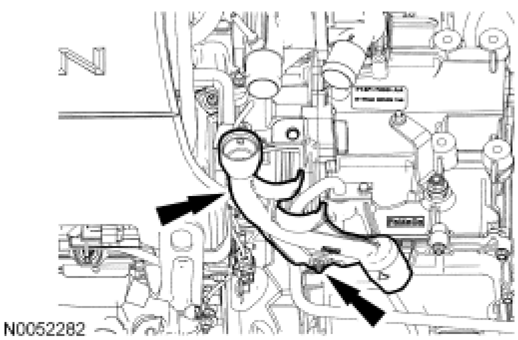


Fig. 143: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

12. Loosen the transmission fluid cooler tube fitting from the thermal bypass valve.

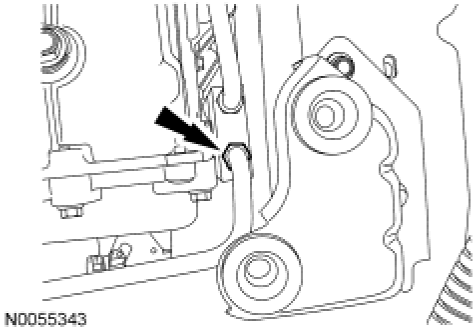


Fig. 144: Identifying Transmission Fluid Cooler Tube Fitting From Thermal Bypass Valve
Courtesy of FORD MOTOR CO.

13. Remove and discard the transmission fluid cooler tube bolt and remove the transmission fluid cooler tube.

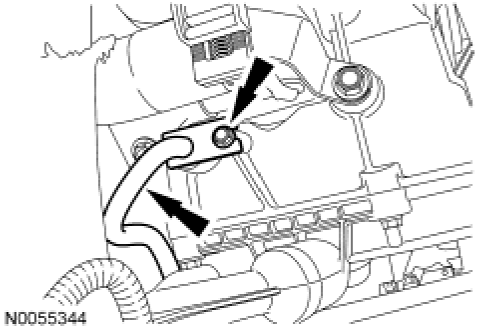


Fig. 145: Identifying Transmission Fluid Cooler Tube Bolt
Courtesy of FORD MOTOR CO.

14. Inspect the transaxle case to make sure that the transmission fluid cooler tube seal and backing ring were removed with the transmission fluid cooler tube and are not stuck in the transaxle case. If the transmission fluid cooler tube seal or backing ring are stuck in the transaxle case, remove the seal and backing ring.

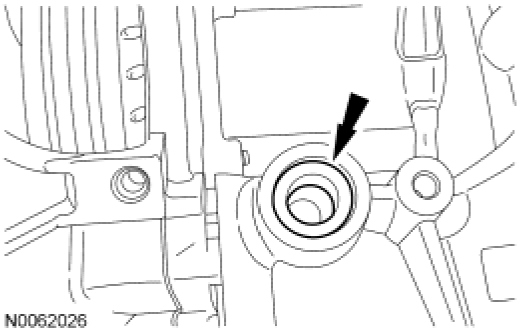


Fig. 146: Identifying Transmission Fluid Cooler Tube Seal
Courtesy of FORD MOTOR CO.

15. Disconnect the transaxle electrical connector.

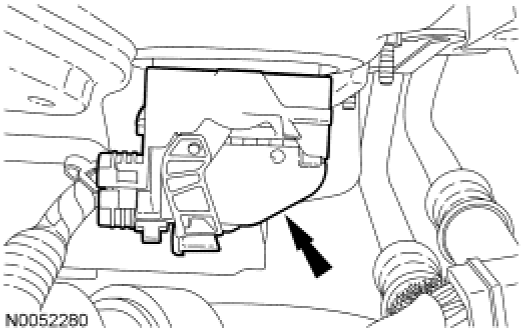


Fig. 147: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

16. Remove the 2 nuts, pull the transmission fluid cooler thermal bypass valve straight up and position it aside.

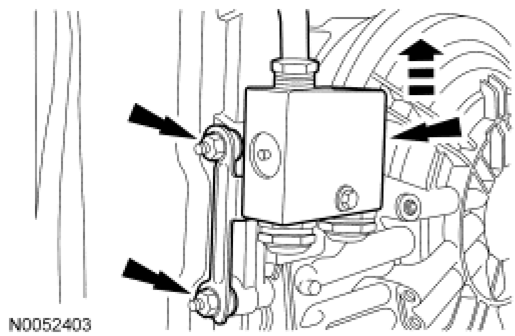


Fig. 148: Removing Nuts & Pulling Transmission Fluid Cooler Thermal Bypass Valve Straight Up
Courtesy of FORD MOTOR CO.

NOTE: Note the location of the stud bolts for assembly.

17. Remove the 14 bolts and the main control cover.

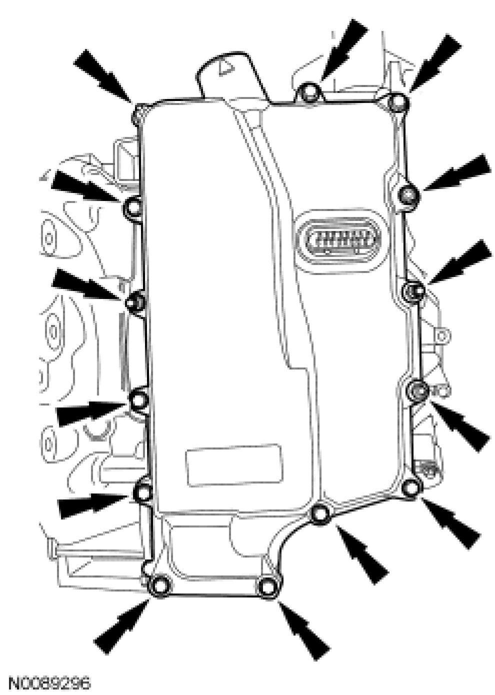


Fig. 149: Main Control Valve Cover Bolts
Courtesy of FORD MOTOR CO.

18. Disconnect the Transmission Range (TR) sensor electrical connector.
    1. Slide the lock over.
    2. Press the tab and disconnect the connector.

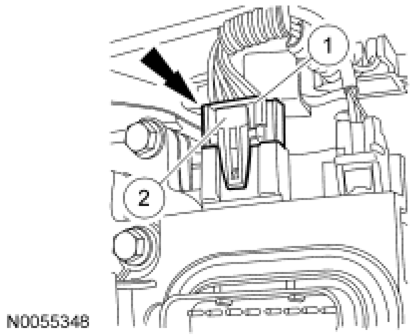


Fig. 150: Pressing Tab & Disconnecting Connector
Courtesy of FORD MOTOR CO.

19. Disconnect the Turbine Shaft Speed (TSS) and Output Shaft Speed (OSS) sensor electrical connectors.

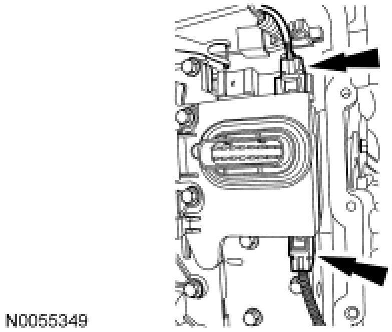
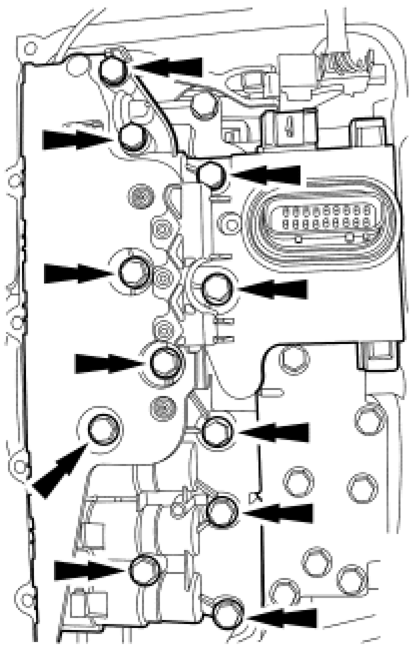


Fig. 151: Locating Turbine Shaft Speed (TSS) & Output Shaft Speed (OSS) Sensor Electrical Connectors
Courtesy of FORD MOTOR CO.

NOTE: **The solenoid body should be handled with care or damage to the solenoid body may occur.**

NOTE: **Note the location of the different length bolts for assembly.**

20. Remove the 11 bolts and the solenoid body.



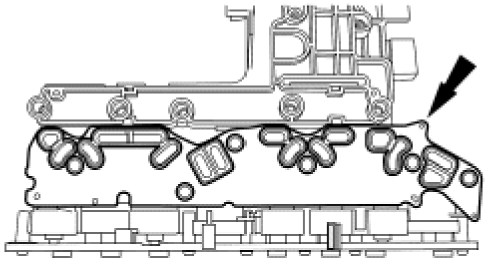
N0055350

Fig. 152: Locating Solenoid Body Bolts
Courtesy of FORD MOTOR CO.

NOTE: **Do not handle the solenoid body in the leadframe area or by the screens of the solenoid body filter or damage to the solenoid body can occur.**

NOTE: **Use care not to break the alignment tabs when removing the solenoid body filter. Damage to the transaxle will occur if the solenoid body is not correctly aligned.**

21. Remove the solenoid body filter assembly by pulling it straight up from the alignment tabs. Discard the filter.



N0055016

Fig. 153: Identifying Solenoid Body Filter Assembly
Courtesy of FORD MOTOR CO.

22. Remove the 10 bolts, the TR sensor detent spring and the main control valve body.

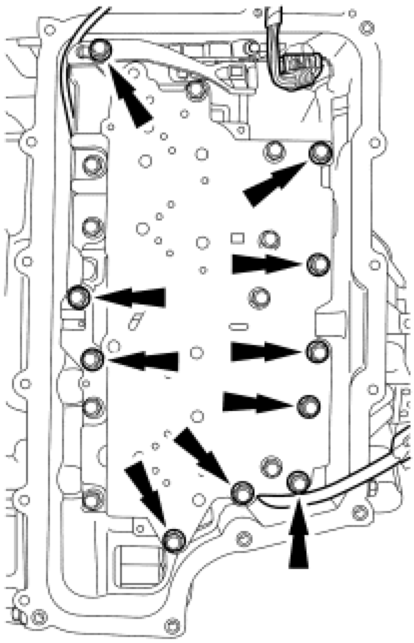


Fig. 154: Locating Main Control Valve Body Bolts
Courtesy of FORD MOTOR CO.

23. Remove the bolt and the OSS sensor.

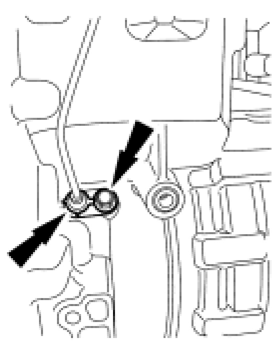


Fig. 155: Identifying OSS Sensor & Bolt
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Install the OSS sensor and the bolt.
   - Tighten to 12 Nm (106 lb-in).

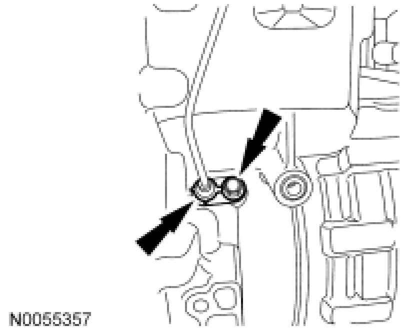


Fig. 156: Identifying OSS Sensor & Bolt
Courtesy of FORD MOTOR CO.

NOTE: Make sure that the manual pin (part of the TR sensor) is correctly installed in the manual valve.

2. Position the TSS, OSS and TR sensor wiring harnesses aside and install the main control valve body.

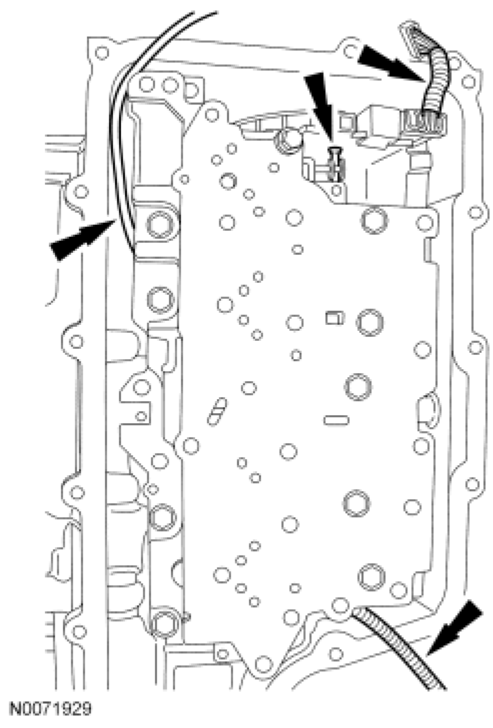


Fig. 157: Locating TSS, OSS & TR Sensor Wiring Harnesses
Courtesy of FORD MOTOR CO.

3. Inspect the manual pin to make sure it is correctly installed in the manual valve. If it is not, pull the valve body off the transaxle case. Correctly install the manual pin in the manual valve and position the valve body in place.

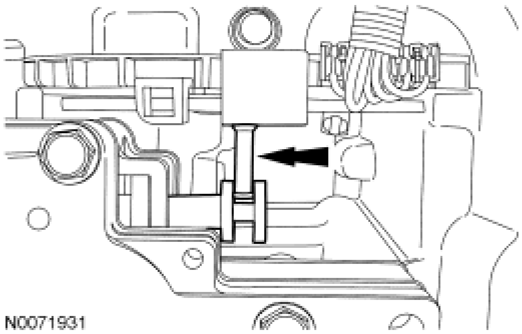


Fig. 158: Identifying Manual Pin
Courtesy of FORD MOTOR CO.

4. Install the TR sensor detent spring and the 10 bolts. Tighten the bolts in the sequence shown.
    - Tighten to 12 Nm (106 lb-in).

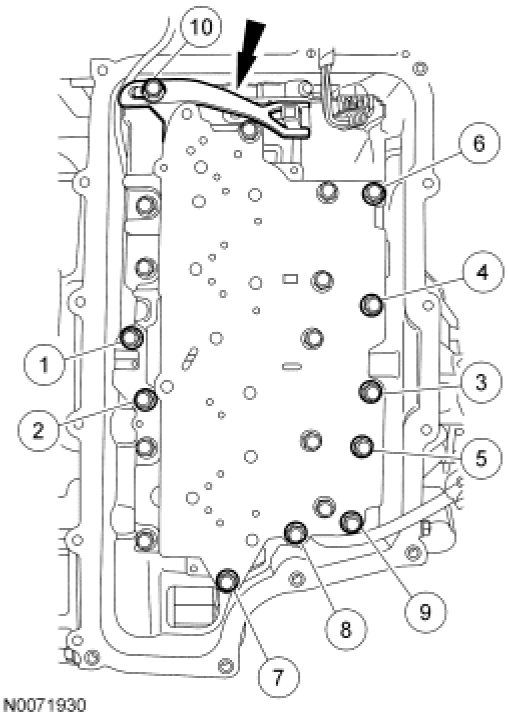
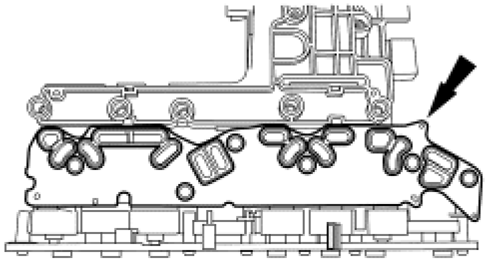


Fig. 159: Tightening TR Sensor Detent Spring Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE:	**Do not handle the solenoid body in the leadframe area or by the screens of the solenoid body filter or damage to the solenoid body can occur.**
NOTE:	**Use care not to break the alignment tabs when installing the solenoid body filter. Damage to the transaxle will occur if the solenoid body is not correctly aligned.**

NOTE: **Make sure that the filter passage areas are clean of foreign material before installing the filter. Damage to the transaxle will occur if the filter passages are not clean.**

5. Install a new solenoid body filter assembly by pushing it straight down on to the alignment tabs.



N0055016

Fig. 160: Identifying Solenoid Body Filter Assembly
Courtesy of FORD MOTOR CO.

NOTE: **Make sure not to pinch the Turbine Shaft Speed (TSS), Output Shaft Speed (OSS) or Transmission Range (TR) sensor wiring harnesses when installing the solenoid body. Damage to the wiring harness will occur.**

NOTE: **Install the different length bolts in the locations noted during disassembly.**

6. Install the solenoid body and the 11 bolts.
    1. 42 mm (1.65 in) bolt
    2. 63 mm (2.48 in) bolts
    3. 80 mm (3.14 in) bolts
    4. 95 mm (3.74 in) bolts

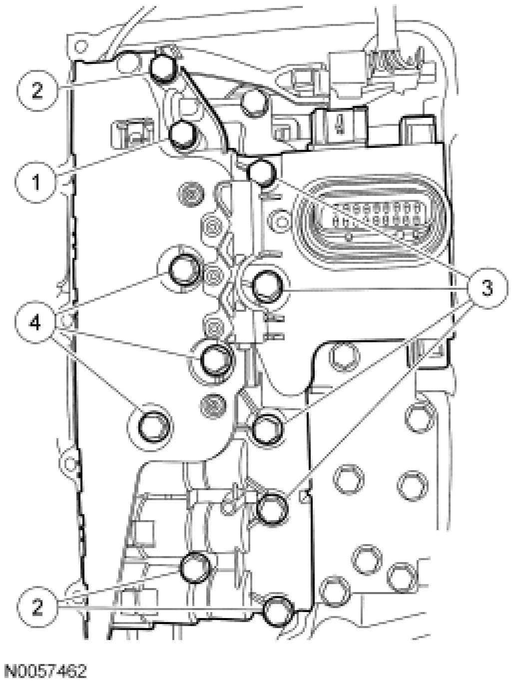


Fig. 161: Locating Solenoid Body Bolts
Courtesy of FORD MOTOR CO.

7. Tighten the solenoid body bolts in the sequence shown.
   - Tighten to 12 Nm (106 lb-in).

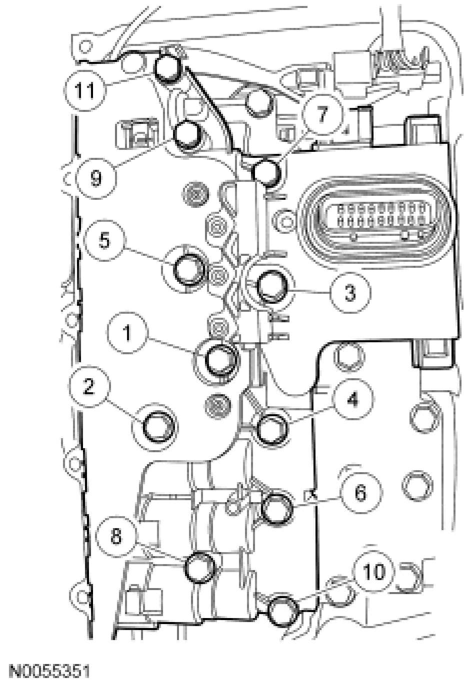


Fig. 162: Tightening Solenoid Body Bolts In Sequence
Courtesy of FORD MOTOR CO.

8. Route the OSS sensor wiring harness and connect the electrical connector.

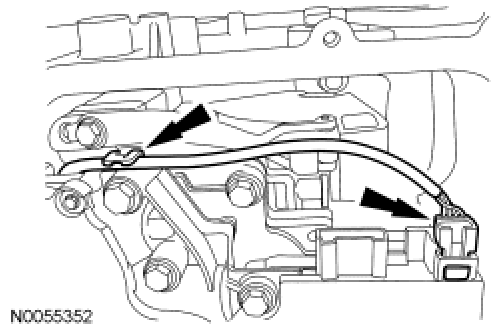


Fig. 163: Locating OSS Sensor Wiring Harness & Electrical Connector
Courtesy of FORD MOTOR CO.

9. Connect the TR sensor electrical connector.
    1. Connect the electrical connector.
    2. Slide the locking tab over.

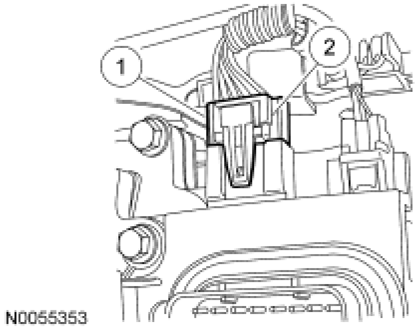


Fig. 164: Identifying TR Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

10. Connect the TSS sensor electrical connector.

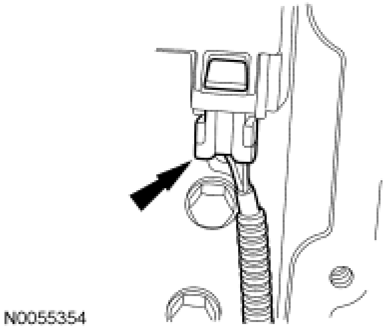


Fig. 165: Identifying TSS Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

11. Inspect the transaxle side cover seal for damage and install new if necessary.

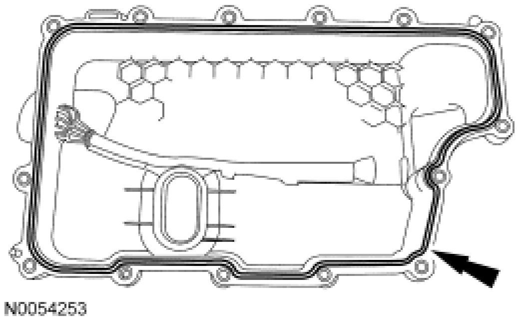


Fig. 166: Inspecting Transaxle Main Control Cover Seal For Damage
Courtesy of FORD MOTOR CO.

NOTE: **Inspect the 20-pin solenoid body connector seal to make sure that the seal is on the inside of the main control cover or a transmission fluid leak will occur.**

NOTE: Install the studbolts in the locations noted during disassembly.

12. Install the main control cover and loosely install the 14 bolts.
    1. Bolt location
    2. Studbolt location

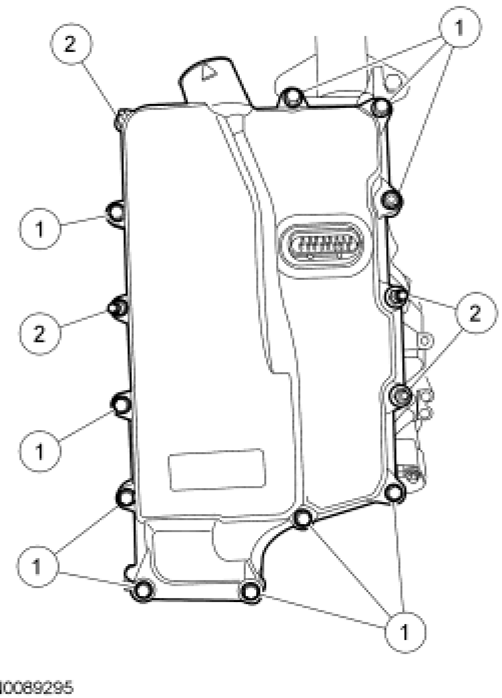


Fig. 167: Main Control Cover Bolts
Courtesy of FORD MOTOR CO.

13. Tighten the main control cover bolts in the sequence shown.
    - Tighten to 12 Nm (106 lb-in).

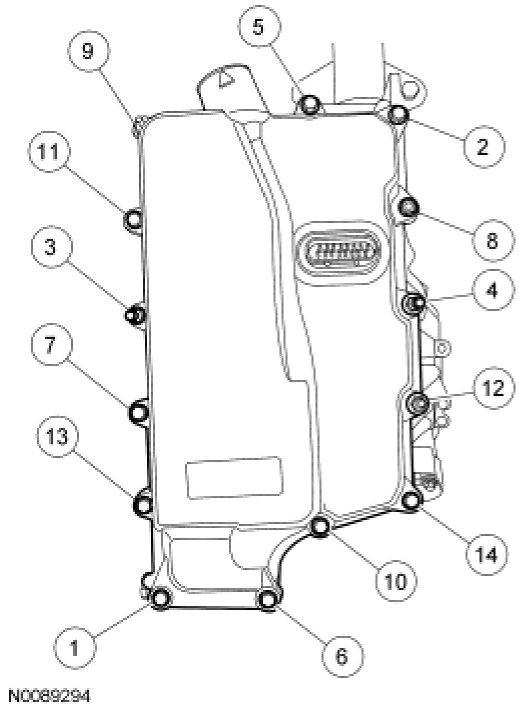


Fig. 168: Main Control Cover Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

14. Position the transmission fluid cooler thermal bypass valve and transmission fluid cooler tube assembly in place and install the 2 transmission fluid cooler tube bracket nuts.
    - Tighten to 9 Nm (80 lb-in).

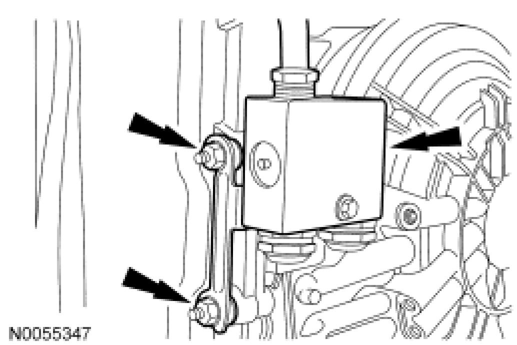


Fig. 169: Identifying Transmission Fluid Cooler Tube Assembly & Nuts
Courtesy of FORD MOTOR CO.

15. Connect the transaxle electrical connector.

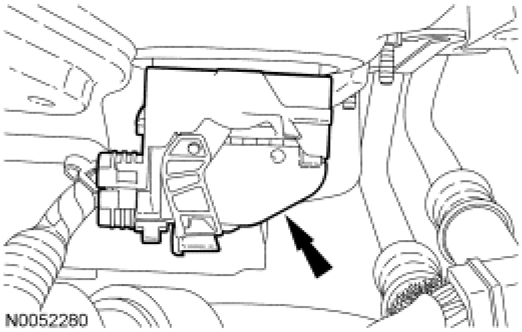


Fig. 170: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

16. Inspect the transmission fluid cooler tube backing ring and seal for damage and install a new backing ring or seal if necessary. Lubricate the transmission fluid cooler tube seal with clean transmission fluid and install the backing ring and seal on the transmission fluid cooler tube.

Item	Part Number	Description
1	7D285	Seal
2	7J324	Backing ring

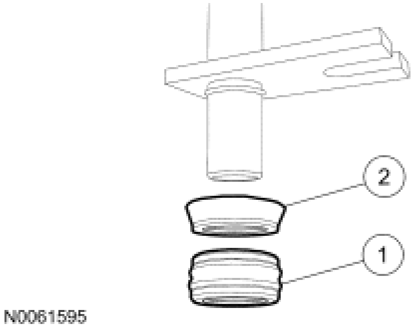


Fig. 171: Identifying Transmission Fluid Cooler Tube Backing Ring & Seal
Courtesy of FORD MOTOR CO.

17. Position the transmission fluid cooler tube in place and install a new bolt.
    - Tighten to 9 Nm (80 lb-in).

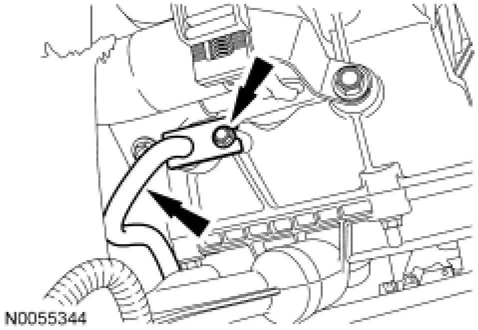


Fig. 172: Identifying Transmission Fluid Cooler Tube Bolt
Courtesy of FORD MOTOR CO.

18. Tighten the transmission fluid cooler tube fitting.
    - Tighten to 25 Nm (18 lb-ft).

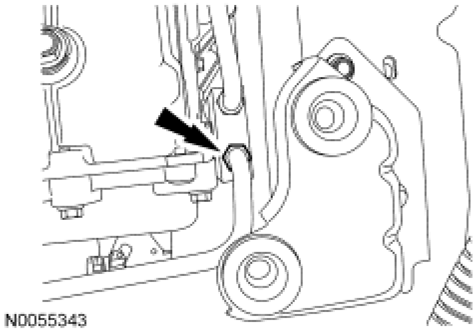


Fig. 173: Identifying Transmission Fluid Cooler Tube Fitting From Thermal Bypass Valve
Courtesy of FORD MOTOR CO.

19. Install the transmission fluid filler tube and the nut.
    - Tighten to 11 Nm (97 lb-in).

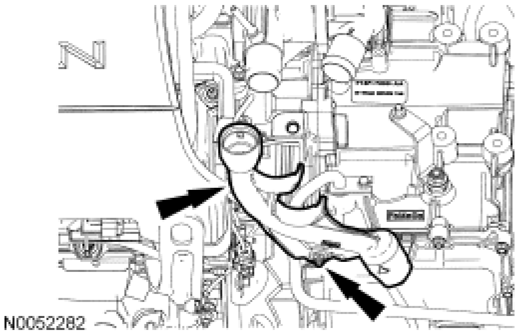


Fig. 174: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

20. Install the transmission fluid level indicator.

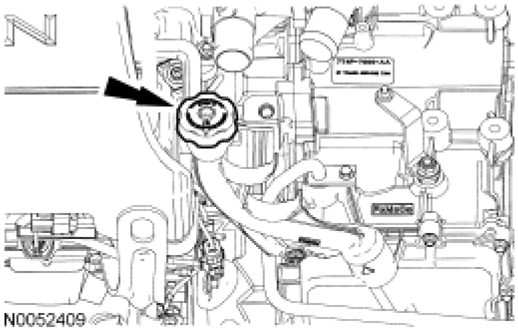


Fig. 175: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

21. Route the coolant hoses in the transmission fluid filler tube.

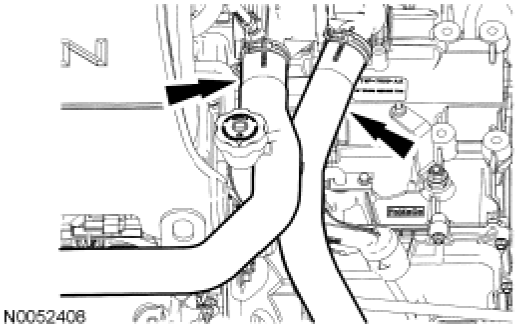


Fig. 176: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

22. Position the ACL assembly in place and install the bolt.
    - Tighten to 11 Nm (97 lb-in).

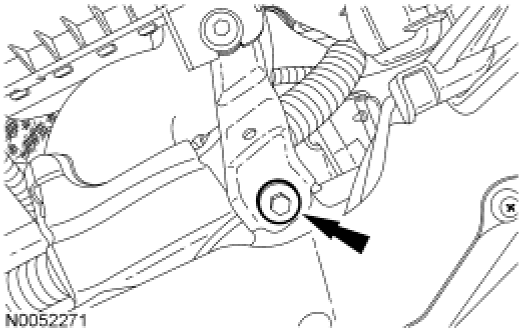


Fig. 177: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

23. Tighten the ACL outlet pipe clamp at the TB.
    - Tighten to 5 Nm (44 lb-in).

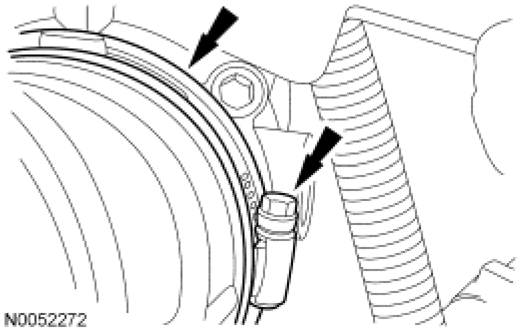


Fig. 178: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

24. Connect the engine breather to the ACL assembly.

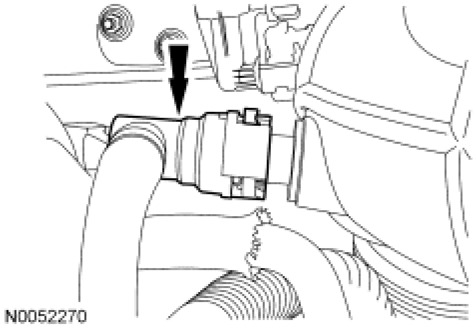


Fig. 179: Locating Engine Breather
Courtesy of FORD MOTOR CO.

25. Connect the brake booster vacuum hose to the ACL assembly.

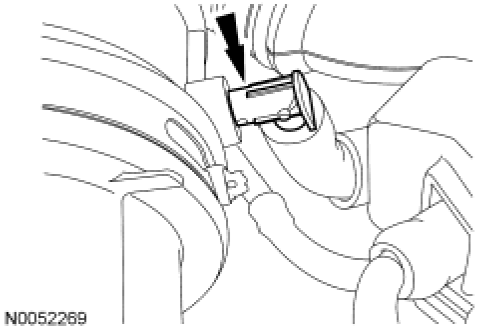


Fig. 180: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

26. Connect the MAF sensor electrical connector and connect the electrical harness fastener.

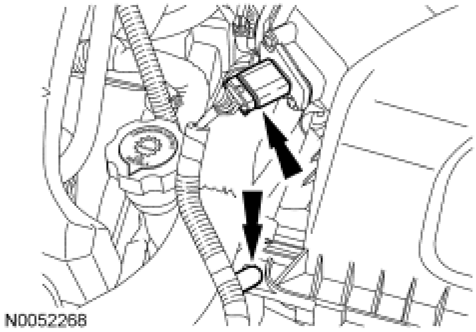
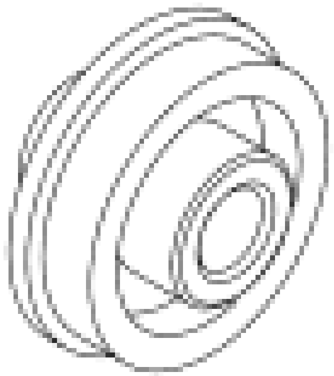


Fig. 181: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

27. Fill with clean transmission fluid to the correct level.

HALFSHAFT SEAL - LH

Special Tools

Illustration	Tool Name	Tool Number
 ST1255-A	Adapter for 303-224 (Handle)	205-153 (T80T-4000-W)
 ST3004-A	Installer, Halfshaft Seal	307-582A

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the front LH halfshaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.

3. Inspect the halfshaft hub for wear or damage and install a new halfshaft if necessary.
    1. Inspect the differential seal surface.
    2. Inspect the halfshaft bushing surface. If this surface is damaged, inspect the halfshaft bushing for damage.
    3. Inspect the differential side gear splines.

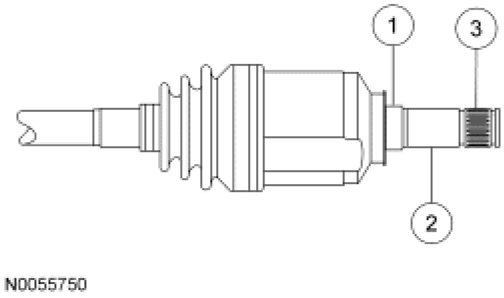


Fig. 182: Identifying Differential Side Gear Splines, Halfshaft Bushing & Differential Seal
Courtesy of FORD MOTOR CO.

4. Using a suitable awl, poke a small hole in the halfshaft seal.

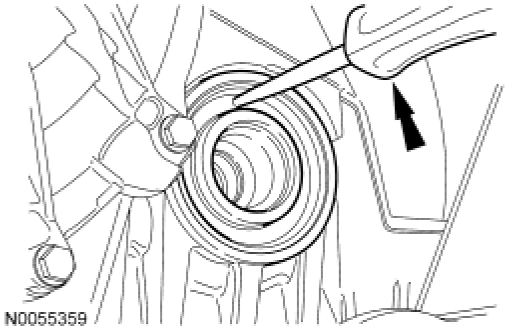


Fig. 183: Poking A Small Hole In The Halfshaft Seal Using A Suitable Awl
Courtesy of FORD MOTOR CO.

5. Using a suitable dent puller, remove the halfshaft seal.

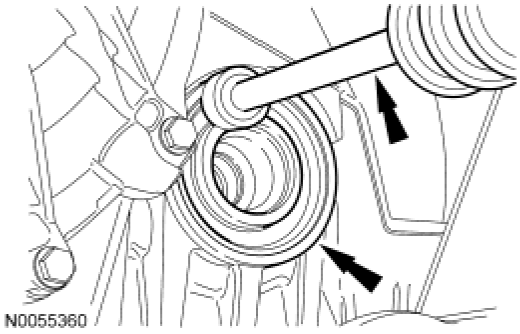


Fig. 184: Removing Halfshaft Seal Using A Suitable Dent Puller
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Install a new halfshaft seal on the Cover Axle Seal Installer and Handle.

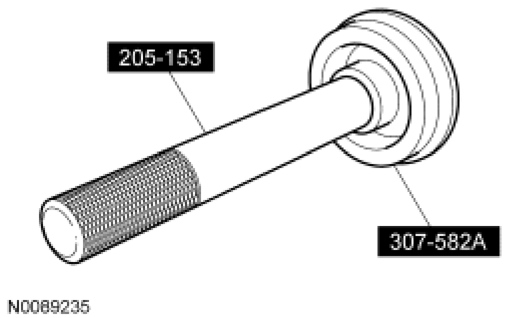


Fig. 185: Axle Seal Installer & Handle
Courtesy of FORD MOTOR CO.

2. Using the Cover Axle Seal Installer and Handle, install the LH halfshaft seal.

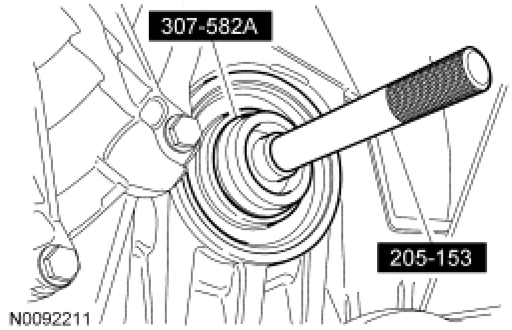


Fig. 186: Installing LH Halfshaft Seal
Courtesy of FORD MOTOR CO.

3. Install the front LH halfshaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.
4. Fill with clean transmission fluid to the correct level.

HALFSHAFT SEAL - RH

Special Tools

Illustration	Tool Name	Tool Number
	Adapter for 303-224 (Handle)	205-153 (T80T-4000-W)

		
	Installer, Halfshaft Seal	307-582A

Material

Item	**Specification**
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

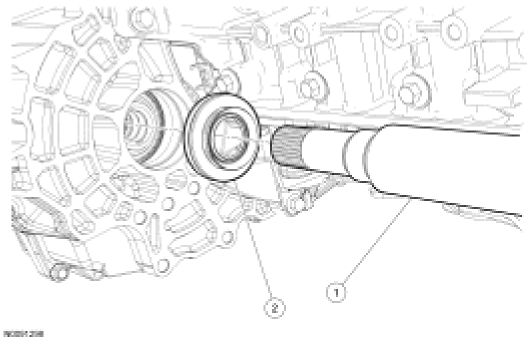


Fig. 187: Halfshaft & Seal
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3K183	Intermediate shaft
2	7H260	Seal assembly - halfshaft

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the RH front wheel and tire. For additional information, refer to **WHEELS & TIRES** article.
3. Remove the RH halfshaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.
4. Inspect the halfshaft hub for wear or damage and install a new halfshaft if necessary.
    1. Inspect the differential seal surface.
    2. Inspect the halfshaft bushing surface. If this surface is damaged, inspect the halfshaft bushing for damage.
    3. Inspect the differential side gear splines.

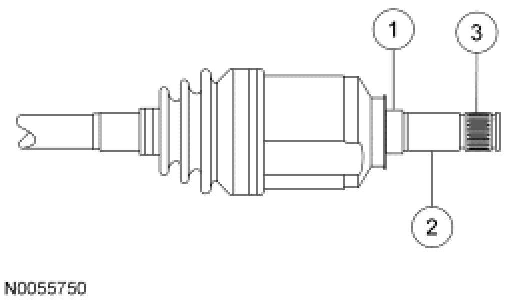


Fig. 188: Identifying Differential Side Gear Splines, Halfshaft Bushing & Differential Seal
Courtesy of FORD MOTOR CO.

5. Using a suitable awl, poke a small hole in the halfshaft seal.

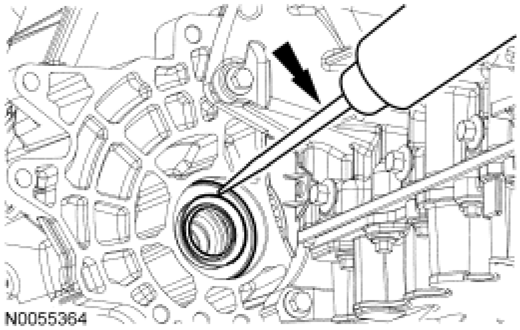


Fig. 189: Poking A Small Hole In Halfshaft Seal Using A Suitable Awl
Courtesy of FORD MOTOR CO.

6. Using a suitable dent puller, remove the halfshaft seal.

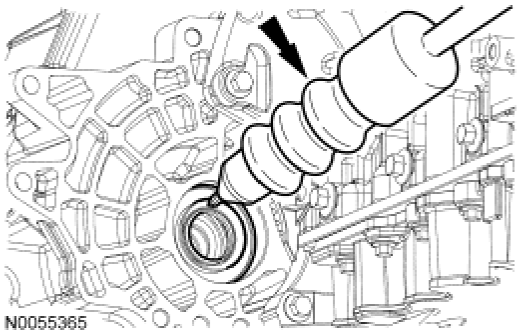


Fig. 190: Removing Halfshaft Seal Using A Suitable Dent Puller
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Install a new halfshaft seal on the Cover Axle Seal Installer and Handle.

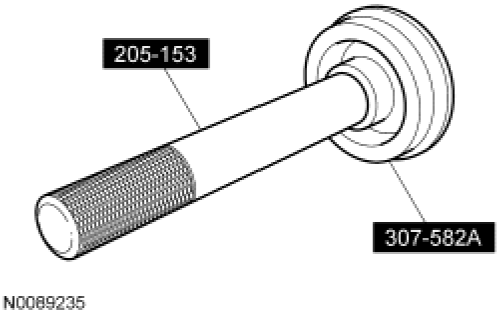


Fig. 191: Axle Seal Installer & Handle
Courtesy of FORD MOTOR CO.

2. Using the Cover Axle Seal Installer and Handle, install the RH halfshaft seal.

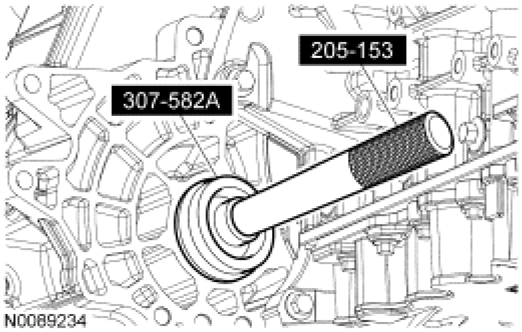


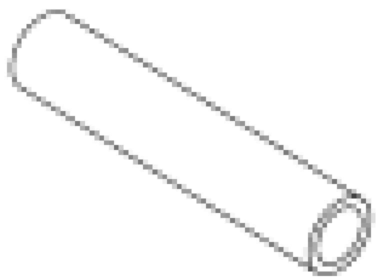
Fig. 192: installing RH Halfshaft Seal
Courtesy of FORD MOTOR CO.

3. Install the RH halfshaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.
4. Install the RH wheel and tire. For additional information, refer to **WHEELS & TIRES** article.

5. Fill with clean automatic transmission fluid to the correct level.

DIGITAL TRANSMISSION RANGE (TR) SENSOR

Special Tools

Illustration	Tool Name	Tool Number
 ST3000-A	Installer, Manual Lever Retaining Pin	307-592

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Disconnect the Mass Air Flow (MAF) sensor electrical connector and the wiring harness fastener from the Air Cleaner (ACL) assembly.

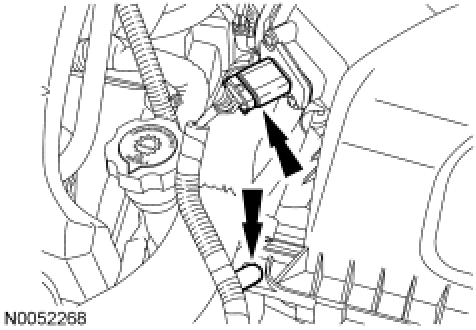


Fig. 193: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

3. Disconnect the brake booster vacuum hose from the ACL outlet pipe.

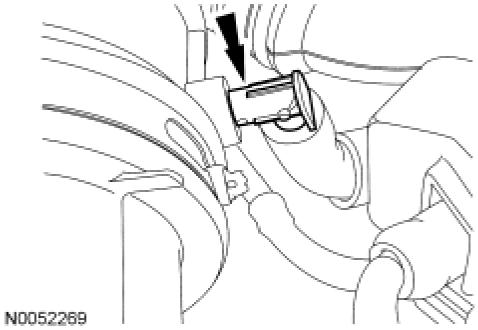


Fig. 194: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

4. Disconnect the engine breather from the ACL assembly.

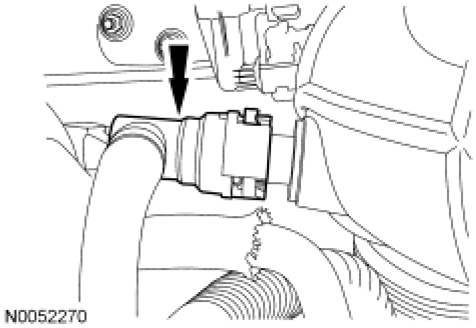


Fig. 195: Locating Engine Breather
Courtesy of FORD MOTOR CO.

5. Remove the ACL assembly bracket bolt.

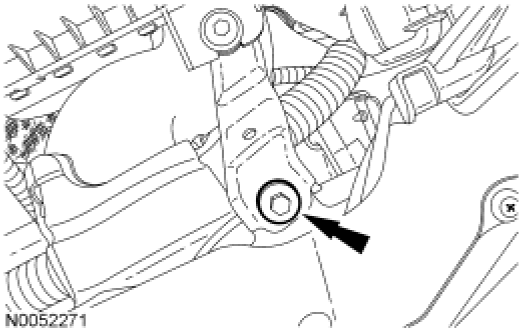


Fig. 196: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

6. Loosen the ACL outlet pipe clamp at the Throttle Body (TB) and remove the ACL and ACL outlet pipe assembly.

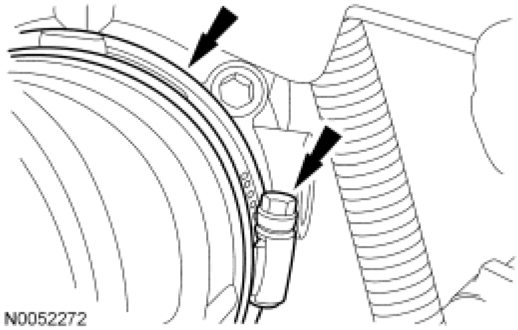


Fig. 197: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

7. Remove the transmission fluid drain plug and allow the transmission fluid to drain.

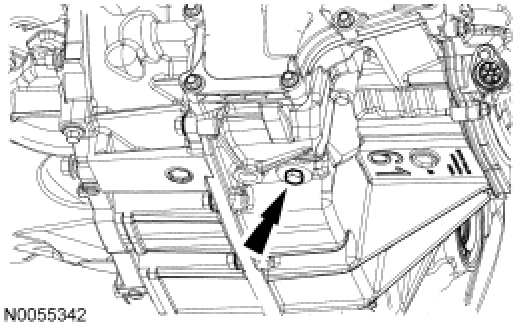


Fig. 198: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

8. Install the transmission fluid drain plug.
   - Tighten to 9 Nm (80 lb-in).

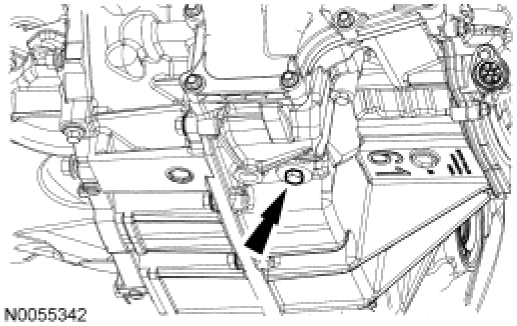


Fig. 199: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses do not need to be removed from the engine.

9. Remove the coolant hoses from the transmission fluid filler tube and position aside.

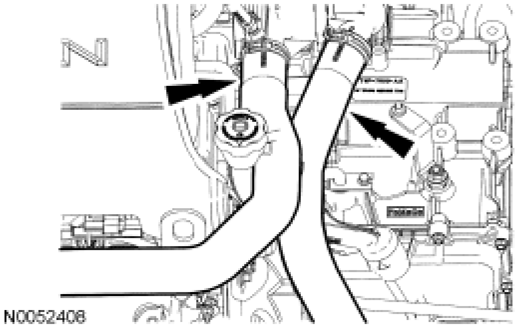


Fig. 200: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

10. Remove the transmission fluid level indicator.

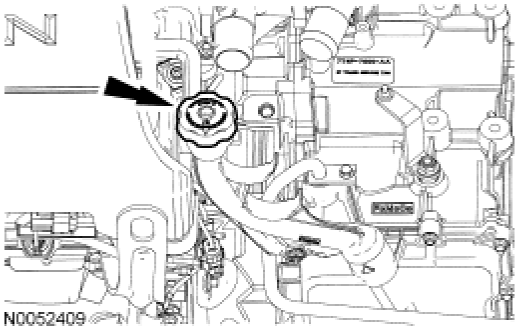


Fig. 201: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

11. Remove the nut, rotate the transmission fluid filler tube counterclockwise 90 degrees and remove the transmission fluid filler tube.

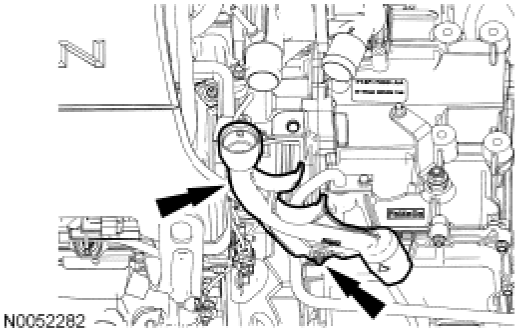


Fig. 202: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

12. Disconnect the selector lever cable end from the manual control lever.

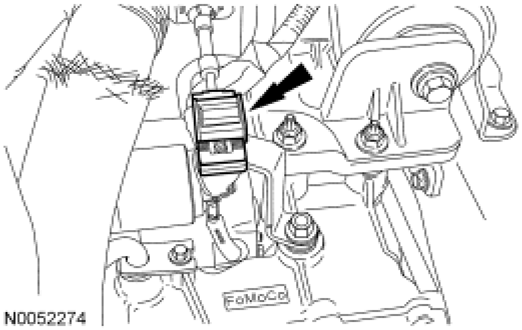


Fig. 203: Locating Selector Lever Cable End From Manual Lever
Courtesy of FORD MOTOR CO.

13. Remove the nut and the manual control lever.

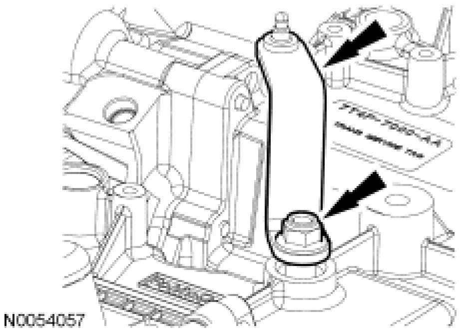


Fig. 204: Identifying Manual Control Lever & Nut
Courtesy of FORD MOTOR CO.

14. Loosen the transmission fluid cooler tube fitting from the thermal bypass valve.

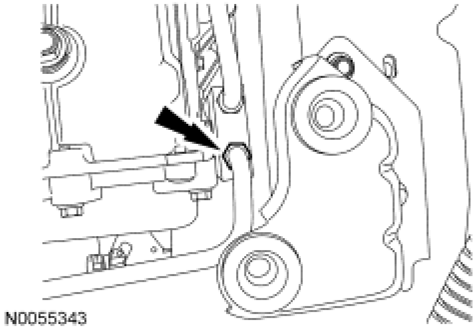


Fig. 205: Identifying Transmission Fluid Cooler Tube Fitting From Thermal Bypass Valve
Courtesy of FORD MOTOR CO.

15. Remove and discard the transmission fluid cooler tube bolt and remove the transmission fluid cooler tube.

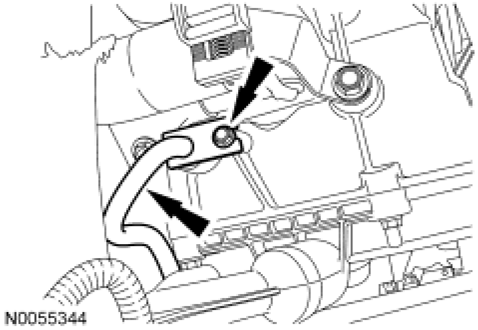


Fig. 206: Identifying Transmission Fluid Cooler Tube Bolt
Courtesy of FORD MOTOR CO.

16. Inspect the transaxle case to make sure that the transmission fluid cooler tube seal and backing ring were removed with the transmission fluid cooler tube and are not stuck in the transaxle case. If the transmission fluid cooler tube seal or backing ring are stuck in the transaxle case, remove the seal and backing ring.

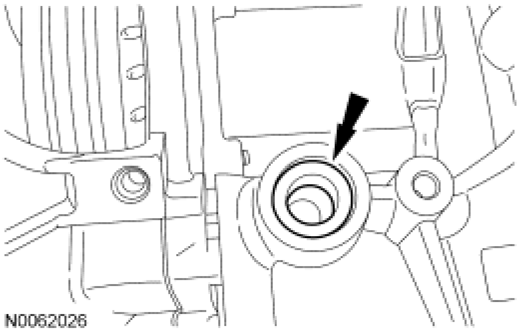


Fig. 207: Identifying Transmission Fluid Cooler Tube Seal
Courtesy of FORD MOTOR CO.

17. Disconnect the transaxle electrical connector.

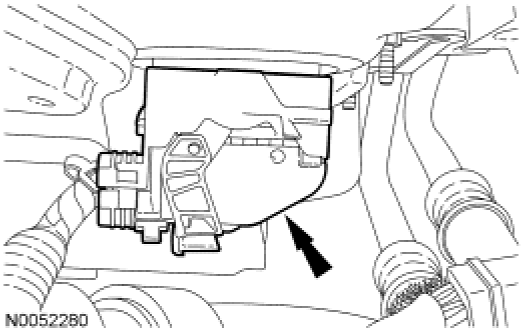


Fig. 208: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

18. Remove the transmission fluid cooler tube bracket nuts, pull the transmission fluid cooler thermal bypass valve straight up and position it aside.

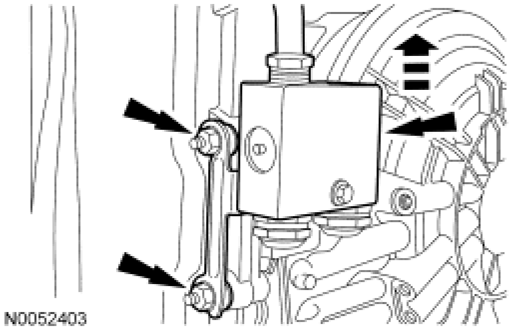


Fig. 209: Removing Nuts & Pulling Transmission Fluid Cooler Thermal Bypass Valve Straight Up
Courtesy of FORD MOTOR CO.

NOTE: Note the location of the studbolts for assembly.

19. Remove the bolts and the main control cover.

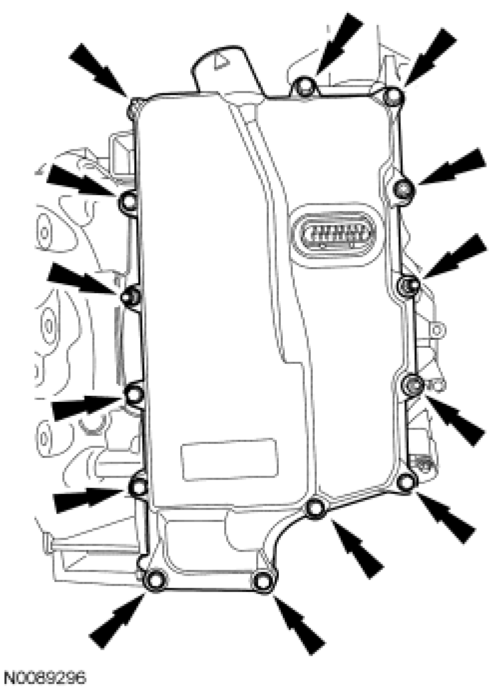


Fig. 210: Main Control Valve Cover Bolts
Courtesy of FORD MOTOR CO.

20. Disconnect the Transmission Range (TR) sensor electrical connector.
    1. Slide the lock over.
    2. Press the tab and disconnect the connector.

N0055348

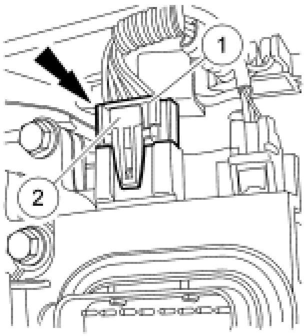


Fig. 211: Pressing Tab & Disconnecting Connector
Courtesy of FORD MOTOR CO.

21. Disconnect the Turbine Shaft Speed (TSS) and Output Shaft Speed (OSS) sensor electrical connectors.

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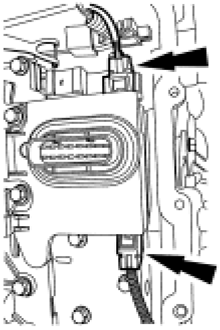


Fig. 212: Locating Turbine Shaft Speed (TSS) & Output Shaft Speed (OSS) Sensor Electrical Connectors
Courtesy of FORD MOTOR CO.

NOTE: The solenoid body should be handled with care, damage to the solenoid body may occur.

NOTE: Note the location of the different length bolts for assembly.

22. Remove the bolts and the solenoid body.

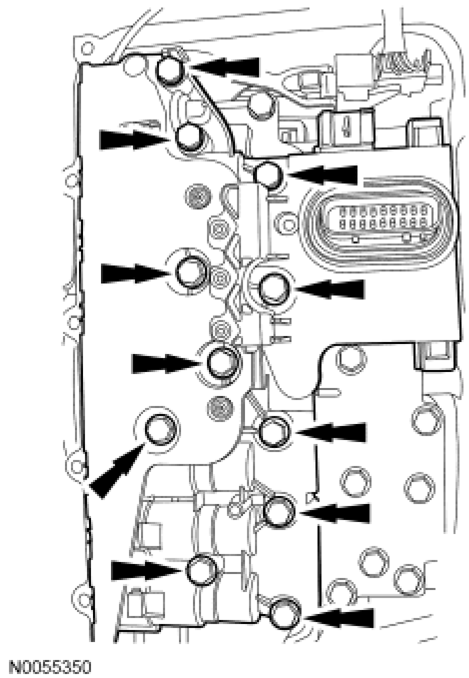


Fig. 213: Locating Solenoid Body Bolts
Courtesy of FORD MOTOR CO.

NOTE: **Do not handle the solenoid body in the leadframe area or by the screens of the solenoid body filter or damage to the solenoid body can occur.**

NOTE: **Use care not to break the alignment tabs when removing the solenoid body filter.**

23. Remove the solenoid body filter assembly by pulling it straight up from the alignment tabs. Discard the filter.

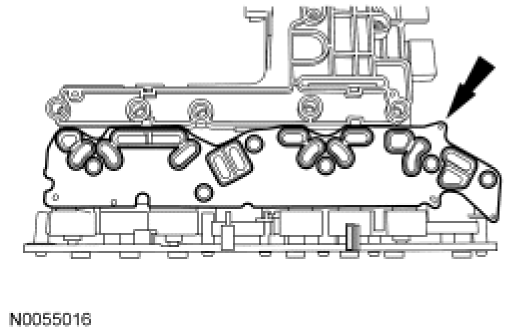


Fig. 214: Identifying Solenoid Body Filter Assembly
Courtesy of FORD MOTOR CO.

24. Remove the bolts, the TR sensor detent spring and the main control valve body.

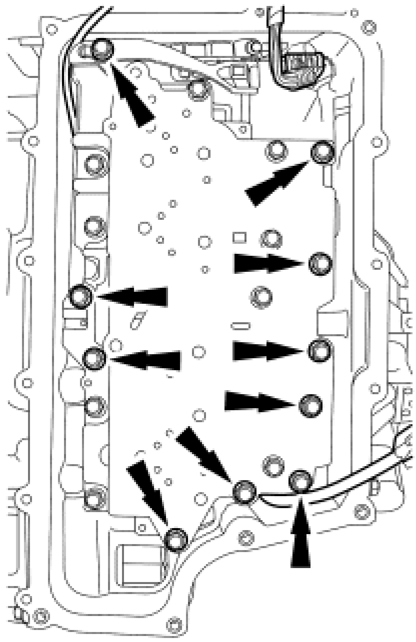


Fig. 215: Locating Main Control Valve Body Bolts
Courtesy of FORD MOTOR CO.

25. Using a suitable tool, remove and discard the TR sensor locking pin.

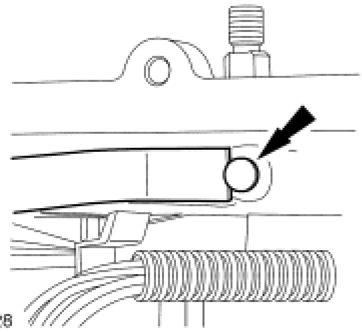


Fig. 216: Locating TR Sensor Locking Pin
Courtesy of FORD MOTOR CO.

NOTE:	**TR sensor removed for clarity.**

26. Make sure that the park pawl actuator rod does not become disengaged from the park pawl and the abutment by keeping the end of the park pawl actuator rod behind the machined valve body mating surface of the transaxle case. If the park pawl actuator rod becomes disengaged from the park pawl and the abutment, transaxle removal and disassembly is required to reinstall the actuator rod.

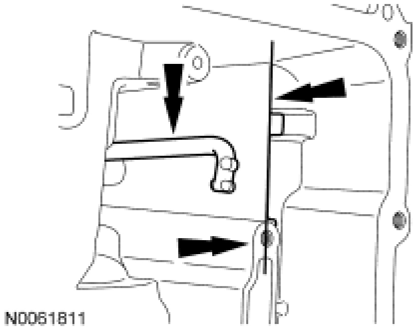


Fig. 217: Making Sure That Park Pawl Actuator Rod Does Not Become Disengaged From Park Pawl
Courtesy of FORD MOTOR CO.

NOTE: **Make sure that the park pawl actuator rod does not become disengaged from the park pawl and the abutment or transaxle removal and disassembly is required to reinstall the actuator rod.**

27. Remove the TR sensor.
    1. Slide the TR sensor down until the manual shaft is out of the transaxle case.
    2. Rotate the TR sensor detent plate counterclockwise, as viewed from below, until the plate rests against the transaxle case. Remove the park pawl actuating rod from the TR sensor and remove the TR sensor.

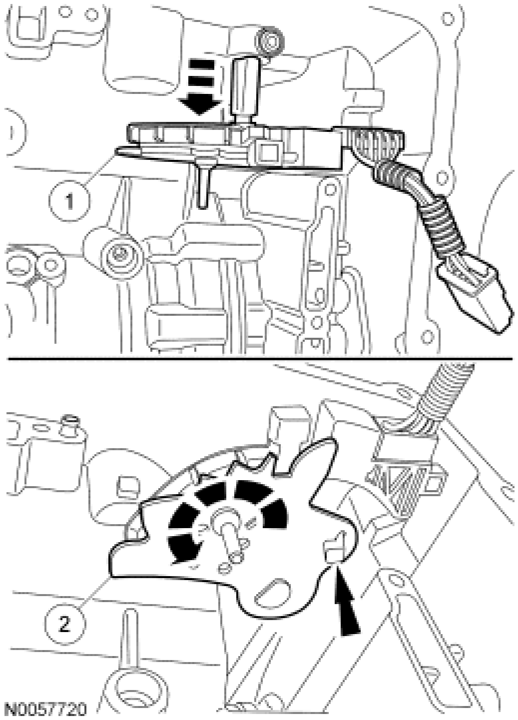


Fig. 218: Sliding TR Sensor Down & Rotating TR Sensor Detent Plate Counterclockwise
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Install the TR sensor.
    1. Position the park pawl actuating rod in the TR sensor.
    2. Install the TR sensor in the transaxle case.

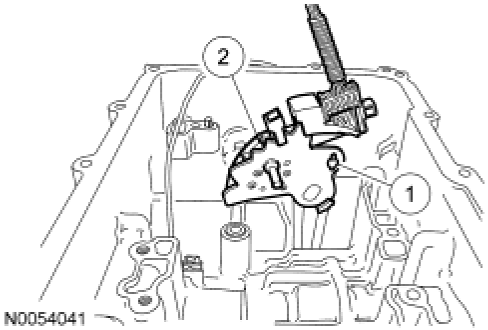


Fig. 219: Identifying TR Sensor In Transaxle Case
Courtesy of FORD MOTOR CO.

2. Using the Manual Retaining Pin Installer, install a new TR sensor locking pin.

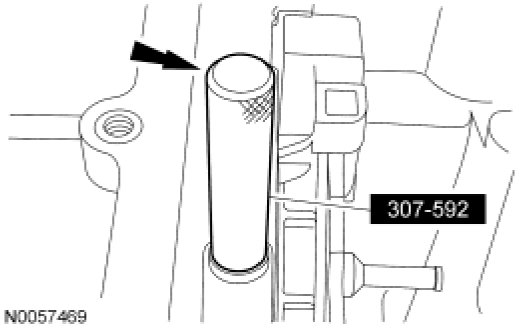


Fig. 220: Installing TR Sensor Locking Pin Using Special Tool (307-592)
Courtesy of FORD MOTOR CO.

NOTE: Make sure that the manual pin (part of the TR sensor) is correctly installed in the manual valve.

3. Position the TSS, OSS and TR sensor wiring harnesses aside and install the main control valve body.

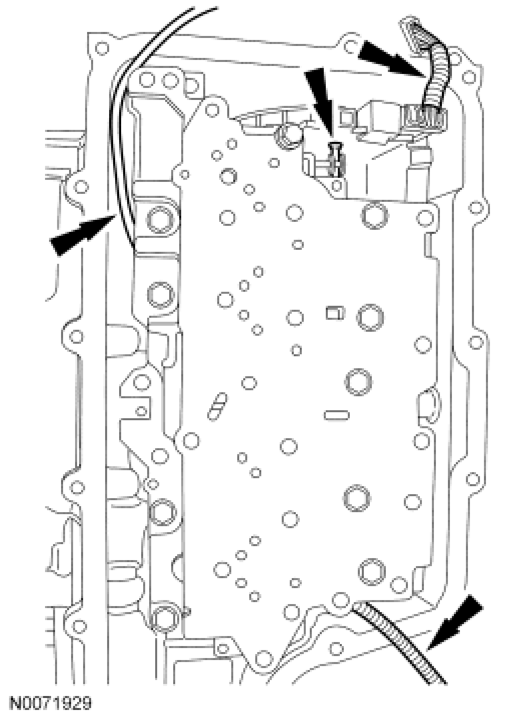


Fig. 221: Locating TSS, OSS & TR Sensor Wiring Harnesses
Courtesy of FORD MOTOR CO.

4. Inspect the manual pin to make sure it is correctly installed in the manual control valve. If it is not, pull the valve body off the transaxle case. Correctly install the manual pin in the manual control valve and position the valve body in place.

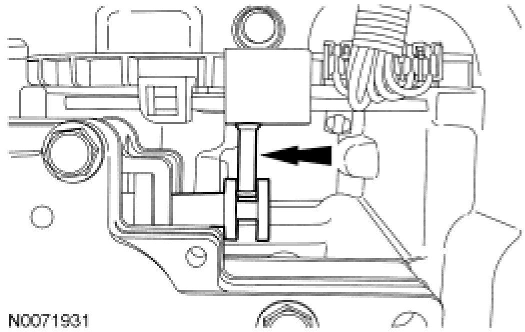


Fig. 222: Identifying Manual Pin
Courtesy of FORD MOTOR CO.

5. Install the TR sensor detent spring and the bolts. Tighten the bolts in the sequence shown.
   - Tighten to 12 Nm (106 lb-in).

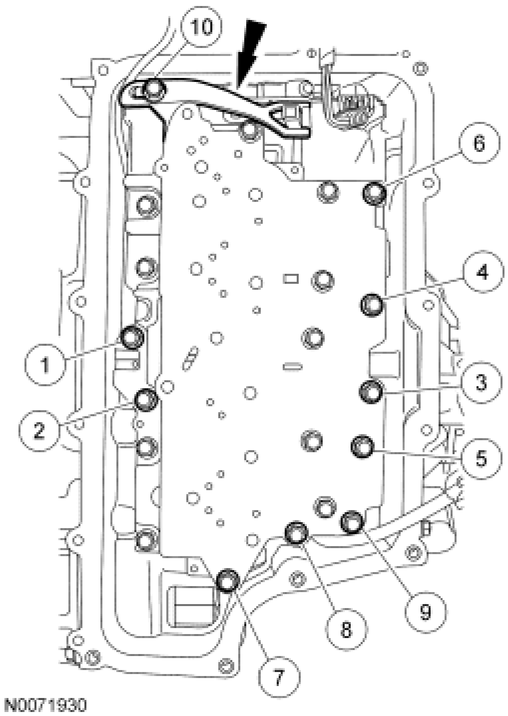


Fig. 223: Tightening TR Sensor Detent Spring Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: **Do not handle the solenoid body in the leadframe area or by the screens of the solenoid body filter or damage to the solenoid body can occur.**

NOTE: **Use care not to break the alignment tabs when installing the solenoid body filter. Damage to the transaxle will occur if the solenoid body is not correctly aligned.**

NOTE: **Make sure that the filter passage areas are clean of foreign material before installing the filter. Damage to the transaxle will occur if the filter passages are not clean.**

6. Install a new solenoid body filter assembly by pushing it straight down on to the alignment tabs.

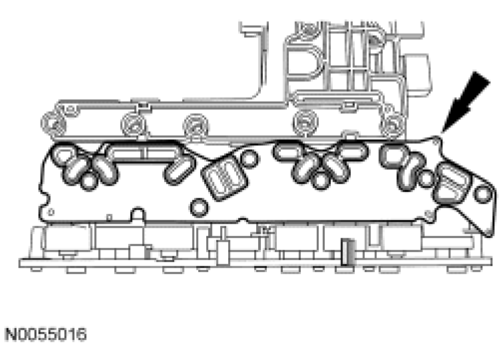


Fig. 224: Identifying Solenoid Body Filter Assembly
Courtesy of FORD MOTOR CO.

NOTE: Make sure not to pinch the Turbine Shaft Speed (TSS), Output Shaft Speed (OSS) or Transmission Range (TR) sensor wiring harnesses when installing the solenoid body. Damage to the wiring harness will occur.

NOTE: Install the different length bolts in the locations noted during disassembly.

7. Install the solenoid body and the bolts.
    1. 42 mm (1.65 in) bolt
    2. 63 mm (2.48 in) bolts
    3. 80 mm (3.14 in) bolts
    4. 95 mm (3.74 in) bolts

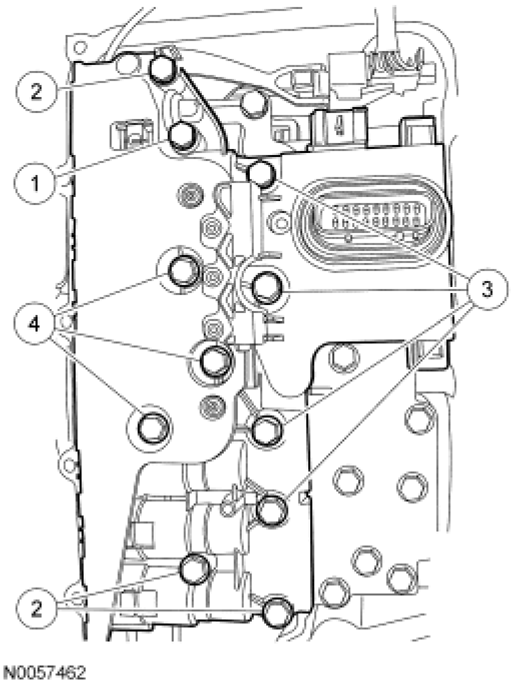


Fig. 225: Locating Solenoid Body Bolts
Courtesy of FORD MOTOR CO.

8. Tighten the solenoid body bolts in the sequence shown.
    - Tighten to 12 Nm (106 lb-in).

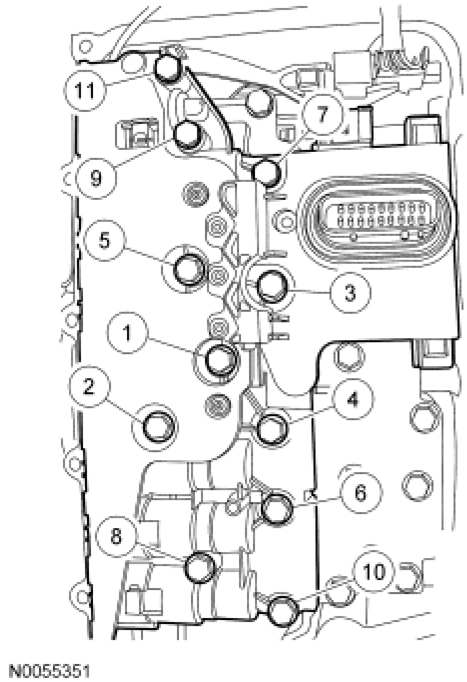


Fig. 226: Tightening Solenoid Body Bolts In Sequence
Courtesy of FORD MOTOR CO.

9. Route the OSS sensor wiring harness and connect the electrical connector.

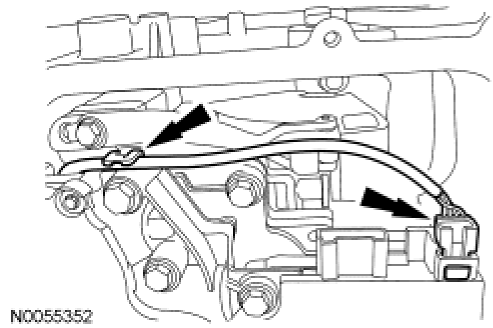


Fig. 227: Locating OSS Sensor Wiring Harness & Electrical Connector
Courtesy of FORD MOTOR CO.

10. Connect the TR sensor electrical connector.
    1. Connect the electrical connector.
    2. Slide the locking tab over.

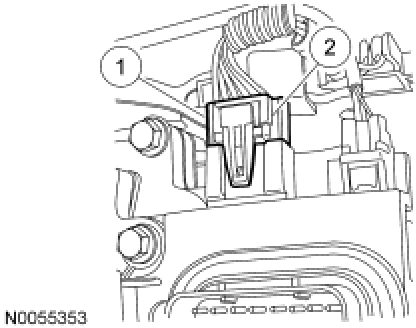


Fig. 228: Identifying TR Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

11. Connect the TSS sensor electrical connector.

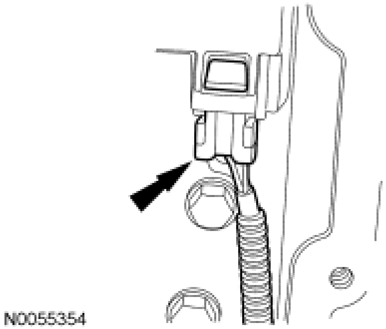


Fig. 229: Identifying TSS Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

12. Inspect the transaxle main control cover seal for damage and install new if necessary.

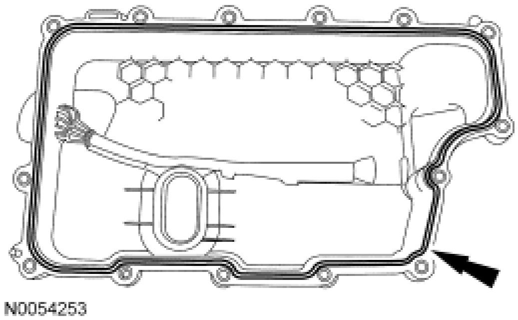


Fig. 230: Inspecting Transaxle Main Control Cover Seal For Damage
Courtesy of FORD MOTOR CO.

NOTE: **Inspect the 20-pin solenoid body connector seal to make sure that the seal is on the inside of the main control cover or a transmission fluid leak will occur resulting in transmission damage.**

NOTE: Install the studbolts in the locations noted during disassembly.

13. Install the main control cover and loosely install the bolts.
    1. Bolt location
    2. Studbolt location

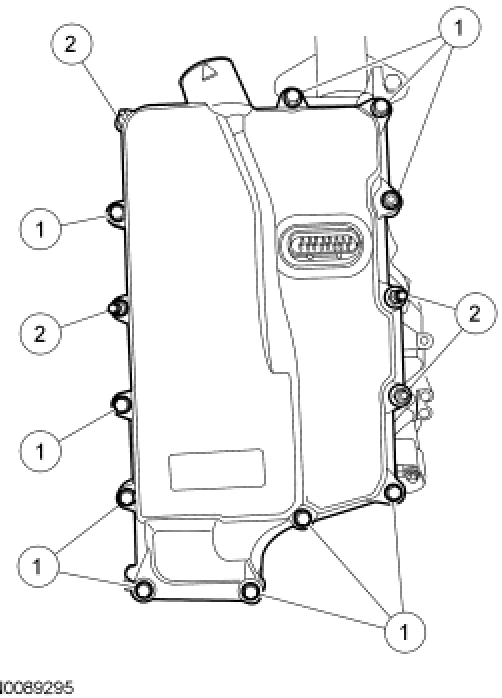


Fig. 231: Main Control Cover Bolts
Courtesy of FORD MOTOR CO.

14. Tighten the main control cover bolts in the sequence shown.
    - Tighten to 12 Nm (106 lb-in).

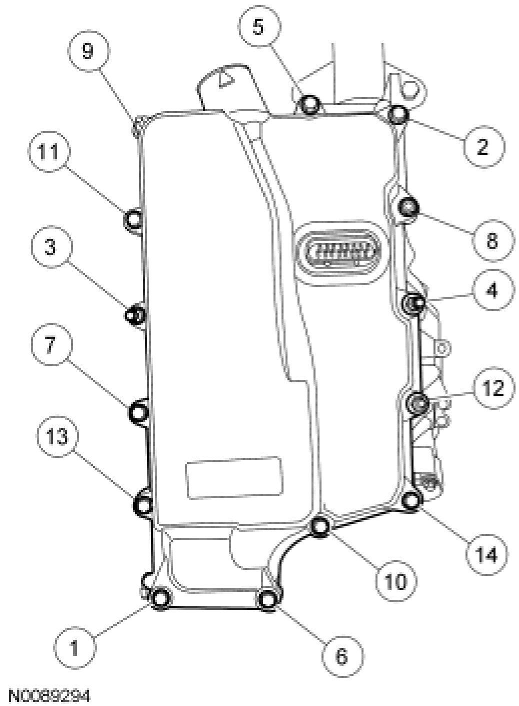


Fig. 232: Main Control Cover Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

15. Position the transmission fluid cooler thermal bypass valve and transmission fluid cooler tube assembly in place and install the nuts.
    - Tighten to 9 Nm (80 lb-in).

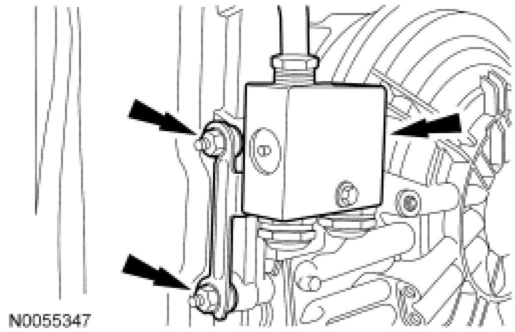


Fig. 233: Identifying Transmission Fluid Cooler Tube Assembly & Nuts
Courtesy of FORD MOTOR CO.

16. Connect the transaxle electrical connector.

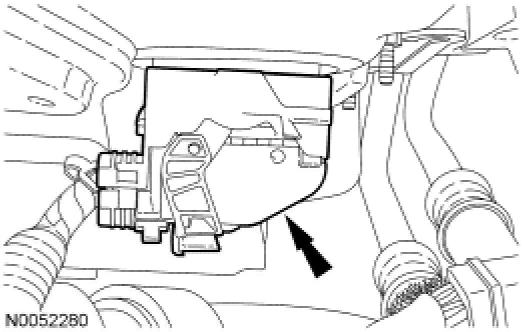


Fig. 234: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

17. Inspect the transmission fluid cooler tube backing ring and seal for damage and install a new backing ring or seal if necessary. Lubricate the transmission fluid cooler tube seal with clean transmission fluid and install the backing ring and seal on the transmission fluid cooler tube.

Item	Part Number	Description
1	7D285	Seal
2	7J324	Backing ring

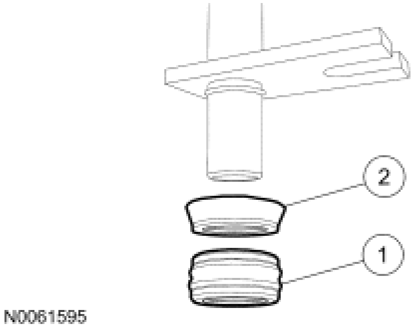


Fig. 235: Identifying Transmission Fluid Cooler Tube Backing Ring & Seal
Courtesy of FORD MOTOR CO.

18. Position the transmission fluid cooler tube in place and install a new bolt.
    - Tighten to 9 Nm (80 lb-in).

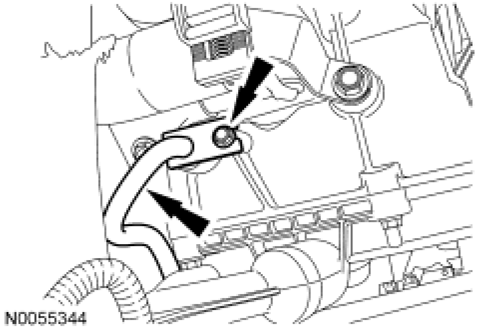


Fig. 236: Identifying Transmission Fluid Cooler Tube Bolt
Courtesy of FORD MOTOR CO.

19. Tighten the transmission fluid cooler tube fitting.
    - Tighten to 25 Nm (18 lb-ft).

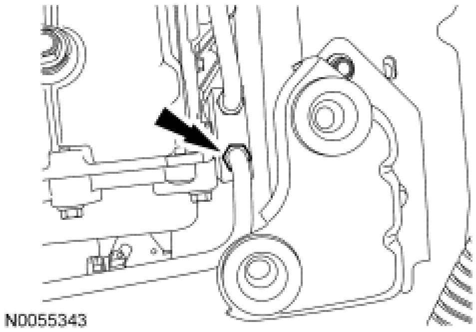


Fig. 237: Identifying Transmission Fluid Cooler Tube Fitting From Thermal Bypass Valve
Courtesy of FORD MOTOR CO.

NOTE:	**Make sure that when installing the manual control lever it is fully seated onto the manual control lever shaft. Damage to the manual control lever shaft will occur and the lever will come loose.**

NOTE:	**Make sure to hold the manual control lever while tightening the manual control lever nut or damage to the manual control lever and park components will occur.**

20. Install the manual control lever and the nut.
    - Tighten to 18 Nm (159 lb-in).

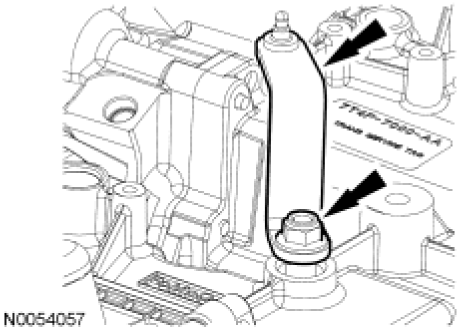


Fig. 238: Identifying Manual Control Lever & Nut
Courtesy of FORD MOTOR CO.

21. Connect the selector lever cable end to the manual control lever.

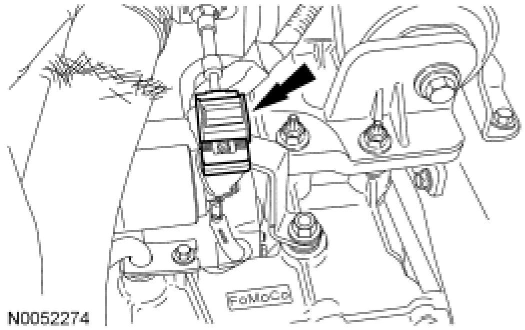


Fig. 239: Locating Selector Lever Cable End From Manual Lever
Courtesy of FORD MOTOR CO.

22. Install the transmission fluid filler tube and the nut.
    - Tighten to 11 Nm (97 lb-in).

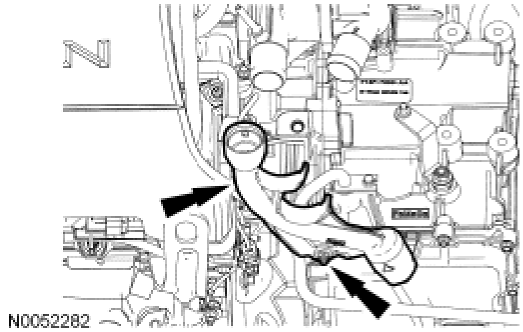


Fig. 240: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

23. Install the transmission fluid level indicator.

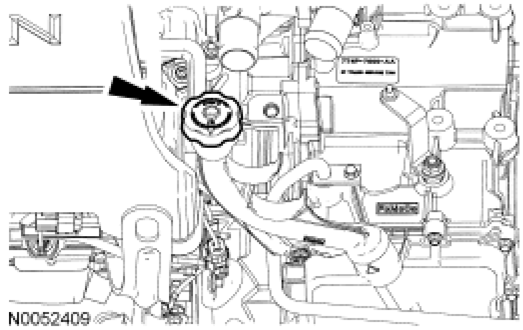


Fig. 241: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

24. Route the coolant hoses to the correct position on the transmission fluid filler tube.

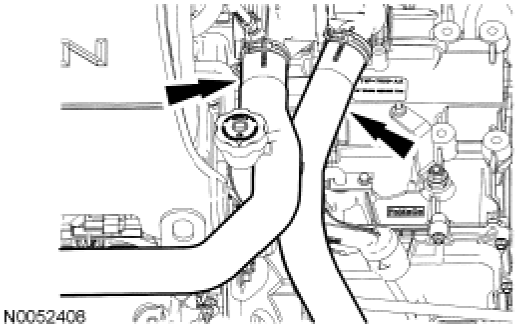


Fig. 242: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

25. Position the ACL assembly in place and install the bolt.
    - Tighten to 11 Nm (97 lb-in).

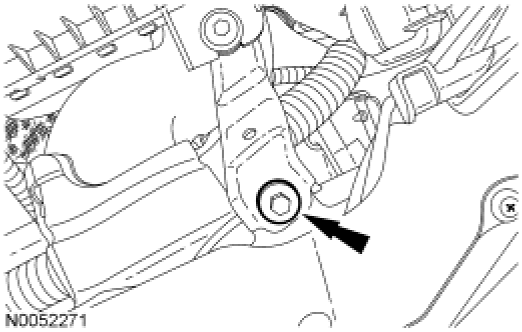


Fig. 243: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

26. Tighten the ACL outlet pipe clamp at the TB.
    - Tighten to 5 Nm (44 lb-in).

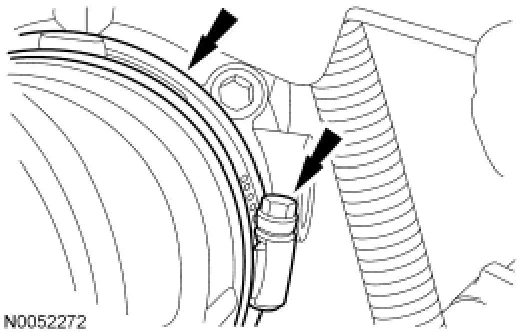


Fig. 244: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

27. Connect the engine breather to the ACL assembly.

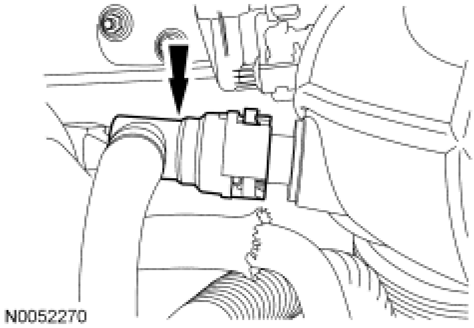


Fig. 245: Locating Engine Breather
Courtesy of FORD MOTOR CO.

28. Connect the brake booster vacuum hose to the ACL assembly.

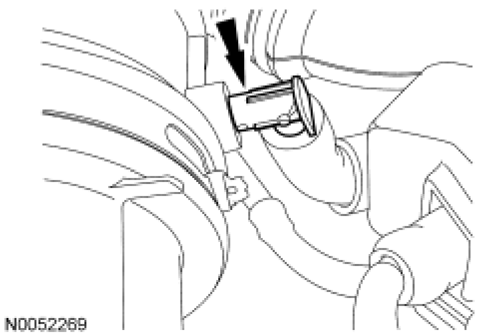


Fig. 246: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

29. Connect the MAF sensor electrical connector and connect the electrical harness fastener.

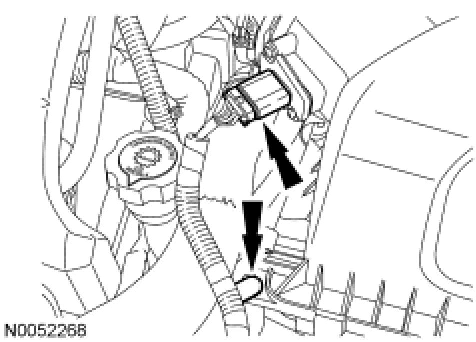
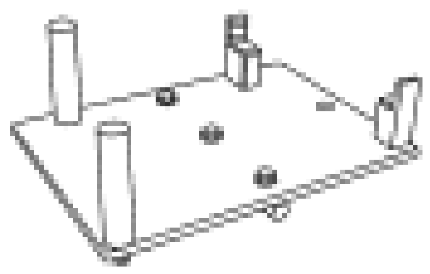


Fig. 247: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

30. Fill with clean transmission fluid to the correct level.

TRANSAXLE SUPPORT INSULATOR

Special Tools

Illustration	Tool Name	Tool Number
	Oil Pan Holding Fixture	303-1295

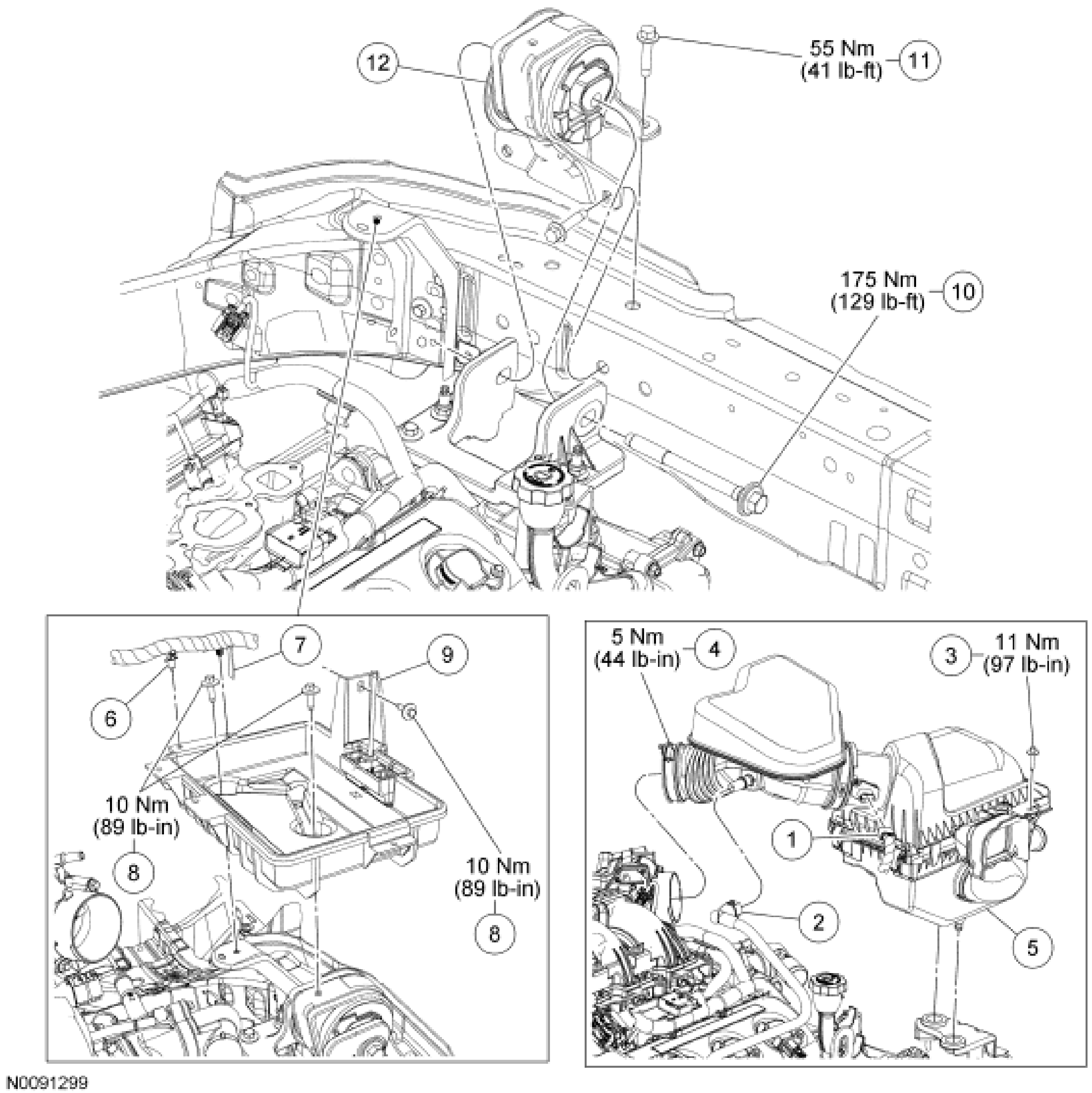


Fig. 248: Replacing Transaxle Support Insulator
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Electrical connector - Mass Air Flow (MAF) sensor
2	6758	Tube assembly - crankcase vent
3	N606678	Bolt - Air Cleaner (ACL) bracket
4	9C632	Clamp - ACL outlet pipe
5	9C662	ACL assembly
6	13A506	Fastener - wiring harness
7	13A506	Fastener - wiring harness
8	W503924	Bolts - battery tray
9	10723	Battery tray

10	W711873	Through bolt - transaxle support insulator
11	W709234	Bolt - transaxle support insulator (4 required)
12	6F020	Transaxle support insulator

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Loosen the exhaust flexible pipe clamp and disconnect the 2 exhaust hangers.

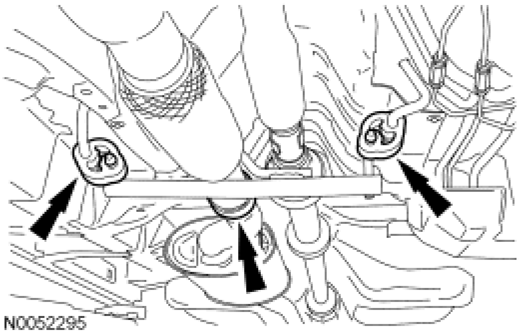


Fig. 249: Locating Exhaust Flexible Pipe Clamp & Exhaust Hangers
Courtesy of FORD MOTOR CO.

3. Remove the 4 nuts and the exhaust flexible pipe and Y-pipe as an assembly.
   - Discard the nuts and the gasket.

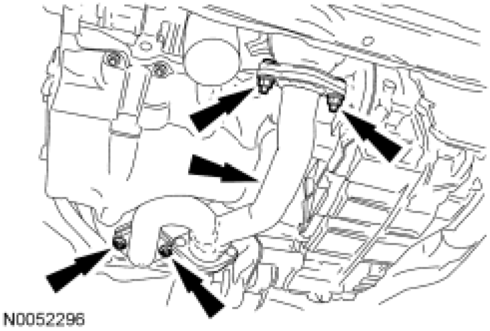


Fig. 250: Locating Exhaust Flexible Pipe, Y-Pipe & Nuts
Courtesy of FORD MOTOR CO.

4. Remove the 2 nuts and the roll restrictor heat shield.

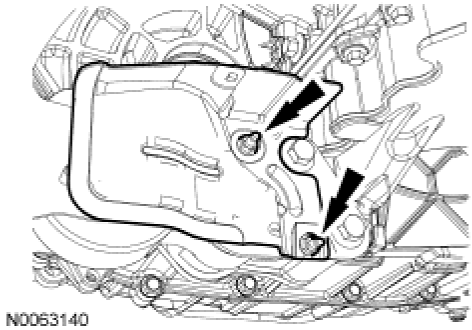


Fig. 251: Locating Roll Restrictor Heat Shield Nuts
Courtesy of FORD MOTOR CO.

5. Loosen the engine roll restrictor-to-subframe through bolt.

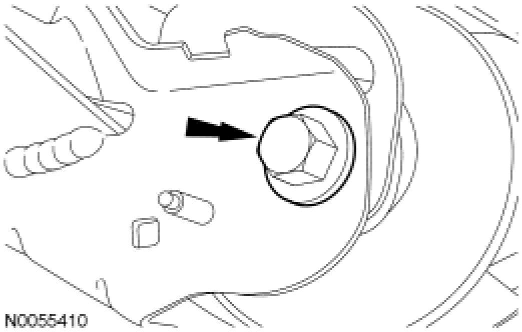


Fig. 252: Locating Roll Restrictor-To-Subframe Bolt
Courtesy of FORD MOTOR CO.

6. Remove the 3 bolts from the roll restrictor bracket.

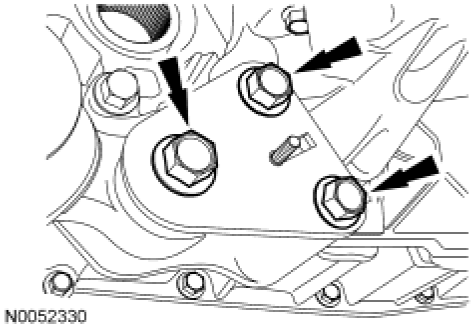
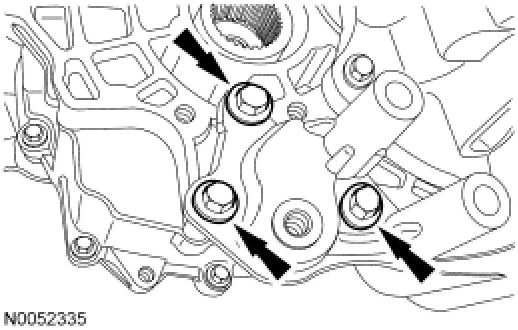


Fig. 253: Locating Roll Restrictor-To-Transaxle Bracket Plate Bolts
Courtesy of FORD MOTOR CO.

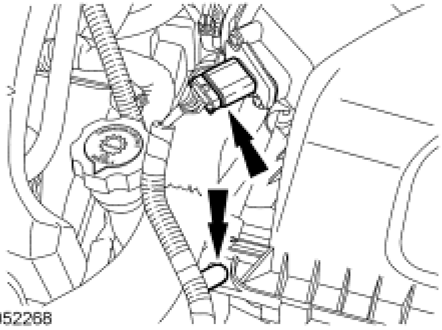
7. Remove the 3 bolts and the roll restrictor bracket.



N0052335

Fig. 254: Locating Transaxle Bracket Bolts
Courtesy of FORD MOTOR CO.

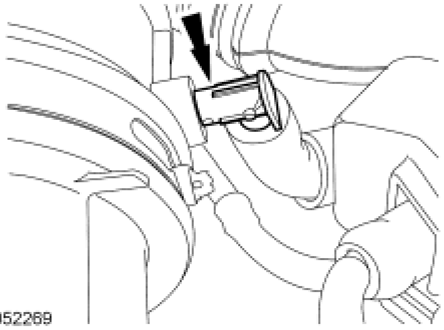
8. Disconnect the Mass Air Flow (MAF) sensor electrical connector and the wiring harness fastener from the Air Cleaner (ACL) assembly.



N0052268

Fig. 255: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

9. Disconnect the brake booster vacuum hose from the ACL outlet pipe.



N0052269

Fig. 256: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

10. Disconnect the engine breather from the ACL assembly.

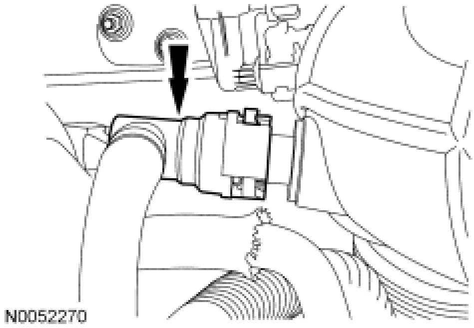


Fig. 257: Locating Engine Breather
Courtesy of FORD MOTOR CO.

11. Remove the ACL assembly bracket bolt.

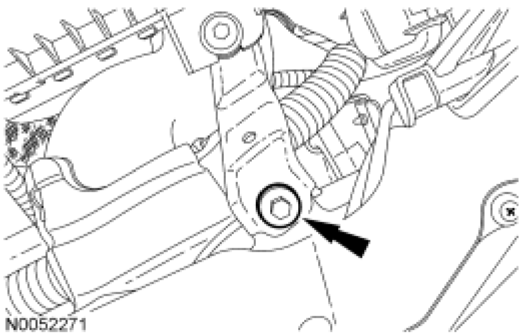


Fig. 258: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

12. Loosen the ACL outlet pipe clamp at the Throttle Body (TB) and remove the ACL and ACL outlet pipe assembly.

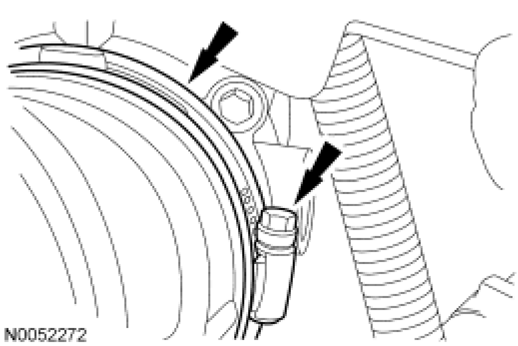


Fig. 259: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

13. Remove the battery. For additional information, refer to **BATTERY, MOUNTING & CABLES** article.
14. Remove the battery tray.
    1. Disconnect the wiring harness fasteners.

2. Remove the 3 bolts and the battery tray.

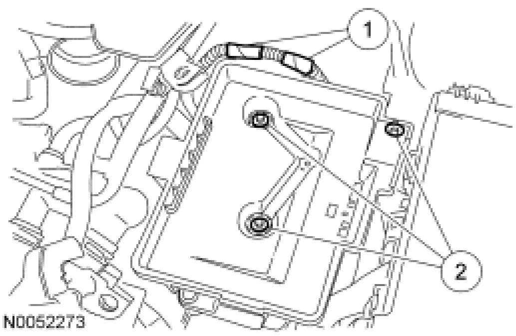


Fig. 260: Identifying Wiring Harness Fasteners, Battery Tray & Bolts
Courtesy of FORD MOTOR CO.

NOTE: The Oil Pan Holding Fixture must be carefully aligned to the mounting bosses on the oil pan. Failure to follow these instructions may result in damage to the oil pan.

NOTE: The Oil Pan Holding Fixture and floor jack are used to raise and lower the engine to access the engine front cover and engine mount bracket fasteners.

15. Position a floor jack and the Oil Pan Holding Fixture under the oil pan and raise the floor jack high enough to release the pressure on the transaxle support insulator.

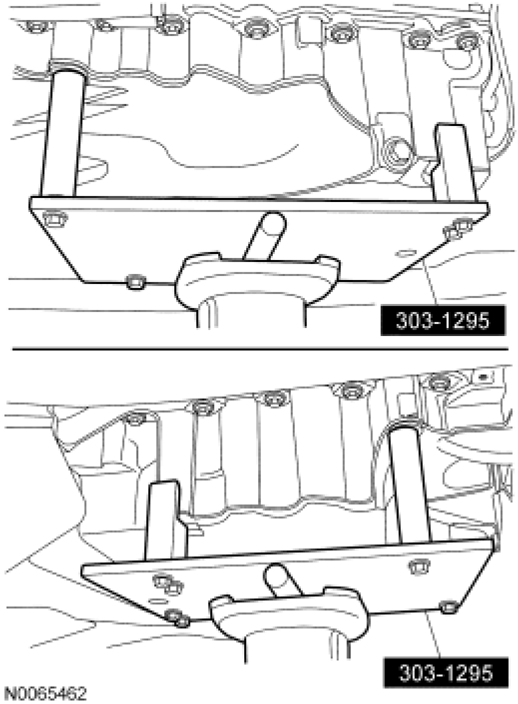


Fig. 261: Positioning Floor Jack & Special Tool (303-1295) Under Oil Pan
Courtesy of FORD MOTOR CO.

16. Remove the transaxle support insulator through bolt.

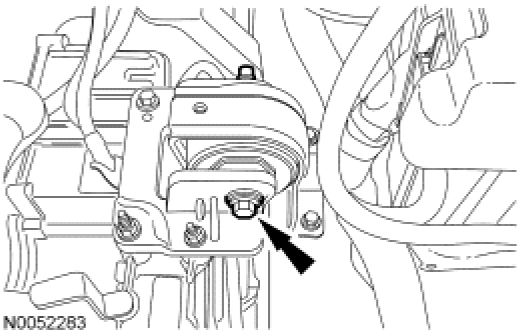


Fig. 262: Identifying Transaxle Support Insulator Bolt
Courtesy of FORD MOTOR CO.

17. Remove the 3 nuts, the bolt and the transaxle support insulator bracket.

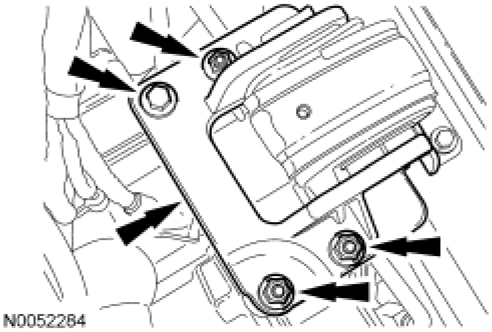


Fig. 263: Identifying Transaxle Support Insulator Bracket, Nuts & Bolts
Courtesy of FORD MOTOR CO.

18. Lower the jack until the transmission fluid cooler tube clears the lower transmission support insulator bolts.
19. Loosen the battery tray support bracket bolts.

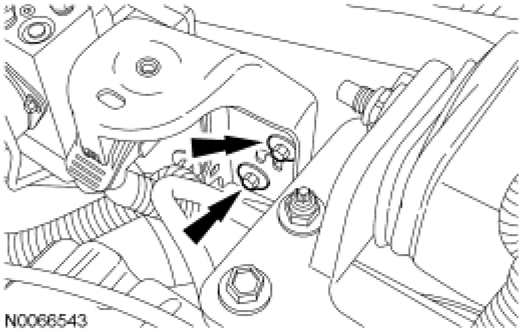


Fig. 264: Identifying Battery Tray Support Bracket Bolts
Courtesy of FORD MOTOR CO.

20. Remove the top transaxle support insulator bolts.

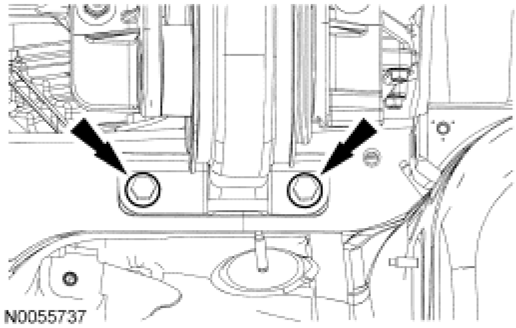


Fig. 265: Identifying Top Transaxle Support Insulator Bolts
Courtesy of FORD MOTOR CO.

21. Remove the bottom transaxle support insulator bolts.

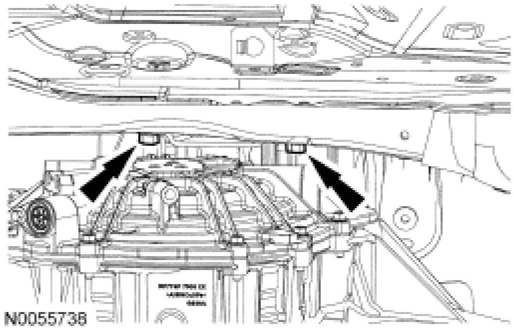


Fig. 266: Identifying Bottom Transaxle Support Insulator Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Install the bottom transaxle support insulator bolts.
   - Tighten to 55 Nm (41 lb-ft).

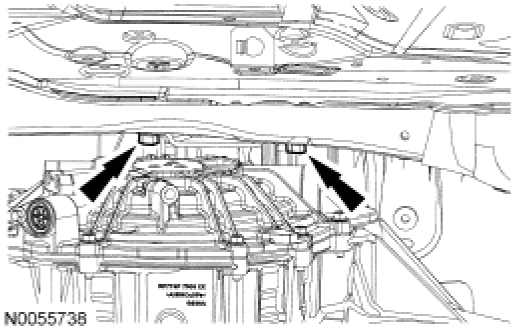


Fig. 267: Identifying Bottom Transaxle Support Insulator Bolts
Courtesy of FORD MOTOR CO.

2. Install the top transaxle support insulator bolts.
   - Tighten to 55 Nm (41 lb-ft).

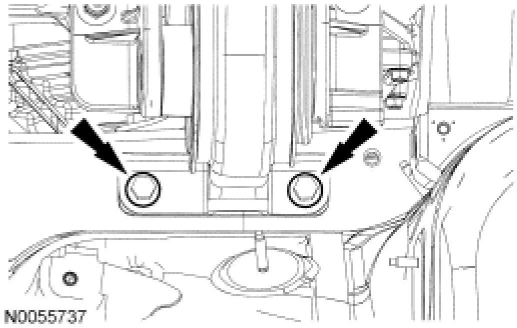


Fig. 268: Identifying Top Transaxle Support Insulator Bolts
Courtesy of FORD MOTOR CO.

3. Tighten the battery tray support bracket bolts.
   - Tighten to 10 Nm (89 lb-in).

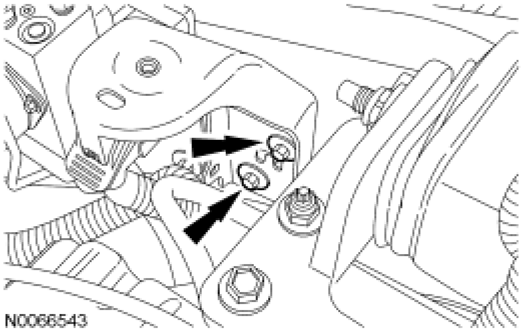


Fig. 269: Identifying Battery Tray Support Bracket Bolts
Courtesy of FORD MOTOR CO.

4. Using the jack and the Oil Pan Holding Fixture, lift the transaxle into place.

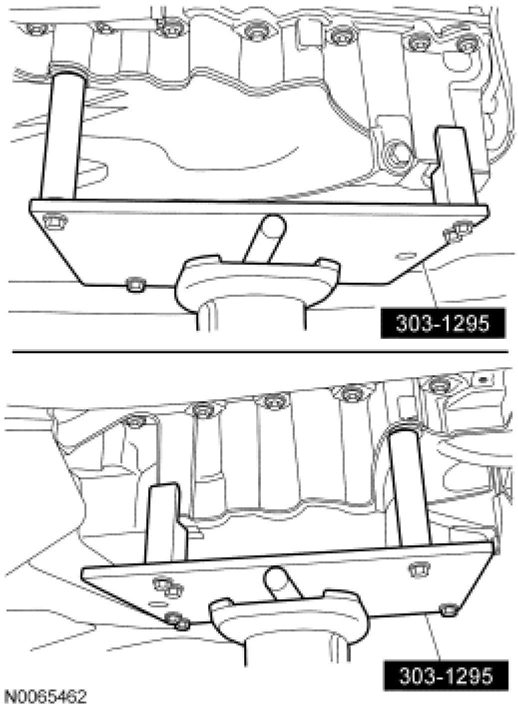


Fig. 270: Positioning Floor Jack & Special Tool (303-1295) Under Oil Pan
Courtesy of FORD MOTOR CO.

5. Install the transaxle support insulator bracket, bolt and the 3 nuts.
   - Tighten the transaxle support insulator bracket nuts to 63 Nm (46 lb-ft).
   - Tighten the transaxle support insulator bracket bolt to 63 Nm (46 lb-ft).

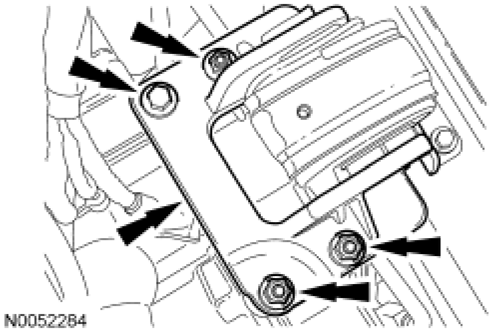


Fig. 271: Identifying Transaxle Support Insulator Bracket, Nuts & Bolts
Courtesy of FORD MOTOR CO.

6. Install the transaxle support insulator through bolt.
   - Tighten to 175 Nm (129 lb-ft).

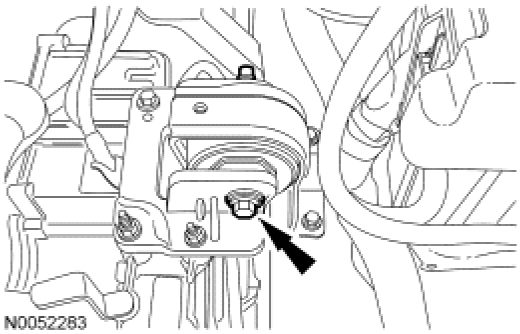


Fig. 272: Identifying Transaxle Support Insulator Bolt
Courtesy of FORD MOTOR CO.

7. Install the battery tray.
    1. Install the 3 bolts.
        - Tighten to 10 Nm (89 lb-in).
    2. Connect the wiring harness fasteners to the battery tray.

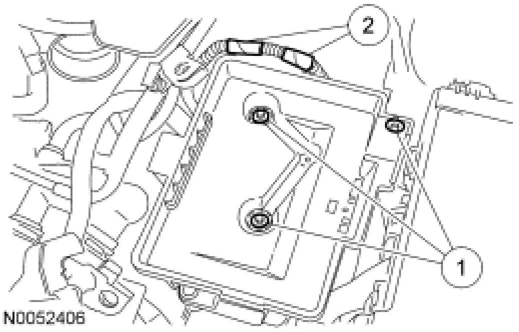


Fig. 273: Identifying Wiring Harness Fasteners, Battery Tray & Bolts
Courtesy of FORD MOTOR CO.

8. Install the battery. For additional information, refer to **BATTERY, MOUNTING & CABLES** article.
9. Position the ACL assembly in place and install the bolt.
    - Tighten to 11 Nm (97 lb-in).

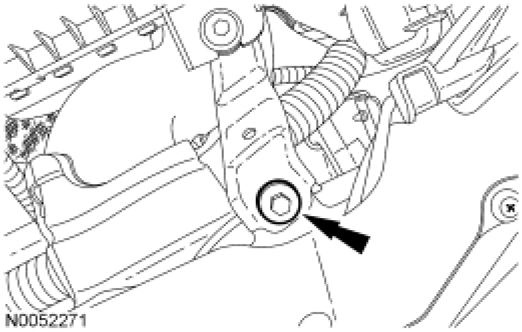


Fig. 274: Locating Air Cleaner Assembly Bracket Bolt

Courtesy of FORD MOTOR CO.

10. Tighten the ACL outlet pipe clamp at the TB.
    - Tighten to 5 Nm (44 lb-in).

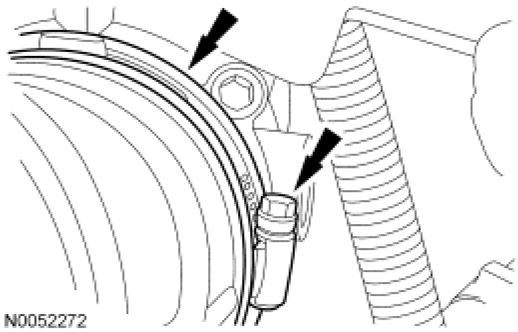


Fig. 275: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

11. Connect the engine breather to the ACL assembly.

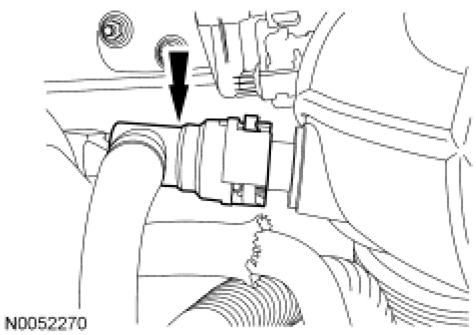


Fig. 276: Locating Engine Breather
Courtesy of FORD MOTOR CO.

12. Connect the brake booster vacuum hose to the ACL assembly.

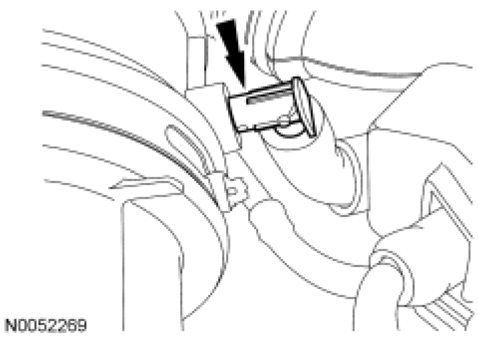


Fig. 277: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

13. Connect the MAF sensor electrical connector and connect the electrical harness fastener.

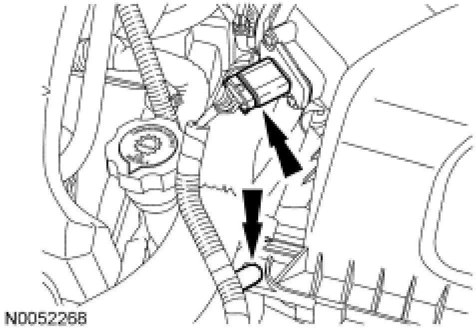


Fig. 278: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

14. Position the roll restrictor bracket on the transaxle and install the 3 bolts.
    - Tighten to 90 Nm (66 lb-ft).

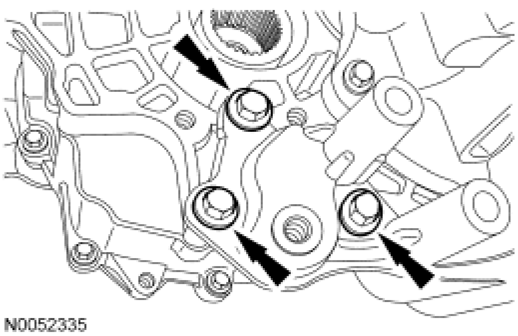


Fig. 279: Locating Transaxle Bracket Bolts
Courtesy of FORD MOTOR CO.

15. Position the roll restrictor in place, install the bracket and the 3 bolts.
    - Tighten to 90 Nm (66 lb-ft).

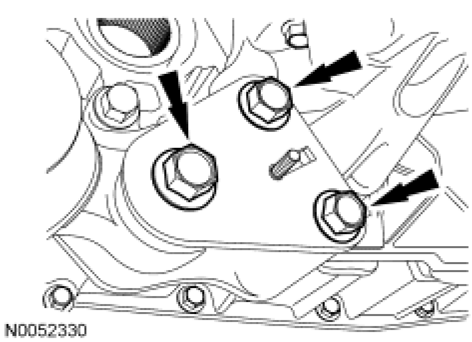


Fig. 280: Locating Roll Restrictor-To-Transaxle Bracket Plate Bolts
Courtesy of FORD MOTOR CO.

16. Install the engine roll restrictor-to-subframe through bolt.
    - Tighten to 103 Nm (76 lb-ft).

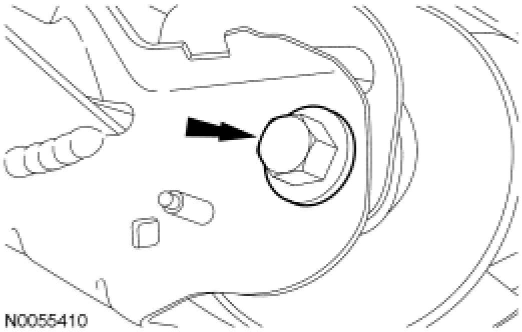


Fig. 281: Locating Roll Restrictor-To-Subframe Bolt
Courtesy of FORD MOTOR CO.

17. Install the roll restrictor heat shield and the 2 nuts.
    - Tighten to 11 Nm (97 lb-in).

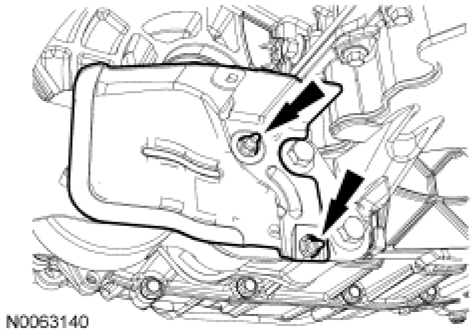


Fig. 282: Locating Roll Restrictor Heat Shield Nuts
Courtesy of FORD MOTOR CO.

18. Position the exhaust Y-pipe assembly in place and install a new gasket and 4 new nuts.
    - Tighten to 40 Nm (30 lb-ft).

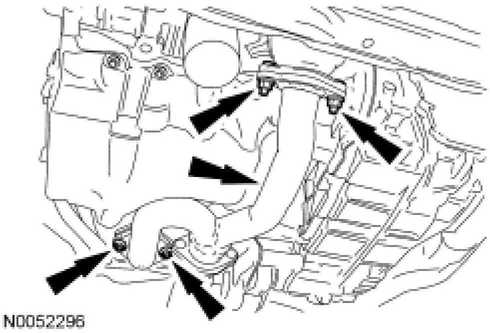


Fig. 283: Locating Exhaust Flexible Pipe, Y-Pipe & Nuts

Courtesy of FORD MOTOR CO.

19. Install the 2 exhaust hangers and tighten the exhaust clamp.
    - Tighten to 40 Nm (30 lb-ft).

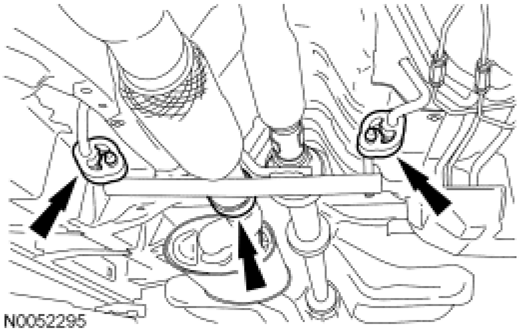


Fig. 284: Locating Exhaust Flexible Pipe Clamp & Exhaust Hangers
Courtesy of FORD MOTOR CO.

20. Check the transmission fluid level and fill with clean transmission fluid to the correct level.

SOLENOID BODY ASSEMBLY

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

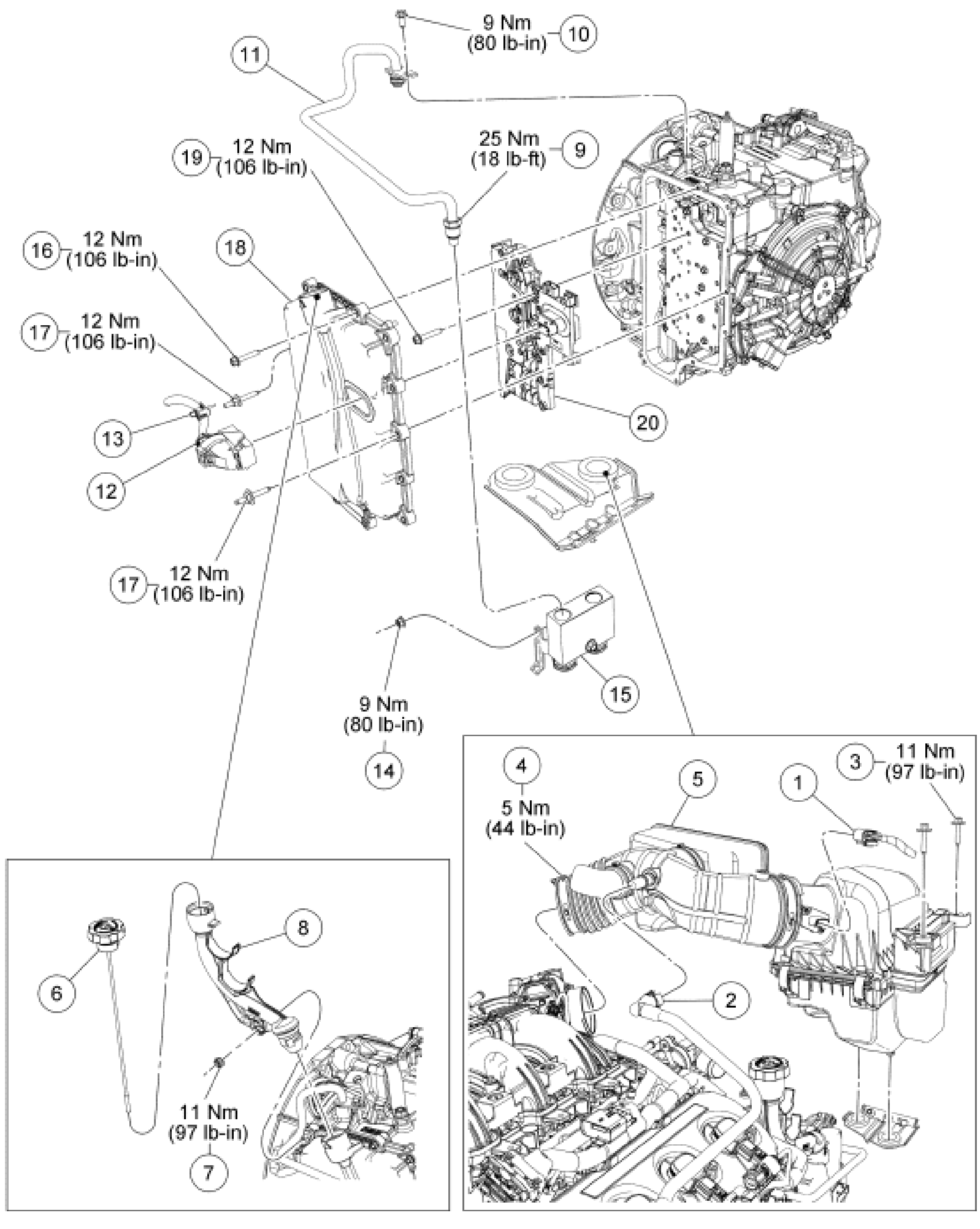


Fig. 285: Main Control & Solenoid Body Components (With Torque Specifications)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Electrical connector - Mass Air Flow (MAF) sensor
2	6758	Tube assembly - crankcase vent

3	N606678	Bolt - Air Cleaner (ACL) bracket
4	9C632	Clamp - ACL outlet pipe
5	9C662	ACL assembly
6	7A020	Transmission fluid level indicator
7	W520101	Transmission fluid filler tube nut
8	7A228	Transmission fluid filler tube
9	-	Nut - transmission fluid cooler tube (part of 7H420)
10	W711538	Bolt - transmission fluid cooler tube-to-transaxle
11	7H420	Tube - transmission fluid cooler
12	7A488	Connector - transaxle harness
13	14A169	Retainer - transaxle harness
14	W520101	Nut - bypass valve
15	7H322	Valve - transaxle fluid cooler bypass
16	7J289	Bolt - solenoid body cover (11 required)
17	W708442	Studbolt - solenoid body cover (3 required)
18	7G004	Cover - solenoid body
19	7J291	Bolt - solenoid body
20	7Z369	Solenoid body

REMOVAL

NOTE: **The PCM must be updated with a new solenoid body strategy data file and solenoid body identification anytime a new solenoid body is installed. A new solenoid body service tag must be installed over the current solenoid body service tag on top of the transaxle case.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Disconnect the Mass Air Flow (MAF) sensor electrical connector and the wiring harness fastener from the Air Cleaner (ACL) assembly.

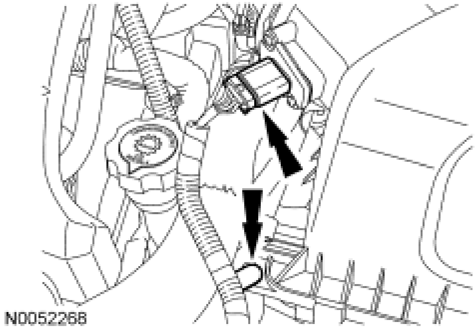


Fig. 286: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

3. Disconnect the brake booster vacuum hose from the ACL outlet pipe.

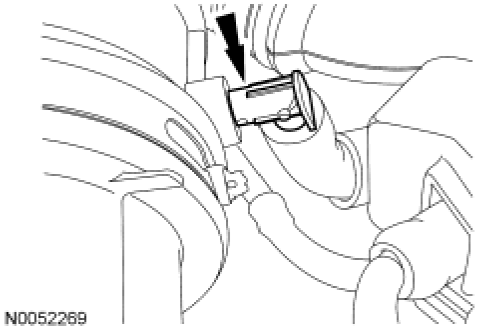


Fig. 287: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

4. Disconnect the engine breather from the ACL assembly.

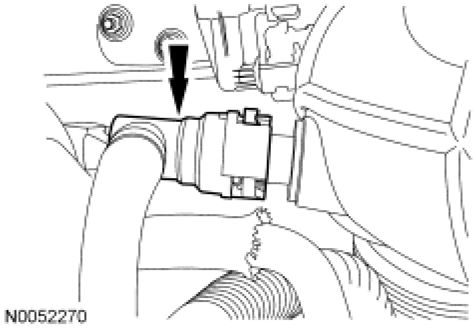


Fig. 288: Locating Engine Breather
Courtesy of FORD MOTOR CO.

5. Remove the ACL assembly bracket bolt.

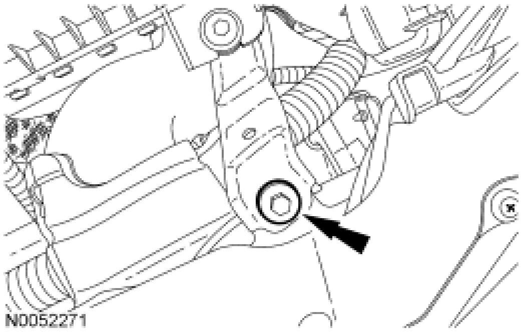


Fig. 289: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

6. Loosen the ACL outlet pipe clamp at the Throttle Body (TB) and remove the ACL and ACL outlet pipe assembly.

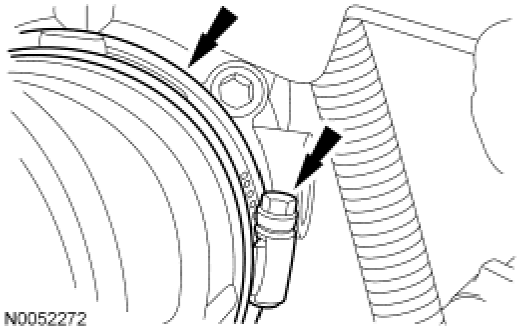


Fig. 290: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

7. Remove the transmission fluid drain plug and allow the transmission fluid to drain.

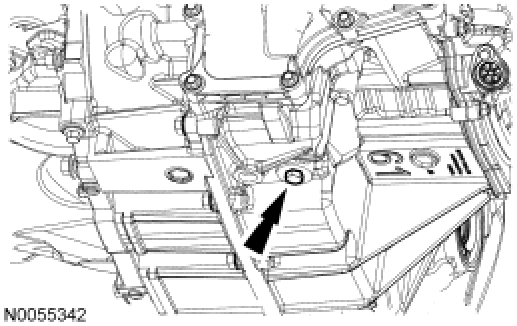


Fig. 291: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

8. Install the transmission fluid drain plug.
   - Tighten to 9 Nm (80 lb-in).

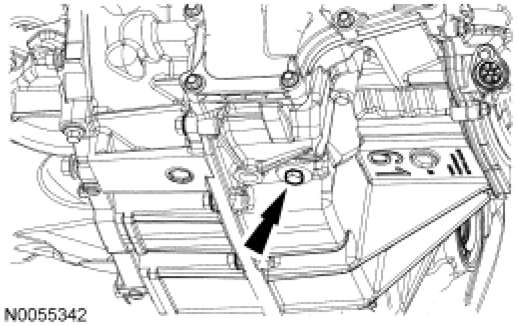


Fig. 292: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses do not need to be removed from the engine.

9. Remove the coolant hoses from the transmission fluid filler tube and position aside.

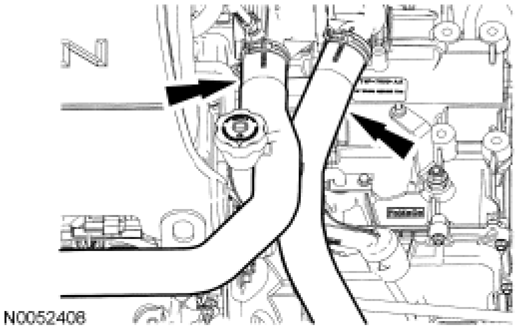


Fig. 293: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

10. Remove the transmission fluid level indicator.

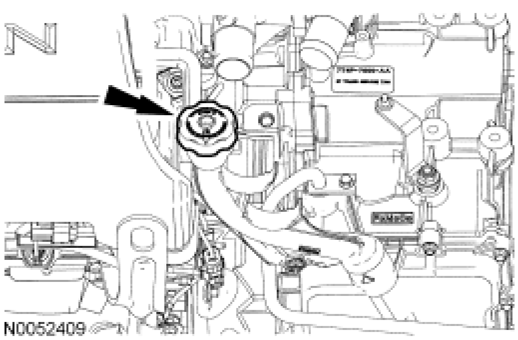


Fig. 294: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

11. Remove the nut, rotate the transmission fluid filler tube counterclockwise 90 degrees and remove the transmission fluid filler tube.

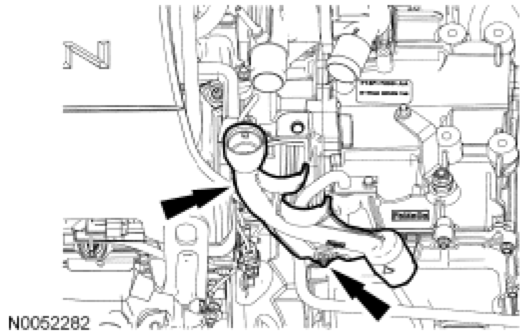


Fig. 295: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

12. Loosen the transmission fluid cooler tube fitting from the thermal bypass valve.

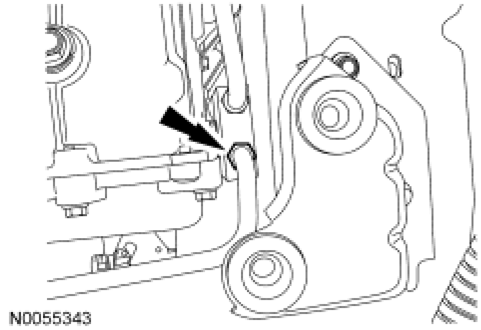


Fig. 296: Identifying Transmission Fluid Cooler Tube Fitting From Thermal Bypass Valve
Courtesy of FORD MOTOR CO.

13. Remove and discard the transmission fluid cooler tube bolt and remove the transmission fluid cooler tube.

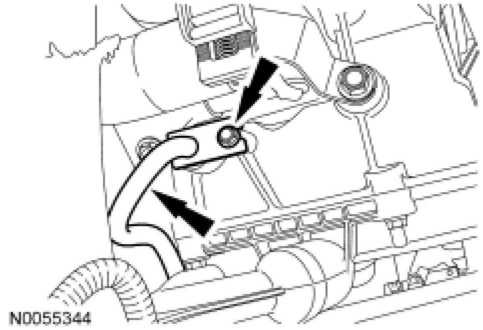


Fig. 297: Identifying Transmission Fluid Cooler Tube Bolt
Courtesy of FORD MOTOR CO.

14. Inspect the transaxle case to make sure that the transmission fluid cooler tube seal and backing ring were removed with the transmission fluid cooler tube and are not stuck in the transaxle case. If the transmission fluid cooler tube seal or backing ring are stuck in the transaxle case, remove the seal and backing ring.

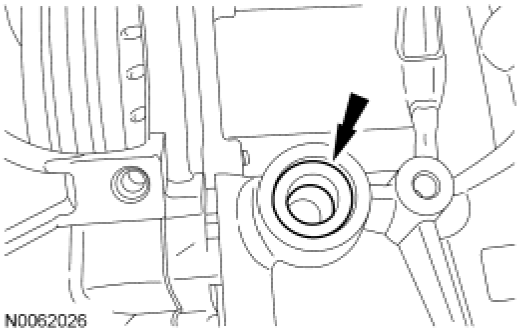


Fig. 298: Identifying Transmission Fluid Cooler Tube Seal
Courtesy of FORD MOTOR CO.

15. Disconnect the transaxle electrical connector.

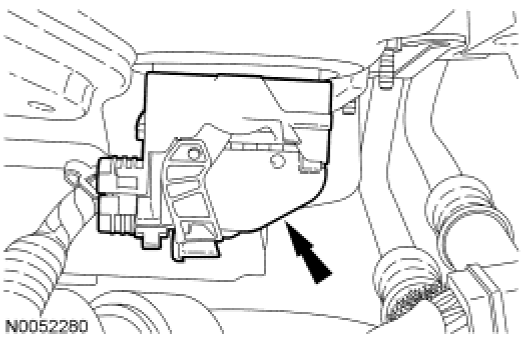


Fig. 299: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

16. Remove the 2 transmission fluid cooler thermal bypass valve nuts, pull the transmission fluid cooler thermal bypass valve straight up and position it aside.

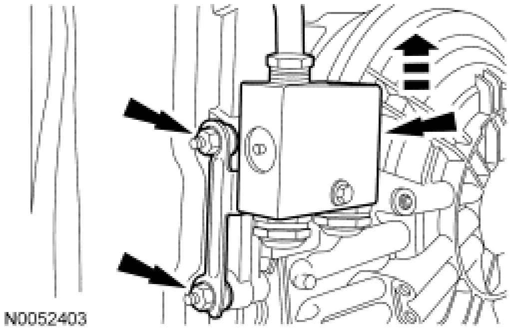


Fig. 300: Removing Nuts & Pulling Transmission Fluid Cooler Thermal Bypass Valve Straight Up
Courtesy of FORD MOTOR CO.

NOTE: Note the location of the studbolts for assembly.

17. Remove the 14 bolts and the main control cover.

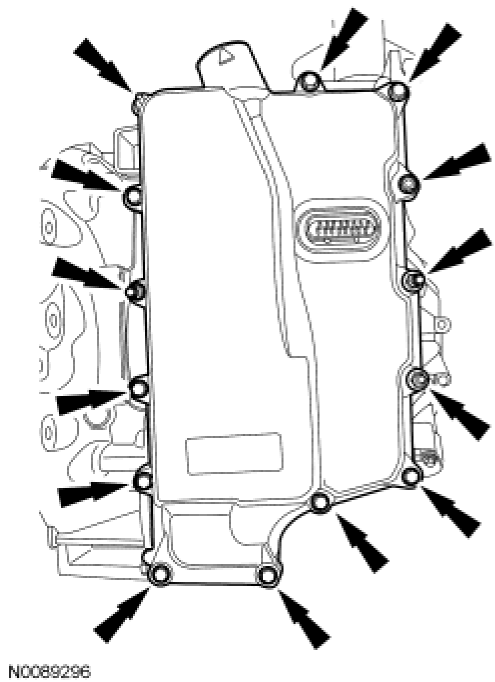


Fig. 301: Main Control Valve Cover Bolts
Courtesy of FORD MOTOR CO.

18. Disconnect the Transmission Range (TR) sensor electrical connector.
    1. Slide the lock over.
    2. Press the tab and disconnect the connector.

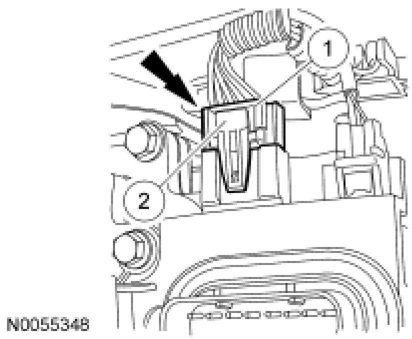


Fig. 302: Pressing Tab & Disconnecting Connector
Courtesy of FORD MOTOR CO.

19. Disconnect the Turbine Shaft Speed (TSS) and Output Shaft Speed (OSS) sensor electrical connectors.

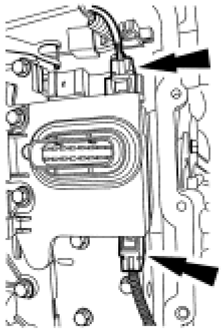


Fig. 303: Locating Turbine Shaft Speed (TSS) & Output Shaft Speed (OSS) Sensor Electrical Connectors
Courtesy of FORD MOTOR CO.

NOTE: The solenoid body should be handled with care, damage to the solenoid body may occur.

NOTE: Note the location of the different length bolts for assembly.

20. Remove the 11 bolts and the solenoid body.

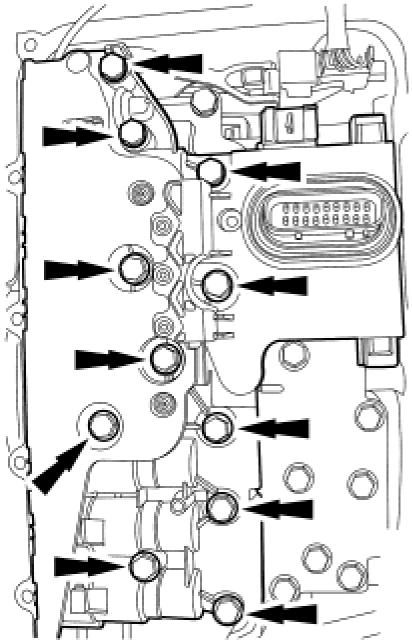


Fig. 304: Locating Solenoid Body Bolts
Courtesy of FORD MOTOR CO.

NOTE: Do not handle the solenoid body in the leadframe area or by the screens of

the solenoid body filter or damage to the solenoid body can occur.

NOTE: Use care not to break the alignment tabs when installing the solenoid body filter. Damage to the transaxle will occur if the solenoid body is not correctly aligned.

21. Remove the solenoid body filter assembly by pulling it straight up from the alignment tabs. Discard the filter.

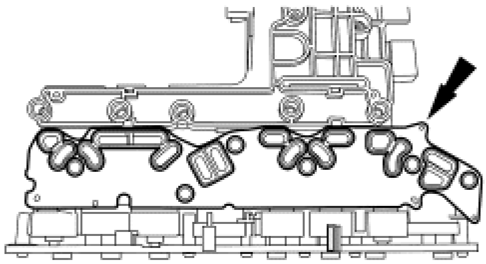


Fig. 305: Identifying Solenoid Body Filter Assembly
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: Do not handle the solenoid body in the leadframe area or by the screens of the solenoid body filter or damage to the solenoid body can occur.

NOTE: Use care not to break the alignment tabs when installing the solenoid body filter. Damage to the transaxle will occur if the solenoid body is not correctly aligned.

NOTE: Make sure that the filter passage areas are clean of foreign material before installing the filter. Damage to the transaxle will occur if the filter passages are not clean.

1. Install a new solenoid body filter assembly by pushing it straight down on to the alignment tabs.

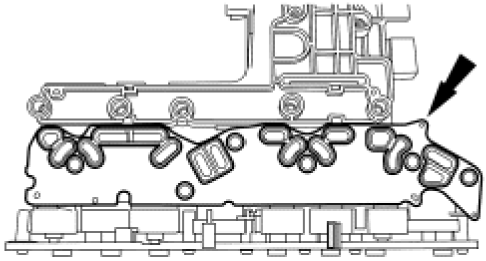


Fig. 306: Identifying Solenoid Body Filter Assembly
Courtesy of FORD MOTOR CO.

NOTE:	**Make sure not to pinch the Turbine Shaft Speed (TSS), Output Shaft Speed (OSS) or Transmission Range (TR) sensor wiring harnesses when installing the solenoid body. Damage to the wiring harness will occur.**

NOTE:	**Install the different length bolts in the locations noted during disassembly.**

2. Install the solenoid body and the 11 bolts.
   1. 42 mm (1.65 in) bolt
   2. 63 mm (2.48 in) bolts
   3. 80 mm (3.14 in) bolts
   4. 95 mm (3.74 in) bolts

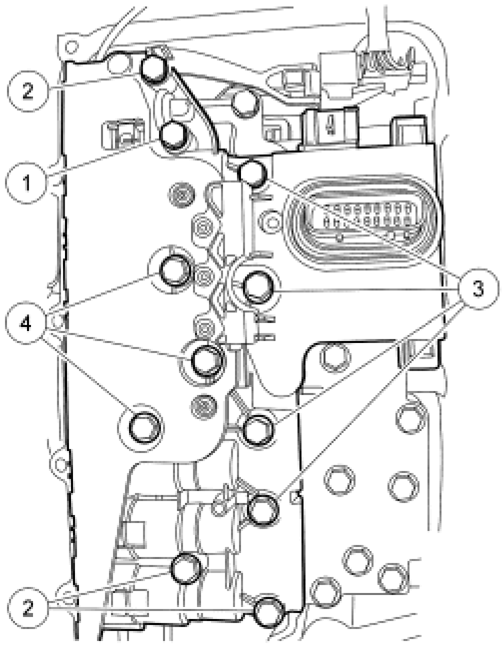


Fig. 307: Locating Solenoid Body Bolts
Courtesy of FORD MOTOR CO.

3. Tighten the solenoid body bolts in the sequence shown.
   - Tighten to 12 Nm (106 lb-in).

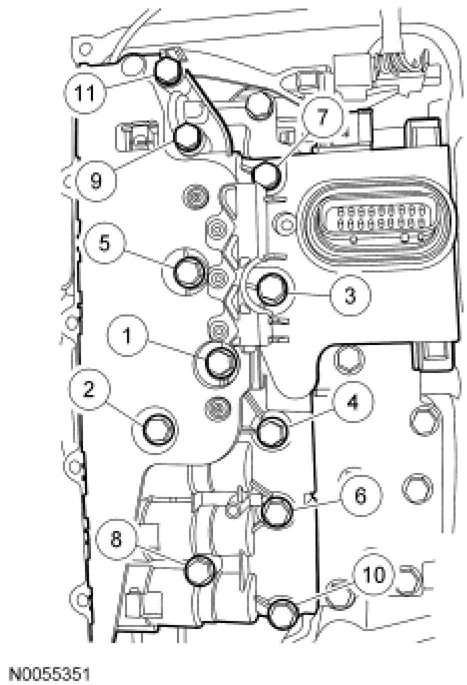


Fig. 308: Tightening Solenoid Body Bolts In Sequence
Courtesy of FORD MOTOR CO.

4. Route the OSS sensor wiring harness and connect the electrical connector.

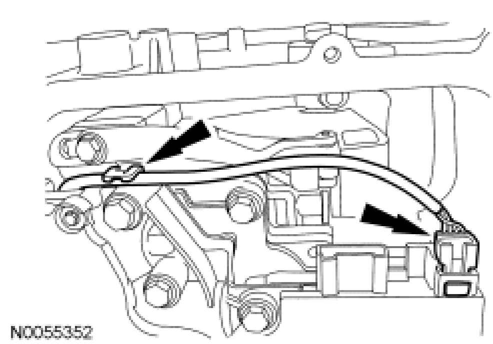


Fig. 309: Locating OSS Sensor Wiring Harness & Electrical Connector
Courtesy of FORD MOTOR CO.

5. Connect the TR sensor electrical connector.
   1. Connect the electrical connector.

2. Slide the locking tab over.

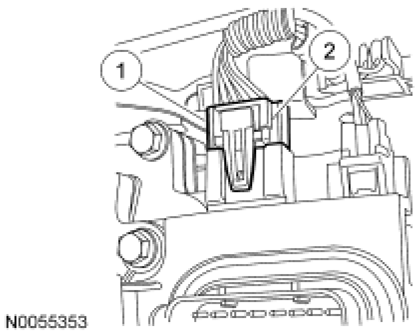


Fig. 310: Identifying TR Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

6. Connect the TSS sensor electrical connector.

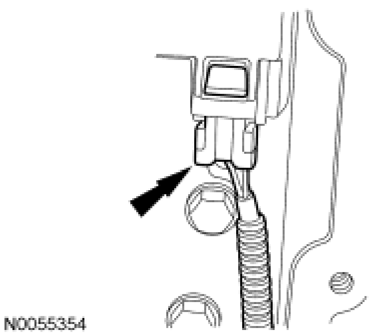


Fig. 311: Identifying TSS Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

7. Inspect the transaxle main control cover seal for damage and install new if necessary.

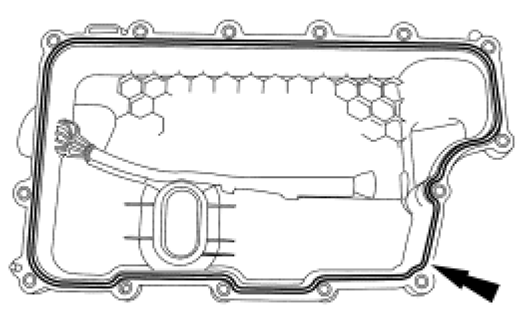


Fig. 312: Inspecting Transaxle Main Control Cover Seal For Damage
Courtesy of FORD MOTOR CO.

NOTE:	**Inspect the 20-pin solenoid body connector seal to make sure that the seal is on the inside of the main control cover or a transmission fluid leak will**

occur resulting in transmission damage.

NOTE: Install the studbolts in the locations noted during disassembly.

8. Install the main control cover and loosely install the 14 bolts.
    1. Bolt location
    2. Studbolt location

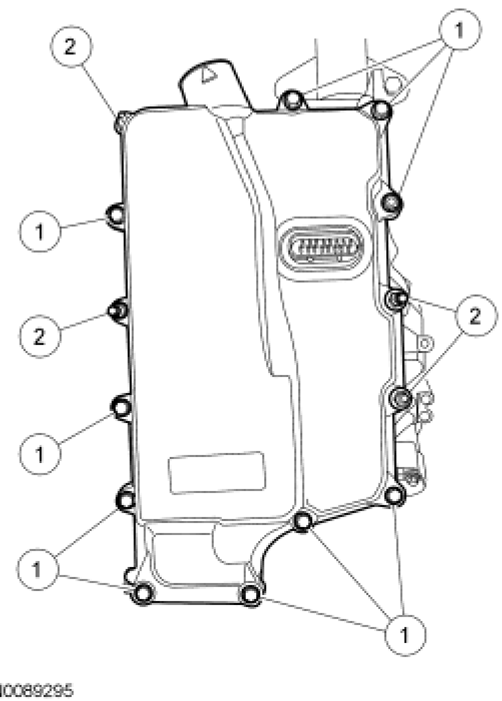


Fig. 313: Main Control Cover Bolts
Courtesy of FORD MOTOR CO.

9. Tighten the main control cover bolts in the sequence shown.
    - Tighten to 12 Nm (106 lb-in).

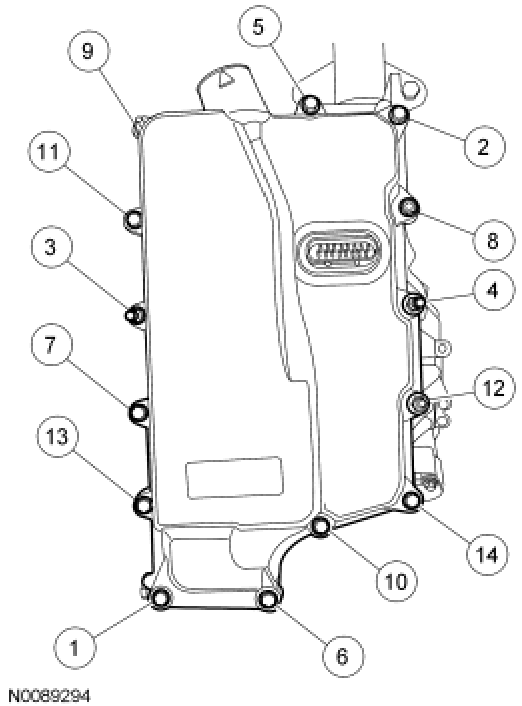


Fig. 314: Main Control Cover Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

10. Wipe the surface of the existing solenoid body strategy tag on top of the transaxle case clean and install the new solenoid body strategy tag (supplied with the solenoid body service kit) over it.

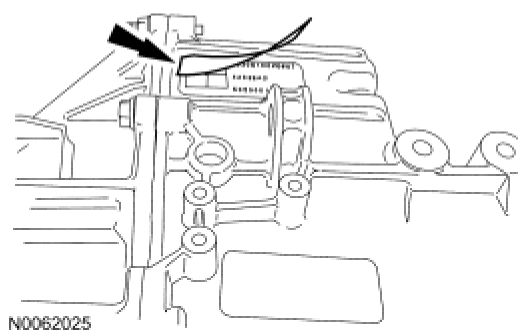


Fig. 315: Installing New Solenoid Body Strategy Tag Over Existing Solenoid Body Strategy Tag
Courtesy of FORD MOTOR CO.

11. Position the transmission fluid cooler thermal bypass valve and transmission fluid cooler tube assembly in place and install the 2 transmission fluid cooler thermal bypass valve bracket nuts.
    - Tighten to 9 Nm (80 lb-in).

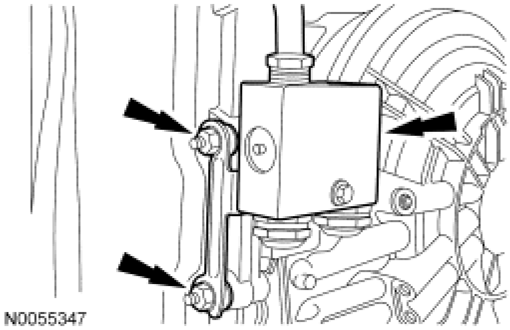


Fig. 316: Identifying Transmission Fluid Cooler Tube Assembly & Nuts
Courtesy of FORD MOTOR CO.

12. Connect the transaxle electrical connector.

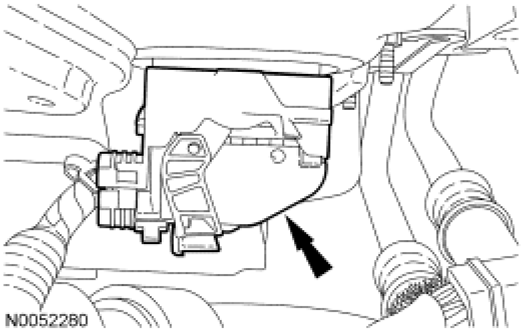


Fig. 317: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

13. Inspect the transmission fluid cooler tube backing ring and seal for damage and install a new backing ring or seal if necessary. Lubricate the transmission fluid cooler tube seal with clean transmission fluid and install the backing ring and seal on the transmission fluid cooler tube.

Item	Part Number	Description
1	7D285	Seal
2	7J324	Backing ring

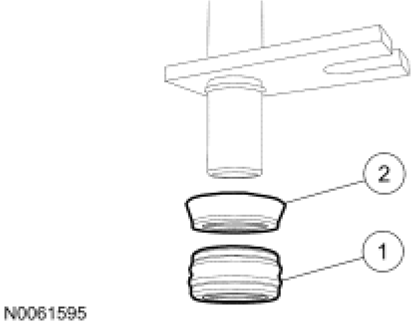


Fig. 318: Identifying Transmission Fluid Cooler Tube Backing Ring & Seal

Courtesy of FORD MOTOR CO.

14. Position the transmission fluid cooler tube in place and install a new bolt.
    - Tighten to 9 Nm (80 lb-in).

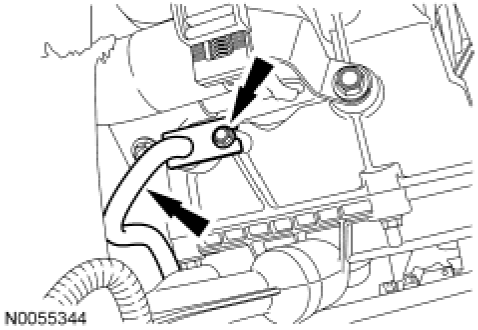


Fig. 319: Identifying Transmission Fluid Cooler Tube Bolt
Courtesy of FORD MOTOR CO.

15. Tighten the transmission fluid cooler tube fitting.
    - Tighten to 25 Nm (18 lb-ft).

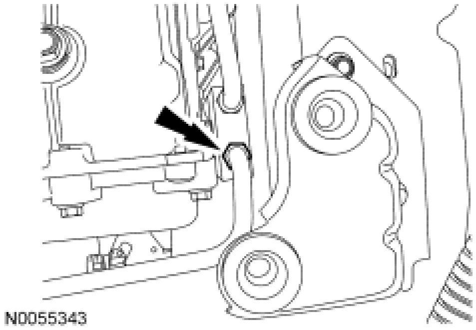


Fig. 320: Identifying Transmission Fluid Cooler Tube Fitting From Thermal Bypass Valve
Courtesy of FORD MOTOR CO.

16. Install the transmission fluid filler tube and the nut.
    - Tighten to 11 Nm (97 lb-in).

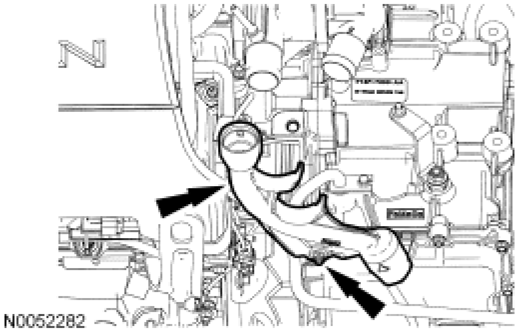


Fig. 321: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

17. Install the transmission fluid level indicator.

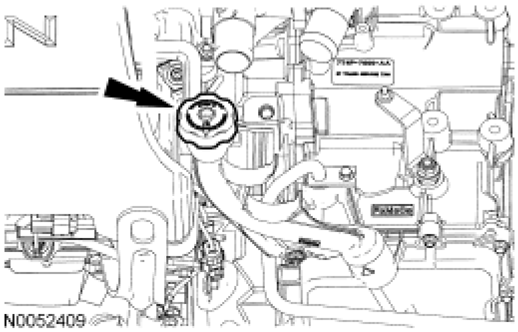


Fig. 322: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

18. Route the coolant hoses in the transmission fluid filler tube.

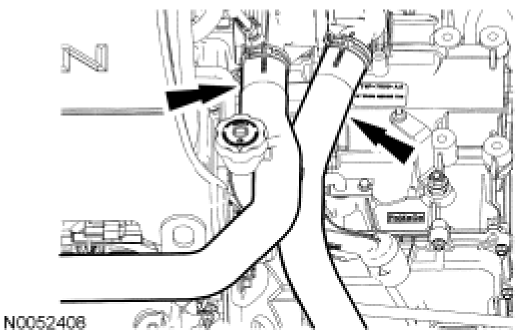


Fig. 323: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

19. Position the ACL assembly in place and install the bolt.
    - Tighten to 11 Nm (97 lb-in).

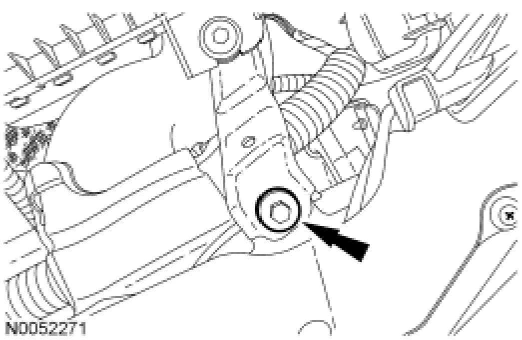


Fig. 324: Locating Air Cleaner Assembly Bracket Bolt

Courtesy of FORD MOTOR CO.

20. Tighten the ACL outlet pipe clamp at the TB.
    - Tighten to 5 Nm (44 lb-in).

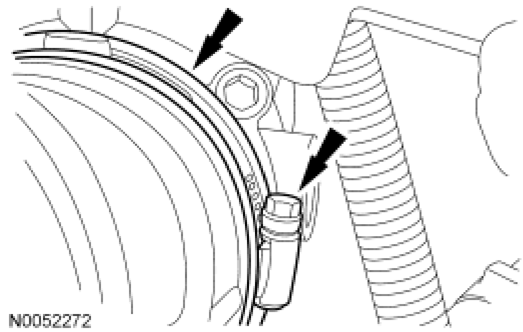


Fig. 325: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

21. Connect the engine breather to the ACL assembly.

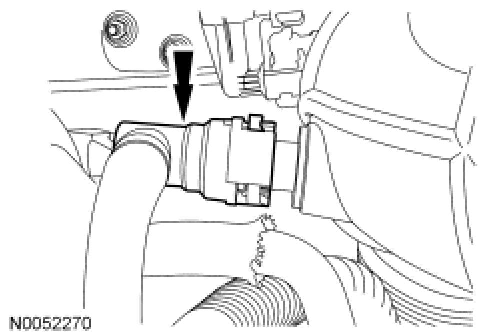


Fig. 326: Locating Engine Breather
Courtesy of FORD MOTOR CO.

22. Connect the brake booster vacuum hose to the ACL assembly.

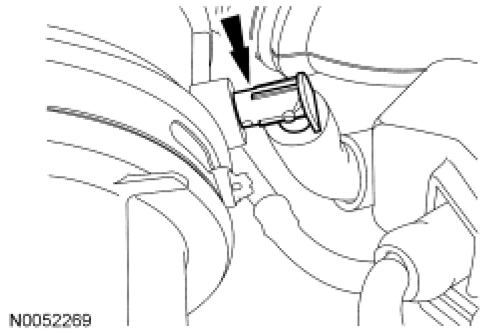


Fig. 327: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

23. Connect the MAF sensor electrical connector and connect the electrical harness fastener.

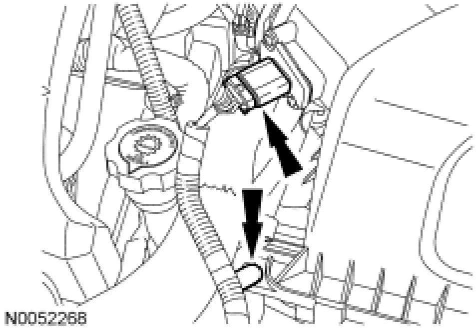


Fig. 328: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

24. Fill with clean transmission fluid to the correct level.
25. Download a new solenoid body strategy to the PCM. Refer to **Solenoid Body Strategy**.

MAIN CONTROL COVER

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

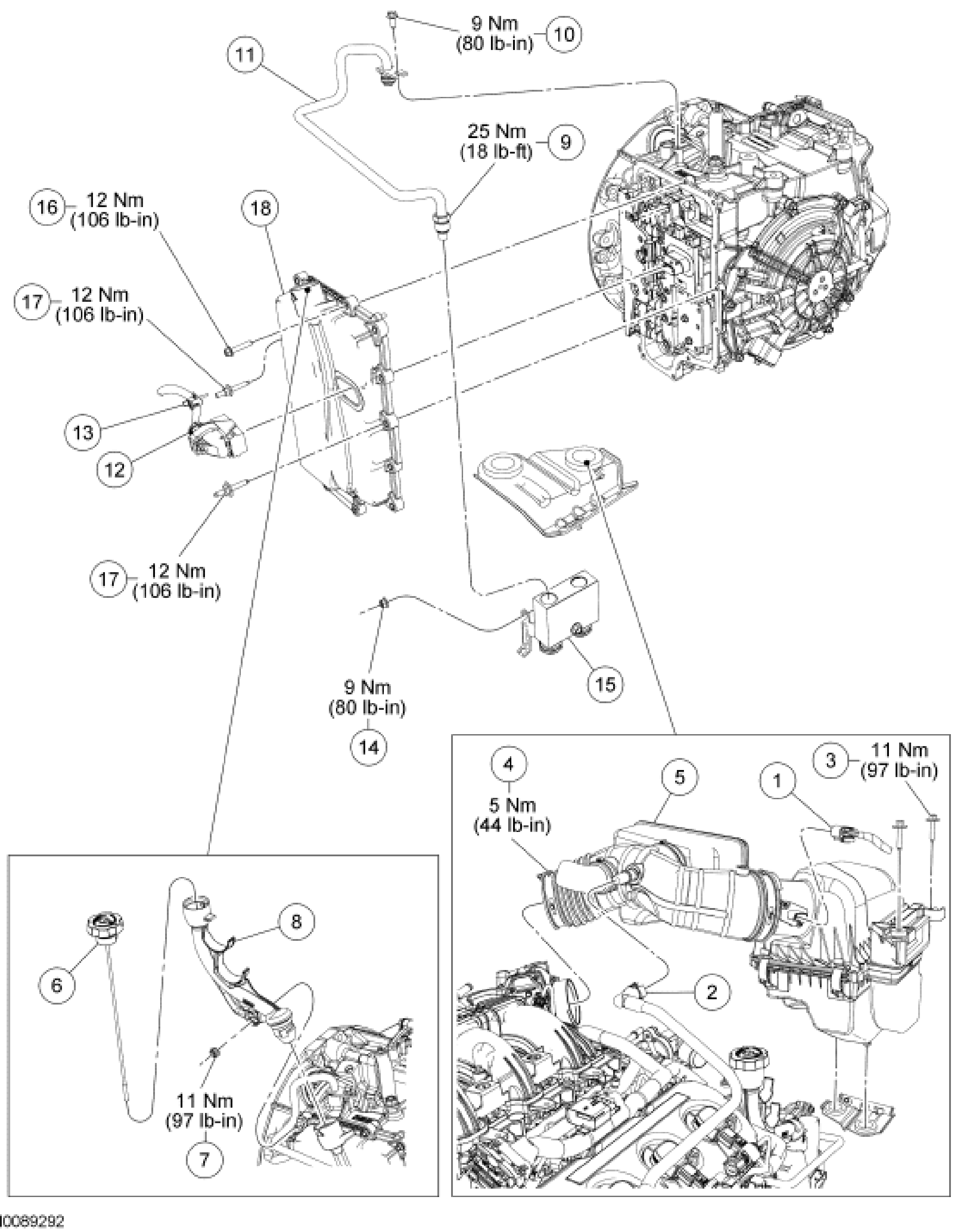


Fig. 329: Main Control & Solenoid Body Components (With Torque Specifications)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Electrical connector - Mass Air Flow (MAF) sensor
2	6758	Tube assembly - crankcase vent

3	N606678	Bolt - Air Cleaner (ACL) bracket
4	9C632	Clamp - ACL outlet pipe
5	9C662	ACL assembly
6	7A020	Transmission fluid level indicator
7	W520101	Transmission fluid filler tube nut
8	7A228	Transmission fluid filler tube
9	-	Nut - transmission fluid cooler tube (part of 7H420)
10	W711538	Bolt - transmission fluid cooler tube
11	7H420	Tube - transmission fluid cooler
12	7A488	Connector - transaxle harness
13	14A169	Retainer - transaxle harness
14	W520101	Nut - bypass valve
15	7H322	Valve - transaxle fluid cooler bypass
16	7J289	Bolt - solenoid body cover (11 required)
17	W708442	Studbolt - solenoid body cover (3 required)
18	7G004	Cover - solenoid body

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Disconnect the Mass Air Flow (MAF) sensor electrical connector and the wiring harness fastener from the Air Cleaner (ACL) assembly.

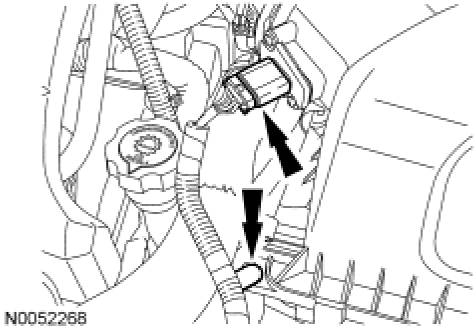


Fig. 330: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

3. Disconnect the brake booster vacuum hose from the ACL outlet pipe.

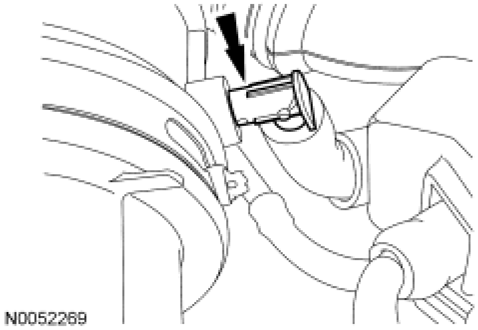


Fig. 331: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

4. Disconnect the engine breather from the ACL assembly.

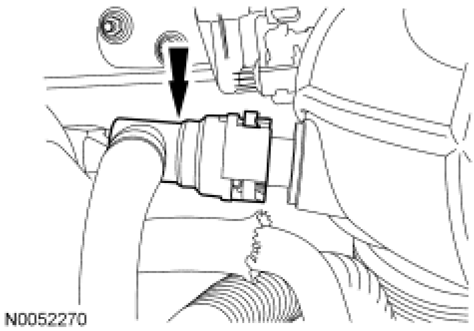


Fig. 332: Locating Engine Breather
Courtesy of FORD MOTOR CO.

5. Remove the ACL assembly bracket bolt.

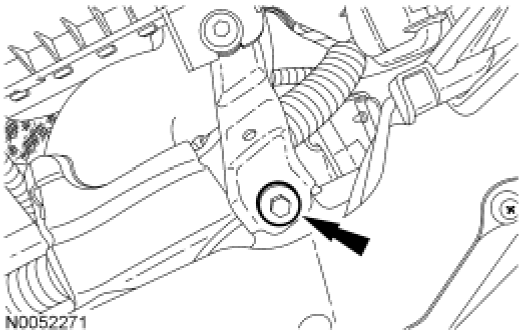


Fig. 333: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

6. Loosen the ACL outlet pipe clamp at the Throttle Body (TB) and remove the ACL and ACL outlet pipe assembly.

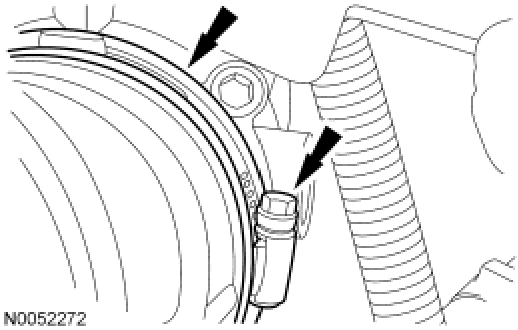


Fig. 334: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

7. Remove the transmission fluid drain plug and allow the transmission fluid to drain.

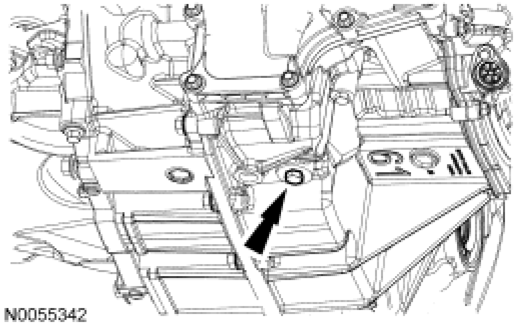


Fig. 335: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

8. Install the transmission fluid drain plug.
   - Tighten to 9 Nm (80 lb-in).

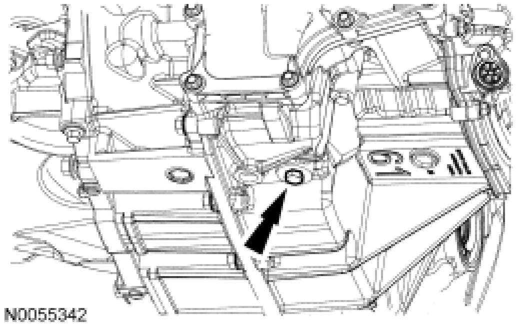


Fig. 336: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses do not need to be removed from the engine.

9. Remove the coolant hoses from the transmission fluid filler tube and position aside.

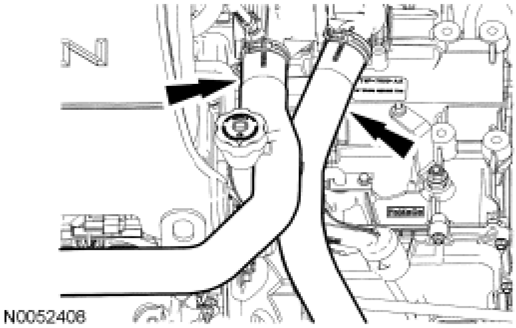


Fig. 337: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

10. Remove the transmission fluid level indicator.

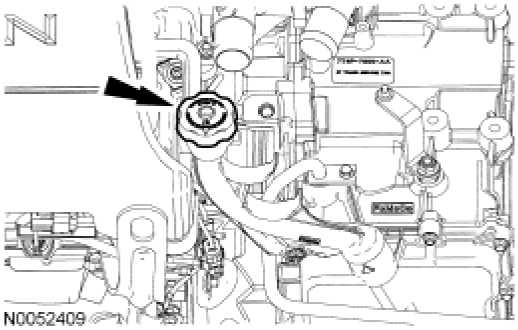


Fig. 338: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

11. Remove the nut, rotate the transmission fluid filler tube counterclockwise 90 degrees and remove the transmission fluid filler tube.

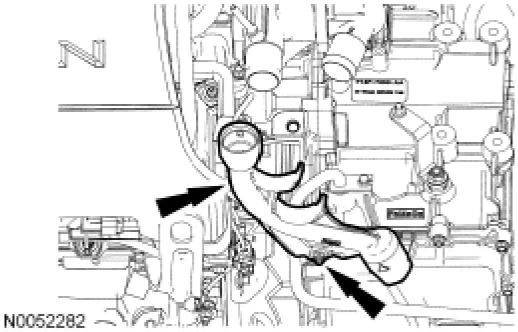


Fig. 339: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

12. Loosen the transmission fluid cooler tube fitting from the thermal bypass valve.

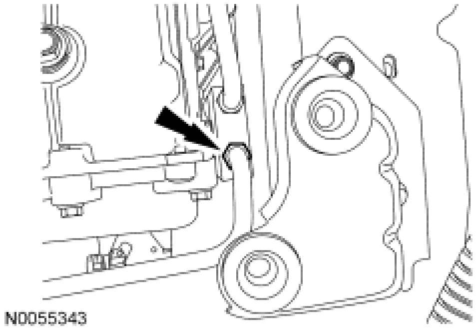


Fig. 340: Identifying Transmission Fluid Cooler Tube Fitting From Thermal Bypass Valve
Courtesy of FORD MOTOR CO.

13. Remove and discard the transmission fluid cooler tube bolt and remove the transmission fluid cooler tube.

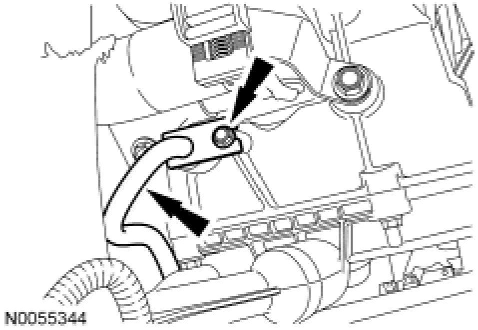


Fig. 341: Identifying Transmission Fluid Cooler Tube Bolt
Courtesy of FORD MOTOR CO.

14. Inspect the transaxle case to make sure that the transmission fluid cooler tube seal and backing ring were removed with the transmission fluid cooler tube and are not stuck in the transaxle case. If the transmission fluid cooler tube seal or backing ring are stuck in the transaxle case, remove the seal and backing ring.

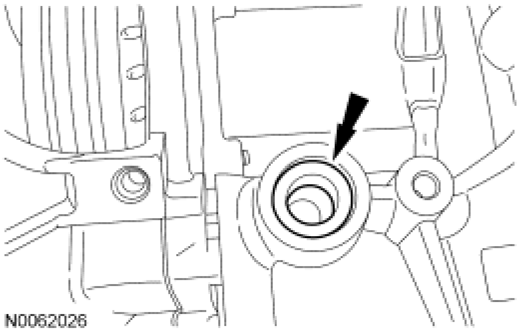


Fig. 342: Identifying Transmission Fluid Cooler Tube Seal
Courtesy of FORD MOTOR CO.

15. Disconnect the transaxle electrical connector.

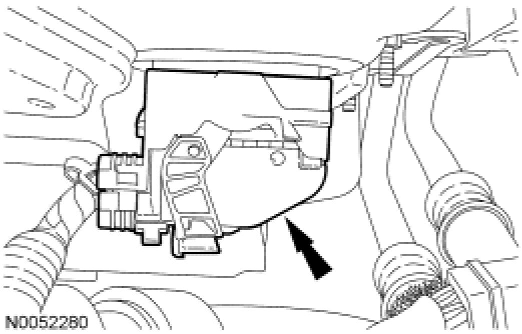


Fig. 343: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

16. Remove the 2 transmission fluid cooler thermal bypass valve bracket nuts, pull the transmission fluid cooler thermal bypass valve straight up and position it aside.

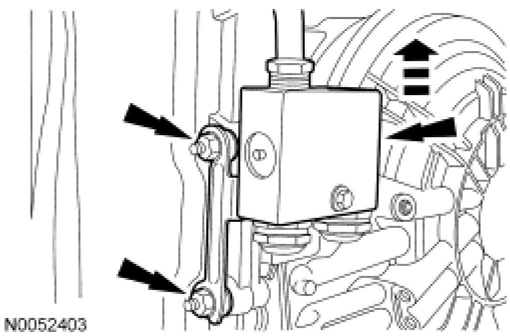
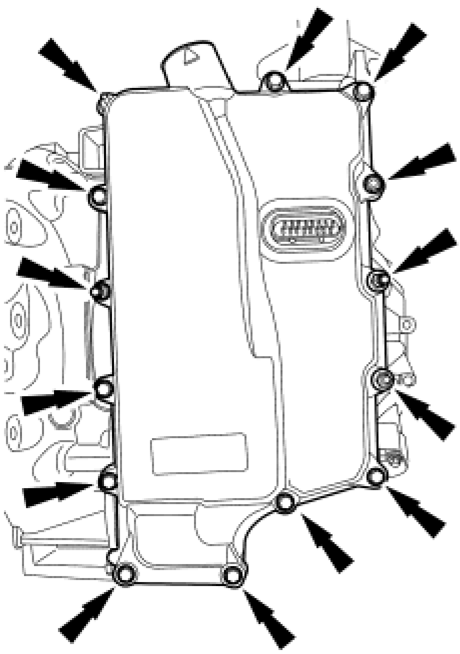


Fig. 344: Removing Nuts & Pulling Transmission Fluid Cooler Thermal Bypass Valve Straight Up
Courtesy of FORD MOTOR CO.

NOTE: Note the location of the studbolts for assembly.

17. Remove the 14 bolts and the main control cover.

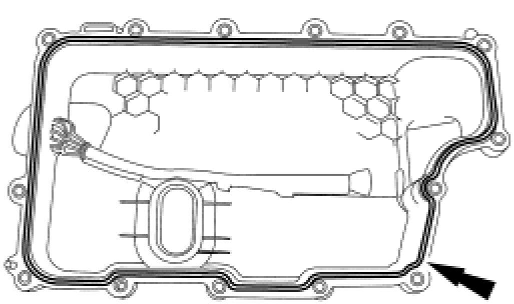


N0089296

Fig. 345: Main Control Valve Cover Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Inspect the transaxle main control cover seal for damage and install new if necessary.



N0054253

Fig. 346: Inspecting Transaxle Main Control Cover Seal For Damage
Courtesy of FORD MOTOR CO.

NOTE:	**Inspect the 20-pin solenoid body connector seal to make sure that the seal is on the inside of the main control cover or a transmission fluid leak will occur resulting in transmission damage.**

NOTE:	**Install the studbolts in the locations noted during disassembly.**

2. Install the main control cover and loosely install the 14 bolts.
    1. Bolt location
    2. Studbolt location

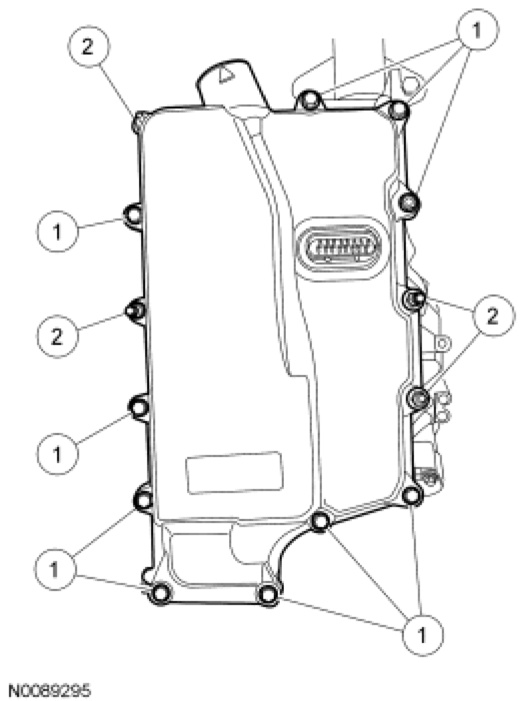


Fig. 347: Main Control Cover Bolts
Courtesy of FORD MOTOR CO.

3. Tighten the main control cover bolts in the sequence shown.
    - Tighten to 12 Nm (106 lb-in).

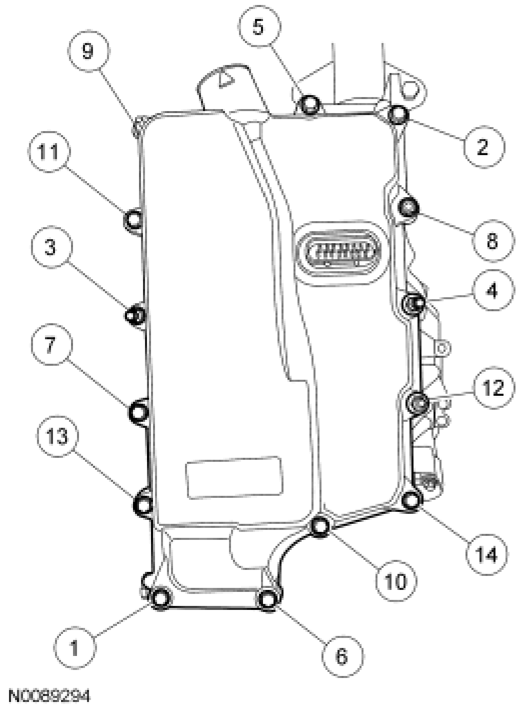


Fig. 348: Main Control Cover Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

4. Position the transmission fluid cooler thermal bypass valve and transmission fluid cooler tube assembly in place and install the 2 transmission fluid cooler thermal bypass valve bracket nuts.
   - Tighten to 9 Nm (80 lb-in).

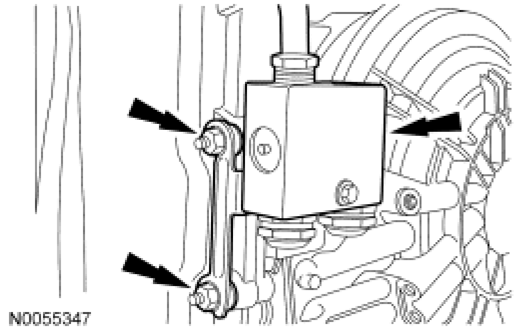


Fig. 349: Identifying Transmission Fluid Cooler Tube Assembly & Nuts
Courtesy of FORD MOTOR CO.

5. Connect the transaxle electrical connector.

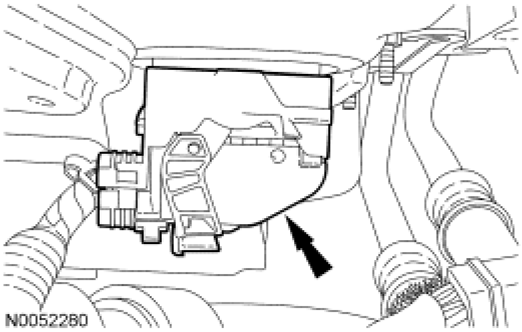


Fig. 350: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

6. Inspect the transmission fluid cooler tube backing ring and seal for damage and install a new backing ring or seal if necessary. Lubricate the transmission fluid cooler tube seal with clean transmission fluid and install the backing ring and seal on the transmission fluid cooler tube.

Item	Part Number	Description
1	7D285	Seal
2	7J324	Backing ring

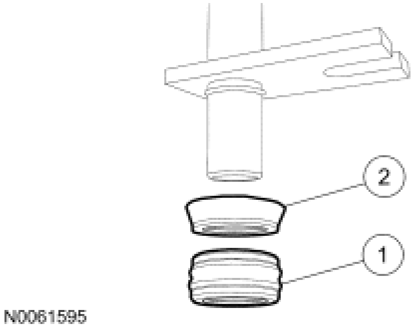


Fig. 351: Identifying Transmission Fluid Cooler Tube Backing Ring & Seal
Courtesy of FORD MOTOR CO.

7. Position the transmission fluid cooler tube in place and install a new bolt.
   - Tighten to 9 Nm (80 lb-in).

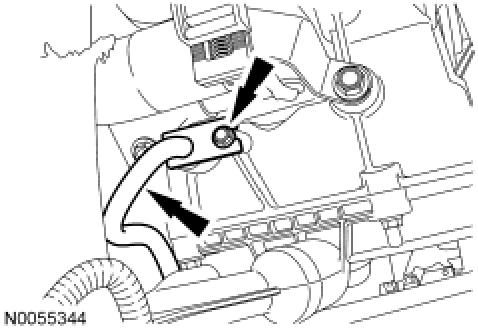


Fig. 352: Identifying Transmission Fluid Cooler Tube Bolt
Courtesy of FORD MOTOR CO.

8. Tighten the transmission fluid cooler tube fitting.
    - Tighten to 25 Nm (18 lb-ft).

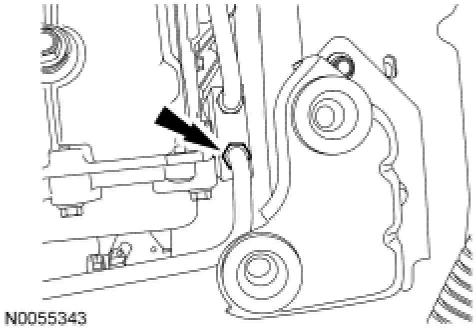


Fig. 353: Identifying Transmission Fluid Cooler Tube Fitting From Thermal Bypass Valve
Courtesy of FORD MOTOR CO.

9. Install the transmission fluid filler tube and the nut.
    - Tighten to 11 Nm (97 lb-in).

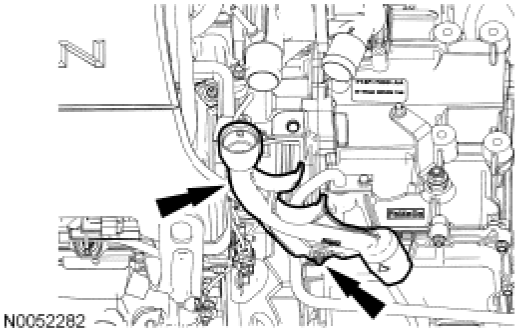


Fig. 354: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

10. Install the transmission fluid level indicator.

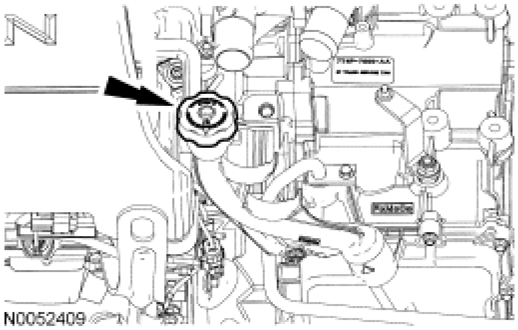


Fig. 355: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

11. Route the coolant hoses in the transmission fluid filler tube.

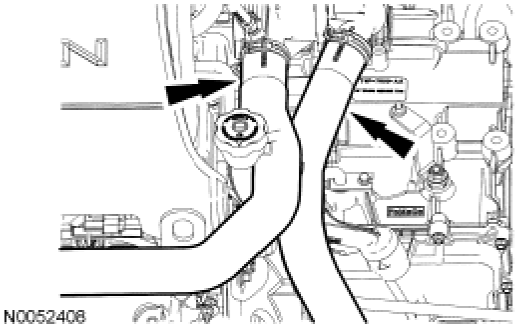


Fig. 356: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

12. Position the ACL assembly in place and install the bolt.
    - Tighten to 11 Nm (97 lb-in).

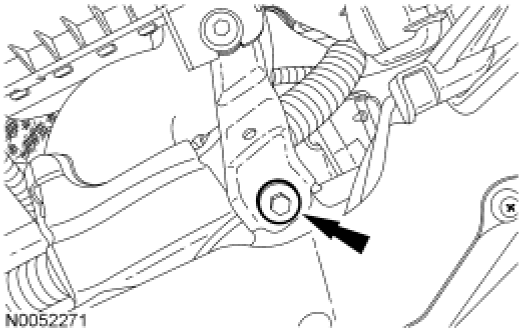


Fig. 357: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

13. Tighten the ACL outlet pipe clamp at the TB.
    - Tighten to 5 Nm (44 lb-in).

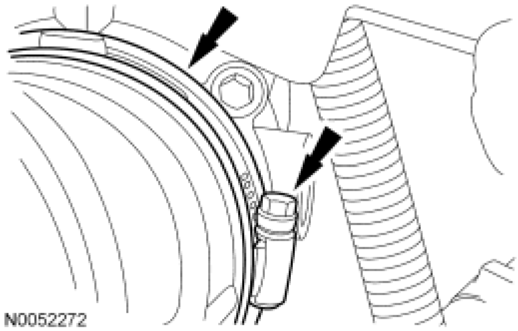


Fig. 358: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

14. Connect the engine breather to the ACL assembly.

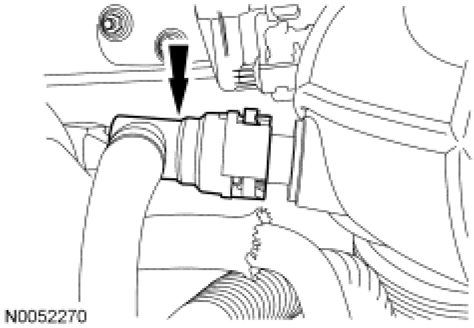


Fig. 359: Locating Engine Breather
Courtesy of FORD MOTOR CO.

15. Connect the brake booster vacuum hose to the ACL assembly.

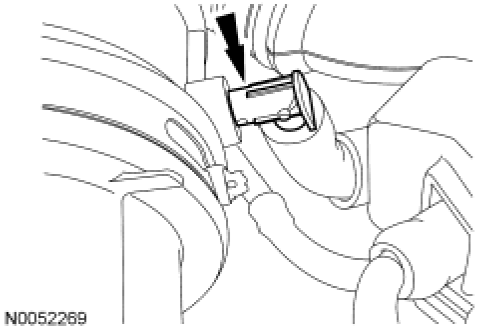


Fig. 360: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

16. Connect the MAF sensor electrical connector and connect the electrical harness fastener.

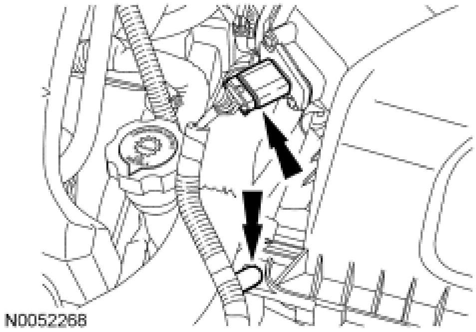


Fig. 361: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

17. Fill with clean transmission fluid to the correct level.

TRANSAXLE FILLER TUBE

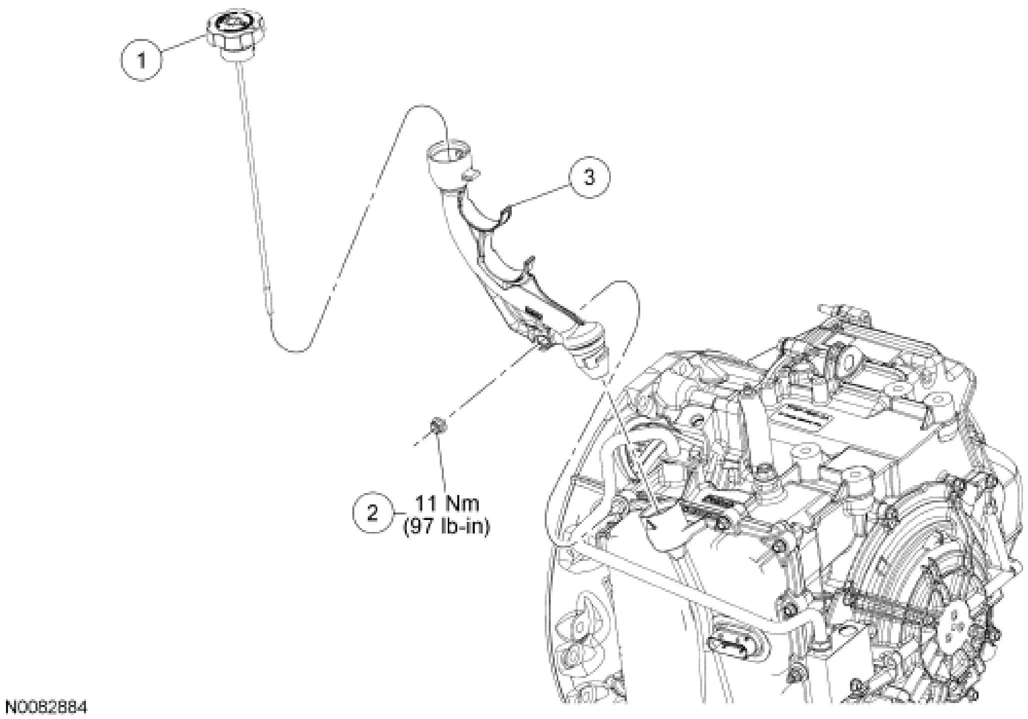


Fig. 362: Transaxle Filler Tube (With Torque Specifications)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7A020	Transmission fluid level indicator
2	W520101	Transmission fluid filler tube nut
3	7A228	Transmission fluid filler tube

REMOVAL

NOTE: The coolant hoses do not need to be removed from the engine.

1. Remove the coolant hoses from the transmission fluid filler tube and position aside.

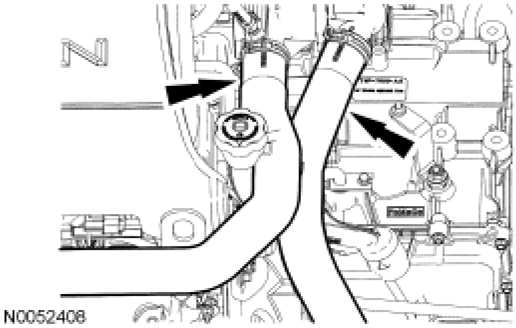


Fig. 363: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

2. Remove the transmission fluid level indicator.

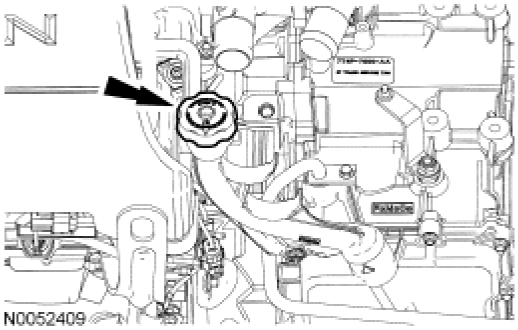


Fig. 364: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

3. Remove the nut, rotate the transmission fluid filler tube counterclockwise 90 degrees and remove the transmission fluid filler tube.

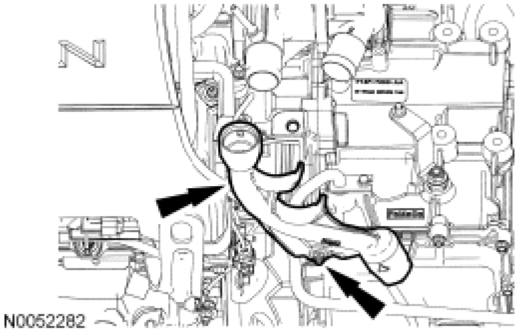


Fig. 365: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Install the transmission fluid filler tube and the nut.
    - Tighten to 11 Nm (97 lb-in).

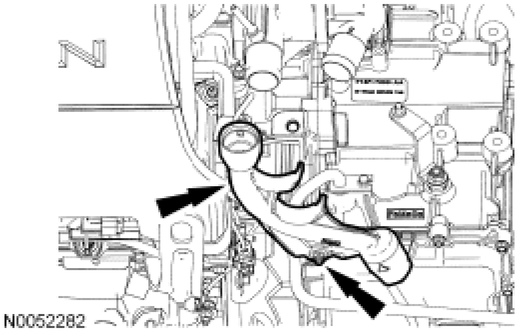


Fig. 366: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

2. Install the transmission fluid level indicator.

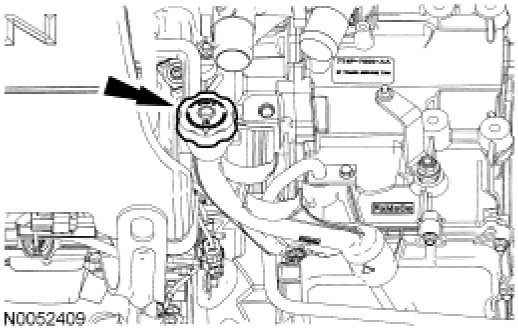


Fig. 367: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

3. Route the coolant hoses in the transmission fluid filler tube.

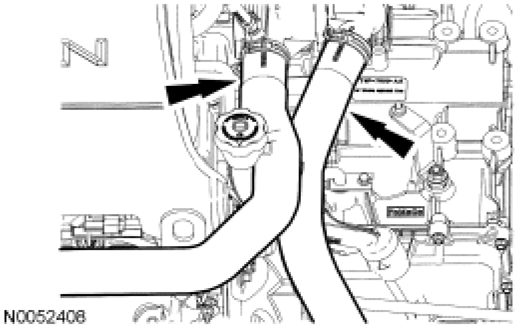
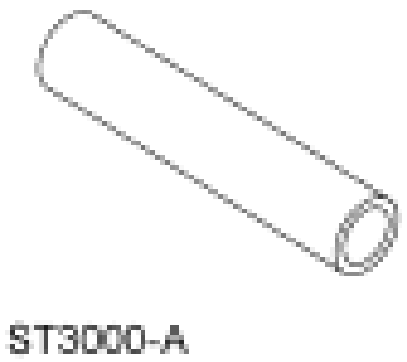
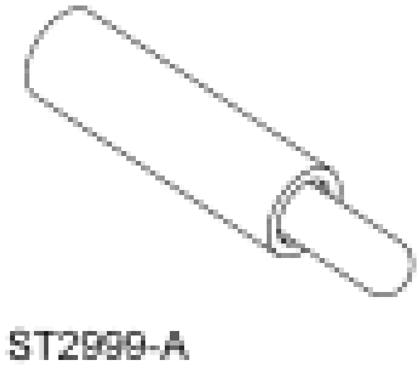


Fig. 368: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

MANUAL CONTROL LEVER SHAFT SEAL

Special Tools

Illustration	Tool Name	Tool Number
	Installer, Manual Lever Retaining Pin	307-592
	Installer, Manual Lever Shaft Seal	307-581

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Disconnect the Mass Air Flow (MAF) sensor electrical connector and the wiring harness fastener from the Air Cleaner (ACL) assembly.

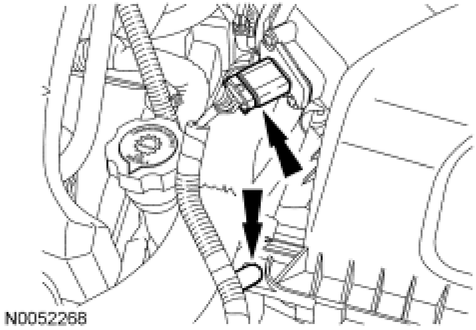


Fig. 369: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

3. Disconnect the brake booster vacuum hose from the ACL outlet pipe.

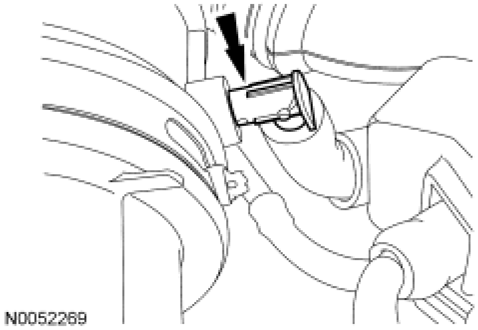


Fig. 370: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

4. Disconnect the engine breather from the ACL assembly.

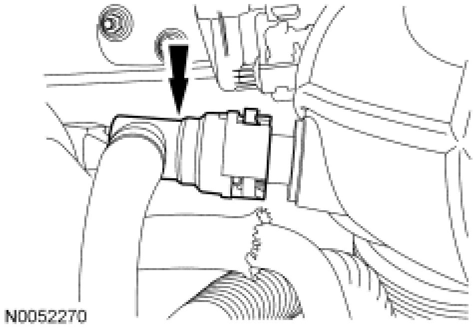


Fig. 371: Locating Engine Breather
Courtesy of FORD MOTOR CO.

5. Remove the ACL assembly bracket bolt.

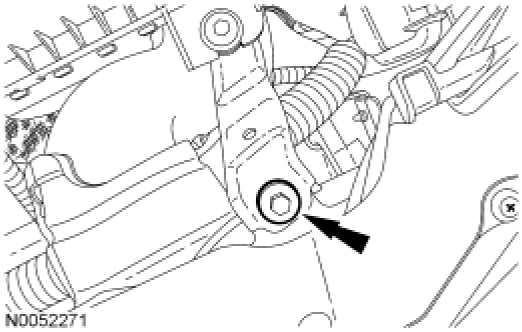


Fig. 372: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

6. Loosen the ACL outlet pipe clamp at the Throttle Body (TB) and remove the ACL and ACL outlet pipe assembly.

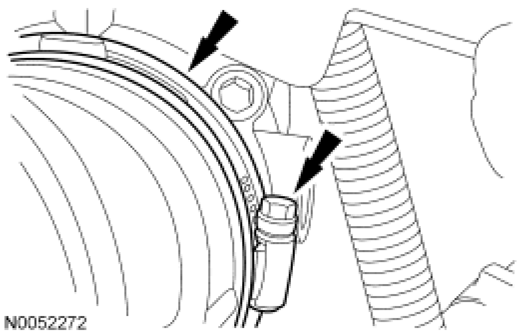


Fig. 373: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

7. Remove the transmission fluid drain plug and allow the transmission fluid to drain.

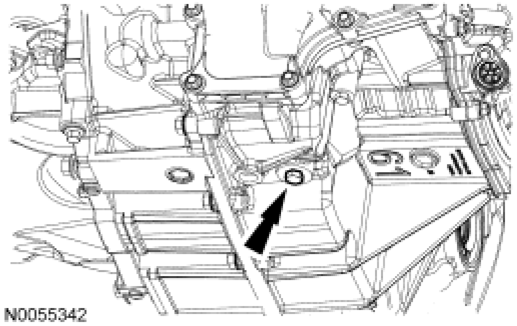


Fig. 374: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

8. Install the transmission fluid drain plug.
   - Tighten to 9 Nm (80 lb-in).

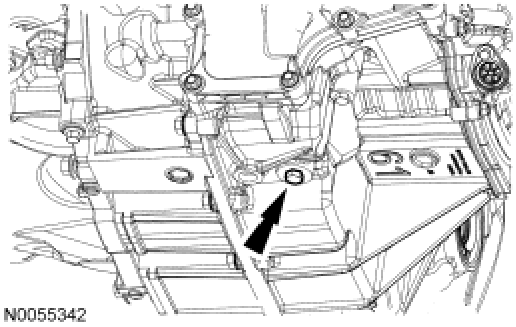


Fig. 375: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses do not need to be removed from the engine.

9. Remove the coolant hoses from the transmission fluid filler tube and position aside.

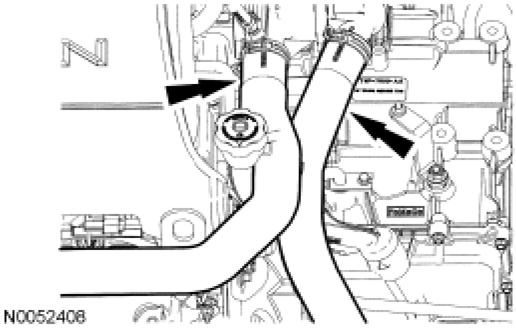


Fig. 376: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

10. Remove the transmission fluid level indicator.

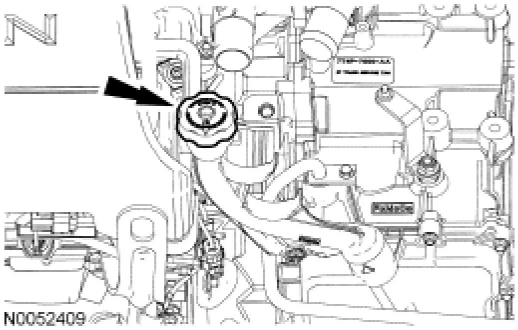


Fig. 377: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

11. Remove the nut, rotate the transmission fluid filler tube counterclockwise 90 degrees and remove the transmission fluid filler tube.

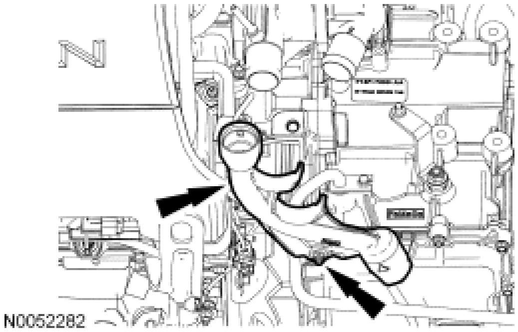


Fig. 378: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

12. Disconnect the selector lever cable end from the manual control lever.

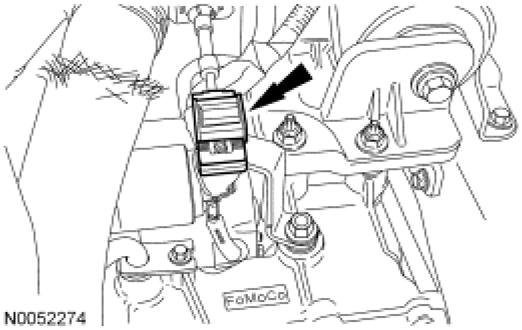


Fig. 379: Locating Selector Lever Cable End From Manual Lever
Courtesy of FORD MOTOR CO.

13. Remove the nut and the manual control lever.

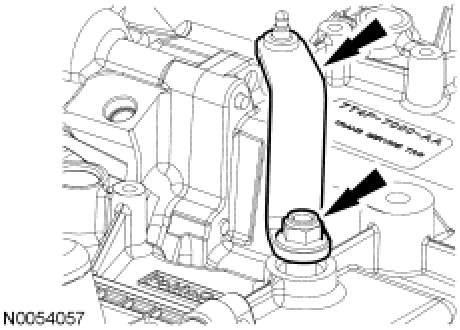


Fig. 380: Identifying Manual Control Lever & Nut
Courtesy of FORD MOTOR CO.

14. Loosen the transmission fluid cooler tube fitting from the thermal bypass valve.

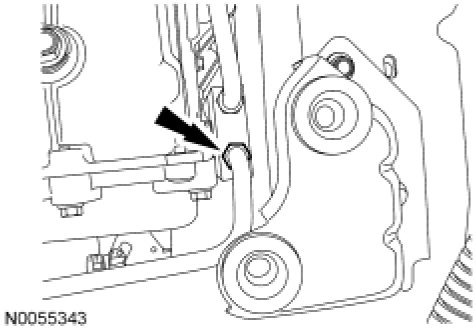


Fig. 381: Identifying Transmission Fluid Cooler Tube Fitting From Thermal Bypass Valve
Courtesy of FORD MOTOR CO.

15. Remove and discard the transmission fluid cooler tube bolt and remove the transmission fluid cooler tube.

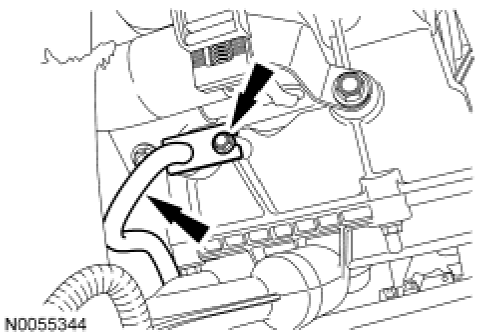


Fig. 382: Identifying Transmission Fluid Cooler Tube Bolt
Courtesy of FORD MOTOR CO.

16. Inspect the transaxle case to make sure that the transmission fluid cooler tube seal and backing ring were removed with the transmission fluid cooler tube and are not stuck in the transaxle case. If the transmission fluid cooler tube seal or backing ring are stuck in the transaxle case, remove the seal and backing ring.

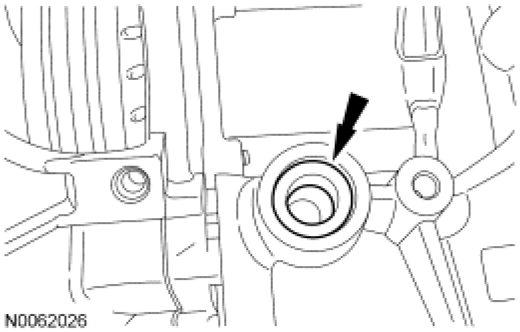


Fig. 383: Identifying Transmission Fluid Cooler Tube Seal
Courtesy of FORD MOTOR CO.

17. Disconnect the transaxle electrical connector.

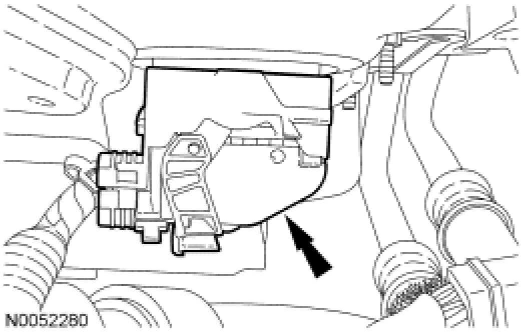


Fig. 384: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

18. Remove the transmission fluid cooler tube bracket nuts, pull the transmission fluid cooler thermal bypass valve straight up and position it aside.

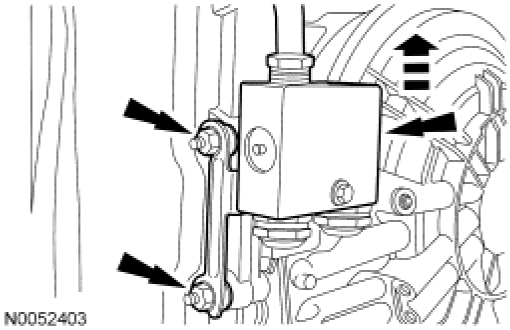


Fig. 385: Removing Nuts & Pulling Transmission Fluid Cooler Thermal Bypass Valve Straight Up
Courtesy of FORD MOTOR CO.

NOTE: **Note the location of the studbolts for assembly.**

19. Remove the bolts and the main control cover.

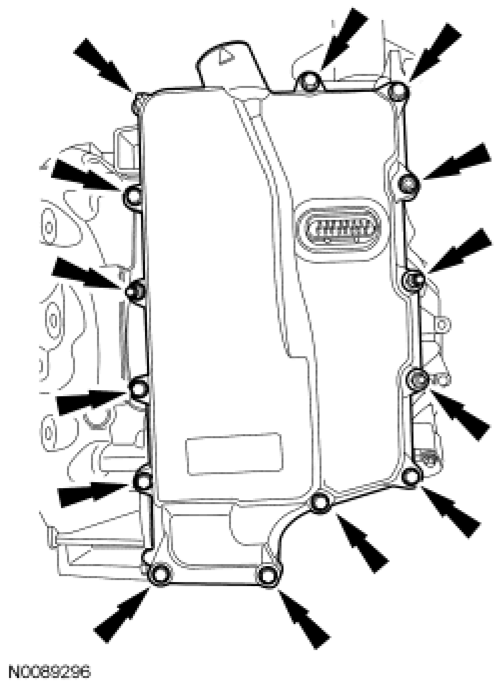


Fig. 386: Main Control Valve Cover Bolts
Courtesy of FORD MOTOR CO.

20. Disconnect the Transmission Range (TR) sensor electrical connector.
    1. Slide the lock over.
    2. Press the tab and disconnect the connector.

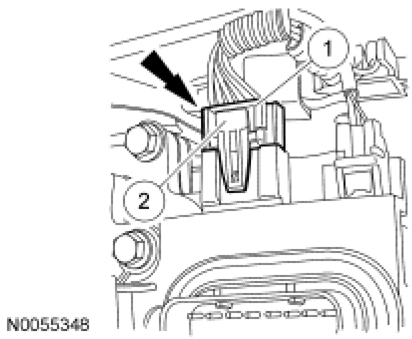


Fig. 387: Pressing Tab & Disconnecting Connector
Courtesy of FORD MOTOR CO.

21. Disconnect the Turbine Shaft Speed (TSS) and Output Shaft Speed (OSS) sensor electrical connectors.

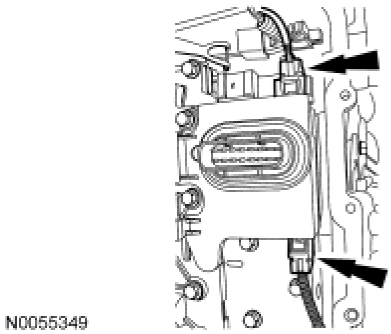


Fig. 388: Locating Turbine Shaft Speed (TSS) & Output Shaft Speed (OSS) Sensor Electrical Connectors
Courtesy of FORD MOTOR CO.

NOTE: **The solenoid body should be handled with care, damage to the solenoid body may occur.**

NOTE: **Note the location of the different length bolts for assembly.**

22. Remove the bolts and the solenoid body.

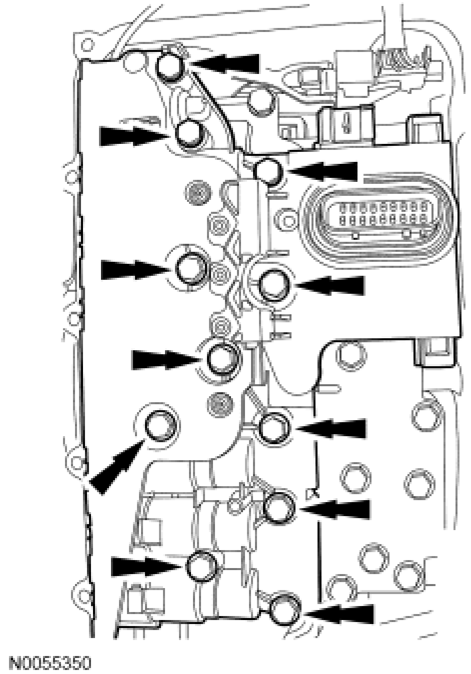


Fig. 389: Locating Solenoid Body Bolts
Courtesy of FORD MOTOR CO.

NOTE: **Do not handle the solenoid body in the leadframe area or by the screens of**

the solenoid body filter or damage to the solenoid body can occur.

NOTE: **Use care not to break the alignment tabs when removing the solenoid body filter.**

23. Remove the solenoid body filter assembly by pulling it straight up from the alignment tabs. Discard the filter.

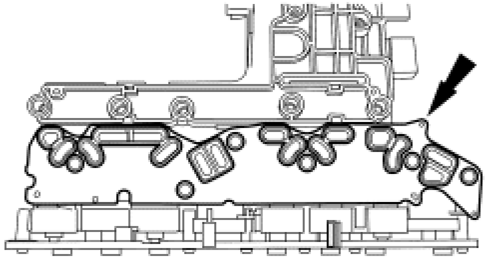


Fig. 390: Identifying Solenoid Body Filter Assembly
Courtesy of FORD MOTOR CO.

24. Remove the bolts, the TR sensor detent spring and the main control valve body.

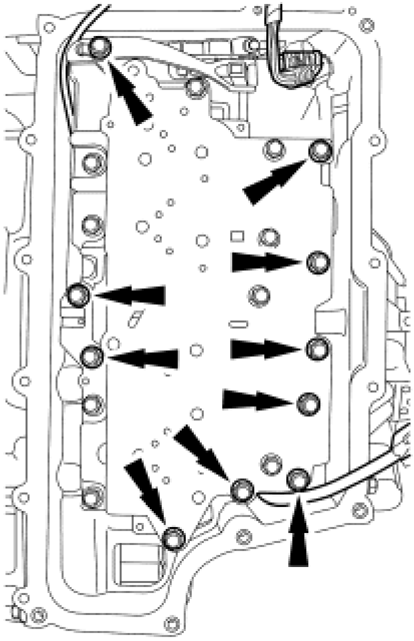


Fig. 391: Locating Main Control Valve Body Bolts
Courtesy of FORD MOTOR CO.

25. Using a suitable tool, remove and discard the TR sensor locking pin.

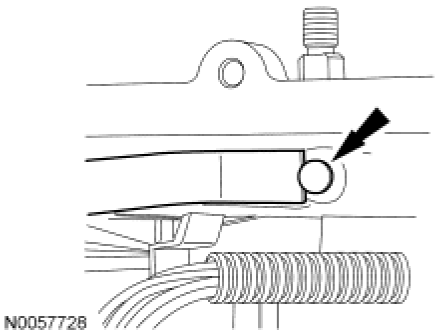


Fig. 392: Locating TR Sensor Locking Pin
Courtesy of FORD MOTOR CO.

NOTE: **TR sensor removed for clarity.**

26. Make sure that the park pawl actuator rod does not become disengaged from the park pawl and the abutment by keeping the end of the park pawl actuator rod behind the machined valve body mating surface of the transaxle case. If the park pawl actuator rod becomes disengaged from the park pawl and the abutment, transaxle removal and disassembly is required to reinstall the actuator rod.

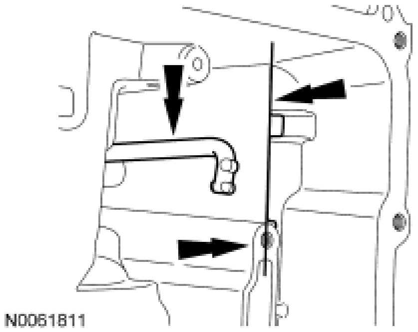


Fig. 393: Making Sure That Park Pawl Actuator Rod Does Not Become Disengaged From Park Pawl
Courtesy of FORD MOTOR CO.

NOTE: **Make sure that the park pawl actuator rod does not become disengaged from the park pawl and the abutment or transaxle removal and disassembly is required to reinstall the actuator rod.**

27. Remove the TR sensor.
    1. Slide the TR sensor down until the manual shaft is out of the transaxle case.
    2. Rotate the TR sensor detent plate counterclockwise, as viewed from below until the plate rests against the transaxle case, remove the park pawl actuating rod from the TR sensor and remove the TR sensor.

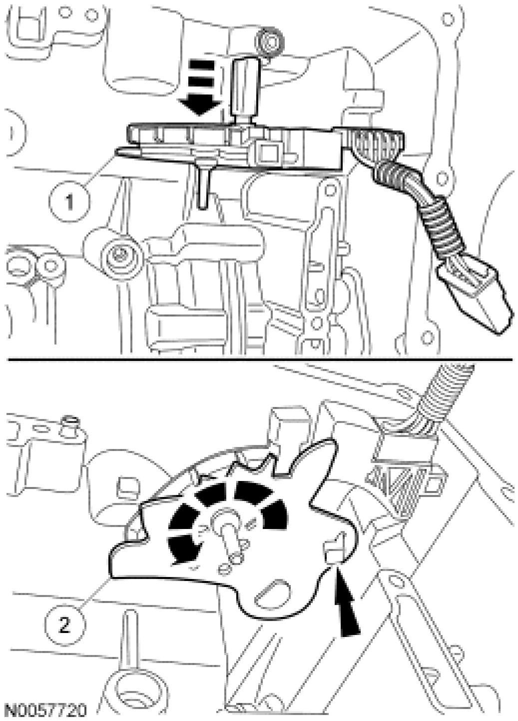


Fig. 394: Sliding TR Sensor Down & Rotating TR Sensor Detent Plate Counterclockwise
Courtesy of FORD MOTOR CO.

28. Using a suitable tool, remove the manual control lever shaft seal.

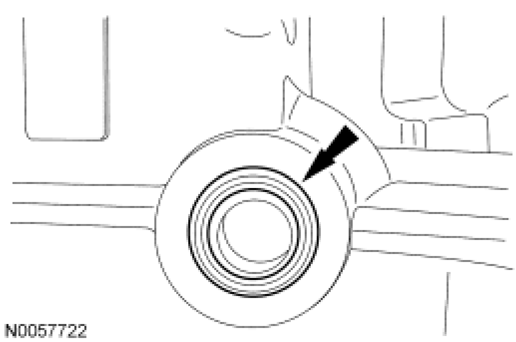


Fig. 395: Identifying Manual Control Lever Shaft Seal
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Using the Manual Lever Shaft Seal Installer, install a new manual control lever shaft seal.

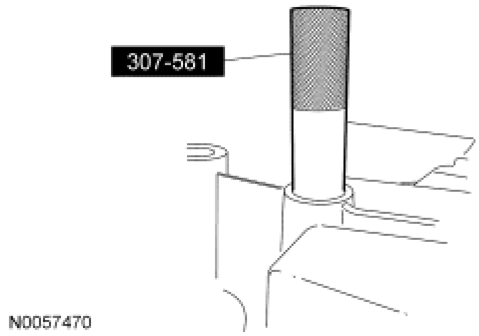


Fig. 396: Installing New Manual Control Lever Shaft Seal Using Special Tool (307-581)
Courtesy of FORD MOTOR CO.

2. Install the TR sensor.
    1. Position the park pawl actuating rod in the TR sensor.
    2. Install the TR sensor in the transaxle case.

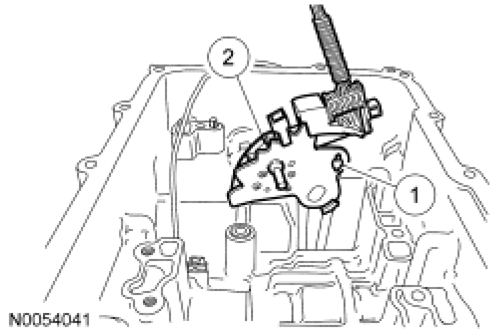


Fig. 397: Identifying TR Sensor In Transaxle Case
Courtesy of FORD MOTOR CO.

3. Using the Manual Retaining Pin Installer, install a new TR sensor locking pin.

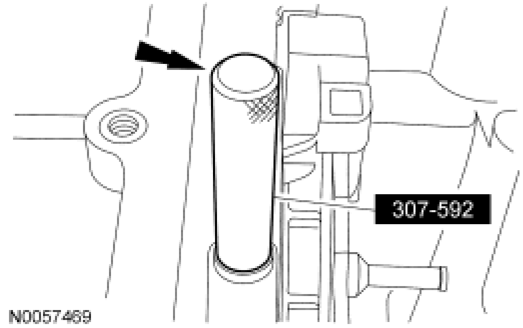


Fig. 398: Installing TR Sensor Locking Pin Using Special Tool (307-592)
Courtesy of FORD MOTOR CO.

NOTE: Make sure that the manual pin (part of the TR sensor) is correctly installed

in the manual valve.

4. Position the TSS, OSS and TR sensor wiring harnesses aside and install the main control valve body.

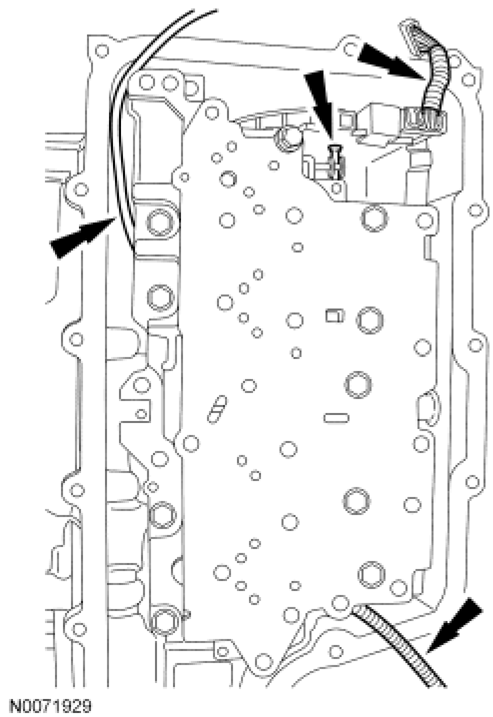


Fig. 399: Locating TSS, OSS & TR Sensor Wiring Harnesses
Courtesy of FORD MOTOR CO.

5. Inspect the manual pin to make sure it is correctly installed in the manual control valve. If it is not, pull the valve body off the transaxle case. Correctly install the manual pin in the manual control valve and position the valve body in place.

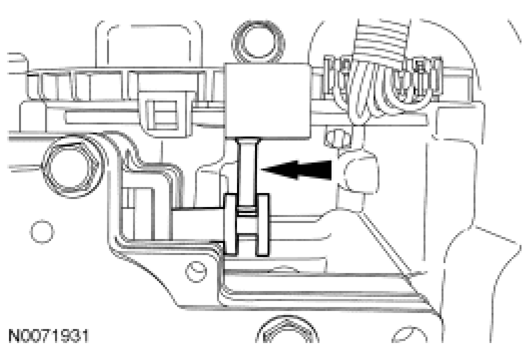


Fig. 400: Identifying Manual Pin
Courtesy of FORD MOTOR CO.

6. Install the TR sensor detent spring and the bolts. Tighten the bolts in the sequence shown.
    - Tighten to 12 Nm (106 lb-in).

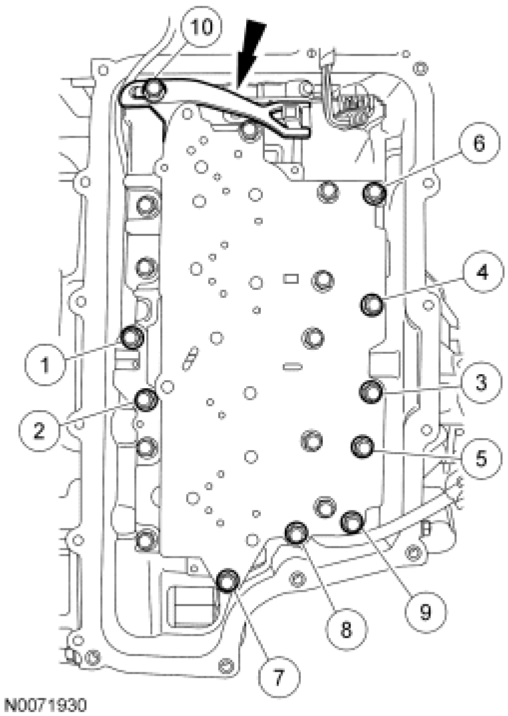


Fig. 401: Tightening TR Sensor Detent Spring Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE:	**Do not handle the solenoid body in the leadframe area or by the screens of the solenoid body filter or damage to the solenoid body can occur.**
NOTE:	**Use care not to break the alignment tabs when installing the solenoid body filter. Damage to the transaxle will occur if the solenoid body is not correctly aligned.**
NOTE:	**Make sure that the filter passage areas are clean of foreign material before installing the filter. Damage to the transaxle will occur if the filter passages are not clean.**

7. Install a new solenoid body filter assembly by pushing it straight down on to the alignment tabs.

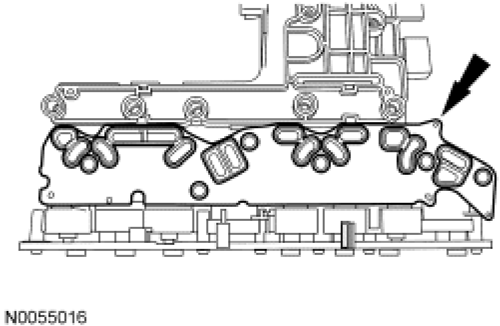


Fig. 402: Identifying Solenoid Body Filter Assembly
Courtesy of FORD MOTOR CO.

NOTE: **Make sure not to pinch the Turbine Shaft Speed (TSS), Output Shaft Speed (OSS) or Transmission Range (TR) sensor wiring harnesses when installing the solenoid body. Damage to the wiring harness will occur.**

NOTE: **Install the different length bolts in the locations noted during disassembly.**

8. Install the solenoid body and the bolts.
   1. 42 mm (1.65 in) bolt
   2. 63 mm (2.48 in) bolts
   3. 80 mm (3.14 in) bolts
   4. 95 mm (3.74 in) bolts

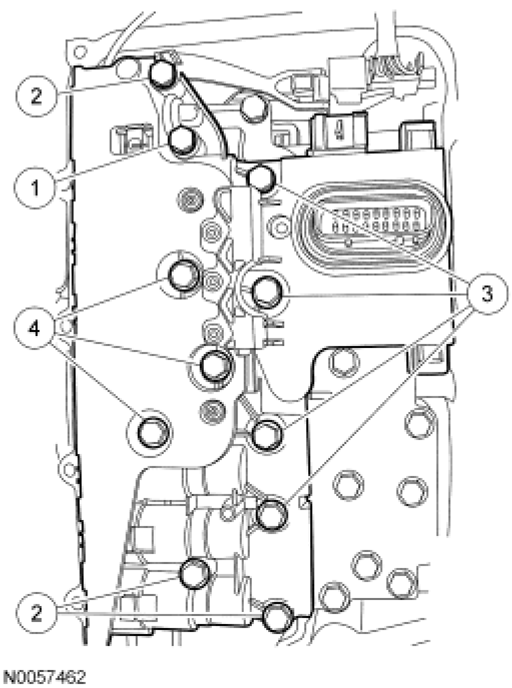


Fig. 403: Locating Solenoid Body Bolts
Courtesy of FORD MOTOR CO.

9. Tighten the solenoid body bolts in the sequence shown.
   - Tighten to 12 Nm (106 lb-in).

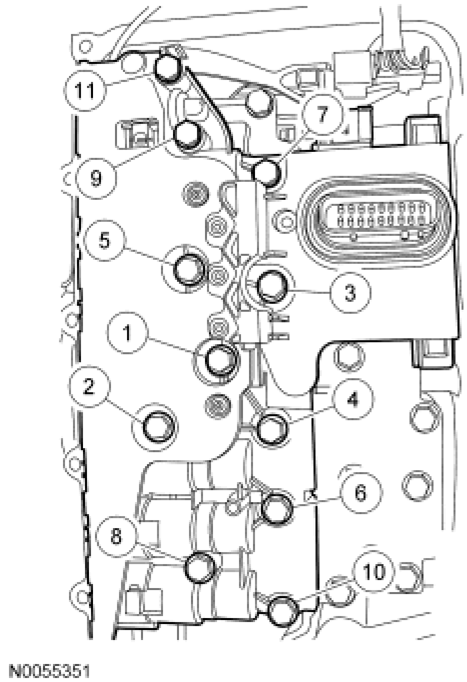


Fig. 404: Tightening Solenoid Body Bolts In Sequence
Courtesy of FORD MOTOR CO.

10. Route the OSS sensor wiring harness and connect the electrical connector.

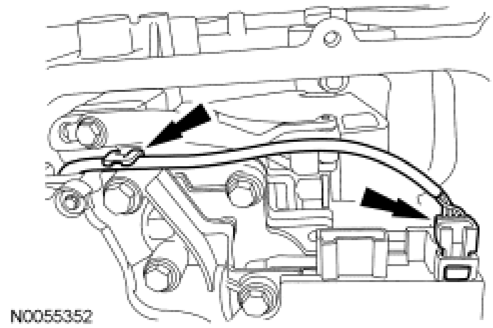


Fig. 405: Locating OSS Sensor Wiring Harness & Electrical Connector
Courtesy of FORD MOTOR CO.

11. Connect the TR sensor electrical connector.
    1. Connect the electrical connector.
    2. Slide the locking tab over.

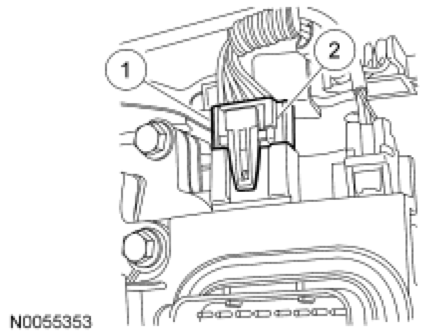


Fig. 406: Identifying TR Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

12. Connect the TSS sensor electrical connector.

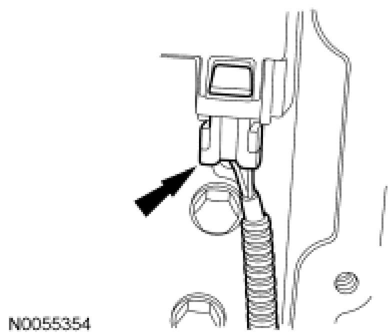


Fig. 407: Identifying TSS Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

13. Inspect the transaxle main control cover seal for damage and install new if necessary.

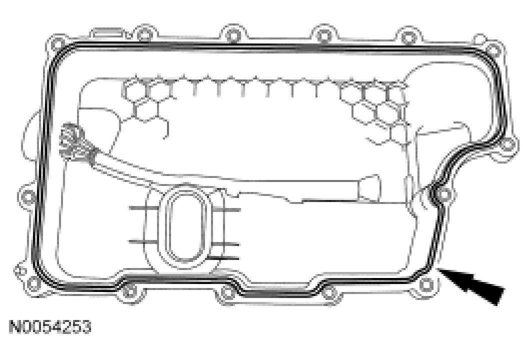


Fig. 408: Inspecting Transaxle Main Control Cover Seal For Damage
Courtesy of FORD MOTOR CO.

NOTE:	**Inspect the 20-pin solenoid body connector seal to make sure that the seal is on the inside of the main control cover or a transmission fluid leak will occur resulting in transmission damage.**

NOTE: Install the studbolts in the locations noted during disassembly.

14. Install the main control cover and loosely install the bolts.
    1. Bolt location
    2. Studbolt location

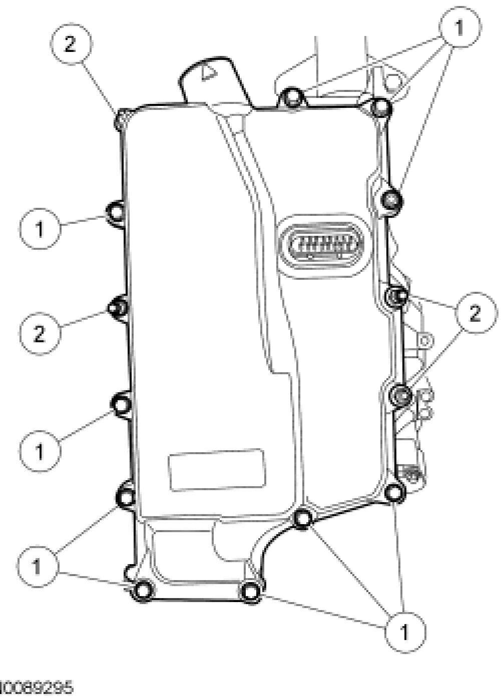


Fig. 409: Main Control Cover Bolts
Courtesy of FORD MOTOR CO.

15. Tighten the main control cover bolts in the sequence shown.
    - Tighten to 12 Nm (106 lb-in).

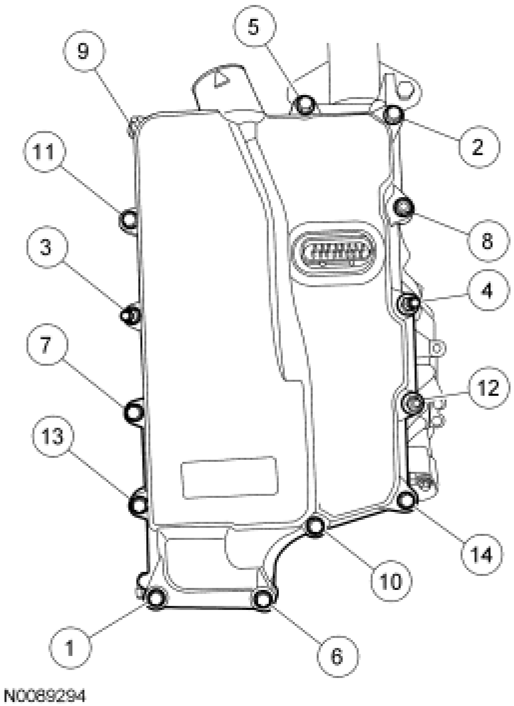


Fig. 410: Main Control Cover Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

16. Position the transmission fluid cooler thermal bypass valve and transmission fluid cooler tube assembly in place and install the nuts.
    - Tighten to 9 Nm (80 lb-in).

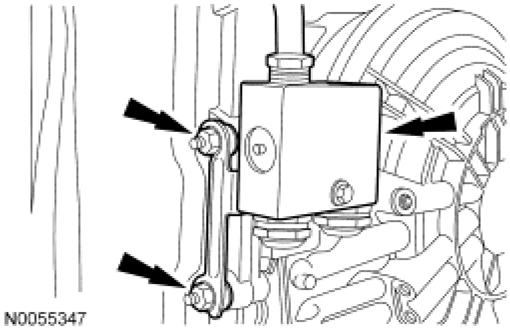


Fig. 411: Identifying Transmission Fluid Cooler Tube Assembly & Nuts
Courtesy of FORD MOTOR CO.

17. Connect the transaxle electrical connector.

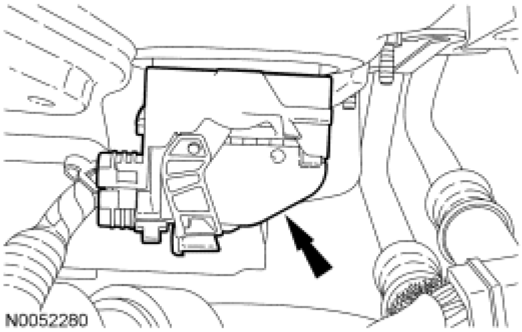


Fig. 412: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

18. Inspect the transmission fluid cooler tube backing ring and seal for damage and install a new backing ring or seal if necessary. Lubricate the transmission fluid cooler tube seal with clean transmission fluid and install the backing ring and seal on the transmission fluid cooler tube.

Item	Part Number	Description
1	7D285	Seal
2	7J324	Backing ring

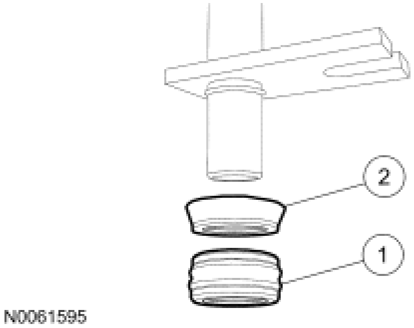


Fig. 413: Identifying Transmission Fluid Cooler Tube Backing Ring & Seal
Courtesy of FORD MOTOR CO.

19. Position the transmission fluid cooler tube in place and install a new bolt.
    - Tighten to 9 Nm (80 lb-in).

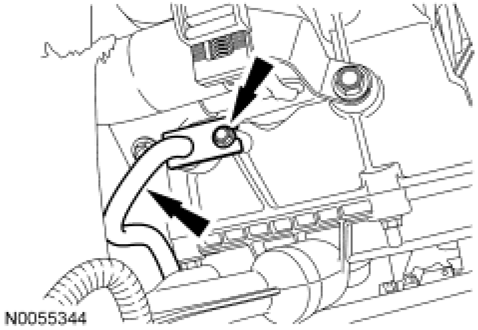


Fig. 414: Identifying Transmission Fluid Cooler Tube Bolt
Courtesy of FORD MOTOR CO.

20. Tighten the transmission fluid cooler tube fitting.
    - Tighten to 25 Nm (18 lb-ft).

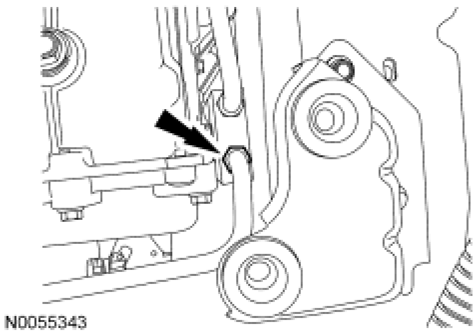


Fig. 415: Identifying Transmission Fluid Cooler Tube Fitting From Thermal Bypass Valve
Courtesy of FORD MOTOR CO.

NOTE:	**Make sure that when installing the manual control lever it is fully seated onto the manual control lever shaft. Damage to the manual control lever shaft will occur and the lever will come loose.**

NOTE:	**Make sure to hold the manual control lever while tightening the manual control lever nut or damage to the manual control lever and park components will occur.**

21. Install the manual control lever and the nut.
    - Tighten to 18 Nm (159 lb-in).

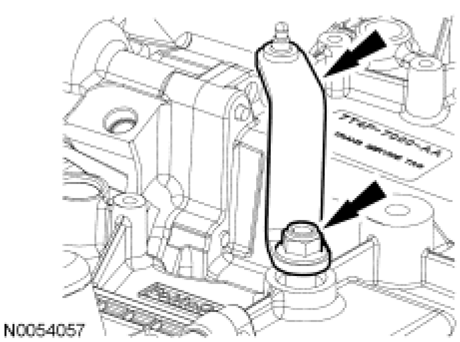


Fig. 416: Identifying Manual Control Lever & Nut
Courtesy of FORD MOTOR CO.

22. Connect the selector lever cable end to the manual control lever.

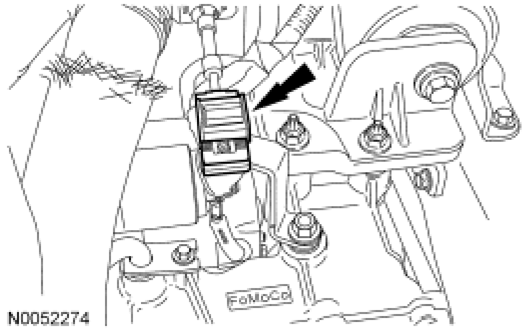


Fig. 417: Locating Selector Lever Cable End From Manual Lever
Courtesy of FORD MOTOR CO.

23. Install the transmission fluid filler tube and the nut.
    - Tighten to 11 Nm (97 lb-in).

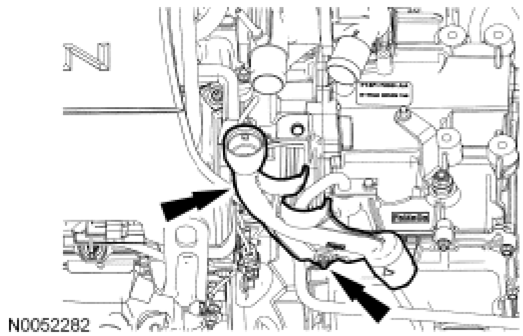


Fig. 418: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

24. Install the transmission fluid level indicator.

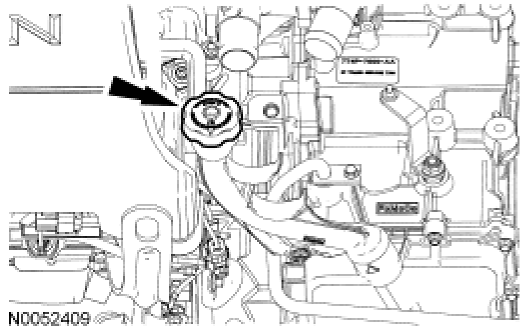


Fig. 419: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

25. Route the coolant hoses to the correct position on the transmission fluid filler tube.

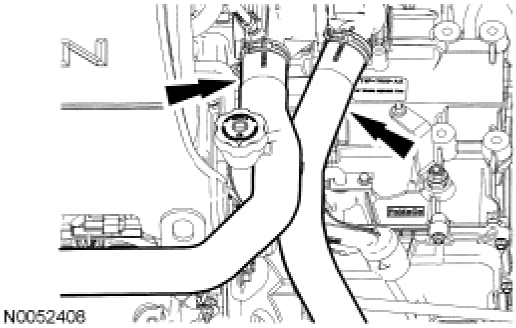


Fig. 420: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

26. Position the ACL assembly in place and install the bolt.
    - Tighten to 11 Nm (97 lb-in).

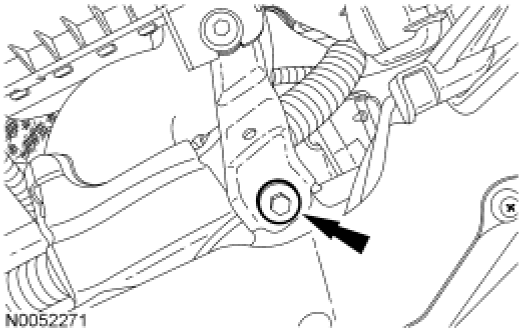


Fig. 421: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

27. Tighten the ACL outlet pipe clamp at the TB.
    - Tighten to 5 Nm (44 lb-in).

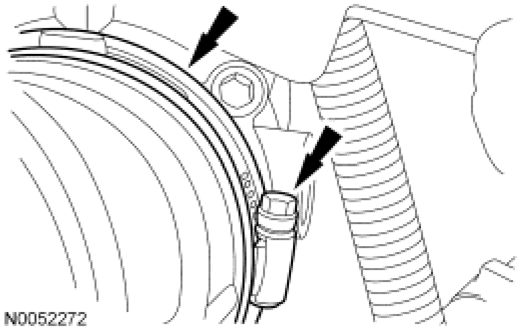


Fig. 422: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

28. Connect the engine breather to the ACL assembly.

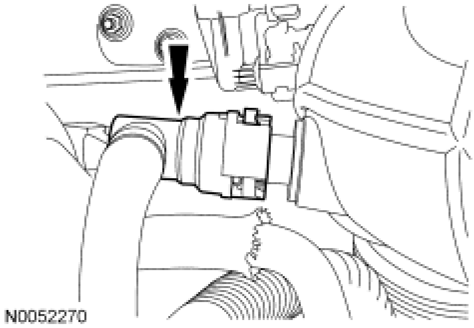


Fig. 423: Locating Engine Breather
Courtesy of FORD MOTOR CO.

29. Connect the brake booster vacuum hose to the ACL assembly.

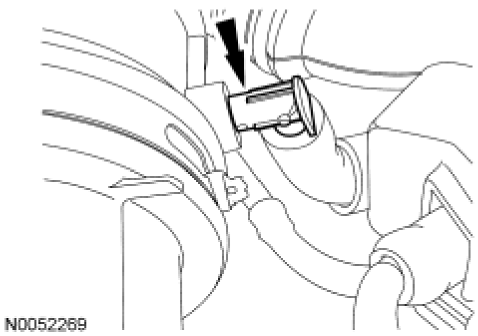


Fig. 424: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

30. Connect the MAF sensor electrical connector and connect the electrical harness fastener.

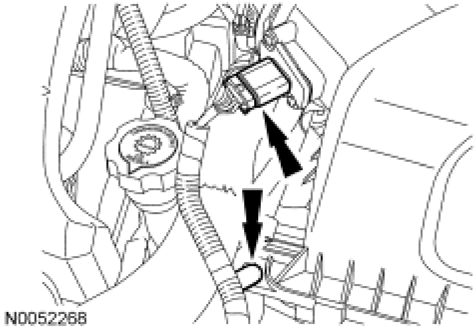


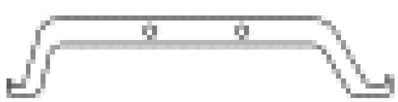
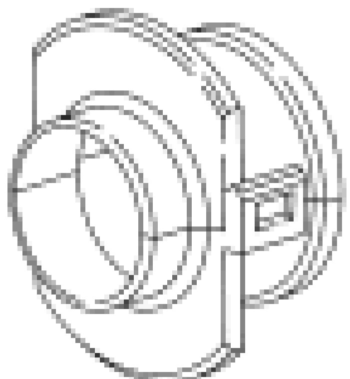
Fig. 425: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

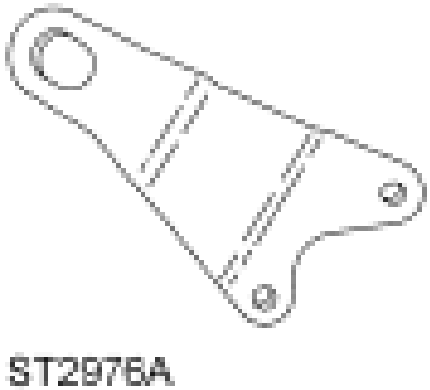
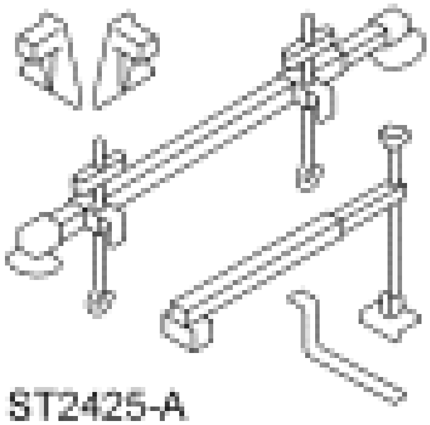
31. Fill with clean transmission fluid to the correct level.

REMOVAL

TRANSAXLE

Special Tools

Illustration	Tool Name	Tool Number
 ST3033-A	Adapter, Transmission Jack	209-00152
 ST2977-A	Bar, Engine Spreader	303-1246
 ST2870-A	Disconnect Tool, Transmission Cooler Line	307-569
	Engine Lifting Bracket	303-1245

		
	Powertrain Lift	014-00765
	Support Bar, Engine	303-F072

REMOVAL

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.

2. Disconnect the Mass Air Flow (MAF) sensor electrical connector and the wiring harness fastener from the Air Cleaner (ACL) assembly.

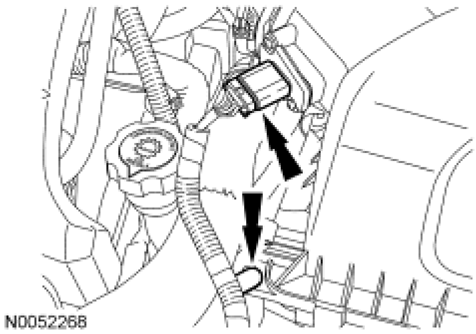


Fig. 426: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

3. Disconnect the brake booster vacuum hose from the ACL outlet pipe.

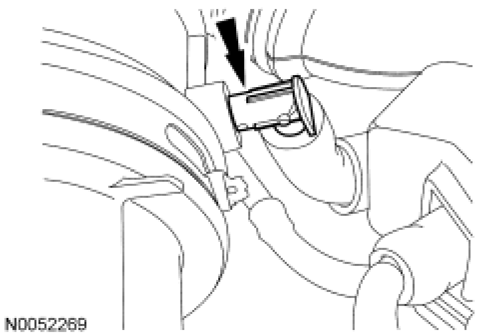


Fig. 427: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

4. Disconnect the engine breather from the ACL assembly.

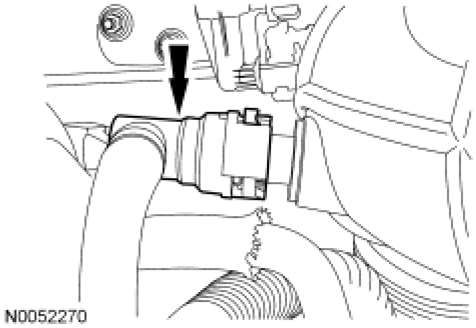


Fig. 428: Locating Engine Breather
Courtesy of FORD MOTOR CO.

5. Remove the ACL assembly bracket bolt.

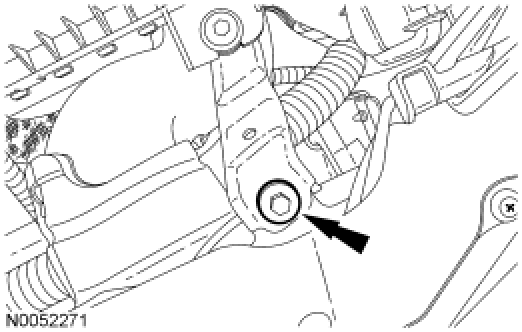


Fig. 429: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

6. Loosen the ACL outlet pipe clamp at the Throttle Body (TB) and remove the ACL and ACL outlet pipe assembly.

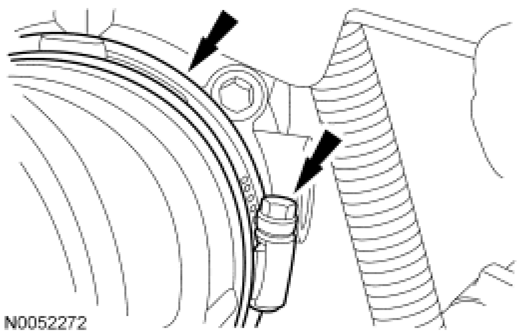


Fig. 430: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses do not need to be removed from the engine.

7. Remove the coolant hoses from the transmission fluid filler tube and position aside.

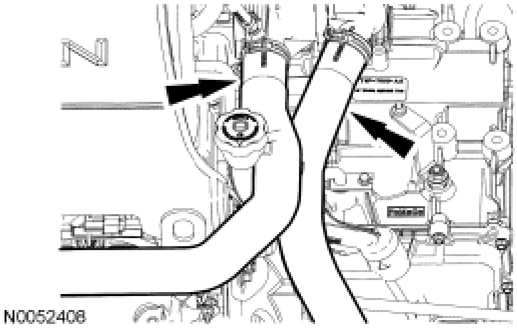


Fig. 431: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

8. Remove the transmission fluid level indicator.

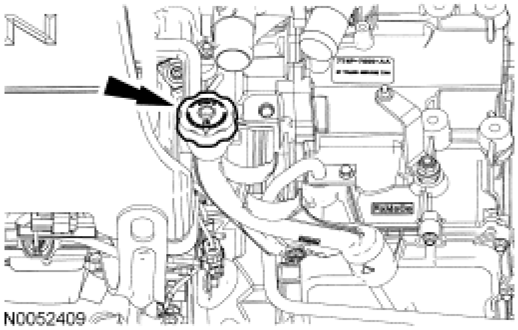


Fig. 432: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: The coolant hoses have been removed for clarity.

9. Remove the nut, rotate the transmission fluid filler tube counterclockwise 90 degrees and remove the transmission fluid filler tube.

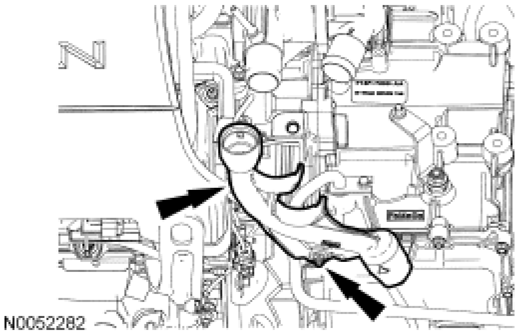


Fig. 433: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

10. Disconnect the selector lever cable end from the manual control lever.

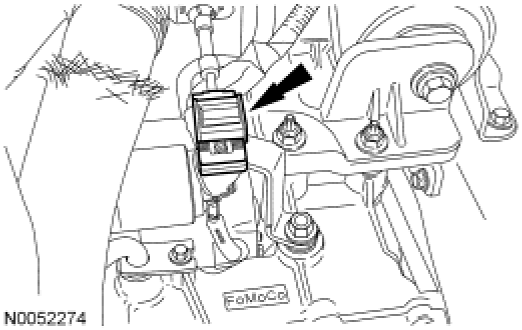


Fig. 434: Locating Selector Lever Cable End From Manual Lever
Courtesy of FORD MOTOR CO.

11. Remove the 3 selector lever cable bracket bolts and position aside the selector lever cable.

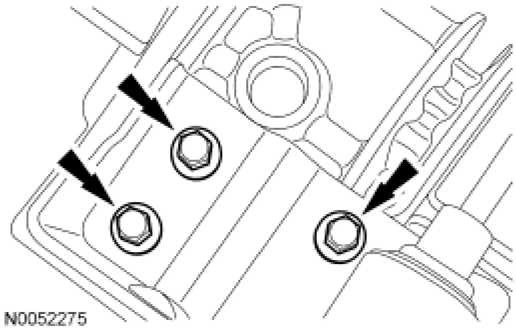


Fig. 435: Identifying Selector Lever Cable Bracket Bolts
Courtesy of FORD MOTOR CO.

12. Remove the starter motor electrical terminal cover.

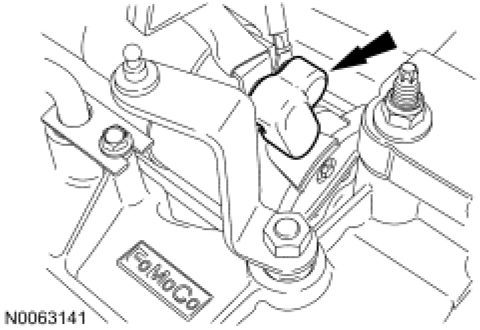


Fig. 436: Locating Starter Motor Electrical Terminal Cover
Courtesy of FORD MOTOR CO.

13. Position the starter cable boot back and remove the starter terminals from the starter.

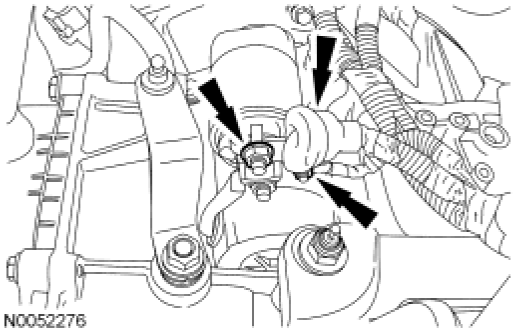


Fig. 437: Identifying Wire Terminals From Starter
Courtesy of FORD MOTOR CO.

14. Disconnect the wiring harness fastener from the starter motor studbolt.

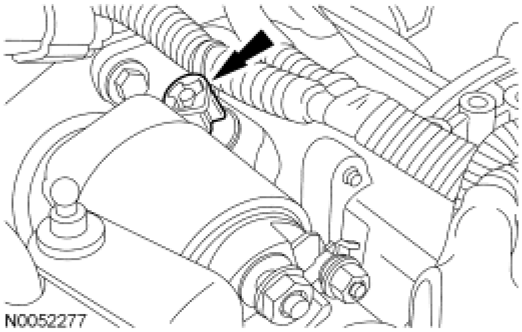


Fig. 438: Identifying Wiring Harness Retainer From Starter Motor Stud Bolt
Courtesy of FORD MOTOR CO.

15. Remove the bolt, studbolt and the starter.

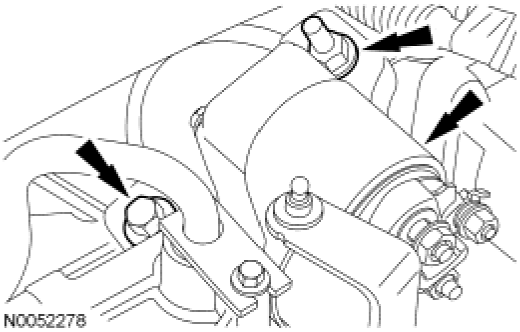


Fig. 439: Identifying Bolt, Stud Bolt & Starter
Courtesy of FORD MOTOR CO.

16. Disconnect the fuel hose routing clip from the transaxle stud and position the fuel hose aside.

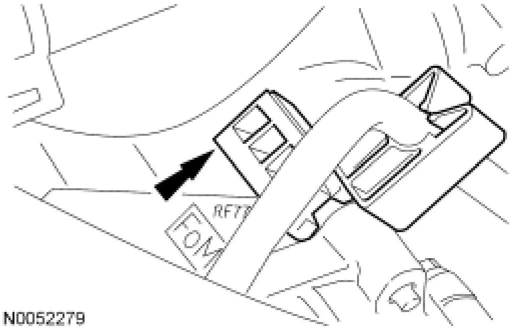


Fig. 440: Identifying Fuel Hose Routing Clip From Transaxle Stud
Courtesy of FORD MOTOR CO.

17. Disconnect the transaxle electrical connector.

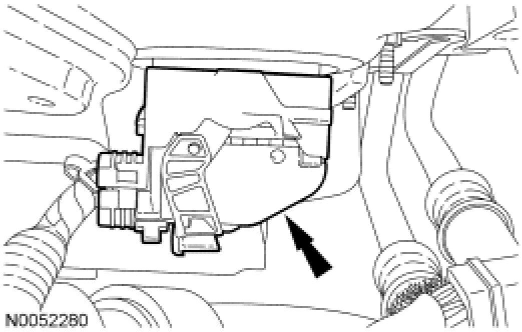


Fig. 441: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

18. Remove the top 4 torque converter housing bolts.

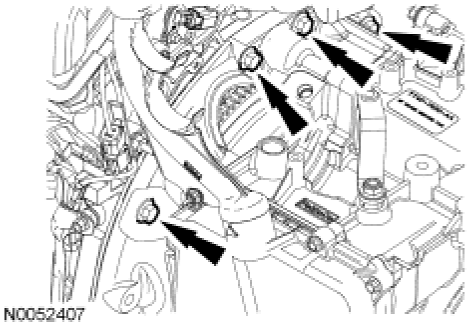


Fig. 442: Locating Torque Converter Housing Bolts
Courtesy of FORD MOTOR CO.

19. Install the Engine Lifting Bracket on the LH cylinder head.

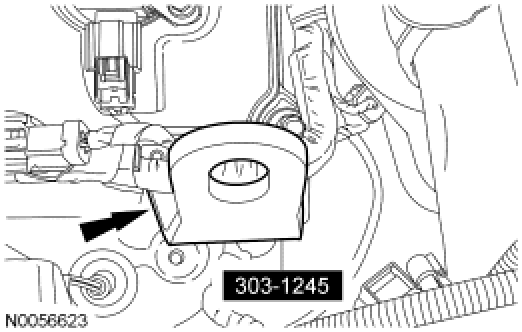


Fig. 443: Special Tool (303-1245) On LH Cylinder Head
Courtesy of FORD MOTOR CO.

20. Install the Engine Support Bar and Engine Spreader Bar to support the engine.

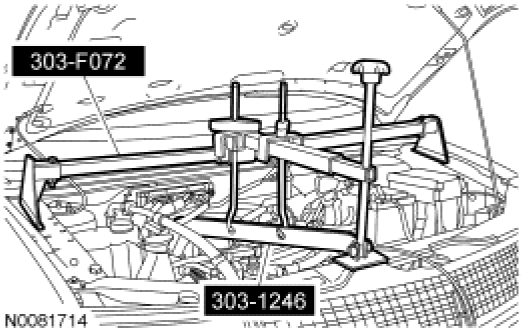


Fig. 444: Engine Support Bar & Engine Spreader Bar
Courtesy of FORD MOTOR CO.

21. Remove the transaxle support insulator through bolt.

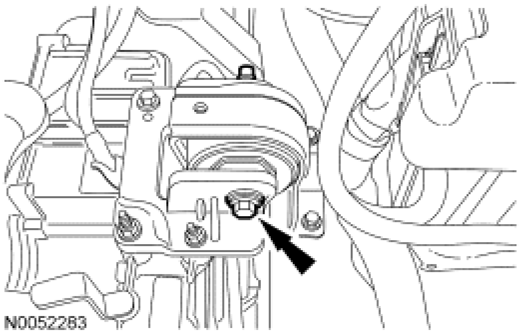


Fig. 445: Identifying Transaxle Support Insulator Bolt
Courtesy of FORD MOTOR CO.

22. Remove the 3 nuts, the bolt and the transaxle support insulator bracket.

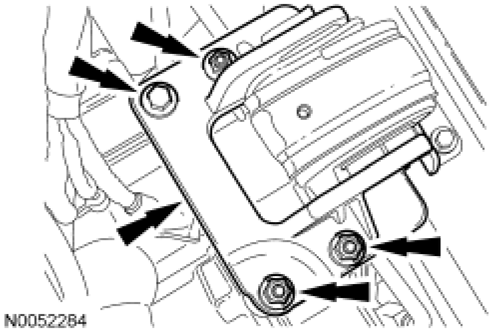


Fig. 446: Identifying Transaxle Support Insulator Bracket, Nuts & Bolts
Courtesy of FORD MOTOR CO.

23. Remove the RH splash shield.
    1. Remove the screws.
    2. Remove the pushpin fasteners and the RH splash shield.

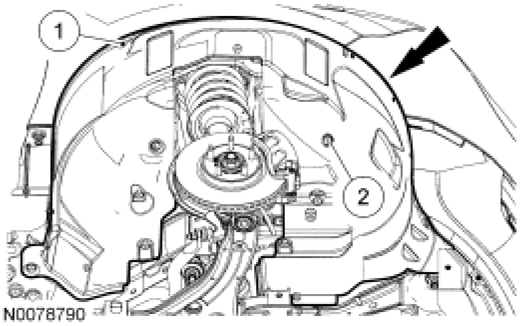


Fig. 447: Locating Push Pin Fasteners & RH Splash Shield
Courtesy of FORD MOTOR CO.

24. Remove the 3 pushpin fasteners, the 8 screws and the front splash shield.

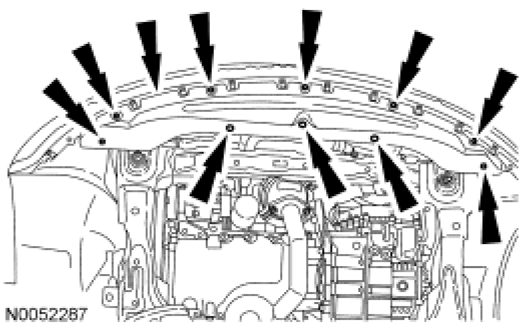


Fig. 448: Locating Push Pin Fasteners & Front Splash Shield Screws
Courtesy of FORD MOTOR CO.

25. Remove the 3 RH subframe-to-lower bumper nuts.

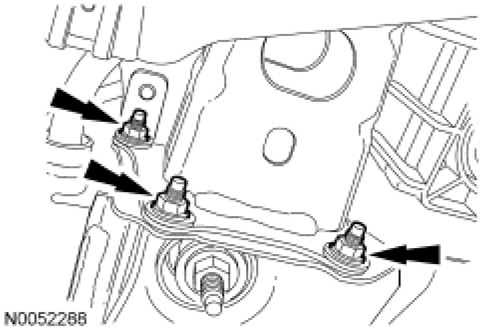


Fig. 449: Locating RH Subframe-To-Lower Bumper Nuts
Courtesy of FORD MOTOR CO.

26. Remove the 3 LH subframe-to-lower bumper nuts and separate the front support from the subframe.

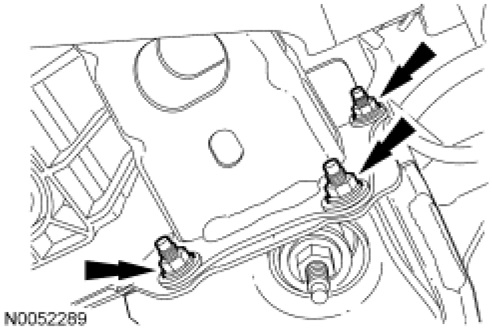


Fig. 450: Locating LH Subframe-To-Lower Bumper Nuts
Courtesy of FORD MOTOR CO.

27. Remove the 3 power steering tube bracket bolts from the subframe and position the power steering tube aside.

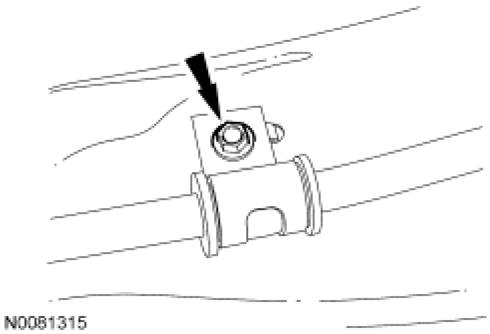


Fig. 451: Power Steering Tube Bracket Bolt
Courtesy of FORD MOTOR CO.

28. Remove the transmission fluid drain plug and allow the transmission fluid to drain.

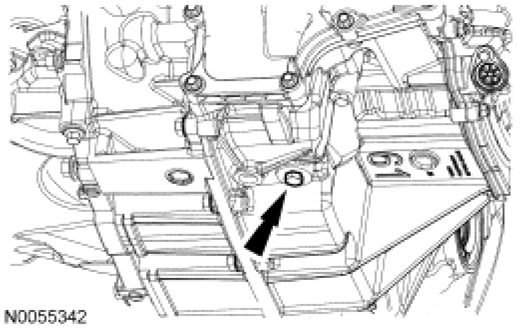


Fig. 452: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

29. Install the transmission fluid drain plug.
    - Tighten to 9 Nm (80 lb-in).

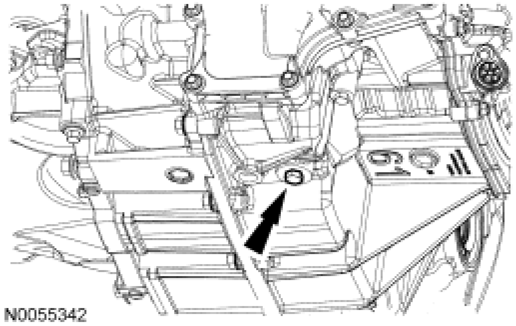


Fig. 453: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

30. Remove the LH and RH front halfshafts. For additional information, refer to**FRONT DRIVE HALFSHAFTS** article.
31. Inspect the halfshaft hubs for wear or damage and replace the halfshaft(s), if necessary.
    1. Inspect the differential seal surface.
    2. Inspect the halfshaft bushing surface. If this surface is damaged, inspect the halfshaft bushing for damage.
    3. Inspect the differential side gear splines.

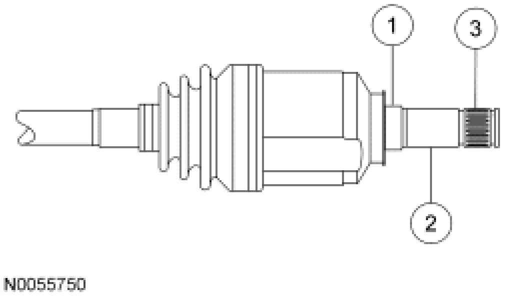


Fig. 454: Identifying Differential Side Gear Splines, Halfshaft Bushing & Differential Seal
Courtesy of FORD MOTOR CO.

32. Remove the bolts and the power steering rack heat shield.

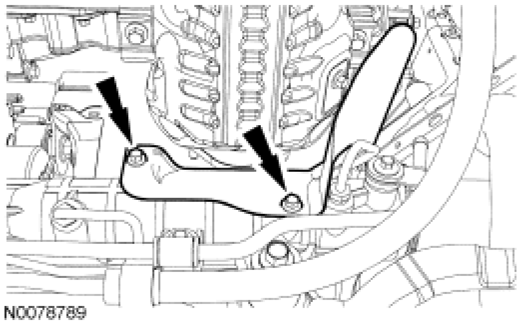


Fig. 455: Locating Power Steering Rack Heat Shield Bolts
Courtesy of FORD MOTOR CO.

33. Loosen the Y-pipe clamp and disconnect the 2 exhaust hangers.

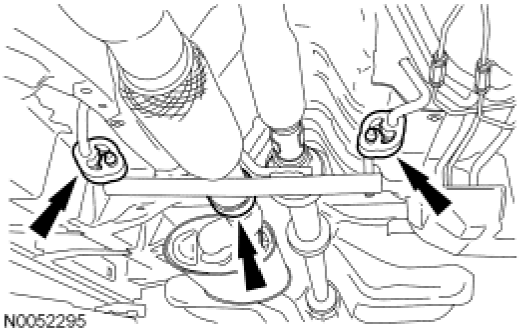


Fig. 456: Locating Exhaust Flexible Pipe Clamp & Exhaust Hangers
Courtesy of FORD MOTOR CO.

34. Remove the 4 nuts and the Y-pipe assembly.

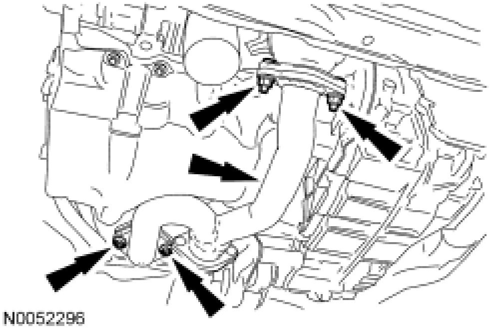


Fig. 457: Locating Exhaust Flexible Pipe, Y-Pipe & Nuts
Courtesy of FORD MOTOR CO.

35. Remove the 4 bolts and position the steering rack aside, using a suitable length of mechanic's wire.

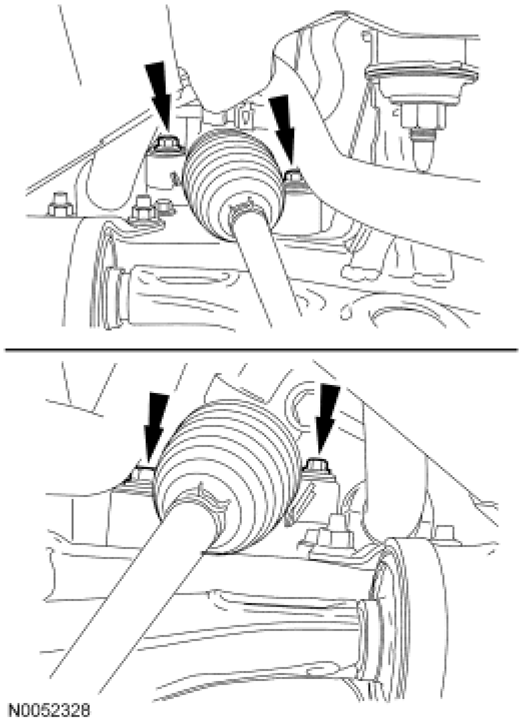


Fig. 458: Locating Steering Rack Bolts
Courtesy of FORD MOTOR CO.

36. Remove the 4 bolts and position the sway bar aside, using a suitable length of mechanic's wire.

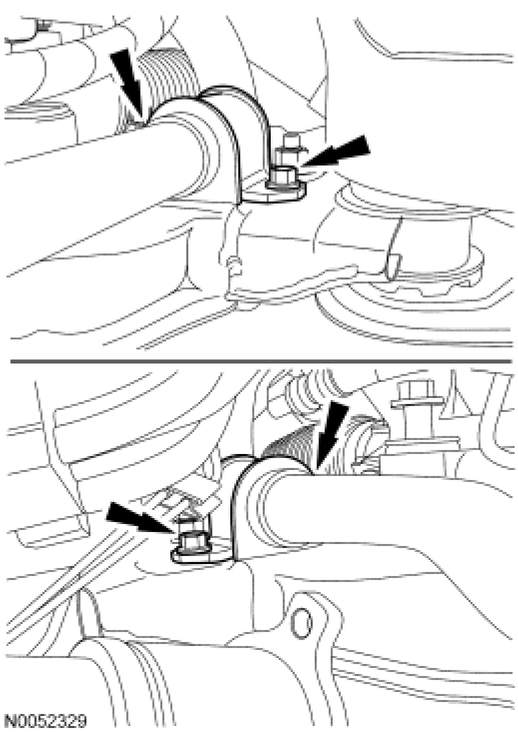


Fig. 459: Locating Stabilizer Bar & Bolts

Courtesy of FORD MOTOR CO.

37. Remove the 2 nuts and the roll restrictor heat shield.

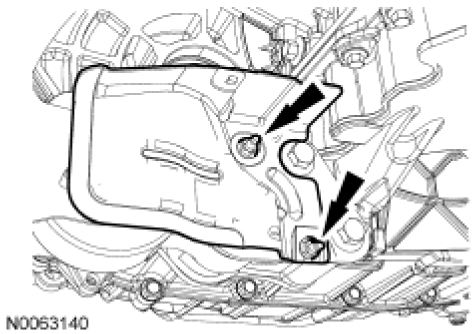


Fig. 460: Locating Roll Restrictor Heat Shield Nuts
Courtesy of FORD MOTOR CO.

38. Remove the 3 bolts from the roll restrictor bracket.

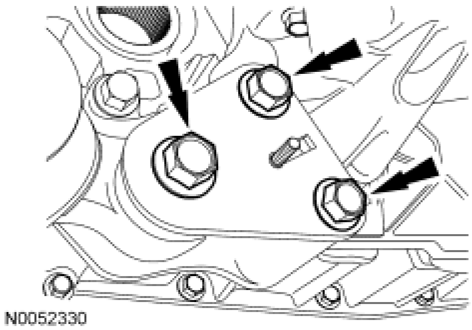


Fig. 461: Locating Roll Restrictor-To-Transaxle Bracket Plate Bolts
Courtesy of FORD MOTOR CO.

39. Support the subframe using the Powertrain Lift.
40. Remove the 2 nuts, 4 bolts and the subframe support brackets.

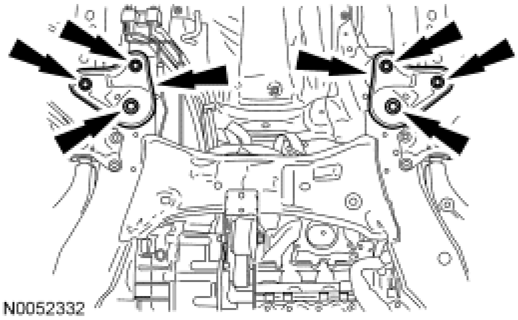


Fig. 462: Locating Subframe Support Brackets, Nuts & Bolts
Courtesy of FORD MOTOR CO.

41. Remove the 2 front subframe nuts.

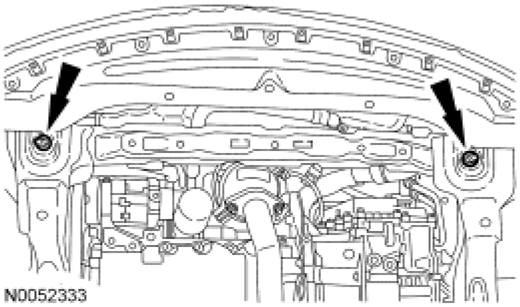


Fig. 463: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

42. Remove the 2 middle subframe nuts and remove the subframe.

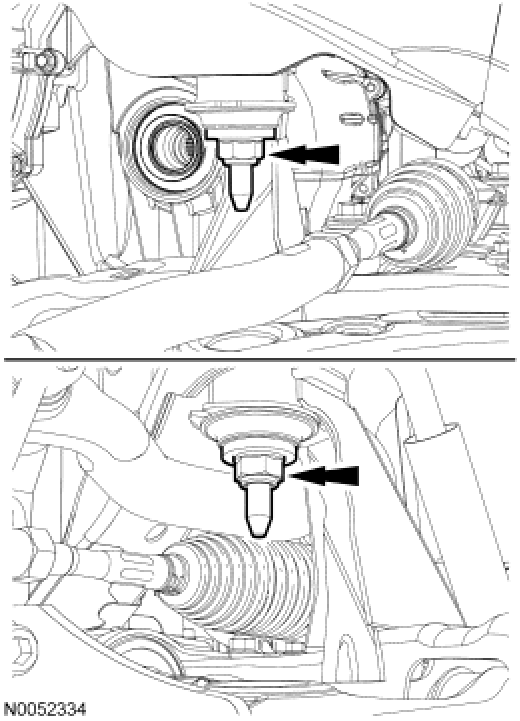


Fig. 464: Locating Middle Subframe Nuts
Courtesy of FORD MOTOR CO.

43. Remove the 3 bolts and the roll restrictor bracket.

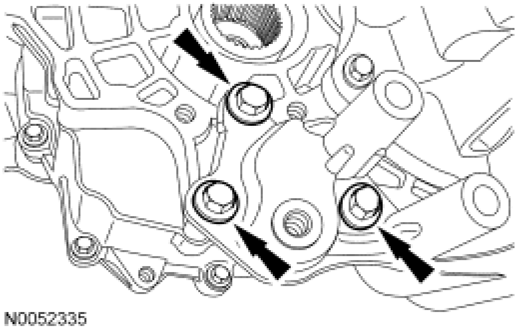


Fig. 465: Locating Transaxle Bracket Bolts
Courtesy of FORD MOTOR CO.

AWD vehicles

44. Index-mark the driveshaft, remove the 4 bolts and position the driveshaft aside.

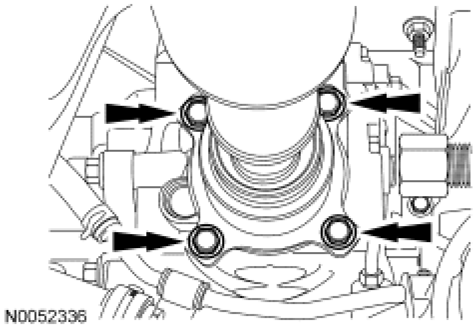


Fig. 466: Locating Driveshaft Aside Bolts
Courtesy of FORD MOTOR CO.

45. Disconnect the RH catalyst monitor electrical connector.

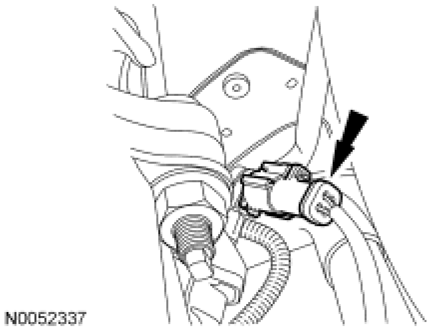


Fig. 467: Identifying RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

46. Remove the 2 catalytic converter support bracket bolts.

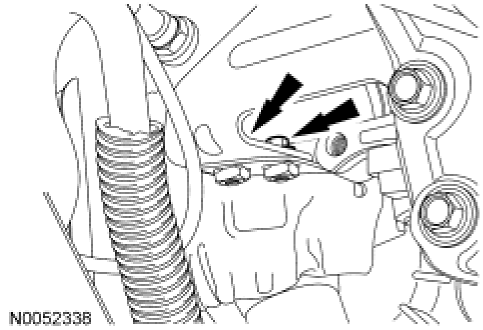


Fig. 468: Locating Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

47. Remove the 4 RH catalytic converter nuts and the RH catalytic converter.

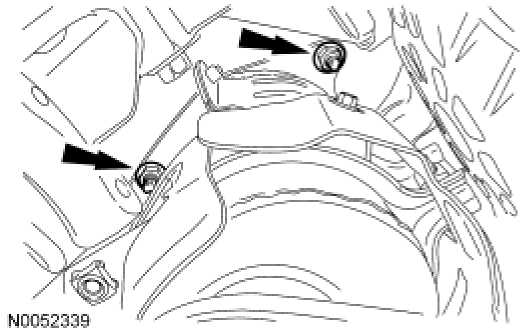


Fig. 469: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

48. Remove the 5 bolts and the Power Transfer Unit (PTU) support bracket.

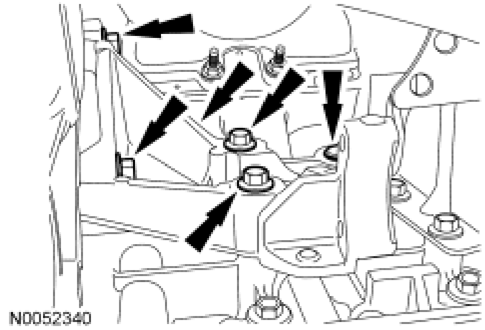


Fig. 470: Locating Power Transfer Unit (PTU) Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

49. Remove the 5 bolts and the PTU.

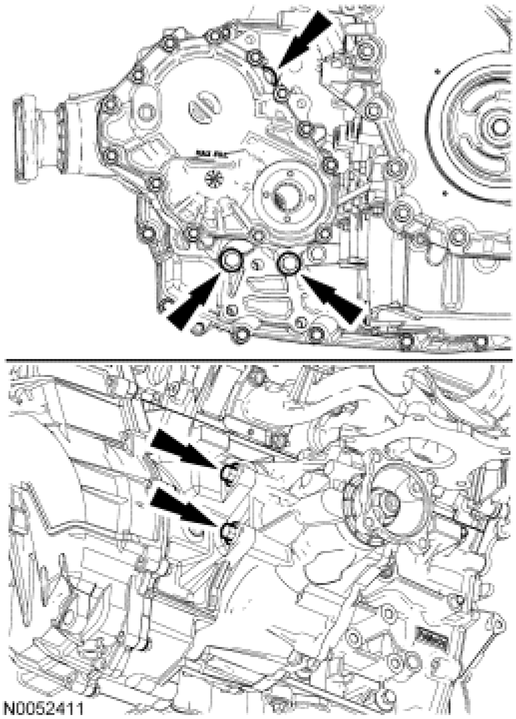


Fig. 471: Identifying PTU & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

50. Remove the 2 fasteners and the inspection cover.

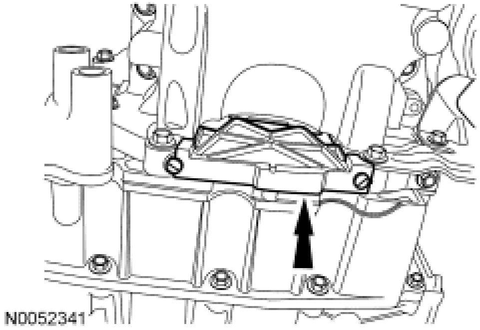


Fig. 472: Locating Oil Fasteners On Inspection Cover
Courtesy of FORD MOTOR CO.

51. Remove and discard the 3 torque converter bolts.

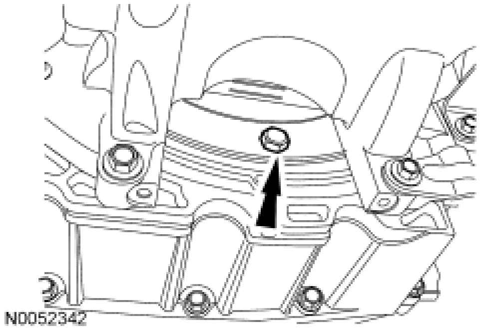


Fig. 473: Locating Torque Converter Bolts
Courtesy of FORD MOTOR CO.

52. Remove the 2 secondary latches from the transmission fluid cooler tubes at the transmission fluid cooler thermal bypass valve.

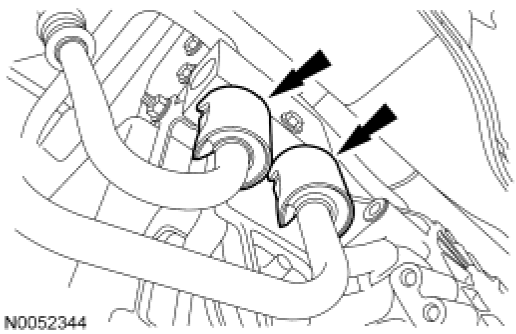


Fig. 474: Locating Secondary Latches On Transmission Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

53. Using the Transmission Cooler Line Disconnect Tool, disconnect the transmission fluid cooler tubes from the transmission fluid cooler thermal bypass valve.

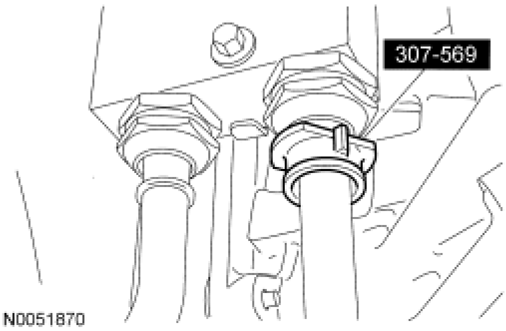


Fig. 475: Disconnecting Transmission Cooling Tubes Using Special Tool (307-569)
Courtesy of FORD MOTOR CO.

54. Using the Transmission Jack Adapter and a suitable transmission jack, support the transaxle.

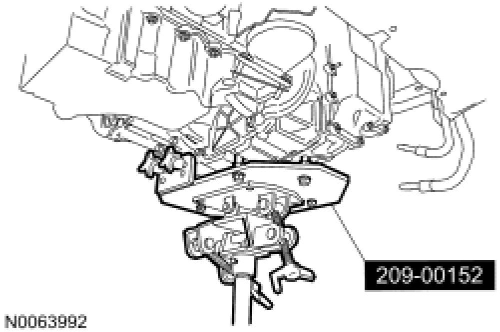


Fig. 476: Supporting Transaxle Using Special Tool (209-00152) & A Suitable Transmission Jack
Courtesy of FORD MOTOR CO.

55. Remove the 7 torque converter housing bolts and remove the transaxle from the vehicle.

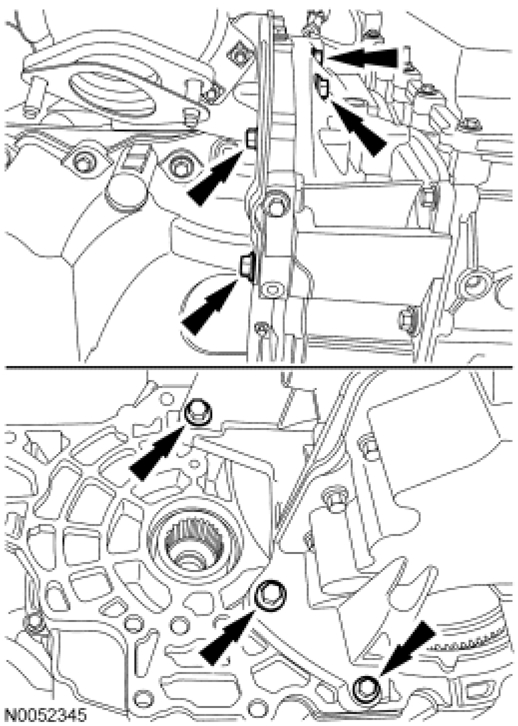


Fig. 477: Locating torque converter housing bolts
Courtesy of FORD MOTOR CO.

56. Inspect the torque converter housing mating surface to make sure that the dowel pins did not come out of the engine block when the transaxle was removed. If the dowel pin is stuck in the torque converter housing, remove the dowel pin from the torque converter housing.

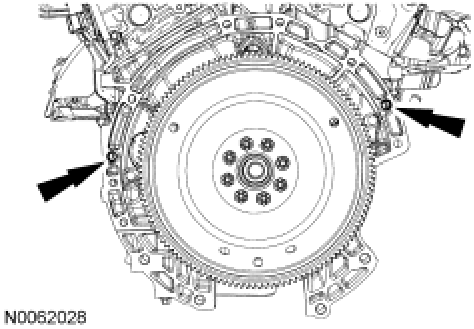


Fig. 478: Locating dowel pin from torque converter housing
Courtesy of FORD MOTOR CO.

57. Remove manual control lever.

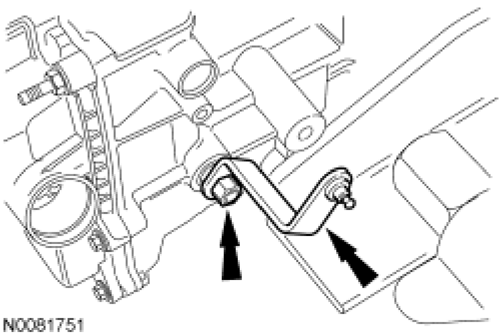


Fig. 479: Manual Control Lever
Courtesy of FORD MOTOR CO.

58. Remove and discard the transmission fluid cooler tube bolts.

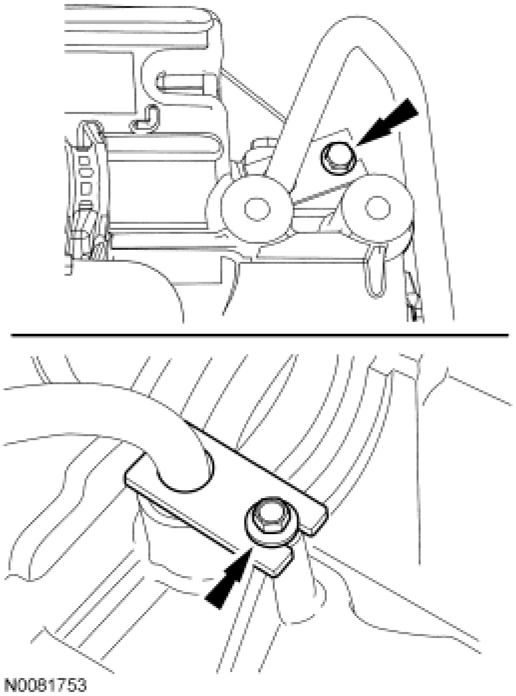


Fig. 480: Transmission Fluid Cooler Tube Bolts
Courtesy of FORD MOTOR CO.

59. Remove the 2 transmission fluid cooler thermal bypass valve bracket nuts, pull the transmission fluid cooler thermal bypass valve and the transmission fluid cooler tubes straight up and remove the assembly from the transaxle.

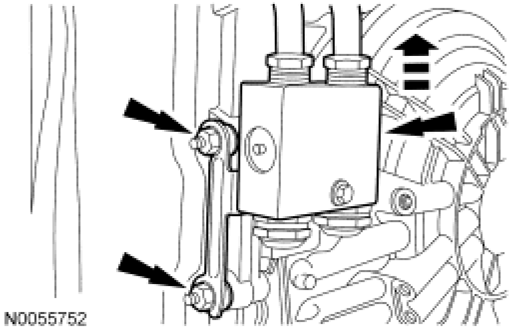


Fig. 481: Removing Nuts & Pulling Transmission Fluid Cooler Thermal Bypass Valve & Transmission Fluid Cooler Tubes Straight Up
Courtesy of FORD MOTOR CO.

60. Inspect the transaxle case to make sure that the transmission fluid cooler tube seals and backing rings were removed with the transmission fluid cooler tubes and are not stuck in the transaxle case. If the transmission fluid cooler tube seals or backing rings are stuck in the transaxle case, remove the seals and backing rings.

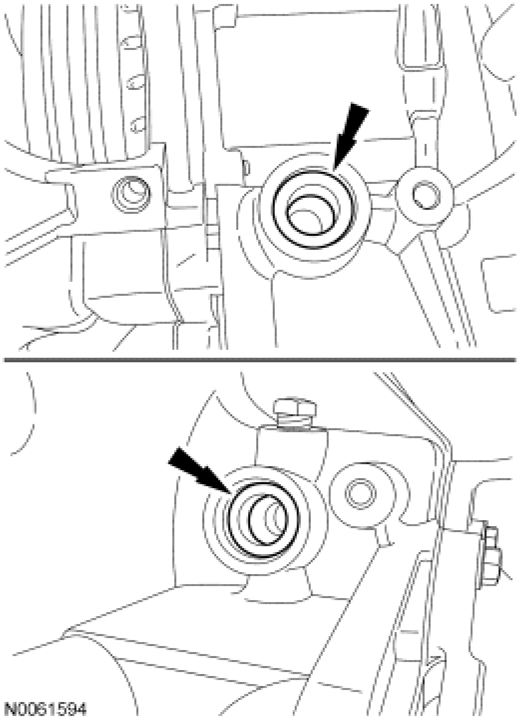


Fig. 482: Locating Transmission Fluid Cooler Tube Seals & Backing Rings
Courtesy of FORD MOTOR CO.

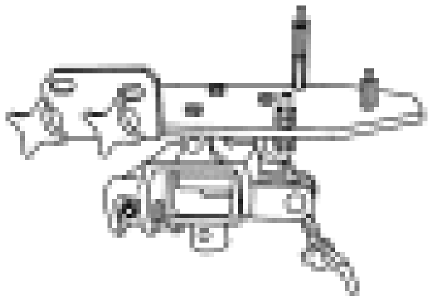
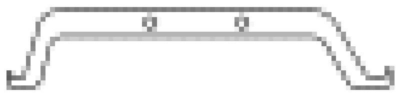
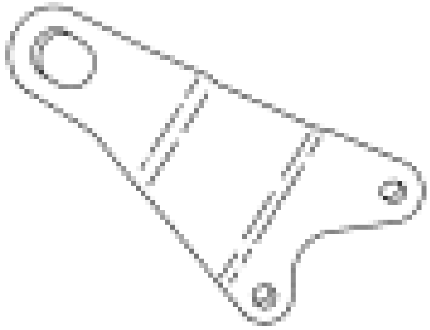
61. If the transaxle is to be overhauled or if installing a new transaxle, carry out transmission fluid cooler backflushing and cleaning. For additional information, refer to **Transmission Fluid Cooler Backflushing and Cleaning**.
62. If a replacement transaxle assembly is being installed or a new solenoid body is installed, the PCM will have to be reflashed with a new solenoid body strategy and identification data file. For additional information, refer to **Solenoid Body Strategy**.

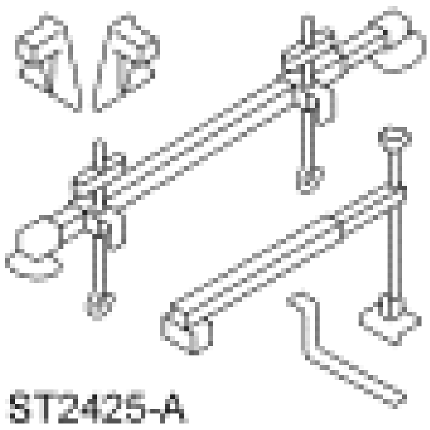
INSTALLATION

TRANSAXLE

Special Tools

Illustration	Tool Name	Tool Number
	Adapter, Transmission Jack	209-00152

 ST3033-A		
 ST2977-A	Bar, Engine Spreader	303-1246
 ST2976A	Eye, Engine Lift	303-1245
	Support Bar, Engine	303-F072



Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B

INSTALLATION

All vehicles

NOTE: Prior to installation of a new or overhauled transaxle, the transmission fluid cooler tubes must be cleaned, otherwise transaxle failure can occur.

NOTE: Prior to installation of a new or overhauled transaxle, flush out the cooler and cooler lines. For additional information, refer to Transmission Fluid Cooler Backflushing and Cleaning.

1. Inspect the transmission fluid cooler tube backing rings and seals for damage and install a new backing rings or seals if necessary. Lubricate the transmission fluid cooler tube seals with clean automatic transmission fluid and install the backing rings and seals on the transmission fluid cooler tube.

Item	Part Number	Description
1	7D285	Seal
2	7J324	Backing ring

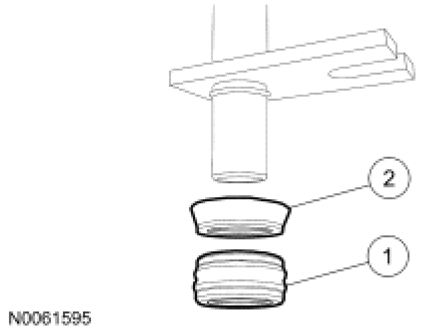


Fig. 483: Identifying Transmission Fluid Cooler Tube Backing Ring & Seal
Courtesy of FORD MOTOR CO.

2. Position the transmission fluid cooler thermal bypass valve and transmission fluid cooler tube assembly in place and install the transmission fluid cooler thermal bypass valve bracket nuts.
   - Tighten to 9 Nm (80 lb-in).

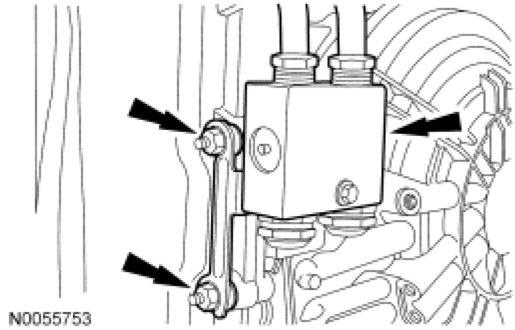


Fig. 484: Identifying Transmission Fluid Cooler Tube Assembly & Nuts
Courtesy of FORD MOTOR CO.

3. Install new transmission fluid cooler tube bolts.
   - Tighten to 9 Nm (80 lb-in).

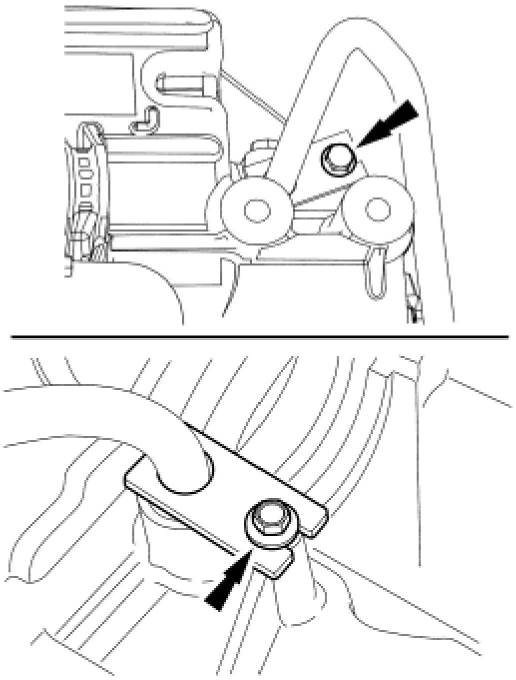


Fig. 485: Transmission Fluid Cooler Tube Bolts
Courtesy of FORD MOTOR CO.

4. Lubricate the torque converter pilot hub with grease and install the torque converter into the transaxle.

NOTE: **Make sure that when installing the manual control lever it is fully seated onto the manual control lever shaft or damage to the manual control lever shaft will occur and the lever will come loose.**

NOTE: **Make sure to hold the manual control lever while tightening the manual control lever nut or damage to the manual control lever and park components will occur.**

5. Install the manual control lever and nut.
   - Tighten to 18 Nm (159 lb-in).

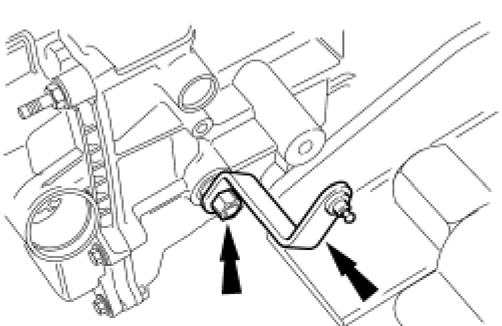


Fig. 486: Manual Control Lever
Courtesy of FORD MOTOR CO.

NOTE: If the transaxle is not positioned on the dowel pins, damage to the transaxle can occur.

6. If the dowel pins were pulled out of the engine block during removal, install new dowel pins in the engine block.

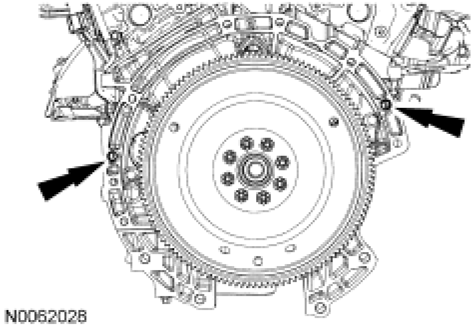


Fig. 487: Locating dowel pin from torque converter housing
Courtesy of FORD MOTOR CO.

7. Position the transaxle in place and install the 7 torque converter housing bolts.
    - Tighten to 48 Nm (35 lb-ft).

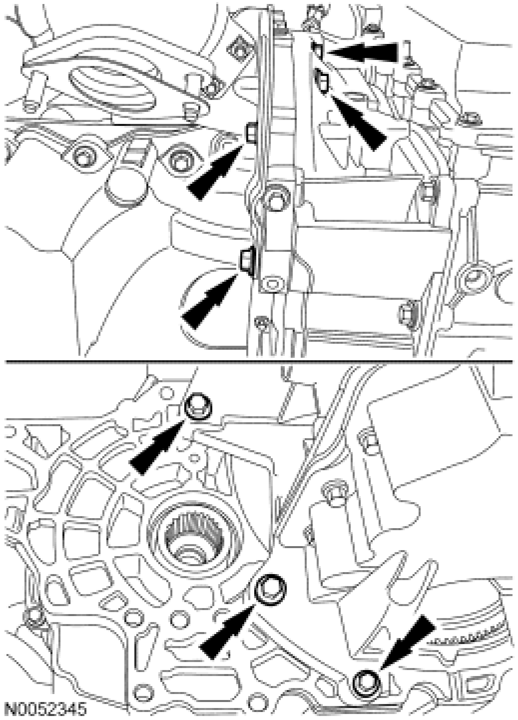


Fig. 488: Locating torque converter housing bolts

Courtesy of FORD MOTOR CO.

8. Remove the Transmission Jack Adapter from the transaxle.

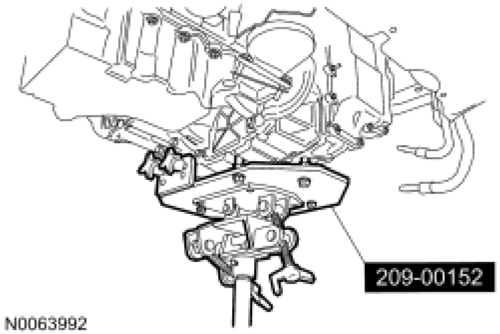


Fig. 489: Supporting Transaxle Using Special Tool (209-00152) & A Suitable Transmission Jack
Courtesy of FORD MOTOR CO.

9. Install the transmission fluid cooler tubes in the transmission fluid cooler thermal bypass valve.

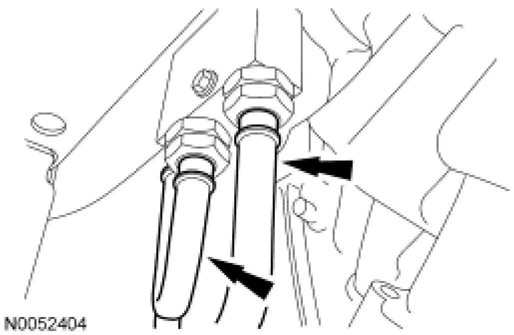


Fig. 490: Locating Transmission Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

10. Install the 2 secondary latches on the transmission fluid cooler tubes at the transmission fluid cooler thermal bypass valve.

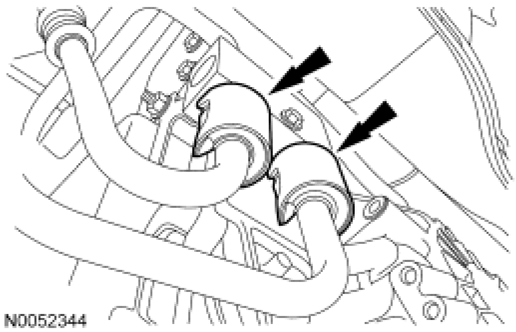


Fig. 491: Locating Secondary Latches On Transmission Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

11. Install 3 new torque converter bolts.
    - Tighten to 55 Nm (41 lb-ft).

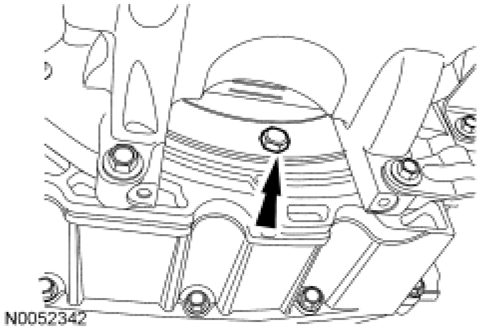


Fig. 492: Locating Torque Converter Bolts
Courtesy of FORD MOTOR CO.

12. Install the inspection cover and the 2 fasteners.

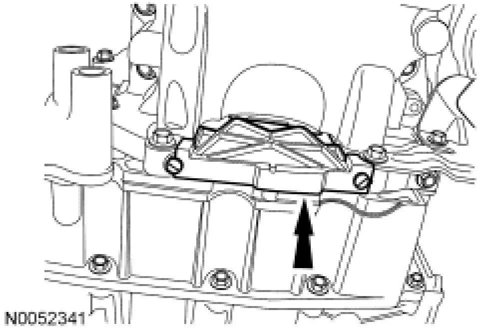


Fig. 493: Locating Oil Fasteners On Inspection Cover
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

13. Position the Power Transfer Unit (PTU) in place and install the 5 PTU-to-transaxle bolts.
    - Tighten to 90 Nm (66 lb-ft).

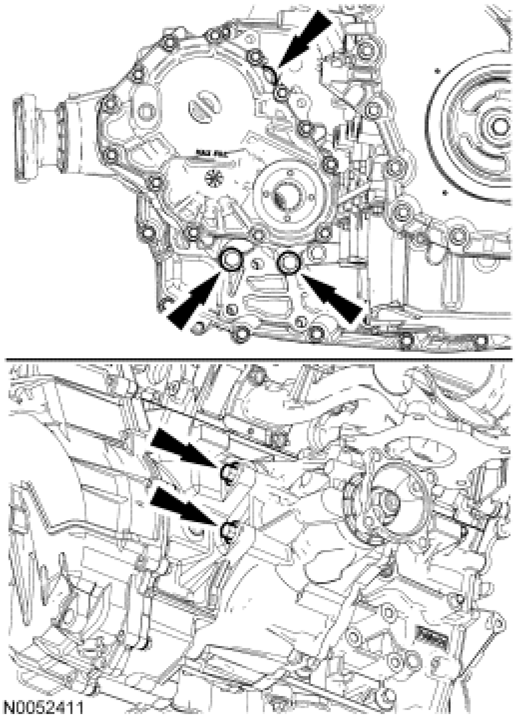


Fig. 494: Identifying PTU & Bolts
Courtesy of FORD MOTOR CO.

14. Position the PTU support bracket in place and install the 5 bolts.
    - Tighten to 70 Nm (52 lb-ft).

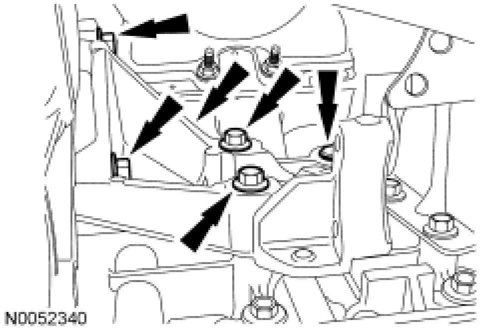


Fig. 495: Locating Power Transfer Unit (PTU) Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

15. Position the RH catalytic converter in place and install the 4 nuts.
    - Tighten to 40 Nm (30 lb-ft).

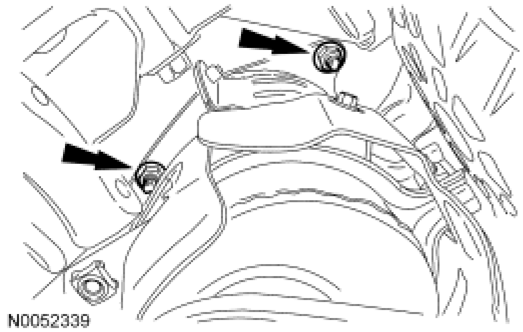


Fig. 496: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

16. Install the 2 RH catalytic converter support bracket bolts.
    - Tighten to 20 Nm (177 lb-in).

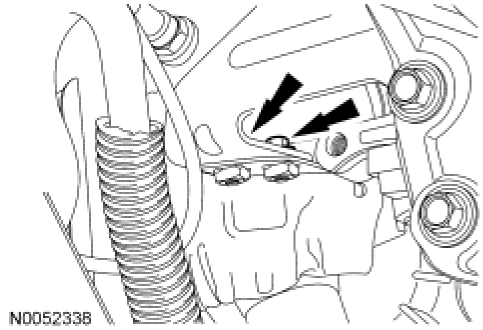


Fig. 497: Locating Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

17. Connect the RH catalyst monitor electrical connector.

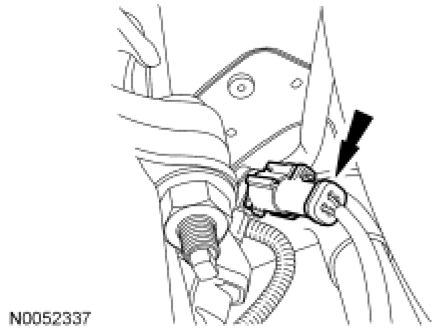


Fig. 498: Identifying RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

18. Line up the index marks on the rear driveshaft to the index marks on the PTU flange made during removal and install the 4 bolts.
    - Tighten to 70 Nm (52 lb-ft).

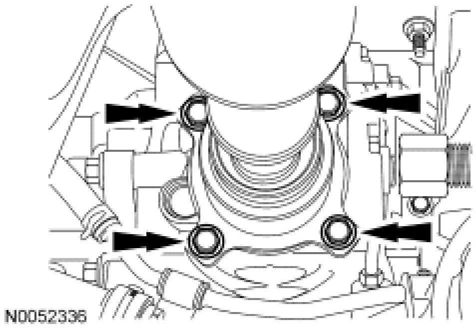


Fig. 499: Locating Driveshaft Aside Bolts
Courtesy of FORD MOTOR CO.

All vehicles

19. Position the roll restrictor bracket on the transaxle and install the 3 bolts.
    - Tighten to 90 Nm (66 lb-ft).

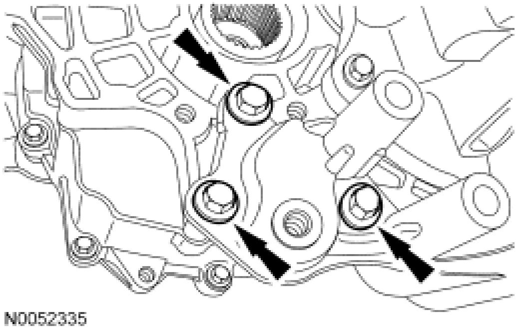


Fig. 500: Locating Transaxle Bracket Bolts
Courtesy of FORD MOTOR CO.

20. Position the subframe in place and install the 2 middle nuts.
    - Tighten to 150 Nm (111 lb-ft).

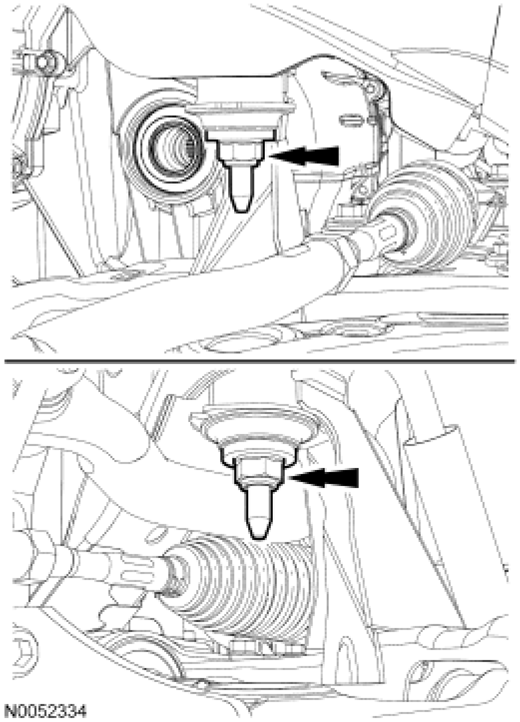


Fig. 501: Locating Middle Subframe Nuts
Courtesy of FORD MOTOR CO.

21. Install the 2 front subframe nuts.
    - Tighten to 150 Nm (111 lb-ft).

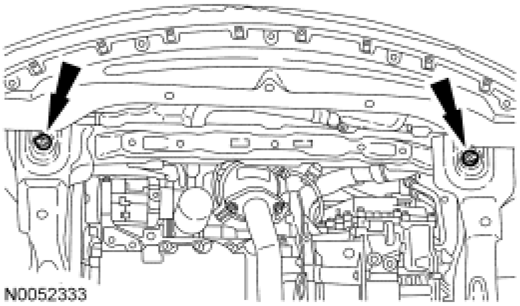


Fig. 502: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

22. Position the subframe support brackets in place and loosely install the bolts.

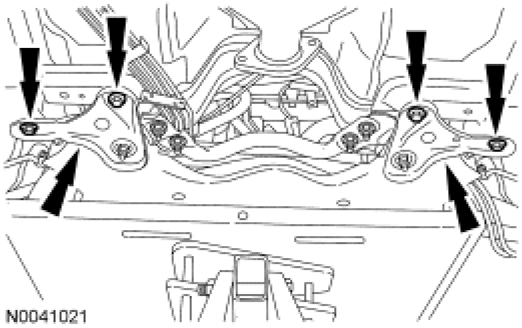


Fig. 503: Locating Subframe Support Brackets And Bolts
Courtesy of FORD MOTOR CO.

23. Install the rear subframe nuts.
    - Tighten to 150 Nm (111 lb-ft).

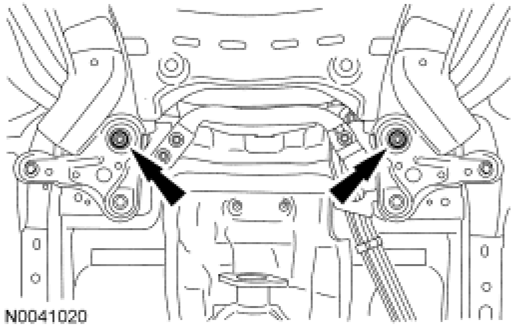


Fig. 504: Locating Rear Subframe Nuts
Courtesy of FORD MOTOR CO.

24. Tighten the subframe support bracket bolts.
    - Tighten to 103 Nm (76 lb-ft).

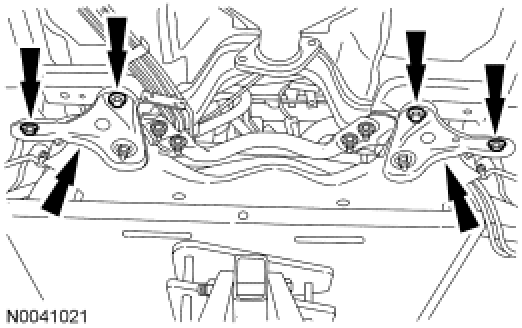


Fig. 505: Locating Subframe Support Brackets And Bolts
Courtesy of FORD MOTOR CO.

25. Position the roll restrictor in place, install the bracket and the 3 roll restrictor bolts.

- Tighten to 90 Nm (66 lb-ft).

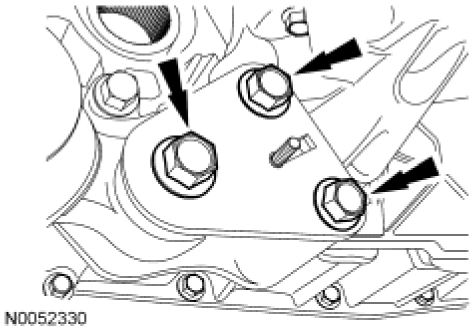


Fig. 506: Locating Roll Restrictor-To-Transaxle Bracket Plate Bolts
Courtesy of FORD MOTOR CO.

26. Install the roll restrictor heat shield and the 2 nuts.
    - Tighten to 11 Nm (97 lb-in).

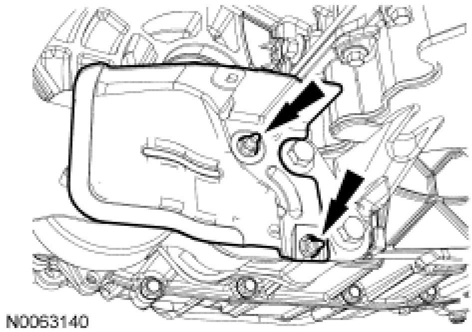


Fig. 507: Locating Roll Restrictor Heat Shield Nuts
Courtesy of FORD MOTOR CO.

27. Position the stabilizer bar in place and install the 4 stabilizer bar bracket bolts.
    - Tighten to 48 Nm (35 lb-ft).

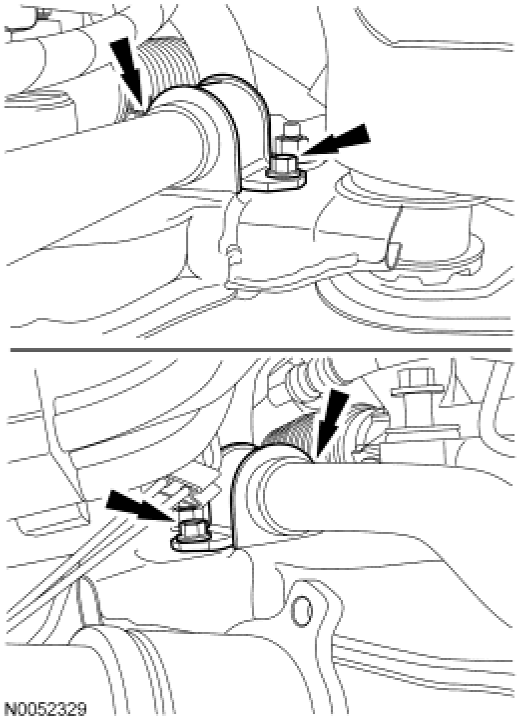


Fig. 508: Locating Stabilizer Bar & Bolts
Courtesy of FORD MOTOR CO.

28. Position the power steering rack in place and install the 4 power steering rack bolts.
    - Tighten to 107 Nm (79 lb-ft).

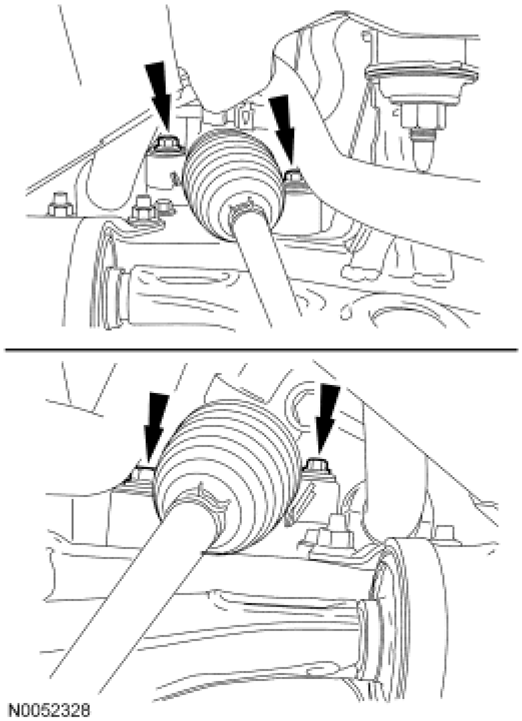


Fig. 509: Locating Steering Rack Bolts
Courtesy of FORD MOTOR CO.

29. Install the steering rack heat shield and the 2 bolts.
    - Tighten to 6 Nm (53 lb-in).

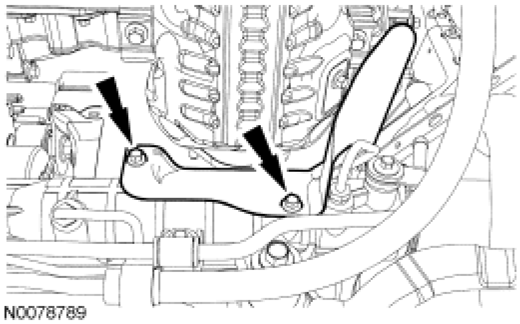


Fig. 510: Locating Power Steering Rack Heat Shield Bolts
Courtesy of FORD MOTOR CO.

30. Position the exhaust Y-pipe assembly in place and install the 4 exhaust Y-pipe nuts.
    - Tighten to 40 Nm (30 lb-ft).

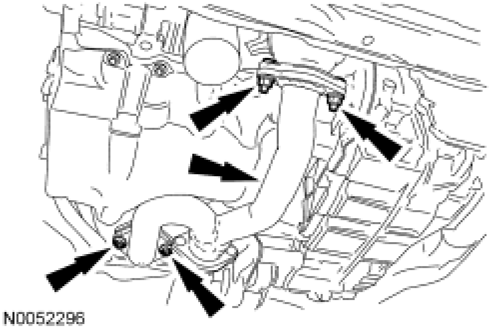


Fig. 511: Locating Exhaust Flexible Pipe, Y-Pipe & Nuts
Courtesy of FORD MOTOR CO.

31. Install the 2 exhaust hangers and tighten the exhaust clamp.
    - Tighten to 40 Nm (30 lb-ft).

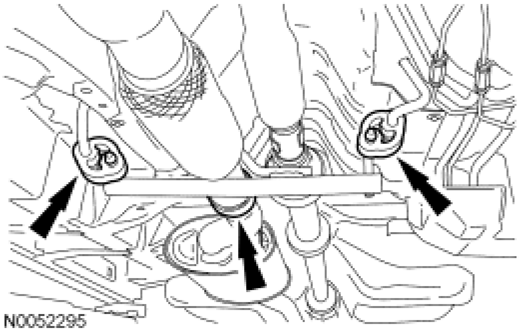


Fig. 512: Locating Exhaust Flexible Pipe Clamp & Exhaust Hangers
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

32. Position the RH halfshaft and intermediate shaft support bracket in the transaxle and in the steering knuckle. Install 1 stud bolt and 1 bolt.
    - Tighten to 55 Nm (41 lb-ft).

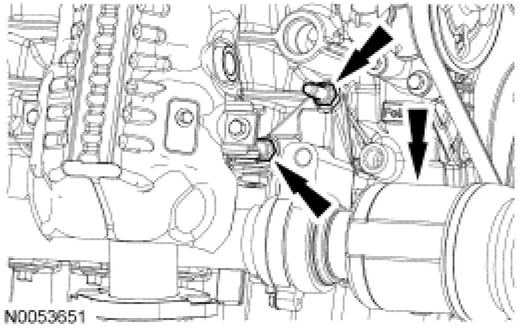


Fig. 513: Locating Stud Bolts & RH Halfshaft/Intermediate Shaft Assembly
Courtesy of FORD MOTOR CO.

33. Position the catalytic converter support bracket in place and install the bolt and the nut.
    1. Tighten the nut to 40 Nm (30 lb-ft).
    2. Tighten the bolt to 55 Nm (41 lb-ft).

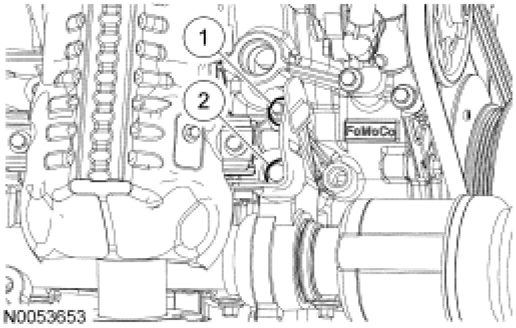


Fig. 514: Locating Catalytic Converter Bracket Bolt & Nut
Courtesy of FORD MOTOR CO.

34. Install the 2 RH catalytic converter support bracket bolts.
    - Tighten to 20 Nm (177 lb-in).

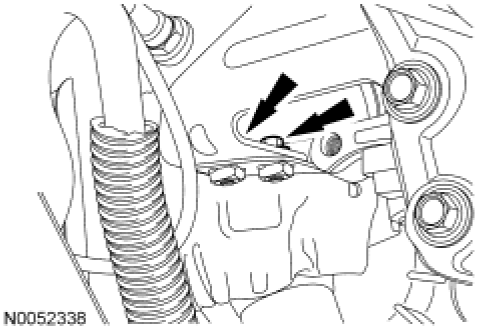


Fig. 515: Locating Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

All vehicles

35. Install the LH and RH halfshafts. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.
36. Position the lower bumper on the subframe and install the 3 LH lower bumper-to-subframe nuts.
    - Tighten to 10 Nm (89 lb-in).

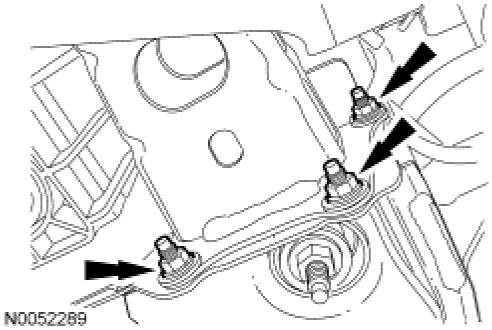


Fig. 516: Locating LH Subframe-To-Lower Bumper Nuts
Courtesy of FORD MOTOR CO.

37. Install the 3 RH lower bumper-to-subframe nuts.
    - Tighten to 10 Nm (89 lb-in).

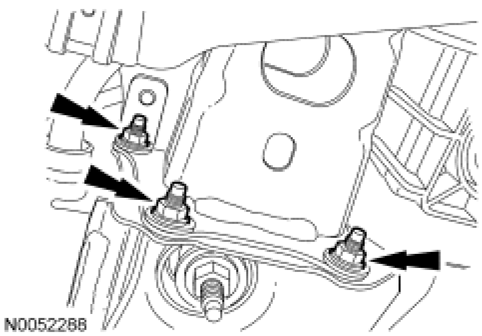


Fig. 517: Locating RH Subframe-To-Lower Bumper Nuts
Courtesy of FORD MOTOR CO.

38. Install the front splash shield and install the 7 screws and the 3 pushpin fasteners.

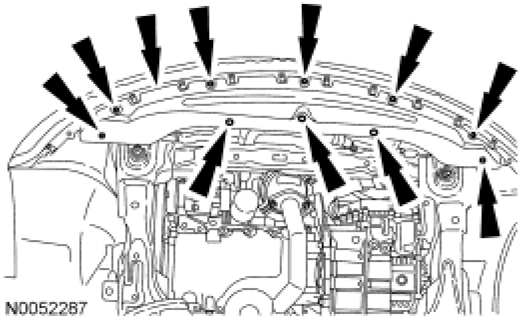


Fig. 518: Locating Push Pin Fasteners & Front Splash Shield Screws
Courtesy of FORD MOTOR CO.

39. Install the RH splash shield.
    1. Install the screws.

2. Install the pushpin fasteners.

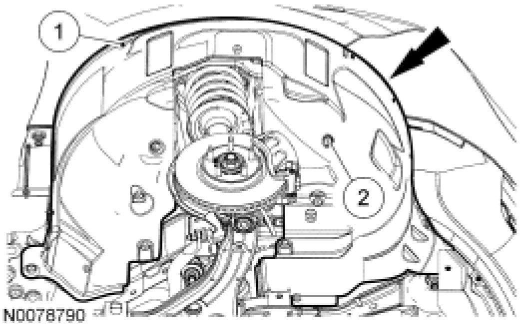


Fig. 519: Locating Push Pin Fasteners & RH Splash Shield
Courtesy of FORD MOTOR CO.

40. Install the transaxle support insulator bracket, install the bolt and the 3 nuts.
    - Tighten to 63 Nm (46 lb-ft).

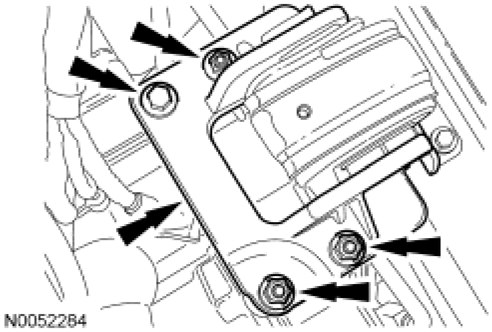


Fig. 520: Identifying Transaxle Support Insulator Bracket, Nuts & Bolts
Courtesy of FORD MOTOR CO.

41. Install the transaxle support insulator through bolt.
    - Tighten to 175 Nm (129 lb-ft).

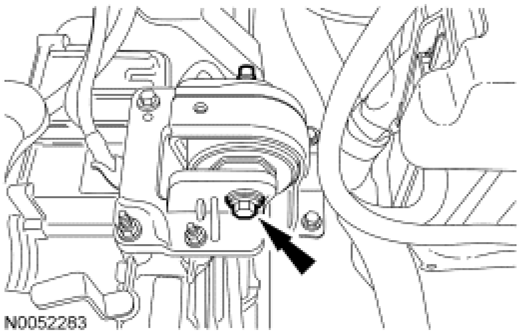


Fig. 521: Identifying Transaxle Support Insulator Bolt
Courtesy of FORD MOTOR CO.

42. Remove the Engine Support Bar and Engine Spreader Bar.

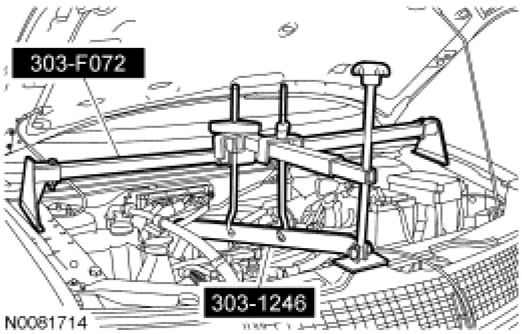


Fig. 522: Engine Support Bar & Engine Spreader Bar
Courtesy of FORD MOTOR CO.

43. Remove the Engine Lift Eye from the LH cylinder head.

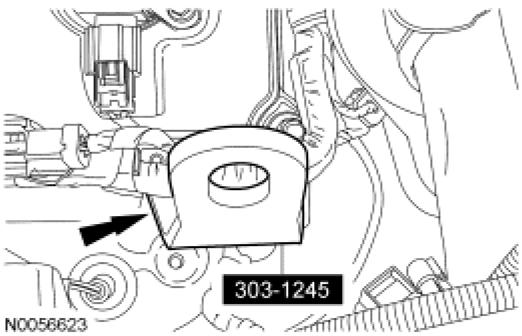


Fig. 523: Special Tool (303-1245) On LH Cylinder Head
Courtesy of FORD MOTOR CO.

44. If a new solenoid body was installed, wipe the surface of the existing solenoid body strategy tag on top of the transaxle case clean and install the new solenoid body strategy tag (supplied with the solenoid body service kit) over it.

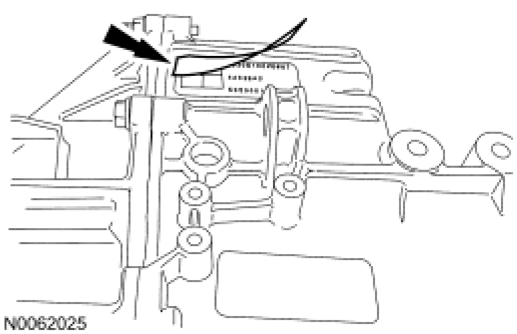


Fig. 524: Installing New Solenoid Body Strategy Tag Over Existing Solenoid Body Strategy Tag
Courtesy of FORD MOTOR CO.

45. Install the transmission fluid filler tube and the nut.
    - Tighten to 11 Nm (97 lb-in).

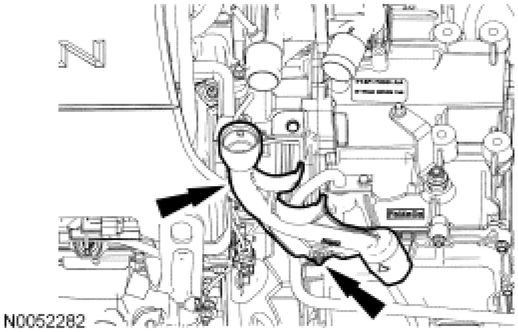


Fig. 525: Identifying Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

46. Install the transmission fluid level indicator.

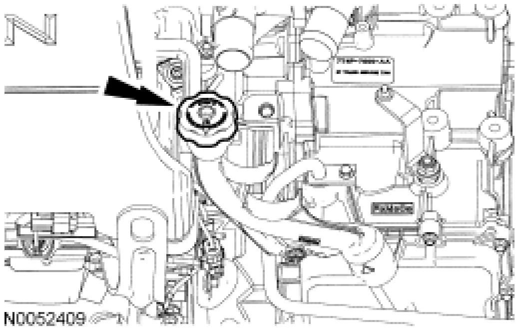


Fig. 526: Identifying Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

47. Route the coolant hoses in the transmission fluid filler tube.

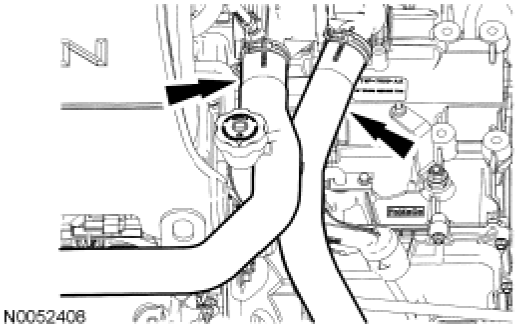


Fig. 527: Identifying Coolant Hoses From Transmission Fluid Filler Tube
Courtesy of FORD MOTOR CO.

48. Install the top 4 torque converter housing bolts.

- Tighten to 48 Nm (35 lb-ft).

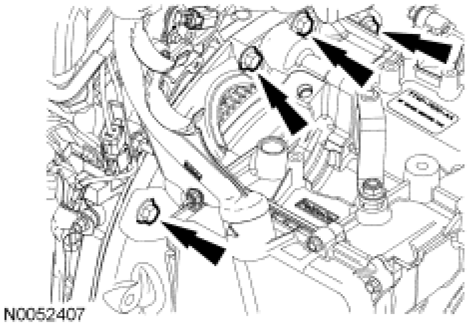


Fig. 528: Locating Torque Converter Housing Bolts
Courtesy of FORD MOTOR CO.

49. Connect the transaxle electrical connector.

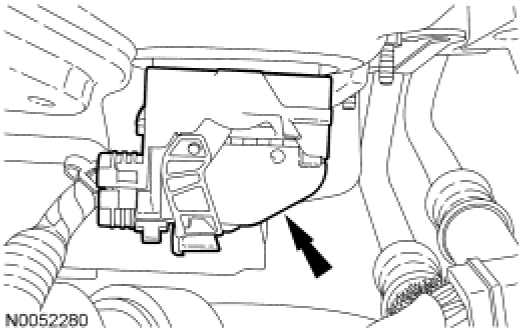


Fig. 529: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

50. Position the fuel hose routing clip on the transaxle stud.

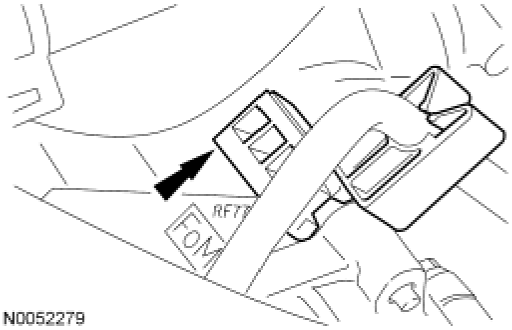


Fig. 530: Identifying Fuel Hose Routing Clip From Transaxle Stud
Courtesy of FORD MOTOR CO.

51. Install the starter, bolt and studbolt.
    - Tighten to 26 Nm (19 lb-ft).

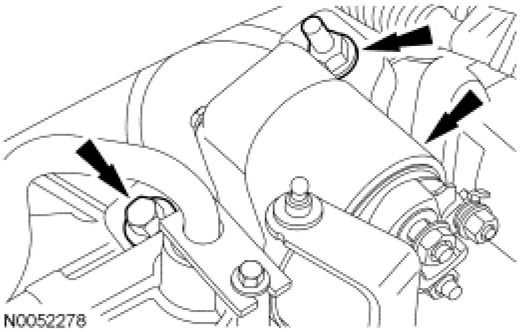


Fig. 531: Identifying Bolt, Stud Bolt & Starter
Courtesy of FORD MOTOR CO.

52. Install the wiring harness fastener on the starter motor studbolt.

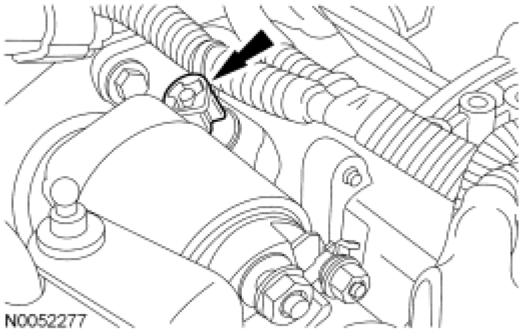


Fig. 532: Identifying Wiring Harness Retainer From Starter Motor Stud Bolt
Courtesy of FORD MOTOR CO.

53. Connect the starter motor terminals and position the starter terminal boot over the battery cable terminal.
    1. Tighten to 12 Nm (106 lb-in).
    2. Tighten to 6 Nm (53 lb-in).

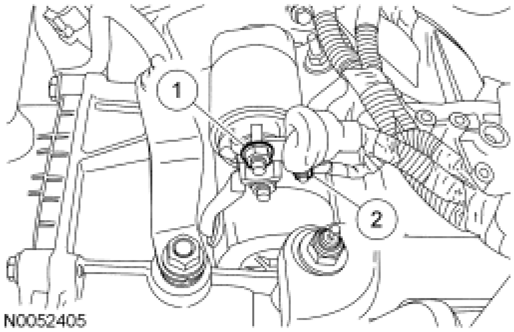


Fig. 533: Identifying Starter Motor Wire Terminals & Nuts
Courtesy of FORD MOTOR CO.

54. Install the starter motor electrical terminal cover.

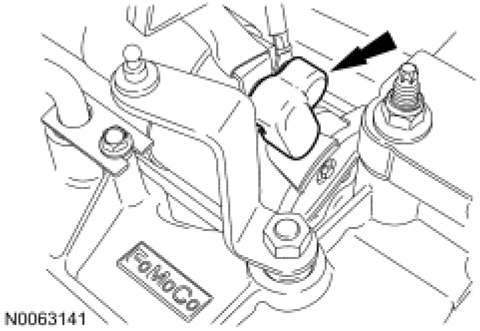


Fig. 534: Locating Starter Motor Electrical Terminal Cover
Courtesy of FORD MOTOR CO.

55. Position the selector lever cable and bracket in place and install the 3 bolts.
    - Tighten to 12 Nm (106 lb-in).

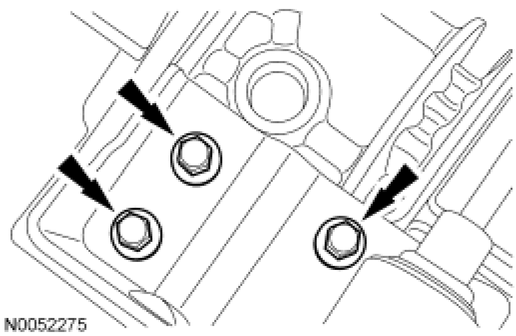


Fig. 535: Identifying Selector Lever Cable Bracket Bolts
Courtesy of FORD MOTOR CO.

56. Place the selector lever in DRIVE.

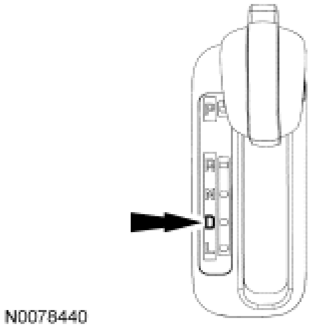


Fig. 536: Placing Selector Lever In Drive
Courtesy of FORD MOTOR CO.

57. Place the manual control lever in DRIVE.
    1. Rotate the manual control lever clockwise until it stops.

2. Rotate the manual control lever counterclockwise one detent until it stops.

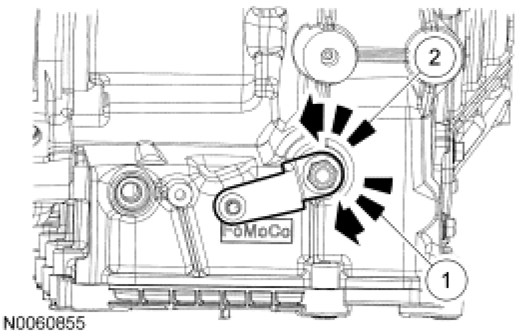


Fig. 537: Rotating Manual Control Lever Clockwise & Counterclockwise
Courtesy of FORD MOTOR CO.

58. Unlock the selector lever cable adjuster.
    1. Pry the latch up.
    2. Push the lock tab to slide it over.

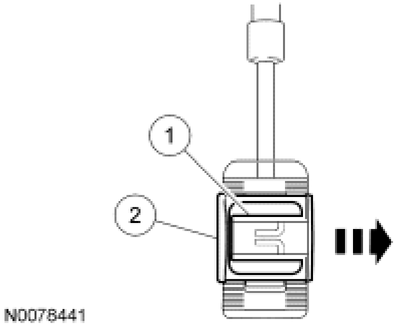


Fig. 538: Pushing Lock Tab To Slide It Over
Courtesy of FORD MOTOR CO.

59. Slide the cable end forward or backward to align it with the manual control lever.

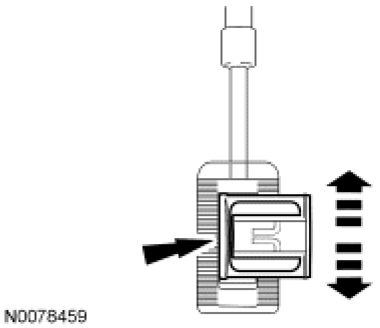


Fig. 539: Sliding Cable End Forward Or Backward To Align It With Manual Control Lever
Courtesy of FORD MOTOR CO.

60. With the adjuster locking tab released, connect the selector lever cable end to the manual control lever.

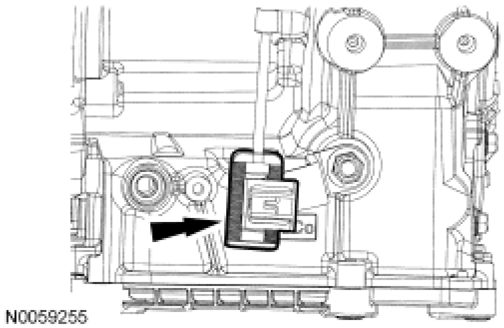


Fig. 540: Connecting Selector Lever Cable End To Manual Lever
Courtesy of FORD MOTOR CO.

61. Slide the release tab back to lock the adjuster.

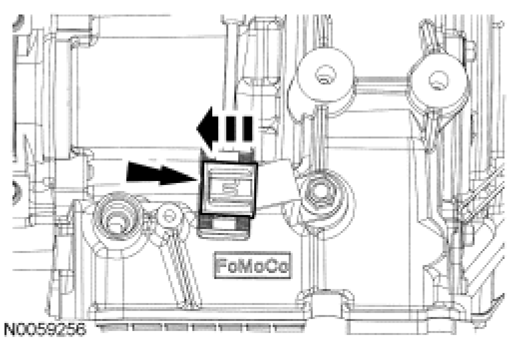


Fig. 541: Sliding Release Tab Back To Lock Adjuster
Courtesy of FORD MOTOR CO.

62. Install the upper intake manifold. For additional information, refer to **ENGINE - 3.5L** article.
63. Install the battery tray.
    1. Install the 3 bolts.
        - Tighten to 10 Nm (89 lb-in).
    2. Connect the wiring harness fasteners to the battery tray.

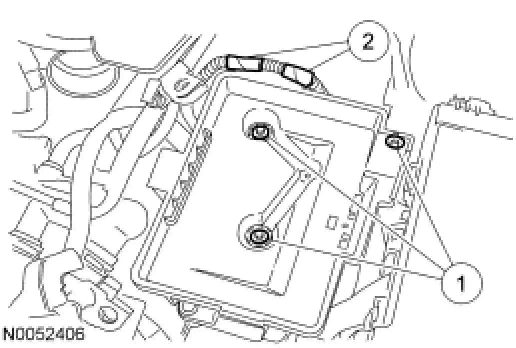


Fig. 542: Identifying Wiring Harness Fasteners, Battery Tray & Bolts
Courtesy of FORD MOTOR CO.

64. Install the battery. For additional information, refer to **BATTERY, MOUNTING & CABLES** article.
65. Position the Air Cleaner (ACL) assembly in place and install the bolt.
    - Tighten to 11 Nm (97 lb-in).

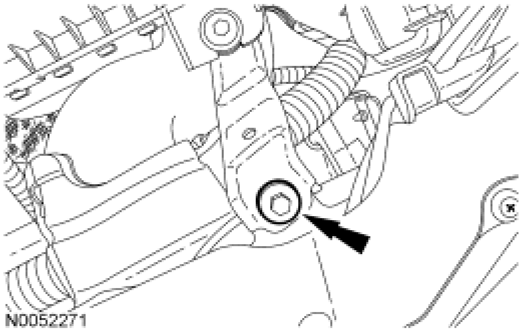


Fig. 543: Locating Air Cleaner Assembly Bracket Bolt
Courtesy of FORD MOTOR CO.

66. Tighten the ACL outlet pipe clamp at the TB.
    - Tighten to 5 Nm (44 lb-in).

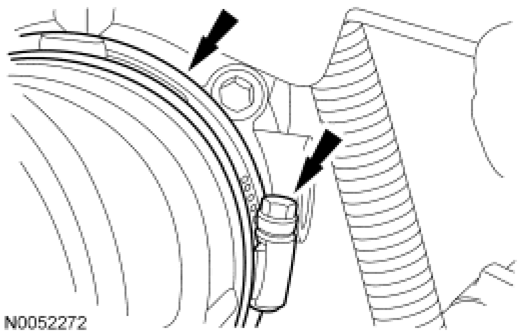


Fig. 544: Locating Air Cleaner Outlet Pipe Clamp
Courtesy of FORD MOTOR CO.

67. Connect the engine breather to the ACL assembly.

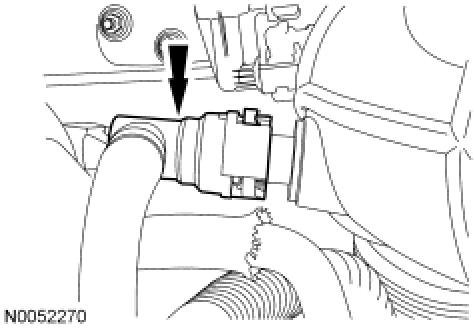


Fig. 545: Locating Engine Breather
Courtesy of FORD MOTOR CO.

68. Connect the brake booster vacuum hose to the ACL assembly.

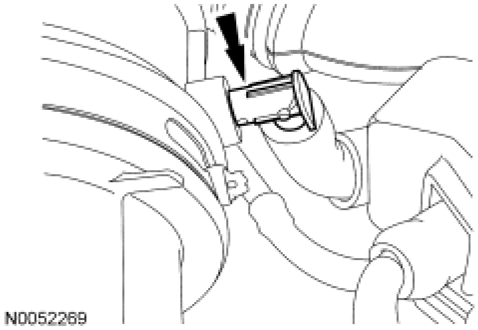


Fig. 546: Locating Brake Booster Vacuum Hose
Courtesy of FORD MOTOR CO.

69. Connect the MAF sensor electrical connector and connect the electrical harness fastener.

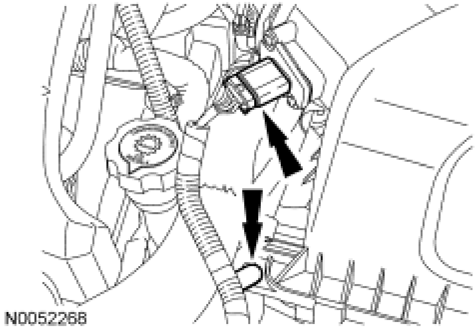


Fig. 547: Locating Mass Air Flow (MAF) Sensor Electrical Connector & Wiring Harness Fastener
Courtesy of FORD MOTOR CO.

70. Fill with clean transmission fluid to the correct level.
71. If a new solenoid body is installed, the solenoid body strategy and solenoid body identification will need to be updated. Refer to **Solenoid Body Strategy**.
72. If a replacement transaxle assembly is being installed or a new solenoid body is installed, the PCM will

have to be reflashed with a new solenoid body strategy and identification data file. For additional information, refer to **Solenoid Body Strategy**.

2008 DRIVELINE/AXLES

Front Drive Halfshafts - Edge & MKX

SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Left front halfshaft assembled length	671.8 mm (26.44 in)
Right front halfshaft assembled length (all wheel drive [AWD])	632.4 mm (24.89 in)
Right front halfshaft assembled length (front wheel drive [FWD])	605.4 mm (23.83 in)

LUBRICANTS & CAPACITIES

Lubricant	Specification	Capacity
Front Halfshaft Inboard Constant Velocity (CV) Joint		
Constant Velocity Joint Grease (from 3A331 kit)	-	295 g (10.41 oz)
Front Halfshaft Outboard CV Joint		
Constant Velocity Joint Grease (from 3A331 kit)	-	130 g (4.58 oz)

TORQUE SPECIFICATIONS

Description	Nm	lb-ft
Ball joint pinch nut	55	41
Catalytic converter support bracket bolts	20	15
Front stabilizer bar link nut	90	66
Front wheel hub nut	350	258
Intermediate shaft bearing support bolts (AWD)	40	30
Intermediate shaft bearing support bolts (FWD)	40	30

DESCRIPTION AND OPERATION

FRONT DRIVE HALFSHAFTS

The front drive halfshafts consist of the following:

- Inboard and outboard constant velocity (CV) joints connect to a splined shaft. Driveshaft bearing retainer circlips retain the CV joints to the splined shaft.
- A front axle wheel hub nut that secures the splined outboard CV joint to the wheel hub.
- Lubed-for-life CV joints use special CV joint grease requiring no periodic lubrication.
- A boot repair kit, 3A331, which includes the boots, clamps and grease is available.

On the LH side, the inboard CV joint is retained in the differential side gear with a 33 mm (1.29 in) retainer circlip. This circlip is oval in shape when viewed at the end. Install a new circlip every time the halfshaft is disconnected. On the RH side, a 30 mm (1.181 in) driveshaft bearing retainer circlip retains the splined inboard CV joint to the intermediate shaft. This circlip is round when view at the end. Install a new circlip every time you disconnect the halfshaft from the intermediate shaft.

The halfshafts are splined on the outboard stub shaft to drive the wheel hubs. They are retained in the wheel hubs by special wheel hub nuts which also control the wheel bearing preload. The LH halfshaft is splined on the inboard stub shaft and is retained in the differential side gear in the transaxle by a circlip. The RH halfshaft has internal splines which are driven by the intermediate shaft. The intermediate shaft has a circlip on the outboard end and is retained inside the inboard stub shaft. The circlips must be installed new whenever they are removed. The intermediate shaft is retained in the transaxle differential side gear by bolts that go through the intermediate shaft support bearing. The intermediate shaft also goes through the power transfer unit (PTU) on all wheel drive (AWD) vehicles. The outer seal of the PTU must be installed new whenever the intermediate shaft is removed.

Halfshaft Handling

CAUTION: Never pick up or hold the halfshaft only by the inboard or outboard constant velocity (CV) joint or damage to the component may occur.

Handle all halfshaft components carefully during removal and installation and during various component disassembly and assembly procedures. Do not overangle the CV joints. Damage will occur to an assembled inboard CV joint if it is overplunged outward from the joint housing. Never use the halfshaft assembly as a lever to position other components. Always support the free end of the halfshaft. Do not allow the boots to contact sharp edges or hot exhaust components. Handle the halfshaft only by the interconnecting shaft to avoid pull-apart and potential damage to the CV joints. Excessive pulling force on the interconnecting shaft between joints of the halfshaft will result in internal joint damage. Axial loads used in assisting removal must be applied through the inboard joint housing only. Do not drop assembled halfshafts. The impact will cut the boots from the inside without evidence of external damage.

DIAGNOSTIC TESTS

FRONT DRIVE HALFSHAFTS

Refer to **DRIVELINE SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

HALFSHAFT - RH

Special Tools

Illustration	Tool Name	Tool Number
	Remover, Front Wheel Hub	205-D070 (D93P-1175-B) or equivalent

 ST2272-A		

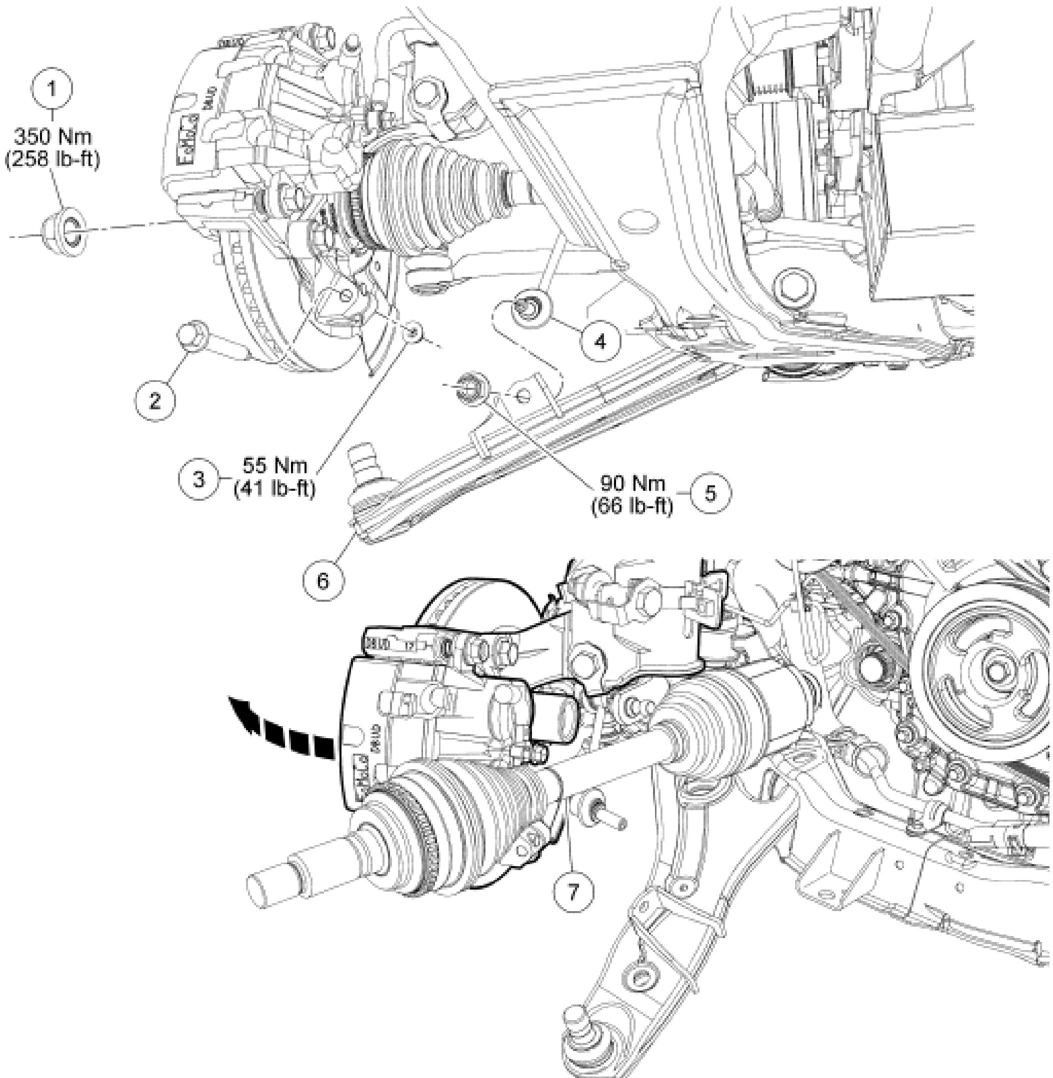


Fig. 1: Identifying Halfshaft With Torque Specifications - RH
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3N404	Wheel hub nut
2	W712481	Ball joint pinch bolt
3	W520213	Ball joint pinch nut
4	3B438	Stabilizer bar link

5	W520214	Stabilizer bar link nut
6	3A423	Lower arm
7	3A427	Halfshaft assembly

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the front tire and wheel. For additional information, refer to **WHEELS & TIRES** article.

NOTE: Apply the brake to keep the halfshaft from rotating.

3. Remove and discard the front wheel hub nut.

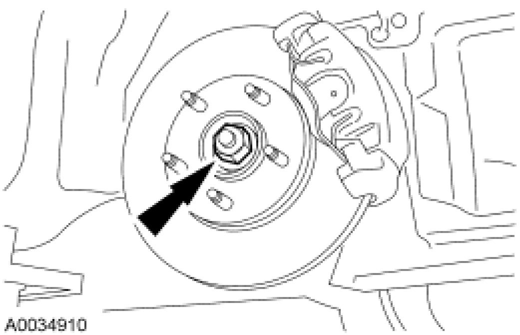


Fig. 2: Locating Front Wheel Hub Nut
Courtesy of FORD MOTOR CO.

4. Remove the stabilizer bar link nut and position the link aside.

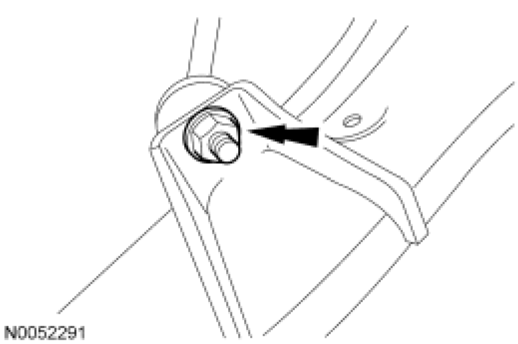


Fig. 3: Locating Stabilizer Bar Link Nut
Courtesy of FORD MOTOR CO.

5. Remove the ball joint pinch bolt from the knuckle and separate the lower control arm.

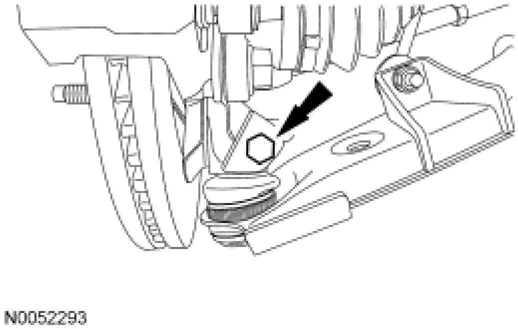


Fig. 4: Locating Ball Joint Pinch Bolt
Courtesy of FORD MOTOR CO.

6. Using the special tool, separate the halfshaft from the wheel hub.

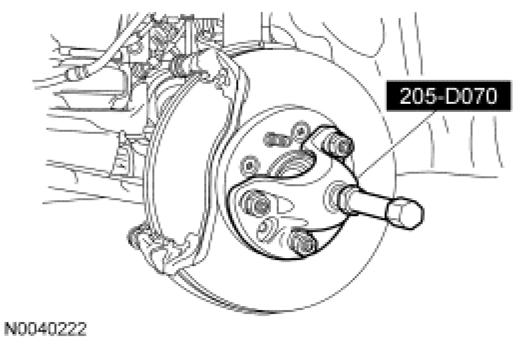


Fig. 5: Separating Halfshaft From Wheel Hub Using Special Tool (205-D070)
Courtesy of FORD MOTOR CO.

NOTE: Support the knuckle with a suitable jackstand.

7. Pull the knuckle outboard and rotate it toward the rear of the vehicle.
8. Use a brass drift to strike the right side halfshaft in the indicated area and separate the RH halfshaft from the intermediate shaft.

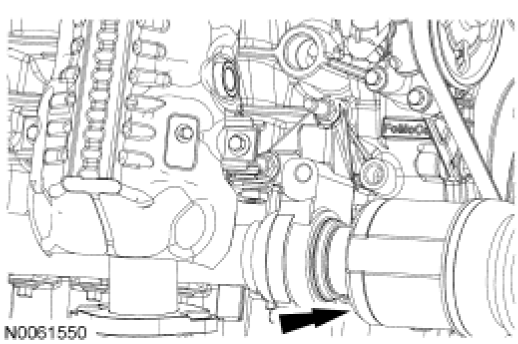


Fig. 6: Identifying Right Side Halfshaft
Courtesy of FORD MOTOR CO.

9. Remove and discard the circlip from the intermediate shaft.

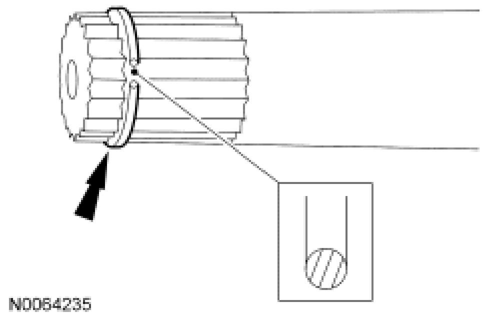


Fig. 7: Identifying Circlip From Intermediate Shaft
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Install a new 30 mm (1.181 in) intermediate shaft circlip.

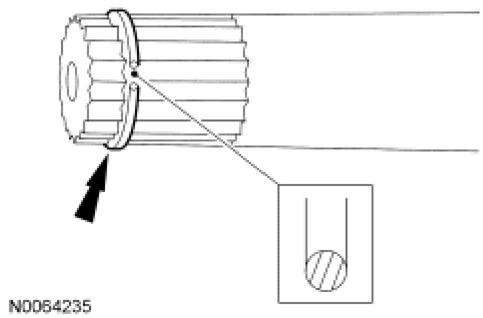


Fig. 8: Identifying Circlip From Intermediate Shaft
Courtesy of FORD MOTOR CO.

NOTE: Pull the right side inboard joint outward to make sure the circlip is locked.

2. Align the splines on the right side shaft with the intermediate shaft and push the stub shaft in until the circlip locks the shafts together.

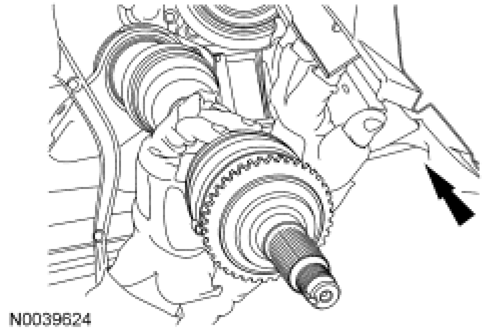


Fig. 9: Locating Pushpins
Courtesy of FORD MOTOR CO.

3. Insert the halfshaft into the wheel hub.
4. Rotate the knuckle into position.
5. Install the ball joint in the knuckle and install the pinch bolt and nut.
    - Tighten to 55 Nm (41 lb-ft).

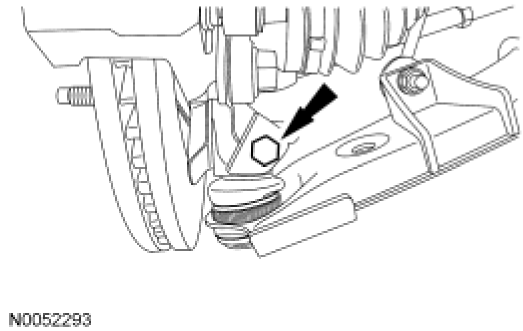


Fig. 10: Locating Ball Joint Pinch Bolt
Courtesy of FORD MOTOR CO.

6. Position the stabilizer bar link and install the link nut.
    - Tighten to 90 Nm (66 lb-ft).

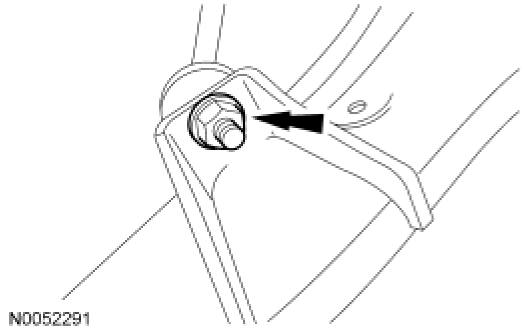


Fig. 11: Locating Stabilizer Bar Link Nut
Courtesy of FORD MOTOR CO.

7. Using a suitable tool, install the halfshaft in the wheel hub.

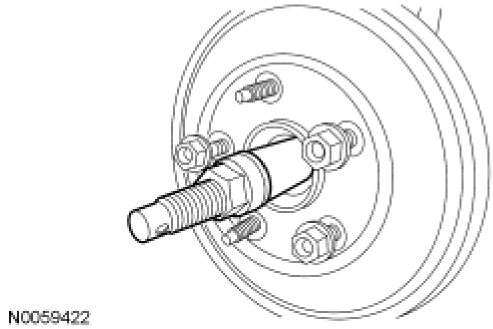


Fig. 12: Locating Halfshaft On Wheel Hub
Courtesy of FORD MOTOR CO.

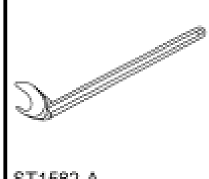
NOTE: Do not tighten the front wheel hub nut with the vehicle on the ground. The nut must be tightened to specification before the vehicle is lowered onto the wheels. Wheel bearing damage may occur if the wheel bearing is loaded with the weight of the vehicle applied.

NOTE: Apply the brake to keep the halfshaft from rotating.

8. Install a new front wheel hub nut.
   - Tighten to 350 Nm (258 lb-ft).
9. Install the front tire and wheel. For additional information, refer to **WHEELS & TIRES** article.

HALFSHAFT - LH

Special Tools

Illustration	Tool Name	Tool Number
	Remover, Front Wheel Hub	205-D070 (D93P-1175-B) or equivalent
	Remover, Halfshaft	205-241
	Remover, Halfshaft (Plate)	205-290

 ST1185-A	Slide Hammer	100-001 (T50T-100-A)

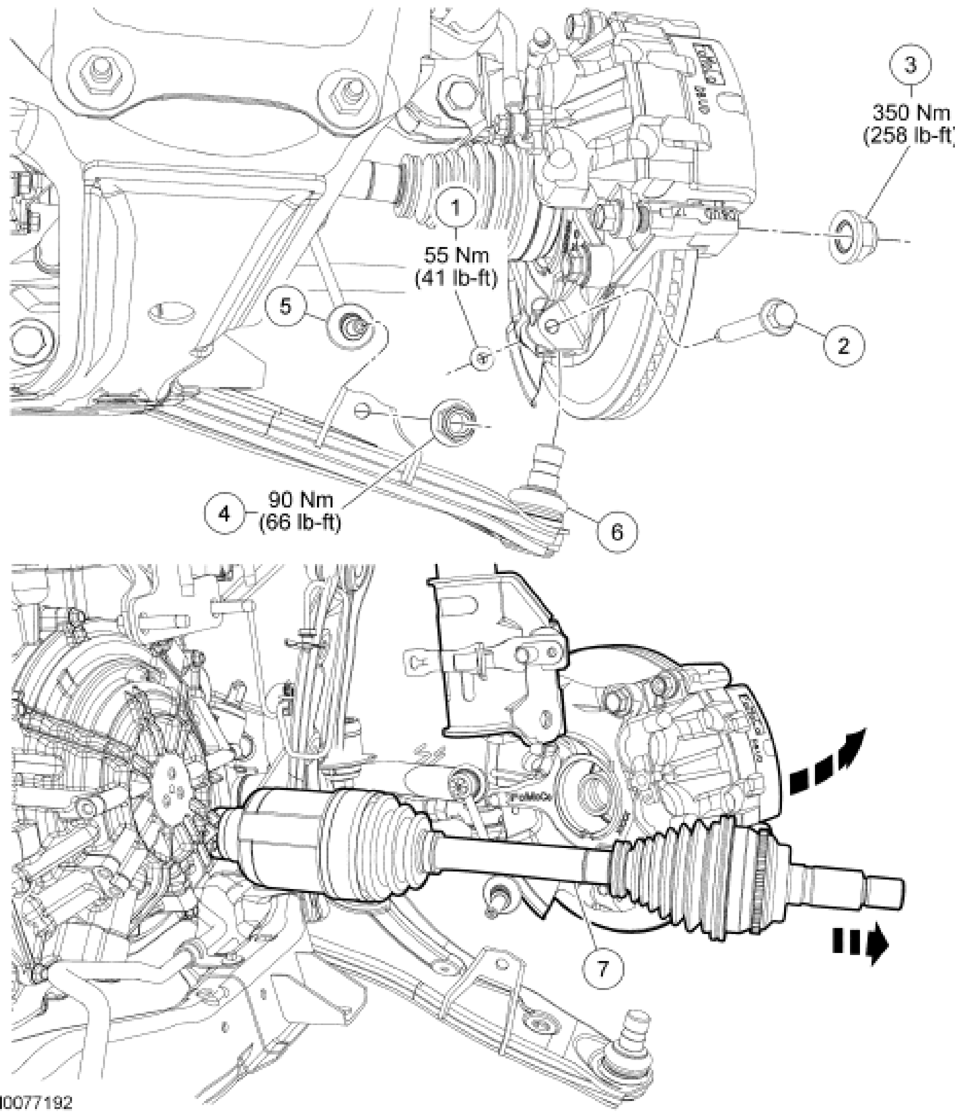


Fig. 13: Identifying Halfshaft With Torque Specifications - LH
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W520213	Lower ball joint pinch nut
2	W712481	Lower ball joint pinch bolt
3	3N404	Wheel end nut and washer assembly
4	W520214	Stabilizer bar link nut

5	3B438	Stabilizer bar link
6	3A423	Lower arm
7	3A428	Halfshaft assembly

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the front tire and wheel. For additional information, refer to **WHEELS & TIRES** article.

NOTE: Apply the brake to keep the halfshaft from rotating.

3. Remove and discard the front wheel hub nut.
4. Remove the ball joint pinch bolt from the knuckle and separate the lower control arm.

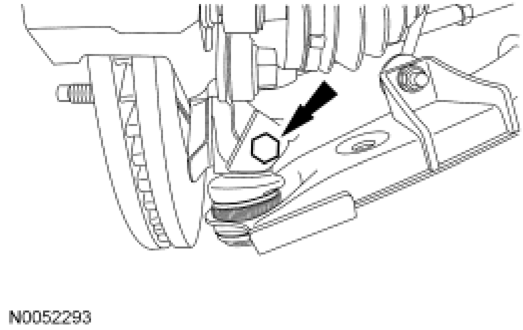


Fig. 14: Locating Ball Joint Pinch Bolt
Courtesy of FORD MOTOR CO.

5. Remove the stabilizer bar link nut and position the link aside.

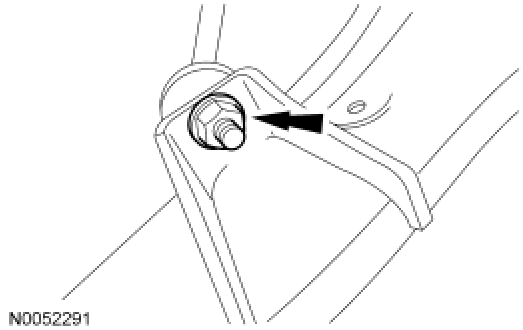


Fig. 15: Locating Stabilizer Bar Link Nut
Courtesy of FORD MOTOR CO.

6. Using the special tool, separate the halfshaft from the wheel hub.

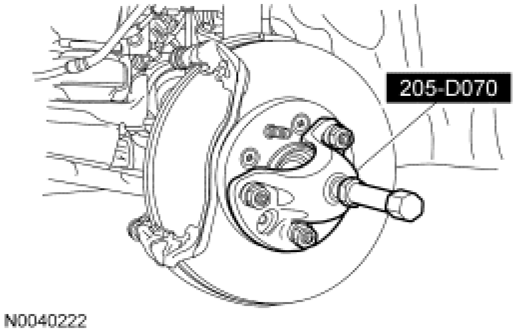


Fig. 16: Separating Halfshaft From Wheel Hub Using Special Tool (205-D070)
Courtesy of FORD MOTOR CO.

NOTE: Support the knuckle with a suitable jackstand.

7. Pull the knuckle outboard and rotate it toward the front of the vehicle.

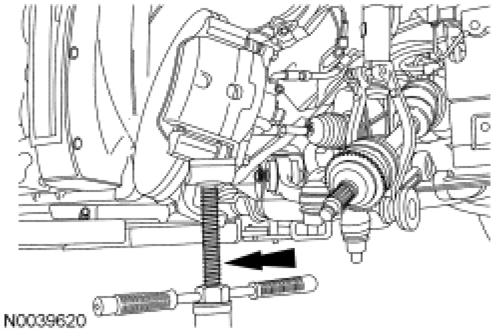


Fig. 17: Locating Jackstand
Courtesy of FORD MOTOR CO.

8. Using the special tools, remove the halfshaft from the transmission.

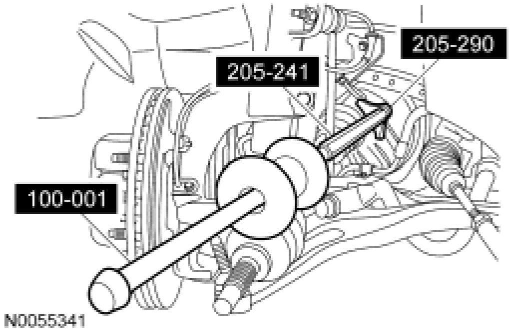


Fig. 18: Removing Halfshaft Using Special Tools (100-001), (205-241) & (205-290)
Courtesy of FORD MOTOR CO.

9. Remove and discard the circlip from the stub shaft.

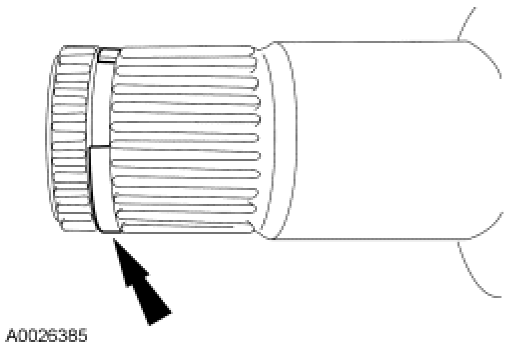


Fig. 19: Locating Halfshaft Circlip
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Install a new stub shaft circlip.

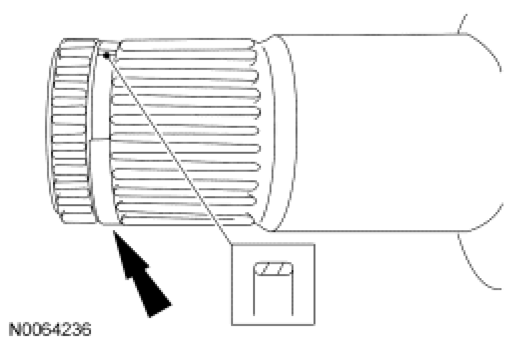


Fig. 20: Installing New Stub Shaft Circlip
Courtesy of FORD MOTOR CO.

2. Insert the halfshaft into the wheel hub.

CAUTION: The sharp edges on the stub shaft splines can slice or puncture the oil seal. Use care when inserting the stub shaft into the transmission to avoid oil seal damage.

NOTE: After insertion, pull the halfshaft inner end to make sure the circlip is locked.

3. Push the stub shaft into the transmission so the circlip locks into the differential side gear.
4. Rotate the knuckle into position.
5. Install the ball joint in the knuckle and install the pinch bolt and nut.
   - Tighten to 55 Nm (41 lb-ft).

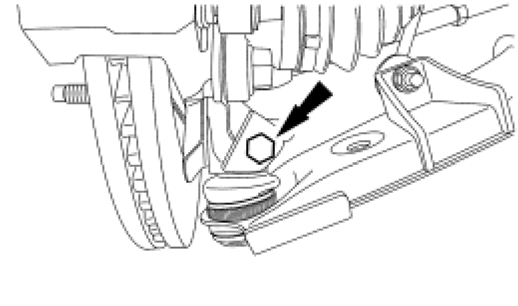


Fig. 21: Locating Ball Joint Pinch Bolt
Courtesy of FORD MOTOR CO.

6. Position the stabilizer bar link and install the link nut.
    - Tighten to 90 Nm (66 lb-ft).

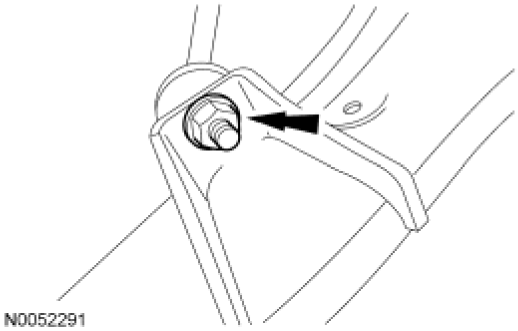


Fig. 22: Locating Stabilizer Bar Link Nut
Courtesy of FORD MOTOR CO.

7. Using a suitable tool, install the halfshaft in the wheel hub.

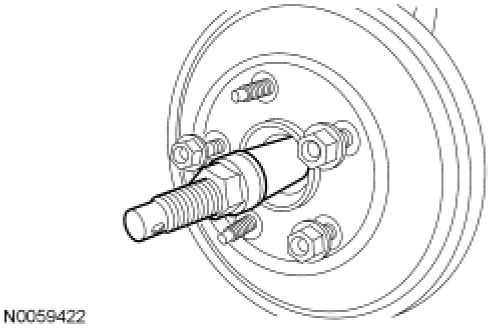


Fig. 23: Locating Halfshaft On Wheel Hub
Courtesy of FORD MOTOR CO.

CAUTION: Do not tighten the front wheel hub nut with the vehicle on the ground. The nut must be tightened to specification before the vehicle is lowered onto the wheels. Wheel bearing damage will occur if the

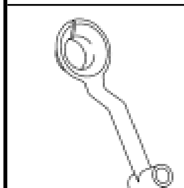
wheel bearing is loaded with the weight of the vehicle applied.

NOTE: Apply the brake to keep the halfshaft from rotating.

8. Install a new front wheel hub nut.
   - Tighten to 350 Nm (258 lb-ft).
9. Install the front tire and wheel. For additional information, refer to **WHEELS & TIRES** article.

INTERMEDIATE SHAFT - FRONT WHEEL DRIVE (FWD)

Special Tools

Illustration	Tool Name	Tool Number
 ST2828-A	Seal Protector, Rear Axle Shaft	205-816

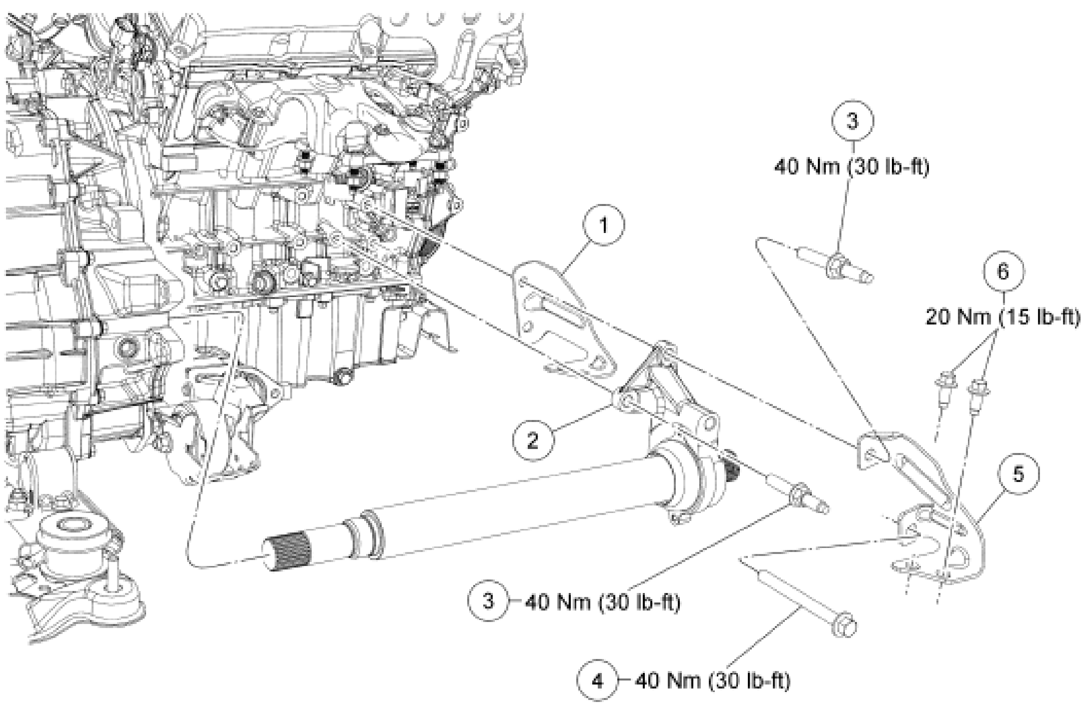


Fig. 24: Exploded View Of Intermediate Shaft - Front Wheel Drive (FWD) With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5G288	Exhaust converter bracket

2	3K183	Intermediate shaft assembly
3	W500235-S	Bracket-to-block bolts (2 required)
4	W500131	Bracket-to-block bolt
5	5G288	Exhaust converter bracket
6	W500210	Exhaust converter bracket bolts (2 required)

REMOVAL

1. Remove the right halfshaft. For additional information, refer to **Halfshaft - RH**.
2. Remove the 2 RH catalytic converter support bracket bolts.

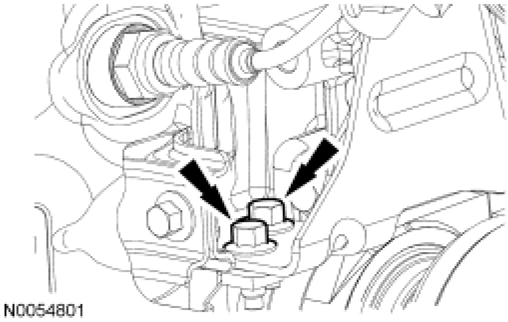


Fig. 25: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

3. Remove the bolts from RH catalytic converter support bracket.

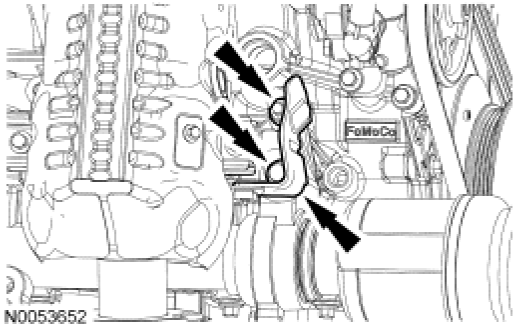


Fig. 26: Identifying RH Catalytic Converter Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

4. Remove the intermediate shaft bearing support bracket-to-block bolt.
5. Carefully remove the intermediate shaft while supporting both ends of the intermediate shaft.

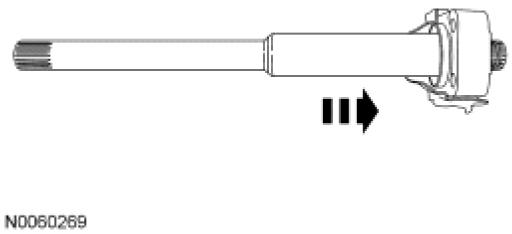


Fig. 27: Identifying Intermediate Shaft
Courtesy of FORD MOTOR CO.

6. Remove and discard the circlip from the outboard end of the intermediate shaft.

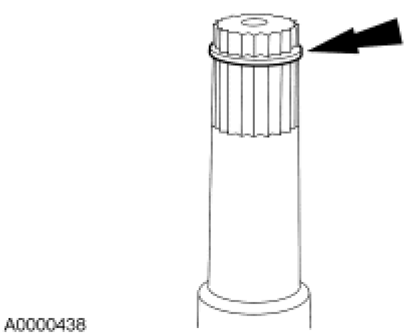


Fig. 28: Locating Intermediate Shaft Circlip
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Install a new 30 mm (1.181 in) circlip on the outboard end of the intermediate shaft.

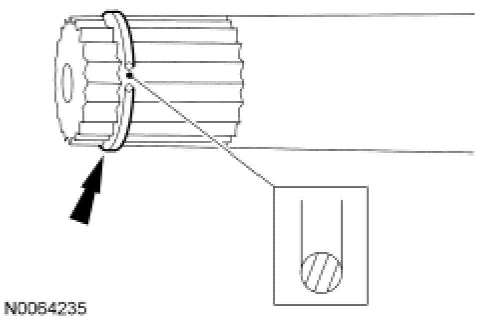


Fig. 29: Identifying Circlip From Intermediate Shaft
Courtesy of FORD MOTOR CO.

2. Position the special tool over the halfshaft oil seal.

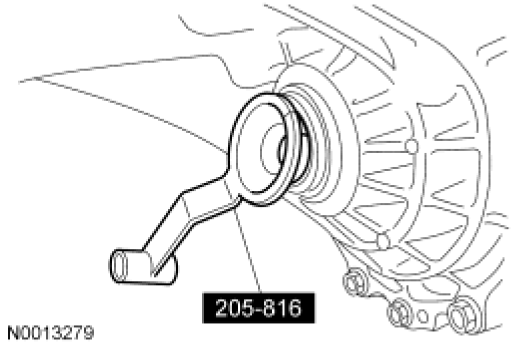


Fig. 30: Identifying Special Tool (205-816)
Courtesy of FORD MOTOR CO.

3. Position the intermediate shaft in the transaxle and engage the intermediate shaft splines with the transaxle side gears. Make sure the circlip is locked in the gear.
4. Install the intermediate shaft support bracket-to-block stud bolt.
   - Tighten to 40 Nm (30 lb-ft).
5. Install the RH catalytic converter support brackets and bolts.
   - Tighten to 40 Nm (30 lb-ft).

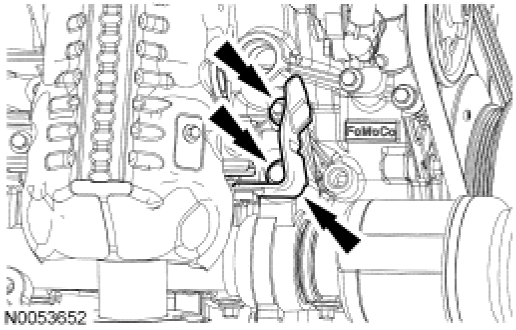


Fig. 31: Identifying RH Catalytic Converter Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

6. Install the 2 RH catalytic converter support bracket bolts.
   - Tighten to 20 Nm (15 lb-ft).

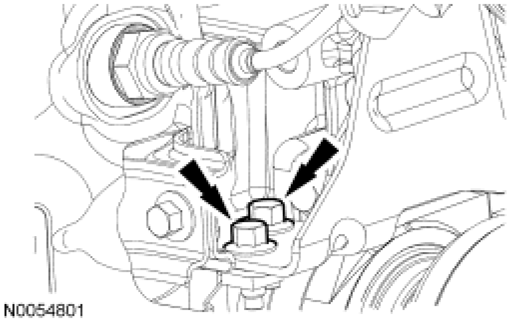


Fig. 32: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

7. Install the right halfshaft. For additional information, refer to **Halfshaft - RH**.

INTERMEDIATE SHAFT - ALL WHEEL DRIVE (AWD)

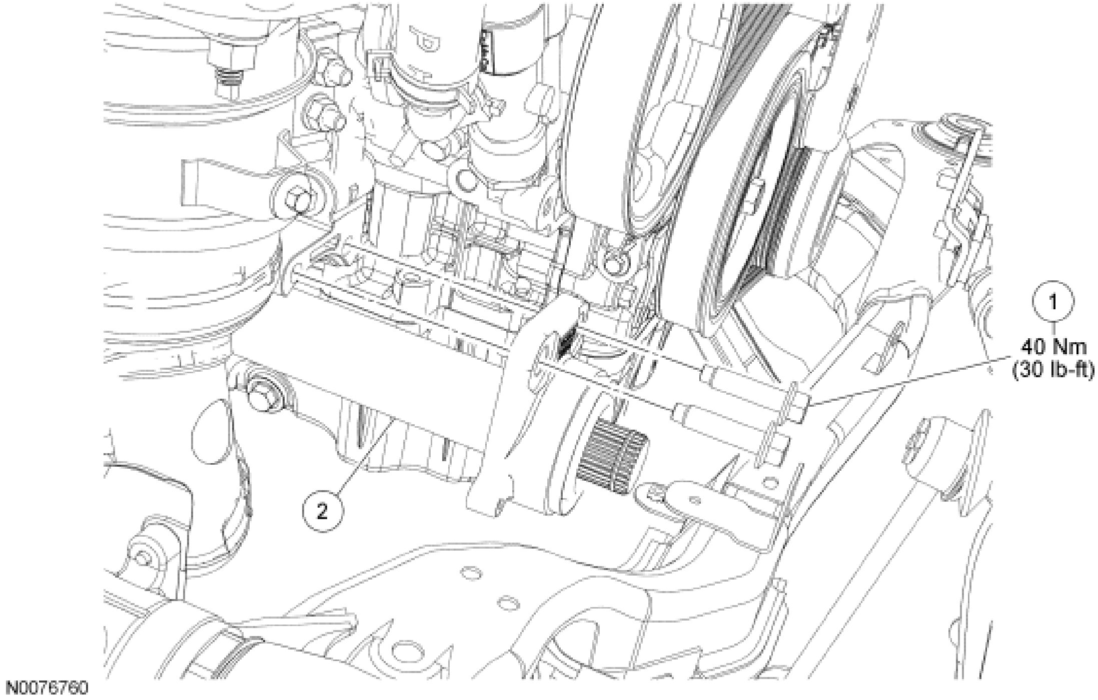


Fig. 33: Exploded View Of Intermediate Shaft - All Wheel Drive (AWD) With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W500235-S	Intermediate shaft support bracket bolt (2 required)
2	3K183	Intermediate shaft assembly

REMOVAL

NOTE: The intermediate shaft seal in the Power Transfer Unit (PTU) must be replaced whenever the intermediate shaft is removed. For additional information, refer to TRANSFER CASE - POWER TRANSFER UNIT (PTU) article.

1. Remove the right halfshaft assembly. For additional information, refer to **Halfshaft - RH**.
2. Remove the 2 intermediate shaft support bracket bolts and the intermediate shaft.
3. Remove and discard the circlip from the outboard end of the intermediate shaft.

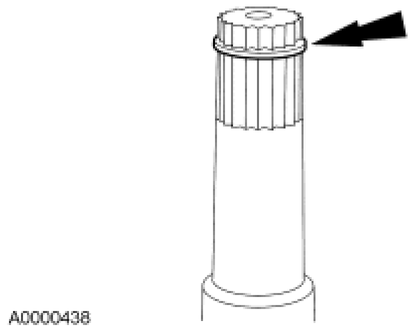


Fig. 34: Locating Intermediate Shaft Circlip
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Install a new 30 mm (1.181 in) circlip on the outboard end of the intermediate shaft.

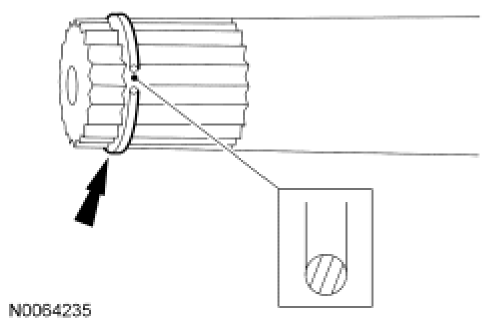


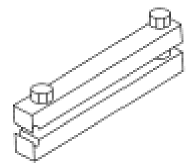
Fig. 35: Identifying Circlip From Intermediate Shaft
Courtesy of FORD MOTOR CO.

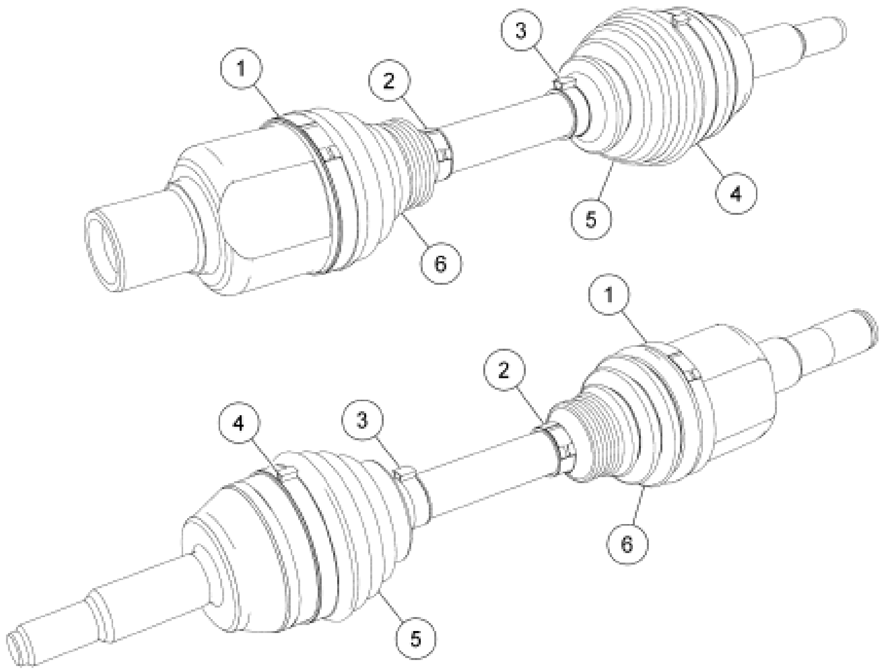
2. Install a new intermediate shaft seal in the PTU. For additional information, refer to **TRANSFER CASE - POWER TRANSFER UNIT (PTU)** article.
3. Position the intermediate shaft in the PTU and engage the intermediate shaft splines with the PTU gears.
4. Install the 2 intermediate shaft support bracket bolts.
   - Tighten to 40 Nm (30 lb-ft).
5. Install the right halfshaft. For additional information, refer to **Halfshaft - RH**.

CONSTANT VELOCITY (CV) JOINT BOOT

Special Tools

Illustration	Tool Name	Tool Number
	Installer, Constant Velocity Joint Boot Clamp	205-343 (T95P-3514-A)

 ST1301-A		



N0061549

Fig. 36: Exploded View Of Constant Velocity (CV) Joint Boot
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Low profile large inboard boots inner clamps (serviced in 3A331 kit only)
2	-	Low profile small inboard boots (serviced in 3A331 kit only)
3	-	Intermediate shaft boot clamps (serviced in 3A331 kit only)
4	-	Outboard boot outer clamps (serviced in 3A331 kit only)
5	-	Outboard constant velocity (CV) joint boots (serviced in 3A331 kit only)
6	-	Inboard CV joint boots (serviced in 3A331 kit only)

DISASSEMBLY

1. Remove the halfshaft assembly. For additional information, refer to **Halfshaft - RH** and **Halfshaft - LH**.
2. For the inboard constant velocity (CV) joint, remove and discard the boot clamps.
3. Remove the inboard CV joint retaining ring.

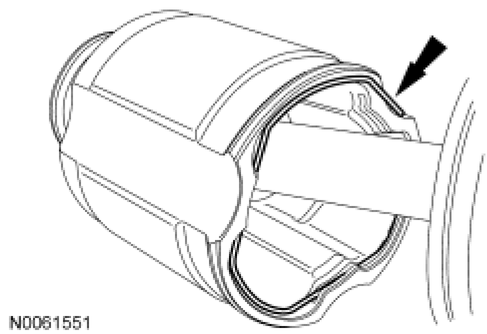


Fig. 37: Locating Retaining Ring
Courtesy of FORD MOTOR CO.

CAUTION: Do not let the roller bearings fall or damage to the component may occur.

4. For the inboard CV joint, carry out the following:
   - Remove and discard the retainer circlip.
   - Slide the boot away from the CV joint.

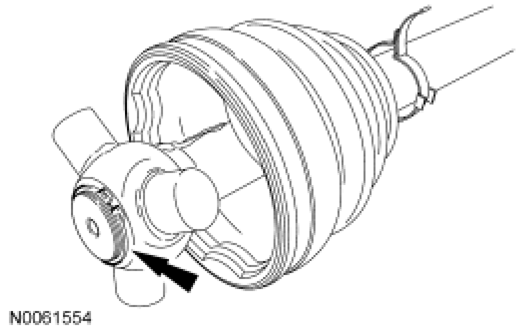


Fig. 38: Identifying CV Joint & Snap Ring On Halfshaft
Courtesy of FORD MOTOR CO.

5. Using a suitable 3-jaw puller, remove the CV joint.

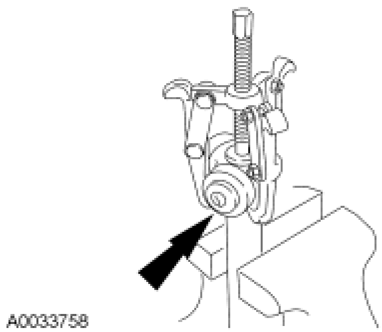


Fig. 39: Identifying CV Joint Using Suitable 3-Jaw Puller
Courtesy of FORD MOTOR CO.

6. Remove and discard the inner CV boot.

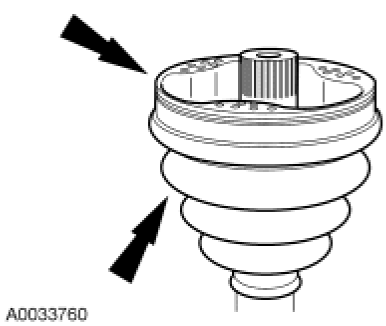


Fig. 40: Locating Inner CV Boot
Courtesy of FORD MOTOR CO.

NOTE:	**The outboard CV joint is not removable from the halfshaft. The boot must be removed or installed from the inboard CV joint side of the shaft.**

7. For the outboard CV joint, carry out the following:
   1. Remove and discard the boot clamps.
   2. Remove and discard the boot.

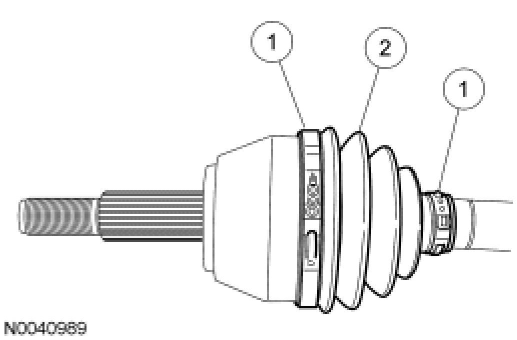


Fig. 41: Identifying Boot Clamps & Boot

Courtesy of FORD MOTOR CO.

ASSEMBLY

NOTE: Do not mix the boot clamps.

1. Lubricate the outboard CV joint.
    1. Pack the outboard CV joint with grease from the kit.
        - One-third of the grease must be installed in the joint with the remainder placed in the boot.
    2. Spread the remaining grease evenly inside the boot.

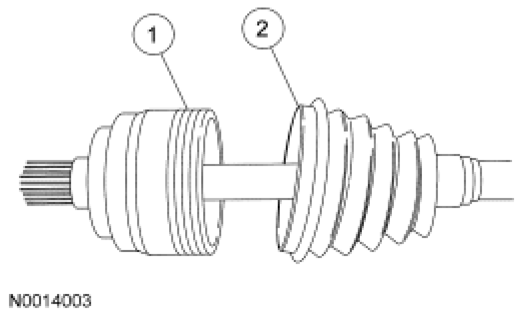


Fig. 42: Identifying Outboard CV Joint & Boot
Courtesy of FORD MOTOR CO.

2. Position the boot so the rib on the boot is located in the groove of the shaft.

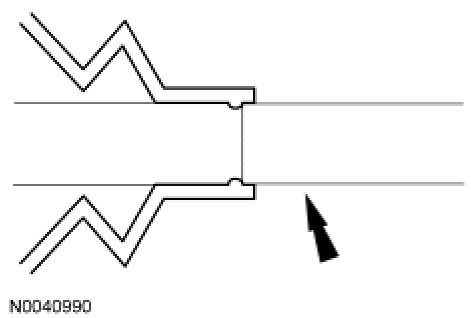


Fig. 43: Locating Boot In Groove Of Shaft
Courtesy of FORD MOTOR CO.

3. Position the outboard halfshaft boot and the outboard boot clamps.
    1. Position the boot.
    2. Position the boot clamps.

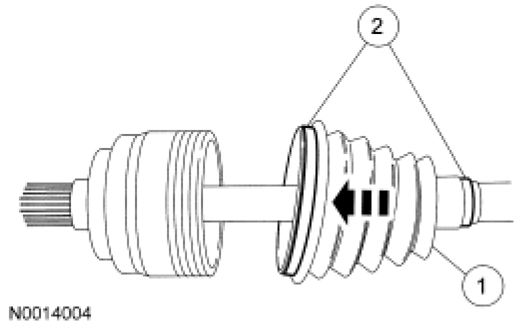


Fig. 44: Positioning Boot Clamps
Courtesy of FORD MOTOR CO.

4. Install the outboard CV boot clamps.

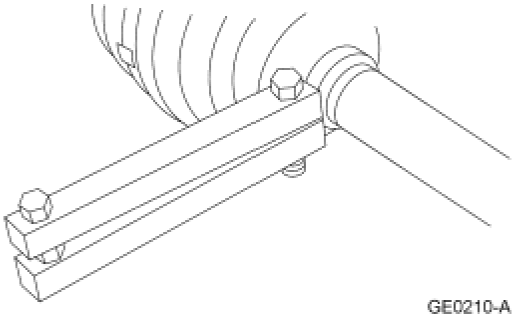


Fig. 45: Identifying Outboard CV Boot Clamp
Courtesy of FORD MOTOR CO.

5. Position the inboard clamp and boot.

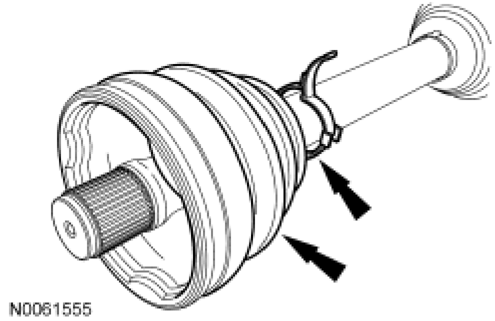


Fig. 46: Identifying Inboard Clamp & Boot
Courtesy of FORD MOTOR CO.

6. Install the CV joint and snap ring on the halfshaft.

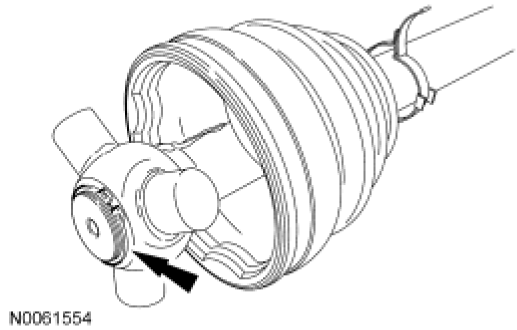


Fig. 47: Identifying CV Joint & Snap Ring On Halfshaft
Courtesy of FORD MOTOR CO.

7. Fill the inboard CV joint housing with grease from the kit.
   - One-half of the grease must be installed in the joint and the remainder placed in the boot.

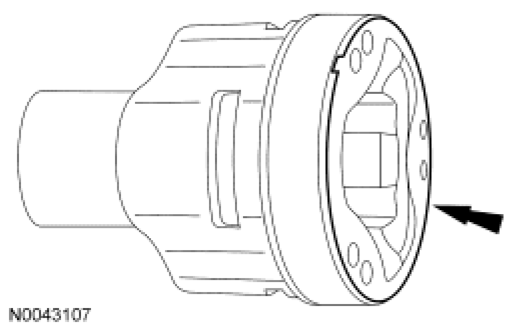


Fig. 48: Locating Inboard CV Joint Housing
Courtesy of FORD MOTOR CO.

CAUTION: Do not let the roller bearings fall or damage to the component may occur.

8. Position the CV housing on the CV joint.

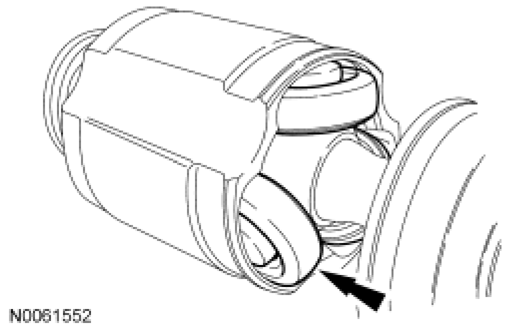


Fig. 49: Locating CV Housing On CV Joint
Courtesy of FORD MOTOR CO.

9. Install the retaining ring.

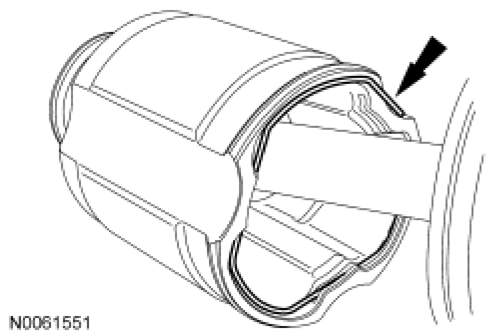


Fig. 50: Locating Retaining Ring
Courtesy of FORD MOTOR CO.

10. Position the inboard halfshaft boot and clamps.
    - Position the boot in the housing groove.
    - Position the boot clamps.

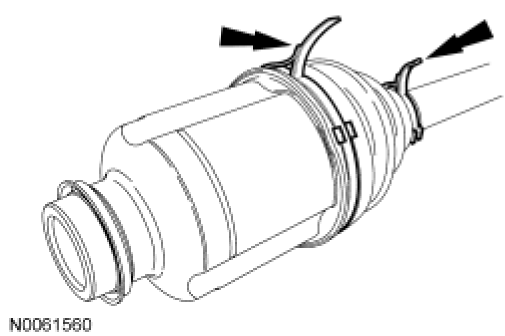


Fig. 51: Locating Boot Clamps & Housing Groove
Courtesy of FORD MOTOR CO.

11. Set the halfshaft assembled length to specifications. For additional information, refer to **SPECIFICATIONS** .
    1. Measure the entire assembly length.
    2. Push in or pull out on the inner joint as necessary to adjust the halfshaft assembled length.
    3. Hold the inner joint to prevent the assembled length from changing and insert a small flat-blade screwdriver between the boot and the joint to equalize the pressure.

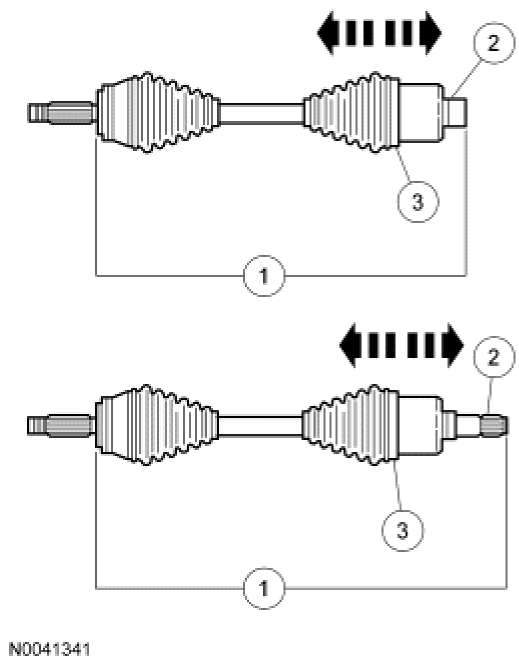


Fig. 52: Identifying Halfshaft Length Measurements
Courtesy of FORD MOTOR CO.

12. Install the boot clamps.
    - Place the lever arm to the closed position and use a soft-faced hammer to close the tabs.

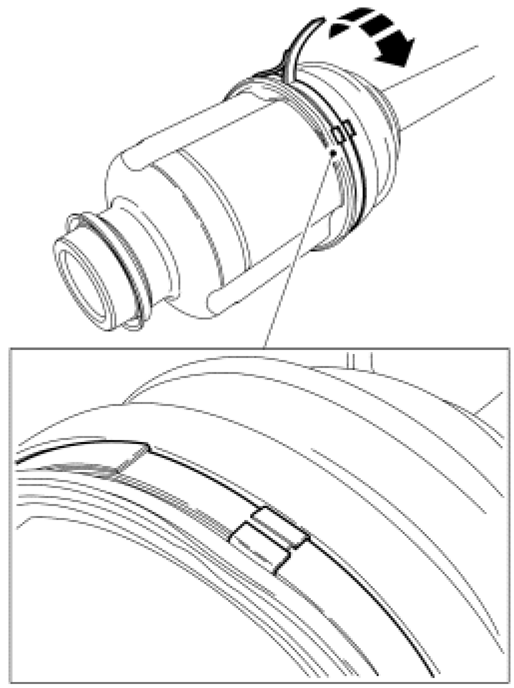


Fig. 53: Placing Lever Arm To Closed Position & Use A Soft-Faced Hammer To Close Tabs
Courtesy of FORD MOTOR CO.

13. Install the halfshaft assembly. For additional information, refer to **Halfshaft - RH** and **Halfshaft - LH**.

2008 TRANSMISSIONS

Rear Drive Halfshafts - Edge & MKX

SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Left rear halfshaft assembled length	863.9 mm (34.01 in)
Right rear halfshaft assembled length	915.6 mm (36.05 in)

LUBRICANTS AND CAPACITIES

Lubricant	Specification	Capacity
Rear Halfshaft Inboard Constant Velocity (CV) Joint		
Constant Velocity Joint Grease supplied in boot kit 4L537	-	108 g (3.80 oz)
Rear Halfshaft Outboard CV Joint		
Constant Velocity Joint Grease supplied in boot kit 4L537	-	88 g (3.10 oz)

TORQUE SPECIFICATIONS

Description	Nm	lb-ft
Brake caliper hose bracket bolt	15	11
Lower arm outboard bolt	150	111
Lower shock absorber nut	80	59
Rear wheel hub nut (inner)	275	203
Rear wheel hub nut (outer)	175	129
Stabilizer bar link nut	35	26
Toe link bracket bolt	200	148
Toe link outboard bolt	150	111
Upper arm outboard bolt	150	111

DESCRIPTION AND OPERATION

REAR DRIVE HALFSHAFTS

Rear Drive Halfshafts

The rear drive halfshafts consist of the following:

- Inner constant velocity (CV) joints
- Outer CV joints
- Interconnecting shafts

- Convoluted CV joint boots
- CV joint boot clamps
- Special CV high-temperature grease
- Tripod joint housings
- Ball and cage housings
- Circlip stopper that holds the cross-groove inboard race assembly (inboard CV joint) together
- Circlip that retains the splined inboard CV joint to the differential side gear
- RH and LH halfshafts that are different lengths, with the LH halfshaft being the longer of the two

The rear drive halfshafts link the rear axle to the rear wheel hubs. The CV joints allow the halfshafts to rotate smoothly through the required changes in angles between the stationary axle and the varying angles of the rear wheels including jounce and rebound. The CV joints are either tri-lobed style or the caged-ball type, depending on inboard or outboard. New halfshaft components are available in kit 4L537 which contains grease, circlips, boots and clamps.

Handle all halfshaft components carefully during removal and installation and during various component disassembly and assembly procedures. Never pick up or hold the halfshaft only by the inboard or outboard CV joint. Do not overangle the CV joints. Damage will occur to an assembled inboard CV joint if it is overplunged outward from the joint housing. Never use a hammer to remove or install the halfshafts from the hub. Never use the halfshaft assembly as a lever to position other components. Always support the free end of the halfshaft. Do not allow the boots to contact sharp edges or hot exhaust components. Handle the halfshaft only by the interconnecting shaft to avoid pull-apart and potential damage to the CV joints. Excessive pulling force on the interconnecting shaft between joints of the halfshaft will result in internal joint damage. Axial loads used in assisting removal must be applied through the inboard joint housing only. Do not drop assembled halfshafts. The impact will cut the boots from the inside without evidence of external damage. Do not remove the outer CV joint by pulling on the interconnecting shaft. Inspect all machined surfaces and splines for damage.

DIAGNOSTIC TESTS

REAR DRIVE HALFSHAFTS

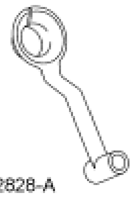
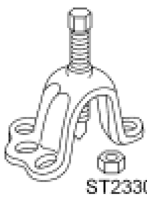
Refer to **DRIVELINE SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

HALFSHAFT

Special Tools

Illustration	Tool Name	Tool Number
	Axle Seal Protector	205-816

 ST2828-A		
 ST2330-A	Front Hub Remover	205-D070 (D93P-1175-B) or equivalent

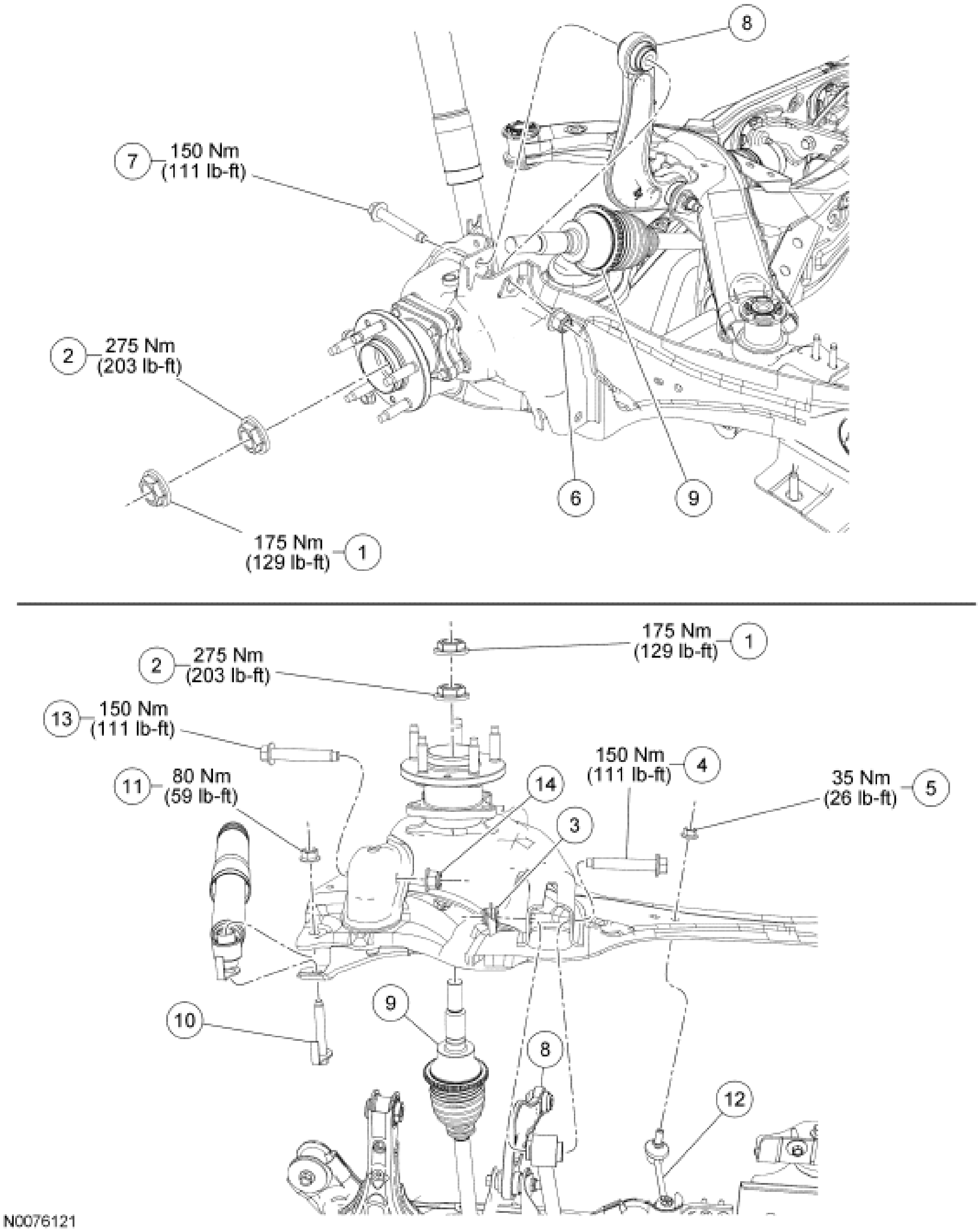


Fig. 1: Exploded View Of Halfshaft Components With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W712435	Outer hub bearing nut
2	W712435	Inner hub bearing nut

3	W520516	Toe link outboard nut
4	W500766	Toe link outboard bolt
5	W520414	Stabilizer bar link nut
6	W520516	Upper arm outboard nut
7	W500766	Upper arm outboard bolt
8	5500	Upper control arm
9	4B402	Halfshaft assembly
10	W712459	Lower shock absorber flag bolt
11	W520214	Lower shock absorber nut
12	5A486	Stabilizer bar link
13	W500766	Lower arm outboard bolt
14	W520516	Lower arm outboard nut

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the rear wheel speed sensor. For additional information, refer to **VEHICLE DYNAMIC SYSTEMS** article.
3. Remove and discard the inner and outer rear wheel hub nuts.
4. Remove the brake caliper hose bracket bolt.

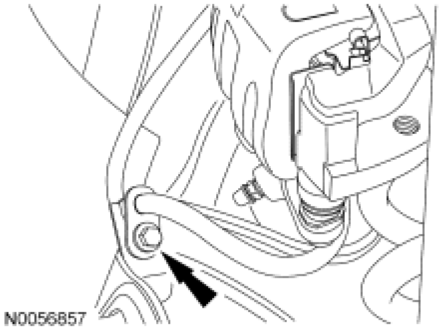


Fig. 2: Locating Brake Caliper Hose Bracket Bolt
Courtesy of FORD MOTOR CO.

5. Remove the rear brake disc. For additional information, refer to **REAR DISC BRAKE** article.
6. Remove the upper arm outboard bolt.

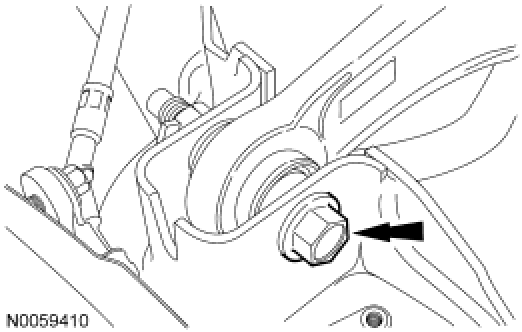


Fig. 3: Locating Upper Arm Bolt
Courtesy of FORD MOTOR CO.

7. Lift the upper arm from the knuckle.

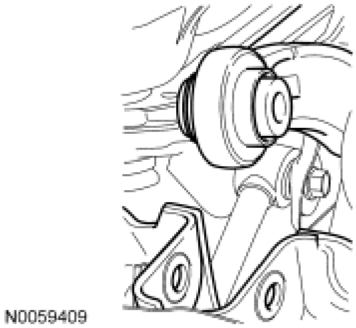


Fig. 4: Lifting Upper Arm From Knuckle
Courtesy of FORD MOTOR CO.

8. Support the lower arm and remove the lower shock nut and bolt.

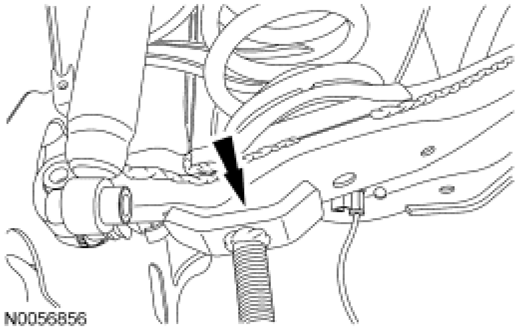


Fig. 5: Supporting Lower Arm
Courtesy of FORD MOTOR CO.

9. Remove the stabilizer link upper nut.

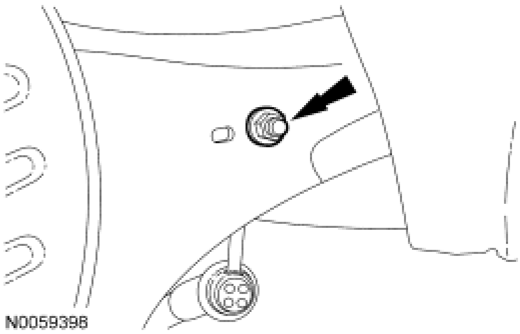


Fig. 6: Locating Stabilizer Link Upper Nut
Courtesy of FORD MOTOR CO.

10. Remove the outer toe link nut and bolt.

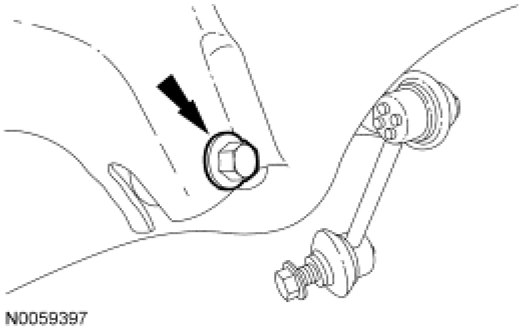


Fig. 7: Locating Outer Toe Link Nut & Bolt
Courtesy of FORD MOTOR CO.

11. Support the wheel knuckle and remove the lower arm nut and bolt.

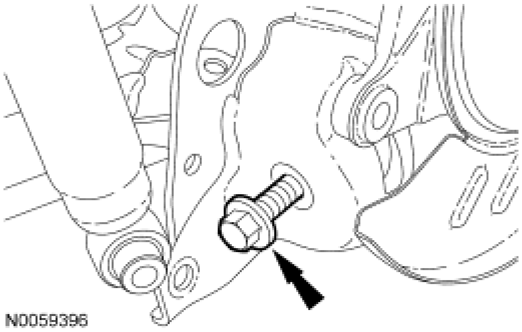


Fig. 8: Locating Lower Arm Bolt
Courtesy of FORD MOTOR CO.

12. Using the special tool, separate the halfshaft from the rear axle hub assembly.

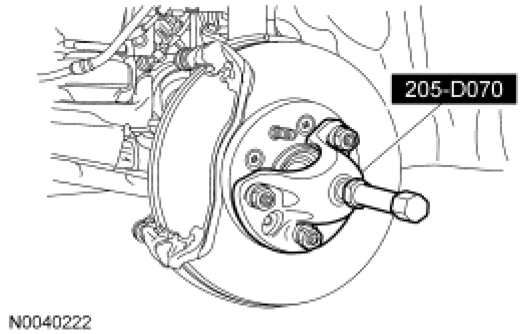


Fig. 9: Separating Halfshaft From Wheel Hub Using Special Tool (205-D070)
Courtesy of FORD MOTOR CO.

CAUTION: Do not damage the oil seal when removing the axle halfshaft from the differential.

13. Using a suitable pry bar, remove the halfshaft.

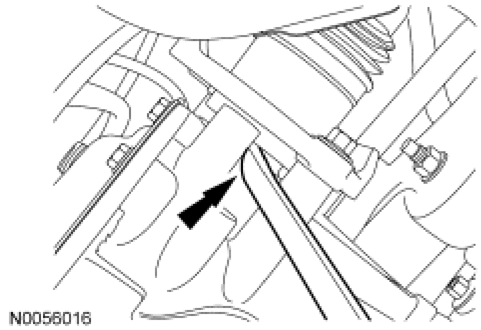


Fig. 10: Removing Halfshaft Using A Suitable Pry Bar
Courtesy of FORD MOTOR CO.

14. Position the halfshaft up through the wheel knuckle opening and remove the halfshaft.

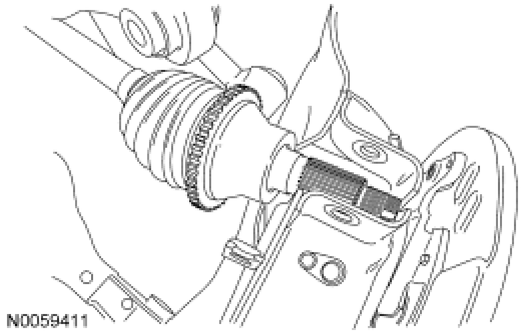


Fig. 11: Identifying Halfshaft & Wheel Knuckle
Courtesy of FORD MOTOR CO.

15. Remove and discard the circlip from the stub shaft.

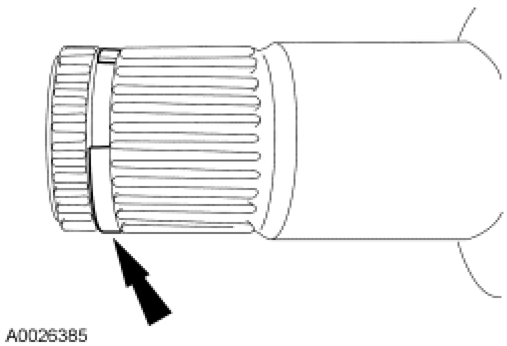


Fig. 12: Locating Halfshaft Circlip
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Install a new 28 mm (1.102 in) circlip on the stub shaft.

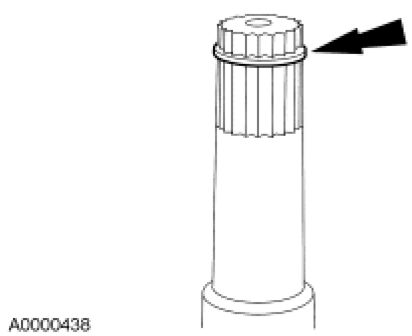


Fig. 13: Locating Intermediate Shaft Circlip
Courtesy of FORD MOTOR CO.

NOTE: **Make sure the oil seal protector is correctly aligned with the differential oil seal during installation.**

2. Using the special tool, install the halfshaft in the differential.

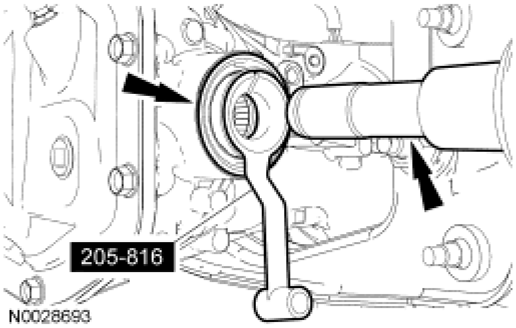


Fig. 14: Installing Halfshaft In Differential Using Special Tool (205-816)
Courtesy of FORD MOTOR CO.

3. Install the stub shaft in the rear drive unit.
   - Make sure the circlip locks in the side gear.

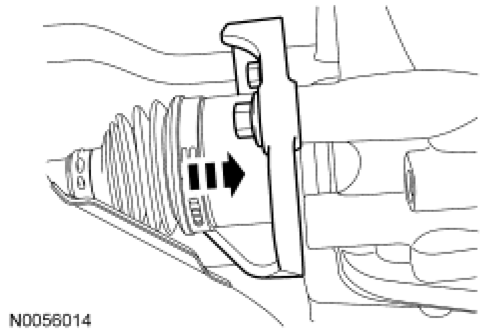


Fig. 15: Installing Stub Shaft In Rear Drive Unit
Courtesy of FORD MOTOR CO.

4. Slide the outboard CV joint down through the knuckle.

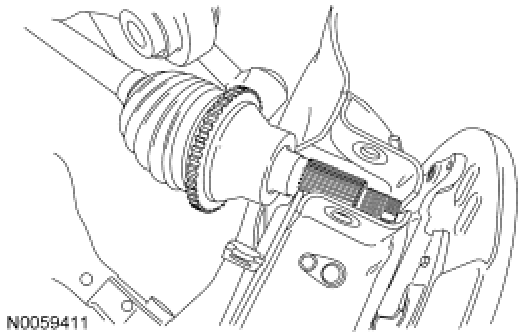


Fig. 16: Identifying Halfshaft & Wheel Knuckle
Courtesy of FORD MOTOR CO.

5. Position the halfshaft outer CV joint through the hub bearing.
6. Using a suitable tool, install the outer halfshaft end into the hub assembly.

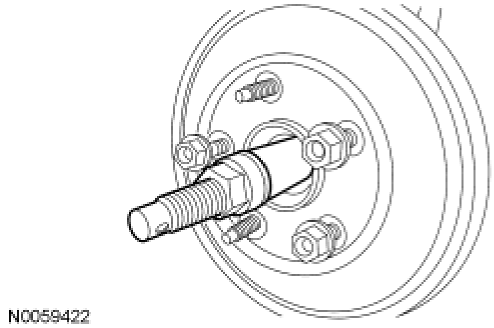


Fig. 17: Locating Halfshaft On Wheel Hub
Courtesy of FORD MOTOR CO.

7. Position the upper arm outboard end and install the bolt.
   - Tighten to 150 Nm (111 lb-ft).

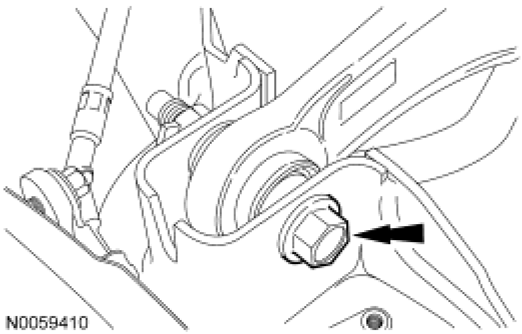


Fig. 18: Locating Upper Arm Bolt
Courtesy of FORD MOTOR CO.

8. Position the lower arm and install the lower arm bolt and nut.
   - Tighten to 150 Nm (111 lb-ft).

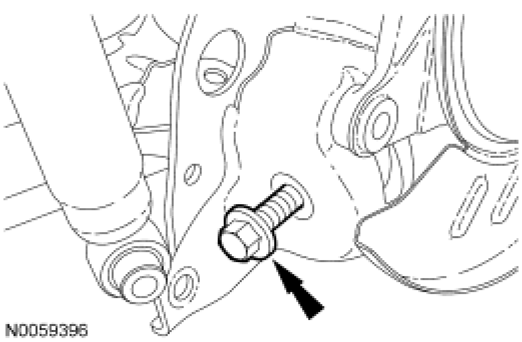


Fig. 19: Locating Lower Arm Bolt
Courtesy of FORD MOTOR CO.

CAUTION: Do not tighten the rear wheel hub nut with the vehicle on the ground. The nut must be tightened to specification before the vehicle is lowered to the ground. Wheel bearing damage will occur if the wheel bearing is loaded with the weight of the vehicle applied.

9. Install the 2 new rear wheel hub nuts.
   - Tighten the inner hub nut to 275 Nm (203 lb-ft).
   - Tighten the outer hub nut to 175 Nm (129 lb-ft).
10. Install the rear toe link bolt.
    - Tighten to 200 Nm (148 lb-ft).

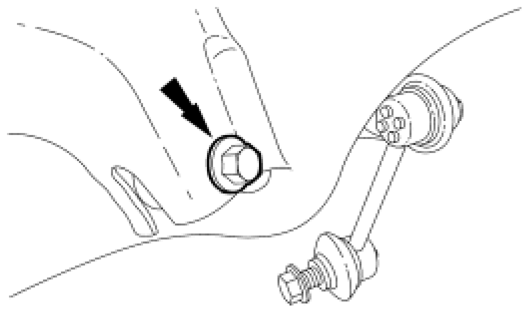


Fig. 20: Locating Outer Toe Link Nut & Bolt
Courtesy of FORD MOTOR CO.

11. Install stabilizer link upper nut.
    - Tighten to 35 Nm (26 lb-ft).

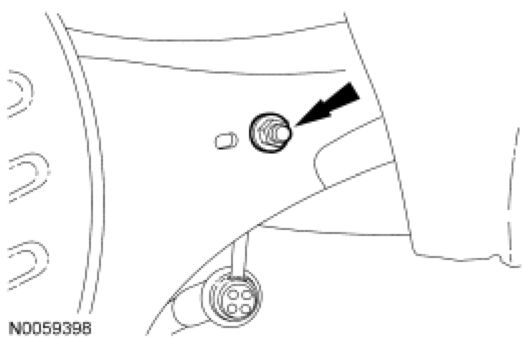


Fig. 21: Locating Stabilizer Link Upper Nut
Courtesy of FORD MOTOR CO.

12. Install the lower shock absorber bolt.
    - Tighten to 115 Nm (85 lb-ft).
13. Install the rear wheel speed sensor. For additional information, refer to **VEHICLE DYNAMIC SYSTEMS** article.
14. Install the rear brake disc. For additional information, refer to **REAR DISC BRAKE** article.
15. Install the brake caliper hose bracket bolt.
    - Tighten to 15 Nm (11 lb-ft).

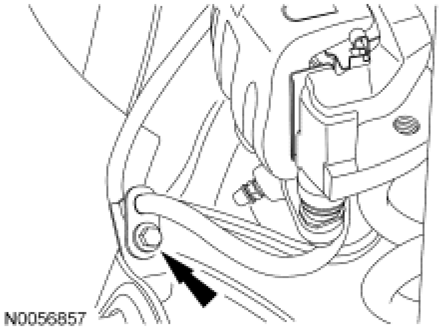
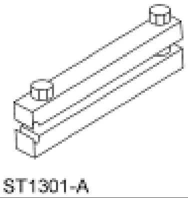


Fig. 22: Locating Brake Caliper Hose Bracket Bolt
Courtesy of FORD MOTOR CO.

16. Install the tire and wheel. For additional information, refer to **WHEELS AND TIRES** article.

CONSTANT VELOCITY (CV) JOINT BOOT

Special Tools

Illustration	Tool Name	Tool Number
	Installer, Constant Velocity Joint Boot Clamp	205-343 (T95P-3514-A)

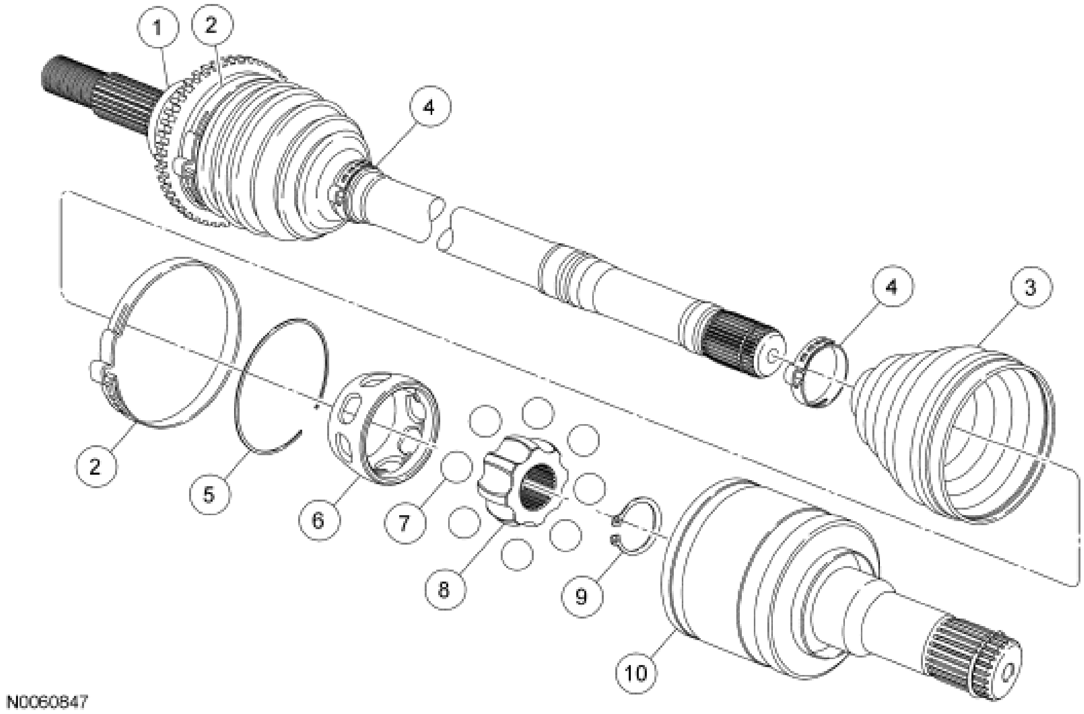


Fig. 23: Exploded View Of Constant Velocity (CV) Joint Boot
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	4B202	Outboard constant velocity (CV) joint and interconnecting shaft assembly
2	4B478	Boot clamps (part of 4L537)
3	3L537	CV joint boot (part of 4L537)
4	4B478	Boot clamps (part of 4L537)
5	4B422	Retaining ring
6	-	Ball cage (part of 3C092)
7	-	Ball (8 required) (part of 3C092)
8	-	Inner race (part of 3C092)
9	3B426	Snap ring
10	3C092	Inboard CV joint housing

DISASSEMBLY

1. Remove the halfshaft assembly. For additional information, refer to **Halfshaft** .
2. Remove and discard the inboard constant velocity (CV) joint boot clamps.

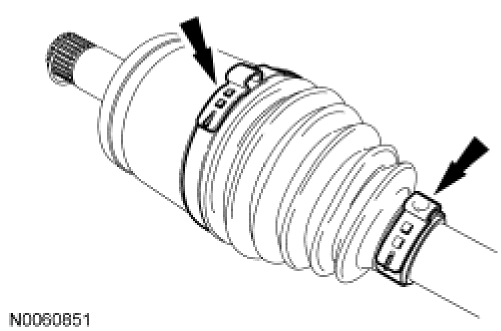
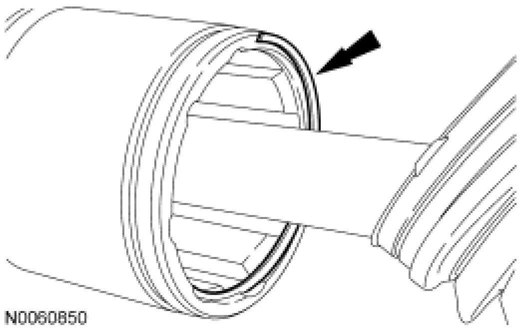


Fig. 24: Identifying Inboard Constant Velocity (CV) Joint Boot Clamps
Courtesy of FORD MOTOR CO.

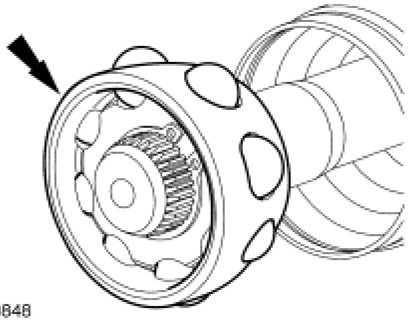
3. With the inboard CV joint boot removed from the housing, remove the retaining ring.



N0060850

Fig. 25: Locating Retaining Ring
Courtesy of FORD MOTOR CO.

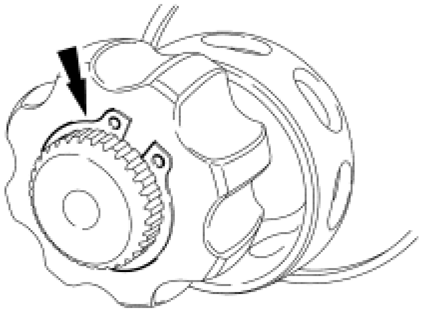
4. Remove the 8 balls and outer race.



N0060848

Fig. 26: Locating Outer Race Balls
Courtesy of FORD MOTOR CO.

5. Remove the CV joint housing snap ring.



N0060849

Fig. 27: Locating Retainer Snap Ring
Courtesy of FORD MOTOR CO.

6. Remove and discard the boot.

NOTE: **The outboard CV joint is not removable from the halfshaft. The boot must be removed or installed from the inboard CV joint side of the shaft.**

7. For the outboard CV joint boot, carry out the following:
    1. Remove and discard the boot clamps.
    2. Remove and discard the boot.

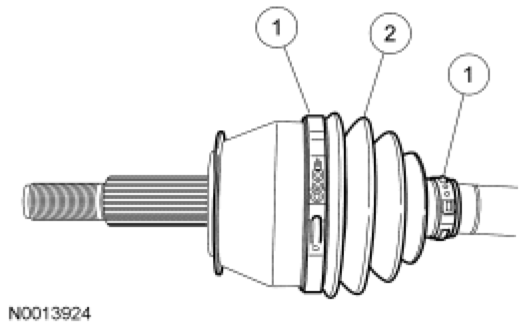


Fig. 28: Identifying Boot Clamps And Boot
Courtesy of FORD MOTOR CO.

ASSEMBLY

1. For the outboard CV joint, carry out the following:
    1. Slide the boot on the interconnecting shaft.
    2. Pack the outboard CV joint with 80 g (2.82 oz) of grease supplied in the boot kit.
    3. Spread any remaining grease evenly inside the boot.
    4. Install the boot by seating it in the groove in the CV joint housing.

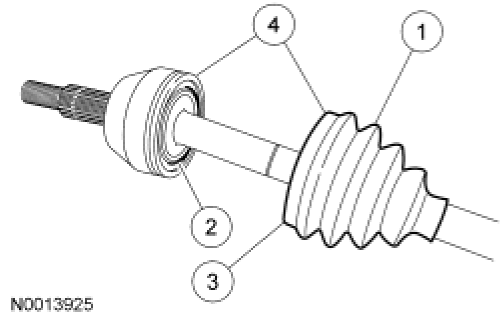


Fig. 29: Identifying CV Joint Housing
Courtesy of FORD MOTOR CO.

2. Using the special tool, install the 79.6 mm (3.13 in) boot clamps on the large end of the boot.

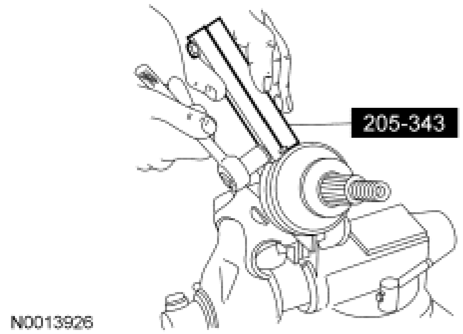


Fig. 30: Installing Boot Clamps Using Special Tool (205-343)
Courtesy of FORD MOTOR CO.

3. Install the small clamp on the small end of the boot.

CAUTION: Install a new circlip every time the halfshaft is removed from the axle or damage to the component may occur.

CAUTION: Start one end of the circlip in the groove and work the circlip over the halfshaft and into the groove to prevent the circlip from overexpanding or damage to the clamp may occur.

4. Install a new retainer circlip.

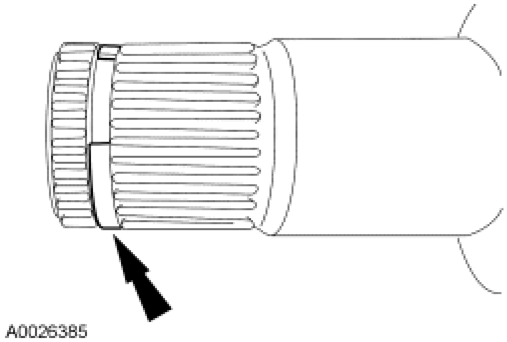


Fig. 31: Locating Halfshaft Circlip
Courtesy of FORD MOTOR CO.

5. Position the small clamp on the interconnecting shaft before installing the boot.
6. Position the boot on the interconnecting shaft.
7. Install the inner race and the retainer snap ring.

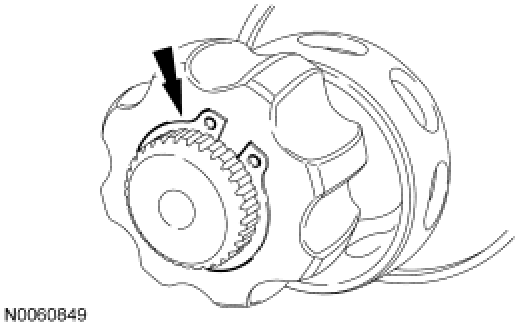


Fig. 32: Locating Retainer Snap Ring
Courtesy of FORD MOTOR CO.

8. Install the outer race with 8 balls.

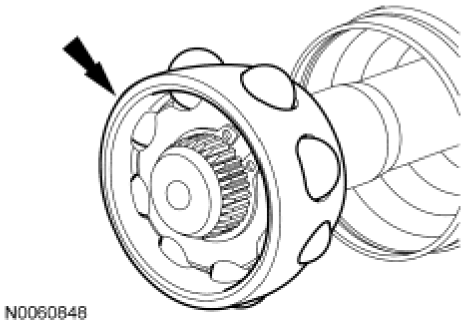


Fig. 33: Locating Outer Race Balls
Courtesy of FORD MOTOR CO.

9. Insert the assembly in the housing.
10. Install the retaining ring.

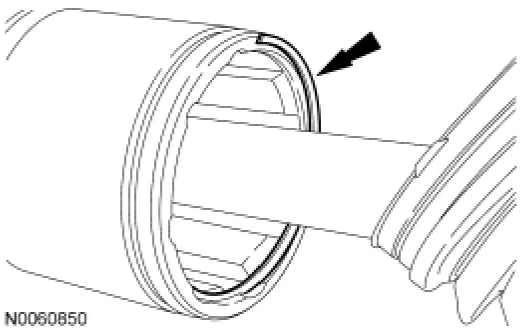


Fig. 34: Locating Retaining Ring
Courtesy of FORD MOTOR CO.

11. For the inboard CV joint, carry out the following steps in sequence:
    1. Pack the inboard CV joint housing with 108 g (3.80 oz) of grease supplied in the boot kit.

2. Spread any remaining grease evenly inside the boot and CV joint.
3. Install the inboard CV joint housing, seating the boot in the groove in the housing.

12. Set the halfshaft assembled length to specifications. For additional information, refer to **SPECIFICATIONS** .
    1. Measure the entire assembly length.
    2. Push in or pull out on the inner joint as necessary to adjust the halfshaft assembled length.
    3. Hold the inner joint to prevent the assembled length from changing and insert a soft, flat tool between the boot and the joint to equalize the pressure.

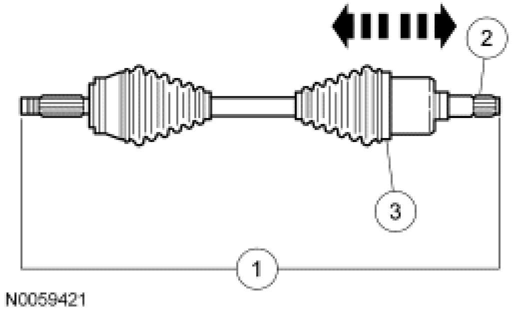


Fig. 35: Pushing In Or Pulling Out On Inner Joint As Necessary To Adjust Halfshaft Assembled Length
Courtesy of FORD MOTOR CO.

13. Using the special tool, install the 77.5 mm (3.05 in) boot clamps on the large end of the boot.

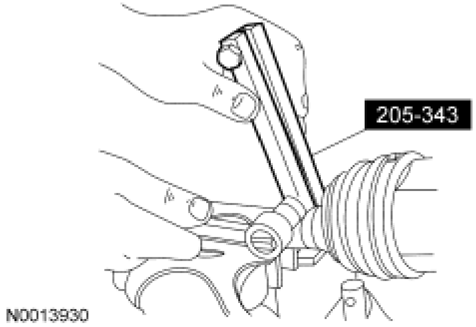


Fig. 36: Installing Both Boot Clamps Using Special Tool (205-343)
Courtesy of FORD MOTOR CO.

14. Install the smaller boot clamp.
15. Install the halfshaft assembly. For additional information, refer to **Halfshaft** .

2008 BRAKES

Power Brake Actuation - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft
Brake booster nuts	23	17

DESCRIPTION AND OPERATION

BRAKE BOOSTER

The power brake actuation system consists of the following components:

- Brake booster
- Brake booster check valve
- Brake booster vacuum supply hose

The brake booster uses engine vacuum from the intake manifold to create a partial vacuum inside the vacuum booster on both sides of the diaphragm. When the brake pedal is pressed, the booster rod opens a valve, allowing air to enter the booster on one side of the diaphragm while sealing off the opposite side. This increases pressure on that side of the diaphragm so that it helps push the rod, which in turn pushes the piston in the master cylinder. As the brake pedal is released, the valve seals off the outside air supply while opening the vacuum valve. This restores vacuum to both sides of the diaphragm, allowing everything to return to its original position.

DIAGNOSTIC TESTS

POWER BRAKE SYSTEM

Refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

BRAKE BOOSTER

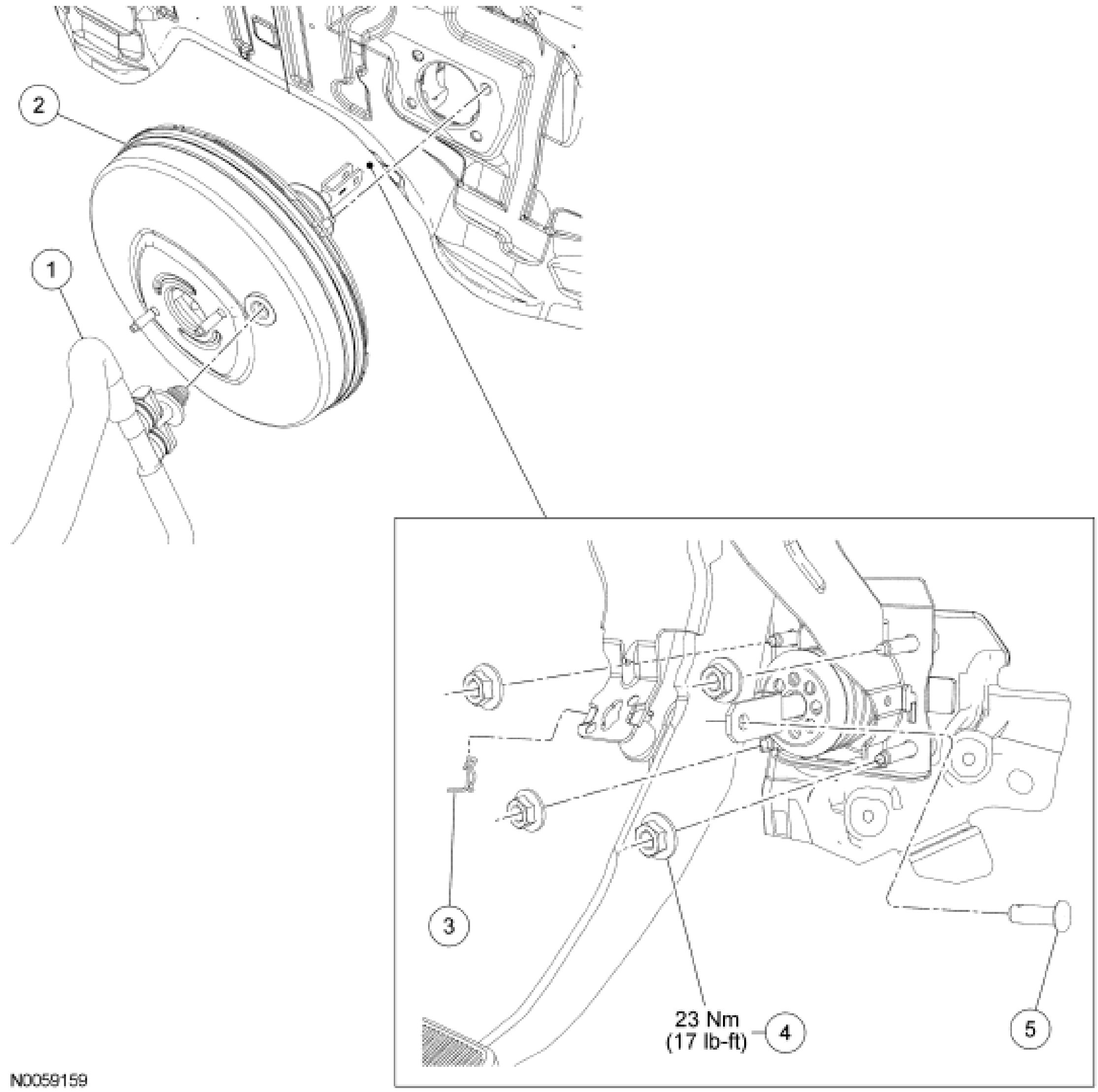


Fig. 1: Exploded View Of Brake Booster With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	9C490	Manifold vacuum hose assembly
2	-	Brake booster
3	7B096	Brake booster push rod spring clip
4	W707144	Brake booster nut (4 required)
5	2N513	Brake booster push rod pin

REMOVAL AND INSTALLATION

CAUTION: Do not service the brake pedal or brake booster without first removing the stoplamp switch and speed control deactivator switch.

These switches must be removed with the brake pedal in the at-rest position. Switch plungers must be compressed for the switch to rotate in the bracket. Attempting to remove the switch when the plunger is extended (during pedal apply) will result in damage to the switch.

1. Remove the stoplamp switch. For additional information, refer to **EXTERIOR LIGHTING** article.

CAUTION: The brake booster check valve must be disconnected from the brake booster (prior to removing the master cylinder) or the master cylinder seal may be drawn into the brake booster.

2. Disconnect the brake booster check valve from the brake booster to deplete the residual vacuum in the brake booster.
3. Remove the brake master cylinder. For additional information, refer to **HYDRAULIC BRAKE ACTUATION** article.

CAUTION: Make sure that the vacuum hose assembly is routed correctly so it does not make contact with surrounding components or damage to the hose may occur.

4. Disconnect the vacuum hose and wire harness from the studs and position aside.

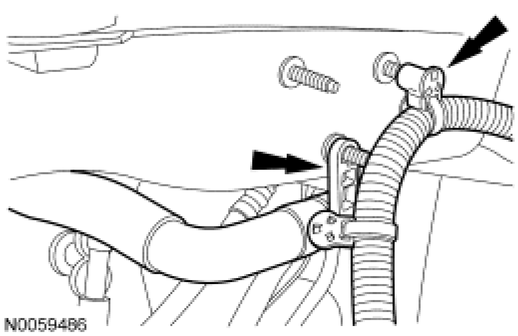


Fig. 2: Identifying Vacuum Hose & Wire Harness Studs
Courtesy of FORD MOTOR CO.

5. Remove the brake booster push rod pin and clip and disconnect the push rod from the brake pedal.
6. Remove the 4 brake booster nuts.
   - To install, tighten to 23 Nm (17 lb-ft).
7. Remove the brake booster.

CAUTION: Do not press, pull or otherwise move the brake pedal while installing the stoplamp switch or the speed control deactivator switch. These switches must be installed with the booster push rod attached to the brake pedal and with the brake pedal in the at-rest position. Installing

these switches with the brake pedal in any other position will result in incorrect adjustment and may damage the switches.

8. To install, reverse the removal procedure.
9. Check the brake booster for correct operation.

2008 GENERAL INFORMATION

Brake System - General Information - Edge & MKX

SPECIFICATIONS

MATERIAL

Item	Specification	Fill Capacity
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1	803 - 821 ml (1.69 - 1.74 pt)
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A	-
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-	-
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A	-

GENERAL SPECIFICATIONS

Item	Specification
Front Brake Disc	
Maximum brake pad taper wear (in any direction)	3.0 mm (0.118 in)
Minimum brake disc thickness	26 mm (1.023 in)
Minimum brake pad thickness	3.0 mm (0.118 in)
Rear Brake Disc	
Maximum brake pad taper wear (in any direction)	3.0 mm (0.118 in)
Minimum brake disc thickness	16 mm (0.629 in)
Minimum brake pad thickness	3.0 mm (0.118 in)

TORQUE SPECIFICATIONS

Description	N.m	lb-ft	lb-in
Brake caliper bleeder screw	8	-	71
Master cylinder brake tube fittings	28	21	-

DESCRIPTION AND OPERATION

BRAKE SYSTEM

The brake system has the following components:

- Fixed position foot pedal
- Vacuum-assisted power brake booster
- Diagonal split hydraulic system
- Front disc brakes
- Rear disc brakes
- Drum-in-hat park brake system
- ABS hydraulic control unit (HCU).

The brake pedal is connected to the power brake booster, which is connected to the brake master cylinder. When the brake pedal is pressed, brake fluid is pushed through the doubled-walled steel tubes and flexible hoses to the front and rear disc brake calipers. The brake fluid enters the disc brake calipers, forcing the caliper pistons and brake pads outward against the brake disc friction surface, slowing or stopping rotation. When the brake pedal is released, brake fluid pressure is relieved, returning the front and rear disc brake caliper pistons and brake pads to the unapplied position.

For information on:

- the non-adjustable pedals, refer to **HYDRAULIC BRAKE ACTUATION** article.
- ABS and HCU, refer to **VEHICLE DYNAMIC SYSTEMS** article.
- the master cylinder and fluid reservoir, refer to **HYDRAULIC BRAKE ACTUATION** article.
- the vacuum assisted power brake booster, refer to **POWER BRAKE ACTUATION** article.
- the front brake calipers, refer to **FRONT DISC BRAKE** article.
- the rear brake calipers, refer to **REAR DISC BRAKE** article.
- the drum-in-hat integrated parking brake system, refer to **PARKING BRAKE AND ACTUATION** article.

DIAGNOSTIC TESTS

BRAKE SYSTEM

MATERIAL

Item	**Specification**
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

Principles of Operation

Brake System

Applying the brake pedal uses lever action to push a rod into the brake booster, which through the use of vacuum, boosts the force of the rod and then transmits this force into the master cylinder. This produces hydraulic pressure in the master cylinder. On vehicles not equipped with ABS, the hydraulic pressure is transmitted by brake fluid through the brake tubes to the individual brake calipers. On vehicles equipped with ABS, the hydraulic pressure is transmitted by brake fluid through the brake tubes to the ABS hydraulic control unit (HCU), which then distributes that pressure to the individual brake calipers. The brake calipers use hydraulic pressure to apply the pads. The application of the brake pads will cause the rotation of the wheels to slow or stop depending on how much brake pressure is applied. The parking brakes carry out the same function except that they are mechanically actuated by a cable that connects only to the rear brakes.

Red Brake Warning Indicator

The red brake warning indicator alerts the driver to certain conditions that exist in the brake system. The instrument cluster performs a bulb check when the ignition key is turned to the RUN position. The conditions that cause the indicator to illuminate are low brake fluid level, the parking brake is applied or there is a fault in the ABS (if the yellow ABS warning indicator is also illuminated).

Inspection and Verification

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

NOTE: **Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.**

NOTE: **Always check the fluid level in the brake master cylinder reservoir before carrying out the test procedures. If the fluid level is not at the correct level, clean the reservoir cap before removing, then add clean, specified brake fluid.**

NOTE: **Prior to carrying out any diagnosis, make sure the brake warning indicator operates correctly. If the brake indicator does not operate correctly, refer to <u>INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES</u> article.**

The first indication that something may be wrong in the brake system is a change in the feeling through the brake pedal. The brake warning indicator in the instrument cluster and the brake fluid level in the brake master cylinder reservoir are also indicators of system concerns.

If a wheel is locked and the vehicle must be moved, open a bleeder screw at the locked wheel to let out enough fluid to relieve the pressure. Close the bleeder screw. This bleeding operation may release the brakes but will not correct the cause of the concern. If this does not relieve the locked wheel condition, repair the locked components before proceeding.

Inspect all hoses and connections. All unused vacuum connectors should be capped. Make sure hoses and their connections are correctly secured and in good condition with no holes, soft or collapsed areas.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Brake master cylinder • Brake master cylinder reservoir • Brake booster • Brake booster check valve • Brake booster vacuum hose • Brake hoses and tubes • Brake caliper • Brake caliper piston seals • Brake caliper guide pins • Brake disc • Brake pads • Brake pedal linkage • Wheel bearings • Tires	• Parking brake switch • Brake fluid level switch • Wiring, terminals or connectors

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, go to **SYMPTOM CHART - BRAKE SYSTEM** table or Go to **SYMPTOM CHART - NOISE, VIBRATION AND HARSHNESS (NVH)** table.

   For low or spongy brake pedal concerns:

- check for fluid leaks. Repair as necessary.
- check and, if necessary, refill the brake master cylinder reservoir with clean, specified brake fluid.
- bleed the brake system and retest the brake pedal feel.
- if the brake pedal is still low or feels spongy, check the brake pedal mounting for looseness and correct installation. Check the power brake booster and the master cylinder for loose mounting. Correct as necessary and retest the system for normal operation.

For a slow or incomplete brake pedal return concern:

- inspect for binding, damage, correct installation or interference at the brake pedal.
- check the power brake booster for binding, damage and correct installation.

Road Test

The technician should have a thorough knowledge of the brake system operation and accepted general braking guidelines in order to detect any problems.

Select a road that is reasonably smooth and level. Gravel or bumpy roads are not suitable because the surface does not allow the tires to grip the road equally. Avoid crowned roads.

A key factor in evaluating brake concerns is the deceleration rate. This varies from vehicle to vehicle and with changes in operating conditions. It is evident how well the brakes are working after just a few applications.

Brake Pads

NOTE:	**It is not required to install new brake pads if the friction material thickness is within specifications. It is also not required to install new brake pads when the brake discs are machined.**

- Remove the brake pads. Refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
- Inspect and measure the thickness of the brake pad friction material. Refer to **SPECIFICATIONS**.
  - If there are missing chunks or cracks in the lining through to the backing plate, install new brake pads. Refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
  - If the thickness of the friction material is less than the specified thickness, install new brake pads, Refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
  - If the friction material shows taper wear that is not within specifications, verify the caliper guide pins are functioning correctly. Refer to Brake Caliper Guide Pins.

Brake Discs

NOTE:	**Using an impact tool without a torque socket will lead to unevenly tightened**

wheel nuts. This causes brake disc on-vehicle lateral runout and brake roughness.

NOTE: It is generally not required to install new brake discs to address noise issues.

- Remove the brake disc. Refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
- Inspect the brake discs and measure the brake disc thickness in a minimum of 4 places around the circumference of the brake disc. Record the measurements, refer to **SPECIFICATIONS**.
    - If the brake disc is cracked or otherwise damaged, install new a brake disc. Refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
    - If any thickness measurement is less than the minimum specification, install a new brake disc. Refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
    - If the diagnosis has revealed vibration in the steering wheel, seat or pedal while braking that varies with vehicle speed, machine the brake disc. Heavily scored brake discs, similar to that caused by pads worn down to the backing plate, should also be machined. In order to machine, discs must be above the minimum thickness specification. Refer to **SPECIFICATIONS** and **BRAKE DISC MACHINING**.

Brake Calipers

Inspect the brake calipers for the following:

- Brake fluid leaks
- Boots and seals for tears or cracks
- Caliper pistons for binding and corrosion
- Guide pins for correct operation. Refer to Brake Caliper Guide Pins.

Brake Caliper Guide Pins

NOTE: Do not use power tools for caliper guide pin bore cleaning. Damage to the bore may result.

NOTE: The guide pins are part of the anchor plate.

The guide pins should slide with a reasonable amount of hand force. If the brake pads show taper wear or the guide pins are difficult to move, install a new brake caliper anchor plate. Refer to **FRONT DISC BRAKE** article for the front brake caliper anchor plate or **REAR DISC BRAKE** article for the rear brake caliper anchor plate.

If the lining is not within specifications, install new brake pads. Refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.

Brake Hoses and Tubes

NOTE: Never use copper tubing. It is subject to fatigue, cracking and corrosion, which may result in brake tube failure.

- Double-wall steel tubing is used throughout the brake hydraulic system. All brake tube fittings must be correctly double flared to provide strong, leakproof connections. When bending tubing to fit the underbody or rear axle contours, be careful not to kink or crack the tube.
- If a section of the brake tube is damaged, the entire section must be installed with a new tube of the same type, size, shape and length.
- When installing the hydraulic brake tubing, hoses or connectors, tighten all connections to specifications. After installation, bleed the brake system. Refer to **BRAKE SYSTEM BLEEDING**.

Install a new brake flexible hose if the hose shows signs of softening, cracking or other damage.

When installing a new brake hose, position the hose to avoid contact with other vehicle components.

Non-Pressure Leaks

Two parts of the brake system that may have a brake fluid loss that does not appear when the system is under pressure are the brake master cylinder reservoir and the brake caliper under the following conditions:

Reservoir

- Missing or poorly-fitted brake master cylinder filler cap
- Missing or damaged brake master cylinder filler cap gasket
- Punctured or otherwise damaged brake master cylinder reservoir
- Missing, damaged or poorly-fitted sealing grommets between the brake master cylinder and the brake master cylinder reservoir

The brake master cylinder reservoir grommets are not serviceable and must be installed new as part of a new brake master cylinder and reservoir assembly. Refer to brake master cylinder in **HYDRAULIC BRAKE ACTUATION** article.

Brake Caliper

- Foreign material in the caliper piston seal groove
- Punctured or otherwise damaged caliper piston seal

The brake caliper piston seals are not serviceable and must be installed new as part of a new brake caliper. Refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.

Brake Master Cylinder - Normal Conditions

The following conditions are considered normal and are not indications that the brake master cylinder is in need of service.

Condition 1: During normal operation of the brake master cylinder, the fluid level in the brake master cylinder reservoir will fall during brake application and rise during release. The net fluid level (such as after brake application and release) will remain unchanged.

Condition 2: A trace of brake fluid will exist on the booster shell below the master cylinder mounting flange. This results from the normal lubricating action of the master cylinder bore and seal.

Condition 3: Fluid level will decrease with pad wear.

Brake Master Cylinder - Abnormal Conditions

Changes in brake pedal feel or travel are indicators that something may be wrong in the brake system. Go to **SYMPTOM CHART - BRAKE SYSTEM** table for abnormal condition diagnosis.

Brake Booster

Inspect the brake booster:

- for excessive corrosion or damage.
- vacuum connections for leakage.
- vacuum hoses for kinks or leakage.
- check valve for correct operation.

Parking Brake

Check the operation of the parking brake system with the vehicle on a hoist and the parking brake control fully released. Check the rear brake adjustment or carry out the brake system diagnosis. Refer to **PARKING BRAKE AND ACTUATION** article.

Symptom Chart - Brake System

SYMPTOM CHART - BRAKE SYSTEM

Condition	Possible Sources	Action
• The red brake warning indicator and the yellow ABS warning indicator are illuminated	• DTCs in the ABS module	• REFER to **VEHICLE DYNAMIC SYSTEMS** article to diagnose the ABS module.
• The red brake warning indicator is always/never on	• Brake fluid level switch • Parking brake switch • Wiring, terminals or connectors	• REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article to diagnose the red brake warning

	• Instrument cluster • Smart junction box (SJB)	indicator.
• The brakes pull or drift	• Tires	• INSPECT the tires for uneven or excessive wear, and correct inflation. REFER to **WHEELS AND TIRES** article.
-	• Brake pads	• INSPECT the brake pads for contamination, uneven taper or excessive wear, REFER to Brake Pads.
-	• Brake discs	• INSPECT the brake discs and the hubs for contamination or damage. INSTALL new brake discs or hubs as necessary. REFER to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes. REFER to **FRONT SUSPENSION** article for front hubs or **REAR SUSPENSION** article for rear hubs.
-	• Brake calipers and/or guide pins	• INSPECT the brake calipers and guide pins, REFER to Brake Calipers and Brake Caliper Guide Pins.
-	• Suspension component and/or wheel alignment	• INSPECT the suspension and CHECK the wheel alignment. REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.
• Brake pedal goes down fast	• Brake fluid leaks and/or air in the system	• INSPECT the system for leaks. REPAIR as necessary. FILL the brake master cylinder reservoir. BLEED the system. REFER to **BRAKE SYSTEM BLEEDING**.
-	• Brake master cylinder	• CARRY OUT the Brake Master Cylinder test in **COMPONENT TESTS**.
-	• Hydraulic control unit (HCU)	• INSPECT the HCU. REFER to **VEHICLE DYNAMIC SYSTEMS** article.

• The brake pedal eases down slowly	• Air in the system	• BLEED the system. REFER to **BRAKE SYSTEM BLEEDING**.
	• Brake master cylinder	• CARRY OUT the Brake Master Cylinder test in **COMPONENT TESTS**.
	• HCU	• INSPECT the HCU. REFER to **VEHICLE DYNAMIC SYSTEMS** article.
• Brakes lock up under light brake pedal force	• Brake pads	• INSPECT the brake pads for uneven taper or excessive wear, REFER to Brake Pads.
	• Brake calipers and/or guide pins	• INSPECT the brake calipers and guide pins, REFER to Brake Calipers and Brake Caliper Guide Pins.
	• Anti-lock brake control system	• CHECK the anti-lock brake control system. REFER to **VEHICLE DYNAMIC SYSTEMS** article.
• Excessive/erratic brake pedal travel	• Brake fluid leaks and/or air in the system	• INSPECT the system for leaks. REPAIR as necessary. BLEED the system. REFER to **BRAKE SYSTEM BLEEDING**.
	• Brake calipers and/or guide pins	• INSPECT the brake calipers and guide pins, REFER to Brake Calipers and Brake Caliper Guide Pins.
	• Brake flexible hose	• INSPECT the brake flexible hoses for swelling and damage. INSTALL new as necessary. REFER to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
	• Brake master cylinder	• CARRY OUT the Brake Master Cylinder test in **COMPONENT TESTS**.
	• Brake pads	• INSPECT the brake pads for taper wear, REFER to Brake Pads.

-	• Brake pedal	• INSPECT the brake pedal for binding, obstructions and correct installation. REPAIR as necessary. CHECK the brake pedal fasteners for correct torque. REFER to Specifications in **HYDRAULIC BRAKE ACTUATION** article.
-	• Anti-lock brake control system	• CHECK the anti-lock brake control system. REFER to **VEHICLE DYNAMIC SYSTEMS** article.
• Brakes drag	• Parking brake component	• REPAIR or INSTALL new components as necessary. REFER to **PARKING BRAKE AND ACTUATION** article.
-	• Brake caliper guide pins	• INSPECT the caliper guide pins for correct operation. INSTALL new components as necessary. REFER to Brake Caliper Guide Pins.
-	• Disc brake caliper(s)	• INSPECT the brake calipers. REFER to Brake Calipers. REPAIR or INSTALL new brake calipers as necessary. REFER to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
-	• Brake booster	• CARRY OUT the Brake Booster test in **COMPONENT TESTS**.
-	• Brake master cylinder	• CARRY OUT the Brake Master Cylinder test in **COMPONENT TESTS**.
• Excessive brake pedal effort	• Insufficient engine vacuum for brake booster operation	• CHECK engine vacuum. REFER to the Intake Manifold Vacuum Test in **ENGINE SYSTEM - GENERAL INFORMATION** article.
-	• Brake booster manifold	• VERIFY engine vacuum at the

	vacuum hose	booster. REROUTE, REPAIR or INSTALL new components as necessary.
-	• Brake booster	• VERIFY engine vacuum at the booster. CARRY OUT the Brake Booster test in **COMPONENT TESTS**.
-	• Brake booster check valve	• VERIFY engine vacuum at the booster. CARRY OUT the Check Valve test in **COMPONENT TESTS**.

Symptom Chart - Noise, Vibration and Harshness (NVH)

NOTE: Noise, vibration and harshness (NVH) symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.

SYMPTOM CHART - NOISE, VIBRATION AND HARSHNESS (NVH)

Condition	Possible Sources	Action
• Vibration when the brakes are applied	• Tires	• CORRECT any wheel and tire concern before diagnosing the brake or suspension systems. REFER to **WHEELS AND TIRES** article to diagnose the tires.
-	• Uneven brake pad wear • Brake disc pad transfer • Uneven brake disc wear • Suspension components	• COMPLETE the brake system inspection described in **INSPECTION AND VERIFICATION**. If the condition still exists, go to **Pinpoint Test A** .
• Brake vibration/shudder - occurs when the brake pedal is released	• Brake caliper guide pins	• INSPECT the brake caliper guide pins for correct operation. REFER to Brake Caliper Guide Pins.
-	• Brake drag	• Go to **SYMPTOM CHART - BRAKE SYSTEM** table.

• Rattling noise	• Caliper mounting bolts loose	• CHECK the caliper bolts. TIGHTEN to specifications. REFER to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
-	• Damaged or worn caliper guide pins or retainers	• CHECK the caliper guide pins and retainers for correct operation. REFER to Brake Caliper Guide Pins. INSTALL new components as necessary.
-	• Missing or damaged anti-rattle clips or springs	• CHECK the brake pads for missing clips or broken springs. INSTALL new components as necessary. REFER to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
-	• Loose brake disc shield	• TIGHTEN the brake disc shield bolts to specification. REFER to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
• Clicking noise - with brakes applied on vehicles equipped with ABS brakes	• ABS hydraulic control unit (HCU)	• Acceptable condition during an ABS event.
• Squealing noise - occurs on first (morning) brake application	• Brake pads	• Acceptable condition. Caused by humidity and low brake pad temperature.
• Squealing noise - a continuous squeal	• Brake pads worn below minimum thickness	• INSPECT brake pads for excessive wear, taper wear or uneven wear. VERIFY brake pads are within minimum specifications. REFER to Brake Pads.
• Squealing noise - an intermittent squeal brought on by cold, heat, water, mud or snow	• Brake pads	• Acceptable condition.
• Groaning noise - occurs at low speeds with brake lightly applied (creeping)	• Brake pads	• Acceptable condition.

• Grinding noise - continuous	• Brake pads worn below minimum thickness	• INSPECT the brake pads, brake discs, and attaching hardware for damage. VERIFY brake components are within specifications. REFER to **SPECIFICATIONS**.
• Moaning noise	• Brake pads contaminated with grease or oil	• INSPECT the brake pads for contamination. REPAIR or INSTALL new components as necessary. REFER to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.

Pinpoint Tests

Pinpoint Test A: Vibration When Brakes are Applied

Normal Operation

During moderate to heavy braking, noise from the hydraulic control unit (HCU) and pulsation in the brake pedal can be observed. Pedal pulsation coupled with noise during heavy braking or on loose gravel, bumps, wet or snowy surfaces is acceptable and indicates correct functioning of the ABS. Pedal pulsation alone or steering wheel nibble when the brakes are applied (frequency is proportional to the vehicle speed) indicates a concern with a brake or suspension component.

This pinpoint test is intended to diagnose the following:

- Brake pad(s)
- Brake disc(s)
- Wheel(s) and tire(s)
- Suspension component(s)

PINPOINT TEST A: VIBRATION WHEN THE BRAKES ARE APPLIED

A1 ROAD TEST THE VEHICLE - LIGHT BRAKING

- Road test the vehicle. Warm the brakes by slowing the vehicle from 80 to 32 km/h (50 to 20 mph) using light brake force. At highway speeds of 89-97 km/h (55-60 mph), apply the brake using light pedal force.
- **Is there a vibration/shudder felt in the steering wheel, seat or brake pedal?**

  YES : Go to A4.

  NO : Go to A2.

A2 ROAD TEST THE VEHICLE - MODERATE TO HEAVY BRAKING

- Road test the vehicle. At highway speeds of 89-97 km/h (55-60 mph), apply the brake using a moderate to heavy pedal force.
- **Is there a vibration/shudder?**

  YES : Go to A3.

  NO : The concern is not present at this time.

A3 CHECK ABS OPERATION

- Road test the vehicle and apply the brakes on a dry, firm surface, then apply the brakes on a wet, snowy or loose surface (such as gravel).
- **Is the vibration/shudder only present on a wet, snowy or loose surface?**

  YES : This is a normal operating condition of the ABS.

  NO : Go to A4.

A4 CHECK THE FRONT SUSPENSION

- Check the front suspension. Refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.
- **Are all the suspension components in satisfactory condition?**

  YES : Go to A5.

  NO : REPAIR or INSTALL new components as necessary. TEST the system for normal operation.

A5 RESURFACE THE FRONT BRAKE DISCS

NOTE: **Do not use a bench lathe to machine the brake discs. A bench lathe may cause brake disc on-vehicle lateral runout and brake roughness.**

NOTE: **Follow the brake lathe manufacturer's instructions to machine the brake discs. After machining, make sure the brake disc meets the thickness specification.**

- Resurface the front brake discs. Refer to **BRAKE DISC MACHINING**.
- Road test the vehicle.
- **Is the vibration/shudder present?**

  YES : Go to A6.

  NO : The concern has been repaired.

A6 CHECK THE REAR SUSPENSION

- Check the rear suspension. Refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.
- **Are all the suspension components in satisfactory condition?**

  YES : RESURFACE the rear brake discs or brake drums. REFER to **BRAKE DISC MACHINING**.

  NO : REPAIR or INSTALL new components as necessary. TEST the system for normal operation.

Component Tests

Brake Booster

1. Disconnect the check valve from the brake booster.
2. Apply the parking brake, start the engine and place the transmission in NEUTRAL.
3. Verify that manifold vacuum is available at the check valve with the engine at idle speed and the transmission in NEUTRAL.
   - If manifold vacuum is available, stop the engine, connect the check valve and continue with Step 5.
   - If manifold vacuum is not available, continue with Step 4.
4. Disconnect the check valve from the vacuum hose and verify that manifold vacuum is available at the hose with the engine at idle speed and the transmission in NEUTRAL.
   - If manifold vacuum is available, stop the engine, install a new check valve and continue with Step 5.
   - If manifold vacuum is not available, stop the engine, connect the vacuum hose to the check valve and refer to **ENGINE SYSTEM - GENERAL INFORMATION** article to diagnose the no vacuum condition.
5. Apply the brake pedal several times to exhaust all vacuum from the system.
6. Apply the brake pedal and hold it in the applied position. Start the engine and verify that the brake pedal moves downward after the engine starts.
   - If the brake pedal moves, the brake booster is operating correctly
   - If the brake pedal does not move, install a new brake booster. Refer to **POWER BRAKE ACTUATION** article.
7. Operate the engine a minimum of 10 seconds at fast idle. Stop the engine, and let the vehicle stand for 10 minutes. Then apply the brake pedal with approximately 89 N (20 lb) of force. The brake pedal feel should be the same as that noted with the engine operating. If the brake pedal feels hard (no power assist), install a new brake booster check valve and retest. If the brake pedal feels spongy, bleed the hydraulic system to remove air. Refer to **BRAKE SYSTEM BLEEDING**.

Brake Booster Check Valve

The function of the brake booster check valve is to allow manifold vacuum to enter the brake booster and prevent the escape of vacuum in case manifold vacuum is lost during sustained full throttle operation.

1. Disconnect the vacuum booster hose from the check valve.
2. Apply the parking brake, start the engine and place the transmission in NEUTRAL.
3. Verify that manifold vacuum is available at the check valve end of the vacuum hose with the engine at idle speed and the transmission in NEUTRAL.
   - If manifold vacuum is available, stop the engine, connect the vacuum hose to the check valve and continue this test.
   - If manifold vacuum is not available, stop the engine, connect the vacuum hose to the check valve and refer to **ENGINE SYSTEM - GENERAL INFORMATION** article to diagnose the no vacuum condition.
4. Connect the vacuum hose to the check valve and run the engine for at least 10 seconds.

5. Operate the brake pedal to check for power assist.
   - If power assist is present, continue with this test.
   - If power assist is not present, refer to Brake Booster test in **COMPONENT TESTS**.

NOTE: Do not remove the brake booster check valve from the brake booster in this step.

6. Stop the engine and disconnect the vacuum booster hose from the brake booster check valve.
7. Apply the brake and verify that there is enough vacuum retained in the brake booster for at least one power-assisted brake application.
   - If there is enough vacuum for at least one power-assisted brake application, the check valve is functioning correctly.
   - If there is not enough vacuum for at least one power-assisted brake application, continue with this test.
8. Inspect the brake booster for any signs of damage that may cause a leak.
   - If any damage is found, install a new brake booster and repeat this test.
   - If no damage is found, install a new check valve.

Brake Master Cylinder - Bypass Condition

1. Disconnect the brake tubes from the master cylinder.
2. Plug the outlet ports of the master cylinder.
3. Apply the brakes. If brake pedal height cannot be maintained, the brake master cylinder has an internal leak and a new brake master cylinder must be installed.

Brake Master Cylinder - Compensator Port

The purpose of the compensator ports in the brake master cylinder is to:

- supply additional brake fluid from the brake master cylinder reservoir needed by the brake system due to brake lining wear.
- allow brake fluid to return to the brake master cylinder reservoir when the brakes are released. The returning brake fluid creates a slight turbulence in the brake master cylinder reservoir. This is a normal condition and indicates that the compensator ports are not clogged.

Clogged compensator ports may cause the brakes to hang up or not fully release. If clogged compensator ports are suspected, proceed as follows:

1. With the vehicle in NEUTRAL, position it on a hoist. Refer to **JACKING AND LIFTING** article.
2. With the brakes released, attempt to rotate each wheel and check for any brake drag.
   - If an excessive amount of brake drag exists at all 4 wheels, continue with the test.
   - If an excessive amount of brake drag exists at only one wheel, it indicates a possible seized brake caliper, brake wheel cylinder or parking brake component. Repair or install new components as

necessary.

3. Check the brake stoplamp switch and the brake pedal free play to verify that the brake pedal is not partially applied.
4. Loosen the brake master cylinder nuts and position the brake master cylinder away from the brake booster.
5. With the brakes released, attempt to rotate each wheel and check for any brake drag.
   - If the brake drag is no longer present, install a new brake booster. Refer to **POWER BRAKE ACTUATION** article.
   - If the brake drag is still present, install a new master cylinder. Refer to **HYDRAULIC BRAKE ACTUATION** article.

GENERAL PROCEDURES

BRAKE DISC MACHINING

NOTE: Do not use a bench lathe to machine the brake discs. Use an on-vehicle brake lathe only. Read the entire operating manual and/or view the video shipped with the lathe before installing, operating or repairing the lathe.

NOTE: An on-vehicle brake lathe with an automatic runout adjustment feature is preferred. However, if the lathe is not self adjusting, the lathe oscillation must be adjusted using a dial indicator. The total indicated runout target is 0.000 mm (0.000 in). The maximum indicated runout should be no more than 0.050 mm (0.002 in). If the runout adjustment (automatic or manual) is carried out correctly prior to machining, then the final brake disc runout will be within specification and a runout measurement is not necessary after machining.

NOTE: Do not machine new brake discs.

NOTE: Lateral runout and disc thickness variation measurements are not required because correct adjustment of the on-vehicle brake lathe will make sure that these dimensions are within specification.

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

   NOTE: Do not allow the caliper to hang from the brake hose or damage to the hose may occur.

   NOTE: It is not necessary to disconnect the brake tube from the brake caliper.

2. Remove the bolts and position the brake caliper or brake caliper and anchor plate assembly aside, as required.
   - Support the brake caliper using mechanic's wire.

3. Install the hub adapter using:
    - four wheel nuts on a 4-stud wheel hub.
    - five wheel nuts on a 5-stud wheel hub.
    - six wheel nuts on a 6-stud wheel hub.
    - four wheel nuts on a 7- or 8-stud wheel hub.
    - five wheel nuts on a 10-stud wheel hub.
4. Install the cutting lathe.
5. If the lathe is not self adjusting, adjust the lathe oscillation using a dial indicator. The total indicated runout target is 0.000 mm (0.000 in). The maximum indicated runout should be no more than 0.050 mm (0.002 in).
6. Center the cutting head, adjust the cutting bits and install the chip deflector/silencer.

NOTE: The depth of the cut should be between 0.10 and 0.40 mm (0.004 and 0.015 in). Lighter cuts will cause the bit to heat up and wear faster. Heavier cuts will cause poor brake disc surface finish.

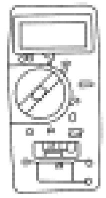
7. Machine the brake disc.
8. Remove the lathe and the silencer.
9. Remove the wheel nuts and hub adapter.
10. Remove the metal shavings.

NOTE: It is not required to install new brake pads if friction material is within specifications. For additional information, refer to SPECIFICATIONS.

11. Position the brake caliper or brake caliper and anchor plate assembly.
    - Install the bolts.
    - For fastener torque specifications, refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
12. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

BRAKE SYSTEM BLEEDING

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST1137-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	-

MATERIAL

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

Pressure Bleed

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.**

NOTE: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: When any part of the hydraulic system has been disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it has been correctly connected.

NOTE: Pressure bleed the brake system at 207-345 kPa (30-50 psi).

NOTE: If the hydraulic control unit (HCU) or any component upstream of the HCU are installed new, carry out the Brake System Pressure Bleeding procedure, then the anti-lock HCU bleed procedure, followed by another Brake System Bleed Procedure.

1. Clean all the dirt from around the brake fluid reservoir cap and remove the cap. Fill the brake master cylinder reservoir with clean, specified brake fluid.

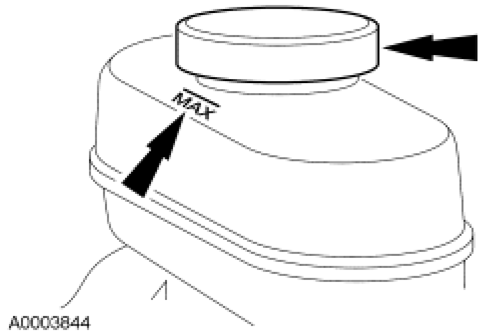


Fig. 1: Identifying Brake Master Cylinder Fluid Reservoir Cap And Max Fill Line
Courtesy of FORD MOTOR CO.

NOTE: **Master cylinder pressure bleeder adapter tools are available from various manufacturers of pressure bleeding equipment. Follow the instructions of the manufacturer when installing the adapter.**

2. Install the bleeder adapter to the brake master cylinder reservoir and attach the bleeder tank hose to the fitting on the adapter.

NOTE: **Bleed the longest line first. Make sure the bleeder tank contains enough specified brake fluid to complete the bleeding operation.**

3. Remove the RH rear brake caliper bleeder cap and place a box-end wrench on the bleeder screw. Attach a rubber drain tube to the RH rear bleeder screw and submerge the free end of the tube in a container partially filled with clean, specified brake fluid.
4. Open the valve on the bleeder tank.
5. Loosen the RH rear brake caliper bleeder screw. Leave open until clear, bubble-free brake fluid flows, then tighten the RH rear bleeder screw.
    - Press and release the parking brake 5 times.
    - Repeat until clear, bubble-free fluid comes out.
6. Tighten the RH rear brake caliper bleeder screw to 8 N.m (71 lb-in), remove the rubber hose and install the bleeder screw cap.
7. Repeat Steps 5 and 6 for the LH rear brake caliper.
    - Tighten the LH rear brake caliper bleeder screw to 8 N.m (71 lb-in).
8. Continue bleeding the front of the system, going in order from the RH front brake caliper and then to the LH front brake caliper.
    - Tighten the front brake caliper bleeder screws to 8 N.m (71 lb-in).
9. Close the bleeder tank valve. Remove the tank hose from the adapter and remove the adapter. Fill the reservoir with clean, specified brake fluid and install the reservoir cap.

Manual Bleeding

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's**

specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.**

NOTE: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: When any part of the hydraulic system is disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it is correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

1. Clean all dirt from and remove the brake master cylinder filler cap and fill the brake master cylinder reservoir with clean, specified brake fluid.

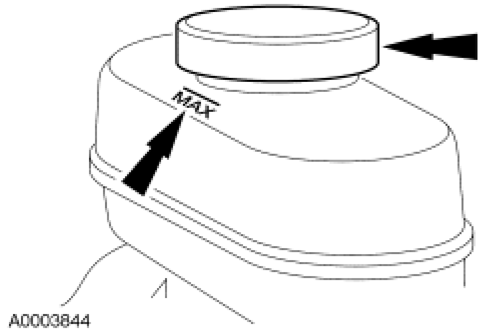


Fig. 2: Identifying Brake Master Cylinder Fluid Reservoir Cap And Max Fill Line
Courtesy of FORD MOTOR CO.

NOTE: Bleed the brake system from the longest to the shortest brake line.

2. Remove the RH rear brake caliper bleeder screw cap and place a box-end wrench on the bleeder screw. Attach a rubber drain hose to the bleeder screw and submerge the free end of the hose in a container

partially filled with clean, specified brake fluid.

3. Have an assistant pump the brake pedal and then hold firm pressure on the brake pedal.
4. Loosen the RH rear brake caliper bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the bleeder screw.
   - Repeat until clear, bubble-free fluid comes out.
   - Refill the brake master cylinder reservoir as necessary.
5. Tighten the RH rear brake caliper bleeder screw to 8 N.m (71 lb-in), remove the rubber hose and install the bleeder screw cap.
6. Repeat Steps 2 through 5 for the LH rear brake caliper bleeder screw.
   - Tighten the LH rear brake caliper bleeder screw to 8 N.m (71 lb-in).
7. Remove the RH front brake caliper bleeder screw cap and place a box-end wrench on the bleeder screw. Attach a rubber drain hose to the bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

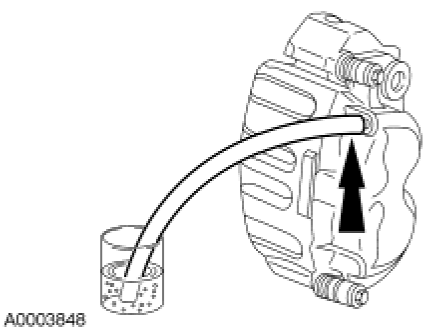


Fig. 3: Locating Rubber Drain Tube
Courtesy of FORD MOTOR CO.

8. Have an assistant pump the brake pedal and then hold firm pressure on the brake pedal.
9. Loosen the RH front brake caliper bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the bleeder screw.
   - Repeat until clear, bubble-free fluid comes out.
   - Refill the brake master cylinder reservoir as necessary.
10. Tighten the RH front brake caliper bleeder screw to 8 N.m (71 lb-in), remove the rubber hose and install the bleeder screw cap.
11. Repeat Steps 7 through 10 for the LH front brake caliper bleeder screw.
    - Tighten the LH front brake caliper bleeder screw to 8 N.m (71 lb-in).

ABS Hydraulic Control Unit (HCU) Bleeding

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal**

injury.

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.**

NOTE: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: This procedure is only required when a new hydraulic control unit (HCU) is installed.

NOTE: When any part of the hydraulic system is disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it is correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

NOTE: Carrying out the System Bleed function drives trapped air from the HCU. Subsequent bleeding removes the air from the brake hydraulic system through the bleeder screws.

NOTE: Adequate voltage to the HCU module is required during the anti-lock control portion of the system bleed.

1. Connect the scan tool to the vehicle.
2. Access the ABS HCU bleed function and follow the directions on the scan tool.
3. Manually bleed the brake hydraulic system. For additional information, refer to **MANUAL BLEEDING**.
4. Repeat the procedure carrying out a total of 2 scan tool cycles and 2 manual bleed cycles.

COMPONENT BLEEDING

MATERIAL

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid	WSS-M6C62-A or WSS-M6C65-A1

PM-1-C (US); CPM-1-C (Canada)	

Master Cylinder

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

NOTE: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: When a new brake master cylinder has been installed or the system has been emptied, or partially emptied, it should be primed to prevent air from getting into the system.

NOTE: When any part of the hydraulic system has been disconnected for repair or new installation, air may get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it has been correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

1. Disconnect the brake master cylinder outlet tubes.

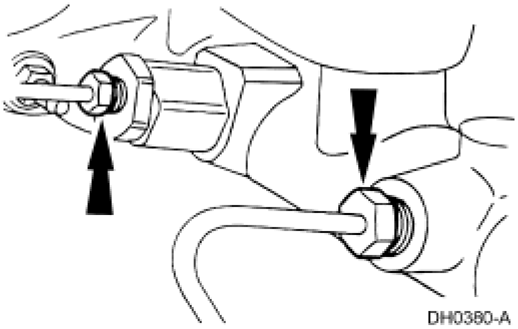


Fig. 4: Identifying Brake Lines
Courtesy of FORD MOTOR CO.

2. Install short brake tubes with ends submerged in the brake master cylinder reservoir and fill the brake master cylinder reservoir with clean, specified brake fluid.

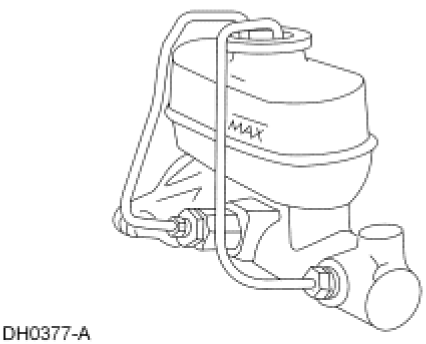


Fig. 5: Identifying Short Brake Tubes
Courtesy of FORD MOTOR CO.

3. Have an assistant pump the brake pedal until clear fluid flows from both brake tubes without air bubbles.
4. Remove the short brake tubes and install the brake outlet tubes.
5. Bleed each brake tube at the brake master cylinder as follows:
    1. Have an assistant pump the brake pedal and then hold firm pressure on the brake pedal.
    2. Loosen the rearmost brake tube fittings until a stream of brake fluid comes out. Have an assistant maintain pressure on the brake pedal while tightening the brake tube fitting.
    3. Repeat this operation until clear, bubble-free fluid comes out.
    4. Refill the brake master cylinder reservoir as necessary. Repeat the bleeding operation at the front brake tube.
6. While the assistant maintains pressure on the brake pedal, tighten the brake tubes.
    - Tighten to 28 N.m (21 lb-ft).

Brake Caliper

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been

previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.**

NOTE: **Brake fluid is harmful to painted and plastic surfaces. If spilled, wipe up immediately before damage to the painted or plastic surface occurs.**

NOTE: **It is not necessary to do a complete brake system bleed if only the brake caliper was disconnected or installed new.**

1. Remove the brake caliper bleeder screw cap and place a box-end wrench on the bleeder screw. Attach a rubber drain hose to the bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

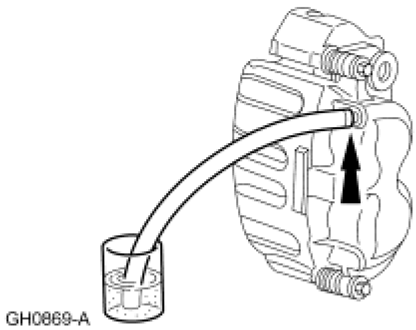


Fig. 6: Attaching Rubber Drain Hose To Disc Brake Caliper Bleeder Screw
Courtesy of FORD MOTOR CO.

2. Have an assistant pump the brake pedal and then hold firm pressure on the brake pedal.
3. Loosen the bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the bleeder screw.
   - Repeat until clear, bubble-free fluid comes out.
   - Refill the brake master cylinder reservoir as necessary.
4. Tighten the brake caliper bleeder screw, remove the rubber hose and install the bleeder screw cap.

- Tighten the bleeder screw to 8 N.m (71 lb-in).

2008 ACCESSORIES & BODY, CAB

Bumpers - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Front bumper-to-radiator support nuts	25	18	-
Front lower bumper nuts	25	18	-
Front upper bumper bolts	67	49	-
Front upper bumper-to-radiator support bolts	9	-	80
Power steering cooler pipe mounting nuts	7	-	62
Rear bumper bolts (with trailer hitch only)	90	66	-
Rear bumper nuts	25	18	-
Rear center bumper bolts	40	30	-

REMOVAL AND INSTALLATION

BUMPER - EXPLODED VIEW, FRONT

NOTE: MKX shown, Edge similar.

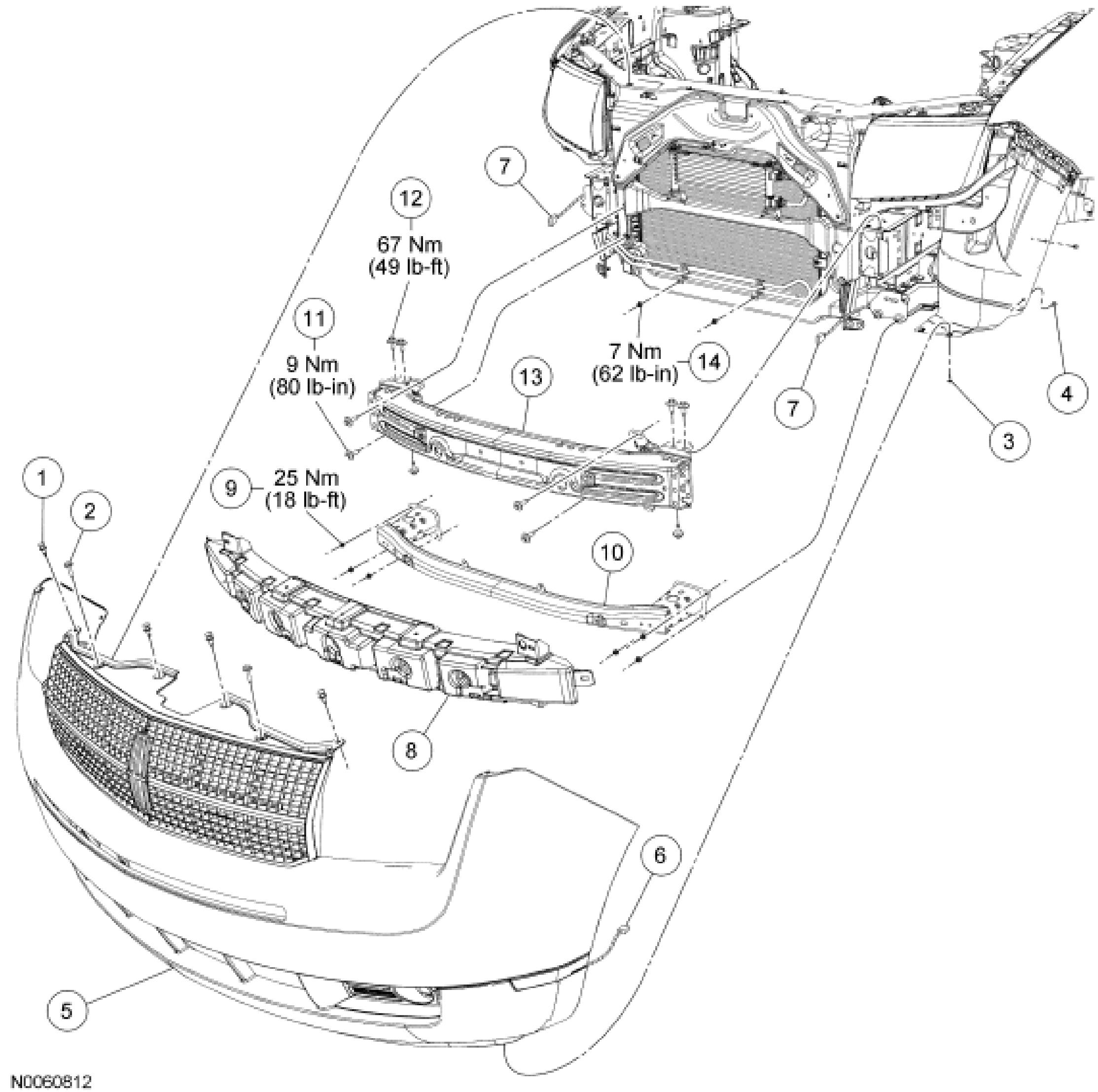


Fig. 1: Exploded View Of Front Bumper With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W711685	Upper radiator grille bolt (2 required)
2	W706350	Upper radiator grille scrivet (4 required)
3	N623332	Bumper cover lower screw (4 required)
4	W711656	Splash shield screw (6 required)
5	17D957	Front bumper cover
6	-	Bumper cover wiring harness assembly (part of 17E810)
7	14290	Wiring harness assembly
8	17C882	Isolator front bumper
		Lower front bumper mounting bolt (6

9	-	required) (part of 5019)
10	5019	Lower front bumper
11	W711617	Upper front bumper-to-radiator support bolt (4 required)
12	W711617	Upper front bumper mounting bolt (6 required)
13	17757	Upper front bumper
14	W711788	Power steering cooler pipe nut (2 required)

1. For additional information, refer to the procedures in this article.

BUMPER COVER - FRONT

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the 2 bolts from the top of the radiator grille.

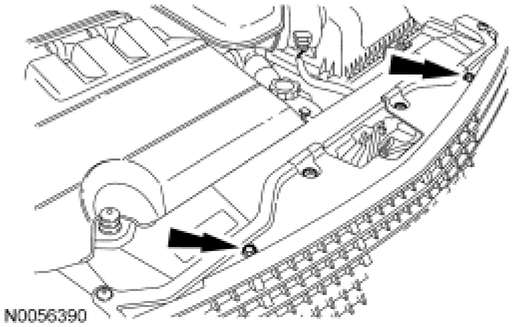


Fig. 2: Locating Bolts From Top Of Radiator Grill
Courtesy of FORD MOTOR CO.

3. Remove the 4 scrivets from the top of the radiator grille.

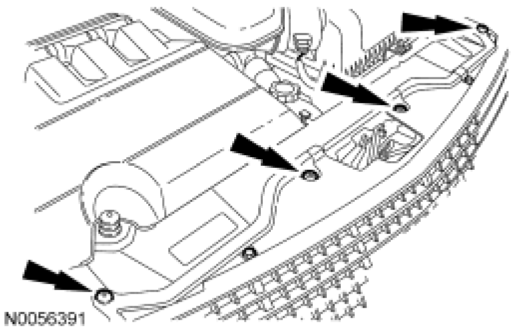


Fig. 3: Locating Scrivets From Top Of Radiator Grille
Courtesy of FORD MOTOR CO.

4. Remove the 3 lower pin-type retainers.

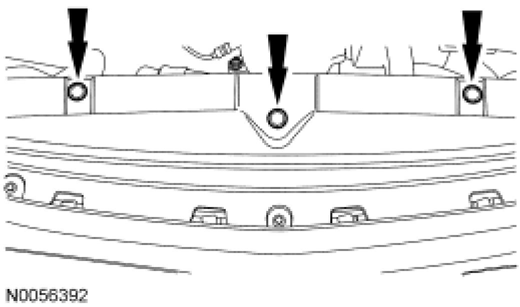


Fig. 4: Identifying Lower Pin-Type Retainer
Courtesy of FORD MOTOR CO.

5. Remove the 6 fender splash shield screws (3 each side).

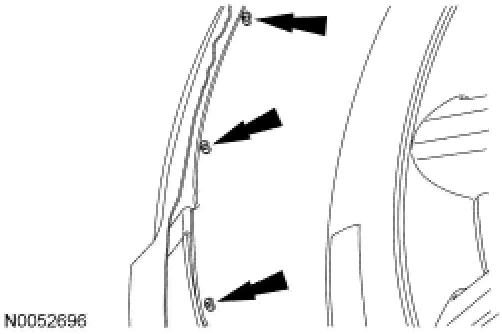


Fig. 5: Identifying Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

6. Remove the 4 lower screws (2 each side).

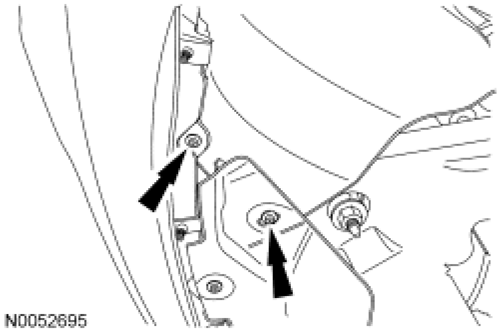


Fig. 6: Identifying Lower Screws
Courtesy of FORD MOTOR CO.

7. Disconnect the side marker lamp electrical connectors, if equipped.

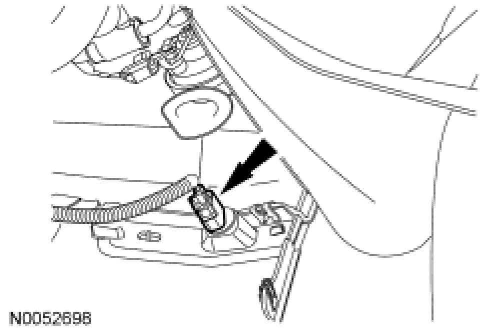


Fig. 7: Identifying Side Marker Lamp Electrical Connectors
Courtesy of FORD MOTOR CO.

8. Disconnect the fog lamp electrical connectors, if equipped.

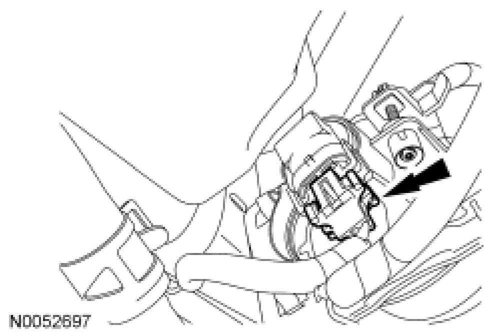


Fig. 8: Identifying Fog Lamp Electrical Connectors
Courtesy of FORD MOTOR CO.

9. Remove the front bumper cover.
   - Pull the corner of the bumper cover from the bracket.

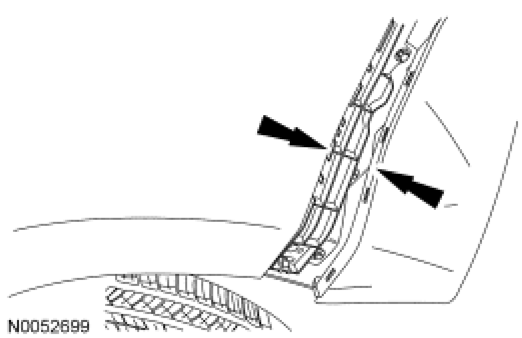


Fig. 9: Identifying Front Bumper Cover
Courtesy of FORD MOTOR CO.

10. To install, reverse the removal procedure.

BUMPER - FRONT

1. Remove the front bumper cover. For additional information, refer to **Bumper Cover - Front**.
2. Remove the 6 front bumper bolts (3 each side).
   - To install, tighten to 67 N.m (49 lb-ft).

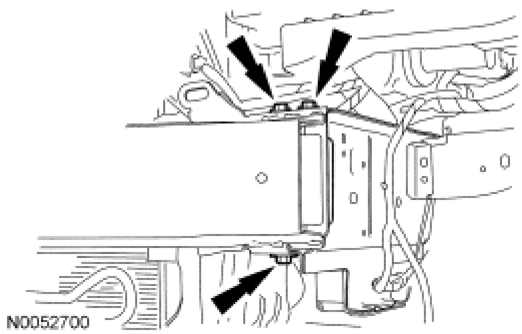


Fig. 10: Identifying Front Bumper Bolts
Courtesy of FORD MOTOR CO.

3. Remove the 4 upper and lower bumper-to-radiator support bolts (2 each side).
   - To install, tighten to 9 N.m (80 lb-in).

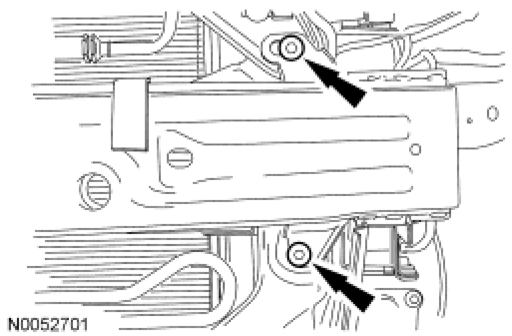


Fig. 11: Identifying Upper & Lower Bumper-To-Radiator Support Bolts
Courtesy of FORD MOTOR CO.

4. Remove the front bumper.
5. To install, reverse the removal procedure.

BUMPER - FRONT, LOWER

1. Remove the front bumper cover. For additional information, refer to **Bumper Cover - Front**.
2. Remove the 2 nuts from the power steering cooler pipe-to-lower front bumper.
   - To install, tighten to 7 N.m (62 lb-in).

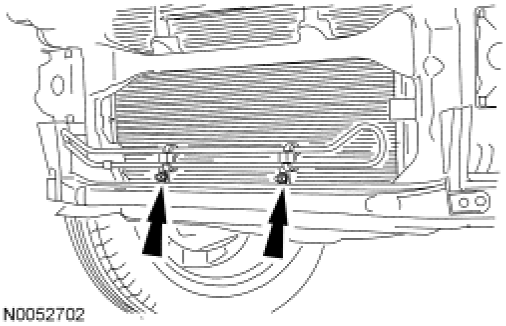


Fig. 12: Locating Nuts From Power Steering Cooler Pipe-To-Lower Front Bumper
Courtesy of FORD MOTOR CO.

3. Remove the 6 bumper-to-radiator support nuts (3 each side) and remove the lower front bumper.
    - To install, tighten to 25 N.m (18 lb-ft).

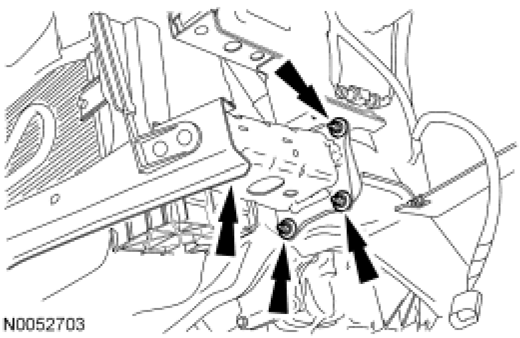


Fig. 13: Identifying Bumper-To-Radiator Support Nuts & Lower Front Bumper
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.

BUMPER - EXPLODED VIEW, REAR

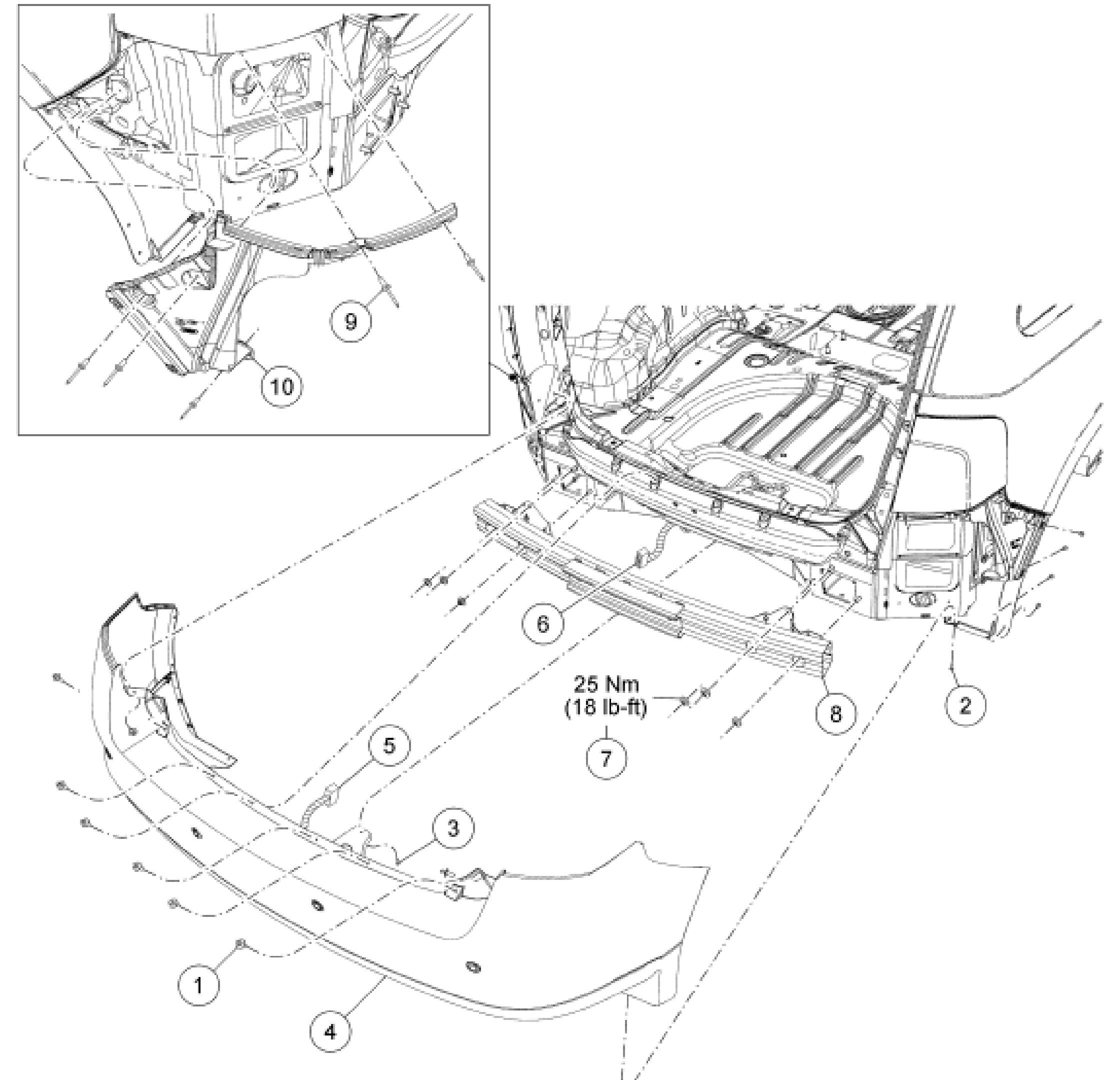


Fig. 14: Exploded View Of Rear Bumper Without Trailer Hitch With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W713202	Rear bumper cover scrivet (Edge) (8 required)
1	W713202	Rear bumper cover scrivet (MKX) (10 required)
2	W711656	Splash shield screw (10 required)
3	W711656	Rear bumper cover body brace screw
4	17K835	Rear bumper cover
5	-	Wiring harness assembly
6	-	Wiring harness assembly
7	N804620	Rear bumper mounting nut (6 required)

8	17906	Rear bumper
9	W705376	Rear bumper cover mounting bracket rivet (5 required)
10	17D980	Rear bumper cover mounting bracket

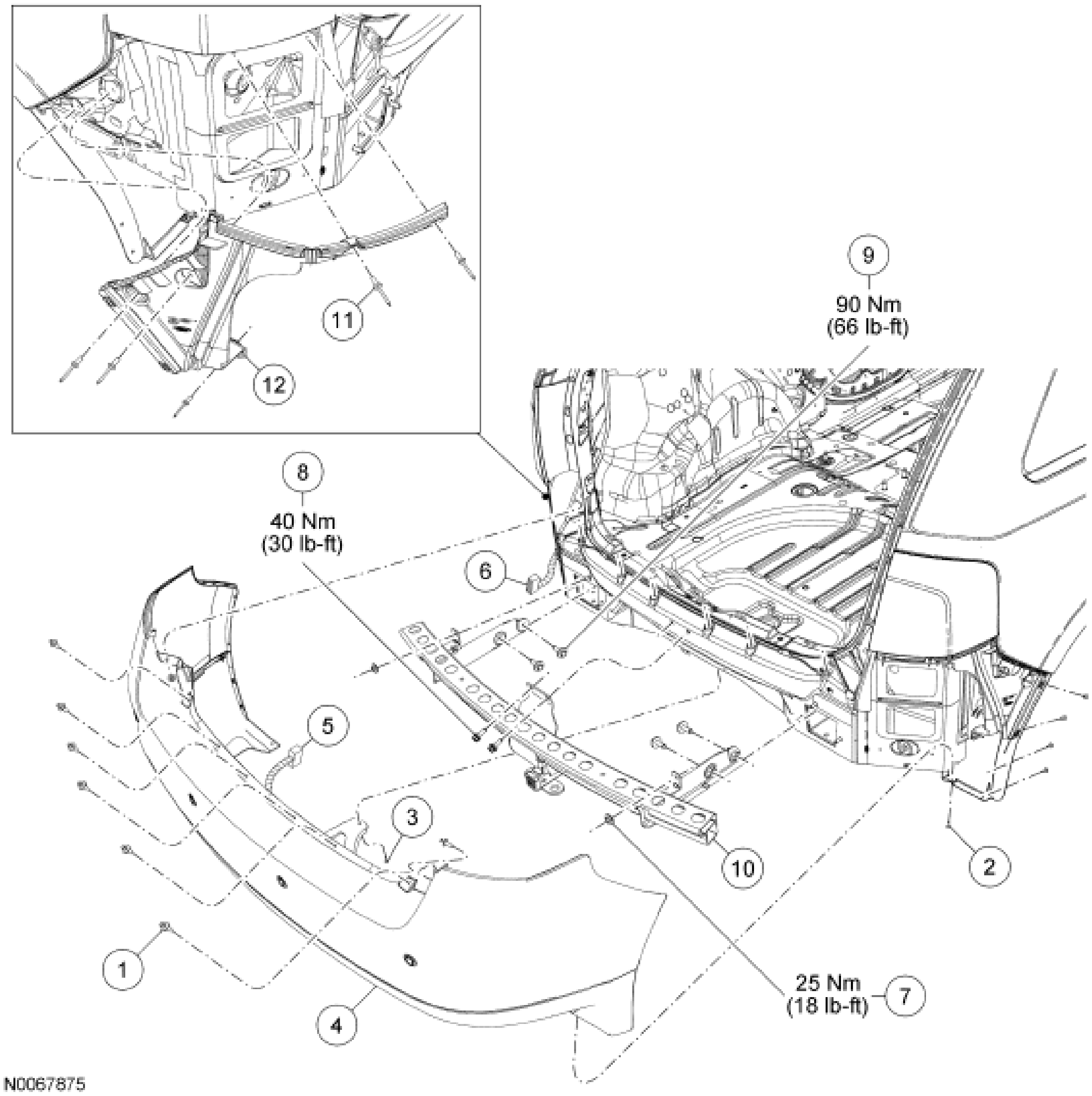


Fig. 15: Exploded View Of Rear Bumper With Trailer Hitch With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W713202	Rear bumper cover scrivet (Edge) (8 required)
1	W713202	Rear bumper cover scrivet (MKX) (10 required)
2	W711656	Splash shield screw (10 required)

3	W711656	Rear bumper cover body brace screw
4	17K835	Rear bumper cover
5	-	Wiring harness assembly
6	-	Wiring harness assembly
7	N804620	Rear bumper mounting nut (2 required)
8	W712171	Rear bumper mounting bolt (2 required)
9	W702256	Rear bumper mounting bolt (4 required)
10	17D826	Rear bumper
11	W705376	Rear bumper cover mounting bracket rivet (5 required)
12	17D980	Rear bumper cover mounting bracket

1. For additional information, refer to the procedures in this article.

BUMPER COVER - REAR

NOTE: MKX shown, Edge similar.

1. Remove the scrivets from the rear bumper cover.

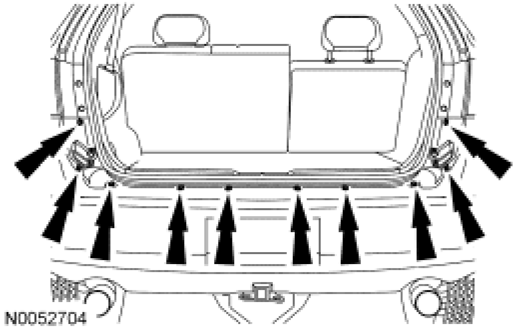


Fig. 16: Locating Scrivets From Rear Bumper Cover
Courtesy of FORD MOTOR CO.

2. Remove the 10 screws (5 each side) from the rear splash shield.

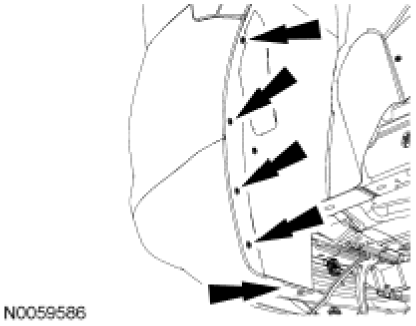


Fig. 17: Locating Screws From Rear Splash Shield
Courtesy of FORD MOTOR CO.

3. Remove the rear bumper cover-to-body brace screw.

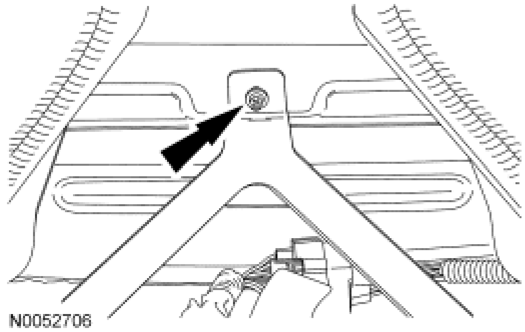


Fig. 18: Identifying Rear Bumper Cover-To-Body Brace Screw
Courtesy of FORD MOTOR CO.

4. Disconnect the trailer hitch and parking aid system wiring harness, if equipped.

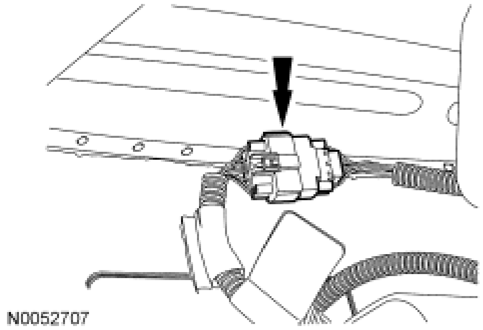


Fig. 19: Identifying Trailer Hitch & Parking Aid System Wiring Harness
Courtesy of FORD MOTOR CO.

5. Disconnect the retainers from the rear bumper cover-to-body brace.

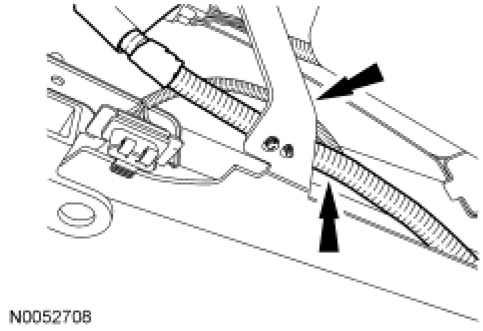


Fig. 20: Locating Retainers From Rear Bumper Cover-To-Body Brace
Courtesy of FORD MOTOR CO.

6. Remove the rear bumper cover.
    - Remove the bumper cover from the bumper cover bracket.
    - Remove the bumper cover.

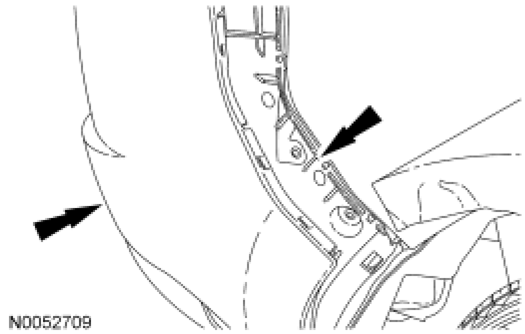


Fig. 21: Locating Bumper Cover From Bumper Cover Bracket
Courtesy of FORD MOTOR CO.

7. To install, reverse the removal procedure.

BUMPER - REAR

All vehicles

1. Remove the rear bumper cover. For additional information, refer to **Bumper Cover - Rear**.

    Without trailer tow

2. Remove the 6 bumper mounting nuts (3 each side).
    - To install, tighten to 25 N.m (18 lb-ft).

    With trailer tow

3. Remove the 2 underbody heat shields.
    - Remove the 6 screws (3 each side).
    - Remove the 2 pushpin retainers (1 each side).
    - Disconnect the wiring harness from the heat shield.

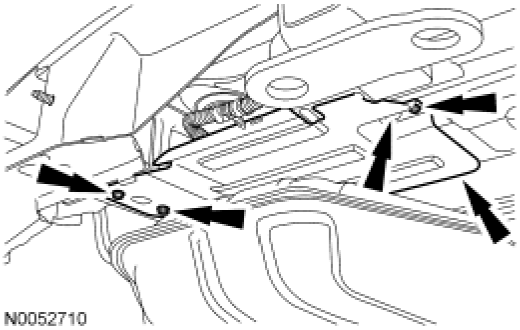


Fig. 22: Locating Wiring Harness From Heat Shield
Courtesy of FORD MOTOR CO.

4. Remove the 4 inside rear bumper bolts (2 each side) and the 2 nuts (1 each side).
   - To install, tighten rear bumper bolts to 90 N.m (66 lb-ft).
   - To install, tighten rear bumper nuts to 25 Nm (18 lb-ft).

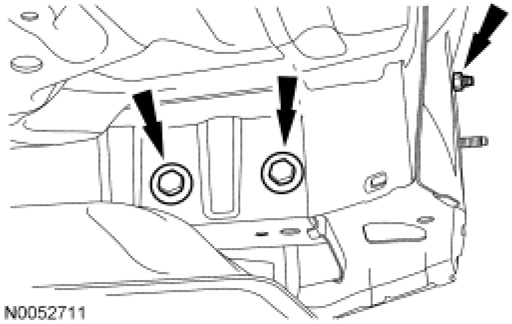


Fig. 23: Identifying Inside Rear Bumper Bolts & Nuts
Courtesy of FORD MOTOR CO.

5. Remove the 2 rear center bumper bolts.
   - To install, tighten to 40 N.m (30 lb-ft).

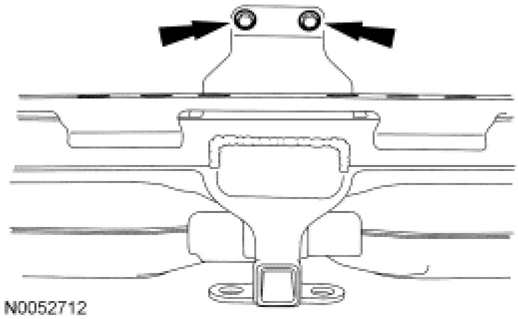


Fig. 24: Identifying Rear Center Bumper Bolts
Courtesy of FORD MOTOR CO.

All vehicles

6. Remove the rear bumper.
7. To install, reverse the removal procedure.

CABIN AIR FILTER

Cabin Air Filter - Edge, MKX

REMOVAL & INSTALLATION

NOTE: Manufacturer's terminology for this filter is Cabin Air Filter, or Air Inlet Screen.

A cabin air filter is available as standard equipment on dual-zone EATC vehicles. EMTC vehicles are not equipped from the factory with a cabin air filter, but are equipped with an air inlet screen in place of the filter to prevent any large foreign material from entering the heater core and evaporator core housing. The cabin air filter or screen can be accessed by removing the glove compartment and removing the cabin air filter access cover.

A cabin air filter can be installed as a dealer accessory on vehicles not originally equipped with a filter.

CAUTION: Only a screen or a filter should be installed, never both.

1. The cabin air filter is located behind glove box. Remove glove box.
2. Remove filter cover (7). See **Fig. 1**
3. Remove cabin air filter (6) See **Fig. 1**

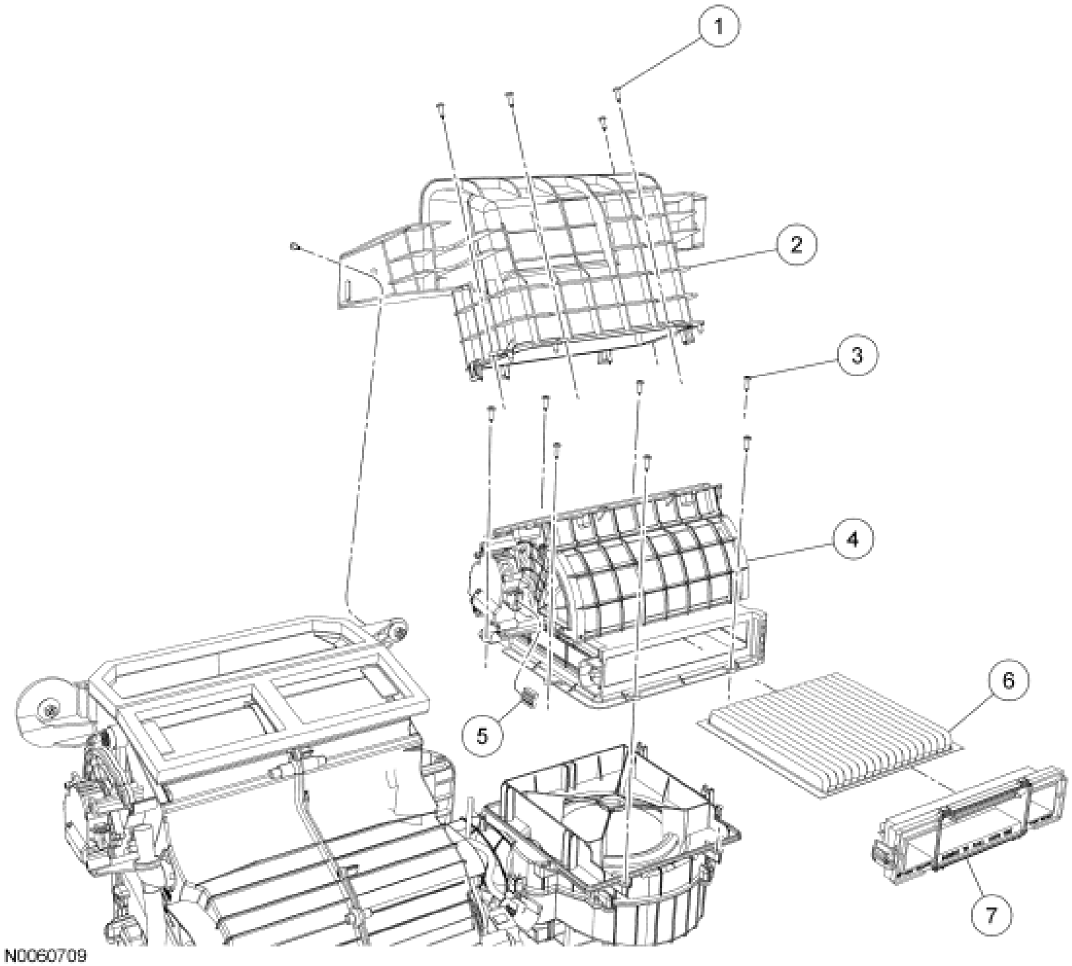


Fig. 1: Exploded View Of Air Inlet Duct
Courtesy of FORD MOTOR CO.

2008 GENERAL INFORMATION

Charging System - General Information - Edge & MKX

SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Generator	
Rating	78/143 amp (max) @ 620-2,500 engine RPM @ normal engine temperature
Voltage	12 volt

DESCRIPTION AND OPERATION

CHARGING SYSTEM

The charging system consists of the following:

- Generator
- Charging system warning indicator
- Necessary wiring and cables

The charging system is a negative ground system. The generator (including an internal voltage regulator) is belt-driven by the engine accessory drive system. When the engine is started, the generator begins to generate AC, which is internally converted to DC. This current is then supplied to the vehicle electrical system through the output (B+) terminal of the generator.

Battery

The battery is a 12V DC source connected in a negative ground system. The battery case is sealed with 2 vent holes to release gases. The battery has 3 major functions:

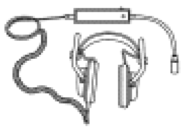
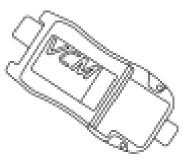
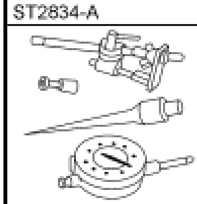
- Engine cranking power source
- Voltage stabilizer for the electrical system
- Temporary power source when electrical loads exceed the generator output current

DIAGNOSTIC TESTS

CHARGING SYSTEM

Special Tools

Illustration	Tool Name	Tool Number

 ST2311-A	73III Automotive Meter	105-R0057 or equivalent
 ST2312-A	Flex Probe Kit	105-R025B
 ST2834-A	SABRE Premium Battery and Electrical System Tester	010-00736 or equivalent
 ST1214-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Principles of Operation

The PCM controlled charging system determines the optimal voltage setpoint for the charging system and communicates this information to the voltage regulator. This system is unique in that it has 2 communication lines between the PCM and the generator/regulator. Both of these communication lines are pulse-width modulated (PWM). The generator communication (GENCOM) line communicates the desired setpoint from the PCM to the voltage regulator. The generator monitor (GENMON) line communicates the generator load and error conditions to the PCM. The third pin on the voltage regulator, the A circuit pin, is a dedicated battery voltage sense line.

The generator charges the battery and at the same time supplies power for all of the electrical loads that are required. The battery is more effectively charged with a higher voltage when the battery is cold and a lower voltage when the battery is warm. The PCM is able to adjust the charging voltage according to the battery temperature by using a signal from the intake air temperature (IAT) sensor. This means the voltage setpoint is calculated by the PCM and communicated to the regulator by the GENCOM circuit.

The PCM simultaneously controls and monitors the output of the generator. When the current consumption is high or the battery is discharged the PCM raises engine speed to increase generator output.

To minimize the engine drag when starting the engine, the PCM does not allow the generator to produce any output until the engine has started. The PCM turns off the generator during cranking to reduce the starter load and improve cranking speed. Once the engine starts, the PCM slowly increases generator output to help establish a stable engine speed.

The PCM controls the charging system warning indicator by sending a message over the high-speed controller area network (HS-CAN) to the instrument cluster (IC). The PCM turns the charging system warning indicator off when generator output begins. The charging system warning indicator is also illuminated by the PCM whenever the key is ON with the engine OFF.

This is a System 4 charging system, which uses the GENMON and GENCOM lines to control and monitor the charging system through the PCM. System 4 charging systems are virtually identical in design and therefore, share the same diagnostics. The circuit numbers and colors may be different, but the functions are the same.

Inspection and Verification

WARNING: **Batteries contain sulfuric acid and produce explosive gases. Work in a well-ventilated area. Do not allow the battery to come in contact with flames, sparks or burning substances. Avoid contact with skin, eyes or clothing. Shield eyes when working near the battery to protect against possible splashing of acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes, then get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always lift a plastic-cased battery with a battery carrier or with hands on opposite corners. Excessive pressure on the battery end walls may cause acid to flow through the vent caps, resulting in personal injury and/or damage to the vehicle or battery.**

CAUTION: Do not make jumper connections except as directed. Incorrect connections may damage the voltage regulator test terminals, fuses or fusible links.

CAUTION: Do not allow any metal object to come in contact with the generator housing and internal diode cooling fins. A short circuit may result and burn out the diodes.

NOTE: While carrying out any pinpoint test, disregard any DTCs set while following a specific pinpoint test. After the completion of a test, be sure to clear all DTCs in the PCM.

NOTE: All voltage measurements are referenced to the negative (-) battery post unless otherwise specified.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Battery • Generator drive belt • Generator pulley	• Battery junction box (BJB) fuse 8 (10A) • Circuitry • Fusible links • Cables • Generator • PCM • Charging system warning indicator

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. Verify the battery condition. Refer to **BATTERY, MOUNTING & CABLES** article.
5. Check the operation of the charging system warning indicator at the instrument cluster (IC). Normal operation is as follows:
   - With the key OFF, the charging system warning indicator should be off.
   - With the key ON and the engine OFF, the charging system warning indicator should be on.
   - With the engine running, the charging system warning indicator should be off.
6. Turn off the headlamps and the A/C system (if equipped). Turn the climate control blower to low/off. Check the battery voltage before and after starting the engine to determine if the battery voltage increases.

NOTE: Make sure to use the latest scan tool software release.

7. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

8. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
9. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
10. Carry out the network test.

- If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
- If the network test passes, retrieve and record continuous memory DTCs.

11. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM and the IC.
12. If the DTCs retrieved are related to the concern, go to the **DTC CHART** . For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
13. If no DTCs related to the concern are retrieved, go to **SYMPTOM CHART**.

NOTE: **DTC P0622 can be set by the loss of the communication lines between the generator and the PCM. The charging system warning indicator then illuminates until the engine is operated at greater than 4,500 RPM (approximately wide open throttle [WOT]) for a minimum of 3 seconds. At this time, the generator self-excites. The charging system warning indicator remains illuminated, and the generator operates in a default mode (approximately 13.5 volts) until the engine is turned off.**

DTC CHART

DTCs	Description	Source	Action
B1317	Battery Voltage High	Various Modules	Go to **Pinpoint Test B** .
B1318	Battery Voltage Low	Various Modules	Go to **Pinpoint Test F** .
B1676	Battery Voltage Out of Range	Various Modules	Go to **Pinpoint Test F** .
P0563	System Voltage High	PCM	Go to **Pinpoint Test B** .
P0620	Generator Control Circuit	PCM	Go to **Pinpoint Test B** .
P0622	Generator Field Term Circuit	PCM	Go to **Pinpoint Test B** .
P0625	Generator Field Terminal Circuit - Low	PCM	Go to **Pinpoint Test B** .
P0626	Generator Field Terminal Circuit - High	PCM	Go to **Pinpoint Test B** .
P065B	Generator Control Circuit Range/ Performance	PCM	Go to **Pinpoint Test B** .
All other DTCs	-	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The battery is discharged	• High key-off current drain(s) • Engine, generator and battery grounds	• Go to **Pinpoint Test**

or battery voltage is low	• Positive battery cable • Circuitry • Battery • Generator	**A** .
• The charging system warning indicator is on with the engine running and no charging system DTCs present	• Circuitry • PCM • Generator • Instrument cluster (IC)	• Go to **Pinpoint Test C** .
• The generator is noisy	• Accessory drive belt • Loose bolts/brackets • Generator/pulley	• Go to **Pinpoint Test D** .
• Radio interference	• Generator • Circuitry • In-vehicle entertainment system	• Go to **Pinpoint Test E** .

Pinpoint Tests

CAUTION: Electronic modules are sensitive to electrostatic discharge. If exposed to these charges, damage can result.

Refer to **INSPECTION AND VERIFICATION** , the **DTC CHART** and the **SYMPTOM CHART** for direction to the appropriate pinpoint test.

Pinpoint Test A: The Battery is Discharged or Battery Voltage is Low

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Charging System for schematic and connector information.

Normal Operation

The generator output voltage is supplied through the positive battery output (B+), circuit SDC14 (RD) terminal on the rear of the generator to the battery and electrical system. During normal operation the charging system warning indicator is off with the key ON engine running (KOER). The charging system warning indicator is on with the key ON engine OFF (KOEO).

This pinpoint test is intended to diagnose the following:

- High key-off current drain(s)
- Engine, generator and battery grounds
- Positive battery cable
- Circuitry

- Battery
- Generator

PINPOINT TEST A: THE BATTERY IS DISCHARGED OR BATTERY VOLTAGE IS LOW

A1 CHECK THE BATTERY CONDITION

- Carry out the Battery - Condition Test to determine if the battery can hold a charge and is OK for use. Refer to **BATTERY, MOUNTING & CABLES** article.
- **Does the battery pass the condition test?**

YES : Go to A2.

NO : INSTALL a new battery. REFER to **BATTERY, MOUNTING & CABLES** article. TEST the system for normal operation.

A2 CHECK THE GENERATOR OUTPUT

- Carry out the Generator On-Vehicle Load Test and No Load Test. Refer to the Component Tests in this service information.
- **Does the generator pass the component tests?**

YES : Go to A3.

NO : Go to **Pinpoint Test B** .

A3 CHECK FOR CURRENT DRAINS

- Carry out the Battery - Drain Testing. Refer to the Component Tests in this service information.
- **Are any circuits causing excessive current drains?**

YES : REPAIR as necessary. TEST the system for normal operation.

NO : Go to A4.

A4 CHECK THE VEHICLE GROUNDS

- Key in START position.

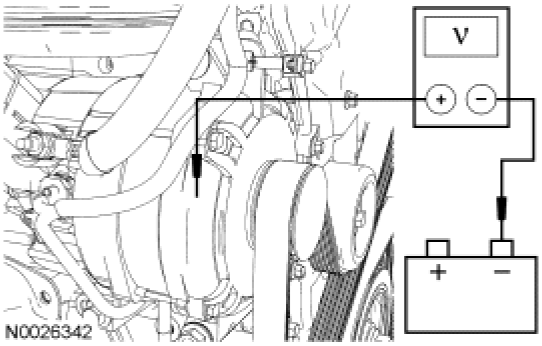


Fig. 1: Checking Vehicle Grounds
Courtesy of FORD MOTOR CO.

- With the engine running, measure the voltage drop between the generator housing and the negative battery terminal.
- **Is the voltage drop less than 0.1 volt?**

YES : Go to A5.

NO : CHECK the engine ground, generator ground and the battery ground for corrosion. TEST the system for normal operation.

A5 CHECK THE VOLTAGE DROP IN THE B+ CIRCUIT SDC14 (RD)

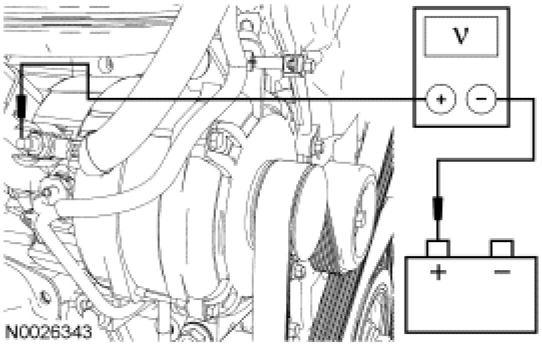


Fig. 2: Checking Voltage Drop
Courtesy of FORD MOTOR CO.

- With the engine running, measure the voltage drop between generator B+ C102b circuit SDC14 (RD) and the positive battery terminal.
- **Is the voltage drop less than 0.5 volt?**

  YES : CHECK if the customer left any electrical system(s) on or if there is an intermittent excessive battery draw. TEST the system for normal operation.

  NO : CHECK for any corrosion in the B+ SDC14 (RD), positive battery cable and/or connections. REPAIR as necessary. TEST the system for normal operation.

Pinpoint Test B: DTCs B1317, P0563, P0620, P0625, P0626 and P065B - Charging System Failure

Refer to appropriate WIRING DIAGRAMS ARTICLE, Charging System for schematic and connector information.

Normal Operation

With the engine running, the charging system warning indicator is off. The A sense circuit SBB08 (VT/RD) to the generator field coil is 13-15 volts. This voltage feedback is used by the regulator to maintain the battery voltage at the desired setpoint. The S (stator) circuit (internal to the generator) is used to monitor generator operation. This circuit and other regulator internal conditions are checked by the regulator to allow the PCM to turn off the charging system warning indicator by sending a message over the controller area network (CAN) bus to the instrument cluster (IC). The positive battery output (B+) circuit SDC14 (RD) is the generator output voltage supplied to the battery and electrical system.

This pinpoint test is intended to diagnose the following:

- Generator
- IC

- PCM

DTC Description	Fault Trigger Conditions
• B1317 - Battery Voltage High • P0563 - System Voltage High • P0620 - Generator Control Circuit • P0625 - Generator Field Circuit - Low • P0626 - Generator Field Circuit - High • P065B - Generator Control Circuit Range	Open, short to ground or battery. Charging system voltage is below 13 volts or above 16 volts and charging system lamp is illuminated.

PINPOINT TEST B: DTCs B1317, P0563, P0620, P0625, P0626 AND P065B - CHARGING SYSTEM FAILURE

NOTE: Make sure battery voltage is greater than 12.2 volts prior to carrying out this pinpoint test.

NOTE: Do not have a battery charger attached during vehicle testing.

B1 CONFIRM THE BATTERY CONDITION

- Carry out the Battery Condition Test. Refer to **BATTERY, MOUNTING & CABLES** article.
- **Is the battery OK?**

  YES : Go to B2.

  NO : CORRECT the battery condition and Go to B2.

B2 CHECK THE BATTERY JUNCTION BOX (BJB) FUSE 8 (10A)

- Check fuse: BJB 8 (10A)
- **Is BJB 8 (10A) OK?**

  YES : Go to B3.

  NO : REPAIR circuit SBB08 (VT/RD) and INSTALL a fuse. INSPECT PCM and engine ground circuits and make sure they are securely attached. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B3 CHECK THE GENERATOR B+ CONNECTION

- Key in OFF position.
- Inspect generator C102b circuit SDC14 (RD) connection. Connection should be tight.

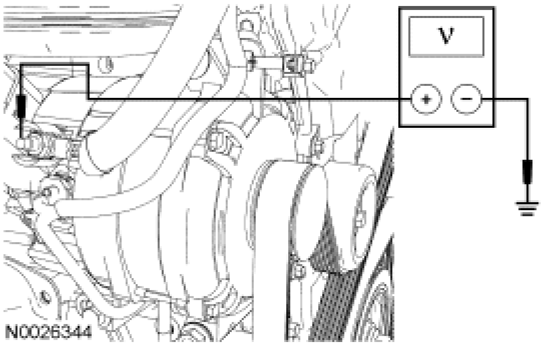


Fig. 3: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between generator C102b circuit SDC14 (RD) and ground.
- **Is generator C102b connection tight and does the generator B+ measure battery voltage?**

  YES : Go to B4.

  NO : TIGHTEN the generator B+ connection or REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B4 MONITOR THE PCM PIDs WITH KEY ON/ENGINE OFF (KOEO)

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Clear the PCM DTCs
- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger

  NOTE: Many of the PCM PIDs selected will be monitored later in this pinpoint test.

  Select and monitor the following PCM PIDs:

  - Generator Monitor (GENMON).
  - Generator Command Duty Cycle (GENCMD).
  - Generator Voltage Desired (GENVDSD).
  - Generator Fault Indicator Lamp (GENFIL).
  - Engine Revolutions Per Minute (RPM).
  - Module Supply Voltage (VPWR).
- Monitor the GENMON PID.
- **Does the PID read 0%?**

  YES : Go to B5.

  NO : Go to B8.

B5 MONITOR THE PCM PID GENMON WITH KEY ON/ENGINE RUNNING (KOER)

- Key in START position.
- With the engine at idle, wait 15 seconds for the GENVDSD PID to increase to greater than 13 volts.

- Monitor PID GENMON at idle and 3,000 RPM.
- **Does the GENMON PID read between 3% and 98% at engine idle speed and at 3,000 RPM?**

  YES : Go to B6.

  NO : Go to B8.

B6 MONITOR THE PCM PIDs GENMON, VPWR AND GENVDSD WITH THE ENGINE AT 3,000 RPM

- Turn all electrical accessories (lights, blower motor, etc.) off.

NOTE: If GENMON PID does not remain below 85%, make sure that the battery is at an acceptable state of charge and that all electrical accessories are off.

- Increase the engine speed to 3,000 RPM (or road test).
- **Does the VPWR PID remain within ± 0.5 volt of the GENVDSD PID when the GENMON PID is less than 85%?**

  YES : Go to B7.

  NO : Go to B17.

B7 MONITOR THE PCM PIDs GENMON, VPWR AND GENVDSD WITH THE ENGINE AT IDLE

- Return the engine speed to idle.

CAUTION: On vehicles with low electrical loads, it may be necessary to add external loads (devices connected to power points, etc.) to determine the maximum GENMON value. GENMON value will not read between 95%-98% on a vehicle with minimal electrical accessories. As long as there is a significant increase in the GENMON PID following the procedure below, answer YES to the question.

- Determine the maximum GENMON PID value by lowering engine idle RPM to 500 RPM or less using output state control (manual transaxle vehicles require the parking brake applied and the clutch pedal depressed) and turn on all electrical accessories until the VPWR PID is less than the GENVDSD PID by at least 0.7 volt. Under this condition the GENMON PID should read between 95% and 98%.
- **Does the GENMON PID read between 95% and 98%?**

  YES : Go to B19.

  NO : Go to B17.

B8 CHECK THE VOLTAGE OUTPUTS FROM THE PCM

- Key in OFF position.
- Disconnect: Generator C102a
- Key in ON position.

- Measure the voltage of the following circuits:

EXPECTED VOLTAGES

Generator Connector	Circuit	Expected Voltage (Approximate)
C102a-1	CDC15 (VT)	8-11 volts (should be less than battery voltage)
C102a-2	CDC10 (BU/OG)	0 volts
C102a-3	SBB08 (VT/RD)	Battery voltage

- **Are the voltages as indicated for each circuit?**

  YES : Go to B13.

  NO : If a fault is detected in the GENCOM circuit CDC10 (BU/OG) or GENMON circuit CDC15 (VT), go to B9.

  If a fault is detected in the A sense circuit SBB08 (VT/RD) circuit, go to B12.

B9 CHECK CIRCUITS CDC10 (BU/OG) AND CDC15 (VT) FOR DAMAGE OR AN OPEN

- Key in OFF position.
- Disconnect: Generator C102a
- Disconnect: PCM C175b
- Inspect the following for damaged or pushed-out pins:

Component	Connector	Circuit
PCM	C175b-22	CDC10 (BU/OG)
PCM	C175b-23	CDC15 (VT)
Generator	C102a-2	CDC10 (BU/OG)
Generator	C102a-1	CDC15 (VT)

- Measure the resistance between PCM C175b-22, circuit CDC10 (BU/OG) harness side and generator C102a-2, circuit CDC10 (BU/OG) harness side and PCM C175b-23, circuit CDC15 (VT) harness side and generator C102a-1, circuit CDC15 (VT) harness side.
- **Are the connectors and pins free of damage and are the resistances less than 5 ohms?**

  YES : Go to B10.

NO : REPAIR the affected circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B10 CHECK CIRCUITS CDC10 (BU/OG) AND CDC15 (VT) FOR SHORT TO VOLTAGE

- Key in ON position.
- Measure the voltage between generator C102a-1, circuit CDC15 (VT) harness side and ground and generator C102a-2, circuit CDC10 (BU/OG) harness side and ground.
- **Are the voltages approximately 0 volt?**

  YES : Go to B11.

  NO : REPAIR the affected circuits. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B11 CHECK CIRCUITS CDC10 (BU/OG) AND CDC15 (VT) FOR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between generator C102a-1, circuit CDC15 (VT) harness side and ground and generator C102a-2, CDC10 (BU/OG) harness side and ground and measure resistance between generator C102a-1, circuit CDC15 (VT) harness side and generator C102a-2, circuit CDC10 (BU/OG) harness side.
- **Are the resistances less than 5 ohms?**

  YES : REPAIR the affected circuits. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : Go to B24.

B12 CHECK CIRCUIT SBB08 (VT/RD) FOR DAMAGE OR AN OPEN

- Key in OFF position.
- Disconnect: Generator C102a
- Inspect C102a-3 for damaged or pushed-out pins.
- Measure the resistance of the A sense circuit SBB08 (VT/RD) between the battery and C102a-3 generator connector.
- **Are the connectors and pins free of damage and are the resistances less than 5 ohms?**

  YES : Go to B24.

  NO : REPAIR the affected circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B13 CHECK FOR SHORTED CIRCUITS

- Key in OFF position.
- Disconnect: Generator C102a
- Connect: PCM C175b
- Key in ON position.
- Verify that PID GENMON reads 100%.
- Carry out the Wiggle Test of wiring to determine if PID GENMON changes from 100%.
- **Does PID GENMON change from 100%?**

  YES : REPAIR short circuit on CDC15 (VT) C102a-1.

NO : Go to B14.

B14 CHECK THE PCM PID GENMON INPUT TO THE PCM

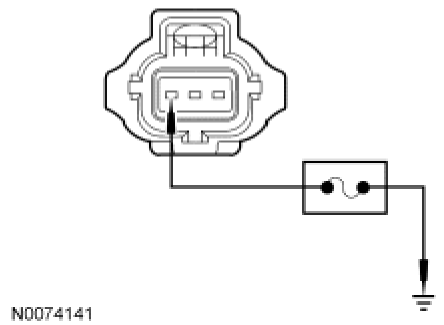


Fig. 4: Connecting Fused Jumper Wire
Courtesy of FORD MOTOR CO.

- Connect a fused (10A) jumper wire between generator C102a-1, circuit CDC15 (VT), harness side and ground.
- Key in ON position.
- Monitor the GENMON PID while performing a wiggle test on the wire harness.
- **Does the PID read 0%?**

  YES : Go to B15.

  NO : REPAIR open connection on circuit CDC15 (VT). INSPECT generator C102a-1 and PCM C175e-16 for damage. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B15 COMPARE THE PCM PIDS GENMON AND GENCMD

- Key in OFF position.
- Disconnect: Fused (10A) Jumper Wire

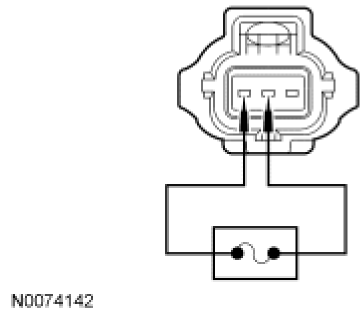


Fig. 5: Connecting Fused Jumper Wire
Courtesy of FORD MOTOR CO.

- Connect a fused (10A) jumper wire between generator C102a-1, circuit CDC15 (VT), harness side and generator C102a-2, circuit CDC10 (BU/OG), harness side.

- Key in ON position.
- Monitor the GENMON and GENCMD PIDs while performing a wiggle test on the harness.
- **Does the GENMON PID read within 2% of the GENCMD PID?**

  YES : Go to B16.

  NO : INSPECT C175b-66, circuit GD124 (BK/VT), PCM ground circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B16 A SENSE CIRCUIT LOAD TEST

NOTE: **This step puts a load on the A sense circuit. If there are corroded or loose connections, loading the circuit may help show the fault.**

- Key in ON position.
- Using a 12-volt test lamp, check for voltage at C102a-3, circuit SBB08 (VT/RD).
- **Does the test lamp illuminate?**

  YES : Go to B23.

  NO : REPAIR connection on circuit SBB08 (VT/RD). INSPECT generator C102a-3 for damage. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B17 CHECK THE PCM VPWR PID

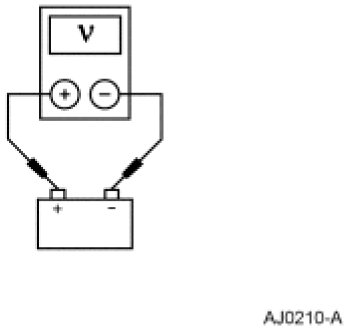


Fig. 6: Checking Charging System Voltage
Courtesy of FORD MOTOR CO.

- With the engine running, measure the battery voltage.
- Monitor the VPWR PID.
- **Are the battery voltage and PID within 0.5 volt of each other?**

  YES : Go to B19.

  NO : Go to B18.

B18 MEASURE THE PCM INPUT VOLTAGE

- Key in OFF position.
- Disconnect: PCM C175b
- Connect a fused (10A) jumper wire between C175b-8 and ground.

- Key in ON position.

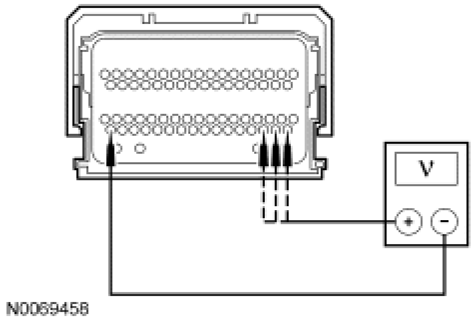


Fig. 7: Checking Circuits For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between PCM input voltage pins 51, 52 and 53 to PCM ground pin 66.
- **Are voltages within 0.5 volt of PID VPWR?**

YES : Go to B24.

NO : REPAIR high resistance or loose connections between C175b-51 circuit CBB30 (YE/BU), C175b-52 circuit CBB30 (YE/BU), C175b-53 circuit CBB30 (YE/BU) PCM power circuits or C175b-10, circuit GD122 (BK), PCM ground circuit.

B19 CHECK THE GENERATOR B+ RESISTANCE

- Key in OFF position.
- Disconnect: Battery
- Disconnect: Generator C102b

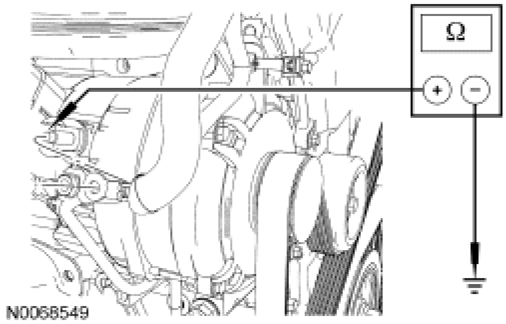


Fig. 8: Checking Circuit For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between generator C102b, component side and the generator housing.
- **Is the resistance greater than 125K ohms?**

YES : Go to B20.

NO : INSTALL a new generator. REFER to **GENERATOR & REGULATOR** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B20 CHECK THE RESISTANCE OF THE VOLTAGE REGULATOR INTERNAL CIRCUITS TO GROUND

- Measure the resistance between generator C102a, component side and ground. Refer to the following table.

Pin	Expected Resistance
1	Greater than 1,000K ohms
2	Greater than 125K ohms
3	Greater than 125K ohms

- **Are the resistance values as indicated?**

  YES : Go to B21.

  NO : INSTALL a new generator. REFER to **GENERATOR & REGULATOR** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B21 ROAD TEST IN AN ATTEMPT TO VERIFY THE FAULT

- Connect: Generator C102b
- Connect: Generator C102a
- Connect: Battery
- Carry out a road test and monitor the following PIDs:
  - Generator monitor (GENMON).
  - Generator voltage desired (GENVDSD).
  - Module supply voltage (VPWR).
- **Does the GENMON PID read either 0% or 100% during the road test?**

  YES : Go to B2.

  NO : If a road test did not cause the fault to occur, intermittent fault condition may be present. Go to B22.

B22 USE THE VEHICLE DATA RECORDER (VDR) TO CAPTURE INTERMITTENT FAULT CONDITION

- Connect a VDR to the vehicle and setup to capture the following PIDs:
  - Generator monitor (GENMON).
  - Generator command duty cycle (GENCMD).
  - Generator voltage desired (GENVDSD).
  - Generator fault indicator lamp (GENFIL).

- Engine revolutions per minute (RPM).
- Module supply voltage (VPWR).
- Set the VDR to trigger if any of the following events occur during vehicle operation (waiting 15 seconds after start):
  - VPWR PID reads greater than 15.2 volts.
  - GENMON PID reads 0% or 100%.
- Road test the vehicle.
- **Was a fault captured by the VDR?**

  YES : RECORD any values from the VDR that may have been captured. If no charging system DTCs are present, go to **Pinpoint Test C** . If any charging system DTCs are present, go to B3.

  NO : No problem found at this time. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B23 CHECK THE CHARGING SYSTEM CIRCUITS FOR INTERMITTENT FAULTS

- Key in OFF position.
- Connect: Generator C102b
- Connect: Generator C102a
- Connect: PCM C175b
- Connect the diagnostic tool.
- Key in START position.
- With the engine running, monitor the charging system warning indicator lamp and the scan tool for DTCs.
- **Does the charging system warning indicator lamp illuminate and does any charging system DTC get stored into memory?**

  YES : INSTALL a new generator. REFER to **GENERATOR & REGULATOR** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : The fault is not present and cannot be recreated at this time. This may indicate an intermittent fault. Go to B19.

B24 CHECK THE CHARGING SYSTEM CIRCUITS FOR INTERMITTENT FAULTS

- Key in OFF position.
- Connect: Generator C102b
- Connect: Generator C102a
- Connect: PCM C175b
- Connect the diagnostic tool.
- Key in START position.
- With the engine running, monitor the charging system warning indicator lamp and the scan tool for DTCs.
- **Does the charging system warning indicator lamp illuminate and does any charging system DTC get stored into memory?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article.

NO : The fault is not present and cannot be recreated at this time. This may indicate an intermittent fault. Go to B19.

Pinpoint Test C: The Charging System Warning Indicator is On With the Engine Running and No Charging System DTCs Present

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Charging System for schematic and connector information.

Normal Operation

With the engine running, the charging system warning indicator is off. The A sense circuit SBB08 (VT/RD) from the battery B+ to the generator regulator is 13-15 volts. This voltage feedback is used by the regulator to maintain the battery voltage at the desired setpoint. The S (stator) circuit (internal to the generator) is used to monitor generator operation. This circuit and other regulator internal conditions are checked by the regulator to allow the PCM to turn off the charging system warning indicator by sending a message over the controller area network (CAN) bus to the instrument cluster (IC). The positive battery output (B+) circuit SDC14 (RD) is the generator output supplied to the battery and electrical system.

This pinpoint test is intended to diagnose the following:

- Generator
- Circuitry
- IC
- PCM

PINPOINT TEST C: THE CHARGING SYSTEM WARNING INDICATOR IS ON WITH THE ENGINE RUNNING AND NO CHARGING SYSTEM DTCs PRESENT

NOTE:	**Make sure battery voltage is greater than 12.2 volts prior to carrying out this pinpoint test.**

NOTE:	**Do not have a battery charger attached during vehicle testing.**

C1 CHECK THE BATTERY CONDITION

- Carry out the Battery - Condition Test to determine if the battery can hold a charge and is OK for use. Refer to **BATTERY, MOUNTING & CABLES** article.
- **Does the battery pass the condition test?**

  YES : Go to C2.

  NO : INSTALL a new battery. REFER to **BATTERY, MOUNTING & CABLES** article. TEST the system for normal operation.

C2 CHECK THE GENERATOR B+ CONNECTION

- Key in OFF position.

- Inspect generator C102b circuit SDC14 (RD) connection. Connection should be tight.

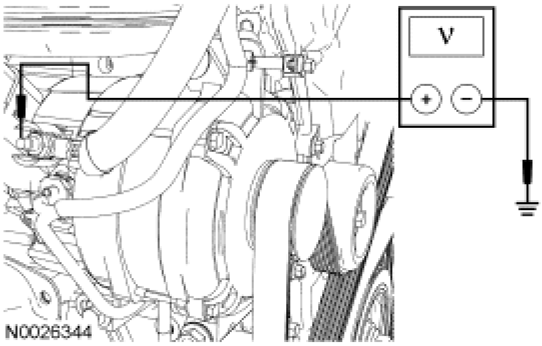


Fig. 9: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between generator C102b circuit SDC14 (RD) and ground.
- **Is generator C102b connection tight and does the generator B+ measure battery voltage?**

  YES : Go to C3.

  NO : TIGHTEN the generator B+ connection or REPAIR the circuit. CLEAR the any DTCs. REPEAT the self-test. TEST the system for normal operation.

C3 CHECK THE VOLTAGE DROP IN THE B+ CIRCUIT SDC14 (RD)

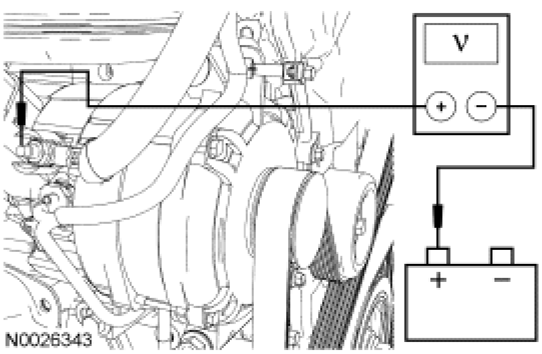


Fig. 10: Checking Voltage Drop
Courtesy of FORD MOTOR CO.

- With the engine running, measure the voltage drop between generator B+ C102b circuit SDC14 (RD) and the positive battery terminal.
- **Is the voltage drop less than 0.5 volt?**

  YES : Go to C4.

  NO : CHECK for any corrosion in the B+ C102b circuit SDC14 (RD), positive battery cable and/or connections. REPAIR as necessary. TEST the system for normal operation.

C4 CHECK THE DTCs IN THE PCM

- Key in OFF position.
- Connect the diagnostic tool.
- Key in START position.

- Enter the following diagnostic mode on the diagnostic tool: Retrieve PCM DTCs
- Use the recorded PCM DTCs from the continuous and on-demand self tests.
- **Are any PCM DTCs recorded?**

  YES : For all DTCs EXCEPT charging system DTCs, REFER to the **INTRODUCTION - GASOLINE ENGINES** article. If any charging system DTCs are present, go to **Pinpoint Test B** . If referred here by the PC/ED, go to C5.

  NO : Go to C5.

C5 MONITOR PID GENFIL

- With the engine running, monitor PID GENFIL.
- **Does PID GENFIL show fault?**

  YES : Go to C6.

  NO : REPAIR/INSTALL a new IC, IC-to-PCM connection or the PCM. TEST the system for normal operation.

C6 MONITOR PID VPWR

- With the engine running, monitor PIDS VPWR, GENFIL, GENVDSD.
- **Is PID VPWR greater than 15.6 volts?**

  YES : Go to C7.

  NO : Go to C8.

C7 CHECK PCM VPWR PID

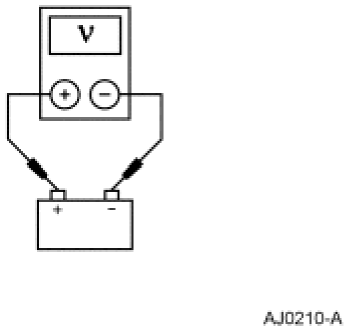


Fig. 11: Checking Charging System Voltage
Courtesy of FORD MOTOR CO.

- With the engine running, measure the battery voltage.
- Monitor the VPWR PID.
- **Are the battery voltage and VPWR PID within 0.6 volt of each other?**

  YES : Go to C8.

  NO : Go to C9.

C8 MEASURE THE PCM INPUT VOLTAGE

- Key in OFF position.
- Disconnect: PCM C175b

- Connect a fused (10A) jumper wire between C175b-8 and ground.
- Key in ON position.

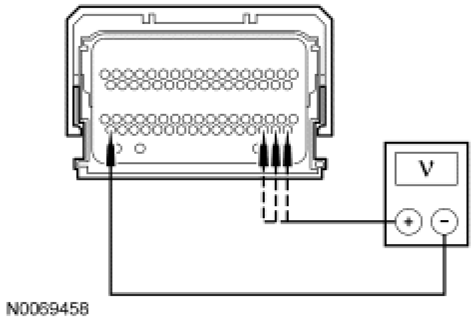


Fig. 12: Checking Circuits For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between PCM input voltage pins 51, 52 and 53 to PCM ground pin 66.
- **Are voltages within 0.5 volt of PID VPWR?**

  YES : INSTALL a new PCM.

  NO : REPAIR high resistance or loose connections between C175b-51 circuit CBB30 (YE/BU), C175b-52 circuit CBB30 (YE/BU), C175b-53 circuit CBB30 (YE/BU) PCM power circuits or C175b-10, circuit GD122 (BK), PCM ground circuit.

C9 MONITOR THE PCM PID GENERATOR MONITOR WITH KEY ON/ENGINE RUNNING

- Key in START position.
- With the engine at idle, wait 15 seconds for the GENVDSD PID to increase to greater than 13 volts.
- Monitor PID GENMON at idle and 3,000 RPM.
- **Does the GENMON PID read between 3% and 98% at engine idle speed and at 3,000 RPM?**

  YES : Go to C10.

  NO : Go to C11.

C10 MONITOR PID GENVDSD

- With the engine running, monitor PID GENVDSD.
- **Is PID GENVDSD greater than 15.2 volts?**

  YES : REPAIR connection on circuit SBB08 (VT/RD). INSPECT generator C102a-3 for damage. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. If no problems are found, INSTALL a new generator. REFER to **GENERATOR & REGULATOR** article. TEST the system for normal operation.

  NO : INSTALL a new PCM.

C11 CHECK FOR SHORTED CIRCUITS

- Key in OFF position.
- Disconnect: Generator C102a
- Verify that PID GENMON reads 100%.

- Carry out the Wiggle Test of wiring to determine if PID GENMON changes from 100%.
- **Does PID GENMON change from 100%?**

  YES : REPAIR short circuit on C102a-1 CDC15 (VT).

  NO : Go to C12.

C12 CHECK THE PCM PID GENERATOR MONITOR INPUT TO THE PCM

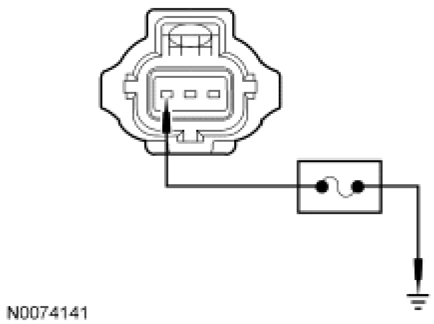


Fig. 13: Connecting Fused Jumper Wire
Courtesy of FORD MOTOR CO.

- Connect a fused (10A) jumper wire between generator C102a-1, circuit CDC15 (VT), harness side and ground.
- Key in ON position.
- Monitor the GENMON PID while carrying out a Wiggle Test on the wire harness.
- **Does the GENMON PID read 0%?**

  YES : REPAIR open connection on circuit CDC15 (VT) C102a-1 and PCM C175b-23. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : INSTALL a new generator. REFER to **GENERATOR & REGULATOR** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test D: The Generator is Noisy

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Charging System for schematic and connector information.

Normal Operation

The generator is belt-driven by the engine accessory drive system.

This pinpoint test is intended to diagnose the following:

- Accessory drive belt
- Loose bolts/brackets
- Generator/pulley

PINPOINT TEST D: THE GENERATOR IS NOISY

D1 CHECK FOR ACCESSORY DRIVE BELT NOISE AND LOOSE MOUNTING BRACKETS

- Key in OFF position.
- Check the accessory drive belt for damage and correct installation. Refer to **ACCESSORY DRIVE** article.
- Check the accessory mounting brackets and generator pulley for looseness or misalignment.
- **Is the accessory drive OK?**

  YES : Go to D2.

  NO : REPAIR as necessary. REFER to **ACCESSORY DRIVE** article for diagnosis and testing of the accessory drive system. TEST the system for normal operation.

D2 CHECK THE GENERATOR MOUNTING

- Check the generator mounting for loose bolts or misalignment.
- **Is the generator mounted correctly?**

  YES : Go to D3.

  NO : REPAIR as necessary. TEST the system for normal operation.

D3 CHECK THE GENERATOR FOR ELECTRICAL NOISE

- Disconnect: Generator C102b
- Key in START position.
- With the engine running, use a stethoscope or equivalent listening device to probe the generator.
- **Is the noise still present?**

  YES : Go to D4.

  NO : INSTALL a new generator. REFER to **GENERATOR & REGULATOR** article. TEST the system for normal operation.

D4 CHECK THE GENERATOR FOR MECHANICAL NOISE

- With the engine running, use a stethoscope or equivalent listening device to probe the generator and the accessory drive area for unusual mechanical noise.
- **Is the generator the noise source?**

  YES : INSTALL a new generator. REFER to **GENERATOR & REGULATOR** article. TEST the system for normal operation.

  NO : REFER to **ENGINE SYSTEM - GENERAL INFORMATION** article to diagnose the source of the engine noise.

Pinpoint Test E: Radio Interference

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Charging System for schematic and connector information.

Normal Operation

The generator radio suppression equipment reduces interference transmitted through the speakers by the vehicle electrical system.

This pinpoint test is intended to diagnose the following:

- Generator
- Circuitry
- In-vehicle entertainment system

PINPOINT TEST E: RADIO INTERFERENCE

E1 VERIFY THE GENERATOR IS THE SOURCE OF THE RADIO INTERFERENCE

NOTE: **If the OEM audio unit has been replaced with an aftermarket unit, the vehicle may not pass this test. Return the vehicle to OEM condition before following this pinpoint test.**

- Key in START position.
- Start and run the engine.
- Tune the audio unit to a station where the interference is present.
- Key in OFF position.
- Disconnect: Generator C102b
- Key in START position.
- With the engine running, determine if the interference is still present.
- **Is the interference present with the generator disconnected?**

  YES : REFER to **INFORMATION & ENTERTAINMENT SYSTEMS** article for diagnosis and testing of the in-vehicle entertainment system.

  NO : INSTALL a new generator. REFER to **GENERATOR & REGULATOR** article. TEST the system for normal operation.

Pinpoint Test F: DTC B1318 or B1676 - Battery Voltage Low or Battery Voltage Out of Range

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Charging System for schematic and connector information.

Normal Operation

Various control modules within the vehicle operate at a voltage between 10-17 volts. Voltage to these modules is supplied through the vehicle harness to the module(s). Ground for the modules is provided by the modules ground circuit(s). If voltages to these modules rise above 17 volts, DTC B1317 or B1676 may set or if voltage drops below 10 volts, DTC B1318 or B1676 may set.

- DTC B1318 Battery Voltage Out Of Range - If charging system voltage falls below a certain voltage, some modules within the vehicle may set this DTC. Some modules have a different voltage minimum set point to set this DTC.

- DTC B1676 Battery Voltage High - If charging system voltage falls below or above a certain voltage, some modules within the vehicle may set this DTC. Some modules have a different voltage minimum or maximum set point to set this DTC.

This pinpoint test is intended to diagnose the following:

- Battery
- Charging system
- Module voltage supply
- Module ground

NOTE: DTC B1317 or B1318 can be set if the vehicle has had a discharged battery, has been recently jump started or has had the vehicle battery charged.

PINPOINT TEST F: DTC B1318 OR B1676 - BATTERY VOLTAGE LOW OR BATTERY VOLTAGE OUT OF RANGE

F1 CHECK FOR DTCs

- Key in OFF position.
- Connect the diagnostic tool.
- Enter the following diagnostic mode on the diagnostic tool: Retrieve all continuous DTCs
- **Is DTC B1318 or B1676 present in only one module?**

  YES : If DTC B1317 or B1676 are recorded in only one module, go to F2.

  NO : If DTC B1318 or B1676 are recorded in more than one module, go to **Pinpoint Test B** .

F2 CHECK THE BATTERY VOLTAGE

- Measure the battery voltage between the positive and negative battery posts with the key ON engine OFF (KOEO), and with the engine running, all accessory loads OFF.
- **Is the battery voltage between 10 and 13 volts with KOEO, and between 11 and 17 volts with the engine running?**

  YES : Go to F3.

  NO : CHECK and/or REPAIR the charging system as necessary. Go to **Pinpoint Test B** . TEST the system for normal operation. CLEAR the DTCs. REPEAT the self-test.

F3 CHECK THE VOLTAGE TO THE MODULE

- Key in OFF position.
- Disconnect: Affected module which recorded the DTC B1317 or B1676
- Key in ON position.
- Measure all of the affected module's power circuits, harness side to ground. Refer to affected module Wiring Diagrams for schematic and connector information. Refer to appropriate SYSTEM WIRING DIAGRAMS article.
- **Is the voltage greater than 10 volts?**

  YES : Go to F4.

NO : REPAIR the module power circuit(s). CLEAR the DTCs. REPEAT the self-test.

F4 CHECK THE MODULE GROUNDS

- Key in OFF position.
- Measure the resistance between all of the affected module's ground circuits, harness side to ground. Refer to affected module Wiring Diagrams for schematic and connector information. Refer to appropriate SYSTEM WIRING DIAGRAMS article.
- **Is the resistance less than 5 ohms?**

  YES : Go to F5.

  NO : REPAIR the module ground circuit(s). CLEAR the DTCs. REPEAT the self-test.

F5 CHECK THE MODULE FOR CORRECT OPERATION

- Key in OFF position.
- Disconnect: All of the affected module connectors
- Check the connector and module for:
  - corrosion.
  - pushed out or damaged pins.
  - connector or module damage.
- Connect: All of the affected module connectors
- Clear all DTCs.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new module. REFER to the removal and installation procedure in the affected module's service information . CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been the result of a loose connection, may recently have had a discharged battery or may have been jump started. CLEAR the DTCs. REPEAT the self-test.

Component Tests

Battery - Drain Testing

WARNING: **Do not attempt to service, charge, recharge or jump start a battery unless the following information has been read and understood. Failure to follow this instruction may result in serious personal injury.**

CAUTION: To prevent damage to the meter, do not crank the engine or operate accessories that draw more than 10A.

CAUTION: If equipped with the CD6 audio unit, precautions must be taken when the battery has been disconnected. When reconnecting the battery, make sure no interruption of power occurs for 30 seconds. If power is interrupted

during the first 30 seconds, permanent damage to the CD6 audio unit will result.

NOTE: **No factory-equipped vehicle should have more than a 50 mA (0.050 amp) draw.**

Check for current drains on the battery in excess of 50 mA (0.050 amp) with all the electrical accessories off and the vehicle at rest for at least 40 minutes. Current drains can be tested with the following procedure.

NOTE: **Many electronic modules draw 10 mA (0.010 amp) or more continuously.**

NOTE: **Use an in-line ammeter between the negative battery post and its respective cable.**

NOTE: **Typically, a drain of approximately one amp is attributed to an engine compartment lamp, glove compartment lamp or interior lamp staying on continually. Other component failures or wiring shorts are located by selectively pulling fuses to pinpoint the location of the current drain. When the current drain is found, the meter reading falls to an acceptable level. If the drain is still not located after checking all the fuses, it is due to the generator.**

NOTE: **To accurately test the drain on a battery, an in-line ammeter must be used. Use of a test lamp or voltmeter is not an accurate method due to the number of electronic modules.**

1. Make sure the junction box(es)/fuse panel(s) is accessible without turning on the interior lights or the underhood lights.
2. Drive the vehicle at least 5 minutes and over 48 km/h (30 mph) to turn on and activate the vehicle systems.
3. Allow the vehicle to sit with the key off for at least 40 minutes to allow the modules to time out/power down.
4. Connect a fused jumper wire (30A) between the negative battery cable and the negative battery post to prevent modules from resetting and to catch capacitive drains.
5. Disconnect the negative battery cable from the negative battery post without breaking the connection of the jumper wire.

   NOTE: **It is very important that continuity is not broken between the battery and the negative battery cable when connecting the meter. If this happens, the entire procedure must be repeated.**

6. Connect the battery tester between the negative battery cable and the post. The meter must be capable of reading milliamps and should have a 10 amp capability.

   NOTE: **If the meter settings need to be switched or the test leads need to be**

moved to another jack, the jumper wire must be reinstalled to avoid breaking continuity.

NOTE: **Amperage draw varies from vehicle to vehicle depending on the equipment package. Compare to a similar vehicle for reference.**

NOTE: **No factory-equipped vehicle should have more than a 50 mA (0.050 amp) draw.**

7. Remove the jumper wire.
8. Note the amperage draw. Draw varies from vehicle to vehicle depending on the equipment package. Compare to a similar vehicle for reference.
9. If the draw is found to be excessive, remove the fuses from the smart junction box (SJB) one at a time and note the current reading. Do not reinstall the fuses until you have finished testing. To correctly isolate each of the circuits, all of the fuses may need to be removed and then install one fuse, note the amperage draw, remove the fuse and install the next fuse. Continue this process with each fuse.
10. If the current draw is still excessive, remove the fuses from the battery junction box (BJB) one at a time and note the current drop. Do not reinstall the fuses until you have finished testing. To correctly isolate each of the circuits, all of the fuses may need to be removed, then install one fuse, note the amperage draw, remove the fuse and install the next fuse. Continue this process with each fuse. When the current level drops to an acceptable level after removing a fuse, the circuit containing the excessive draw has been located.
11. Check the wiring diagrams for any circuits that run from the battery without passing through the BJB or the SJB. Refer to appropriate SYSTEM WIRING DIAGRAMS article. If the current draw is still excessive, disconnect these circuits until the draw is found. Disconnect the generator electrical connections if the draw cannot be located. The generator may be internally shorted, causing the current drain.

Generator On-Vehicle Tests

CAUTION: **To prevent damage to the generator, do not make the jumper wire connections except as directed.**

CAUTION: **Do not allow any metal object to come in contact with the housing and the internal diode cooling fins with the key on or off. A short circuit may result and burn out the diodes.**

NOTE: **Battery posts and cable clamps must be clean and tight for accurate meter indications.**

NOTE: **Refer to the battery tester manual for complete directions for testing the charging system.**

1. Turn off all lamps and electrical components.
2. Place the transmission in NEUTRAL and apply the parking brake.
3. Carry out the Load Test and No-Load Test according to the following component tests:

Generator On-Vehicle Tests - Load Test

1. Switch the tester to the ammeter function.
2. Connect the positive and negative leads of the tester to the corresponding battery terminals.
3. Connect the current probe to the generator B+ output terminal, circuit SDC14 (RD).
4. With the engine running at approximately 2,000 RPM, adjust the tester load bank to determine the output of the generator. Generator output should be greater than the graph shown below. If not, refer back to the pinpoint test or Go to **Symptom Chart**.

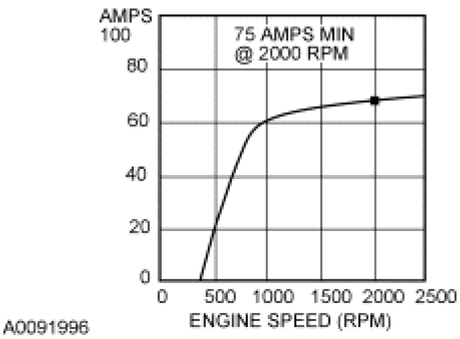


Fig. 14: Load Test Output Chart
Courtesy of FORD MOTOR CO.

Generator On-Vehicle Tests - No-Load Test

1. Switch the tester to the voltmeter function.
2. Connect the voltmeter positive lead to the generator B+ terminal, circuit SDC14 (RD), and the negative lead to ground.
3. Turn all electrical accessories off.
4. With the engine running at approximately 2,000 RPM, check the generator output voltage. The voltage should be between 13.2 and 15.5 volts. If not, refer back to the pinpoint test or Go to **Symptom Chart**.

2008 ELECTRICAL

Generator and Regulator - Edge & MKX

SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Generator pulley ratio	2.66:1
Rating	78/143 amp (max) @ 620-2,500 engine RPM @ normal engine temperature
Voltage regulator type	Electronic internal with generator

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Generator B+ terminal nut	12	9	-
Generator bolts	47	35	-
Generator nuts	47	35	-
Generator stud	8	-	71

DESCRIPTION AND OPERATION

GENERATOR

The charging system consists of the following components:

- Generator
- Integral voltage regulator

The generator is belt-driven by the engine accessory drive system. The generator has an internal voltage regulator that is not replaced separately. The generator and voltage regulator are repaired as an assembly.

DIAGNOSTIC TESTS

GENERATOR

Refer to **CHARGING SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

GENERATOR

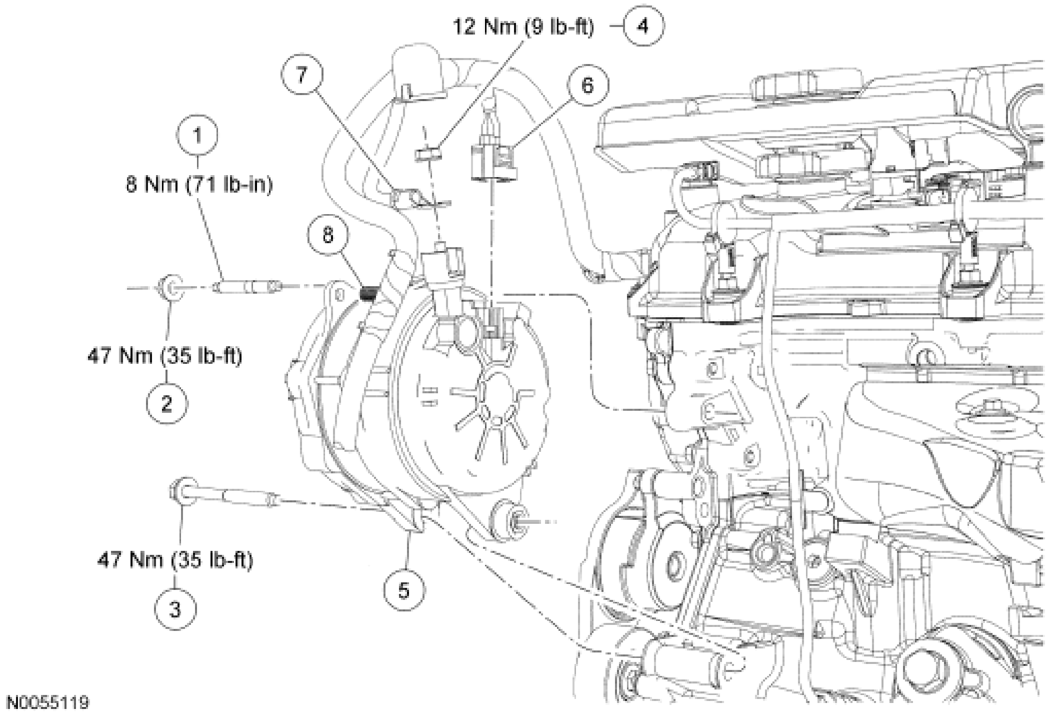


Fig. 1: Exploded View Of Generator Components With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W712609	Generator stud
2	W520414	Generator nut
3	W709986	Generator bolt
4	7H953	Generator B+ terminal nut
5	10300	Generator
6	-	Generator electrical connector (part of 14B060)
7	-	Generator B+ terminal (part of 14B060)
8	-	Pin-type retainer, wiring harness

REMOVAL AND INSTALLATION

1. Disconnect the battery. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
2. Remove the cooling fan. For additional information, refer to **ENGINE COOLING** article.
3. Rotate the accessory drive belt tensioner counterclockwise and position the accessory drive belt aside.
4. Position the generator B+ terminal protective cover aside, remove the nut and position the generator B+ terminal aside.
    - To install, tighten to 12 Nm (9 lb-ft).
5. Disconnect the generator electrical connector.

- Detach the pin-type retainer and wiring harness.

6. Remove the generator stud nut.
   - To install, tighten to 47 Nm (35 lb-ft).
7. Remove the generator stud.
   - To install, tighten to 8 Nm (71 lb-in).
8. Remove the RH fender splash shield. For additional information, refer to **FRONT END BODY PANELS** article.
9. Loosen the generator bolt and remove the generator.
   - To install, tighten to 47 Nm (35 lb-ft).
10. To install, reverse the removal procedure.

2008 ENGINE

Engine Cooling - Edge & MKX

SPECIFICATIONS

MATERIAL

Item	Specification	Fill Capacity
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1	9.2L (9.7 qt)
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	-
Premium Cooling System Flush VC-1	ESR-M14P7-A	-

GENERAL SPECIFICATIONS

Item	Specification
Cooling System Pressure Test Specifications	
Cooling System	124 kPa (18 psi)
Radiator Cap Pressure Test Specification	
Pressure release cap	89-124 kPa (13-18 psi)
Thermostat Opening Temperatures	
Thermostat starts to open	86°C (187°F)
Thermostat fully open	96°C (205°F)

TORQUE SPECIFICATIONS

Description	N.m	lb-ft	lb-in
A/C condenser-to-radiator bolts	10	-	89
Block heater	40	30	-
Compressor-to-condenser bracket bolt	7	-	62
Coolant pump bolts[a]	-	-	-
Cooling fan motor and shroud bolts	6	-	53
Degas bottle-to-fender bolt	9	-	80
Engine oil filter [(1)]	-	-	-
Exhaust clamp	40	30	-

Oil cooler bracket bolt	6	-	53
Oil pan drain plug	27	20	-
Primary timing chain guide bolts	10	-	89
Primary timing chain tensioner bolts	10	-	89
Thermostat housing bolts	10	-	89
Thermostat housing cover bolts	10	-	89
Variable camshaft timing (VCT) oil control solenoid housing bolts (1)	-	-	-
Y-pipe nuts	40	30	-
(1) Refer to the procedure in this service information.			

DESCRIPTION AND OPERATION

ENGINE COOLING

CAUTION: The engine cooling system is filled with Motorcraft Premium Gold Engine Coolant. Mixing coolant types degrades the corrosion protection of Motorcraft Premium Gold Engine coolant.

NOTE: Stop-leak style pellets/products must not be used as an additive in this engine cooling system. The addition of stop-leak style pellets/products can clog or damage the cooling system, resulting in degraded cooling system performance and/or failure.

The cooling system components are the:

- radiator.
- bypass tube.
- pressure relief cap.
- degas bottle.
- radiator draincock.
- coolant pump.
- engine coolant temperature indicator unit.
- thermostat (cold side).
- variable speed fan motor assembly.
- fan control module.
- engine block coolant weep hole.

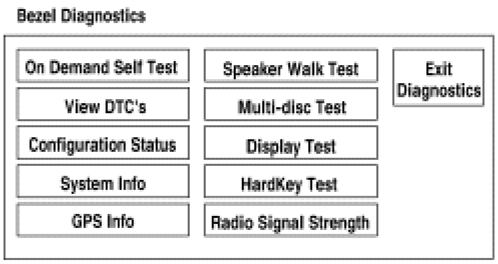


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Fig. 1: Locating Engine Block Coolant Weep Hole
Courtesy of FORD MOTOR CO.

The engine is equipped with an engine block coolant weep hole. If the inner coolant pump shaft seal fails, coolant will be diverted out the weep hole in the LH side of the engine block. This prevents any coolant from entering the crankcase.

Engine coolant provides freeze protection, boil protection, cooling efficiency and corrosion protection to the engine and cooling components. In order to obtain these protections, the engine coolant must be maintained at the correct concentration and fluid level in the degas bottle.

When adding engine coolant, use a 50/50 mixture of engine coolant and distilled water.

To maintain the integrity of the coolant and the cooling system:

- add Motorcraft Premium Gold Engine Coolant. Do not mix coolant types.
- do not add/mix orange-colored Motorcraft Specialty Orange Engine Coolant or equivalent meeting Ford specification WSS-M97B44-D or green colored Motorcraft Premium Engine Coolant meeting Ford specification ESE-M97B44-A or equivalent. Mixing coolants may degrade the coolant's corrosion protection.
- do not add alcohol, methanol or brine, or any engine coolants mixed with alcohol or methanol antifreeze. These can cause engine damage from overheating or freezing.
- Ford Motor Company does NOT recommend the use of recycled engine coolant in vehicles originally equipped with Motorcraft Premium Gold Engine Coolant since a Ford-approved recycling process is not yet available.

NOTE: In the following illustration, Black arrows indicate hot, white arrows indicate cold.

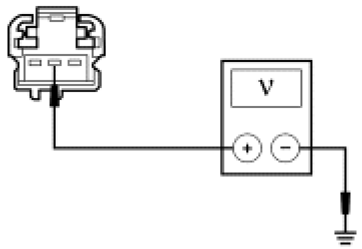


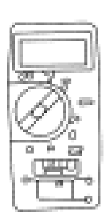
Fig. 2: Coolant Flow Diagram, 3.5L
Courtesy of FORD MOTOR CO.

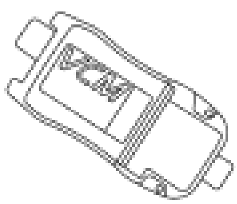
Item	Part Number	Description
1	8C633	Lower degas bottle hose
2	8005	Radiator
3	8B273	Lower radiator hose
4	8B274	Upper radiator hose
5	6050	Cylinder head
6	6083	Cylinder head gasket
7	8A586	Thermostat housing
8	9N271	Heater inlet tube
9	9K461	Lower intake manifold
10	8501	Coolant pump
11	6010	Engine block
12	8W005	Upper degas bottle hose
13	18C553	Heater hose assembly
14	18B539	Heater core
15	8A080	Degas bottle

DIAGNOSTIC TESTS

ENGINE COOLING

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent

 ST1720-A	Battery/Antifreeze Tester	014-R1060 or equivalent
 ST1474-A	Pressure Test Kit	014-R1072 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware or equivalent scan tool	-

MATERIAL

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1

Principles of Operation

Engine coolant flows primarily from the engine to the radiator circuit and back to the coolant pump. From the coolant pump, coolant is sent through the engine block and cylinder heads. A separate circuit from the engine also feeds the heater core with coolant. On most engines, the coolant pump is operated by engine rotation through a pulley which is driven by the accessory drive belt to circulate the coolant. Some engines use a belt driven by a pulley attached to the camshaft, and some engines use a sprocket driven by the timing chain to operate the coolant pump. The coolant thermostat is a control valve actuated by coolant temperature. When the thermostat is closed, coolant flow bypasses the radiator circuit and returns to the coolant pump. When the thermostat is opened, coolant is allowed to flow through the radiator circuit in order to transfer engine generated heat to the outside air.

NOTE: The vehicle is equipped with either a degas bottle or an expansion tank.

The degas bottle, if equipped, holds surplus coolant and removes air from the cooling system, which reduces hot spots. It also allows for coolant expansion and system pressurization, replenishes coolant to the cooling system and serves as the location for service fill.

The coolant expansion tank, if equipped, holds surplus coolant, allows for coolant expansion and replenishes coolant to the cooling system. It is equipped with a non-pressurized cap which allows coolant to be added to the tank to keep it filled to prescribed levels.

The cooling fan draws air through the radiator to help cool the system coolant as it passes through the radiator.

The thermostat monitor is a function of the PCM and is designed to verify correct thermostat operation. The monitor will be executed once per drive cycle and has a monitor run duration of 300-800 seconds. If a malfunction occurs, DTC P0125 or P0128 is set, and the malfunction indicator lamp will be illuminated.

For vehicle/engine specific information, refer to **ENGINE COOLING** in Description and Operation.

Inspection and Verification

WARNING: **Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

CAUTION: The engine cooling system is filled with Motorcraft Premium Gold Engine Coolant. Mixing coolant types degrades the corrosion protection of Motorcraft Premium Gold Engine Coolant. Do not mix coolant types. Failure to follow these instructions may result in engine or cooling system damage.

NOTE: Vehicles equipped with a degas bottle system have the pressure relief cap on the degas bottle and no radiator cap. Vehicles equipped with a coolant expansion tank system have the pressure relief cap on the radiator.

1. Verify the customer concern.
2. Visually check the engine coolant level at the degas bottle or coolant expansion tank when the system is cold.
3. Make sure the pressure relief cap is installed correctly.
4. Record any cooling system DTCs retrieved. Refer to the **PCM DTC CHART** in this service information for DTC descriptions.

   NOTE: Take note of any coolant odor or steam coming from cooling system components.

5. If the system coolant is filled correctly and no DTCs associated with fail-safe cooling are retrieved, verify the customer's concern by operating the engine to duplicate the condition.

NOTE: **Refer to the coolant flow diagram in ENGINE COOLING in Description and Operation .**

6. Inspect to determine if any of the following mechanical or electrical concerns apply.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Leaks or weeps at: ○ Hoses ○ Tubes ○ Clamp joints ○ Quick connect couplings (if equipped) ○ Gaskets ○ O-rings ○ Thermostat housing ○ Radiator ○ Pressure relief cap ○ Coolant pump ○ Heater core (wet floor or coolant odor in vehicle) ○ Heater control valve ○ Heated throttle body (TB) or heated TB adapter (if equipped) ○ Coolant crossover manifold assembly (if equipped) ○ Oil cooler (if equipped) ○ Degas bottle (if equipped) ○ Coolant expansion tank (if equipped)	• Inoperative or damaged: ○ Electric cooling fan (if equipped) ○ Electronically actuated fan clutch ○ Electronically actuated fan clutch controller ○ Wiring, connectors, relays or modules ○ Engine coolant temperature (ECT) sensor (if equipped) ○ Cylinder head temperature (CHT) sensor (if equipped) ○ Intake air temperature (IAT) sensor (if equipped) ○ Mass air flow (MAF) sensor ○ Vehicle speed sensor (VSS)

- Heated PCV (if equipped) - Fuel pressure regulator coolant bowl (if equipped, natural gas engine) - Cylinder block core plugs (if equipped) - Cylinder head core plugs (if equipped) - Block heater (if equipped)	

VISUAL INSPECTION CHART

Mechanical	Electrical
- Cracked or damaged: - Hoses - Tubes - Hose clamps - Heater control valve (if equipped) - Thermostat housing - Radiator - Pressure relief cap - Cooling fan - Fan clutch (if equipped) - Coolant pump - Degas bottle (if equipped) - Coolant expansion tank (if equipped) - Oil cooler (if equipped)	

- Coolant crossover manifold assembly (if equipped) - Cylinder block core plugs (if equipped) - Cylinder head core plugs (if equipped) - Block heater (if equipped) • Restricted airflow through the A/C condenser/radiator • Drive belt loose, worn or installed incorrectly • Broken or weak drive belt tensioner • Excessive white or light gray exhaust smoke (may have burnt coolant odor) • Coolant in engine oil • Engine oil in coolant • Coolant in automatic transmission fluid (if equipped) • Automatic transmission fluid (if equipped) in coolant	

7. If the inspection reveals an obvious concern that can be readily identified, repair it as necessary. Test the system for normal operation.
8. Inspect the coolant condition in the following sequence:
    1. Inspect the coolant color.
        - If Motorcraft Premium Gold Engine Coolant has a clear or pale yellow color, this indicates higher water content than required. Test the engine coolant freezing point range with the Battery/Antifreeze Tester. The freezing point should be in the range -45°C to -23°C (-50°F to -10°F). If the vehicle is driven in cold climates less than -36°C (-34°F), it may be necessary to increase the coolant concentration to get adequate freeze protection. Recommended coolant concentration is 50/50 ethylene glycol to distilled water.
        - A pale green color indicates incorrect coolant (green in color) may have been added to the

system. Use of incorrect (green in color) coolant degrades the corrosion protection of Motorcraft Premium Gold Engine Coolant. Flush the system and refill with the correct mixture of distilled water and Motorcraft Premium Gold Engine Coolant.

NOTE: If Cooling System Stop Leak Pellets are used, darkening of the Motorcraft Premium Gold Engine Coolant from yellow to golden tan will occur.

- Dark brown could indicate a commercially available stop leak may have been used. Flush the system and refill with the correct mixture of distilled water and Motorcraft Premium Gold Engine Coolant.
- A light or reddish brown color indicates that rust may be present in the cooling system. Flush the system and refill with the correct mixture of distilled water and Motorcraft Premium Gold Engine Coolant.
- An iridescent sheen on top of the coolant could indicate a trace of oil is entering the system. For information on engine diagnosis, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
- A milky brown color may indicate that engine oil is entering the cooling system. Pressure test the cooling system. Refer to component tests in this service information. If engine oil is suspected, the cause of the leak may be internal to the engine. Refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
- A red, orange or light green colored sheen on top of the coolant may indicate that transmission fluid is entering the cooling system. The cause may be a leaky radiator. Pressure test the cooling system. Refer to **COMPONENT TESTS**.

2. If the engine coolant appearance is acceptable, test the engine coolant freezing point range with the Battery/Antifreeze Tester. The freezing point should be in the range -45°C to -23°C (-50°F to -10°F). If the vehicle is driven in cold climates less than -36°C (-34°F), it may be necessary to increase the coolant concentration to get adequate freeze protection. Recommended coolant concentration is 50/50 ethylene glycol to distilled water.
   - Maximum coolant concentration is 60/40 for cold weather areas.
   - Minimum coolant concentration is 40/60 for warm weather areas.
3. Adjust coolant range and level if necessary:
   - If coolant is low, add specified coolant mixture only.
   - If the engine coolant tests too weak, remove some of the engine coolant and add undiluted engine coolant until the readings are within acceptable levels.
   - If the engine coolant tests strong, remove some of the engine coolant and add distilled water until the readings are within acceptable levels.

9. If an obvious cause for an observed or reported concern is found, correct the cause and test the system for normal operation before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

10. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

11. If the scan tool does not communicate with the VCM:
    - check the VCM connection to the vehicle.
    - check the scan tool connection to the VCM.
    - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
12. If the scan tool does not communicate with the vehicle:
    - verify the ignition key is in the ON position.
    - verify the scan tool operation with a known good vehicle.
    - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
13. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record continuous memory DTCs.
14. Clear the continuous DTCs and carry out the self-test diagnostics PCM.
15. If the DTCs recovered are related to the concern, go to the PCM DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
16. If no DTCs related to the concern are retrieved, go to **SYMPTOM CHART** table.

PCM DTC CHART

DTC	Description	Action
P0217	Engine Coolant Overtemperature Condition	Go to **Pinpoint Test B** .
P1285	Cylinder Head Overtemperature Condition	Go to **Pinpoint Test B** .
P1299	Cylinder Head Overtemperature Protection Active	Go to **Pinpoint Test B** .
P0125	Insufficient Coolant Temp For Closed Loop Fuel Control	Go to **Pinpoint Test c** .
P0128	Coolant Thermostat (Coolant Temp Below Thermostat Regulating Temperature)	Go to **Pinpoint Test c** .
P0480 P0481 P0482	Fan 1, 2 or 3 Control Circuit, Respectively	REFER to the **Introduction - Gasoline Engines** article.
All Other DTCs	-	REFER to the **Introduction - Gasoline Engines** article.

Symptom Chart

SYMPTOM CHART

Condition	Possible Sources	Action

• Loss of coolant	• Coolant hoses or tubes • Hose clamps • Coolant pump O-ring seal or gasket • Thermostat O-ring seal or gasket • Thermostat housing • Radiator • Transmission fluid cooler (in radiator) (if equipped) (may leak internally or externally) • Degas bottle (if equipped) • Coolant expansion tank (if equipped) • Pressure relief cap • Coolant pump leaking from weep hole • Auxiliary coolant pump (if equipped) • Heater core • Heater control valve (if equipped) • Coolant crossover manifold assembly (if equipped) • Engine gaskets (may leak internally or externally) • Oil cooler (if equipped) (may leak internally or externally) • Heated throttle body (TB) or heated TB adapter (if equipped) • Heated PCV (if equipped) • Fuel pressure regulator coolant bowl (if equipped, natural gas engine) • Cylinder block core plugs (if equipped) • Cylinder head core plugs (if equipped) • Block heater (if equipped)	• Go to **Pinpoint Test A** .
• The engine overheats	• Low coolant level • External engine coolant leak • Airlock in system • Pressure relief cap installation • Restricted airflow through the A/C condenser/radiator	• Go to **Pinpoint Test B** .

	• Internal engine coolant leak • Coolant condition/concentration • Accessory drive components • Non-OEM engine enhancement components • Electric cooling fan (if equipped) • Mechanical cooling fan (if equipped) • Mechanical cooling fan clutch (if equipped) • Radiator • Thermostat • Engine coolant temperature (ECT) indicator system (gauge) • ECT sensor (if equipped) • Cylinder head temperature (CHT) sensor (if equipped) • Heater core • Coolant pump • Coolant flow restriction	
• The engine does not reach normal operating temperature	• Low coolant level • Thermostat • Mechanical fan clutch always engaged • Electric cooling fan always on • Engine coolant temperature indicator system (gauge) • ECT sensor (if equipped) • CHT sensor (if equipped)	• Go to **Pinpoint Test C** .
• The block heater does not operate correctly	• Block heater power cable	• CHECK continuity in all 3 power cable circuits. If any circuit measures greater than 5 ohms, INSTALL a new power cable.
-	• Block heater	• CHECK the resistance of the block heater. If the resistance does not measure between 12.5 and 17.0 ohms, INSTALL a new block

		heater.
• The electric cooling fan (s) or electronically controlled fan clutch is inoperative in one or more speeds or does not operate correctly (if equipped)	• Wiring • Relays • Fuses • Fan control module • Cooling fan motor(s) • Cooling fan resistor(s) • Electric fan clutch	• REFER to the **Introduction - Gasoline Engines** article.
• The electric cooling fan (s) stay(s) on all the time (if equipped)	• Wiring • Relays	• REFER to the **Introduction - Gasoline Engines** article.
• Noisy electric cooling fan operation (if equipped)	• Foreign material contamination • Fan motor	• REMOVE the foreign material from the cooling fan and shroud. TEST the system for normal operation. If still noisy, INSTALL a new cooling fan assembly.
-	• Fan blade detached from fan motor	• INSTALL a new cooling fan assembly.
• Noisy mechanical fan operation (if equipped)	• Fan clutch	• CARRY OUT the Fan Clutch Test - Minimum Speed Requirement component test.

Pinpoint Tests

Pinpoint Test A: Loss of Coolant

Normal Operation

The engine cooling system is a closed system that provides for coolant expansion and contraction and also changes in pressure as coolant warms and cools with engine operation. Various gaskets, seals, hoses and clamps are used to contain coolant within the cooling system and keep other fluids and contaminants from entering the cooling system.

Coolant loss can be attributed to either external or internal leaks anywhere within the cooling system.

For vehicle/engine specific information, refer to **ENGINE COOLING** in Description and Operation.

This pinpoint test is intended to diagnose the following:

- Coolant hoses or tubes
- Hose clamps
- Thermostat O-ring seal or gasket
- Coolant pump O-ring seal or gasket
- Thermostat housing
- Heater control valve (if equipped)
- Radiator
- Transmission fluid cooler (in radiator) (if equipped)
- Pressure relief cap
- Coolant pump leaking from weep hole
- Auxiliary coolant pump (if equipped)
- Heater core
- Heated throttle body (TB) or heated TB adapter (if equipped)
- Coolant crossover manifold assembly (if equipped)
- Engine gaskets
- Oil cooler (if equipped)
- Degas bottle (if equipped)
- Coolant expansion tank (if equipped)
- Heated PCV (if equipped)
- Fuel pressure regulator coolant bowl (if equipped, natural gas engine)
- Cylinder block core plugs (if equipped)
- Cylinder head core plugs (if equipped)
- Block heater (if equipped)
- Engine coolant temperature (ECT) sensor (if equipped)

PINPOINT TEST A: LOSS OF COOLANT

WARNING: **Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

A1 CARRY OUT INSPECTION AND VERIFICATION

- Carry out the Inspection and Verification procedure in this service information.
- **Were any concerns found?**

  YES : REPAIR as needed. TEST the system for normal operation.

  NO : Go to A2 .

A2 CHECK THE ENGINE COOLANT LEVEL

NOTE: Allow the engine to cool before checking the engine coolant level.

- Key in OFF position.
- Visually inspect the engine coolant level at the degas bottle or the coolant expansion tank.
- **Is the engine coolant level within specifications?**

  YES : Go to A3.

  NO : ADJUST the engine coolant level as necessary. Go to A3.

A3 PRESSURE TEST THE ENGINE COOLING SYSTEM

- Pressure test the engine cooling system. Refer to Cooling System Pressure Test in **COMPONENT TESTS** in this service information.
- **Does the engine cooling system leak?**

  YES : REPAIR or INSTALL new components. TEST the system for normal operation.

  NO : If the vehicle is equipped with a coolant expansion tank, go to A4. If the vehicle is equipped with a degas bottle, go to A5.

A4 CHECK THE PRESSURE RELIEF CAP

- Carry out the pressure relief cap pressure test. Refer to Pressure Relief Cap Pressure Test in **COMPONENT TESTS** in this service information.
- **Is the pressure relief cap OK?**

  YES : Go to A5.

  NO : INSTALL a new pressure relief cap. TEST the system for normal operation.

A5 CHECK THE ENGINE COOLANT FOR AN INTERNAL LEAK

- Inspect the engine coolant in the degas bottle or coolant expansion tank for signs of engine oil or transmission fluid.
- **Is engine oil or transmission fluid evident in the coolant?**

  YES : If engine oil is evident, go to **ENGINE SYSTEM - GENERAL INFORMATION** article for engine diagnosis. If transmission fluid is evident, INSTALL a new radiator. REPAIR the transmission as necessary. Refer to the appropriate Automatic Transmission article for the procedure. TEST the system for normal operation.

  NO : Go to A6.

A6 CHECK THE ENGINE OIL AND TRANSMISSION FLUID FOR COOLANT

- Remove the oil level indicators from the engine and the transmission.
- **Is coolant evident in the oil or transmission fluid?**

  YES : If coolant is in the engine oil, go to **ENGINE SYSTEM - GENERAL INFORMATION** article. If coolant is in the transmission fluid, INSTALL a new radiator. REPAIR the transmission as necessary. Refer to the appropriate Automatic Transmission article for the procedure.

  NO : Go to A7.

A7 CHECK THE COOLING SYSTEM FOR COMBUSTION GASES

NOTE: Use U-View® Combustion Leak Tester part number 560000 or equivalent.

- Using a cooling system combustion gas leak tester, following the instructions supplied with the tester, check the coolant for combustion gases.
- **Are combustion gases present?**

  YES : Go to **ENGINE SYSTEM - GENERAL INFORMATION** article for engine diagnosis.

  NO : The cooling system is operational.

Pinpoint Test B: The Engine Overheats

Normal Operation

The engine cooling system functions to maintain engine temperatures during operation. Correct coolant flow through the engine, radiator and remainder of cooling system passages and components is essential to maintaining a correct engine temperature.

Engine coolant flows primarily from the engine to the radiator circuit and back to the coolant pump. From the coolant pump, coolant is sent through the engine block and cylinder heads. A separate circuit from the engine also feeds the heater core with coolant. On most engines, the coolant pump is operated by engine rotation through a pulley which is driven by the accessory drive belt to circulate the coolant. Some engines use a belt driven by a pulley attached to the camshaft, and some engines use a sprocket driven by the timing chain to operate the coolant pump. The coolant thermostat is a control valve actuated by coolant temperature. When the thermostat is closed, coolant flow bypasses the radiator circuit and returns to the coolant pump. When the thermostat is opened, coolant is allowed to flow through the radiator circuit in order to transfer engine generated heat to the outside air.

Engine overheating generally occurs when there is a disruption in the ability to control either coolant flow at the correct rate, the inability to transfer heat from the engine through the coolant (including low coolant), or an inability to transfer engine generated heat to the outside air through the radiator.

For vehicle/engine specific information, refer to **ENGINE COOLING** in Description and Operation.

- DTC P0217 Engine Coolant Overtemperature Condition
- DTC P1285 Cylinder Head Overtemperature Condition
- DTC P1299 Cylinder Head Overtemperature Protection Active

This pinpoint test is intended to diagnose the following:

- Low coolant level
- External engine coolant leak
- Airlock in system
- Pressure relief cap installation
- Restricted airflow through the A/C condenser/radiator

- Internal engine coolant leak
- Coolant condition/concentration
- Accessory drive components
- Non-OEM engine enhancement components
- Electric cooling fan (if equipped)
- Mechanical cooling fan blade (if equipped)
- Mechanical cooling fan clutch (if equipped)
- Engine coolant temperature (ECT) indicator system (gauge)
- ECT sensor (if equipped)
- Cylinder head temperature (CHT) sensor (if equipped)
- Heater core
- Coolant pump
- Coolant flow restriction

PINPOINT TEST B: THE ENGINE OVERHEATS

WARNING: **Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

B1 CARRY OUT INSPECTION AND VERIFICATION

- Carry out the Inspection and Verification procedure in this service information.
- **Were any concerns found?**

  YES : REPAIR as needed. TEST the system for normal operation.

  NO : Go to B2 .

B2 CHECK FOR DTCs

NOTE: **Refer to the INTRODUCTION - GASOLINE ENGINES article for correct scan tool hook-up procedure.**

- Check for DTC P0217, P1285 or P1299.
- **Is DTC P0217, P1285 or P1299 present?**

  YES : Go to B3.

  NO : Actual engine overheating has not been verified. CHECK the ECT gauge operation. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. If any other DTCs are retrieved, REFER to the **INTRODUCTION - GASOLINE ENGINES** article.

B3 CHECK FOR AN AIRFLOW OBSTRUCTION

- Check the radiator or A/C condenser for an obstruction such as leaves or cardboard.
- **Is an obstruction present?**

  YES : REMOVE the obstruction. TEST the system for normal operation.

  NO : Go to B4.

B4 CHECK THE ENGINE COOLANT LEVEL

NOTE: Allow the engine to cool before checking the coolant level.

- Key in OFF position.
- Visually check the engine coolant level in the degas bottle or coolant expansion tank.
- **Is the engine coolant level within specification?**

  YES : Go to B5.

  NO : ADJUST the engine coolant level as necessary. Go to B5.

B5 PRESSURE TEST THE ENGINE COOLING SYSTEM

- Pressure test the engine cooling system. Refer to Cooling System Pressure Test in **COMPONENT TESTS** in this service information.
- **Does the engine cooling system leak?**

  YES : REPAIR or INSTALL new components. TEST the system for normal operation.

  NO : Vehicles equipped with an expansion tank, go to B6. Vehicles equipped with a degas bottle, go to B7.

B6 CHECK THE PRESSURE RELIEF CAP

- Carry out the pressure relief cap pressure test. Refer to Pressure Relief Cap Pressure Test in **COMPONENT TESTS** in this service information.
- **Is the pressure relief cap OK?**

  YES : Go to B7.

  NO : INSTALL a new pressure relief cap. TEST the system for normal operation.

B7 CHECK THE ENGINE COOLANT FOR AN INTERNAL LEAK

- Inspect the engine coolant in the degas bottle or coolant expansion tank for signs of engine oil or transmission fluid.
- **Is engine oil or transmission fluid evident in the coolant?**

  YES : If engine oil is evident, go to **ENGINE SYSTEM - GENERAL INFORMATION** article for engine diagnosis. If transmission fluid is evident, INSTALL a new radiator. REPAIR the transmission as necessary. Refer to the appropriate Automatic Transmission article for the procedure. TEST the system for normal operation.

  NO : Go to B8.

B8 CHECK THE ENGINE OIL AND TRANSMISSION FLUID FOR COOLANT

- Remove the oil level indicators from the engine and the transmission.
- **Is coolant evident in the oil or transmission fluid?**

  YES : If coolant is in the engine oil, go to **ENGINE SYSTEM - GENERAL INFORMATION**

article. If coolant is in the transmission fluid, INSTALL a new radiator. REPAIR the transmission as necessary. Refer to the appropriate Automatic Transmission article for the procedure.

NO : Go to B9.

B9 CHECK THE COOLING SYSTEM FOR COMBUSTION GASES

NOTE:	**Use U-View® Combustion Leak Tester part number 560000 or equivalent.**

- Using a cooling system combustion gas leak tester, following the instructions supplied with the tester, check the coolant for combustion gases.
- **Are combustion gases present?**

  YES : Go to **ENGINE SYSTEM - GENERAL INFORMATION** article for engine diagnosis.

  NO : Go to B10.

B10 CHECK COOLANT CONDITION

- Check the coolant for dirt, rust or contamination and check the coolant concentration.
- **Is the coolant condition OK?**

  YES : Vehicles equipped with an electric cooling fan, go to B11 . Vehicles equipped with only a mechanical cooling fan, go to B12 .

  NO : FLUSH the engine cooling system. REFER to **COOLING SYSTEM FLUSHING**. TEST the system for normal operation.

B11 CHECK THE ELECTRIC COOLING FAN OPERATION

- Start the engine.
- Place the climate control function selector in the MAX A/C position and the blower motor switch in the HI position.
- **Did the electric cooling fan operate?**

  YES : If the vehicle is also equipped with a mechanical cooling fan, go to B12. Otherwise, go to B13.

  NO : DIAGNOSE the electric cooling fan operation. REFER to **INTRODUCTION - GASOLINE ENGINES** article.

B12 CHECK THE MECHANICAL COOLING FAN OPERATION

- Key in OFF position.
- If the vehicle is equipped with a viscous fan clutch, carry out the Fan Clutch Tests in **COMPONENT TESTS**. If the vehicle is equipped with an electronically actuated fan clutch, refer to the **INTRODUCTION - GASOLINE ENGINES** article.
- **Is the cooling fan operation OK?**

  YES : Go to B13.

  NO : INSTALL a new fan clutch. TEST the system for normal operation.

B13 CHECK THE COOLANT PUMP OPERATION

- Start the engine.
- Allow the engine to run for 10 minutes (hot side thermostat equipped vehicles) or 30 minutes (cold

side thermostat equipped vehicles). Place the climate control function selector in the MAX HEAT position. Feel the heater outlet hose.

- **Is the heater outlet hose hot?**

  YES : Go to B14.

  NO : INSTALL a new coolant pump. TEST the system for normal operation.

B14 CHECK THE THERMOSTAT OPERATION

- Start the engine.
- Allow the engine to run for 10 minutes (hot side thermostat equipped vehicles) or 30 minutes (cold side thermostat equipped vehicles). Feel the upper radiator hose (hot side thermostat equipped vehicles) or the lower radiator hose (cold side thermostat equipped vehicles).
- **Is the upper (hot side thermostat equipped vehicles) or lower (cold side equipped vehicles) radiator hose hot?**

  YES : CHECK the engine coolant temperature gauge operation. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

  NO : Go to B15.

B15 VISUALLY INSPECT THE THERMOSTAT

- Carry out the Thermostat Visual Inspection in **COMPONENT TESTS**.
- **Is the thermostat damaged?**

  YES : INSTALL a new thermostat. TEST the system for normal operation.

  NO : INSTALL a new thermostat. TEST the system for normal operation. If the engine still overheats, INSTALL a new radiator. TEST the system for normal operation.

Pinpoint Test C: The Engine Does Not Reach Normal Operating Temperature

Normal Operation

The engine cooling system functions to maintain engine temperatures during operation. Correct coolant flow through the engine, radiator and remainder of cooling system passages and components is essential to maintaining a correct engine temperature.

Engine coolant flows primarily from the engine to the radiator circuit and back to the coolant pump. From the coolant pump, coolant is sent through the engine block and cylinder heads. A separate circuit from the engine also feeds the heater core with coolant. On most engines, the coolant pump is operated by engine rotation through a pulley which is driven by the accessory drive belt to circulate the coolant. Some engines use a belt driven by a pulley attached to the camshaft, and some engines use a sprocket driven by the timing chain to operate the coolant pump. The coolant thermostat is a control valve actuated by coolant temperature. When the thermostat is closed, coolant flow bypasses the radiator circuit and returns to the coolant pump. When the thermostat is opened, coolant is allowed to flow through the radiator circuit in order to transfer engine generated heat to the outside air.

Concerns of engine inability to reach normal operating temperature typically occur when the rate of coolant flow through some coolant circuits (radiator, heater core) is more than expected given the conditions, or when the cooling fans operate all the time (electric fans) or the fan clutch is always engaged (engine driven fans). Heat is not allowed to build in the engine because a heat exchanger is removing too much heat, including the radiator, heater core and oil cooler. In addition, perceived concerns that the engine does not reach normal operating temperature can be related to a low coolant level or trapped air which does not allow for hot coolant to be available at the heater core, an inoperative climate control system, or for concerns perceived or related to an incorrect engine temperature gauge indication.

For vehicle/engine specific information, refer to **ENGINE COOLING** in Description and Operation.

- DTC P0125 Insufficient Coolant Temp for Closed Loop Fuel Control
- DTC P0128 Coolant Thermostat (Coolant Temp Below Thermostat Regulating Temperature)

This pinpoint test is intended to diagnose the following:

- Low coolant level
- Thermostat
- Engine coolant temperature (ECT) indicator system (gauge)
- Engine cooling fan

PINPOINT TEST C: THE ENGINE DOES NOT REACH NORMAL OPERATING TEMPERATURE

WARNING: **Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

C1 CARRY OUT INSPECTION AND VERIFICATION

- Carry out the Inspection and Verification procedure in this service information.
- **Were any concerns found?**

  YES : REPAIR as needed. TEST the system for normal operation.

  NO : Go to C2.

C2 CHECK FOR DTCs P0125 or P0128

NOTE: **Refer to the INTRODUCTION - GASOLINE ENGINES article for correct scan tool hook-up procedure.**

- Check for DTC P0125 or P0128.
- **Is DTC P0125 or P0128 present?**

  YES : If the vehicle is equipped with an electric cooling fan, go to C3. If the vehicle is equipped with only a mechanical cooling fan, go to C4.

  NO : The cooling system is operational. If an inoperative engine coolant temperature gauge is suspected, CHECK the engine coolant temperature gauge operation. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. If an inoperative climate control system is suspected, CHECK the climate control system operation. REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article. If any other DTCs are retrieved, REFER to the **INTRODUCTION - GASOLINE ENGINES** article.

C3 CHECK THE ELECTRIC COOLING FAN OPERATION

- Allow the engine to cool.
- Make sure the A/C switch is OFF (if equipped).
- Start the engine.
- Check the electric cooling fan.
- **Is the electric cooling fan on all the time?**

  YES : DIAGNOSE the electric cooling fan operation. REFER to the **INTRODUCTION - GASOLINE ENGINES** article.

  NO : If the vehicle is also equipped with a mechanical cooling fan, go to C4. Otherwise, go to C5.

C4 CHECK THE MECHANICAL COOLING FAN OPERATION

- Carry out the Cooling Fan Clutch Component Test. For a mechanical cooling fan clutch, refer to **COMPONENT TESTS** in this service information. For an electronic cooling fan clutch, refer to the **INTRODUCTION - GASOLINE ENGINES** article.
- **Is the cooling fan clutch OK?**

  YES : Go to C5.

  NO : INSTALL a new cooling fan clutch. TEST the system for normal operation.

C5 CHECK THE COOLANT LEVEL

NOTE: Allow the engine to cool before checking the coolant level.

- Visually check the engine coolant level in the degas bottle or coolant expansion tank.
- **Is the engine coolant level within specification?**

  YES : INSTALL a new thermostat. TEST the system for normal operation.

  NO : Go to **Pinpoint Test A** to diagnose a coolant leak.

Component Tests

Pressure Test - Degas Bottle Systems

WARNING: Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

NOTE: Vehicles equipped with a degas bottle system have the pressure relief cap on the degas bottle and no radiator cap. Vehicles equipped with a coolant

expansion tank system have the pressure relief cap on the radiator.

1. Turn the engine OFF.
2. Check the engine coolant level. Adjust the coolant level as necessary.
3. Attach the Radiator/Heater Core Pressure Tester to the degas bottle nipple and overflow hose. Install a pressure test pump to the quick connect fitting of the test adapter.

CAUTION: Do not pressurize the cooling system beyond the maximum pressure listed in SPECIFICATIONS in this service information or cooling system components may be damaged.

NOTE: If the plunger of the pressure tester is depressed too fast, an erroneous pressure reading will result.

4. Slowly depress the plunger of the pressure test pump until the pressure gauge reading stops increasing and note the highest pressure reading obtained. If the pressure reading exceeds the maximum cap pressure listed in the **SPECIFICATIONS** , install a new pressure relief cap.
5. If the system does not hold pressure, remove the pressure relief cap and wash in clean water to dislodge all the foreign material from the gasket. Check the sealing surface in the filler neck of the degas bottle for nicks or cuts. Install the pressure relief cap.
6. Pressurize the engine cooling system as described in Step 4 above. Observe the gauge reading for approximately 2 minutes. Pressure should not drop during this time. If the pressure drops within this time, inspect for leaks and repair as necessary.
7. If no leaks are found and the pressure drops. the pressure relief cap may be leaking. Install a new pressure relief cap and retest the system.
8. If no leaks are found after a new pressure relief cap is installed, and the pressure drops, the leak may be internal to the radiator transmission cooler (if equipped). Inspect the coolant for transmission fluid and the transmission fluid for coolant. Repair as necessary.
9. If there is no contamination of the coolant or transmission fluid, the leak may be internal to the engine. Inspect the coolant for engine oil and the engine oil for coolant. Refer to **ENGINE SYSTEM - GENERAL INFORMATION** article to diagnose the engine.
10. Release the system pressure by loosening the pressure relief cap. Check the coolant level and adjust as necessary.

Pressure Test - Coolant Expansion Tank Systems

WARNING: **Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

NOTE: **Vehicles equipped with a degas bottle system have the pressure relief cap on the degas bottle and no radiator cap. Vehicles equipped with a coolant expansion tank system have the pressure relief cap on the radiator.**

1. Turn the engine OFF.
2. Remove the pressure relief cap. Top off the radiator as needed. Fit the pressure tester to the radiator fill neck.

    CAUTION: **Do not pressurize the cooling system beyond 138 kPa (20 psi) or cooling system components may be damaged.**

    NOTE: **If the plunger of the pressure tester is depressed too fast, an incorrect pressure reading will result.**

3. Pump the cooling system to a maximum of 138 kPa (20 psi) and hold for 2 minutes. If the pressure drops within this time, inspect for leaks and repair as necessary.
4. If no leaks are found and the pressure drops, the leak may be internal to the radiator transmission cooler (if equipped). Inspect the coolant for transmission fluid and the transmission fluid for coolant. Repair as necessary.
5. If there is no contamination of the coolant or transmission fluid, the leak may be internal to the engine. Inspect the coolant for engine oil and the engine oil for coolant. Refer to **ENGINE SYSTEM - GENERAL INFORMATION** article to diagnose the engine.

Cap

1. Inspect the pressure relief cap and seals for damage or deterioration. Install a new pressure relief cap if necessary.
2. Fit the pressure relief cap to the Radiator/Heater Core Pressure Tester Kit using the correct adapter.

    NOTE: **If the plunger of the pressure tester is depressed too fast, an incorrect pressure reading will result.**

3. Slowly pump the pressure tester until the pressure gauge stops increasing and note the highest pressure reading. Release the pressure and repeat the test. Install a new pressure relief cap if the pressure is not within specification. Refer to the **GENERAL SPECIFICATIONS** table in this service information.

Thermostat

A new thermostat should be installed only after the following tests and checks have been carried out:

- Pinpoint Test A, B or C
- Thermostat Visual Inspection

Thermostat Visual Inspection

1. Remove the thermostat.
2. Examine the thermostat for signs of damage including:
    - Valve not fully seated (light visible through the valve)
    - Foreign material lodged in the main valve
    - Bent or broken frame or flange
    - Bent or broken spring
    - Bent or broken valve or valve stem
    - Wax leaking from wax reservoir or a bulge in the reservoir
    - Any other damage or distortion

NOTE: If no damage is found during the inspection, do not attempt to open the thermostat using hot water or other heat sources. This method is not an accurate means to test the function of the thermostat and may damage the thermostat.

3. If damage is found during the inspection, remove any foreign material or broken pieces and install a new thermostat.
4. If no damage is found during the inspection, continue troubleshooting the system concern. Go to the Symptom Chart for further instructions.

Radiator Leak Test, Removed From Vehicle

CAUTION: Never leak test an aluminum radiator in the same water that copper/brass radiators are tested in. Flux and caustic cleaners may be present in the cleaning tank and they will damage aluminum radiators.

NOTE: Always install plugs in the oil cooler fittings before leak testing or cleaning any radiator.

NOTE: Clean the radiator before leak testing to avoid contamination of tank.

1. Leak test the radiator in clean water with 138 kPa (20 psi) air pressure.

Fan Clutch Test

1. Turn the engine OFF and wait until the fan comes to a complete stop.
2. Spin the fan blade by hand. A light resistance should be felt. If there is no resistance or very high resistance, the minimum and maximum fan speeds must be checked. For an electronically actuated fan clutch, refer to the **INTRODUCTION - GASOLINE ENGINES** article. For a viscous fan clutch, carry out the following:

Fan Clutch Test - Minimum Speed Requirement

1. Use a suitable marker to mark the coolant pump or fan pulley and one of the fan blades.
2. Make sure the A/C is OFF, if equipped.

WARNING: **Do not operate the engine with the hood open until the fan blade has been examined for possible cracks and separation. A damaged fan can separate during operation. Failure to follow this instruction may result in serious personal injury.**

3. Start the engine and run it at approximately 2,000 RPM for 5 minutes or until there is a noticeable reduction in fan noise to allow the fan clutch to go into disengaged mode.
4. Aim a laser photo tachometer at the coolant pump or fan pulley. Run the engine to achieve 3,000 RPM at the coolant pump or fan pulley.
5. With the coolant pump or fan pulley at 3,000 RPM, aim the laser photo tachometer at the fan blade. Monitor and record fan speed.
6. The fan blade speed must be less than the specified RPM at 3,000 RPM coolant pump or fan pulley RPM. Refer to **SPECIFICATIONS** table in this service information for correct fan speed.
7. Turn the engine off.
8. If the fan blade speed was greater than specified, install a new fan clutch.

Fan Clutch Test - Maximum Speed Requirement

1. Use a suitable marker to mark the coolant pump or fan pulley and one of the fan blades.
2. Block off areas on each side of the radiator in the engine compartment, the front of the radiator grille and the bumper. Close the hood. This will raise the temperature of the air striking the fan clutch and should cause the fan blade to operate at maximum speed.
3. Place the climate control function selector switch in the MAX A/C position and the blower motor switch in the HI position, if equipped.

WARNING: **Do not operate the engine with the hood open until the fan blade has been examined for possible cracks and separation. A damaged fan can separate during operation. Failure to follow this instruction may result in serious personal injury.**

NOTE: **Do not open the hood to check the coolant pump or fan pulley temperature. This will lower the temperature of the air reaching the fan clutch and void the test. Aim the infrared thermometer through the wheel well or from under the vehicle.**

4. Start the engine and run it at approximately 2,000 RPM until normal operating temperature has been achieved. Using an infrared thermometer, monitor the coolant pump or fan pulley. Run the engine until the coolant pump or fan pulley is at least 96°C (205°F).

NOTE: **Do not open the hood to check the coolant pump or fan pulley or fan blade**

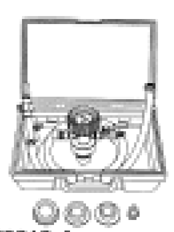
speed. This will lower the temperature of the air reaching the fan clutch and void the test. Aim the laser photo tachometer through the wheel well or from under the vehicle.

5. Aim a laser photo tachometer at the coolant pump or fan pulley. Run the engine to achieve 3,000 RPM at the coolant pump or fan pulley.
6. With the coolant pump or fan pulley at 3,000 RPM, aim the laser photo tachometer at the fan blade. Monitor and record fan blade speed.
7. The fan blade speed must be greater than the specified RPM at 3,000 RPM coolant pump or fan pulley RPM. Refer to **SPECIFICATIONS** in this service information for correct fan speed.
8. Open the hood and allow the engine to idle momentarily to lower engine temperature. Turn the engine off and remove the blocks from the radiator, grille and bumper.
9. If the fan blade speed is less than specified, install a new fan clutch.

GENERAL PROCEDURES

COOLING SYSTEM DRAINING, FILLING AND BLEEDING

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
	RADKITPLUS	078-00497

MATERIAL

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1

Draining

WARNING: **Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

CAUTION: The coolant must be recovered in a suitable, clean container for reuse. If the coolant is contaminated, it must be recycled or disposed of correctly. Using contaminated coolant may result in damage to the engine or cooling system components.

CAUTION: The engine cooling system is filled with Motorcraft Premium Gold Engine Coolant. Mixing coolant types degrades the corrosion protection of Motorcraft Premium Gold Engine Coolant.

NOTE: Stop-leak style pellets/products must not be used as an additive in this engine cooling system. The addition of stop-leak style pellets/products can clog or damage the cooling system resulting in degraded cooling system performance and/or failure.

NOTE: Less than 80% of coolant capacity can be recovered with the engine in the vehicle. Dirty, rusty or contaminated coolant requires replacement.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Release the pressure in the cooling system by slowly turning the pressure relief cap 1/2 turn counterclockwise. When the pressure is released, remove the pressure relief cap.
3. Place a suitable container below the radiator draincock.
    - Open the draincock and allow to drain.
    - Close the draincock after draining.
4. When the coolant is drained, make sure drain plugs are installed and tight.

Filling and Bleeding with RADKITPLUS

1. Using the special tool, install the RADKITPLUS and follow the manufacturer's instructions to fill and bleed the cooling system.

Filling and Bleeding without RADKITPLUS

CAUTION: Engine coolant provides freeze protection, boil protection, cooling efficiency and corrosion protection to the engine and cooling components. In order to obtain these protections, the engine coolant must be maintained at the correct concentration and fluid level in the degas bottle.

When adding engine coolant, use a 50/50 mixture of engine coolant and distilled water.

To maintain the integrity of the coolant and the cooling system:

- **Vehicle cooling systems are filled with Motorcraft Premium Gold**

Engine Coolant. Always fill the cooling system with the same coolant that is present in the system. Do not mix coolant types.

- **Do not add/mix orange-colored Motorcraft Specialty Orange Engine Coolant or equivalent, meeting Ford specification WSS-M97B44-D or green colored Premium Engine Coolant. Mixing coolants may degrade the coolant's corrosion protection.**
- **Do not add alcohol, methanol or brine, or any engine coolants mixed with alcohol or methanol antifreeze. These can cause engine damage from overheating or freezing.**
- **Ford Motor Company does NOT recommend the use of recycled engine coolant in vehicles originally equipped with Motorcraft Premium Gold Engine Coolant since a Ford-approved recycling process is not yet available.**
- **Used engine coolant should be disposed of in an appropriate manner. Follow your community's regulations and standards for recycling and disposing of automotive fluids.**

NOTE: Stop-leak style pellets/products must not be used as an additive in this engine cooling system. The addition of stop-leak style pellets/products can clog or damage the cooling system resulting in degraded cooling system performance and/or failure.

1. Open the degas bottle cap and fill the degas bottle to the MAX fill line.
2. Close the degas bottle cap.

CAUTION: If the engine overheats or the fluid level drops below the minimum fill line, shut off the engine and add fluid to the degas bottle maximum fill line once the engine cools. Failure to follow these instructions may result in damage to the engine.

3. Start the engine and let idle for 10 minutes or until the engine reaches normal operating temperature.
4. Repeat Step 3 if necessary.
5. Start the engine and turn the heater to the MAX position.

CAUTION: If the engine overheats or the fluid level drops below the minimum fill line, shut off the engine and add fluid to the degas bottle maximum fill line once the engine cools. Failure to follow these instructions may result in damage to the engine.

6. Run the engine at 2,500 RPM for 10 minutes.
7. Repeat Step 6 if necessary.

WARNING: Always allow the engine to cool before opening the cooling system.

Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

8. Check the engine coolant level in degas bottle and fill as necessary.

COOLING SYSTEM FLUSHING

MATERIAL

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1
Premium Cooling System Flush VC-1	ESR-M14P7-A

1. To remove rust, sludge and other foreign material from the cooling system, use cooling system flush that is safe for use with aluminum radiators, For additional information, refer to **SPECIFICATIONS**. This cleaning restores cooling system efficiency and helps prevent overheating. A pulsating or reversed direction of flushing water will loosen sediment more quickly than a steady flow in the normal coolant flow direction. In severe cases where cleaning solvents will not clean the cooling system efficiently, it will be necessary to use the pressure flushing method using cooling system flusher. Dispose of old coolant and flushing water contaminated with antifreeze and cleaning chemicals in accordance with local, state or federal laws.
2. Remove the radiator. For additional information, refer to **RADIATOR**.

CAUTION: Radiator internal pressure must not exceed 138 kPa (20 psi). Damage to the radiator can result.

3. Backflush the radiator with the radiator in an upside-down position with a high-pressure hose in the lower hose location and backflush.
4. Remove the thermostat. For additional information, refer to **THERMOSTAT**.
5. Backflush the engine. Position the high-pressure water hose into the engine through the engine return and backflush the engine.

REMOVAL AND INSTALLATION

BLOCK HEATER

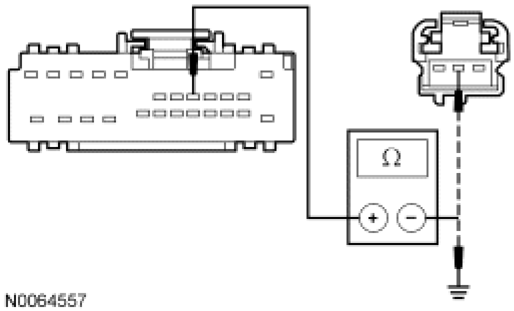


Fig. 3: Exploded View Of Block Heater With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	030104	Block heater cover
2	6B018	Block heater electrical connector
3	6A051	Block heater

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Drain the cooling system. For additional information, refer to **COOLING SYSTEM DRAINING, FILLING AND BLEEDING**.
3. Remove the RH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.
4. Remove the block heater cover.

NOTE: Make sure that the block heater wiring is routed and secured away from rotating or hot components, or damage to the wiring may occur.

5. Disconnect the block heater electrical connector.
6. Remove the block heater.
   - To install, tighten to 40 N.m (30 lb-ft).
7. To install, reverse the removal procedure.
8. Fill and bleed the cooling system. For additional information, refer to **COOLING SYSTEM DRAINING, FILLING AND BLEEDING**.

THERMOSTAT

MATERIAL

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent	WSS-M97B51-A1

(yellow color)	

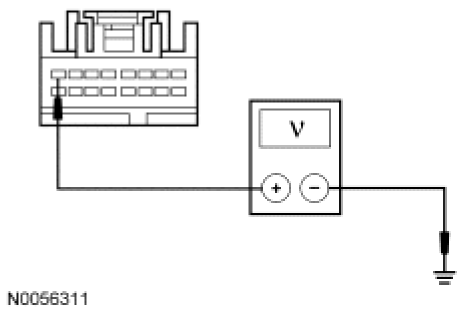


Fig. 4: Exploded View Of Thermostat With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W500014	Thermostat housing cover bolt (2 required)
2	8594	Thermostat housing cover
3	-	O-ring seal
4	8575	Thermostat

REMOVAL AND INSTALLATION

1. Drain the cooling system. For additional information, refer to **COOLING SYSTEM DRAINING, FILLING AND BLEEDING**.
2. Remove the air cleaner assembly and outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.
3. Remove the 2 bolts and position aside the thermostat housing cover.
   - To install, tighten to 10 N.m (89 lb-in).
4. Remove the O-ring seal and thermostat.
   - Clean and inspect the O-ring seal. Install a new seal if necessary.

NOTE: Lubricate the thermostat O-ring seal with clean engine coolant.

5. To install, reverse the removal procedure.
6. Fill and bleed the cooling system. For additional information, refer to **COOLING SYSTEM DRAINING, FILLING AND BLEEDING**.

THERMOSTAT HOUSING

MATERIAL

Item	Specification

Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1

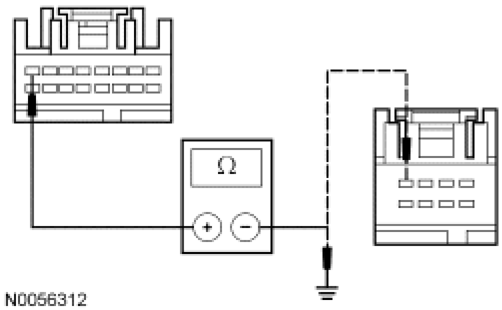


Fig. 5: Identifying Thermostat Housing With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	8W005	Vent hose
2	8B273	Lower radiator hose
3	8B274	Upper radiator hose
4	18K580	Heater core outlet hose
5	18K579	Heater core inlet hose
6	W503279	Thermostat housing bolt (3 required)
7	8565	O-ring seal
8	8A571	O-ring seal
9	8A587	Thermostat housing

REMOVAL AND INSTALLATION

1. Drain the cooling system. For additional information, refer to **COOLING SYSTEM DRAINING, FILLING AND BLEEDING**.
2. Remove the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.
3. Disconnect the 5 coolant hoses from the thermostat housing and position them aside.
4. Remove the 3 thermostat housing bolts.
   - To install, tighten to 10 N.m (89 lb-in).

NOTE: Do not pull the other end of the coolant tube out of the engine block when separating the thermostat housing.

5. Separate the thermostat housing from the coolant tube and remove the thermostat housing.
   - Remove and discard the O-ring seals.

6. To install, reverse the removal procedure.
   - Lubricate the new O-ring seals with clean engine coolant.
7. Fill and bleed the cooling system. For additional information, refer to **COOLING SYSTEM DRAINING, FILLING AND BLEEDING**.

COOLANT PUMP

REMOVAL

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan can cause engine failure.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Drain the cooling system.
3. Remove the engine front cover. For additional information, refer to **ENGINE - 3.5L** article.
4. Remove and discard the engine oil filter.
5. Rotate the crankshaft clockwise and align the timing marks on the variable camshaft timing (VCT) assemblies as shown in illustration.

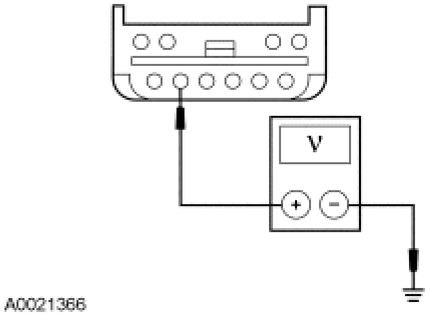


Fig. 6: Aligning Timing Marks On Variable Camshaft Timing (VCT) Assemblies
Courtesy of FORD MOTOR CO.

NOTE: The special tool will hold the camshafts in the top dead center (TDC) position.

6. Install the special tool onto the flats of the LH camshafts.

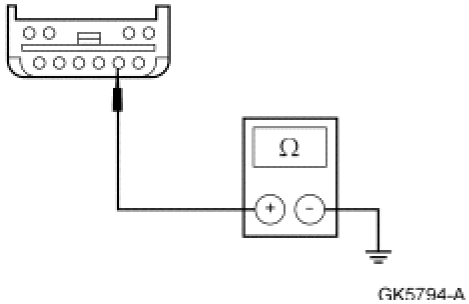


Fig. 7: Installing Special Tool Onto Flats Of LH Camshafts
Courtesy of FORD MOTOR CO.

NOTE: The special tool will hold the camshafts in the TDC position.

7. Install the special tool onto the flats of the RH camshafts.

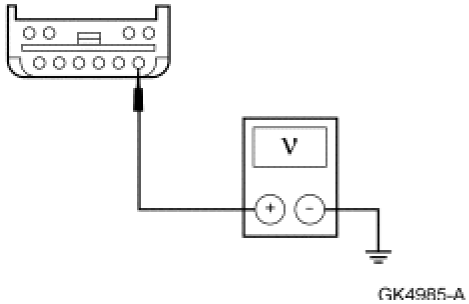


Fig. 8: Installing Special Tool Onto Flats Of RH Camshafts
Courtesy of FORD MOTOR CO.

8. Remove the 3 bolts and the RH VCT housing.

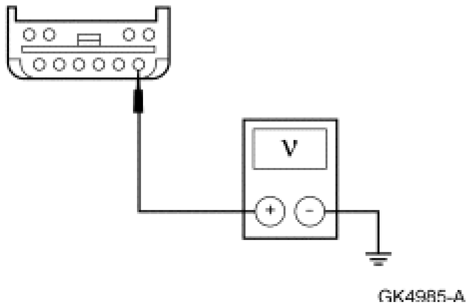


Fig. 9: Locating RH VCT Housing
Courtesy of FORD MOTOR CO.

9. Remove the 3 bolts and the LH VCT housing.

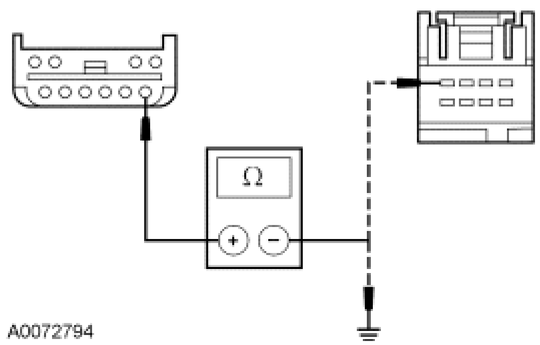


Fig. 10: Locating LH VCT Housing
Courtesy of FORD MOTOR CO.

10. Remove and discard the VCT housing seals.

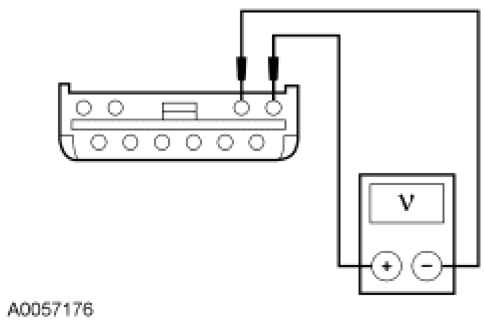


Fig. 11: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

11. Remove the 2 bolts and the primary timing chain tensioner.

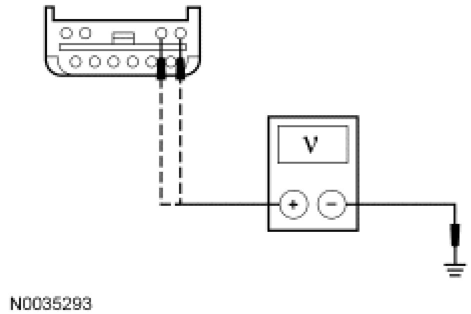


Fig. 12: Locating Primary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

12. Remove the primary timing chain tensioner arm.

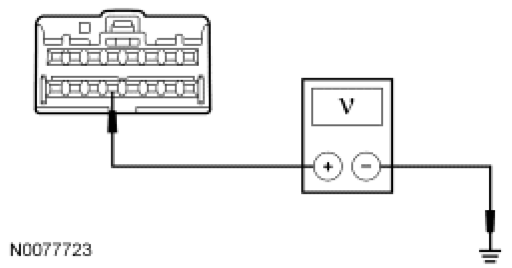


Fig. 13: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

13. Remove the 2 bolts and the lower LH primary timing chain guide.

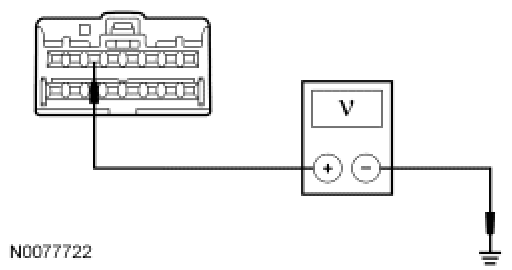


Fig. 14: Locating Lower LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

14. Remove the primary timing chain.

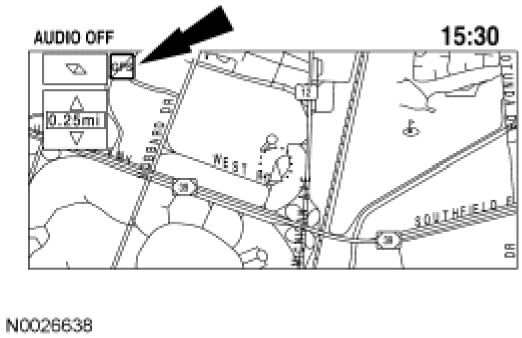
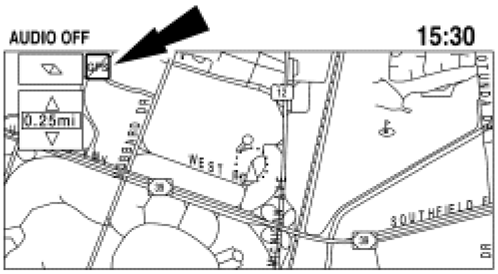


Fig. 15: Locating Primary Timing Chain
Courtesy of FORD MOTOR CO.

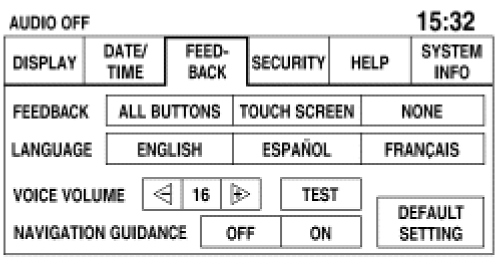
15. Remove the 2 bolts and the upper LH primary timing chain guide.



N0026638

Fig. 16: Locating Upper LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

16. Remove the RH primary timing chain guide lower bolt.

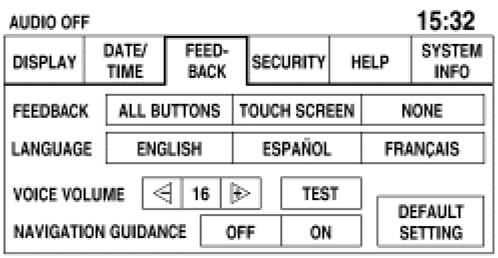


N0026637

Fig. 17: Locating RH Primary Timing Chain Guide Lower Bolt
Courtesy of FORD MOTOR CO.

NOTE: The RH primary timing chain guide must be repositioned to allow the coolant pump to be removed.

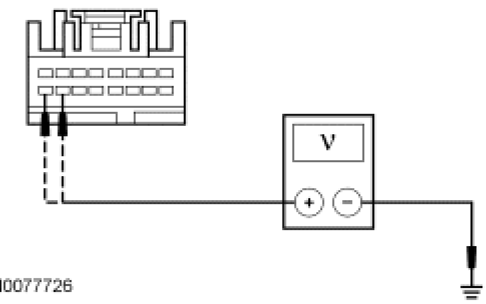
17. Loosen the RH primary timing chain guide upper bolt.
    - Rotate the guide and tighten the bolt.



N0026637

Fig. 18: Locating RH Primary Timing Chain Guide Upper Bolt
Courtesy of FORD MOTOR CO.

18. Place clean lint-free shop towels in the oil pan opening to prevent coolant from entering the oil pan during coolant pump removal.
19. Remove the 8 bolts and the coolant pump.



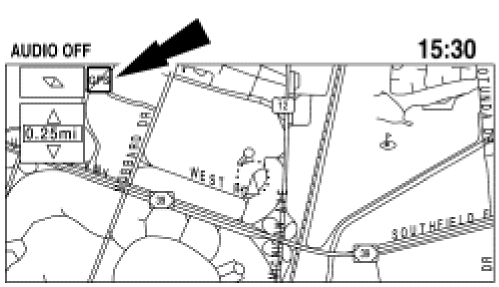
N0077726

Fig. 19: Locating Coolant Pump Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: Clean and inspect all sealing surfaces.

1. Install the coolant pump and the 8 bolts.
   - Tighten in the sequence shown in illustration to 10 N.m (89 lb-in).



N0026638

Fig. 20: Identifying Coolant Pump Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

2. Remove all of the shop towels from the oil pan opening.

CAUTION: Any coolant that has accumulated in the oil pan must be drained from the pan and any residual coolant cleaned from the front of the engine and oil pan. Failure to remove all traces of the coolant can result in oil contamination and severe engine damage.

3. Remove the oil pan drain plug and allow any accumulated coolant to drain.
   - Remove any residual coolant from the front of the engine and the oil pan using regulated

compressed air and clean lint-free shop towels.
- Install the oil pan drain plug and tighten to 27 N.m (20 lb-ft).

4. Loosen the RH primary timing chain guide upper bolt.
    - Position the RH primary timing chain guide and install the lower bolt.
    - Tighten the 2 bolts to 10 N.m (89 lb-in).

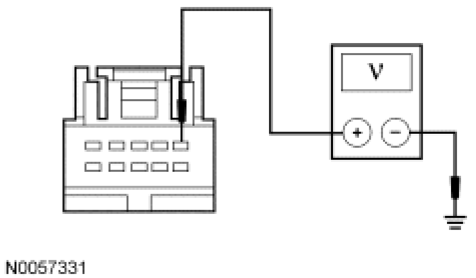


Fig. 21: Locating RH Primary Timing Chain Guide Lower Bolt
Courtesy of FORD MOTOR CO.

5. Install the primary timing chain with the colored links aligned with the timing marks on the VCT assemblies and the crankshaft sprocket.

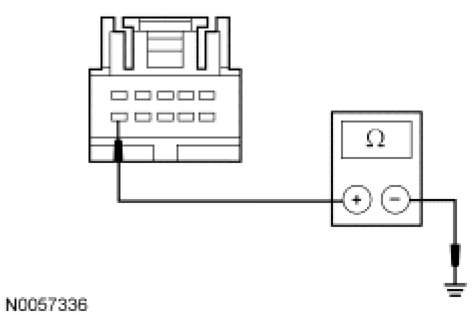


Fig. 22: Aligning Timing Marks On VCT Assemblies & Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

6. Install the upper LH primary timing chain guide and the 2 bolts.
    - Tighten to 10 N.m (89 lb-in).

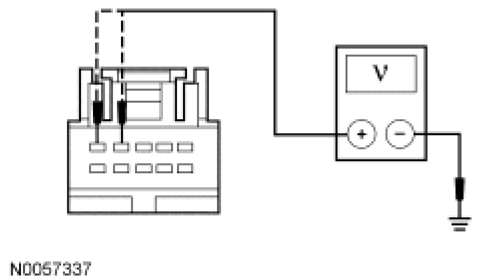


Fig. 23: Locating Upper LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

7. Install the lower LH primary timing chain guide and the 2 bolts.
   - Tighten to 10 N.m (89 lb-in).

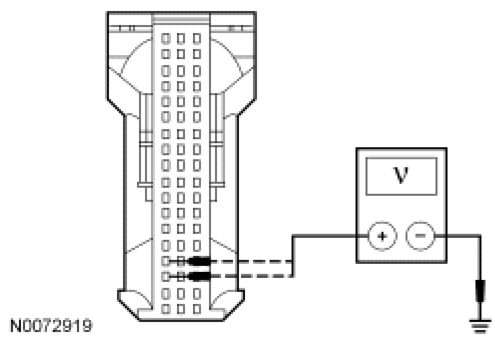


Fig. 24: Locating Lower LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

8. Install the primary timing chain tensioner arm.

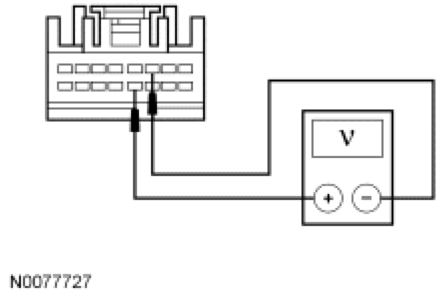
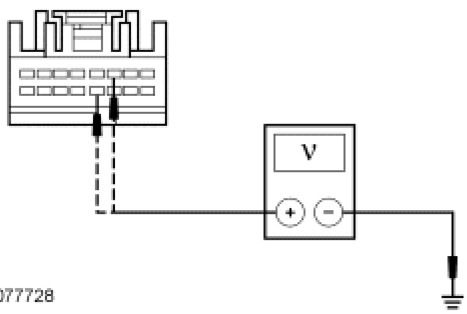


Fig. 25: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

9. Reset the primary timing chain tensioner.
   - Rotate the lever counterclockwise.

- Using a soft-jawed vise, compress the plunger.
- Align the hole in the lever with the hole in the tensioner housing.
- Install a suitable lock pin.

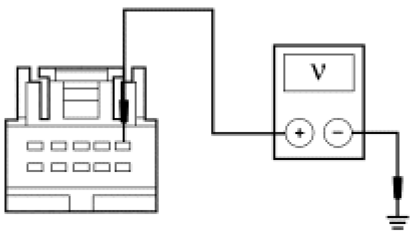


N0077728

Fig. 26: Compressing Plunger Using A Soft-Jawed Vise
Courtesy of FORD MOTOR CO.

NOTE: **It may be necessary to rotate the crankshaft slightly to remove slack from the timing chain and install the tensioner.**

10. Install the primary tensioner and the 2 bolts.
    - Tighten to 10 N.m (89 lb-in).
    - Remove the lock pin.



N0057331

Fig. 27: Locating Primary Tensioner Bolts
Courtesy of FORD MOTOR CO.

11. As a post check, verify correct alignment of all timing marks.

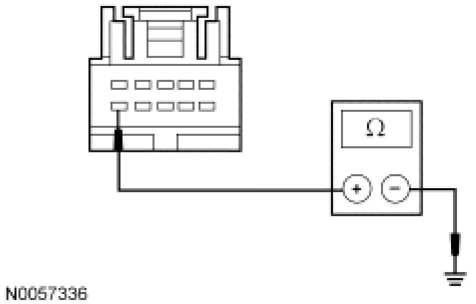


Fig. 28: Verifying Correct Alignment Of All Timing Marks
Courtesy of FORD MOTOR CO.

12. Install new VCT housing seals.

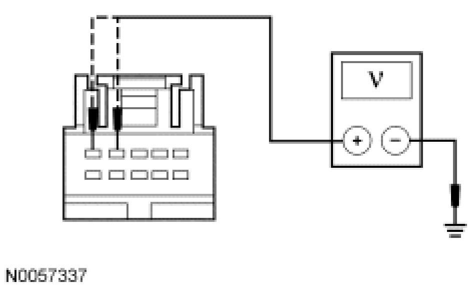


Fig. 29: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

CAUTION: Make sure the dowels on the variable camshaft timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

13. Install the LH VCT housing and the 3 bolts.
    - Tighten in the sequence shown in illustration to 10 N.m (89 lb-in).

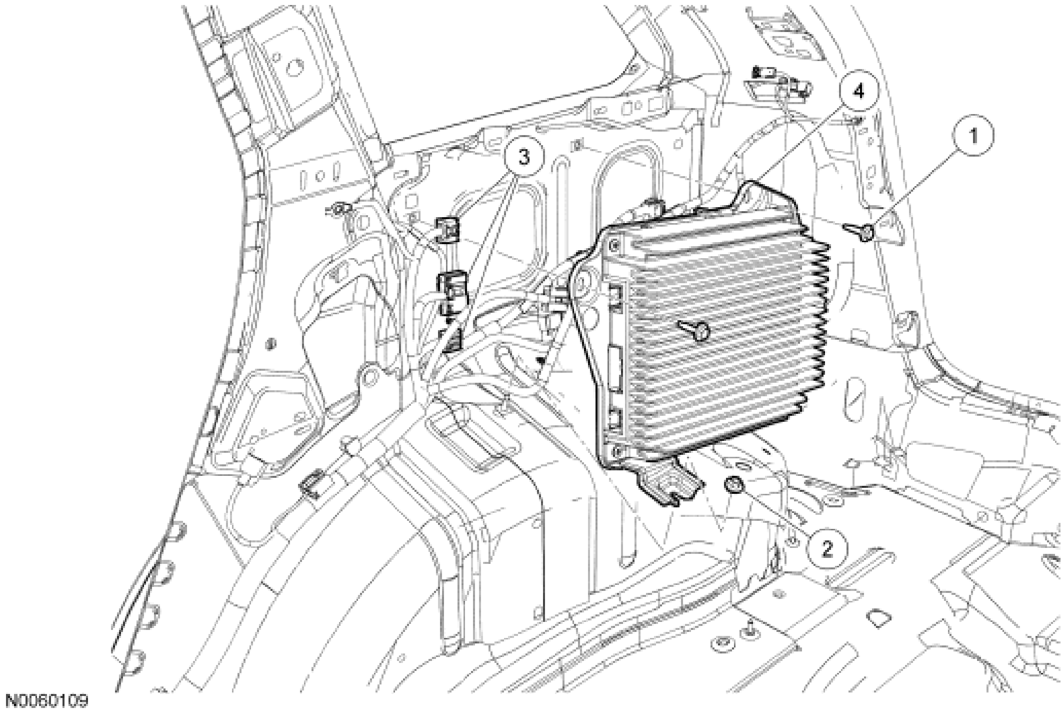


Fig. 30: Identifying LH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

CAUTION: Make sure the dowels on the variable camshaft timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

14. Install the RH VCT housing and the 3 bolts.
    - Tighten in the sequence shown in illustration to 10 N.m (89 lb-in).

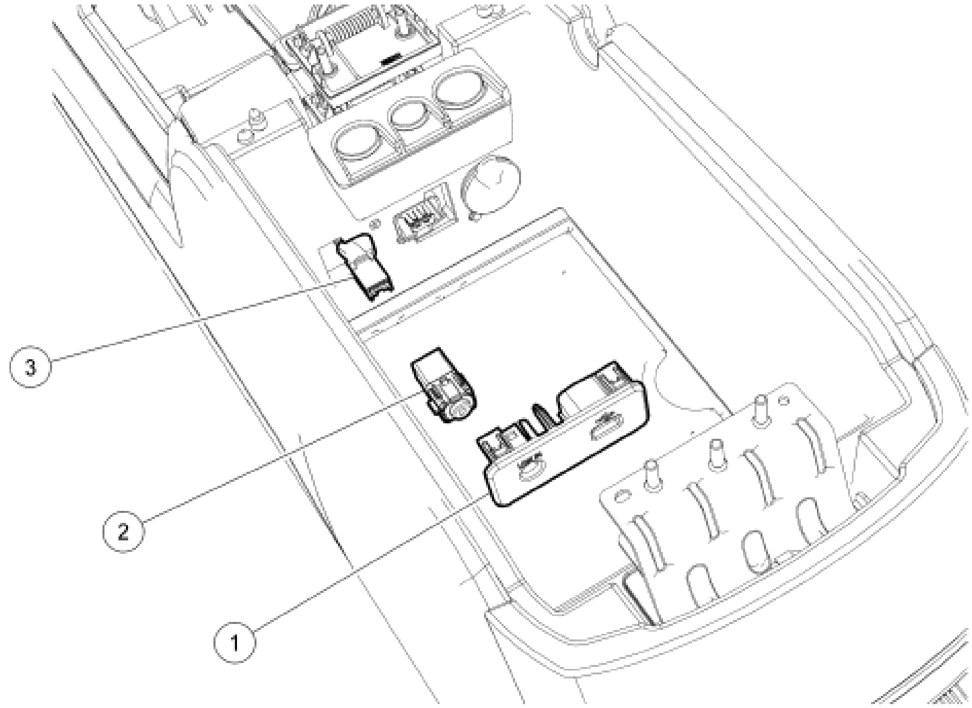


Fig. 31: Identifying RH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the engine oil filter gasket with clean engine oil prior to installing the oil filter.

15. Install a new engine oil filter.
    - Tighten to 5 N.m (44 lb-in) and then rotate an additional 180 degrees.
16. Install the engine front cover. For additional information, refer to **ENGINE - 3.5L** article.
17. Fill and bleed the cooling system.

COOLING FAN MOTOR AND SHROUD

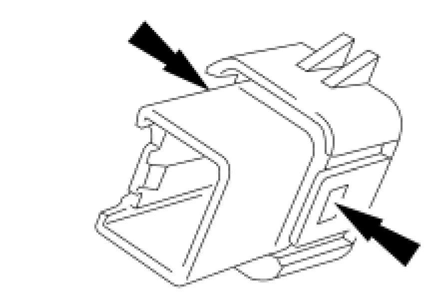


Fig. 32: Exploded View Of Cooling Fan Motor & Shroud With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	13A506	Wiring harness retainer
2	8B274	Upper radiator hose
3	14A464	Cooling fan motor and shroud electrical connector
4	W503924	Cooling fan motor and shroud bolt (2 required)
5	8C607	Cooling fan motor and shroud
6	W503924	Oil cooler bracket bolt (if equipped)
7	-	Oil cooler bracket (if equipped)

REMOVAL AND INSTALLATION

1. Remove the air cleaner assembly. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.
2. If equipped, detach the 2 block heater wiring clips from the radiator support.

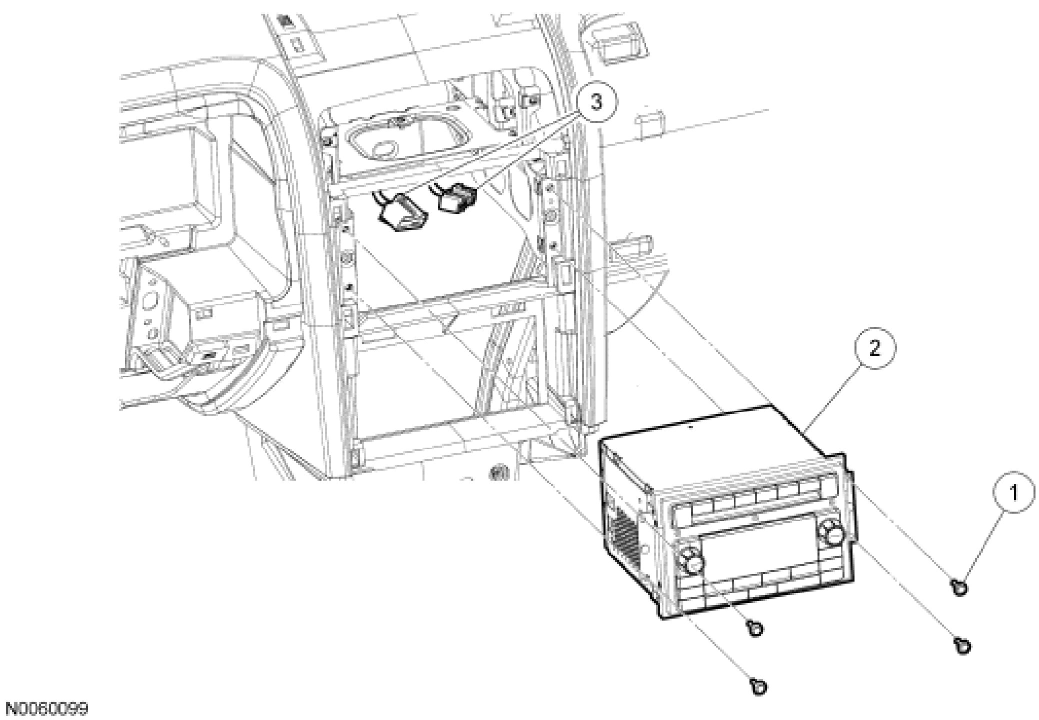


Fig. 33: Identifying Block Heater Wiring Clips
Courtesy of FORD MOTOR CO.

3. Detach the wiring harness retainers and position the harness aside.
4. Position aside the upper radiator hose from the cooling fan motor and shroud.
5. Disconnect the cooling fan motor and shroud electrical connector.
6. If equipped, remove the bolt and position aside the oil cooler bracket.

- To install, tighten to 6 N.m (53 lb-in).

7. Remove the 2 bolts and the cooling fan motor and shroud.
    - To install, tighten to 6 N.m (53 lb-in).
8. To install, reverse the removal procedure.

RADIATOR

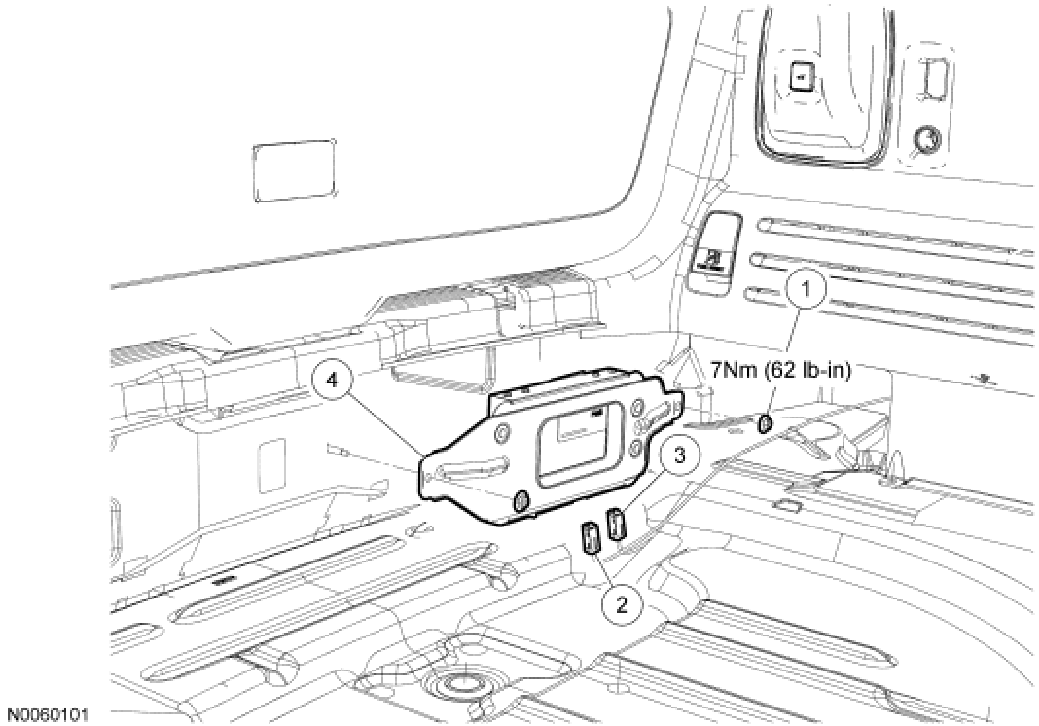


Fig. 34: Exploded View Of Radiator (Without A/C)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	8B274	Upper radiator hose
2	8C633	Lower degas bottle hose
3	8B273	Lower radiator hose
4	8A194	Upper radiator support bracket (2 required)

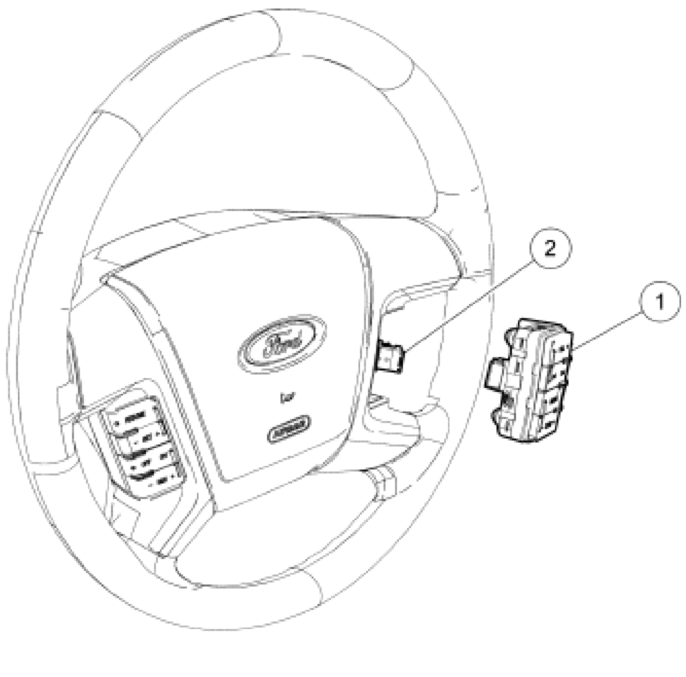


Fig. 35: Exploded View Of Radiator (With A/C) With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
5	-	A/C condenser bolt (2 required)
6	19710	A/C condenser
7	8005	Radiator
8	19D738	Pin-type retainer (2 required)
9	W707400	Compressor-to-condenser discharge line bracket bolt

REMOVAL AND INSTALLATION

1. Drain the cooling system. For additional information, refer to **COOLING SYSTEM DRAINING, FILLING AND BLEEDING**.
2. Remove the cooling fan motor and shroud. For additional information, refer to **COOLING FAN MOTOR AND SHROUD**.
3. Remove the front bumper cover. For additional information, refer to **BUMPERS** article.
4. Disconnect the upper radiator hose and lower degas bottle hose from the radiator.
5. Disconnect the lower radiator hose from the radiator.
6. Remove the compressor-to-condenser discharge line bracket bolt.
    - To install, tighten to 7 N.m (62 lb-in).
7. Lift and remove the tabs from the radiator support and position the radiator towards the engine.

8. Detach the 2 pin-type retainers from the radiator.
9. Remove the 2 A/C condenser bolts from the radiator and separate the condenser from the radiator.
   - To install, tighten to 10 N.m (89 lb-in).
10. Remove the radiator.
11. To install, reverse the removal procedure.
12. Fill and bleed the cooling system. For additional information, refer to **COOLING SYSTEM DRAINING, FILLING AND BLEEDING**.

DEGAS BOTTLE

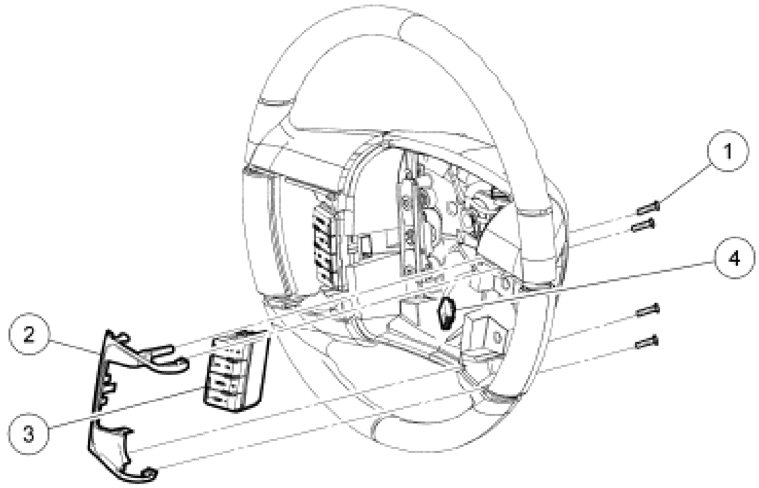


Fig. 36: Exploded View Of Degas Bottle With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	8W005	Upper degas bottle hose
2	8C633	Lower degas bottle hose
3	N807658	Degas bottle-to-fender bolt (2 required)
4	N807658	Degas bottle-to-washer bottle screw
5	8A080	Degas bottle
6	8100	Pressure relief cap

REMOVAL AND INSTALLATION

WARNING: **Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

1. Release the pressure in the cooling system by slowly turning the pressure relief cap one half turn counterclockwise. When the pressure is released, remove the pressure relief cap.
2. Using hose clamp pliers, clamp the lower degas bottle hose.
3. Using a suitable suction device, siphon the coolant from the degas bottle.
4. Disconnect the upper degas bottle hose and position it aside.
5. Disconnect the lower degas bottle hose and position it aside.
6. Remove the degas bottle-to-washer bottle screw.
7. Remove the 2 bolts and the degas bottle.
   - To install, tighten to 9 N.m (80 lb-in).
8. To install, reverse the removal procedure.
9. Fill the degas bottle. For additional information, refer to **COOLING SYSTEM DRAINING, FILLING AND BLEEDING** for the recommended coolant mixture and fill level.

2008 ACCESSORIES & BODY, CAB

Speed Control - Edge & MKX

DESCRIPTION AND OPERATION

SPEED CONTROL

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

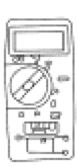
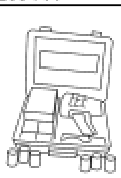
The speed control system consists of the following components:

- Speed control switches
- Speed control deactivator switch (part of the stoplamp switch)
- Stoplamp switch
- Speed control indicator
- PCM

DIAGNOSTIC TESTS

SPEED CONTROL

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST1300-A	Restraint System Diagnostic Tool (2 required)	418-F395

	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The speed control system is controlled by the PCM. The speed control system is designed to maintain a selected vehicle speed between 48 km/h (30 mph) and the maximum limited vehicle speed. The speed control system is controlled by the steering wheel mounted switches (ON, OFF, SET+, SET- and RESUME), the stoplamp switch, and the speed control deactivator switch (part of the stoplamp switch). The steering wheel mounted switches are hardwired to the PCM through the clockspring.

The speed control functions include:

- Turning the speed control system on
- Setting and maintaining the desired vehicle speed
- Accelerating the vehicle speed
- Decelerating the vehicle speed
- Turning the vehicle speed control system off
- Canceling the speed control

Pressing and releasing the ON switch turns the speed control system on. Pressing and releasing the SET+ or SET- switch while the vehicle is traveling at the desired speed activates the speed control system.

Tapping the SET+ or the SET- switch while in the set mode respectively, increases or decreases the maintained vehicle speed by 1.6 km/h (1 mph) per tap. If the respective button is pressed and held, the vehicle speed continues to accelerate or decelerate until the button is released.

Pressing and releasing the OFF switch, or switching the ignition switch to the OFF position, turns the speed control system off. Applying the brake pedal puts the speed control system into the STANDBY mode. Pressing the RESUME button, when the speed control system is in the STANDBY mode causes the vehicle to accelerate to the last set speed. Resume does not function if the OFF button is pressed, the ignition switch is in the OFF position, or if the current vehicle speed is below the minimum operational speed.

The clockspring provides the electrical interface between the steering column wiring and the speed control switches in the steering wheel.

The speed control deactivator switch (part of the stoplamp switch) is provided as an additional safety feature. When the brake pedal is applied, the speed control deactivator switch opens and removes the voltage signal from the PCM input circuit, deactivating the speed control system.

Whenever the speed control system is engaged and active, a speed control icon on the instrument cluster (IC) is illuminated.

The inputs to the PCM are:

- Output shaft speed (OSS) sensor
- Digital transmission range (TR) sensor
- Speed control switch
- Speed control deactivator switch (part of the stoplamp switch)
- Accelerator pedal position sensor
- Smart junction box (SJB)
- Parking brake

The outputs of the PCM are:

- Speed control indicator lamp
- Throttle command

The speed control system throttle position is completely controlled by the PCM through the electronically controlled throttle body. Speed control electronics are contained entirely within the PCM.

When the speed control system is active, the PCM corrects for deviations in the actual vehicle speed by proportionally moving the throttle plate. The PCM modulates the throttle to minimize error between the actual vehicle speed and the desired speed.

The PCM strategy uses the throttle control for smooth accelerations.

The PCM sends a message over the controller area network (CAN) to the instrument cluster (IC) whenever the speed control telltale should be turned on or off.

In the event of an off command or a deactivation request from any source, the speed control system carries out a deactivation and immediately returns the throttle to the idle position.

The speed control system provides self-diagnostics. Speed control is disabled anytime an error is detected in the system. No cluster telltale or message center messages are displayed when faults occur. Fault codes are logged by the PCM.

An electronically controlled throttle system fault also causes the speed control system to be disabled and the malfunction indicator lamp (MIL) illuminates, or a message center message is displayed.

Additionally, the following conditions cause the speed control system to deactivate:

- Transmission gear selector in a position other than D or OD
- Speed control set speed is over-ridden with the accelerator pedal for a period longer than 5 minutes

- Vehicle speed loss from set speed of greater than 16 km/h (10 mph) occurs
- Vehicle speed falls below the minimum allowable limit of 48 km/h (30 mph)
- Parking brake is applied
- Speed control switch is pressed or stuck for longer than 2 minutes

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Throttle body	• Battery junction box (BJB) fuse 32 (10A) • Wiring, terminals or connectors • Speed control switch • Speed control deactivator switch (part of the stoplamp switch) • Stoplamp switch • PCM

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. Verify the speedometer operates correctly without speed control by test driving the vehicle. If the speedometer does not operate correctly, refer to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, & WARNING CHIMES** article.
5. Verify the stoplamps operate correctly with the ignition switch in the ON position. If the stoplamps do not operate correctly, refer to **EXTERIOR LIGHTING** article.
6. Verify the parking brake warning indicator is operating correctly. If the parking brake warning indicator does not operate correctly, refer to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, & WARNING CHIMES** article.

NOTE: Make sure to use the latest scan tool software release.

7. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

8. If the scan tool does not communicate with the VCM:

- Check the VCM connection to the vehicle.
- Check the scan tool connection to the VCM.
- Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.

9. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
10. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record the continuous memory DTCs.
11. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM.
12. If the DTCs retrieved are related to the concern, go to **PCM DTC CHART**. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
13. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

PCM DTC CHART

DTCs	Description	Action
P0579	Cruise Control Multifunction Input A Circuit Range/Performance	Go to **Pinpoint Test C** .
P0581	Cruise Control Multifunction Circuit High	Go to **Pinpoint Test C** .
P1572	Brake Pedal Switch Circuit	Go to **Pinpoint Test B** .
P1703	Brake Switch Out of Self-Test Range	Go to **Pinpoint Test B** .
All other DTCs	-	REFER to the **INTRODUCTION - GASOLINE ENGINES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The speed control is inoperative	• PCM not configured for speed control • Stoplamp switch • Speed control switch • Digital transmission range (TR) sensor • Vehicle speed signal	• Go to **Pinpoint Test A** .

	• PCM	
• The speed control indicator lamp is always on	• Wiring, terminals or connectors • Instrument cluster (IC) • PCM	• REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, & WARNING CHIMES** article.

Pinpoint Tests

Pinpoint Test A: The Speed Control Is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Speed Control for schematic and connector information.

Normal Operation

The PCM sends a signal through circuit VES10 (WH) to the speed control switches, which passes through the clockspring. The return signal is sent to the PCM through circuit RES08 (GN/BN) and the clockspring. When the brake pedal is applied, the SJB sends a message to the PCM to deactivate the speed control if engaged.

The speed control deactivator switch (part of the stoplamp switch) interrupts circuit CES09 (VT/OG) removing the voltage signal to the PCM when the brake pedal is applied. This is a redundant signal to the PCM.

This pinpoint test is intended to diagnose the following:

- PCM not configured for speed control
- Stoplamp switch
- Speed control switch
- Digital transmission range (TR) sensor
- Vehicle speed signal
- PCM

PINPOINT TEST A: THE SPEED CONTROL IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

A1 VERIFY PCM CONFIGURATION

- Enter the following diagnostic mode on the diagnostic tool: Programmable Parameters
- Verify that the speed control is enabled in the PCM.
- **Is the speed control enabled?**

  YES : Go to A2.

  NO : Enable the speed control in the PCM using the scan tool programmable parameters menu. If no parameter exists, REFER to **MODULE CONFIGURATION** article to carry out PCM programmable module installation (PMI).

A2 RETRIEVE THE RECORDED PCM DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS

- Review the recorded DTCs from the PCM self-test.
- **Are any non-speed control DTCs recorded?**

  YES : REFER to the **INTRODUCTION - GASOLINE ENGINES** article. REPAIR all PCM DTCs and RETEST the speed control.

  NO : Go to A3.

A3 CHECK THE SPEED CONTROL COMMAND SWITCH (SCCS) PID

- Start the engine.
- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger
- With the engine running, monitor the PCM SCCS PID while pressing the speed control switches as follows:

Speed Control Switch	PID Minimum Value	PID Maximum Value
OFF	0.00 volts	1.089 volts
SET -	2.192 volts	3.057 volts
SET +	3.057 volts	3.721 volts
RESUME	3.721 volts	4.209 volts
ON	4.209 volts	4.556 volts
No switch pressed	4.556 volts	4.839 volts

- **Are the PCM SCCS PID values OK?**

  YES : TURN the engine off. Go to A5.

  NO : TURN the engine off. Go to A4.

A4 CHECK THE SPEED CONTROL SWITCH

- Key in OFF position.
- Disconnect: PCM C175b

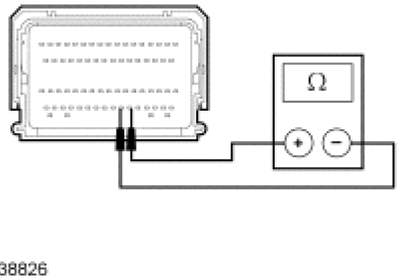


Fig. 1: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and the PCM C175b-57, circuit RES08 (GN/BN), harness side while pressing the speed control switches as follows:

Speed Control Switch	Resistance Value
OFF	Less than 5 ohms
SET -	298 - 304 ohms
SET +	596 - 608 ohms
RESUME	1,101 - 1,123 ohms
ON	2,091 - 2,133 ohms
No switch pressed	4,279 - 4,363 ohms

- **Are the speed control switch resistance values OK?**

  YES : Go to A8.

  NO : INSTALL a new speed control switch. REFER to **SPEED CONTROL SWITCH**. TEST the system for normal operation.

A5 CHECK THE STOPLAMP SWITCH (BOO) PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger
- Monitor the PCM BOO PID.

- Apply and release the brake pedal.
- **Does the PID value agree with the brake pedal position?**

  YES : Go to A6.

  NO : Go to **Pinpoint Test B** .

A6 CHECK THE DIGITAL TRANSMISSION RANGE (TR) SENSOR PID

- Connect: PCM C175b
- Apply the parking brake.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger
- Monitor the PCM TR PID.
- Select DRIVE.
- **Does the PID value agree with the transmission range selector lever position?**

  YES : Go to A7.

  NO : REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article to diagnose the digital TR sensor.

A7 CHECK THE VEHICLE SPEED

NOTE: This step may require an assistant.

- Enter the following diagnostic mode on the diagnostic tool: ABS Control Module DataLogger
- Monitor and record the ABS LF_WSPD PID while driving the vehicle at 48 km/h (30 mph) as indicated on the speedometer.
- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger
- Monitor and record the PCM VSS (vehicle speed) PID while driving the vehicle at 48 km/h (30 mph).
- **Does the speed indicated by the ABS control module wheel speed PID match the PCM VSS PID?**

  YES : Go to A8.

  NO : REFER to the **INTRODUCTION - GASOLINE ENGINES** article to diagnose the output shaft speed (OSS) sensor signal.

A8 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: DTC P1572 or P1703 - Brake On/Off Circuit Failure

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Speed Control for schematic and connector information.

Normal Operation

When the brake pedal is applied, the SJB sends a message to the PCM to deactivate the speed control if engaged.

The speed control deactivator switch (part of the stoplamp switch) interrupts circuit CES09 (VT/OG) removing the voltage signal to the PCM when the brake pedal is applied. This is a redundant signal to the PCM.

- DTC P1572 (Brake Pedal Switch Circuit) - sets when the PCM does not sense the proper sequence of the brake pedal input signal from both the speed control deactivator and stoplamp switches when the brake pedal is pressed and released.
- DTC P1703 (Brake Switch Out of Self-Test Range) - sets when there is an open or short in the deactivator switch circuits or when there is an open or short in the stoplamp circuits.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Speed control deactivator switch (integral to the stoplamp switch)
- ABS control module
- PCM

PINPOINT TEST B: DTC P1572 OR DTC P1703 - BRAKE ON/OFF CIRCUIT FAILURE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

B1 CHECK THE OPERATION OF THE STOPLAMPS

- Key in ON position.
- Operate the stoplamps.
- **Do the stoplamps operate correctly?**

  YES : Go to B2.

  NO : REFER to **EXTERIOR LIGHTING** article.

B2 CHECK CIRCUIT CCB08 (VT/WH) FOR VOLTAGE

- Key in OFF position.
- Disconnect: PCM C175b
- Key in ON position.

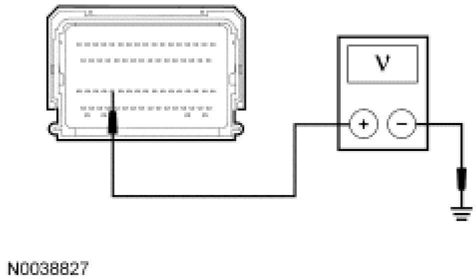


Fig. 2: Measuring Voltage
Courtesy of FORD MOTOR CO.

- While applying the brake pedal, measure the voltage between the PCM C175b-46, circuit CCB08 (VT/WH), harness side and ground.
- **Is the voltage greater than 10 volts with the brake pedal applied?**

  YES : Go to B3.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

B3 CHECK THE SPEED CONTROL DEACTIVATOR SWITCH FOR CORRECT OPERATION

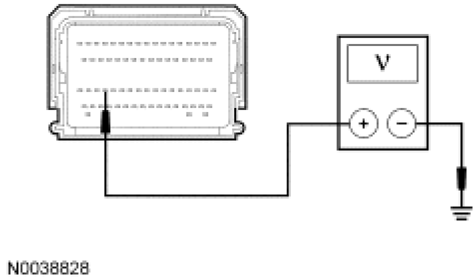


Fig. 3: Measuring Voltage
Courtesy of FORD MOTOR CO.

- While firmly applying and releasing the brake pedal, measure the voltage between the PCM C175b-47, circuit CES09 (VT/OG), harness side and ground.
- **Is the voltage greater than 10 volts with the brake pedal released and 0 volts with the brake pedal firmly applied?**

  YES : Go to B7.

  NO : Go to B4.

B4 CHECK CIRCUIT CBB32 (GN/VT) FOR AN OPEN

- Key in OFF position.
- Disconnect: Stoplamp Switch C2064
- Key in ON position.

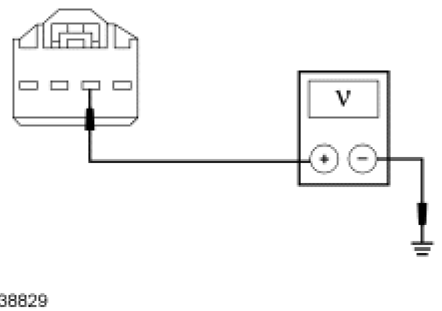


Fig. 4: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the stoplamp switch C2064-2, circuit CBB32 (GN/VT), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to B5.

  NO : VERIFY the battery junction box (BJB) fuse 32 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

B5 CHECK CIRCUIT CES09 (VT/OG) FOR A SHORT TO VOLTAGE

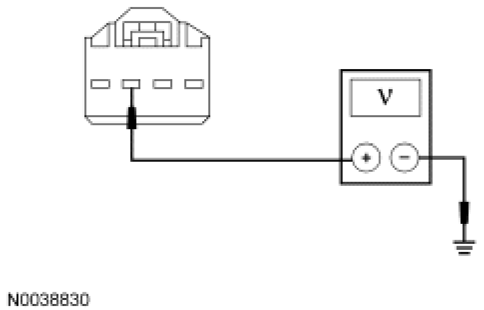


Fig. 5: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the stoplamp switch C2064-3, circuit CES09 (VT/OG), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to B6.

B6 CHECK CIRCUIT CES09 (VT/OG) FOR AN OPEN

- Key in OFF position.

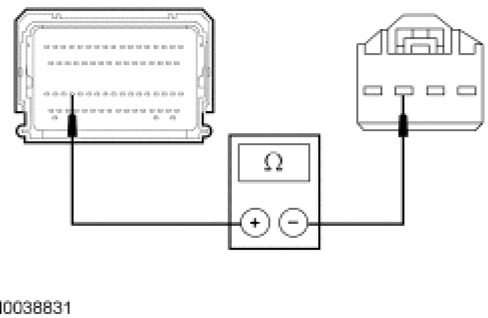


Fig. 6: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the stoplamp switch C2064-3, circuit CES09 (VT/OG), harness side and the PCM C175b-47, circuit CES09 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new stoplamp switch. REFER to **EXTERIOR LIGHTING** article. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to B7.

B7 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test C: DTC P0579 or P0581 - Speed Control Switch Circuit Failure

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Speed Control for schematic and connector information.

Normal Operation

The PCM sends a signal through circuit VES10 (WH) to the speed control switches, which passes through the clockspring. The return signal is sent to the PCM through circuit RES08 (GN/BN) and the clockspring.

- DTC P0579 (Cruise Control Multifunction Input A Circuit Range/Performance) - may set when the speed control switch circuits are open, shorted to voltage or ground.
- DTC P0581 (Cruise Control Multifunction Circuit High) - may set when a speed control switch is stuck or the speed control switch circuits are shorted to voltage or open.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Clockspring
- Speed control switch
- PCM

PINPOINT TEST C: DTC P0579 OR DTC P0581 - SPEED CONTROL SWITCH CIRCUIT FAILURE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

C1 CHECK THE SPEED CONTROL SWITCH CIRCUITRY FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: PCM C175b
- Key in ON position.
- Turn the parking lamps on.

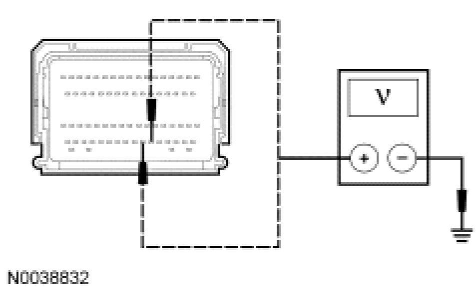


Fig. 7: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.
- **Is any voltage present?**

  YES : TURN the parking lamps off. Go to C2.

NO : TURN the parking lamps off. Go to C4.

C2 CHECK CIRCUITS VES10 (WH) AND RES08 (GN/BN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Clockspring C218a
- Key in ON position.
- Turn the parking lamps on.

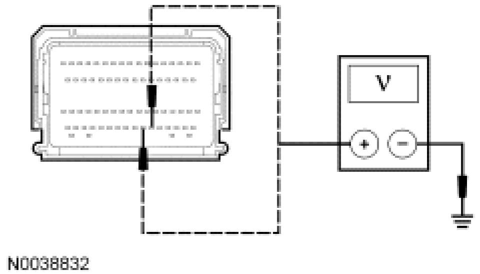


Fig. 8: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

  NO : TURN the parking lamps off. Go to C3.

C3 CHECK THE CLOCKSPRING FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Connect: Clockspring C218a

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Remove the driver air bag module. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Upper Clockspring C218b
- Connect the restraint system diagnostic tools (418-F395) to the upper clockspring air bag connector.
- Connect the battery.
- Key in ON position.
- Turn the parking lamps on.

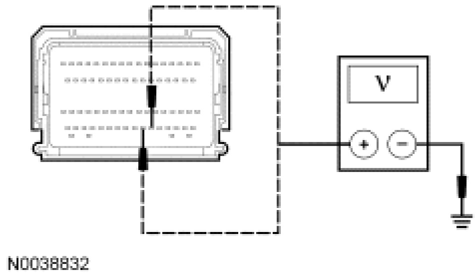


Fig. 9: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.
- **Is any voltage present?**

  YES : INSTALL a new clockspring. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT the battery. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the self-test.

  NO : INSTALL a new speed control switch. REFER to **Speed Control Switch**. DISCONNECT the battery. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the self-test.

C4 CHECK THE SPEED CONTROL SWITCH CIRCUITRY FOR A SHORT TO GROUND

- Key in OFF position.

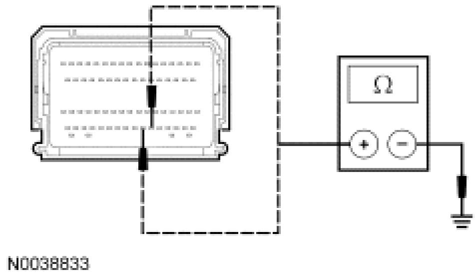


Fig. 10: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to C7.

  NO : Go to C5.

C5 CHECK THE CLOCKSPRING FOR A SHORT TO GROUND

- Remove the driver air bag module. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

- Disconnect: Upper Clockspring C218b

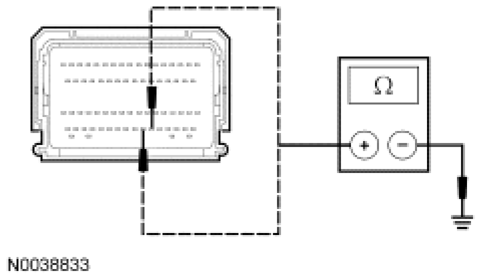


Fig. 11: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new speed control switch. REFER to **Speed Control Switch**. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to C6.

C6 CHECK CIRCUITS VES10 (WH) AND RES08 (GN/BN) FOR A SHORT TO GROUND

- Disconnect: Clockspring C218a

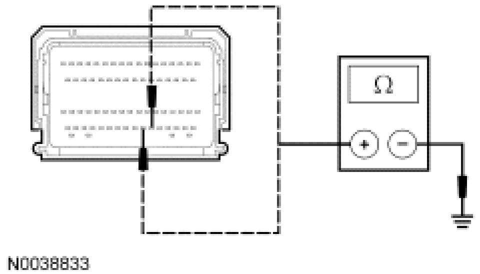


Fig. 12: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new clockspring. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR the circuit in question. INSTALL the driver air bag module. REFER to

SUPPLEMENTAL RESTRAINT SYSTEM article. CLEAR the DTCs. REPEAT the self-test.

C7 CHECK THE SPEED CONTROL SWITCH CIRCUITRY FOR AN OPEN

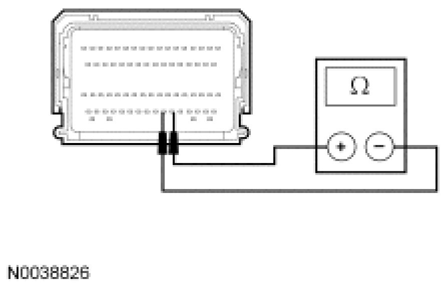


Fig. 13: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and the PCM C175b-57, circuit RES08 (GN/BN), harness side.
- **Is the resistance between 4,279 and 4,363 ohms?**

  YES : Go to C10.

  NO : Go to C8.

C8 CHECK CIRCUITS VES10 (GN/BK) AND RES08 (GN/BN) FOR AN OPEN

- Disconnect: Clockspring C218a

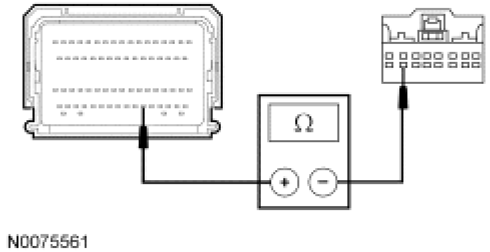


Fig. 14: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and the clockspring C218a-15, circuit VES10 (WH), harness side.

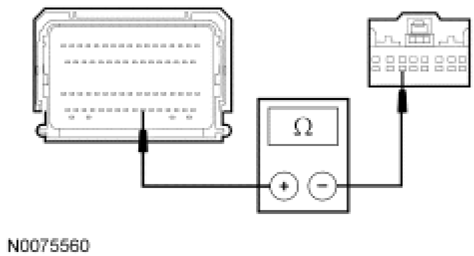


Fig. 15: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-57, RES08 (GN/BN), harness side and the clockspring C218a-14, circuit RES08 (GN/BN), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to C9.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C9 CHECK THE CLOCKSPRING

- Remove the driver air bag module. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

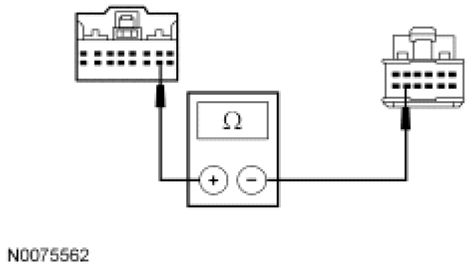


Fig. 16: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218a pin 15, component side and the upper clockspring C218b pin 8, component side.

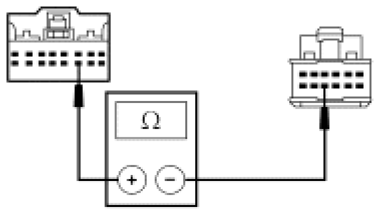


Fig. 17: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218a pin 14, component side and the upper clockspring C218b pin 9, component side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new speed control switch. REFER to **Speed Control Switch**. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the self-test.

  NO : INSTALL a new clockspring. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the self-test.

C10 CHECK FOR CORRECT PCM OPERATION

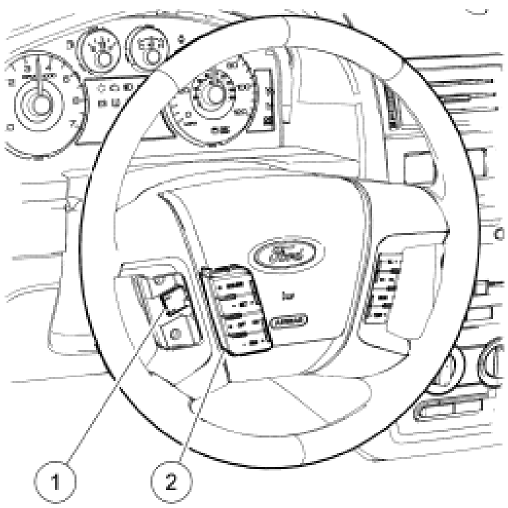
- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the self-test.

REMOVAL AND INSTALLATION

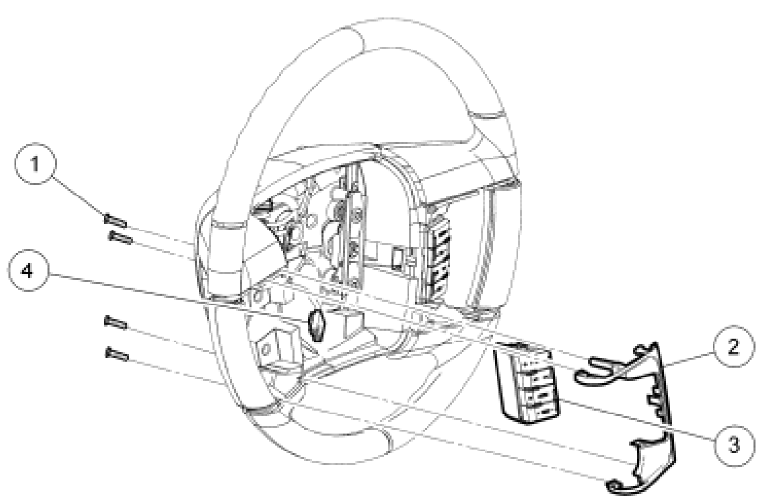
SPEED CONTROL SWITCH



N0060150

Fig. 18: Exploded View Of Speed Control Switch - Edge
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Speed control switch electrical connector (part of 14A411)
2	9C888	Speed control switch



N0060049

Fig. 19: Exploded View Of Speed Control Switch - MKX
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Steering wheel controls bezel screws (4 required)
2	-	Steering wheel controls bezel
3	9C888	Speed control switch
		Speed control switch electrical connector

4	-	(part of 14A441)

REMOVAL AND INSTALLATION

MKX

1. Remove the driver air bag module. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
2. Remove the 4 screws and the steering wheel control bezel.

   All vehicles

3. Remove the speed control switch by pulling the switch toward the rear of the vehicle.
   - Disconnect the electrical connector.
4. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Handles, Locks, Latches & Entry Systems - Edge & MKX

SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Lock Repair/Replacement Specifications	
Ignition Cylinder Lock Kit	F85Z-11582-AA
Door Lock Kit	F87Z-7821990-BA
Lubricants	
Multi-Purpose Grease Spray XL-5	ESB-M1C93-B
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Door latch bolts	8	-	71
Door latch striker screws	23	17	-
Exterior door handle reinforcement bolt	8	-	71
Exterior door handle reinforcement screw	2	-	18
Hood latch bolts	11	-	97
Hood latch striker bolts	11	-	97
Liftgate latch bolts - manual and power liftgate	9	-	80
Liftgate release switch molding nuts - manual liftgate	12	-	106
Liftgate release switch molding bolts - power liftgate	12	-	106
Liftgate striker bolts	30	22	-

DESCRIPTION AND OPERATION

HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

Hood Latch

The hood latch components consist of the following:

- Hood latch release handle and cable
- Hood latch

Front Doors

The front door components consist of the following:

- Door ajar switch (part of the front door latch)
- Door lock control switch
- Door lock cylinder (driver door only)
- Exterior front door handle bezel
- Exterior front door handle reinforcement
- Exterior front door handle strap
- Front door latch
- Front door lock actuator (part of the front door latch)
- Interior front door handle actuating cable
- Interior front door handle
- Keyless entry keypad (driver door only)

Individual lock cylinders are repaired by discarding the inoperative lock cylinder and building a new lock cylinder using the appropriate lock repair package. The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the current key code of the vehicle.

Rear Doors

The rear door components consist of the following:

- Door ajar switch (part of the rear door latch)
- Exterior rear door handle bezel
- Exterior rear door handle reinforcement
- Exterior rear door handle strap
- Interior rear door handle actuating cable
- Interior rear door handle
- Rear door latch
- Rear door lock actuator (part of the rear door latch)

Manual Liftgate

The manual liftgate consists of the following components:

- Liftgate ajar switch (part of the liftgate latch)
- Liftgate release switch (located on the exterior of the liftgate)
- Liftgate latch

Power Liftgate

The power liftgate consists of the following components:

- Liftgate ajar switch (part of the liftgate latch)
- Liftgate release switch (located on the exterior of the liftgate)
- Liftgate latch

Power Lock/Unlock

The power lock/unlock feature requests all of the vehicle doors locked or unlocked upon a customer request from either door lock control switch in the vehicle. The power door locking system functions independently of ignition status or vehicle speed.

Autolocks

The autolock feature will lock all the doors when:

- all the doors are closed,
- the ignition is in the RUN position,
- the vehicle is shifted into any gear putting the vehicle in motion, and
- the vehicle attains a speed greater than 20 km/h (12 mph) for greater than 2 seconds.

The autolock feature repeats when:

- any door is opened then closed while the ignition is in the RUN position and the vehicle speed is 15 km/h (9 mph) or lower, and
- the vehicle attains a speed greater than 20 km/h (12 mph) for greater than 2 seconds.

Auto-Unlock

NOTE: **The doors will not auto-unlock if the vehicle has been electronically locked before the driver door is opened.**

The auto-unlock feature will unlock all the doors when:

- the ignition is in the RUN position, all the doors are closed and the vehicle has been in motion at a speed greater than 20 km/h (12 mph),
- the vehicle has come to a stop and the ignition is turned to the OFF or ACC position, and
- the driver door is opened within 10 minutes of the ignition being transitioned to the OFF or ACC position.

Smart Unlock

The smart unlock feature prevents the doors from locking with the key in the ignition lock cylinder. When the SJB receives a lock command from a door lock control switch only, and the key is in the ignition lock cylinder with one of the front doors open, the SJB commands the doors to lock, then unlock.

The vehicle can still be locked by locking the doors with the push button rods, the door lock cylinder or an RKE command from an integrated key or the keyless entry keypad.

Remote Keyless Entry (RKE)

The remote keyless entry (RKE) system uses an integrated keyhead transmitter (IKT). The IKT incorporates both the passive anti-theft system (PATS) functions and the RKE transmitter functions in a single device.

The RKE transmitter is programmed automatically during PATS programming. During PATS programming, the instrument cluster (IC) obtains the transmitter identification code (TIC) from the IKT and sends the TIC data over the medium speed controller area network (MS-CAN) to the SJB.

The SJB accepts programming of up to 4 IKTs. In addition to the IKTs, 4 conventional keyfobs can also be programmed to the vehicle if requested by the customer. For information on programming the IKTs, refer to Key Programming Using Two Programmed Keys or Integrated Keyhead Transmitter (IKT) Key Programming Using Diagnostic Equipment in **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. For information on programming the conventional keyfobs, refer to **Remote Keyless Entry Transmitter Programming**.

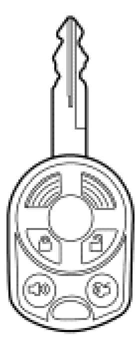


Fig. 1: Identifying Key With Power Liftgate
Courtesy of FORD MOTOR CO.

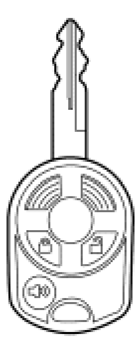


Fig. 2: Identifying Key Without Power Liftgate
Courtesy of FORD MOTOR CO.

The IKT initiates the following electronic system functions:

- Unlocks the driver door

- Unlocks all doors
- Locks all doors
- Opens the power liftgate (if equipped)
- Arms/disarms the perimeter alarm (if equipped)
- Activates/deactivates the panic alarm
- Commands the interior lamps on (when unlocking) and off (when locking)
- Recalls the memory seat position associated with a particular remote entry device (when enabled)
- Sounds the horn once when LOCK is pressed twice within 3 seconds, and the doors are closed
- Sounds the horn twice when LOCK is pressed twice within 3 seconds, and any door is ajar

The IKT has a normal operating range of 10 m (33 ft).

Remote Keyless Entry (RKE) Lock/Unlock Control - Unlock

The RKE feature provides lock/unlock functions independently of key position, vehicle speed, or transmission position. The RKE feature provides a stepped (if enabled) process for unlocking the doors. Upon receipt of the first request for unlocking the doors, the RKE control feature requests the SJB to unlock the driver door only. If another unlock request is received within 3 seconds of the first, the RKE feature requests the SJB to unlock all the doors. This feature can be disabled, so that all the doors unlock on the first press of the unlock button. Refer to **Stepped Unlock Programming** for programming information.

Remote Keyless Entry (RKE) Lock/Unlock Control - Lock

The RKE feature requests that all the doors be locked when the LOCK button is pressed. On any press of the LOCK button with all doors closed, the SJB provides one flash of the turn signals. If any door is ajar, no flash occurs. As soon as the last door is closed, the SJB provides the flash of the turn signals. If 2 presses of the LOCK button are received within 3 seconds, the horn chirps once and the turn signals flash twice to indicate that all the doors are closed and locked. If any door is ajar when the second lock request is received within 3 seconds of the first, the RKE transmitter feature requests the SJB chirp the horn twice without flashing the turn signals to indicate it locked all the doors but one or more doors are ajar. When the key is in the ON or START position, the turn signal flashes and horn chirp confirmations do not occur.

Remote Keyless Entry (RKE) Power Liftgate

The RKE feature provides a power liftgate open/close function independently of key position. The power liftgate button must be pressed twice within 3 seconds for the power liftgate to open or close.

Panic Alarm

The panic alarm feature provides audible and visual alarms which are evident from the exterior of the vehicle. The panic alarm feature requests that the turn signals are flashed and the horn sounds until deactivation. The flashing of the outputs occurs simultaneously. Activation of the panic alarm is accomplished by pressing the PANIC button on an integrated keyhead transmitter (IKT) whenever the key is in the OFF position. At all other times this feature is disabled. Deactivation of an active panic alarm is accomplished by any of the following actions:

- a second press of the IKT PANIC button
- the key is switched out of the OFF position
- a period of 2 minutes and 45 seconds has elapsed since the initial activation

Keyless Entry Keypad

The keyless entry keypad carries out the following functions:

- Unlocks the driver door
- Unlocks all the doors
- Locks all doors
- Enables/disables auto-unlocking
- Enables/disables autolocking
- Arms/disarms the perimeter alarm (if equipped)
- Recalls the memory seat position associated with a particular customer key code (when enabled)
- Programs/erases the customer key code
- Illuminates the keyless entry keypad lamp and issues illuminated entry on/off requests

The keypad feature operates independently of key position status, vehicle speed, or transmission position. When an keypad button is pressed, the keypad buttons illuminate to provide better visibility. If the lock all doors command is entered or 5 seconds have elapsed since the last button press, the illumination is turned off.

Each vehicle equipped with a keypad is programmed with a 5-digit entry code. This code is provided to the customer through a wallet card in the Owner's Literature. In addition, this code is available through a scan tool and is also printed on the SJB label. When entering codes each digit must be entered within 5 seconds of the previous button press.

Locking the Doors with the Keyless Entry Keypad System

It is not necessary to enter the factory set or personal code prior to locking all doors. To lock all doors, press the 7/8 and 9/0 controls at the same time.

Unlocking the Doors with the Keyless Entry Keypad System

To unlock the driver door, enter either the factory set code or a personal code; each digit must be pressed within 5 seconds of the prior digit. The interior lamps illuminate.

To unlock all doors, enter either the factory set code or a personal code (driver door unlocks) and press the 3/4 button within 5 seconds.

Anti-Scan Feature

To provide added security, the keypad is disabled for 1 minute after 35 button presses without a valid entry code being entered. The keypad flashes during this 1-minute mode with all functionality disabled except for 7/8 and

9/0 still being allowed to lock the vehicle.

Anti-scan is turned off after 1 minute of keypad inactivity, the UNLOCK button is pressed on an IKT, or the ignition is switched to the RUN position.

Perimeter Lighting Feature

Vehicles equipped with perimeter lighting can have this feature activated or deactivated. For information on programming the perimeter lighting feature, refer to **Perimeter Lighting Feature Programming**.

NOTE: **On vehicles with autolamps, the perimeter lighting feature does not activate in daylight conditions.**

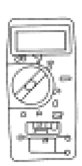
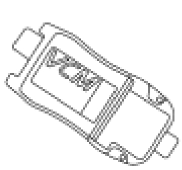
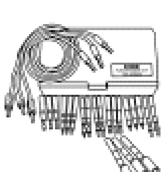
The headlamps, park lamps, and tail lamps illuminate when the unlock control on the IKT is pressed. The illuminated entry system will turn off the interior lamps if:

- The ignition switch is turned to the RUN position
- The IKT lock control is pressed
- The vehicle is locked using the keyless entry keypad (if equipped)
- After 25 seconds have elapsed since the perimeter lighting was activated

DIAGNOSTIC TESTS

LOCKS, LATCHES AND ENTRY SYSTEMS

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

Power Locks

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The SJB monitors the door lock control switches. When the SJB receives an unlock/lock command from either door lock control switch, the SJB energizes a relay to supply the correct power and grounds for the door lock actuators.

Liftgate Release

The liftgate release switch operates the liftgate latch electronically. When the switch is pressed, the SJB processes the input and releases the liftgate latch.

The doors must be unlocked electronically in order for the SJB to release the liftgate latch. When this condition is met and the SJB receives the input from the liftgate release switch, the SJB provides power to the latch release motor.

Keyless Entry Keypad

The SJB monitors the keyless entry keypad input. When the correct codes are entered into the SJB, the SJB carries out functions associated with the code entered. Based on input from the keypad, the SJB:

- locks all doors.
- unlocks the driver door.
- unlocks all doors.
- enters programming mode.
- enables/disables the autolock feature.
- enables/disables the auto-unlock feature.

Remote Keyless Entry (RKE)

The SJB receives input from programmed integrated keyhead transmitters (IKTs). Based on input from the IKT, the SJB:

- locks all doors.
- unlocks the driver door.
- unlocks all doors.
- activates/deactivates the panic alarm.
- arms/disarms the perimeter alarm (if equipped).
- if equipped, issues a command over the communication network to the liftgate/trunk module (LTM) to open the power liftgate.

- if equipped, activates the memory positions.
- turns the interior lamps on (when unlocking) and off (when locking), provided the defeat switch on the dimmer switch is not active.
- sounds the horn once when LOCK is pressed twice within 3 seconds, and the doors are closed.
- sounds the horn twice when LOCK is pressed twice within 3 seconds, and any door is open.

Field-Effect Transistor (FET) Protection

The SJB utilizes a FET protective circuit strategy for many of its outputs (for example, the headlamp output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault is detected. A continuous DTC is stored at that time for the fault. The circuit will then reset after a customer demand of the function (switching the component on, battery saver being energized). When an excessive circuit load occurs several times, the module shuts down the output until a repair procedure is carried out. At the same time, the continuous DTC that was stored on the first failure will not clear by a command to clear the continuous DTCs. The module will not allow this code to be cleared or the circuit restored to normal until a successful on-demand self-test proves that the fault has been repaired. After the on-demand self-test has successfully completed (no on-demand DTCs present), the continuous DTC will have been cleared and the circuit function will return.

Each circuit has 3 predefined levels of short circuit tolerance established in the module based on each circuits' capability. When the first or second level is reached, the continuous DTC associated with the circuit sets along with DTC B106E. These DTCs may be cleared using the Clear DTC operation on the scan tool as long as the fault itself has been corrected. If any of the circuits are shorted past the third level, then DTCs B106F and B1342 set along with the associated continuous DTC. These DTCs cannot be cleared and the module must be replaced.

The SJB FET protected output circuits for the handles, locks, latches and entry systems are the liftgate lock actuator circuit CPL10 (GN/WH) and the keypad illumination circuit CPK28 (WH/GN).

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical

• Door/liftgate handles
• Latches
	• Smart junction box (SJB) fuse(s):
	  ○ 5 (10A)
	  ○ 14 (10A)
	  ○ 17 (20A)
	• Wiring, terminals and connectors
	• Door lock actuators

	• Door lock control switches • Integrated keyhead transmitter (IKT) • Keyless entry keypad • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
    - Check the VCM connection to the vehicle.
    - Check the scan tool connection to the VCM.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
    - Verify the ignition key is in the ON position.
    - Verify the scan tool operation with a known good vehicle.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record the continuous memory DTCs for the SJB.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to **DTC Charts**. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

INSTRUMENT CLUSTER (IC) DTC CHART

DTC	Description	Action
B1137	Data Not Programmed	Go to **Pinpoint Test J** .

B1138	Memory Full	The smart junction box (SJB) limit of 4 integrated keys is exceeded. PROGRAM a maximum of 4 integrated keys. REFER to Integrated Keyhead Transmitter (IKT) Key Programming Using Diagnostic Equipment in **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. CLEAR the DTCs. REPEAT the self-test.
B1139	Invalid Transmitter Identification Code	Go to **Pinpoint Test I** .
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1138	Memory Full	The SJB limit of 4 integrated keys is exceeded. PROGRAM a maximum of 4 integrated keys. REFER to Integrated Keyhead Transmitter (IKT) Key Programming Using Diagnostic Equipment in **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. CLEAR the DTCs. REPEAT the self-test.
B1139	Invalid Transmitter Identification Code	Go to **Pinpoint Test I** .
B1624	Lamp Keypad Output Open Circuit	Go to **Pinpoint Test H** .
B1626	Lamp Keypad Output Short Circuit to Ground	Go to **Pinpoint Test H** .
B2276	Less Than 2 Transmitters Programmed	PROGRAM all of the customer's IKTs (minimum of 2). REFER Integrated Keyhead Transmitter (IKT) Key Programming Using Diagnostic Equipment in **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. TEST the system for normal operation.
B2425	Remote Keyless Entry Out of Synchronization	Go to **Pinpoint Test I** .
B2666	Liftgate Release Switch Circuit Failure	Go to **Pinpoint Test F** .
B273A	Liftgate Release Output Circuit Shorted to Ground	Go to **Pinpoint Test F** .
B273B	Liftgate Release Output Circuit Open or Shorted to Battery Voltage	Go to **Pinpoint Test F** .
B2A25	Trim Panel Lock Switch Circuit Failure	Go to **Pinpoint Test E** .
B2A26	Keypad Switch Circuit Failure	Go to **Pinpoint Test G** .
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• No communication with the instrument cluster (IC)	• Wiring, terminals or connectors • IC	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• All door locks are inoperative	• Fuse • Wiring, terminals or connectors • SJB	• Go to **Pinpoint Test A** .
• A single/more than one door lock is inoperative	• Wiring, terminals or connectors • Door lock actuator • SJB	• Go to **Pinpoint Test B** .
• The door locks operate only one way	• Wiring, terminals or connectors • Door lock control switch • SJB	• Go to **Pinpoint Test C** .
• All door locks are inoperative from one switch	• Wiring, terminals or connectors • Door lock control switch	• Go to **Pinpoint Test D** .
• The liftgate latch release is inoperative/does not operate correctly	• Wiring, terminals or connectors • Liftgate release switch • Liftgate latch • Liftgate/trunk module (LTM) • SJB	• Go to **Pinpoint Test F** .
• The doors do not lock/unlock using the keyless entry keypad	• Wiring, terminals or connectors • Keyless entry keypad • SJB	• Go to **Pinpoint Test G** .

• The keyless entry keypad illumination is inoperative/does not operate correctly	• Wiring, terminals or connectors • Keyless entry keypad • SJB	• Go to **Pinpoint Test H** .
• The remote keyless entry (RKE) transmitter is inoperative	• Integrated keyhead transmitter (IKT) • IKT battery • IKT button pressed a substantial amount of times while outside the range of the vehicle • IKT programming • SJB	• Go to **Pinpoint Test I** .
• An individual button/feature is inoperative from the remote keyless entry (RKE) transmitter	• Door locks • Horn system • Power liftgate release • Turn signal system • IKT	• Go to **Pinpoint Test K** .
• The remote keyless entry (RKE) transmitter has poor range performance	• IKT • IKT battery • Aftermarket systems • High power devices • TV/radio transmission towers • SJB	• Go to **Pinpoint Test L** .
• The smart unlock does not operate correctly	• Key-in-ignition switch • Door ajar switch input • SJB	• Go to **Pinpoint Test M** .
• The autolock does not operate correctly	• Wiring, terminals or connectors • Programming • Door ajar switches • SJB	• Go to **Pinpoint Test N** .
• The memory seat does not operate correctly	• SJB	• ACTIVATE the remote memory. REFER to **Remote Memory Activation**. TEST the system for normal operation. If the remote

using the remote keyless entry (RKE) transmitter	• Memory seat module	memory is still inoperative, REFER to **SEATING** article to diagnose the memory seat.
• The RKE two step door unlocking does not operate correctly	• Two step door unlocking is disabled	• PROGRAM the two step door unlocking. REFER to **Stepped Unlock Programming**. TEST the system for normal operation.

Pinpoint Tests

Pinpoint Test A: All Door Locks Are Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAM article, Power Door Locks for schematic and connector information.

Normal Operation

The smart junction box (SJB) fuse 17 (20A) provides voltage for the power lock/unlock system. Ground for the power lock/unlock system is provided to the SJB through circuit GD133 (BK). The SJB contains internal relays that are energized depending on input received.

When the SJB receives a lock request from the door lock control switch, the SJB provides power to the door lock actuators through circuit CPL11 (GY/BN). Ground for the LH front door actuator is provided through circuit CPL51 (BU/GN) and ground for the remaining door lock actuators is provided through circuit CPL52 (VT/GY). When the SJB receives an unlock request, power and ground are reversed on the previously listed circuits.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- SJB

PINPOINT TEST A: ALL DOOR LOCKS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

A1 CHECK THE RECORDED SJB DTCs FROM ON-DEMAND SELF-TEST

- Check the recorded results from the SJB self-test.
- **Is DTC B2A25 present?**

  YES : Go to **Pinpoint Test E** .

  NO : Go to A2.

A2 VERIFY THE OPERATION OF BOTH DOOR LOCK CONTROL SWITCHES

- Press the LOCK and UNLOCK button on both door lock control switches while observing the door lock operation.
- **Are the door locks inoperative from both switches?**

  YES : Go to A3.

  NO : Go to **Pinpoint Test D** .

A3 VERIFY ALL DOOR LOCKS ARE INOPERATIVE

- Press the LOCK and UNLOCK buttons from a door lock control switch while observing the door locks.
- **Are all the door locks inoperative from both switch positions (lock and unlock)?**

  YES : VERIFY the SJB fuse 17 (20A) is OK. If OK, go to A4.

  If not OK, go to A6.

  NO : Go to **Symptom Chart**.

A4 CHECK CIRCUIT GD133 (BK) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280d

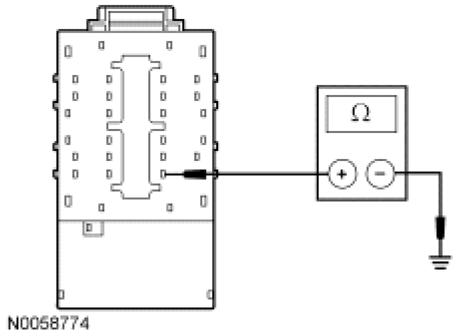


Fig. 3: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280d-7, circuit GD133 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to A5.

  NO : REPAIR the circuit. TEST the system for normal operation.

A5 CHECK CIRCUIT CPL11 (GY/BN) FOR AN OPEN

- Disconnect: LH Front Door Lock Actuator C525

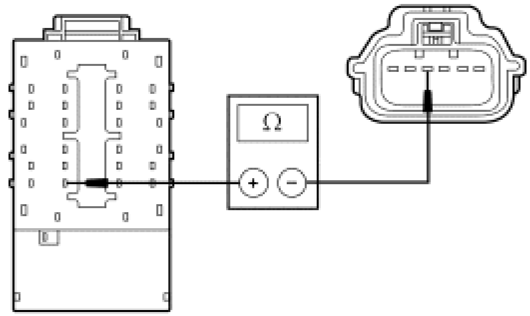


Fig. 4: Measuring Resistance Between SJB C2280D-6, Circuit CPL11 (GY/BN) & LH Front Door Lock Actuator C525-4
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280d-6, circuit CPL11 (GY/BN), harness side and the LH front door lock actuator C525-4, circuit CPL11 (GY/BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A7.

  NO : REPAIR the circuit. TEST the system for normal operation.

A6 CHECK CIRCUIT CPL11 (GY/BN) FOR A SHORT TO GROUND

- Install a new SJB fuse 17 (20A).
- Operate the door lock actuators by pressing LOCK on the door lock control switch.
- **Is the SJB fuse 17 (20A) OK?**

  YES : REPAIR circuit CPL51 (BU/GN) or CPL52 (VT/GY) for a short to ground. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

A7 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: A Single/More Than One Door Lock Is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAM article, Power Door Locks for schematic and connector information.

Normal Operation

When the smart junction box (SJB) receives a lock request from the door lock control switch, the SJB provides power to the door lock actuators through circuit CPL11 (GY/BN). Ground for the LH front door actuator is provided through circuit CPL51 (BU/GN) and ground for the remaining door lock actuators is provided through circuit CPL52 (VT/GY). When the SJB receives an unlock request, power and ground are reversed on the previously listed circuits.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door lock actuator
- SJB

PINPOINT TEST B: A SINGLE/MORE THAN ONE DOOR LOCK IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

B1 CHECK THE DOOR LATCH FOR BINDING

- Lock and unlock the inoperative door lock using the door lock rod.
- **Does the door lock and unlock?**

YES : Go to B2.

NO : INSTALL a new door latch. REFER to **Door Latch**.

B2 CHECK CIRCUIT CPL11 (GY/BN) FOR AN OPEN

- Key in OFF position.
- Disconnect: Inoperative Door Lock Actuator

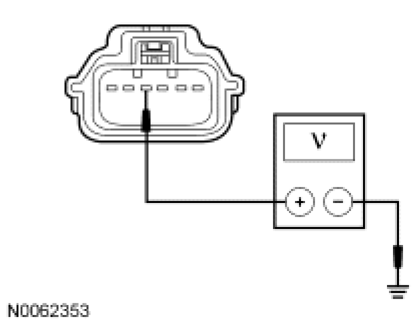


Fig. 5: Measuring Voltage Between Inoperative Door Lock Actuator, Harness Side & Ground
Courtesy of FORD MOTOR CO.

NOTE: The SJB only supplies voltage to the actuator momentarily. It is important to monitor the meter while pressing the door lock control switch.

- While pressing the door lock control switch in the LOCK position, measure the voltage between the inoperative door lock actuator, harness side and ground as follows:

Inoperative Door Lock Actuator	Connector-Pin	Circuit
LH front	C525-4	CPL11 (GY/BN)
RH front	C603-4	CPL11 (GY/BN)
LH rear	C704-4	CPL11 (GY/BN)
RH rear	C804-4	CPL11 (GY/BN)

- **Is the voltage momentarily greater than 10 volts?**

  YES : Go to B3.

  NO : REPAIR the circuit. TEST the system for normal operation.

B3 CHECK CIRCUIT CPL52 (VT/GY) OR CIRCUIT CPL51 (BU/GN) FOR VOLTAGE

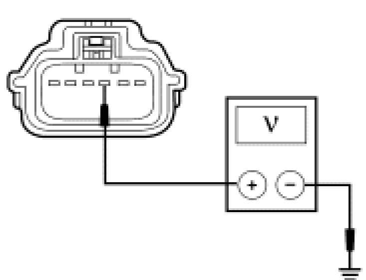


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Fig. 6: Measuring Voltage Between Inoperative Door Lock Actuator, Harness Side & Ground
Courtesy of FORD MOTOR CO.

NOTE: The SJB only supplies voltage to the actuator momentarily. It is important to monitor the meter while pressing the door lock control switch.

- While pressing the door lock control switch in the UNLOCK position, measure the voltage between the inoperative door lock actuator, harness side and ground as follows:

Inoperative Door Lock Actuator	Connector-Pin	Circuit
LH front	C525-3	CPL51 (BU/GN)
RH front	C603-3	CPL52 (VT/GY)
LH rear	C704-3	CPL52 (VT/GY)
RH rear	C804-3	CPL52 (VT/GY)

- **Is the voltage momentarily greater than 10 volts?**

  YES : INSTALL a new door latch. REFER to **Door Latch**.

  NO : Go to B4.

B4 CHECK CIRCUIT CPL51 (BU/GN) OR CIRCUIT CPL52 (VT/GY) FOR AN OPEN

- Disconnect: SJB C2280d

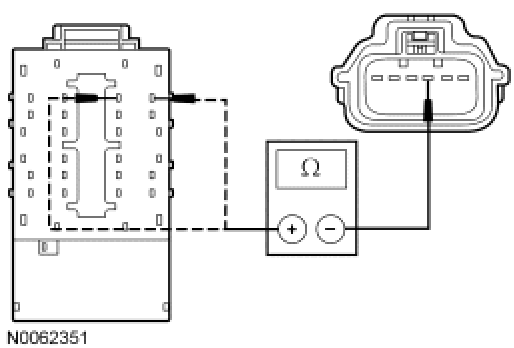

Fig. 7: Measuring Resistance Between SJB, Harness Side & Inoperative Door Lock Actuator, Harness Side
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB, harness side and the inoperative door lock actuator, harness side as follows:

SJB Connector-Pin	Inoperative Door Lock Actuator Connector-Pin	Circuit
C2280d-28	LH front C525-3	CPL51 (BU/GN)
C2280d-27	RH front C603-3	CPL52 (VT/GY)

C2280d-27	LH rear C704-3	CPL52 (VT/GY)
C2280d-27	RH rear C804-3	CPL52 (VT/GY)

- **Is the resistance less than 5 ohms?**

  YES : Go to B5.

  NO : REPAIR the circuit. TEST the system for normal operation.

B5 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test C: The Door Locks Operate Only One Way

Refer to appropriate SYSTEM WIRING DIAGRAM article, Power Door Locks for schematic and connector information.

Normal Operation

The smart junction box SJB sends voltage signals to the door lock control switches through circuits CPL42 (GY/YE) and CPL43 (VT/GY) for the lock and unlock requests, respectively. When the LOCK or UNLOCK switch is pressed, the voltage signal is routed to ground.

The SJB contains internal relays that are energized depending on input received. When the SJB receives a lock or unlock request from the door lock control switch, the SJB energizes the appropriate relay(s) to lock or unlock the doors.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door lock control switch
- SJB

PINPOINT TEST C: THE DOOR LOCKS OPERATE ONLY ONE WAY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

C1 CHECK THE RECORDED SJB DTCs FROM ON-DEMAND SELF-TEST

- Check the recorded results from the SJB self-test.
- **Is DTC B2A25 present?**

  YES : Go to **Pinpoint Test E** .

  NO : Go to C2.

C2 VERIFY THE OPERATION OF BOTH DOOR LOCK CONTROL SWITCHES

- Key in OFF position.
- Press the LOCK and UNLOCK button of both door lock control switches while observing the door lock operation.
- **Do the door locks operate only one way from both switches?**

  YES : Go to C4.

  NO : Go to C3.

C3 CHECK CIRCUIT CPL42 (GY/YE) (LOCK INPUT) OR CIRCUIT CPL43 (VT/GY) (UNLOCK INPUT) FOR AN OPEN (SINGLE SWITCH INOPERATIVE)

- Disconnect: Suspect Door Lock Control Switch
- Unlock the doors from the working door lock control switch.

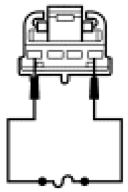

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Fig. 8: Connecting Fused (5A) Jumper Wire Between LH Door Lock Control Switch C505-1, Circuit CPL42 (GY/YE)
Courtesy of FORD MOTOR CO.

- Observe the door locks while connecting a fused (5A) jumper wire between the LH door lock control switch C505-1, circuit CPL42 (GY/YE), harness side and the LH door lock control switch C505-4, circuit GD133 (BK), harness side; or between the RH door lock control switch C605-1, circuit CPL42 (GY/YE), harness side and the RH door lock control switch C605-4, circuit GD140 (BK/GN), harness side.
- Remove the jumper wire.

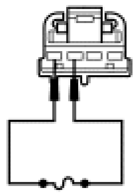

Fig. 9: Connecting Fused (5A) Jumper Wire Between LH Door Lock Control Switch C505-3, Circuit CPL43 (VT/GY)
Courtesy of FORD MOTOR CO.

- Observe the door locks while connecting a fused (5A) jumper wire between the LH door lock control switch C505-3, circuit CPL43 (VT/GY), harness side and the LH door lock control switch C505-4, circuit GD133 (BK), harness side; or between the RH door lock control switch C605-3, circuit CPL43 (VT/GY), harness side and the RH door lock control switch C605-4, circuit GD140 (BK/GN), harness side.
- **Do the doors lock and unlock with the jumper wire?**

  YES : INSTALL a new door lock control switch. REFER to **Door Lock Control Switch**. TEST the system for normal operation.

  NO : REPAIR the input circuit in question. TEST the system for normal operation.

C4 CHECK CIRCUIT CPL42 (GY/YE) (LOCK INPUT) OR CIRCUIT CPL43 (VT/GY) (UNLOCK INPUT) FOR AN OPEN (BOTH SWITCHES INOPERATIVE)

- Disconnect: LH Door Lock Control Switch C505
- Disconnect: SJB C2280c

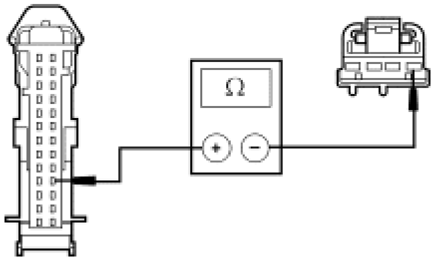

Fig. 10: Measuring Resistance
Courtesy of FORD MOTOR CO.

- If the doors do not lock, measure the resistance between the SJB C2280c-17, circuit CPL42 (GY/YE), harness side and the LH door lock control switch C505-1, circuit CPL42 (GY/YE), harness side.

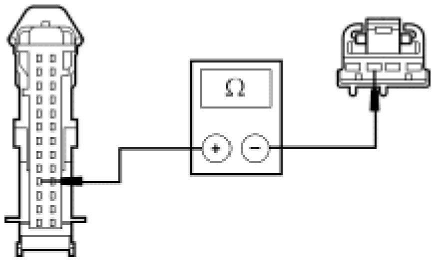

Fig. 11: Measuring Resistance
Courtesy of FORD MOTOR CO.

- If the doors do not unlock, measure the resistance between the SJB C2280c-4, circuit CPL43 (VT/GY), harness side and the LH door lock control switch C505-3, circuit CPL43 (VT/GY), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to C5.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

C5 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test D: All Door Locks Are Inoperative From One Switch

Refer to appropriate SYSTEM WIRING DIAGRAM article, Power Door Locks for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends voltage signals to the door lock control switches through circuits CPL42 (GY/YE) and CPL43 (VT/GY) for the lock and unlock requests, respectively. When the LOCK or UNLOCK switch is pressed, the voltage signal is routed to ground. Ground for the LH door lock control switch is provided through circuit GD133 (BK), and the RH side through circuit GD140 (BK/GN).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door lock control switch

PINPOINT TEST D: ALL DOOR LOCKS ARE INOPERATIVE FROM ONE SWITCH

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

D1 CHECK CIRCUIT GD133 (BK) OR GD140 (BK/GN) FOR AN OPEN

- Disconnect: Inoperative Door Lock Control Switch

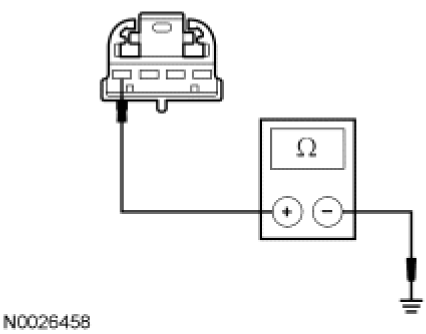

Fig. 12: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the LH door lock control switch C505-4, circuit GD133 (BK), harness side and ground; or between the RH door lock control switch C605-4, circuit GD140 (BK/GN), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new door lock control switch. REFER to **Door Lock Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

Pinpoint Test E: DTC B2A25 - Trim Panel Lock Switch Circuit Failure

Refer to appropriate SYSTEM WIRING DIAGRAM article, Power Door Locks for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends voltage signals to the door lock control switches through circuits CPL42 (GY/YE) and CPL43 (VT/GY) for the lock and unlock requests, respectively. When the LOCK or UNLOCK switch is pressed, the voltage signal is routed to ground. Ground for the LH door lock control switch is provided through circuit GD133 (BK), and the RH side through circuit GD140 (BK/GN).

- DTC B2A25 (Trim Panel Lock Switch Circuit Failure) - is an on-demand DTC that sets when the SJB detects a short to ground from the lock or unlock request input circuits. This DTC may also set if either of the door lock control switches are pressed for longer than 2 minutes.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door lock control switch
- SJB

PINPOINT TEST E: DTC B2A25 - TRIM PANEL LOCK SWITCH CIRCUIT FAILURE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

E1 CHECK THE RECORDED SJB DTCs FROM ON-DEMAND SELF-TEST

- Check the recorded results from the SJB self-test.
- **Is DTC B2A25 present?**

  YES : Go to E2.

  NO : Go to **Symptom Chart**.

E2 CHECK THE LH DOOR LOCK CONTROL SWITCH

- Disconnect: LH Door Lock Control Switch C505
- Repeat the SJB on-demand self-test.
- **Is DTC B2A25 retrieved again?**

  YES : LEAVE the switch disconnected. Go to E3.

  NO : INSTALL a new LH door lock control switch. REFER to **Door Lock Control Switch**. TEST the system for normal operation.

E3 CHECK THE RH DOOR LOCK CONTROL SWITCH

- Disconnect: RH Door Lock Control Switch C605
- Repeat the SJB on-demand self-test.
- **Is DTC B2A25 retrieved again?**

  YES : LEAVE the switch disconnected. Go to E4.

  NO : INSTALL a new RH door lock control switch. REFER to **Door Lock Control Switch**. TEST the system for normal operation.

E4 CHECK THE LOCK INPUT CIRCUIT OR THE UNLOCK INPUT CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280c

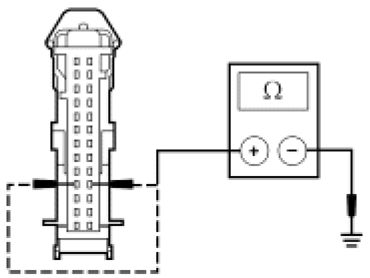

Fig. 13: Measuring Resistance Between SJB C2280c-17 & SJB C2280c-4, CPL42 (VT/GY) & CPL43 (VT/GY)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280c-17, circuit CPL42 (GY/YE), harness side and ground; and between the SJB C2280c-4, circuit CPL43 (VT/GY), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to E5.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E5 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test F: The Liftgate Latch Release Is Inoperative/Does Not Operate Correctly

Refer to appropriate SYSTEM WIRING DIAGRAM article, Power Door Locks for schematic and connector information.

Normal Operation

The smart junction box (SJB) does not release the liftgate unless the doors have been unlocked electronically or the request is initiated from a remote keyless entry (RKE) transmitter.

The SJB sends a voltage signal to the liftgate release switch through circuit CPL45 (BN). When the switch is activated, the signal is routed to ground through circuit GD149 (BK/GY). When the SJB detects a request from the liftgate release switch, the SJB provides voltage through circuit CPL10 (BN/BU) to the liftgate latch (vehicles equipped with a manual liftgate) or the liftgate/trunk module (LTM) (vehicles equipped with a power liftgate). For vehicles with a manual liftgate, ground for the liftgate latch is provided through circuit GD149 (BK/GY).

- DTC B2666 (Liftgate Release Switch Circuit Failure) - is a continuous and on-demand DTC that sets when the SJB detects a short to ground on the liftgate release switch input circuit CPL45 (BN). The DTC is also set if the liftgate release switch is actuated for longer than 2 minutes.
- DTC B273A (Liftgate Release Output Circuit Shorted to Ground) - is a continuous DTC that sets when the SJB detects a short to ground on the liftgate latch release output circuit CPL10 (GN/WH).
- DTC B273B (Liftgate Release Output Circuit Open or Shorted to Battery Voltage) - is a continuous and on-demand DTC that sets when the SJB detects an open or short to voltage on the liftgate latch release output circuit CPL10 (GN/WH).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals and connectors
- Liftgate release switch
- Liftgate latch
- LTM
- SJB

PINPOINT TEST F: THE LIFTGATE LATCH RELEASE IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use correct probe adapter(s) may damage the connector.

F1 RETRIEVE THE RECORDED SJB AND LTM DTCs FROM THE CONTINUOUS AND ON-DEMAND SELF-TESTS

- Check for recorded SJB and LTM DTCs from the continuous and on-demand self-tests.
- **Are any DTCs recorded?**

  YES : For SJB DTC B2666, go to F2.

  For SJB DTC B273A, go to F4.

  For SJB DTC B273B, go to F6 (manual liftgate) or Go to F7 (power liftgate).

  For all other SJB DTCs, REFER to **DTC Charts**.

  For any LTM DTCs, REFER to **BODY CLOSURES** article.

NO : Go to F11.

F2 REPEAT THE SJB CONTINUOUS AND ON-DEMAND SELF-TESTS FOR DTC B2666

- Disconnect: Liftgate Release Switch C4353 (Manual Liftgate) or C4216 (Power Liftgate)
- Clear the DTCs, then repeat the SJB continuous and on-demand self tests.
- **Is DTC B2666 recorded?**

  YES : Go to F3.

  NO : INSTALL a new liftgate release switch. REFER to **Liftgate Release Switch - Manual** or **Liftgate Release Switch - Power**. TEST the system for normal operation.

F3 CHECK CIRCUIT CPL45 (BN) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280c

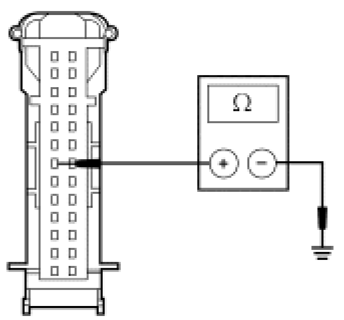

Fig. 14: Measuring Resistance Between SJB C2280C-7, Circuit CPL45 (BN), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280c-7, circuit CPL45 (BN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to F15.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

F4 REPEAT THE SJB CONTINUOUS SELF-TEST FOR DTC B273A

- Disconnect: Liftgate Latch C479 (Manual Liftgate) or Power Liftgate Module C4174b (Power Liftgate)

NOTE: DTC B273B may set and should be ignored when carrying out this step.

- Clear the DTCs, then repeat the SJB continuous self-test.
- **Is DTC B273A present?**

  YES : Go to F5.

  NO : For a manual liftgate, INSTALL a new liftgate latch. REFER to **Liftgate Latch - Manual**. TEST the system for normal operation.

For a power liftgate, go to F14.

F5 CHECK CIRCUIT CPL10 (GN/WH) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280d

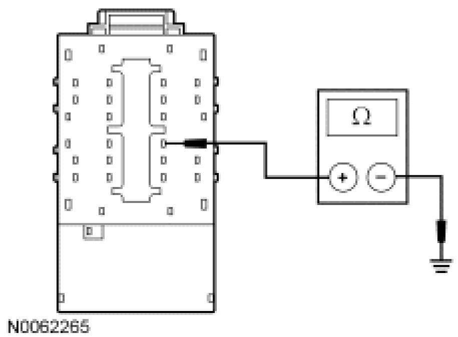

Fig. 15: Measuring Resistance Between SJB C2280D-15, Circuit CPL10 (GN/WH), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280d-15, circuit CPL10 (GN/WH), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

YES : Go to F15.

NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

F6 CHECK CIRCUIT GD149 (BK/GY) FOR AN OPEN (LATCH)

- Key in OFF position.
- Disconnect: Liftgate Latch C479

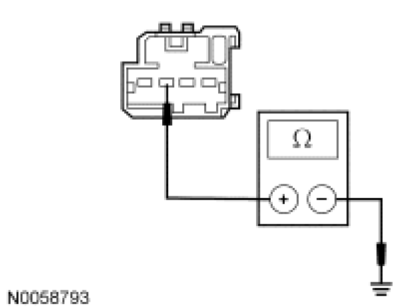

Fig. 16: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the liftgate latch C479-2, circuit GD149 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : Go to F7.

NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

F7 CHECK FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: LTM C4174b (If Equipped)
- Key in ON position.

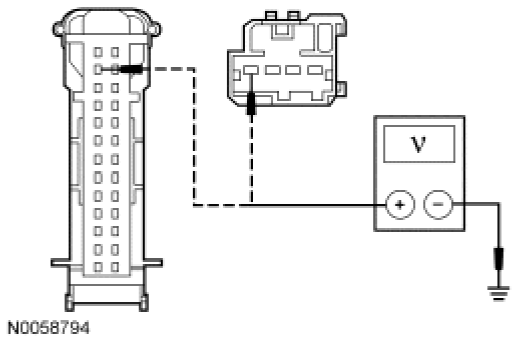

Fig. 17: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the LTM C4174b-12, circuit CPL10 (GN/WH), harness side and ground; or between the liftgate latch C479-1, circuit CPL10 (GN/WH), harness side and ground.
- **Is any voltage present?**

YES : Go to F8.

NO : Go to F9.

F8 CHECK CIRCUIT CPL10 (GN/WH) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280d
- Key in ON position.

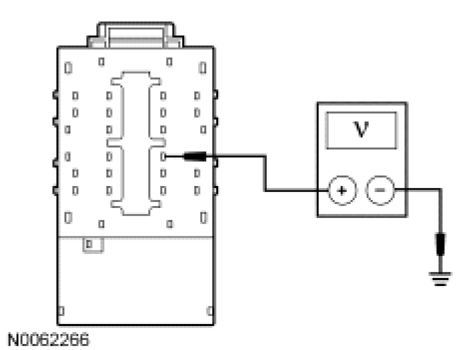

Fig. 18: Measuring Voltage Between SJB C2280D-15, Circuit CPL10 (GN/WH), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the SJB C2280d-15, circuit CPL10 (GN/WH), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to F15.

F9 CHECK FOR SJB OUTPUT

- Key in OFF position.
- Unlock the doors with the door lock control switch.

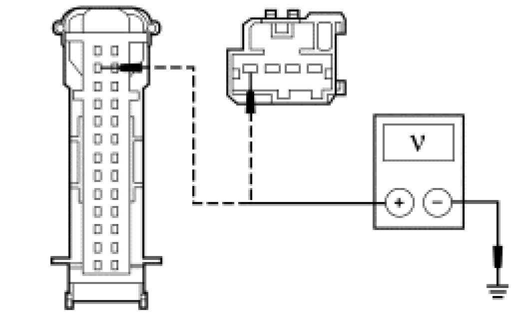

Fig. 19: Measuring Voltage
Courtesy of FORD MOTOR CO.

NOTE: **The SJB only supplies voltage for the liftgate latch release momentarily. It is important to monitor the meter while activating the liftgate release switch.**

- While activating the liftgate release switch, measure the voltage between the LTM C4174b-12, circuit CPL10 (GN/WH), harness side and ground (power liftgate); or between the liftgate latch C479-1, circuit CPL10 (GN/WH), harness side and ground (manual liftgate).
- **Is the voltage greater than 10 volts when the switch is activated?**

  YES : For a manual liftgate, INSTALL a new liftgate latch. REFER to **Liftgate Latch - Manual**. CLEAR the DTCs. REPEAT the self-test.

  For a power liftgate, go to F14.

  NO : Go to F10.

F10 CHECK CIRCUIT CPL10 (GN/WH) FOR AN OPEN

- Disconnect: SJB C2280d

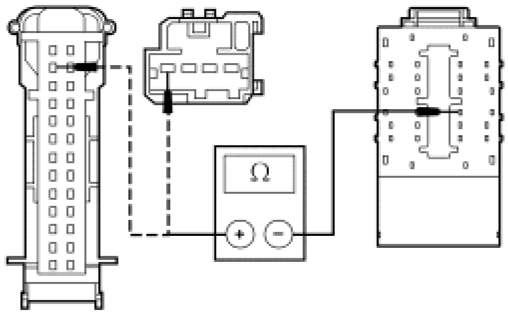

Fig. 20: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the LTM C4174b-12, circuit CPL10 (GN/WH), harness side and the SJB C2280d-15, circuit CPL10 (GN/WH), harness side (power liftgate); or between the liftgate latch C479-1, circuit CPL10 (GN/WH), harness side and the SJB C2280d-15, circuit CPL10 (GN/WH), harness side (manual liftgate).
- **Is the resistance less than 5 ohms?**

  YES : Go to F15.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

F11 CHECK CIRCUIT GD149 (BK/GY) FOR AN OPEN (SWITCH)

- Disconnect: Liftgate Release Switch C4353 (Manual Liftgate) or C4216 (Power Liftgate)

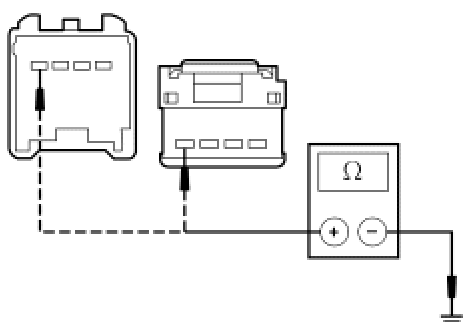

Fig. 21: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the liftgate release switch C4353-4 (manual liftgate), circuit GD149 (BK/GY), harness side and ground; or between the liftgate release switch C4216-4 (power liftgate), circuit GD149 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to F12.

  NO : REPAIR the circuit. TEST the system for normal operation.

F12 CHECK THE LIFTGATE RELEASE SWITCH

- Unlock the doors with the door lock control switch.

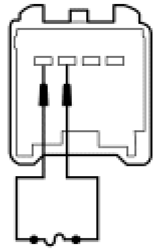

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Fig. 22: Connecting Fused (5A) Jumper Wire Between Liftgate Release Switch C4353-3, Circuit CPL45 (BN)
Courtesy of FORD MOTOR CO.

- For manual liftgate vehicles, connect a fused (5A) jumper wire between the liftgate release switch C4353-3, circuit CPL45 (BN), harness side and the liftgate release switch C4353-4, circuit GD149 (BK/GY), harness side.

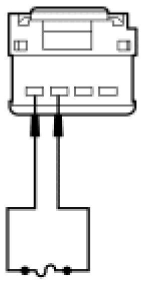

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Fig. 23: Connecting Fused (5A) Jumper Wire Between Liftgate Release Switch C4216-3, Circuit CPL45 (BN)
Courtesy of FORD MOTOR CO.

- For power liftgate vehicles, connect a fused (5A) jumper wire between the liftgate release switch C4216-3, circuit CPL45 (BN), harness side and the liftgate release switch C4216-4, circuit GD149 (BK/GY), harness side.
- **Does the liftgate latch release?**

  YES : INSTALL a new liftgate release switch. REFER to **Liftgate Release Switch - Manual** or **Liftgate Release Switch - Power**. TEST the system for normal operation.

  NO : LEAVE the jumper wire connected. Go to F13.

F13 CHECK CIRCUIT CPL45 (BN) FOR AN OPEN

- Disconnect: SJB C2280c

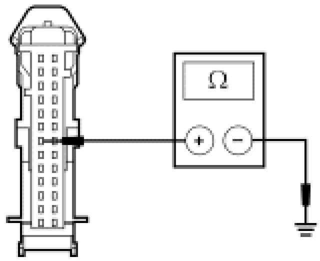


Fig. 24: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280c-7, circuit CPL45 (BN), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to F15.

  NO : REPAIR the circuit. TEST the system for normal operation.

F14 CHECK FOR CORRECT LTM OPERATION

- Disconnect all the LTM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the LTM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new LTM. REFER to **BODY CLOSURES** article. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

F15 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test G: The Doors Do Not Lock/Unlock Using The Keyless Entry Keypad

Refer to appropriate SYSTEM WIRING DIAGRAM article, Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

The smart junction box (SJB) monitors for a ground signal on the reference circuits CPK29 (GY/BU), CPK30 (VT/GN), and CPK31 (YE/GN) for the keyless entry keypad. When an individual keypad button is pressed, an individual or combination of the reference circuits is routed to ground. The SJB then determines which button was pressed based on which circuit(s) are grounded. The keypad is grounded through circuit GD133 (BK). Once the SJB determines that the 5-digit personal entry code, or the factory set 5-digit entry code has been entered on the keypad, the SJB then energizes the driver door unlock relay to unlock the driver door.

To unlock all the doors, the 3/4 button must be pressed within 5 seconds of the 5-digit code being entered.

To lock all the doors, the 5-digit code does not need to be entered. Press the 7/8 and 9/0 buttons at the same time.

- DTC B2A26 (Keypad Switch Circuit Failure) - is a continuous and on-demand DTC that sets when the SJB detects a short to ground on any of the keypad input circuits. This DTC may also set if any of the keypad buttons are pressed for longer than 2 minutes.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Keyless entry keypad
- SJB

PINPOINT TEST G: THE DOORS DO NOT LOCK/UNLOCK USING THE KEYLESS ENTRY KEYPAD

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

G1 CHECK THE SJB KEYCODE PID

- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Observe the SJB PID (KEYCODE). Read and record the 5-digit factory set entry code.
- Enter the 5-digit factory set entry code on the keyless entry keypad, then press the 3/4 button.
- **Do the doors unlock?**

  YES : The system is operating as designed. INFORM the customer of the correct system operation.

NO : Go to G2.

G2 RETRIEVE THE RECORDED SJB DTCs FROM THE RUN-DEMAND SELF-TEST

- Check for recorded SJB DTCs from the on-demand self-test.
- **Is DTC B2A26 recorded?**

YES : Go to G3.

NO : Go to G5.

G3 REPEAT THE SJB RUN-DEMAND SELF-TEST

- Disconnect: Keyless Entry Keypad C500
- Clear the DTCs, then repeat the SJB on-demand self-test.
- **Is DTC B2A26 recorded?**

YES : Go to G4.

NO : INSTALL a new keyless entry keypad. REFER to **Keyless Entry Keypad**. TEST the system for normal operation.

G4 CHECK CIRCUITS CPK29 (GY/BU), CPK30 (VT/GN) AND CPK31 (YE/GN) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280c
- Measure the resistance between the keypad, harness side and ground as follows:

Connector-Pin	Circuit
C500-7	CPK29 (GY/BU)
C500-5	CPK30 (VT/GN)
C500-1	CPK31 (YE/GN)

- **Are the resistances greater than 10,000 ohms?**

YES : Go to G10.

NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

G5 CHECK THE SJB KEY_PAD PID

- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Press each keyless entry keypad button while observing the SJB PID (KEY_PAD).
- **Does the PID display the correct values?**

YES : Go to G10.

NO : Go to G6.

G6 CHECK CIRCUIT GD133 (BK) FOR AN OPEN

- Key in OFF position.

- Disconnect: Keyless Entry Keypad C500

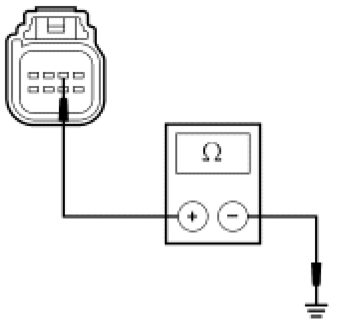


Fig. 25: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the keyless entry keypad C500-2, circuit GD133 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to G7.

  NO : REPAIR the circuit. TEST the system for normal operation.

G7 CHECK THE KEYLESS ENTRY KEYPAD

- Connect a fused (5A) jumper wire between the keyless entry keypad harness side, while monitoring the SJB PID (KEY_PAD) as follows:

Keyless Entry Keypad Connector-Pin/Circuit	Keyless Entry Keypad Connector-Pin/Circuit	SJB PID (KEY_PAD) Value
C500-7 CPK29 (GY/BU)	C500-2 GD133 (BK)	1/2
C500-5 CPK30 (VT/GN)	C500-2 GD133 (BK)	7/8
C500-1 CPK31 (YE/GN)	C500-2 GD133 (BK)	9/0

- **Does the PID display the correct values?**

  YES : INSTALL a new keyless entry keypad. REFER to **Keyless Entry Keypad**.

  NO : Go to G8.

G8 CHECK CIRCUITS CPK29 (GY/BU), CPK30 (VT/GN) AND CPK31 (YE/GN) FOR AN OPEN

- Disconnect: SJB C2280c

- Measure the resistance between the SJB, harness side and the keyless entry keypad, harness side as follows:

SJB Connector-Pin	Circuit	Keyless Entry Keypad Connector-Pin
C2280c-5	CPK29 (GY/BU)	C500-7
C2280c-18	CPK30 (VT/GN)	C500-5
C2280c-6	CPK31 (YE/GN)	C500-1

- **Are the resistances less than 5 ohms?**

  YES : Go to G9.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

G9 CHECK CIRCUITS CPK29 (GY/BU), CPK30 (VT/GN) AND CPK31 (YE/GN) FOR A SHORT TO EACH OTHER

- Measure the resistance between the keypad, harness side as follows:

Keypad Connector-Pin/Circuit	Keypad Connector-Pin/Circuit
C500-7 CPK29 (GY/BU)	C500-5 CPK30 (VT/GN)
C500-7 CPK29 (GY/BU)	C500-1 CPK31 (YE/GN)
C500-5 CPK30 (VT/GN)	C500-1 CPK31 (YE/GN)

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to G10.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

G10 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion

    - damaged pins
    - pushed-out pins
  - Connect all the SJB connectors and make sure they seat correctly.
  - Operate the system and verify the concern is still present.
  - **Is the concern still present?**

    YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

    NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test H: The Keyless Entry Keypad Illumination Is Inoperative/Does Not Operate Correctly

Refer to appropriate SYSTEM WIRING DIAGRAM article, Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

When the smart junction box (SJB) detects that a keyless entry keypad button is pressed, the SJB provides voltage for the keyless entry keypad illumination through circuit CPK28 (WH/GN). Ground for the keyless entry keypad illumination is provided through circuit GD133 (BK).

- DTC B1624 (Lamp Keypad Output Open Circuit) - is an on-demand DTC that sets when the SJB detects an open or short to voltage on the keyless entry keypad illumination output circuit CPK28 (WH/GN).
- DTC B1626 (Lamp Keypad Output Short Circuit to Ground) - is a continuous DTC that sets when the SJB detects a short to ground on the keyless entry keypad illumination output circuit CPK28 (WH/GN).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals and connectors
- Keyless entry keypad
- SJB

PINPOINT TEST H: THE KEYLESS ENTRY KEYPAD ILLUMINATION IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

H1 CHECK THE KEYLESS ENTRY KEYPAD OPERATION

- Press the 7/8 and 9/0 buttons simultaneously on the keypad.
- **Does the doors lock using the keyless entry keypad?**

  YES : Go to H2.

NO : Go to **Pinpoint Test G** .

H2 CHECK THE RECORDED SJB DTCs FROM THE ON-DEMAND SELF-TEST

- Check the recorded results from the SJB self-test.
- **Is DTC B1624 or B1626 present?**

  YES : For DTC B1624, go to H3.

  For DTC B1626, go to H9.

  NO : Go to H11.

H3 CHECK THE KEYLESS ENTRY KEYPAD ILLUMINATION

- Key in OFF position.
- Check the keyless entry keypad illumination.
- **Is the keyless entry keypad illumination always on?**

  YES : Go to H8.

  NO : Go to H4.

H4 CHECK CIRCUIT GD133 (BK) FOR AN OPEN

- Disconnect: Keyless Entry Keypad C500

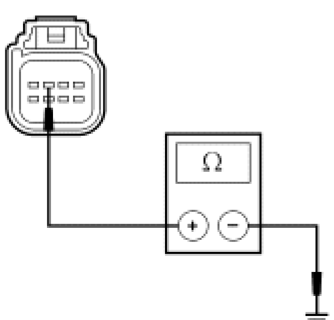


Fig. 26: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the keyless entry keypad C500-3, circuit GD133 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to H5.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

H5 CHECK FOR CIRCUIT CPK28 (WH/GN) FOR REFERENCE VOLTAGE

NOTE:	**The SJB sends out a constant reference voltage on circuit CPK28 (WH/GN) for its own circuit diagnostics. This voltage is 10 volts +/- 1 volt.**

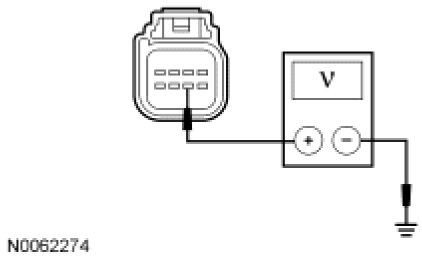


Fig. 27: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the keyless entry keypad C500-6, circuit CPK28 (WH/GN), harness side and ground.
- **Is 10 volts (+/- 1 volt) present?**

  YES : Go to H6.

  NO : Go to H7.

H6 CHECK FOR SJB OUTPUT

- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger

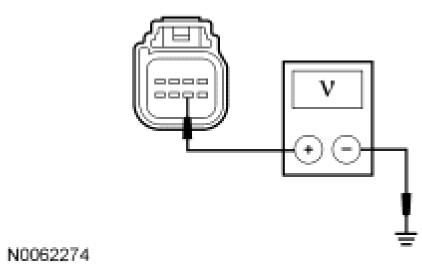


Fig. 28: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the keyless entry keypad C500-6, circuit CPK28 (WH/GN), harness side and ground while active commanding the SJB PID (KY_PAD_LMP) ON.
- **Is the voltage greater than 11 volts?**

  YES : INSTALL a new keyless entry keypad. REFER to **Keyless Entry Keypad**. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to H11.

H7 CHECK CIRCUIT CPK28 (WH/GN) FOR AN OPEN

- Disconnect: SJB C2280c

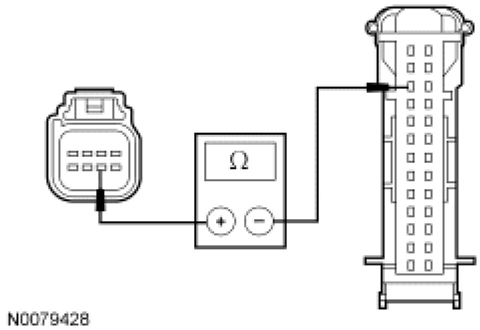


Fig. 29: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the keyless entry keypad C500-6, circuit CPK28 (WH/GN), harness side and the SJB C2280c-11, circuit CPK28 (WH/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to H11.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

H8 CHECK CIRCUIT CPK28 (WH/GN) FOR A SHORT TO VOLTAGE

- Disconnect: SJB C2280c
- Key in ON position.
- Observe the keypad illumination.
- **Is the keypad still illuminated?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to H11.

H9 CHECK THE KEYLESS ENTRY KEYPAD FOR A SHORT TO GROUND

- Disconnect: Keyless Entry Keypad C500

NOTE: **DTC B1624 may set and should be ignored when carrying out this step.**

- Clear the DTCs, then repeat the SJB on-demand self-test.
- **Is DTC B1626 recorded?**

  YES : Go to H10.

  NO : INSTALL a new keyless entry keypad. REFER to **Keyless Entry Keypad**. TEST the system for normal operation.

H10 CHECK CIRCUIT CPK28 (WH/GN) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280c

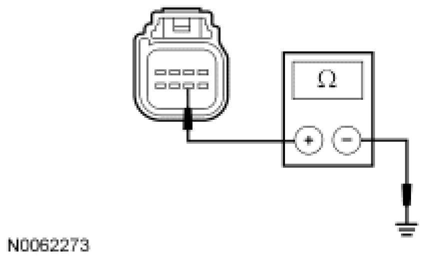


Fig. 30: Measuring Resistance Between Keyless Entry Keypad C500-6, Circuit CPK28 (WH/GN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the keyless entry keypad C500-6, circuit CPK28 (WH/GN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to H11.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

H11 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test I: The Remote Keyless Entry (RKE) Transmitter Is Inoperative

Normal Operation

Remote locking and unlocking of the doors, opening the power liftgate (if equipped), and activating the panic alarm is accomplished by the smart junction box (SJB) receiving a command message from the remote keyless entry (RKE) integrated keyhead transmitter (IKT). The IKTs and SJB also utilize a rolling code to prevent the code from being "captured" by a code grabber. The system advances the counter in the RKE transmitter and SJB every time an IKT button is pressed.

- DTC B1139 (Invalid Transmitter Identification Code) - is a continuous DTC that sets when the SJB detects an invalid TIC from an IKT.
- DTC B2425 (Remote Keyless Entry Out of Synchronization) - is a continuous DTC that sets when the SJB detects the rolling counter received from an RKE transmitter is 1,024 times greater than the rolling counter stored in the module.

This pinpoint test is intended to diagnose the following:

- IKT
- IKT battery
- IKT button pressed a substantial amount of times while outside the range of the vehicle
- IKT programming
- SJB

PINPOINT TEST I: THE REMOTE KEYLESS ENTRY (RKE) TRANSMITTER IS INOPERATIVE

NOTE: **All IKTs must be present to begin diagnosis of the RKE system.**

NOTE: **Aftermarket or dealer-installed systems may adversely affect the RKE system operation. These systems should be disconnected before diagnosing any RKE concerns.**

I1 CHECK FOR THE CORRECT RKE TRANSMITTERS

NOTE: **Make sure the IKTs are those provided with the original equipment manufacturer (OEM) system and not from an aftermarket system, or a dealer-installed system that may have been installed on the vehicle.**

- Check that the correct IKTs are used with the vehicle.
- **Are all the correct IKTs present?**

  YES : Go to I2.

  NO : The system cannot be tested without the correct IKTs. INFORM the customer that all the correct IKTs must be present to proceed with diagnosis of the system.

I2 CHECK THE RECORDED SJB AND INSTRUMENT CLUSTER (IC) DTCs FROM THE ON-DEMAND SELF-TEST

- Check the recorded results from the SJB and IC self-test.
- **Are any DTCs recorded?**

  YES : For SJB DTC B2425, go to I3.

  For IC DTC B1139, go to I4.

  For IC DTC B1137, go to **Pinpoint Test J** .

For all other DTCs, REFER to **DTC Charts**.

NO : Go to I4.

I3 RESYNCHRONIZE THE INOPERATIVE IKT

- Key in OFF position.
- Key in ON position.
- Leave the IKT key in the RUN position for a minimum of 6 seconds.
- Key in OFF position.
- Press any button on the IKT.
- **Does the IKT operate?**

YES : The system is OK. CLEAR the DTCs. REPEAT the self-test.

NO : Go to I4.

I4 MAKE SURE THE RKE TRANSMITTER SIGNAL IS BEING RECEIVED

- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Press a button on the IKT while observing the SJB PID (TIC_LAST).
- **Does the transmitter identification code (TIC) show up on the scan tool screen when a button is pressed?**

YES : Go to I5.

NO : Go to I6.

I5 CHECK IF THE RKE TRANSMITTERS ARE PROGRAMMED

- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Press a button on the IKT and compare the SJB PID (TIC_LAST) with the PIDs (TIC_1, 2, 3, 4, 7, 8, 9, or 10).
- **Does the TIC displayed match any of the TICs stored in memory?**

YES : Go to I7.

NO : PROGRAM all of the IKTs. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. INFORM the customer that any IKTs not present need to be programmed. TEST the system for normal operation.

I6 CHECK THE IKT BATTERY

- Using a thin coin, open the IKT.
- Do not clean off any grease from the battery terminals on the back surface of the circuit board.
- Verify the correct battery is used (CR2032).
- Remove the IKT battery and measure the voltage.
- **Is the voltage greater than 2.5 volts?**

YES : Go to I7.

NO : INSTALL a new battery (make sure the battery is seated correctly). DO NOT reprogram the IKT (weak or dead batteries do not erase TICs from memory). TEST the system for normal operation.

I7 CHECK FOR NORMAL OPERATION WITH A KNOWN GOOD IKT

- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Use the customer's second IKT, and press a button on the IKT while observing the SJB PID (TIC_LAST).
- **Does the TIC show up on the scan tool when a button is pressed?**

  YES : REPLACE the inoperative IKT. PROGRAM the new IKT. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. TEST the system for normal operation.

  NO : Go to I8.

I8 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test J: DTC B1137 - Data Not Programmed

Normal Operation

When an integrated keyhead transmitter (IKT) key is programmed, the remote keyless entry (RKE) transmitter identification code (TIC) data from the key is received by the instrument cluster (IC). The IC then sends the TIC data to the smart junction box (SJB) over the medium speed controller area network (MS-CAN). The SJB stores the TIC data in memory and sends an acknowledgment back to the IC that the TIC data was successfully programmed.

- DTC B1137 (Data Not Programmed) - is a continuous DTC that sets when the IC sends the RKE TIC data to the SJB over the MS-CAN network, and it does not receive a response from the SJB that the TIC data has been stored.

This pinpoint test is intended to diagnose the following:

- IKT programming
- MS-CAN network
- SJB

PINPOINT TEST J: DTC B1137 - DATA NOT PROGRAMMED

J1 CHECK FOR THE CORRECT RKE TRANSMITTERS

NOTE: Make sure the IKTs are those provided with the original equipment manufacturer (OEM) system and not from an aftermarket system, or a dealer-installed system that may have been installed on the vehicle.

- Check that the correct IKTs are used with the vehicle.
- **Are all the correct IKTs present?**

  YES : Go to J2.

  NO : The system cannot be tested without the correct IKTs. INFORM the customer that all the correct IKTs must be present to proceed with diagnosis of the system.

J2 CHECK FOR COMMUNICATION WITH THE IC AND SJB

- Enter the following diagnostic mode on the diagnostic tool: Network Test
- **Does the IC or SJB fail the network test?**

  YES : REFER to **MODULE COMMUNICATIONS NETWORK** article.

  NO : Go to J3.

J3 REPROGRAM THE IKT KEYS

- Erase and program all of the IKT keys using the scan tool method. Refer to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
- Erase all IC DTCs.
- Enter the following diagnostic mode on the diagnostic tool: IC Self-Test
- **Is DTC B1137 retrieved again?**

  YES : Go to J5.

  NO : Go to J4.

J4 CHECK THE OPERATION OF THE RKE TRANSMITTER

- Press any button on the suspect IKT key.
- **Does the RKE transmitter operate?**

  YES : The system is operating normally. The concern may have been caused by an improperly programmed IKT key.

  NO : Go to **Pinpoint Test I** .

J5 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test K: An Individual Button/Feature Is Inoperative From The Remote Keyless Entry (RKE) Transmitter

Normal Operation

When any integrated keyhead transmitter (IKT) button is pressed, the SJB receives and processes the command to provide the appropriate output.

This pinpoint test is intended to diagnose the following:

- Door locks
- Horn system
- Power liftgate release
- Turn signal system
- IKT

PINPOINT TEST K: AN INDIVIDUAL BUTTON/FEATURE IS INOPERATIVE FROM THE REMOTE KEYLESS ENTRY (RKE) TRANSMITTER

NOTE: **The panic feature will only operate when the key is in the OFF or LOCK positions.**

K1 VERIFY THE DOOR LOCK OPERATION

- Press the LOCK and UNLOCK button on the driver door lock control switch while observing the door lock operation.
- **Do the door locks operate correctly?**

  YES : Go to K2.

  NO : Go to **Symptom Chart**.

K2 VERIFY THE HORN OPERATION

- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Select the SJB PID (HORN) and active command the horn on.
- **Does the horn sound when commanded on?**

  YES : Go to K3.

  NO : REFER to **HORN** article.

K3 VERIFY THE HAZARD LAMP OPERATION

- Place the hazard switch in the ON position.
- **Do the hazard lamps operate correctly?**

YES : For vehicles with power liftgate, go to K4.

For vehicles with a manual liftgate, REPLACE the inoperative IKT and PROGRAM all of the IKTs. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. INFORM the customer that any IKTs not present need to be programmed. TEST the system for normal operation.

NO : REFER to **EXTERIOR LIGHTING** article.

K4 VERIFY THE LIFTGATE RELEASE OPERATION

- Press the liftgate release button on the liftgate.
- **Does the liftgate open?**

YES : REPLACE the inoperative IKT and PROGRAM all of the IKTs. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. INFORM the customer that any IKTs not present need to be programmed. TEST the system for normal operation.

NO : Go to **Pinpoint Test F** .

Pinpoint Test L: The Remote Keyless Entry (RKE) Transmitter Has Poor Range Performance

Normal Operation

The remote keyless entry (RKE) transmitter sends a radio signal to the smart junction box (SJB) based on the user selected RKE transmitter button. The SJB then carries out the selected action.

This pinpoint test is intended to diagnose the following:

- IKT
- IKT battery
- Aftermarket systems
- High power devices
- TV/radio transmission towers
- SJB

PINPOINT TEST L: THE REMOTE KEYLESS ENTRY (RKE) TRANSMITTER HAS POOR RANGE PERFORMANCE

NOTE:	**All RKE transmitters must be present to begin diagnosis of the RKE system.**

NOTE:	**Aftermarket or dealer-installed systems may adversely affect RKE system operation. These systems should be disconnected before diagnosing any RKE concerns.**

L1 CHECK FOR THE CORRECT RKE TRANSMITTERS

NOTE: Make sure the RKE transmitters are those provided with the original equipment manufacturer (OEM) system and not from an aftermarket system or a dealer-installed system.

- Check that the correct RKE transmitters are used with the vehicle.
- **Are all the correct RKE transmitters present?**

  YES : Go to L2.

  NO : The system cannot be tested without the correct RKE transmitters. INFORM the customer that all the correct RKE transmitters must be present to proceed with diagnosis of the system.

L2 CHECK ALL THE RKE TRANSMITTERS FOR POOR RANGE PERFORMANCE

NOTE: The 10 m (33 ft) measurement of range is not the standard but is a guideline that clearly indicates a vehicle is experiencing poor range performance.

- Check all the RKE transmitters for poor range performance (less than 10 m [33 ft]).
- **Do all RKE transmitters experience poor range?**

  YES : Go to L4.

  NO : Go to L3.

L3 CHECK THE IKT BATTERY

- Using a thin coin, open the IKT.
- Do not clean off any grease from the battery terminals on the back surface of the circuit board.
- Verify the correct battery is used (CR2032).
- Remove the IKT battery and measure the voltage.
- **Is the voltage greater than 2.5 volts?**

  YES : REPLACE the inoperative integrated key and PROGRAM all the integrated keys. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. INFORM the customer that any RKE transmitters not present need to be programmed. TEST the system for normal operation.

  NO : INSTALL a new battery (make sure the battery is seated correctly). DO NOT reprogram the IKT (weak or dead batteries do not erase TICs from memory). TEST the system for normal operation.

L4 CHECK THE LOCATION OF THE VEHICLE AND THE APPROACH ANGLES AROUND THE VEHICLE

- Make sure the poor performance is consistent in nature and is not from one approaching angle.
- The RKE transmitter range performance may be degraded in certain locations. For example, if the vehicle is within 0.8 km (0.5 miles) of high-power devices or radio/TV towers, the operating distance of the RKE transmitters may be reduced.
- **Is the poor range performance consistent around the vehicle?**

  YES : Go to L5.

  NO : The system is operating correctly at this time. TEST the system for normal operation.

L5 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test M: The Smart Unlock Does Not Operate Correctly

Normal Operation

The smart junction box (SJB) automatically unlocks all the doors after the doors are locked with a door lock control switch if the key is in the ignition lock cylinder and a front door or the liftgate is ajar.

This pinpoint test is intended to diagnose the following:

- Key-in-ignition switch
- Door ajar switch input
- SJB

PINPOINT TEST M: THE SMART UNLOCK DOES NOT OPERATE CORRECTLY

M1 CHECK THE COURTESY LAMP OPERATION

- Open and close the front doors and liftgate while checking the courtesy lamp operation.
- **Do the courtesy lamps operate correctly?**

  YES : Go to M2.

  NO : REFER to **INTERIOR LIGHTING** article.

M2 CHECK THE KEY-IN-IGNITION CHIME

- Insert the key in the ignition lock cylinder.
- Open the driver door.
- **Does the key-in-ignition chime operate correctly?**

  YES : Go to M3.

  NO : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES** article.

M3 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test N: The Autolock Does Not Operate Correctly

Refer to appropriate SYSTEM WIRING DIAGRAM article, Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

The smart junction box (SJB) energizes the lock relay based on input from the ajar switches, the ignition switch, the transmission range (TR) sensor and the vehicle speed sensor (VSS). The SJB locks the doors when the following conditions are met:

- all the doors are closed
- the ignition switch is in the ON position
- the vehicle is shifted into any gear putting the vehicle in motion, and
- the vehicle attains a speed greater than 20 km/h (12 mph) for longer than 2 seconds.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals and connectors
- Programming
- Door ajar switches
- SJB

PINPOINT TEST N: THE AUTOLOCK DOES NOT OPERATE CORRECTLY

N1 VERIFY THE AUTOLOCK FEATURE IS ENABLED

- Verify the autolock feature is enabled. Refer to **Autolock and Horn Chirp Programming**.
- **Is the autolock feature enabled?**

  YES : Go to N2.

NO : PROGRAM the autolock feature. REFER to **Autolock and Horn Chirp Programming**.

N2 CHECK THE COURTESY LAMP OPERATION

- Open and close the doors while checking the courtesy lamp operation.
- **Do the courtesy lamps operate correctly?**

YES : Go to N3.

NO : REFER to **INTERIOR LIGHTING** article.

N3 CHECK THE SJB PID (IGN_R_ECU)

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB IGN PID (IGN_R_ECU).
- **Does the PID indicate RUN?**

YES : Go to N4.

NO : REFER to **STEERING COLUMN SWITCHES** article.

N4 RETRIEVE THE RECORDED SJB DTCs FROM THE CONTINUOUS SELF-TESTS

- Check for recorded SJB DTCs from the continuous self-tests.
- **Is DTC U0155 recorded?**

YES : REFER to **MODULE COMMUNICATIONS NETWORK** article.

NO : Go to N5.

N5 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

GENERAL PROCEDURES

KEYLESS ENTRY KEYPAD CODE PROGRAMMING

Programming a Personal Code and Keypad Association to Memory Seats and Mirrors (If Equipped)

NOTE: **If the wrong code has been entered 7 times (35 consecutive button presses), the**

keypad will go into an anti-scan mode. This mode disables the keypad for one minute (only the lock control will operate on the keypad) and the keypad lamp will flash. The anti-scan feature will turn off after one minute of keypad inactivity, or after pressing the UNLOCK control on the integrated keyhead transmitter (IKT), or after the ignition key has been turned to the ON position.

NOTE: The factory set code cannot be associated with a memory setting.

1. Enter the permanent factory keyless entry keypad code.
2. Within 5 seconds, press the 1/2 button on the keypad.
3. Enter the new 5-digit keyless entry keypad code. Each number must be entered within five seconds of each other.
4. To associate the entry code with a memory setting, enter a sixth digit to indicate which driver should be set in a memory recalled by the personal entry code:
    - Pressing the 1/2 button recalls driver 1 settings
    - Pressing the 3/4 button recalls driver 2 settings
    - Pressing other keypad buttons or not pressing a keypad button as a sixth digit does not set a driver and will not recall a memory setting
5. The doors will lock then unlock to confirm the new code is programmed.

Erasing the Personal Codes

NOTE: If the wrong code has been entered 7 times (35 consecutive button presses), the keypad will go into an anti-scan mode. This mode disables the keypad for one minute (only the lock control will operate on the keypad) and the keypad lamp will flash. The anti-scan feature will turn off after one minute of keypad inactivity, or after pressing the UNLOCK control on the IKT, or after the ignition key has been turned to the ON position.

1. Enter the permanent factory keyless entry keypad code.
2. Within 5 seconds, press the 1/2 button on the keypad and release.
3. Within 5 seconds, press and hold the 1/2 button on the keypad for 2 seconds.
4. All personal codes are now erased and only the permanent factory keyless entry keypad code will work.

REMOTE KEYLESS ENTRY TRANSMITTER PROGRAMMING

NOTE: This procedure is for programming conventional keyfobs only. The Remote Keyless Entry (RKE) transmitter of the Integrated Keyhead Transmitter (IKT) is programmed automatically during the Passive Anti-Theft System (PATS) programming. For additional information, refer to Key Programming Using Two Programmed Keys or Integrated Keyhead Transmitter (IKT) Key Programming Using Diagnostic Equipment in ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS) article to program the IKT.

NOTE: All RKE transmitters must be programmed at the same time.

NOTE: Do not apply the brake pedal during this sequencing, as doing so ends the sequence and the transmitters will not be programmed.

1. Electronically unlock the door locks using the door lock control switch.
2. Cycle the ignition switch from the OFF to the RUN position 8 times in rapid succession (within 10 seconds), with the eighth turn ending in RUN. If the module successfully enters program mode, it locks and then unlocks all the doors.

   NOTE: If no action is taken within 20 seconds after a transmitter has been programmed, the programming sequence ends (the doors lock and unlock to confirm that programming is complete).

3. Within 20 seconds, press any button on the RKE transmitter to be programmed. The doors lock and then unlock to confirm that each RKE transmitter is programmed. Repeat this step for each RKE transmitter.
4. Exiting the programming mode is accomplished if one of the following occurs:
   - The key transitions to the OFF position.
   - 20 seconds have passed since entering programming mode or since the last RKE transmitter was programmed.
   - The maximum number (4) of RKE transmitters have been programmed.
5. Check the operation of the RKE transmitter. If the door locks do not respond for the programmed RKE transmitter(s), wait several seconds and press the button again. If the door locks still fail to respond, refer to **Locks, Latches and Entry Systems**. (Make sure that no more than the maximum number of RKE transmitters are attempted to be programmed.)

REMOTE MEMORY ACTIVATION

1. Position the driver seat and mirrors to the desired position.
2. Press the set button on the driver door panel.
3. Within 5 seconds press the 1 or 2 button on the driver door panel to associate with the driver 1 or driver 2 position.
4. Press the set button again.
5. Within 5 seconds press a button on the associated integrated keyhead transmitter (IKT).
6. Within 5 seconds press the 1 or 2 button on the driver door panel to associate with the driver 1 or driver 2 position.
7. If a second memory setting is desired, repeat the procedure with the second IKT.

REMOTE MEMORY DEACTIVATION

1. Press the set button on the driver door panel.
2. Within 5 seconds press any button on the integrated key that you wish to deactivate and then press the set button on the driver door panel.

3. If a second memory setting is desired to be deactivated, repeat the procedure with the second integrated key.

AUTOLOCK AND HORN CHIRP PROGRAMMING

Programming the Autolock Feature Using the Door Lock Control Switch

NOTE: The autolock feature can be activated or deactivated independently of the auto-unlock feature.

NOTE: The autolock feature of the Smart Junction Box (SJB) can also be configured ON or OFF with the scan tool. For additional information on module configuration, refer to MODULE CONFIGURATION article.

NOTE: When programming the autolock feature using the door lock control switch method the following steps must be carried out within 30 seconds or the procedure will need to be repeated. If the procedure needs to be repeated, wait 30 seconds between programming sessions.

NOTE: Prior to beginning, make sure the ignition key is in the OFF position and all vehicle doors are closed.

1. Turn the ignition key from the OFF to the ON position.
2. Press the unlock button on the door lock control switch 3 times.
3. Turn the ignition key from the ON to the OFF position.
4. Press the unlock button on the door lock control switch 3 times.
5. Turn the ignition key to the ON position. The horn chirps once to indicate that programming mode is entered.
6. To enable/disable the autolock feature, press the unlock button on the door lock control switch, then the lock button. The horn chirps once if the autolocks are disabled or twice (one short chirp followed by a honk) if the autolocks are enabled.
7. Turn the ignition key to the OFF position. The horn chirps once to signal that the programming is complete.

Programming the Autolock Feature Using the Keyless Entry Keypad

NOTE: The autolock feature can be activated or deactivated independently of the auto-unlock feature.

NOTE: The autolock feature of the SJB can also be configured ON or OFF with the scan tool. For additional information on module configuration, refer to MODULE CONFIGURATION article.

1. Turn the ignition key to the OFF position and close all vehicle doors.
2. Enter the factory set 5-digit keyless entry keypad code.
3. Press and hold the 3/4 button on the keypad. While holding the 3/4 button, press the 7/8 button.
4. Release the 7/8 button, then release the 3/4 button. The horn chirps once if the autolocks are disabled or twice (one short chirp followed by a honk) if the autolocks are enabled.

Programming the Autolock Feature Using the Instrument Cluster Message Center

NOTE: The autolock feature can be activated or deactivated independently of the auto-unlock feature.

NOTE: The autolock feature of the SJB can also be configured ON or OFF with the scan tool. For additional information on module configuration, refer to MODULE CONFIGURATION article.

1. With all the vehicle doors closed, turn the ignition key from the OFF to the ON position.
2. Press the SETUP button on the message center switch until AUTOLOCK <ON> OFF is displayed.
3. Press the RESET button to select ON or OFF. If the autolocks are enabled, the message center will have brackets around the <ON> display. If the autolocks are disabled, the message center will have brackets around the <OFF> display.

Programming the Auto-Unlock Feature Using the Door Lock Control Switch

NOTE: The auto-unlock feature can be activated or deactivated independently of the autolock feature.

NOTE: The auto-unlock feature of the SJB can also be configured ON or OFF with the scan tool. For additional information on module configuration, refer to MODULE CONFIGURATION article.

NOTE: When programming the auto-unlock feature using the door lock control switch method the following steps must be carried out within 30 seconds or the procedure will need to be repeated. If the procedure needs to be repeated, wait 30 seconds between programming sessions.

NOTE: Prior to beginning, make sure the ignition key is in the OFF position and all vehicle doors are closed.

1. Turn the ignition key from the OFF to the ON position.
2. Press the unlock button on the door lock control 3 times.
3. Turn the ignition key from the ON to the OFF position.
4. Press the unlock button on the door lock control switch 3 times.

5. Turn the ignition key to the ON position. The horn chirps once to indicate that programming mode is entered.
6. To enable/disable the auto-unlock feature, press the lock button on the door lock control switch then the unlock button. The horn chirps once if auto-unlock is disabled or twice (one short chirp followed by a honk) if auto-unlock is enabled.
7. Turn the ignition key to the OFF position. The horn chirps once to signal that the programming is complete.

Programming the Auto-Unlock Feature Using the Keyless Entry Keypad

NOTE: The auto-unlock feature can be activated or deactivated independently of the autolock feature.

NOTE: The auto-unlock feature of the SJB can also be configured ON or OFF with the scan tool. For additional information on module configuration, refer to MODULE CONFIGURATION article.

1. Turn the ignition key to the OFF position and close all vehicle doors.
2. Enter the factory set 5-digit keyless entry keypad code.
3. Press and hold the 3/4 button on the keypad. While holding the 3/4 button, press and release the 7/8 button. While still holding the 3/4 button, press and release the 7/8 button a second time.
4. Release the 3/4 button. The horn chirps once if auto-unlock is disabled or twice (one short chirp followed by a honk) if auto-unlock is enabled.

Programming the Auto-Unlock Feature Using the Instrument Cluster Message Center

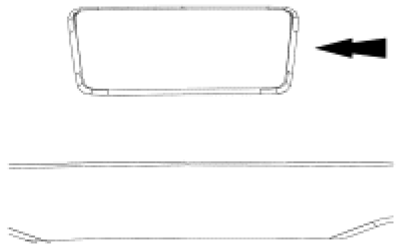
NOTE: The auto-unlock feature can be activated or deactivated independently of the autolock feature.

NOTE: The auto-unlock feature of the SJB can also be configured ON or OFF with the scan tool. For additional information on module configuration, refer to MODULE CONFIGURATION article.

1. Turn the ignition key from the OFF to the ON position.
2. Press the SETUP button on the message center switch until AUTOUNLOCK <ON> OFF is displayed.
3. Press the RESET button to select ON or OFF. If auto-unlock is enabled, the message center will have brackets around the <ON> display. If auto-unlock is disabled, the message center will have brackets around the <OFF> display.

LIFTGATE LATCH MANUAL RELEASE

1. Remove the liftgate latch access cover from the center of the liftgate trim panel.

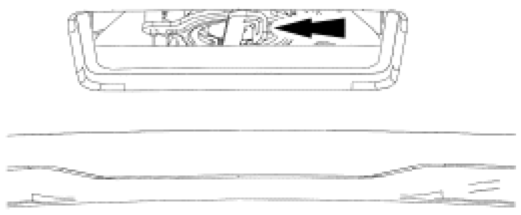


N0068894

Fig. 31: Identifying Liftgate Latch Access Cover
Courtesy of FORD MOTOR CO.

NOTE: Portions of the liftgate sheet metal are removed for clarity.

2. Vehicles with manual liftgate, press the liftgate latch manual release lever to the left to release the liftgate latch.

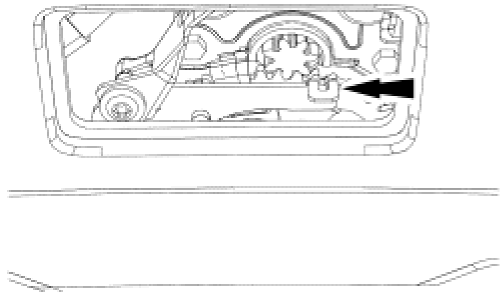


N0068895

Fig. 32: Pressing Liftgate Latch Manual Release Lever To Left To Release Liftgate Latch
Courtesy of FORD MOTOR CO.

NOTE: Portions of the liftgate sheet metal are removed for clarity.

3. Vehicles with power liftgate, press the liftgate latch manual release lever down to release the liftgate latch.



N0068896

Fig. 33: Pressing Liftgate Latch Manual Release Lever Down To Release Liftgate Latch

Courtesy of FORD MOTOR CO.

PERIMETER LIGHTING FEATURE PROGRAMMING

Programming the Perimeter Lighting Feature Using the Door Lock Control Switch

NOTE: The following steps must be carried out within 30 seconds or the procedure will need to be repeated. If the procedure needs to be repeated, wait 30 seconds between programming sessions.

1. Turn the ignition switch from the OFF to the ON position.
2. Press the unlock button on the door lock control switch 3 times.
3. Turn the ignition switch from the ON to the OFF position.
4. Press the unlock button on the door lock control switch 3 times.
5. Turn the ignition switch to the ON position. The horn chirps one time to indicate that programming mode is entered.

   NOTE: The unlock button must be pressed twice within 5 seconds.

6. Within 30 seconds of entering the programming mode, press the unlock button on the door lock control switch twice to enable/disable the perimeter lighting feature. The horn chirps once if the perimeter lighting is disabled or a chirp followed by a honk if the perimeter lighting is enabled.
7. Programming ends when the ignition switch state changes or times out after 2 minutes.

STEPPED UNLOCK PROGRAMMING

1. With the ignition in the OFF mode, press the LOCK and UNLOCK buttons on the Remote Keyless Entry (RKE) transmitter simultaneously for 4 seconds.
   - The turn signals will flash twice to indicate the mode change.
2. Repeat Step 1 to enable/disable the stepped unlocking feature.

REMOVAL AND INSTALLATION

HOOD LATCH AND COMPONENTS - EXPLODED VIEW

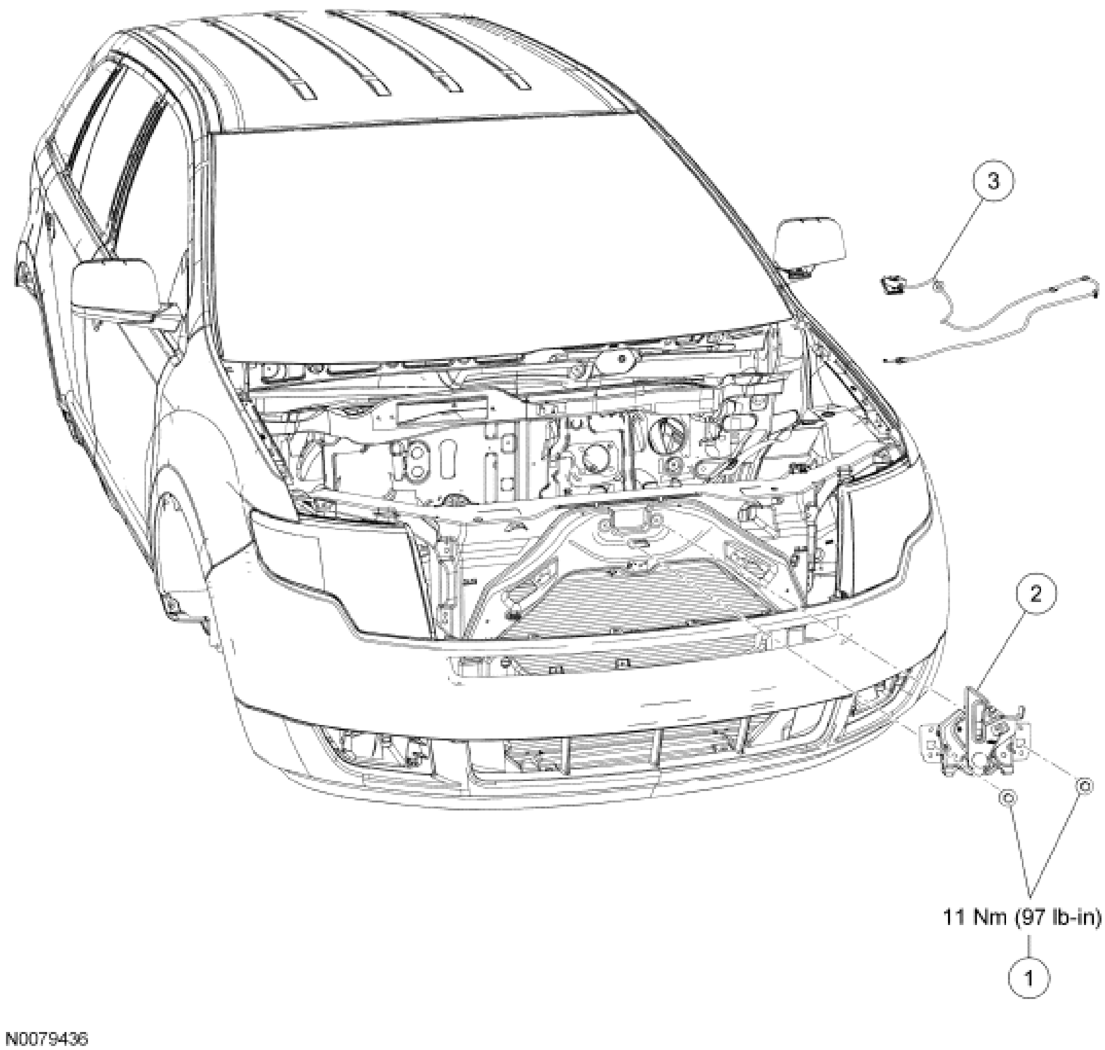


Fig. 34: Identifying Hood Latch and Components
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N808727	Hood latch bolts (2 required)
2	16700	Hood latch
3	16916	Hood latch release handle and cable

1. For additional information, refer to the appropriate procedures in this service information.

HOOD LATCH

Material

Item	Specification

Multi-Purpose Grease Spray XL-5	ESB-M1C93-B

REMOVAL AND INSTALLATION

NOTE: Mark the hood latch position prior to removal of the hood latch bolts.

1. Remove the 2 hood latch bolts and position the hood latch aside.
   - To install, tighten to 11 Nm (97 lb-in).
2. Disconnect the hood latch release cable and remove the hood latch.

NOTE: When the hood latch is installed, the latch adjustment must be checked to make sure the latch is installed and aligned correctly.

3. To install, reverse the removal procedure.
   - Lubricate the hood latch after installation.

HOOD LATCH RELEASE HANDLE

REMOVAL AND INSTALLATION

1. Remove the hood latch. For additional information, refer to **Hood Latch**.
2. Disconnect the hood latch release cable locator from the radiator grille opening panel reinforcement.
3. Disconnect the hood latch release cable locator from the LH inner fender.

NOTE: The hood latch release handle and cable assembly must be pulled through the dash panel into the passenger compartment.

4. Remove the hood latch release handle and cable assembly.
   1. Remove the hood latch release handle screw.
   2. Remove the hood latch release handle and cable assembly.

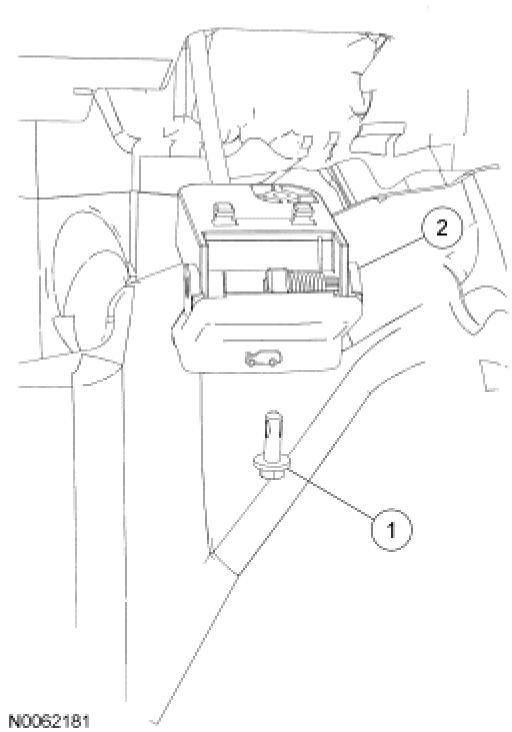


Fig. 35: Identifying Hood Latch Release Handle & Screw
Courtesy of FORD MOTOR CO.

5. To install, reverse the removal procedure.

FRONT DOOR HANDLES, LOCKS AND LATCHES - EXPLODED VIEW

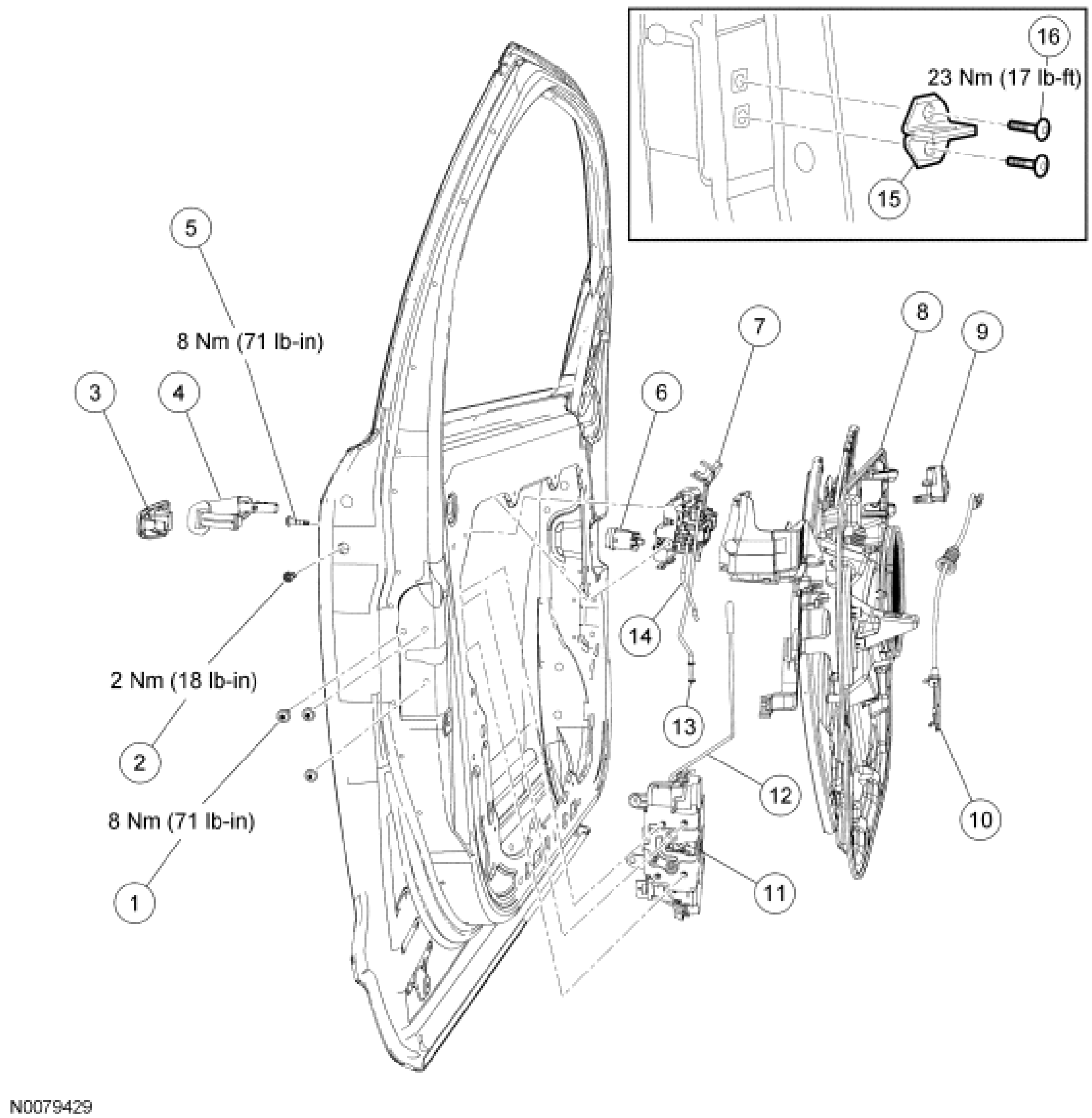


Fig. 36: Identifying Front Door Handles, Locks & Latches With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W705830	Front door latch bolts (3 required)
2	W506965	Exterior front door handle reinforcement screw
3	78218B08/78218A14	Exterior front door handle bezel (RH/LH)
4	7822404	Exterior front door handle strap
5	W708514	Exterior front door handle reinforcement bolt
6	5406082	Front door lock cylinder
7	7826684/7826685	Exterior front door handle

		reinforcement (RH/LH)
8	78235A86/78235A87	Front door panel component module assembly (RH/LH)
9	7822600/7822601	Interior front door handle (RH/LH)
10	78221A00	Interior front door handle actuating cable
11	7821812/7821813	Front door latch (RH/LH)
12	7821852/7821853	Front door lock actuating rod (RH/LH)
13	7822152/7822153	Exterior front door handle actuating rod (RH/LH)
14	7822135	Front door lock cylinder actuating rod (if equipped)
15	7822008	Striker
16	W710993	Door latch striker screws (2 required)

1. For additional information, refer to the appropriate procedures in this service information.

REAR DOOR HANDLES, LOCKS AND LATCHES - EXPLODED VIEW

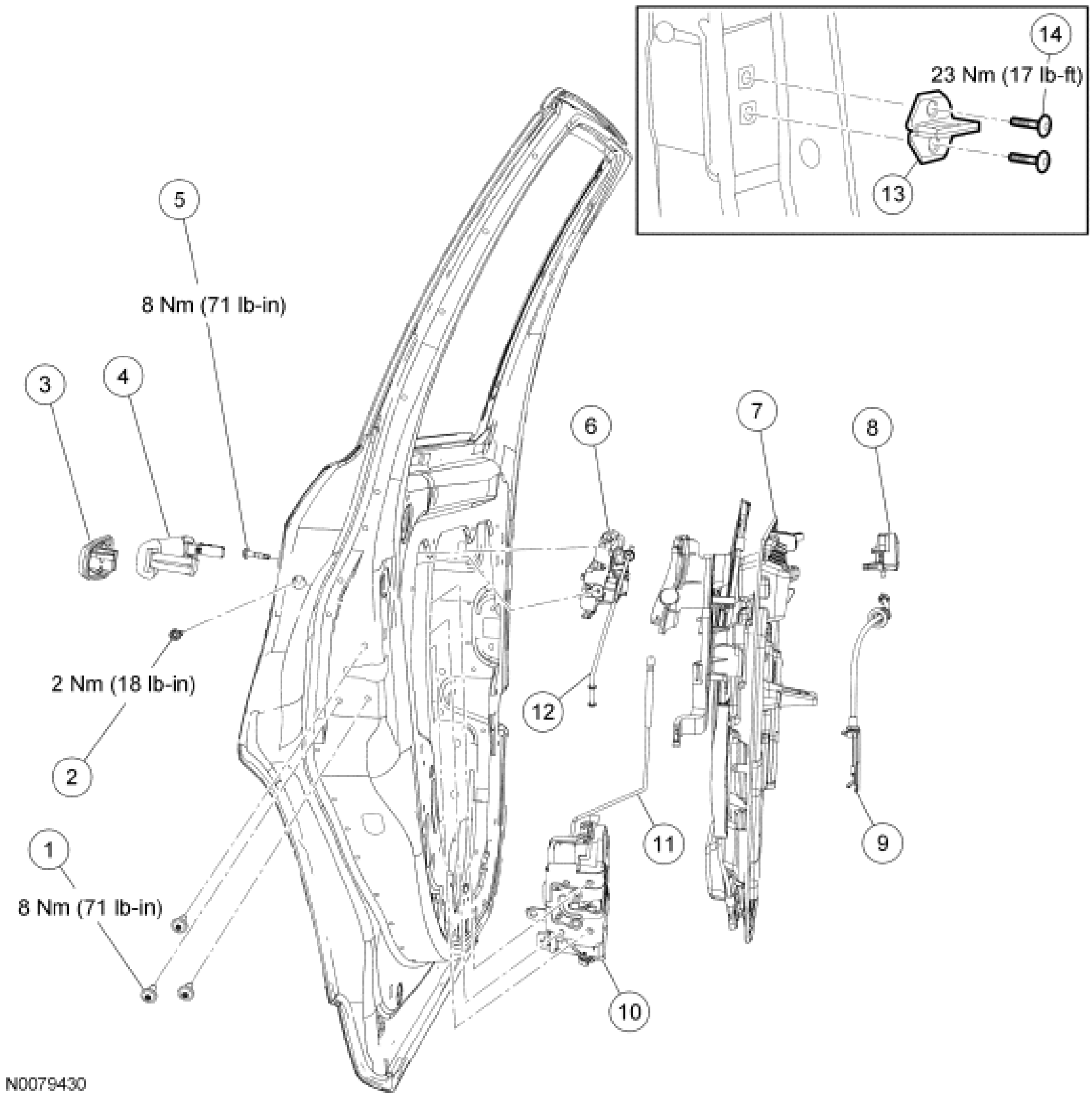


Fig. 37: Identifying Rear Door Handles, Locks & Latches With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W705830	Rear door latch bolts (3 required)
2	W506965	Exterior rear door handle reinforcement screw
3	78218B08	Exterior rear door handle bezel
4	7822404	Exterior rear door handle strap
5	W708514	Exterior rear door handle reinforcement bolt
6	7826684/7826685	Exterior rear door handle reinforcement (RH/LH)
7	78235A88/78235A89	Rear door panel component module

		assembly (RH/LH)
8	7822600/7822601	Interior rear door handle (RH/LH)
9	78221A00	Interior rear door handle actuating cable
10	7821812/7821813	Rear door latch (RH/LH)
11	7826460/7826461	Rear door lock actuating rod (RH/LH)
12	7826596/7826597	Exterior rear door handle actuating rod (RH/LH)
13	7822008	Striker
14	W710993	Door latch striker screws (2 required)

1. For additional information, refer to the appropriate procedures in this service information.

INTERIOR DOOR HANDLE

REMOVAL AND INSTALLATION

1. Remove the door trim panel. For additional information, refer to **INTERIOR TRIM & ORNAMENTATION** article.

NOTE: Front door shown, rear door similar.

2. Disconnect the interior door handle from the door window regulator and motor assembly.

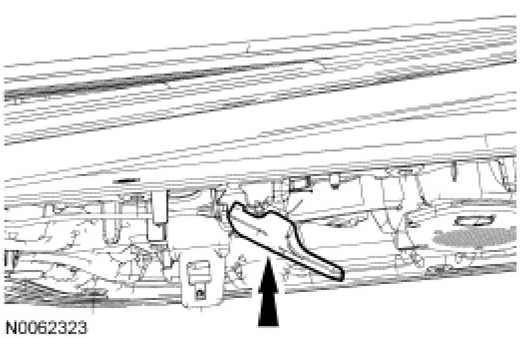


Fig. 38: Disconnecting Interior Door Handle From Door Window Regulator & Motor Assembly
Courtesy of FORD MOTOR CO.

NOTE: Front door shown, rear door similar.

3. Remove the interior door handle.
   - Disconnect the interior door handle actuating cable from the interior door handle.
   - Remove the interior door handle.

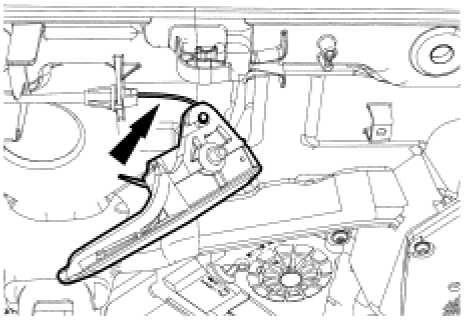


Fig. 39: Disconnecting Interior Door Handle Actuating Cable From Interior Door Handle
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.

EXTERIOR DOOR HANDLE

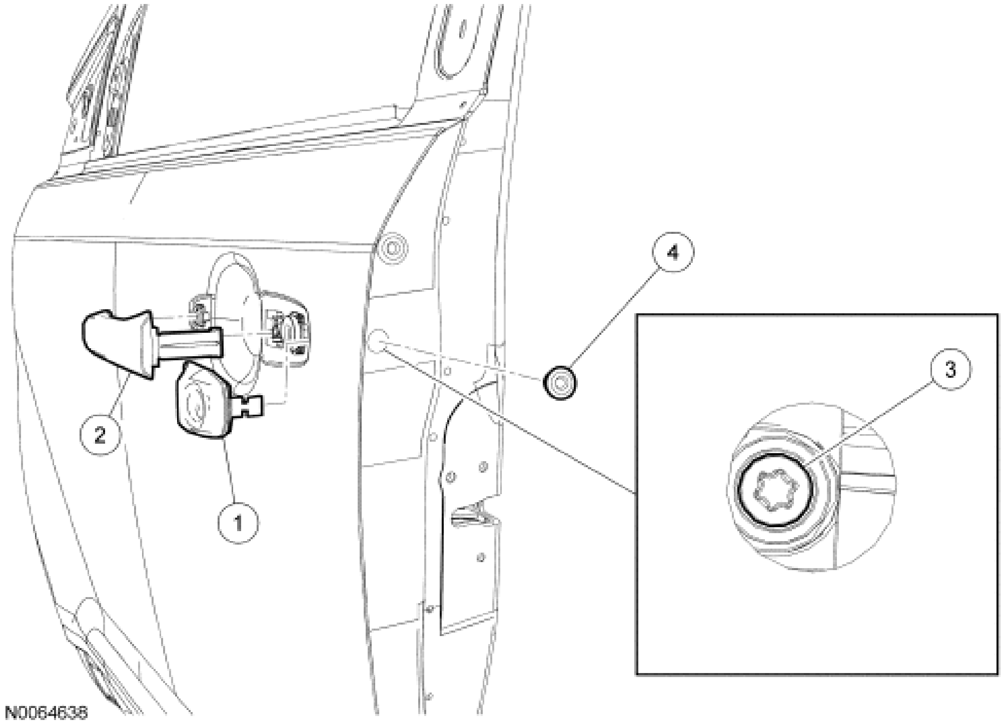


Fig. 40: Identifying Exterior Door Handle
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	78218A14/78218B08	Exterior door handle bezel (LH/RH)
2	7822404	Exterior door handle strap
3	N807169	Exterior door handle reinforcement screw

4	W651011	Plug

REMOVAL AND INSTALLATION

1. Remove the plug from the rear of the door.
2. Loosen the exterior door handle reinforcement screw and remove the exterior door handle bezel.

NOTE: Pull the exterior door handle strap outward and to the rear to release it from the exterior door handle reinforcement.

3. Remove the exterior door handle strap.
4. To install, reverse the removal procedure.

DOOR HANDLE REINFORCEMENT

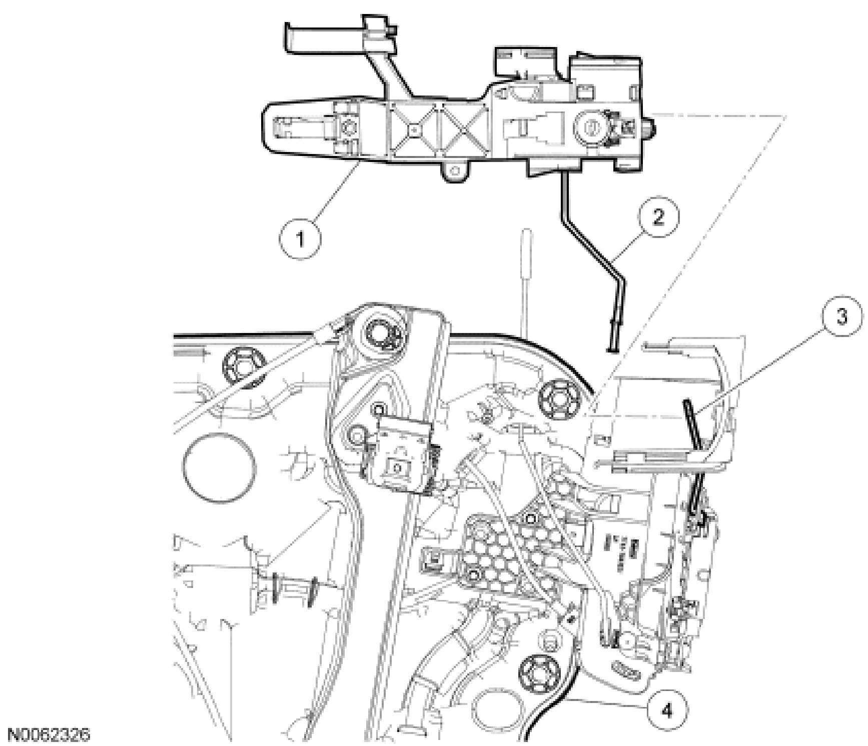


Fig. 41: Exploded View Of Exterior Front
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7826684/7826685	Exterior front door handle reinforcement (RH/LH)
2	7822152/7822153	Exterior front door handle actuating rod (RH/LH)
3	7822135	Front door lock cylinder actuating rod

		(if equipped)
4	-	Front window regulator and motor assembly

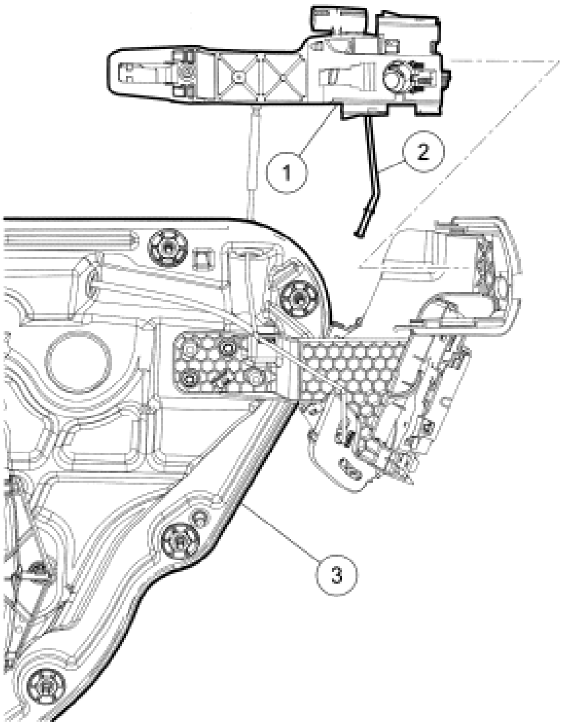


Fig. 42: Exploded View Of Exterior Rear
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7826684/7826685	Exterior rear door handle reinforcement (RH/LH)
2	7826596/7826597	Exterior rear door handle actuating rod (RH/LH)
3	-	Rear window regulator and motor assembly

REMOVAL AND INSTALLATION

1. Remove the exterior door handle. For additional information, refer to **Exterior Door Handle**.
2. Remove the door trim panel. For additional information, refer to **INTERIOR TRIM & ORNAMENTATION** article.
3. Remove the door window regulator and motor assembly. For additional information, refer to **GLASS, FRAMES & MECHANISMS** article.
4. If equipped, disconnect the upper lock cylinder actuating rod.
5. Disconnect the lower exterior door handle reinforcement actuating rod.

NOTE: Front door shown, rear door similar.

6. Remove the exterior door handle reinforcement.
    1. If equipped, disconnect the keyless entry keypad wiring harness retainer.
    2. Release the exterior door handle reinforcement locking clips from the door window regulator and motor assembly.
    3. Remove the exterior door handle reinforcement.

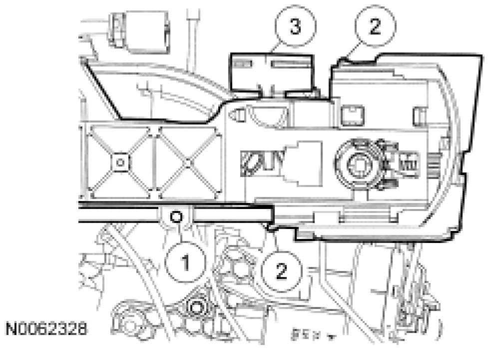


Fig. 43: Identifying Exterior Door Handle Reinforcement Locking Clips & Keyless Entry Keypad Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

7. To install, reverse the removal procedure.

DOOR LATCH

Material

Item	Specification
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B

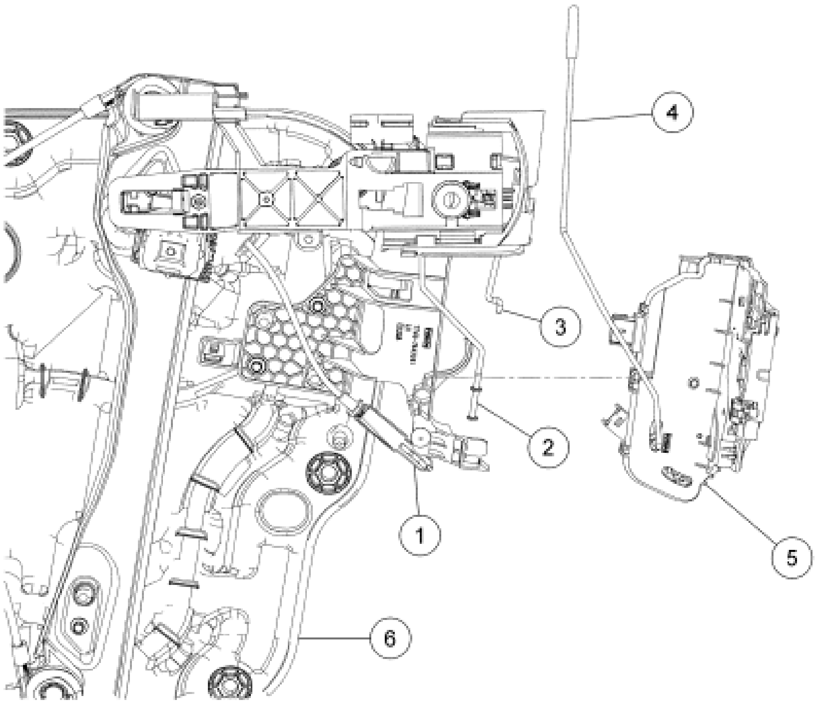


Fig. 44: Exploded View Of Front Door Latch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	78221A00	Interior front door handle actuating cable
2	7822152/7822153	Exterior front door handle actuating rod (RH/LH)
3	7822135	Front door lock cylinder actuating rod (if equipped)
4	7821852/7821853	Front door lock actuating rod (RH/LH)
5	7821812/7821813	Front door latch (RH/LH)
6	-	Front window regulator and motor assembly

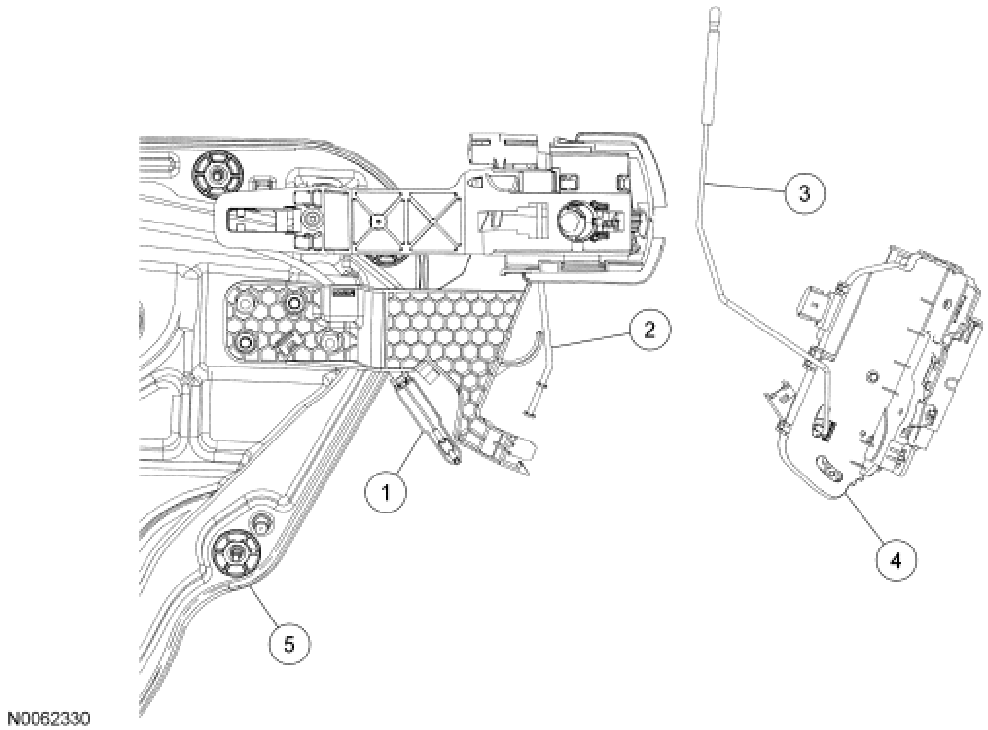


Fig. 45: Exploded View Of Rear Door Latch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	78221A00	Interior rear door handle actuating cable
2	7826596/7826597	Exterior rear door handle actuating rod (RH/LH)
3	7826460/7826461	Rear door lock actuating rod (RH/LH)
4	7821812/7821813	Rear door latch (RH/LH)
5	-	Rear window regulator and motor assembly

REMOVAL AND INSTALLATION

1. Remove the door trim panel. For additional information, refer to **INTERIOR TRIM & ORNAMENTATION** article.
2. Remove the door window regulator and motor assembly. For additional information, refer to **GLASS, FRAMES & MECHANISMS** article.
3. Disconnect the interior door handle actuating cable.
4. If equipped, disconnect the door lock cylinder actuating rod.
5. Disconnect the door handle reinforcement actuating rod.

NOTE: Front door shown, rear door similar.

6. Release the door latch rear locking clip.

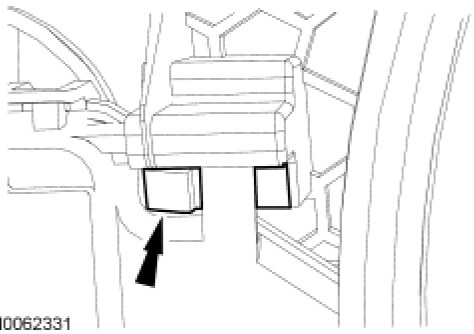


Fig. 46: Locating Door Latch Rear Locking Clip
Courtesy of FORD MOTOR CO.

NOTE: Front door shown, rear door similar.

7. Release the door latch front locking clip.
   1. Disconnect the door latch electrical connector.
   2. Release the door latch front locking clip.

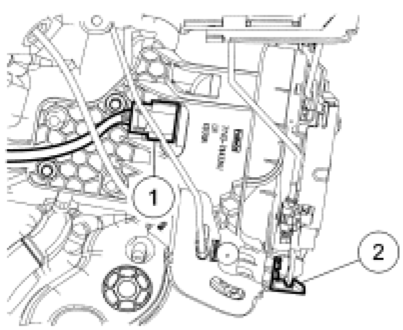


Fig. 47: Locating Door Latch Front Locking Clip & Door Latch Electrical Connector
Courtesy of FORD MOTOR CO.

8. Remove the door latch with the door lock actuating rod.
9. If necessary, disconnect the door lock actuating rod.
10. To install, reverse the removal procedure.
    - Lubricate the door latch to striker surfaces after installation.

DOOR LOCK CYLINDER

REMOVAL AND INSTALLATION

NOTE: Individual lock cylinders are repaired by discarding the inoperative cylinder and building a new lock cylinder using the appropriate lock repair package. The lock

repair package includes a detailed instruction sheet to build the new lock cylinder to the current key code of the vehicle.

1. Remove the exterior door handle. For additional information, refer to **Exterior Door Handle**.

NOTE: Door handle reinforcement shown removed for clarity.

2. Using a suitable tool, release the retaining tab and remove the front door lock cylinder.

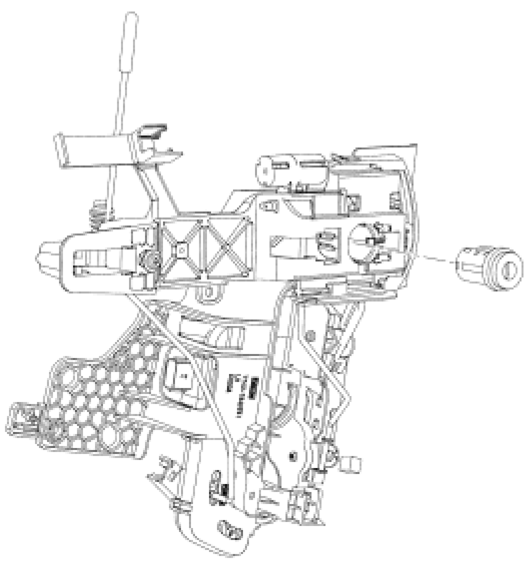


Fig. 48: Identifying Retaining Tab & Front Door Lock Cylinder
Courtesy of FORD MOTOR CO.

3. To install, reverse the removal procedure.

LIFTGATE LATCH - MANUAL

Material

Item	Specification
Multi-Purpose Grease Spray XL-5	ESB-M1C93-B

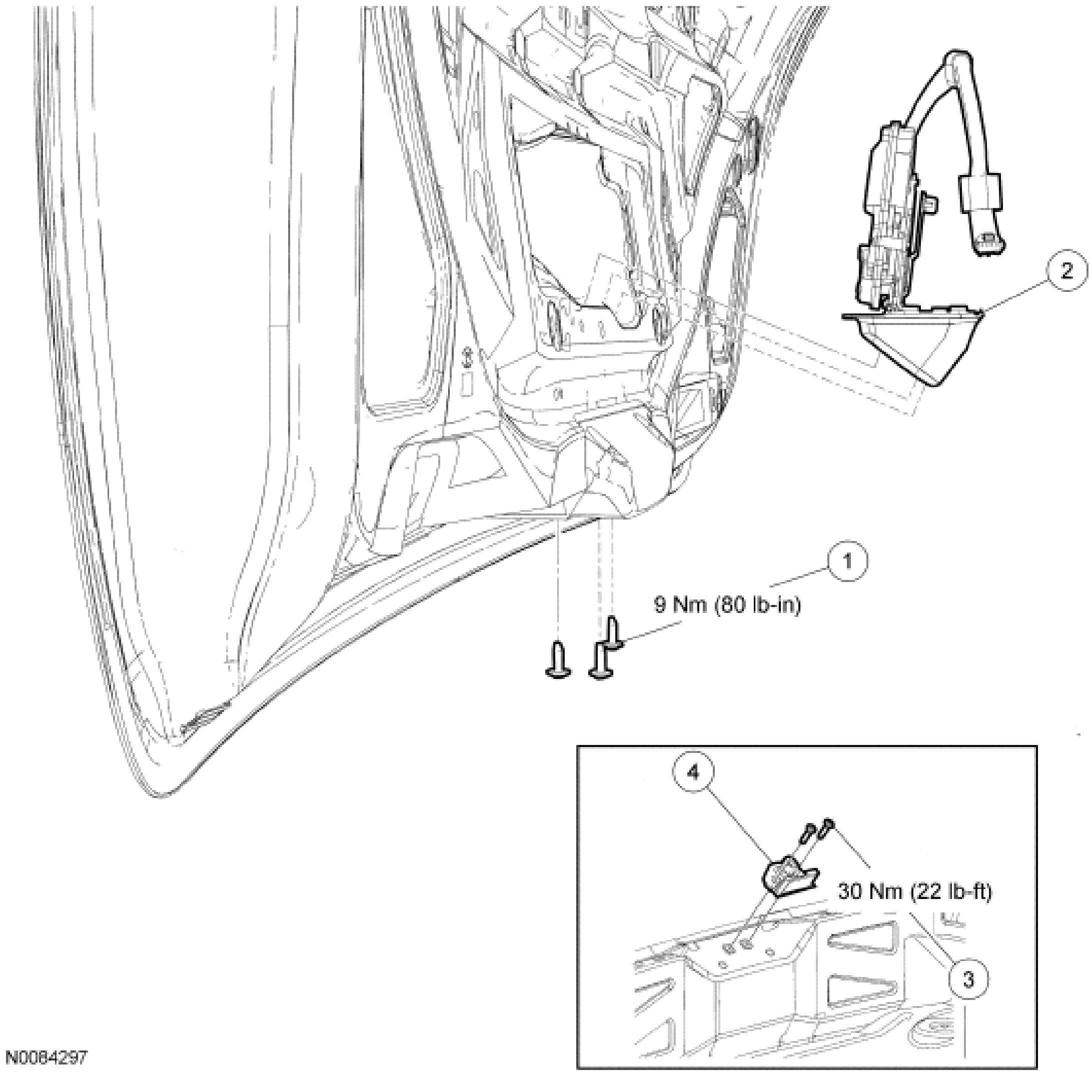


Fig. 49: Identifying Liftgate Latch - Manual With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N807675	Liftgate latch bolts (3 required)
2	7843150	Liftgate latch
3	W709726	Liftgate striker bolts
4	7843252	Liftgate striker

REMOVAL AND INSTALLATION

1. Remove the liftgate trim panel. For additional information, refer to **INTERIOR TRIM & ORNAMENTATION** article.
2. Disconnect the liftgate latch electrical connector.

3. Remove the 3 liftgate latch bolts.
   - To install, tighten to 9 Nm (80 lb-in).
4. Remove the liftgate latch.

NOTE: Lubricate the liftgate latch after installation.

5. To install, reverse the removal procedure.

LIFTGATE LATCH - POWER

Material

Item	Specification
Multi-Purpose Grease Spray XL-5	ESB-M1C93-B

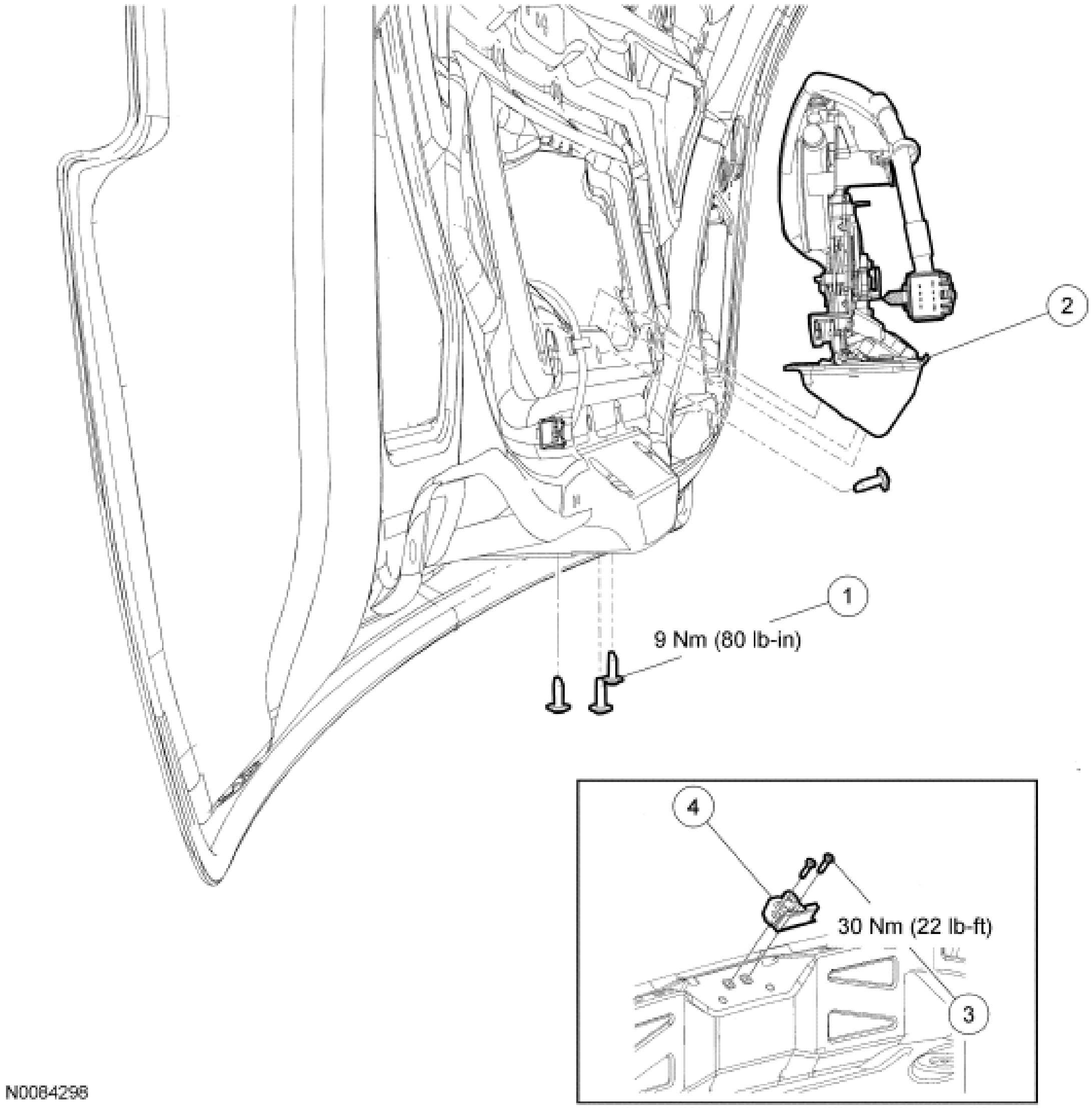


Fig. 50: Identifying Liftgate Latch - Power With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N807675	Liftgate latch bolts (4 required)
2	7843150	Liftgate latch
3	W709726	Liftgate striker bolts
4	7843252	Liftgate striker

REMOVAL AND INSTALLATION

1. Remove the liftgate trim panel. For additional information, refer to **INTERIOR TRIM & ORNAMENTATION** article.
2. Disconnect the liftgate latch electrical connector.

3. Remove the 4 liftgate latch bolts.
    - To install, tighten to 9 Nm (80 lb-in).
4. Remove the liftgate latch.

NOTE: Lubricate the liftgate latch after installation.

5. To install, reverse the removal procedure.

LIFTGATE RELEASE SWITCH - MANUAL

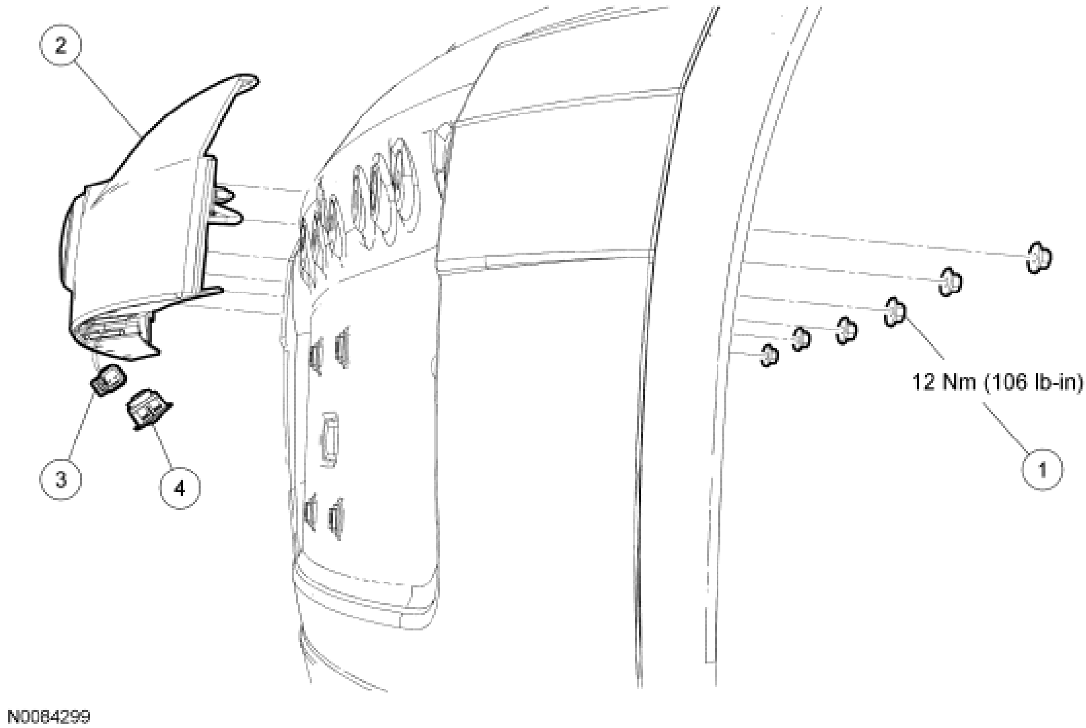


Fig. 51: Identifying Liftgate Release Switch - Manual With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W705760	Liftgate release switch molding nuts (6 required)
2	13508	Liftgate release switch molding
3	-	Liftgate release switch electrical connector (part of 14A583)
4	14018	Liftgate release switch

REMOVAL AND INSTALLATION

1. Remove the liftgate trim panel. For additional information, refer to **INTERIOR TRIM &**

ORNAMENTATION article.

2. Disconnect the liftgate release switch molding electrical connector.
3. Remove the 5 liftgate release switch molding nuts.
    - To install, tighten to 12 Nm (106 lb-in).
4. Press the tabs and remove the liftgate release switch.
5. Disconnect the liftgate release switch electrical connector.
6. To install, reverse the removal procedure.

LIFTGATE RELEASE SWITCH - POWER

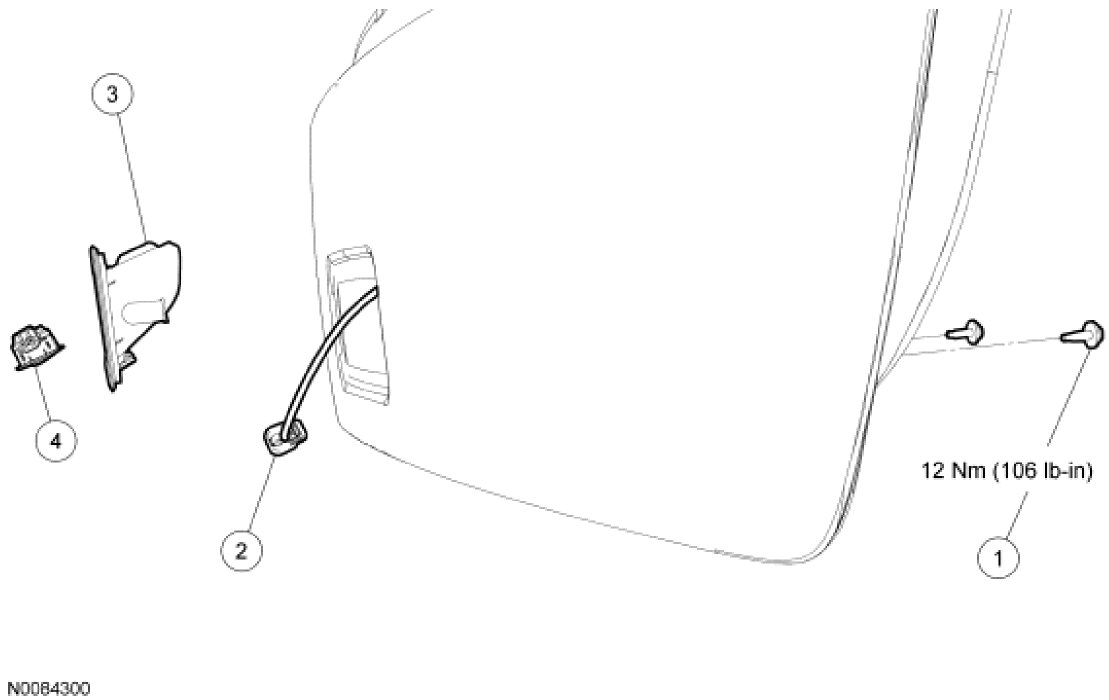


Fig. 52: Identifying Liftgate Release Switch - Power With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W505423	Liftgate release switch molding bolts (2 required)
2	13508	Liftgate release switch molding
3	-	Liftgate release switch electrical connector (part of 14A583)
4	14018	Liftgate release switch

REMOVAL AND INSTALLATION

1. Remove the liftgate trim panel. For additional information, refer to **INTERIOR TRIM &**

ORNAMENTATION article.

2. Disconnect the liftgate release switch electrical connector.
3. Remove the 2 liftgate release switch molding bolts.
   - To install, tighten to 12 Nm (106 lb-in).
4. Press the tabs and remove the liftgate release switch.
5. To install, reverse the removal procedure.

IGNITION LOCK CYLINDER

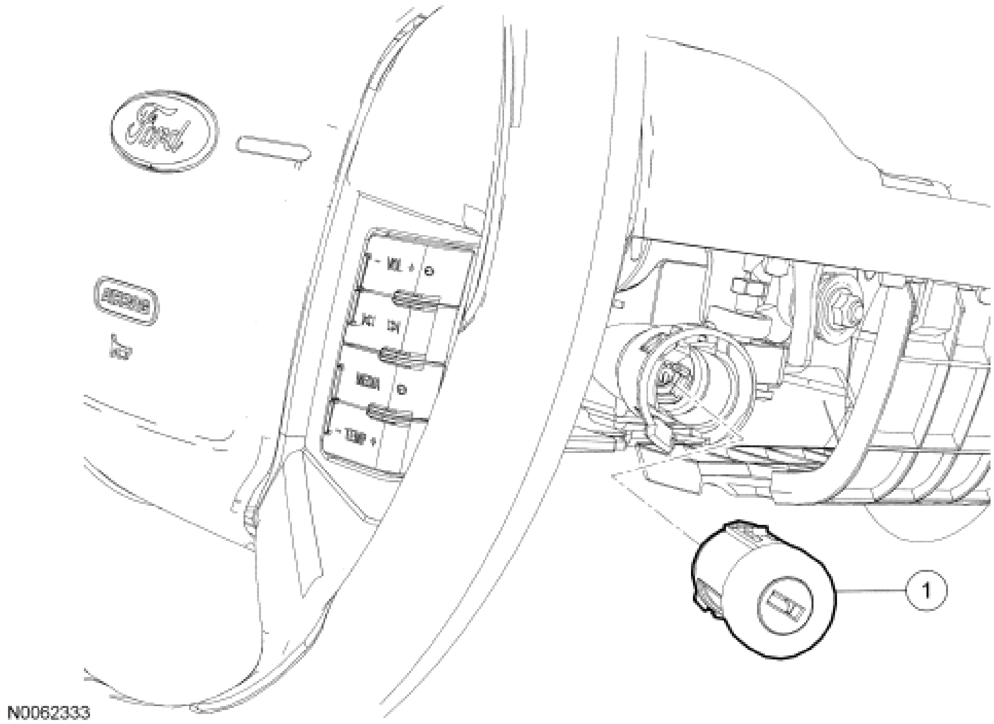


Fig. 53: Exploded View Of Ignition Lock Cylinder
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	11582	Ignition lock cylinder

REMOVAL AND INSTALLATION

1. Remove the passive anti-theft system (PATS) transceiver. For additional information, refer to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
2. Turn the ignition key to the ON position.
3. Using a suitable tool, press the ignition lock cylinder release button and remove the ignition lock cylinder.
4. To install, reverse the removal procedure.

DOOR LOCK CONTROL SWITCH

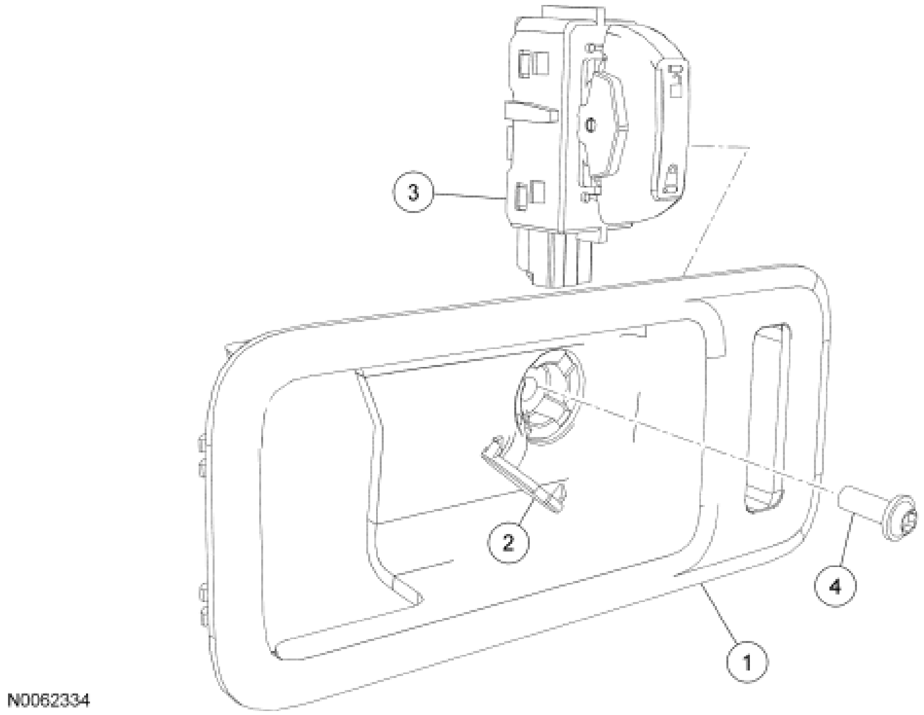


Fig. 54: Exploded View Of Door Lock Control Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Interior front door handle finish panel
2	-	Interior front door handle finish panel screw cover
3	-	Door lock control switch
4	-	Interior front door handle finish panel screw

REMOVAL AND INSTALLATION

1. Open the cover, remove the screw and position the interior front door handle finish panel aside.
2. Disconnect the door lock control switch electrical connector.
3. Release the locking clips and remove the door lock control switch.
4. To install, reverse the removal procedure.

KEYLESS ENTRY KEYPAD

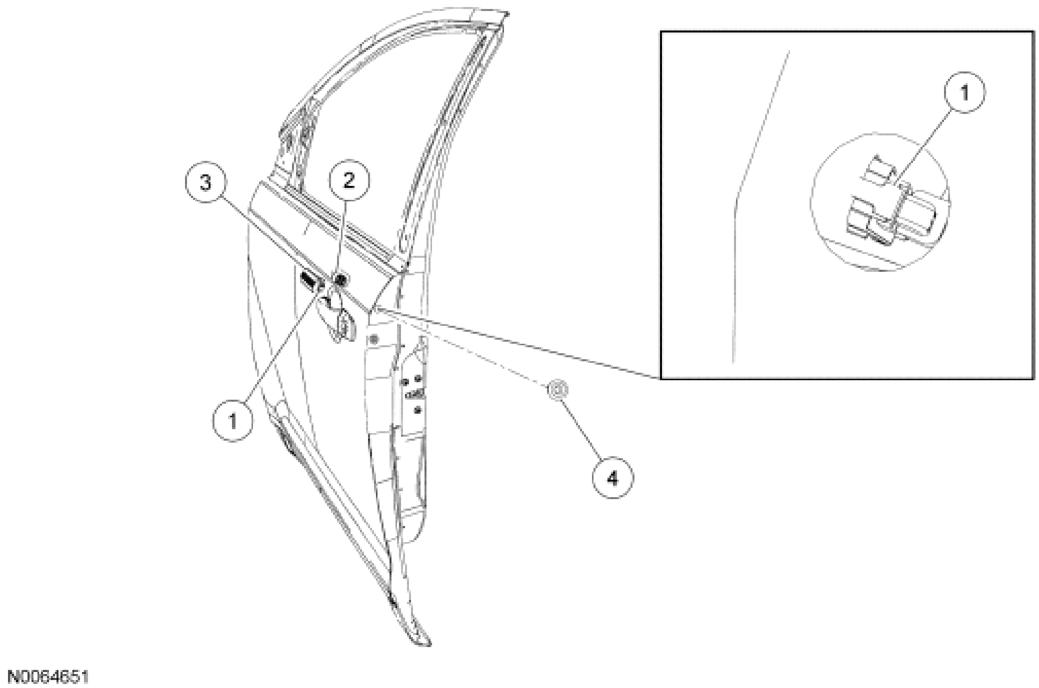


Fig. 55: Exploded View Of Keyless Entry Keypad
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Keyless entry keypad retaining clips (2 required) (part of 14A626)
2	-	Keyless entry keypad electrical connector (part of 14631)
3	14A626	Keyless entry keypad
4	W651011	Upper access plug

REMOVAL AND INSTALLATION

1. Remove the upper access plug.
2. Using a long, flat blade screwdriver, or suitable tool through the upper access hole, release the rear keyless entry keypad retaining clip and position the keyless entry keypad aside.
3. Remove the keyless entry keypad.
    - Disconnect the electrical connector.
4. To install, reverse the removal procedure.

2008 ENGINE

Accessory Drive - Edge & MKX

SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Accessory drive belt	6 ribs
Power steering pump drive belt	4-ribbed

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Accessory drive belt tensioner bolts	11	97

DESCRIPTION AND OPERATION

ACCESSORY DRIVE

This vehicle is equipped with the following components:

- V-ribbed serpentine accessory drive belt
- Automatic drive belt tensioner
- V-ribbed power steering pump drive belt

The accessory drive system provides power to operate components which power other systems. These could include components such as the generator, power steering pump and A/C compressor. Each of these components is equipped with a pulley which is driven by the accessory drive belt. The accessory drive belt is driven by the engine crankshaft pulley. The automatic belt tensioner maintains correct belt tension and compensates for component wear and changes in system load. System load changes can be caused by the A/C compressor clutch engaging or disengaging or demand changes on other systems powered by the accessory drive belt. To maintain correct operation of this system, it is critical that the correct length drive belt be installed. The pulleys must also be correctly aligned and kept clean.

Accessory Drive Belt Routing

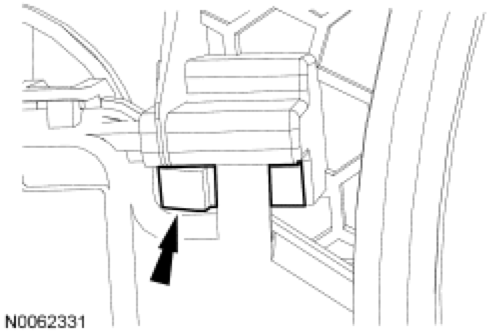


Fig. 1: Front End Accessory Drive (FEAD)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6B209	Accessory drive belt tensioner pulley
2	10300	Generator pulley
3	19D784	A/C clutch pulley
4	8620	Accessory drive belt
5	6316	Crankshaft pulley

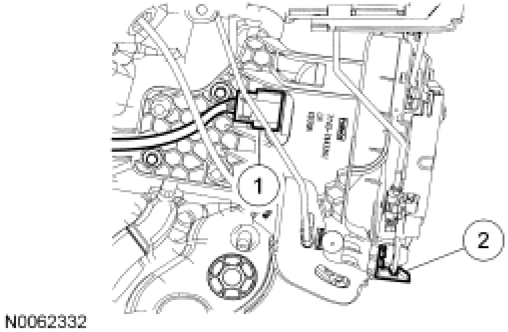


Fig. 2: Power Steering Pump Belt
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6C301	Power steering pump drive belt
2	6316	Crankshaft pulley
3	3D639	Power steering pump pulley

Belt Tensioner

Automatic tensioners are calibrated to provide the correct amount of tension to the belt for a given accessory drive system. Unless a spring or damping band within the tensioner assembly breaks or some other mechanical part of the tensioner fails, there is no need to check the tensioner for correct tension.

DIAGNOSTIC TESTS

ACCESSORY DRIVE

Inspection and Verification

NOTE: Under no circumstances should the accessory drive belt, tensioner or pulleys have any fluids or belt dressing applied to them as damage to the belt material and tensioner damping mechanism may occur.

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical damage.

VISUAL INSPECTION CHART

Mechanical
• Drive belt cracking/chunking/wear • Belt/pulley contamination • Incorrect accessory drive belt • Incorrectly routed accessory drive belt • Pulley misalignment or excessive pulley runout • Loose or mislocated hardware • Incorrectly routed power steering tubes (rubbing) • Loose accessory drive belt • Damaged pulleys • Tensioner arm misalignment

NOTE: Modular engine (without A/C) belt tensioner shown, others similar.

NOTE: Belt tensioner is shown in the free-state position against the arm travel stops.

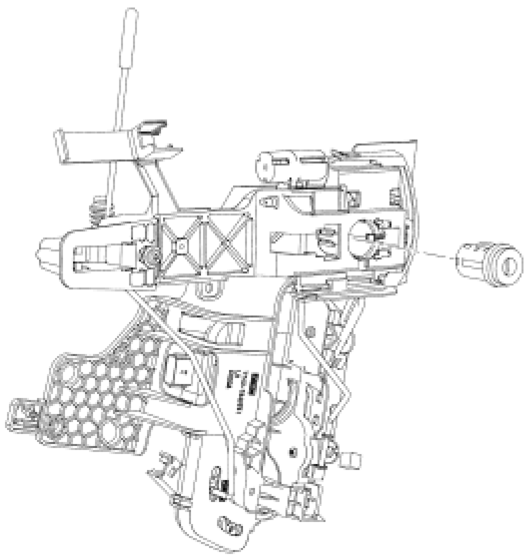


Fig. 3: Belt Tensioner With Belt Length Indicator
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Belt length indicator
2	-	Acceptable belt installation and wear range
3	-	Belt replacement range
4	-	Belt tension relief point

3. Check that the belt length indicator, if equipped, on the belt tensioner is in the acceptable belt installation and wear range. If the indicator is in the belt replacement range, either an incorrect belt is installed or the belt is worn beyond the service limit. Install a new belt as necessary.
4. Eliminate all other non-belt related noises that could cause belt misdiagnosis, such as A/C compressor engagement chirp, A/C slugging noise, power steering cavitations at low temperatures, Variable Camshaft Timing (VCT) tick or generator whine.
5. If a concern is found, correct the condition before proceeding to the next step.

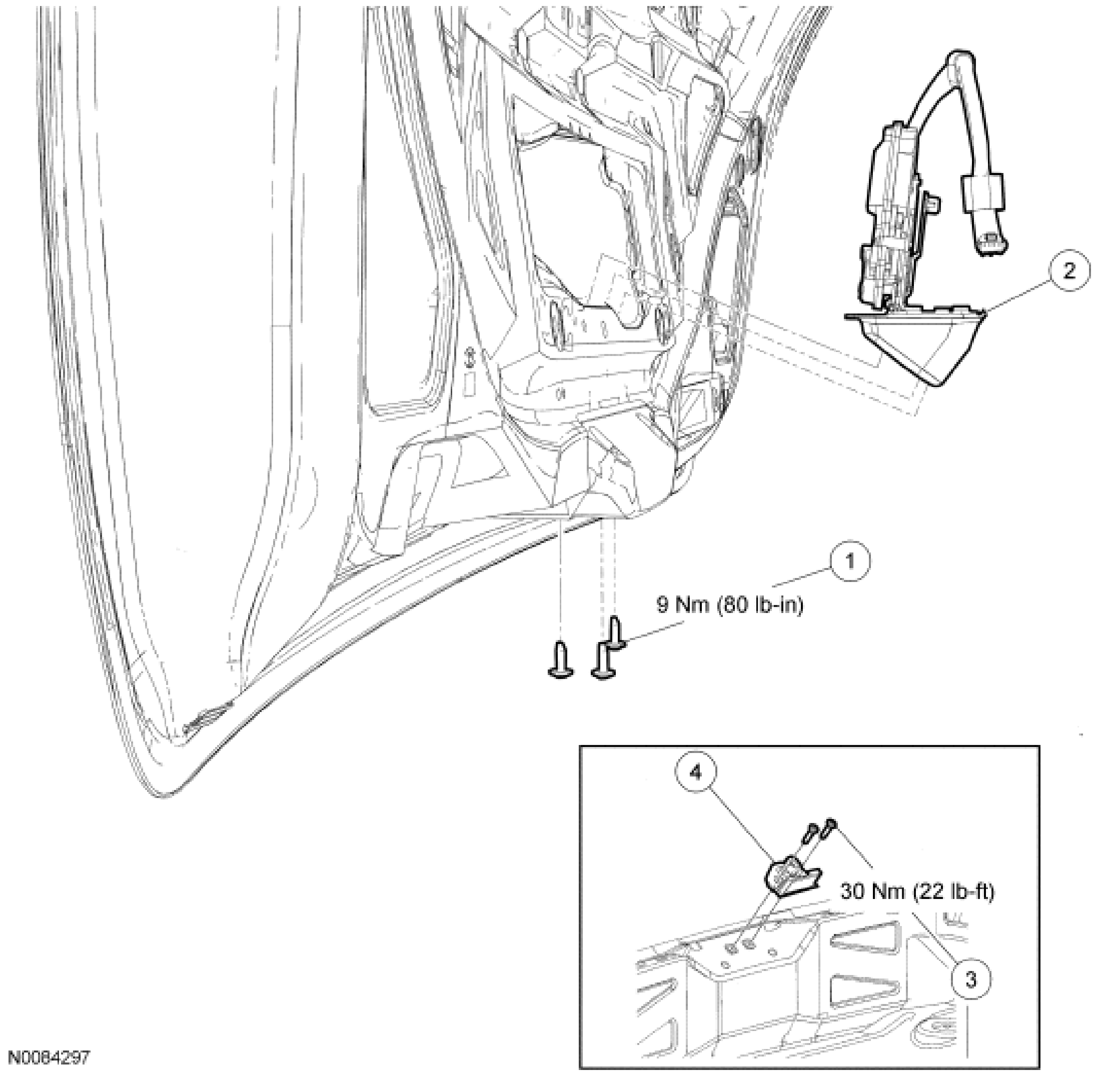


Fig. 4: V-Ribbed Serpentine Drive Belt With Cracks Across Ribs
Courtesy of FORD MOTOR CO.

6. Check the belt for cracks. Up to 15 cracks in a rib over a distance of 100 mm (4.0 in) can be considered acceptable. If cracks exceed this standard, install a new belt.

NOTE: **Piling is an excessive buildup in the V-grooves of the belt.**

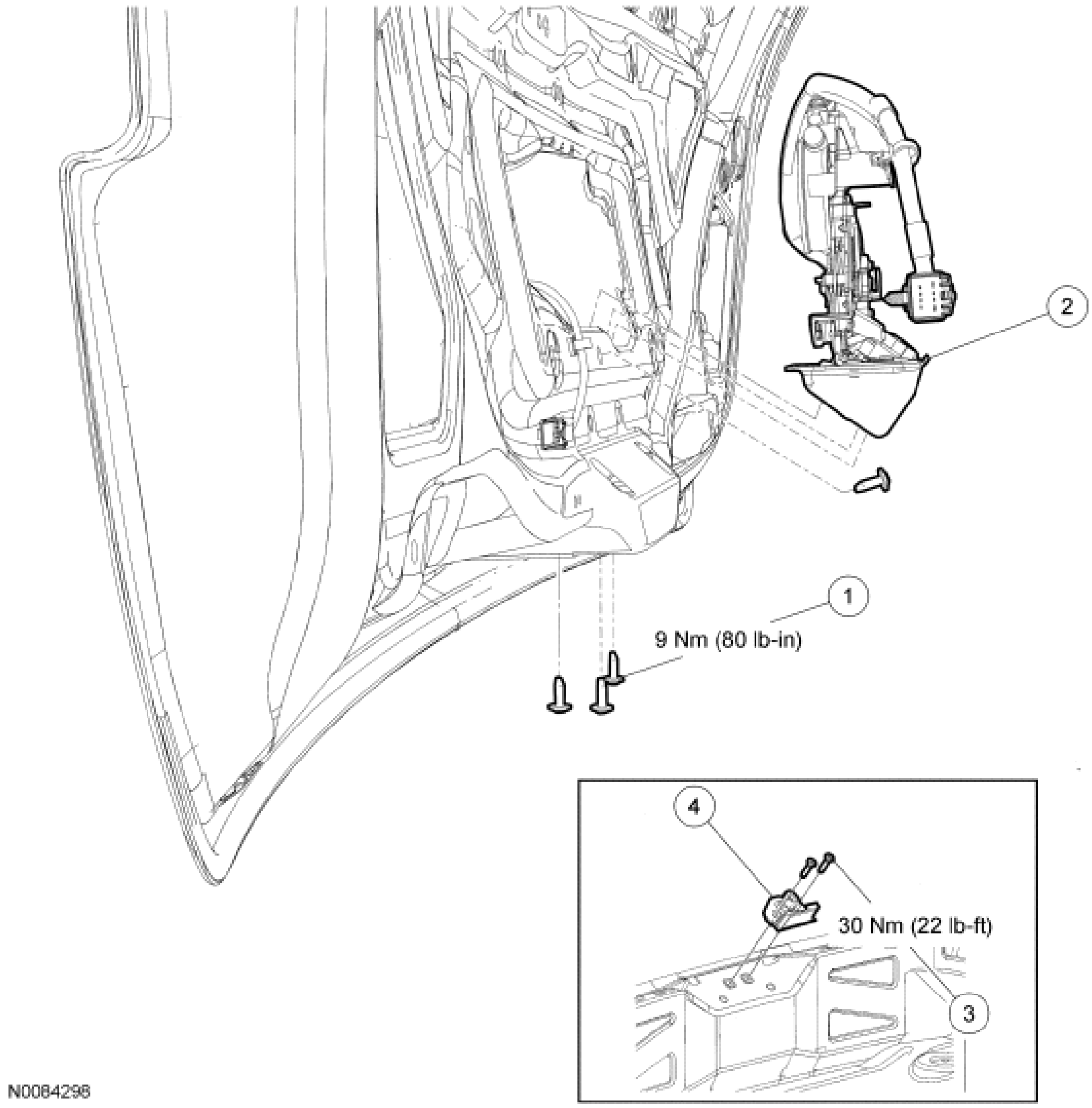


Fig. 5: Identifying V-Ribbed Serpentine Belt With Piling
Courtesy of FORD MOTOR CO.

7. The condition of the V-ribbed drive belt should be compared against the illustration and appropriate action taken.
    1. Small scattered deposits of rubber material. This is not a concern, therefore, installation of a new belt is not required.
    2. Longer deposit areas building up to 50% of the rib height. This is not considered a durability concern, but it can result in excessive noise. If noise is apparent, install a new belt.
    3. Heavy deposits building up along the grooves resulting in a possible noise and belt stability concern. If heavy deposits are apparent, install a new belt.

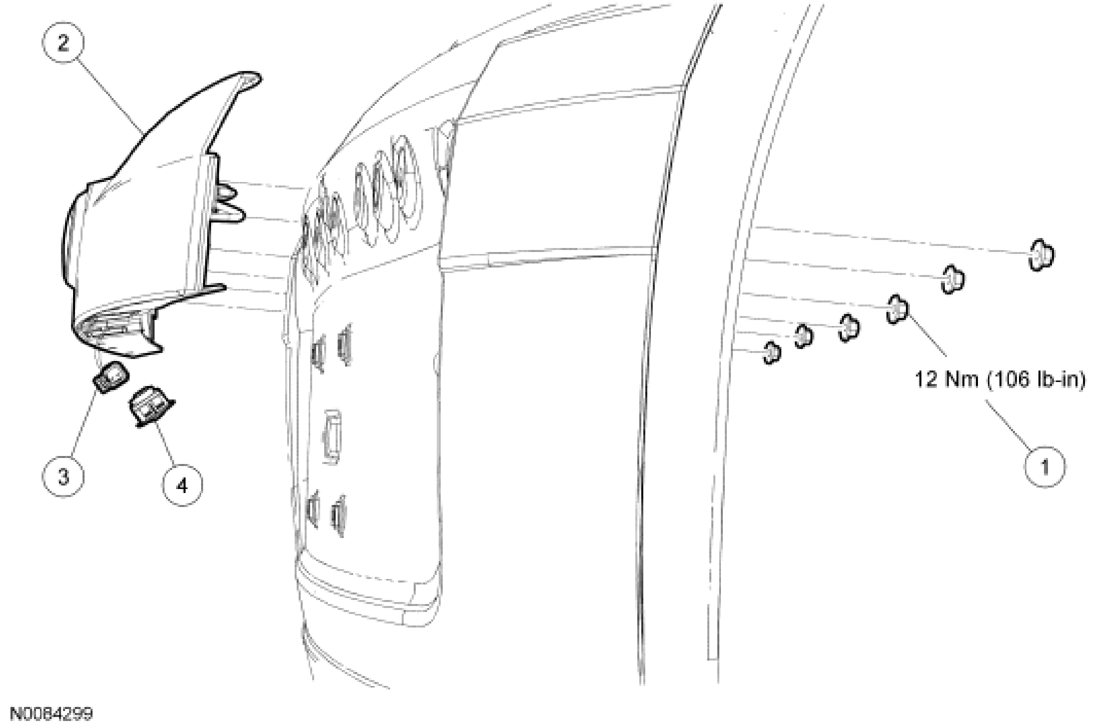


Fig. 6: Identifying V-Ribbed Serpentine Belt With Chunks of Rib Missing
Courtesy of FORD MOTOR CO.

8. There should be no chunks missing from the belt ribs. If the belt shows any evidence of this, install a new accessory drive belt.
9. If the concern is not visually evident, verify the symptom and Go to **Symptom Chart**.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• Accessory drive belt cracking (over 15 cracks in a rib over a distance of 100 mm [4.0 in])	• Accessory drive belt	• INSPECT the accessory drive belt. REFER to **Inspection and Verification**. INSTALL a new accessory drive belt as necessary.
• Accessory drive belt chunking	• Accessory drive belt	• INSPECT the accessory drive belt. REFER to **Inspection and Verification**. INSTALL a new accessory drive belt as necessary. • INSPECT the accessory drive belt pulley grooves for

	• Damaged pulley grooves	damage. INSTALL a new pulley or component as necessary.
• Accessory drive belt noise, squeal, chirping or flutter	• Defective/worn or incorrect accessory drive belt • Misaligned pulley(s) • Pulley runout • Damaged or worn accessory drive component or idler • Fluid contamination of accessory drive belt or pulleys	• REFER to **Component Tests**, Drive Belt - Noise/Flutter. REPAIR or INSTALL new parts as necessary.
	• Damaged or worn accessory drive belt tensioner	• REFER to **Component Tests**, Belt Tensioner - Mechanical and Belt Tensioner - Dynamics. INSTALL a new accessory drive belt tensioner as necessary.
	• Damaged pulley grooves	• INSPECT the accessory drive belt pulley grooves for damage. INSTALL a new pulley or component as necessary.
	• Accessory drive component failure	• CHECK the accessory drive components. INSTALL new components as necessary.
	• Accessory drive belt idler pulley bearing failure	• INSPECT the accessory drive belt idler pulley for freedom of rotation and damage. INSTALL a new accessory drive belt idler pulley as necessary.
• Premature accessory drive belt wear	• Defective or incorrect accessory drive belt • Misaligned pulley(s) • Pulley runout • Damaged accessories • Incorrectly installed drive belt • Fluid contamination	• REFER to **Component Tests**, Drive Belt - Noise/Flutter and Drive Belt - Incorrect Installation. REPAIR or INSTALL new parts as necessary.
	• Damaged pulley grooves	• INSPECT the accessory drive belt pulley grooves for damage. INSTALL a new

		pulley or component as necessary.

Component Tests

Drive Belt - Noise/Flutter

NOTE: Under no circumstances should the accessory drive belt, tensioner or pulleys have any fluids or belt dressing applied to them as damage to the belt material and tensioner damping mechanism may occur.

Drive belt chirp occurs due to pulley misalignment or excessive pulley runout. It can be the result of a damaged or incorrectly aligned grooved pulley.

To correct, determine the area where the noise comes from. Check each of the pulleys in that area with a straightedge to the crankshaft pulley. Look for accessory pulleys out of position in the fore/aft direction or at an angle to the straightedge.

Drive belt squeal may be an intermittent or constant noise that occurs when the drive belt slips on an accessory pulley under certain conditions.

A short intermittent squeal may occur during engine start up and shut down or during very rapid engine acceleration and decelerations, such as:

- Wide Open Throttle (WOT) 1-2 and 2-3 shifts or 2-3 and 3-4 back-out shifts on automatic transmissions.
- WOT 1-2 and 2-3 shifts and any combination of rapid downshifting on manual transmissions.

These special short-term transient events are expected, and are due to the higher system inertias required to meet the electrical and cooling demands on today's vehicle systems. Constant or reoccurring drive belt squeal can occur:

- if the A/C discharge pressure goes above specifications:
  - the A/C system is overcharged.
  - the A/C condenser core airflow is blocked.
  - the A/C anti-slugging strategy executes after a long hot heat soak.
- if the A/C off equalized pressure (the common discharged and suction pressure that occurs after several minutes) exceeds specifications.
- if any of the accessories or idler pulley(s) are damaged or have a worn or damaged bearing. All accessories should be rotatable by hand in the unloaded condition. If not, inspect the accessory.
- if there is evidence of fluid contamination on the accessory drive belt. When the drive belt has been exposed to fluid contamination during vehicle operation, such as leaks from the power steering system, A/C system or cooling system, clean all pulleys with soap and water, rinse with clean water and install a new accessory drive belt. If the drive belt has been exposed to fluids in a localized area during routine vehicle service, such as replacement of hoses or fluids, the drive belt and pulleys should be washed with soap and water immediately (prior to starting the engine), and rinsed with clean water.

- if the accessory drive belt is too long. A drive belt that is too long will allow the accessory drive belt tensioner arm to go all the way to the arm travel stop under certain load conditions, which will release tension to the drive belt. If the accessory drive belt tensioner indicator is outside the normal installation wear range window, install a new accessory drive belt.

NOTE: **The accessory drive belt tensioner arm should rotate freely without binding.**

- Install a new accessory drive belt tensioner if the drive belt tensioner is worn or damaged.

Drive Belt - Incorrect Installation

NOTE: **Incorrect accessory drive belt installation will cause excessive drive belt wear and may cause the drive belt to come off the pulleys.**

Non-standard accessory drive belts can track differently or incorrectly. If an accessory drive belt tracks incorrectly, install a new accessory drive belt to avoid performance failure or loss of the drive belt.

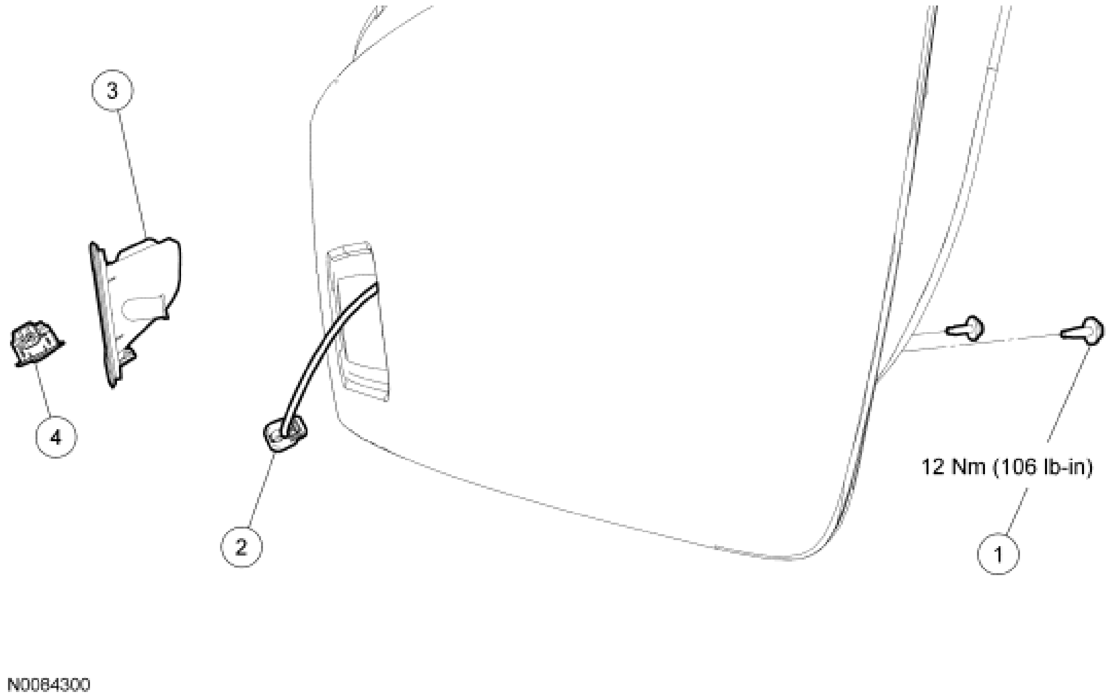


Fig. 7: Identifying Drive Belt Incorrect Installation
Courtesy of FORD MOTOR CO.

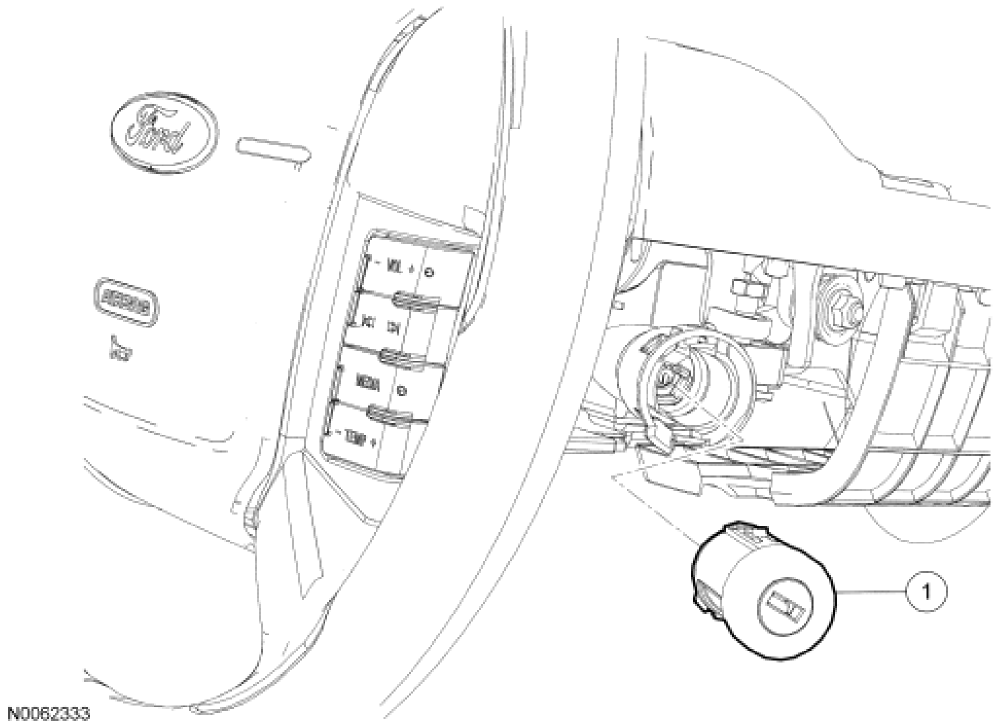


Fig. 8: Identifying Correct Installation Of Drive Belt
Courtesy of FORD MOTOR CO.

With the engine running, check accessory drive belt tracking on all pulleys. If the edge of the accessory drive belt rides beyond the edge of the pulleys, noise and premature wear will occur. Make sure the accessory drive belt rides correctly on the pulley. If an accessory drive belt tracking condition exists, proceed with the following:

- Visually check the accessory drive belt tensioner for damage and wear, especially the mounting pad surface and arm alignment. If the accessory drive belt tensioner is not installed correctly, the mounting surface pad will be out of position. If the tensioner arm is worn, the arm will be out of alignment. Either of these conditions will result in chirp and squeal noises.
- With the engine running, visually observe the grooves in the pulleys (not the pulley flanges or the pulley forward faces) for excessive wobble. Install new components as necessary.
- Check all accessories, mounting brackets and the accessory drive belt tensioner for any interference that would prevent the component from mounting correctly. Correct any interference condition and recheck the accessory drive belt tracking.
- Tighten all accessories, mounting brackets and accessory drive belt tensioner retaining hardware to specification. Recheck the accessory drive belt tracking.

Belt Tensioner - Mechanical

The only mechanical check that needs to be made is a check for tensioner stick, grab or bind.

1. With the engine off, check routing of the accessory drive belt. Refer to the illustrations under **Accessory Drive** .

NOTE: The accessory drive belt tensioner spring is very strong and requires substantial force to release.

2. Using a suitable, commercially available serpentine belt tensioner release tool, release the tension on the belt and detach the accessory drive belt from the tensioner. Carry out the following tests:
    - Using the release tool, move the tensioner from its relaxed position, through its full stroke and back to the relaxed position to make sure there is no stick, grab or bind, and to make sure that there is tension on the tensioner spring.
    - Rotate the tensioner pulley by hand and check for a binding, contaminated or seized condition.
    - Inspect the area surrounding the accessory drive belt tensioner for oil leaks or contamination and repair any leaks.
3. If the accessory drive belt tensioner does not meet the criteria in the previous step, install a new tensioner. If the accessory drive belt tensioner meets the criteria in the previous step, proceed to testing the tensioner dynamically.
4. If the tensioner is saturated with oil and grease internally, install a new tensioner.

Belt Tensioner - Dynamics

The accessory drive belt tensioner can be checked dynamically as follows:

1. With the engine running, observe the accessory drive belt tensioner movement. The accessory drive tensioner should move (respond) when the A/C clutch cycles (if equipped), or when the engine is accelerated rapidly. If the accessory drive belt tensioner movement is excessive without A/C clutch cycling or engine acceleration, check belt rideout. Excessive belt rideout (uneven depth of grooves in the belt) can cause excessive accessory drive belt tensioner movement. Check rideout condition by installing a new belt. If excessive accessory drive belt tensioner movement still exists, install a new accessory drive belt tensioner.

REMOVAL AND INSTALLATION

FRONT END ACCESSORY DRIVE (FEAD) - EXPLODED VIEW

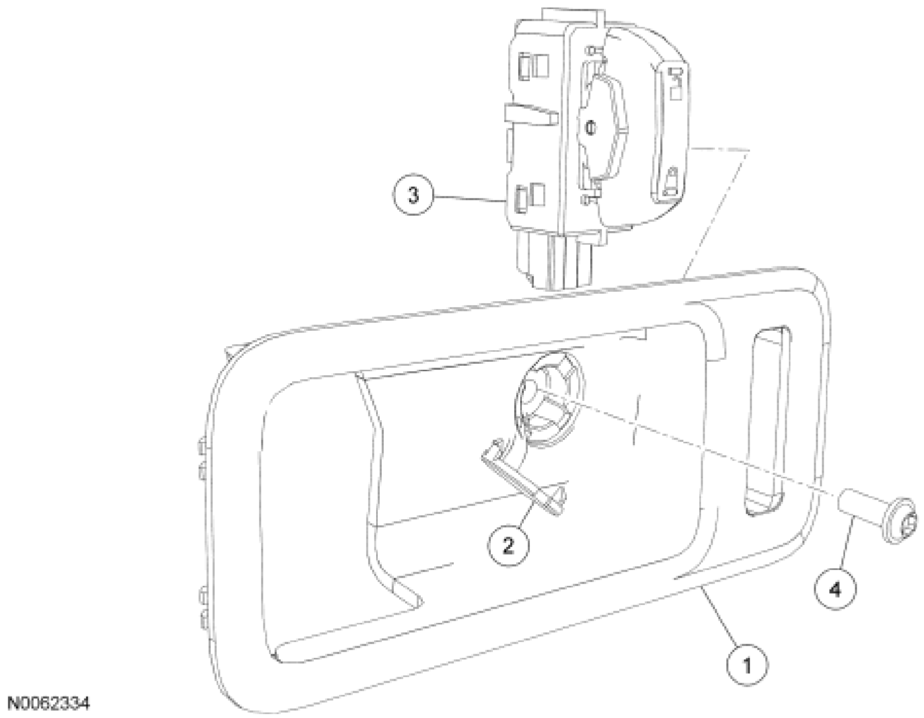


Fig. 9: Exploded View Of Front End Accessory Drive (FEAD) With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	8620	Accessory drive belt
2	W503278	Accessory drive belt tensioner bolt (3 required)
3	6B209	Accessory drive belt tensioner
4	6C301	Power steering pump drive belt

1. For additional information, refer to the appropriate procedure .

ACCESSORY DRIVE BELT

REMOVAL

CAUTION: Under no circumstances should the accessory drive belt, tensioner or pulleys be lubricated as potential damage to the belt material and tensioner damping mechanism will occur. Do not apply any fluids or belt dressing to the accessory drive belt or pulleys.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Working from the top of the vehicle, using a suitable belt tensioner release tool, rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt from the generator pulley.

3. Remove the RH inner fender splash shield. For additional information, refer to **FRONT END BODY PANELS** article.
4. Working from under the vehicle, remove the accessory drive belt.

INSTALLATION

1. Working from under the vehicle, position the accessory drive belt on all pulleys, with the exception of the generator pulley.

NOTE: After installation, make sure the accessory drive belt is correctly seated on all pulleys.

2. Working from the top of the vehicle, using a suitable belt tensioner release tool, rotate the accessory drive belt tensioner clockwise and install the accessory drive belt.
3. Install the RH inner fender splash shield. For additional information, refer to **FRONT END BODY PANELS** article.

ACCESSORY DRIVE BELT TENSIONER

REMOVAL

CAUTION: Under no circumstances should the accessory drive belt, tensioner or pulleys be lubricated as potential damage to the belt material and tensioner damping mechanism will occur. Do not apply any fluids or belt dressing to the accessory drive belt or pulleys.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Working from the top of the vehicle, using a suitable belt tensioner release tool, rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt from the generator pulley.
3. Remove the RH inner fender splash shield. For additional information, refer to **FRONT END BODY PANELS** article.
4. Remove the 3 bolts and the accessory drive belt tensioner.

INSTALLATION

1. Install the accessory drive belt tensioner and the 3 bolts.
    - Tighten to 11 Nm (8 lb-ft).

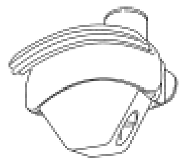
NOTE: After installation, make sure the accessory drive belt is correctly seated on all pulleys.

2. Working from the top of the vehicle, using a suitable belt tensioner release tool, rotate the accessory drive belt tensioner clockwise and install the accessory drive belt on the generator pulley.

3. Install the RH inner fender splash shield. For additional information, refer to **FRONT END BODY PANELS** article

POWER STEERING PUMP BELT

Special Tools

Illustration	Tool Name	Tool Number
	Power Steering Belt Removal Tool	303-1252/1
	Power Steering Belt Installation Tool	303-1252/2

REMOVAL

CAUTION: Under no circumstances should the accessory drive belt, tensioner or pulleys be lubricated as potential damage to the belt material and tensioner damping mechanism will occur. Do not apply any fluids or belt dressing to the accessory drive belt or pulleys.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Working from the top of the vehicle, using a suitable belt tensioner release tool, rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt from the generator pulley.
3. Remove the RH inner fender splash shield. For additional information, refer to **FRONT END BODY PANELS** article.
4. Position the accessory drive belt off the crankshaft pulley.
5. Install the special tool between the power steering pump belt and pulley, turning the crankshaft bolt clockwise to remove the power steering belt.

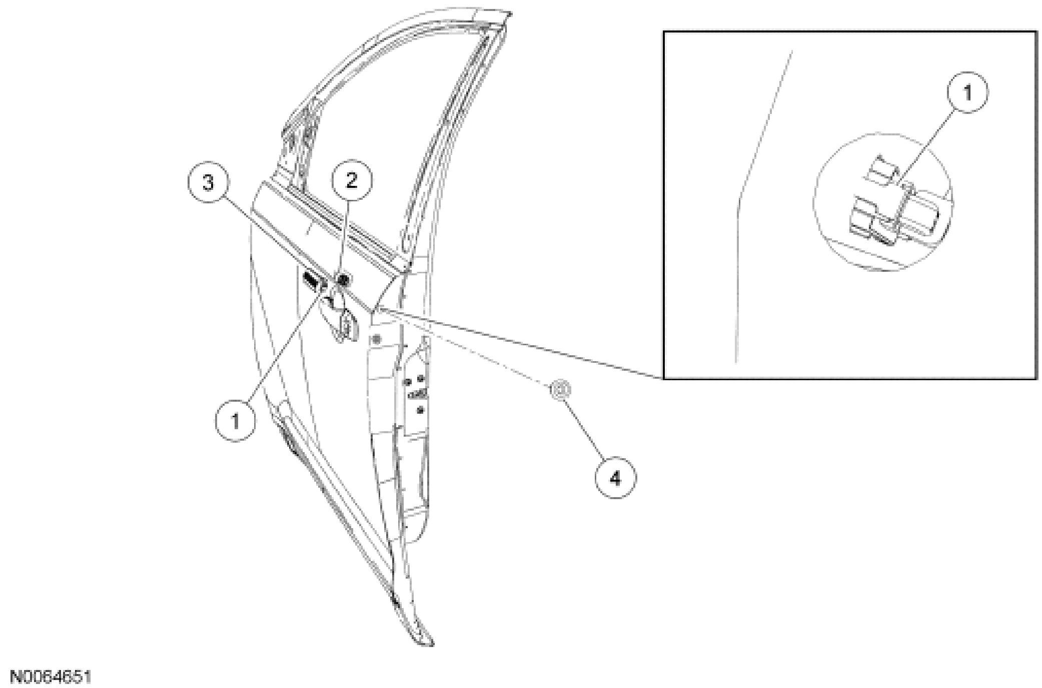


Fig. 10: Installing Special Tool (303-1252/1) Between Power Steering Pump Belt & Pulley, Turning Crankshaft Bolt Clockwise
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Install the power steering belt on the crankshaft pulley.

CAUTION: After installation, make sure the belt is correctly seated on the crankshaft and power steering pulleys.

2. Position the power steering belt around the special tool and the power steering pulley. Make sure that the belt is engaged with the power steering pulley and rotate the crankshaft clockwise to install the power steering belt.

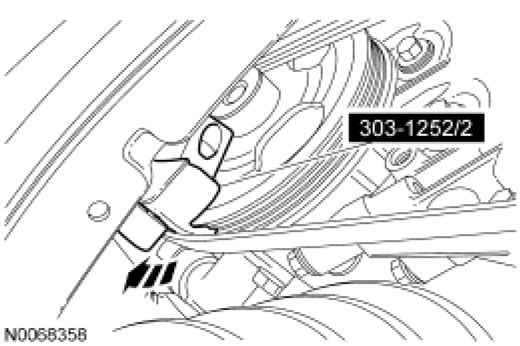


Fig. 11: Positioning Power Steering Belt Around Special Tool (303-1252/2) & Power Steering Pulley

Courtesy of FORD MOTOR CO.

3. Position the accessory drive belt on the crankshaft pulley.

NOTE: **After installation, make sure the accessory drive belt is correctly seated on all pulleys.**

4. Working from the top of the vehicle, using a suitable belt tensioner release tool, rotate the accessory drive belt tensioner clockwise and install the accessory drive belt.
5. Install the RH inner fender splash shield. For additional information, refer to **FRONT END BODY PANELS** article.

2008 GENERAL INFORMATION

Driveline System - General Information - Edge & MKX

SPECIFICATIONS

MATERIAL

Item	Specification	Fill Capacity
Additive Friction Modifier XL-3 (US); CXL-3 (Canada)	EST-M2C118-A	-
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A	1.15L (2.43 pt)

GENERAL SPECIFICATIONS

Item	Specification
End play	
Wheel bearing end play	0.00 mm (0.000 in) maximum
Runout	
Driveshaft runout	0.89 mm (0.035 in)
Pilot runout	0.15 mm (0.006 in) maximum
Wheel hub face runout	0.254 mm (0.010 in) maximum
Wheel hub flange bolt circle runout	0.38 mm (0.015 in) maximum

DESCRIPTION AND OPERATION

DRIVELINE SYSTEM

Driveline System

The driveline system consists of the following components:

- Center support bearing
- Driveshaft assembly
- Front halfshafts
- Rear halfshafts
- Active torque coupling/rear axle

On front wheel drive (FWD) vehicles, the transaxle transmits power from the engine to the halfshafts.

On all wheel drive (AWD) vehicles, power is transmitted from the engine through the transaxle to the power transfer unit (PTU). The PTU transfers engine power from the transaxle to the front halfshafts, and through the driveshaft to the active torque coupling/rear axle and halfshafts. For information on the PTU, refer to **FOUR WHEEL DRIVE (4WD) SYSTEMS** article or **POWER TRANSFER UNIT (PTU)** article.

The engine angle is built into the engine mounts. If the engine angle is out of specification, the engine mounts must be inspected for damage. Refer to **3.5L** article.

Fig. 1: Vehicle Certification (VC) Label Example
Courtesy of FORD MOTOR CO.

The vehicle certification (VC) label is located in the driver door jamb. The axle code is on the VC label. Refer to **IDENTIFICATION CODES** article.

The axle ratio is 2.93 and the ring gear has a diameter of 174 mm (6.85 in).

The wheel speed sensor rings for FWD vehicles are located on the front halfshafts and are mounted to the rear inner spindles.

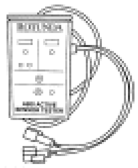
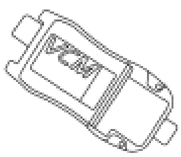
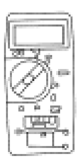
The wheel speed sensor rings are located on the front and rear halfshafts for AWD vehicles.

DIAGNOSTIC TESTS

DRIVELINE SYSTEM

SPECIAL TOOLS

Illustration	Tool Name	Tool Number

 ST3030-A	Gauge, Clutch Housing	308-021 (T75L-4201-A)
 ST2574-A	Dial Indicator Gauge with Holding Fixture	100-002 (TOOL-4201-C) or equivalent
 ST2834-A	Dial Indicator/Gauge with Holding Fixture	100-D002 (D78P-4201-B) or equivalent
 ST1137-A	Vibration Analyzer	100-F027 (014-00344) or equivalent

MATERIAL

Item	Specification
Additive Friction Modifier XL-3 (US); CXL-3 (Canada)	EST-M2C118-A
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada); (Model 60/70 axles)	WSP-M2C197-A
Threadlock and Sealer TA-25	WSK-M2G351-A5

Principals of Operation

Driveline System - General Information

The driveline system enables the power generated by the engine and transferred through the transmission in front wheel drive (FWD), or the transmission and the power transfer unit (PTU) in all wheel drive (AWD) to place the vehicle in motion. Rotational torque received from the transmission or PTU is delivered to the front wheels by halfshafts or the rear axle by way of the driveshaft(s). The U-joints or constant velocity (CV) joints at the ends of the shafts allow the shafts to rotate smoothly in an allowable angle plane. The rotational torque is introduced into the axle drive pinion which drives the differential ring gear. The ring gear is bolted to the axle differential which divides the torque between the left and right axle shafts, while permitting the shafts to turn at different speeds when required, such as when cornering.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

VISUAL INSPECTION CHART

Mechanical
• U-joints • Constant velocity (CV) joints • Center bearings • Driveshaft tubes • Mounting brackets • Flanges • Housing and cover damage • Differential bearings • Differential gearsets • Pinion bearings -

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and go to **SYMPTOM CHART - NOISE, VIBRATION AND HARSHNESS (NVH)**.

Driveshaft Center U-Joint and Constant Velocity (CV) Joint Inspection

With the vehicle in NEUTRAL, position it on a hoist. Refer to **JACKING AND LIFTING** article. Rotate the driveshaft by hand. Check for rough operation or seizure of the U-joints or constant velocity (CV) joints. Install a new driveshaft if it shows signs of seizure, excessive wear or incorrect seating. Refer to **DRIVESHAFT** article.

Driveshaft Center Bearing

With the vehicle in NEUTRAL, position it on a hoist. Refer to **JACKING AND LIFTING** article. Rotate the driveshaft by hand. If the bearing shows signs of roughness or is noisy, install a new driveshaft assembly. Refer to **DRIVESHAFT** article.

Symptom Chart - Noise, Vibration and Harshness (NVH)

NOTE: Noise, vibration and harshness (NVH) symptoms should be identified using the

diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.

SYMPTOM CHART - NOISE, VIBRATION AND HARSHNESS (NVH)

Condition	Possible Sources	Action
• Axle howling or whine - front or rear axle	• Axle lubricant low	• CHECK the lubricant level. FILL the axle to specification.
-	• Axle housing damage	• INSPECT the axle housing for damage. INSTALL a new axle as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
-	• Damaged or worn wheel hub bearings	• CHECK for abnormal wheel hub bearing play or roughness. REFER to **FRONT SUSPENSION** article or **REAR SUSPENSION** article.
-	• Damaged or worn differential ring and pinion	• INSPECT and INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
-	• Damaged or worn differential side or pinion bearings	• INSPECT and INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
• Driveline clunk - loud clunk when shifting from reverse to drive	• Incorrect axle lubricant level	• CHECK the lubricant level. FILL the axle to specification.
-	• Excessive backlash in the axle	• CHECK the axle backlash. INSPECT and INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
-	• Damaged or worn pinion bearings	• INSPECT and INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
-	• Damaged or worn U-joints	• INSPECT the U-joints for wear or damage. INSTALL a new driveshaft as necessary. REFER to

		DRIVESHAFT article.
- • Driveline clunk - occurs as the vehicle starts to move forward following a stop • Driveline clunk (front wheel drive [FWD] vehicles) - occurs during acceleration or from cruise to coast/deceleration	• Worn driveshaft constant velocity (CV) joint or U-joints with excessive play • Loose rear axle mount • Damaged or worn inner CV joint	• INSPECT the CV joint and U-joints for a worn condition. INSTALL a new driveshaft as necessary. REFER to **DRIVESHAFT** article. • CHECK the axle for loose bolts. TIGHTEN to specification. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article. • INSPECT the inner CV joint and boot. INSTALL a new CV joint as necessary. REFER to **FRONT DRIVE HALFSHAFTS** article.
- • Clicking, popping or grinding - occurs while the vehicle is turning • High pitched chattering - noise from the rear axle when the vehicle is turning - • Buzz - buzzing noise is the same at cruise or coast/deceleration	• Inadequate or contaminated lubrication in the CV joints • Another component contacting the halfshaft • Incorrect or contaminated lubricant • Damaged or worn differential (differential side gears and pinion gears) • Incorrect driveline angles	• CHECK the CV boots and joints for wear or damage. INSTALL new components as necessary. REFER to **FRONT DRIVE HALFSHAFTS** article. • CHECK the halfshafts and the area around the halfshafts. REPAIR as necessary. • CHECK the vehicle by driving in tight circles (5 clockwise, 5 counterclockwise). DRAIN and REFILL with the specified rear axle lubricant and friction modifier as necessary. • INSPECT and INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article. • CHECK for correct driveline angles. REPAIR as necessary. REFER to **Driveline Angle Measurement**.
• Rumble or boom - noise occurs at coast/deceleration, usually driveshaft speed-related and noticeable over a wide range of speeds	• Driveshaft is out-of-balance	• CHECK the driveshaft for damage, missing balance weights or undercoating. REFER to appropriate Driveshaft Balancing procedure.

-	• U-joints are binding or seized	• ROTATE the driveshaft and CHECK for rough operation or seized U-joints. INSTALL a new driveshaft as necessary. REFER to **DRIVESHAFT** article.
• Grunting - normally associated with a shudder experienced during acceleration from a complete stop	• Driveshaft CV joint binding	• INSTALL a new driveshaft as necessary. REFER to **DRIVESHAFT** article.
-	• Loose rear axle mount bolts or suspension fasteners	• INSPECT the rear suspension and axle. TIGHTEN the fasteners to specification. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
• Howl - can occur at various speeds and driving conditions. Affected by acceleration and deceleration	• Incorrect ring and pinion contact, incorrect bearing preload or gear damage	• INSPECT and INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
• Chuckle - heard at coast/deceleration. Also described as a knock	• Incorrect ring and pinion contact or damaged teeth on the coast side of the ring and pinion	• INSPECT and INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
• Knock - noise occurs at various speeds. Not affected by acceleration or deceleration	• Gear tooth damage to the drive side of the ring and pinion	• INSPECT and INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
• Scraping noise - a continuous low pitched noise starting at low speeds	• Worn or damaged pinion bearings	• INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
• Driveline shudder - occurs during acceleration from a slow speed or stop	• Rear drive axle assembly mispositioned	• CHECK the axle mounts and the rear suspension for damage or wear. REPAIR as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
-	• Loose rear axle bolts	• CHECK the rear axle for loose bolts. TIGHTEN the bolts to specification. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
-	• Driveline angles out	• CHECK for correct driveline angles.

	of specification	REFER to **Driveline Angle Measurement**.
-	• U-joints binding or seized	• ROTATE the driveshaft and CHECK for rough operation or seized U-joints. INSTALL a new driveshaft as necessary. REFER to **DRIVESHAFT** article.
-	• Binding or damaged driveshaft CV joint	• INSPECT the driveshaft CV joint and coupling shaft for wear or damage. INSTALL a new driveshaft as necessary. REFER to **DRIVESHAFT** article.
• Driveline vibration - occurs at cruising speeds	• Worn U-joints	• CHECK for wear or incorrect seating. INSTALL a new driveshaft as necessary. REFER to **DRIVESHAFT** article.
-	• Worn or damaged driveshaft center bearing support	• CHECK the insulator for damage or wear. ROTATE the driveshaft and CHECK for rough operation. INSTALL a new driveshaft as necessary. REFER to **DRIVESHAFT** article.
-	• Loose axle pinion flange bolts	• INSPECT the axle pinion flange. TIGHTEN the pinion flange bolts to specification. REFER to **DRIVESHAFT** article.
-	• Excessive axle pinion flange runout	• CARRY OUT a runout check. REPAIR as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
-	• Driveshaft is out-of-balance	• CHECK the driveshaft for damage, missing balance weights or undercoating. CHECK the driveshaft balance. CARRY OUT a driveline vibration test. REFER to **Driveshaft Runout and Balancing**.
-	• Binding or damaged driveshaft CV joint	• INSPECT the driveshaft CV joint for wear or damage. INSTALL a new driveshaft as necessary. REFER to **DRIVESHAFT** article.
-	• Excessive driveshaft runout	• CARRY OUT a runout check. REFER to **Driveshaft Runout and Balancing**.

-	• Driveline angles out of specification	• CHECK for correct driveline angles. REPAIR as necessary. REFER to **Driveline Angle Measurement**.
-	• Incorrectly seated CV joint in the wheel hub	• CHECK the outer CV joint for correct seating into the hub. REPAIR as necessary. REFER to **FRONT DRIVE HALFSHAFTS** article for the front CV joints or **REAR DRIVE HALFSHAFTS** article for the rear CV joints.

Analysis of Leakage

Clean up the leaking area enough to identify the exact source.

A plugged rear drive unit (RDU) housing vent can cause excessive pinion seal lip wear due to internal pressure buildup.

Verify the RDU lubricant level is at least 3-5 mm (1/8-3/16 in) below the bottom of the fill hole.

Axle Vent

A plugged vent will cause excessive seal lip wear due to internal pressure buildup. If a leak occurs, check the vent. If the vent cannot be cleared, install a new vent.

Drive Pinion Seal

Leaks at the drive pinion seal originate from the following causes:

- Damaged seal
- Worn seal journal surface

Any damage to the seal bore (dings, dents, gouges or other imperfections) distorts the seal casing and allows leakage past the outer edge of the drive pinion seal.

The drive pinion seal can be torn, cut or gouged if it is not installed correctly. The spring that holds the drive pinion seal against the pinion flange may be knocked out and allow fluid to pass the lip.

Metal chips trapped at the sealing lip can cause oil leaks. These can cause a wear groove on the drive pinion flange and result in pinion seal wear.

When a seal leak occurs, install a new drive pinion seal and check the vent to make sure it is clean and free of foreign material.

A new drive pinion flange must be installed if any of these conditions exist.

Drive Pinion Nut

CAUTION: Install the drive pinion nut to the correct torque specifications or damage to the differential components may occur.

On some high-mileage vehicles, oil may leak through the threads of the drive pinion nut. This condition can be corrected by installing a new nut and applying threadlock and sealer on the threads and nut face.

Differential Seals

CAUTION: When installing shafts, do not allow splines to contact seals during installation or damage to the seals may occur.

Halfshaft pilot bearing housing seals are susceptible to the same types of damage as drive pinion seals if incorrectly installed. The seal bore must be clean and the lip handled carefully to avoid cutting or tearing it. The seal journal surface must be free of nicks, gouges and rough surface texture.

For information on differential seals, refer to **REAR DRIVE AXLE/DIFFERENTIAL** article.

GENERAL PROCEDURES

DRIVELINE ANGLE MEASUREMENT

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST1622-A	Anglemaster II Driveline Inclinometer/Protractor	164-R2402 or equivalent

NOTE: This procedure does not apply to CV joints, flex couplers or double Carden joints that are used in some driveshafts. This check is for single-cross and roller-style joints found in the driveshafts.

NOTE: Prior to checking driveline angularity, inspect the U-joints for correct operation.

NOTE: An incorrect driveline angle can cause a vibration or shudder. For additional information, refer to NOISE, VIBRATION AND HARSHNESS article.

NOTE: Driveline angularity is the angular relationship between the engine crankshaft, the driveshaft and the rear axle pinion. Factors determining driveline angularity include ride height, rear spring and engine mounts.

All vehicles

1. Carry out the following preliminary setup steps:
   - Inspect the U-joints for correct operation.
   - Park the vehicle on a level surface such as a drive-on hoist, or back onto a front end alignment rack.
   - Verify the curb position ride height is within specifications with the vehicle unloaded and all of the tires are inflated to their normal operating pressures.
   - Calibrate the Anglemaster II Driveline Inclinometer/Protractor by placing it on a clean, flat level section of the frame rail and press the ALT-ZERO button.

   Vehicles with flat-flanged, split-pin or slip-flanged U-joints

   NOTE: **If equipped, remove the snap ring to allow access to the base of the U-joint cup. Make sure the Anglemaster II Driveline Inclinometer/Protractor is seated against the U-joint cup.**

   NOTE: **Rotate the driveshaft until the flange U-joint cup is parallel with the floor. This will simplify taking measurements.**

2. To check the U-joint operating angle, install the Anglemaster II Driveline Inclinometer/Protractor. Check and record the flange angle as angle A.

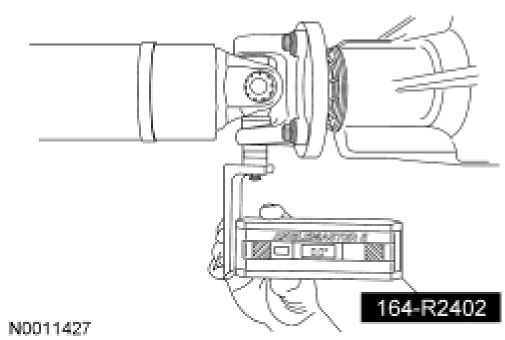


Fig. 2: Checking Flange Angle (1 Of 2)
Courtesy of FORD MOTOR CO.

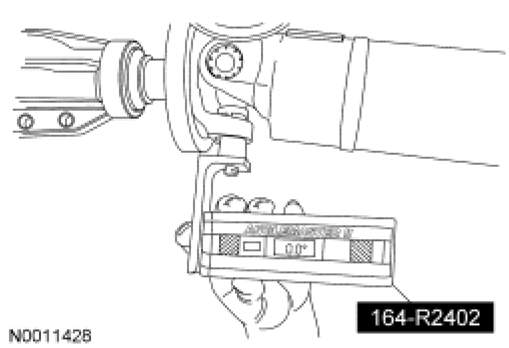


Fig. 3: Checking Flange Angle (2 Of 2)
Courtesy of FORD MOTOR CO.

3. Using the Anglemaster II Driveline Inclinometer/Protractor, measure the slope of the connecting component. Record the measurements of the component's angle as angle B.

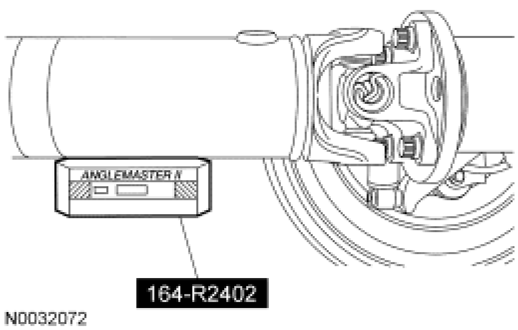


Fig. 4: Checking Driveshaft Angle
Courtesy of FORD MOTOR CO.

Multiple piece driveshafts

NOTE:	**Repeat this step for each center support bearing on the driveshaft.**

NOTE:	**It is not necessary to remove the U-joint snap ring, if equipped, for these measurements.**

4. Using the Anglemaster II Driveline Inclinometer/Protractor, measure the slope of the components in front and behind the center support bearing U-joint in the area indicated. Record the front component as angle A and the rear component as angle B.

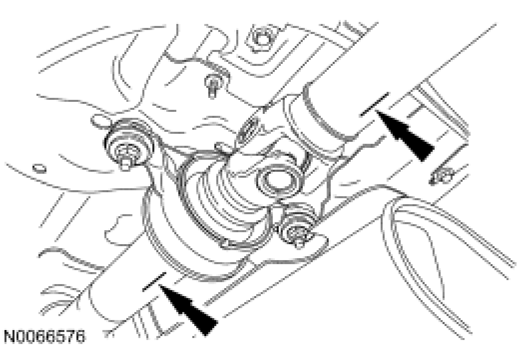


Fig. 5: Locating Index Mark On Driveshaft
Courtesy of FORD MOTOR CO.

All vehicles

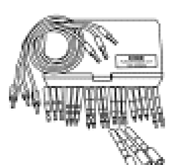
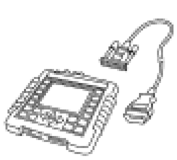
NOTE:	**When 2 connected components slope in the same direction, subtract the**

smallest number from the larger number to find the U-joint operating angle. When 2 connected components slope in the opposite direction, add the measurements to find the U-joint operating angle.

5. Calculate the difference in the slope of the components to determine the U-joint operating angle.
    - The U-joint operating angle is the angle formed by 2 yokes connected by a cross and bearing kit. Ideally, the operating angles on each connection of the driveshaft must:
        - be equal or within one degree of each other.
        - have a 3 degree maximum operating angle.
        - have at least 1/2 of one degree continuous operating angle.
6. If the angle is not within specifications, repair or adjust to obtain the correct angle. Inspect the engine mounts, transmission mounts, center support bearing mounting, rear suspension, rear axle, rear axle mounting or the frame for wear or damage.

DRIVESHAFT RUNOUT AND BALANCING

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST2574-A	Dial Indicator Gauge with Holding Fixture 100-02 (TOOL-4201-C) or equivalent	-
 ST3025-A	Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix)	257-00018 or equivalent

Driveshaft Inspection

NOTE: **Driveline vibration exhibits a higher frequency and lower amplitude than high-speed shake. Driveline vibration is directly related to the speed of the vehicle and is noticed at various speeds. Driveline vibration can be perceived as a tremor in the floorpan or heard as a rumble, hum or boom.**

NOTE: **Refer to <u>SPECIFICATIONS</u> for all runout specifications.**

NOTE: **Do not make any adjustments before carrying out a road test. Do not change the tire pressure or the vehicle load.**

1. Carry out a visual inspection of the vehicle. Operate the vehicle and verify the condition by reproducing it during the road test.

- The concern should be directly related to vehicle road speed, not affected by acceleration or deceleration or could not be reduced by coasting in NEUTRAL.

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
   - The driveshaft should be kept at an angle equal to or close to the curb-weighted position. Use a twin-post hoist or a frame hoist with jackstands.
3. Inspect the driveshaft for damage, undercoating or incorrectly seated U-joints. Rotate the driveshaft slowly by hand and feel for binding or end play in the U-joint trunnions. Remove the driveshaft. For additional information, refer to **DRIVESHAFT** article. Inspect the slip yoke splines for any galling, dirt, rust or incorrect lubrication. Clean the driveshaft or install new U-joints as necessary. Install a new driveshaft if damaged. After any corrections or new components are installed, recheck for the vibration at the road test speed.
   - If the vibration is gone, test drive the vehicle.
   - If the vibration persists or the driveshaft passes visual inspection, measure the driveshaft runout.

Driveshaft Runout

1. Install the suitable Dial Indicator Gauge with Holding Fixture. Rotate the driveshaft by turning the axle and measure the runout at the front, the center and the rear of the driveshaft.
   - If the runout exceeds 0.89 mm (0.035 in) at the front or center, install a new driveshaft.
   - If the front and center is within 1 mm (0.254 in), but the rear runout is not, index-mark the rear runout high point and proceed to Step 2.
   - If the runout is within 0.89 mm (0.035 in) at all points, recheck for vibration at road test speed. If the vibration persists, balance the driveshaft. For additional information, refer to appropriate Driveshaft Balancing procedure.

NOTE: Circular pinion flanges can be turned in 90 degree or 1/4 increments. Half-round pinion flanges are limited to 2 positions.

2. Index-mark the driveshaft to the pinion flange. Disconnect the driveshaft and rotate it 180 degrees. Reconnect the driveshaft. Recheck the runout at the rear of the driveshaft.
   - If the runout is still over specification, mark the high point and proceed to Step 3.
   - If the runout is within specification, check for the vibration at the road test speed. If the vibration is still present, balance the driveshaft. For additional information, refer to appropriate Driveshaft Balancing procedure.
3. Excessive driveshaft runout can originate in the driveshaft itself or from the pinion flange. To find the source, compare the 2 high points previously determined.
   - If the index marks are close together, within 25 mm (1 in), the driveshaft is eccentric. Install a new driveshaft.
   - If the marks are on opposite sides of the driveshaft, 180 degrees apart, the slip yoke or pinion flange is responsible. Check the pinion flange runout. If the pinion flange runout exceeds specifications, a bent pinion is indicated.
   - If the pinion flange and pinion runouts are within specifications, road test and check for the

vibration at the road test speed. If the vibration persists, balance the driveshaft. For additional information, refer to appropriate Driveshaft Balancing procedure.

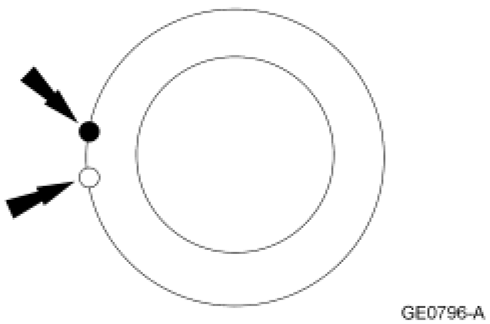


Fig. 6: Finding Excessive Driveshaft Runout (1 Of 2)
Courtesy of FORD MOTOR CO.

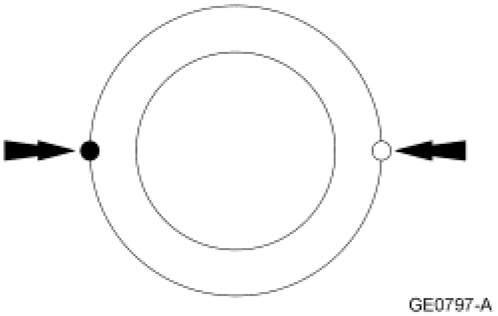


Fig. 7: Finding Excessive Driveshaft Runout (2 Of 2)
Courtesy of FORD MOTOR CO.

Driveshaft Balancing - Using the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix)

All vehicles

1. Install the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix) to the vehicle.
2. Working under the vehicle, install an accelerometer. The accelerometer can be attached and mounted near either the transmission or differential end of the driveshaft.
3. Clean an area of the driveshaft and install the reflective tape, then install the photo-tachometer sensor. The sensor should be placed at approximately a 20-degree angle from perpendicular to the surface of the reflective tape. Make sure the sensor does not get moved during the balance procedure.
    1. Reflective tape.
    2. Photo-tachometer sensor.

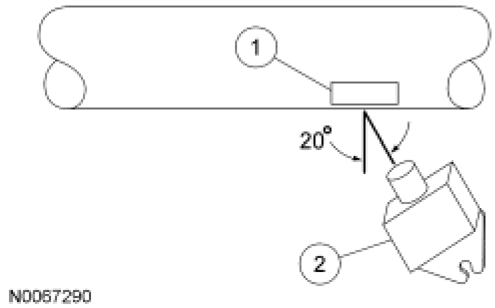


Fig. 8: Driveshaft Balancing - Using the MTS 4000
Courtesy of FORD MOTOR CO.

4. Using the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix), run a driveshaft balance test with the driveshaft unmodified.

Vehicles with tapped pinion flanges

5. Label the tapped holes in the pinion flange numerically, starting at the top hole as 1. Mark the remaining holes 2, 3 and 4. Label in the direction of rotation.

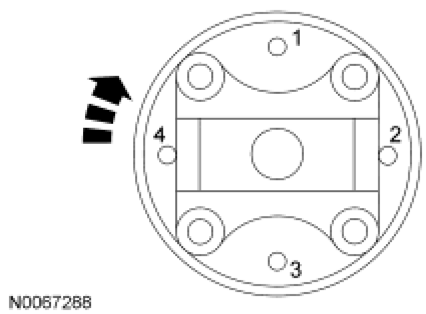


Fig. 9: Labeling Tapped Holes In The Pinion Flange
Courtesy of FORD MOTOR CO.

6. Using the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix), run a second test with the 12 mm (0.47 in) test weight set screw in the No. 1 hole, previously marked on the pinion flange.
7. Remove the test weight, then install the weight combination directed by the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix).

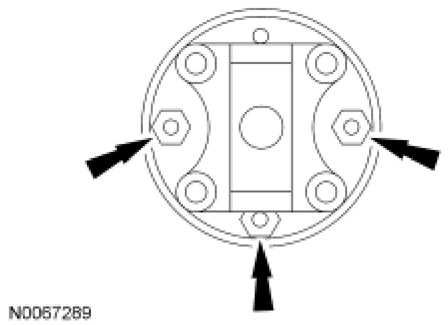


Fig. 10: Identifying Weight Combination
Courtesy of FORD MOTOR CO.

Vehicles without tapped pinion flanges

8. Using the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix), run a second test with a test weight. Using a metal band, secure the test weight to the end of the driveshaft. The weight should be placed at the end of the driveshaft tube, as close to the tube-to-yoke weld seam as possible. Mark the location of the test weight on the driveshaft, as shown in the figure below.
   1. Test weight.
   2. Tube-to-yoke weld seam.
   3. Driveshaft pinion flange.
   4. Select the test weight based on driveshaft size. Larger driveshafts use 10 g (0.353 oz.). Smaller driveshafts use 5 g (0.176 oz.).

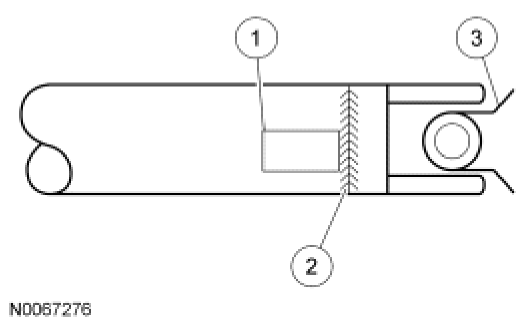


Fig. 11: Test Weight, Tube-To-Yoke Weld Seam, And Driveshaft Pinion Flange
Courtesy of FORD MOTOR CO.

9. Remove the test weight, then install the recommended weight at the position directed by the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix). Using a metal band and epoxy, secure the test weight to the driveshaft, as shown in the figure below.
   1. Test weight.
   2. Measure in this direction.
   3. Driveshaft diameter.
   4. Directional rotation.

5. Balance weight relative to test weight centerline.
6. The results are displayed with respect to the location to where the test weight was placed.

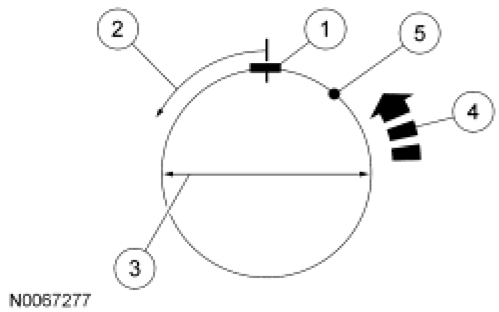


Fig. 12: Identifying Test Weight And Recommended Weight Positions
Courtesy of FORD MOTOR CO.

All vehicles

10. Using the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix), run a third test to verify the repair.

Driveshaft Balancing - Hose Clamp Method

1. Install 1 or 2 hose clamps on the driveshaft, near the rear. Position of the hose clamp head(s) can be determined through trial and error.
2. Mark the rear of the driveshaft into 4 approximately equal sectors and number the marks 1 through 4. Install a hose clamp on the driveshaft with its head at position No. 1, as shown in the figure below. Check for vibration at road speed. Recheck with the clamp at each of the other positions to find the position that shows minimum vibration. If 2 adjacent positions show equal improvement, position the clamp head between them.

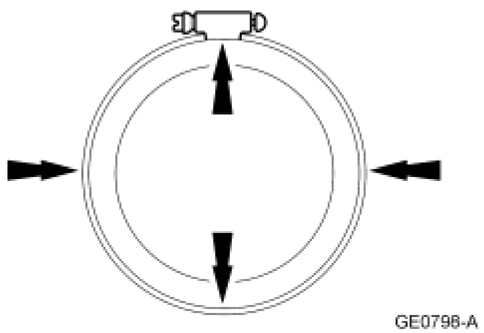


Fig. 13: Marking Rear Driveshaft Into Four Equal Sections
Courtesy of FORD MOTOR CO.

3. If the vibration persists, add a second clamp at the same position and recheck for vibration.

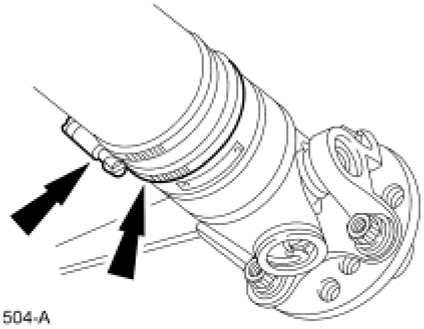


Fig. 14: Adding Second Clamp To Driveshaft
Courtesy of FORD MOTOR CO.

4. If no improvement is noted, rotate the clamps in opposite directions, equal distances from the best position determined in Step 2. Separate the clamp heads about 13 mm (1/2 in) and recheck for vibration at the road speed.

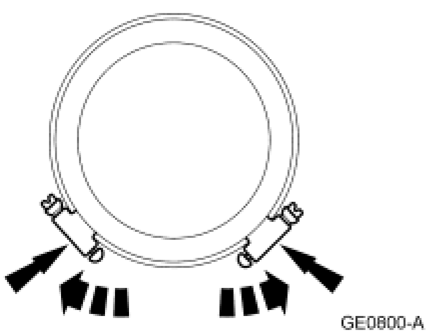


Fig. 15: Rotating Clamps In Opposite Directions
Courtesy of FORD MOTOR CO.

5. Repeat the process with increasing separation until the best combination is found or the vibration is reduced to an acceptable level.

DRIVESHAFT INDEXING

NOTE: **If indexing the driveshaft does not eliminate the vibration, balance the driveshaft. For additional information, refer to Driveshaft Runout and Balancing.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

   NOTE: **Do not reuse constant velocity (CV) joint bolts or flange bolts. Install new bolts or damage to the vehicle may occur.**

2. Remove and discard the driveshaft-to-transfer case bolts.

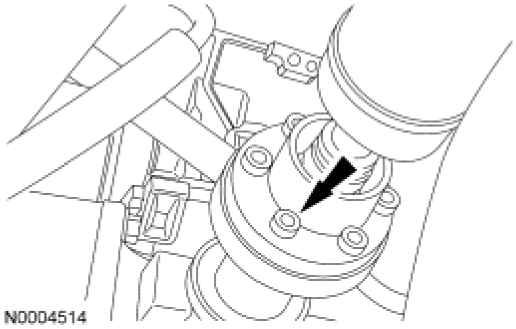


Fig. 16: Identifying Driveshaft Flange Bolts
Courtesy of FORD MOTOR CO.

3. Using a suitable pry bar as shown in illustration, separate the driveshaft from the Power Transfer Unit (PTU) flange.

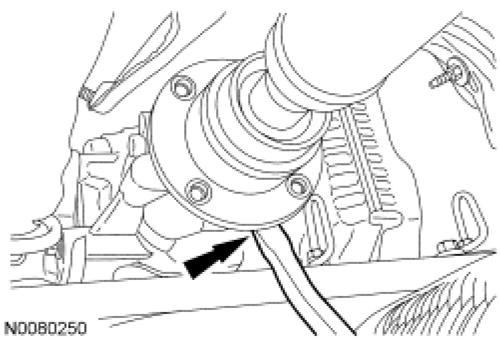


Fig. 17: Separating Driveshaft Flange From PTU Flange Using A Suitable Pry Bar
Courtesy of FORD MOTOR CO.

NOTE: Index-mark the shaft for reference.

4. Rotate the flange 90 degrees clockwise.

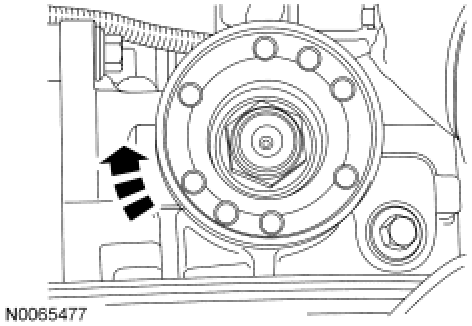


Fig. 18: Rotating Flange 90 Degrees Clockwise
Courtesy of FORD MOTOR CO.

5. Connect the front driveshaft and install the new bolts. For additional information, refer to

DRIVESHAFT article.

NOTE: **Do not reuse the bolts for the pinion yoke. Install new bolts or damage to the vehicle may occur.**

6. Disconnect the rear driveshaft U-joint flange.
   - Discard the bolts.

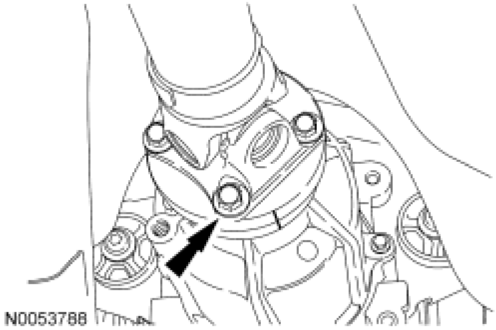


Fig. 19: Locating Rear Driveshaft Universal Joint Flange Bolts
Courtesy of FORD MOTOR CO.

7. Rotate the rear pinion 90 degrees clockwise.

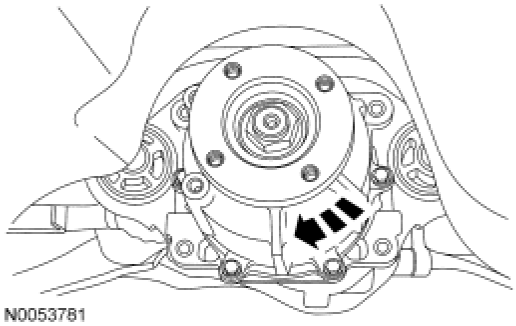


Fig. 20: Rotating Rear Pinion 90 Degrees Clockwise
Courtesy of FORD MOTOR CO.

8. Connect the rear driveshaft and install the new bolts. For additional information, refer to **DRIVESHAFT** article.
9. Test drive the vehicle.
10. Repeat the procedure if necessary.

2008 DRIVELINE/AXLES

Driveshaft - Edge & MKX

SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Driveshaft runout	1.1 mm (0.043 in)

TORQUE SPECIFICATIONS

Description	Nm	lb-ft
Center bearing support nuts	40	30
Front driveshaft-to-transfer case bolts	70	52
Rear driveshaft-to-pinion flange bolts	70	52

DESCRIPTION AND OPERATION

DRIVESHAFT

NOTE: All driveshaft assemblies are balanced. If undercoating the vehicle, protect the driveshaft to prevent overspray of any undercoating material.

The driveshaft assembly consists of the following:

- Rubber isolated center support bearings
- Constant velocity (CV) joint at the power transfer unit (PTU)
- U-joints at the center supports and pinion flange
- Assembly balanced with traditional balance weights
- Lubed-for-life joints requiring no periodic lubrication

The driveshaft transfers torque from the PTU to the rear axle. It is attached to the PTU flange with a CV joint. The 3-piece shaft is connected by a staked U-joint at each center bearing and attached to the rear pinion flange. The driveshaft joints allow the smooth continuous rotation of the driveshaft through the allowable angle planes and length variations required in normal vehicle operation. The driveshaft is always turning at front wheel speed. The driveshaft is not serviceable. A new driveshaft must be installed if worn or damaged.

UNIVERSAL JOINTS

The U-joints consist of the following:

- A single spider (cross)
- Lubed-for-life design and require no periodic lubrication

- Nylon thrust washers, located at each base of the bearing cup, which control end play, position the needle bearing and improve grease movement
- Grease seals located at the opening of each bearing cup to retain the grease for the bearing lubrication
- Bearing cups that retain the needle bearings and locate the spider on the centerline of the shaft bore to control shaft runout and balance

The U-joints are staked in place and are not serviced individually. If worn or damaged, install a new driveshaft assembly.

The 3 U-joints in this driveshaft assembly allow the driveshaft tubes to rotate smoothly through the varying angles of the power transfer unit (PTU), the center support bearings and the rear drive unit (RDU). The angles that cause the U-joints to accelerate and decelerate may cause vibration in the driveshaft assembly if the angles are either too great or too small. Refer to **DRIVELINE SYSTEM - GENERAL INFORMATION** article.

DIAGNOSTIC TESTS

DRIVESHAFT

Refer to **DRIVELINE SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

DRIVESHAFT

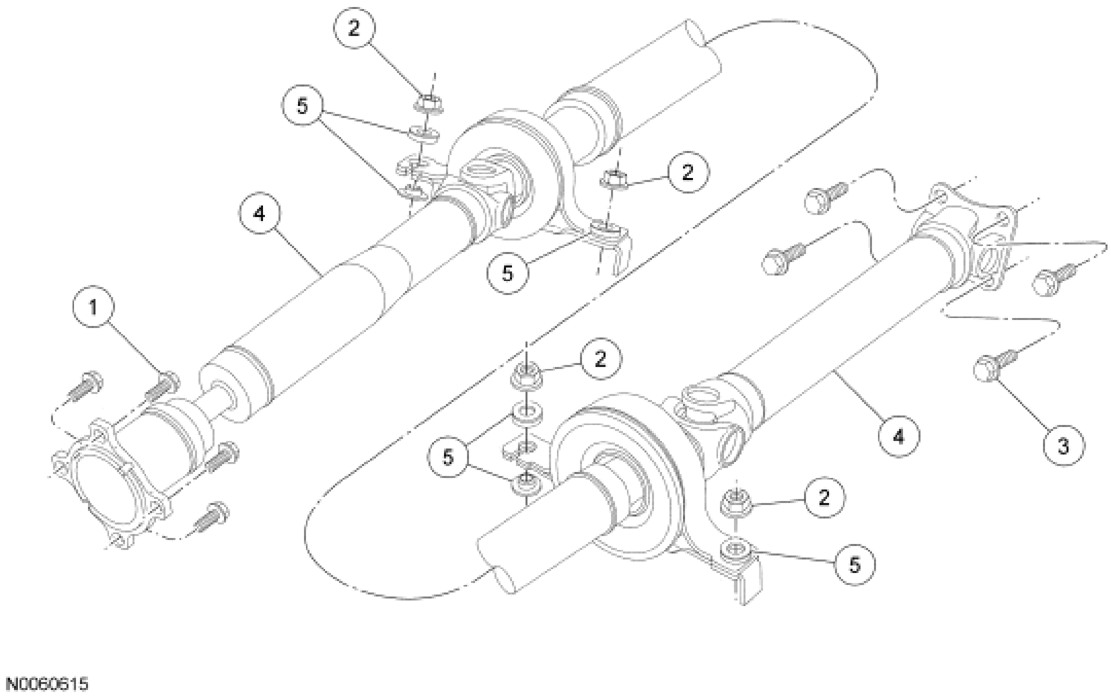


Fig. 1: View Of Driveshaft

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W711918	Front driveshaft-to-transfer case bolt (4 required)
2	W520113	Center bearing support nuts (4 required)
3	W711918	Universal flange-to-pinion flange bolt (4 required)
4	4K357	Driveshafts
5	4A169	Isolators (8 required)

REMOVAL AND INSTALLATION

NOTE: Index-mark both driveshaft flanges.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

CAUTION: Do not reuse the constant velocity (CV) joint bolts. Install new bolts or damage to the vehicle may occur.

2. Remove and discard the 4 front driveshaft-to-transfer case bolts.
   - To install, tighten to 70 Nm (52 lb-ft).

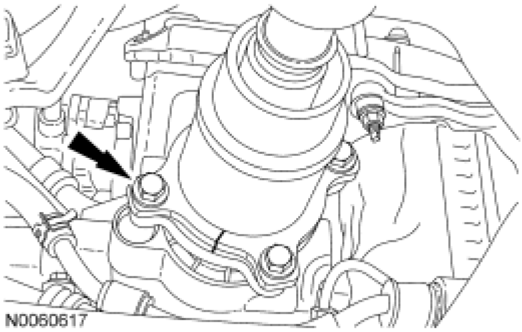


Fig. 2: Locating Front Driveshaft-To-Transfer Case Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Do not reuse the bolts for the rear U-joint flange or damage to the component may occur. Install new bolts.

3. Remove and discard the 4 U-joint flange bolts.
   - To install, tighten to 70 Nm (52 lb-ft).

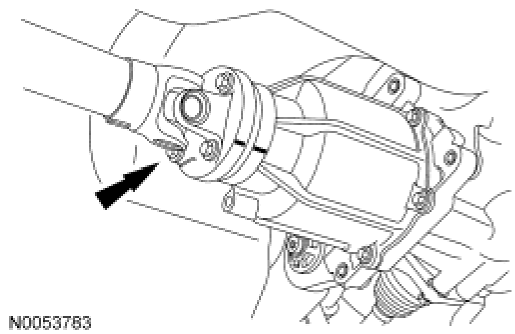


Fig. 3: Locating U-Joint Flange Bolts
Courtesy of FORD MOTOR CO.

4. With the help of an assistant, remove the 4 center bearing support nuts and the driveshaft.
   - To install, tighten to 40 Nm (30 lb-ft).

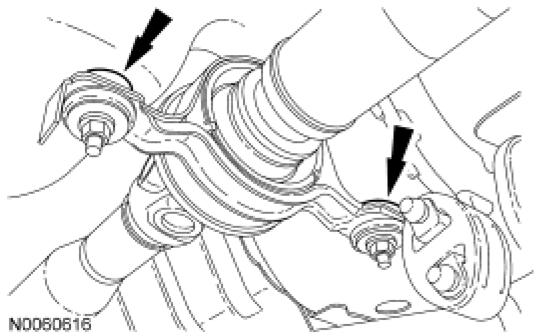


Fig. 4: Locating Center Bearing Support Nuts & Driveshaft
Courtesy of FORD MOTOR CO.

NOTE: **If a driveshaft is installed and driveshaft vibration is encountered after installation, index the driveshaft. For additional information, refer to DRIVELINE SYSTEM - GENERAL INFORMATION article.**

5. To install, reverse the removal procedure.

2008 FORD MOTOR CO.

Edge & MKX

BUZZERS, RELAYS & TIMERS

BUZZERS, RELAYS & TIMERS LOCATION

Component	Location
Accessory Delay Relay	In smart junction box (SJB). See **Fig. 2**.
A/C Clutch Relay	In battery junction box (BJB). See **Fig. 1**.
Front Blower Motor Relay	In battery junction box (BJB). See **Fig. 1**.
Fuel Pump Relay	In battery junction box (BJB). See **Fig. 1**.
Heated Mirror Relay	In battery junction box (BJB). See **Fig. 1**.
PCM Power Relay	In battery junction box (BJB). See **Fig. 1**.
Power Liftgate Chime	Base of left "D" pillar. See **Fig. 15**.
Rear Seat Release Relay	In battery junction box (BJB). See **Fig. 1**.
Rear Window Defrost Relay	In battery junction box (BJB). See **Fig. 1**.
Reversing Lamps Relay	In battery junction box (BJB). See **Fig. 1**.
Run/Start Relay	In battery junction box (BJB). See **Fig. 1**.
Starter Relay	In battery junction box (BJB). See **Fig. 1**.
Trailer Tow Left Stop/Turn Lamp Relay	In battery junction box (BJB). See **Fig. 1**.
Trailer Tow Park Lamp Relay	In battery junction box (BJB). See **Fig. 1**.
Trailer Tow Right Stop/Turn Lamp Relay	In battery junction box (BJB). See **Fig. 1**.

CIRCUIT PROTECTION DEVICES

CIRCUIT PROTECTION DEVICES LOCATION

Component	Location
Battery Junction Box (BJB) (Edge)	Left side of engine compartment. See **Fig. 3**.
Battery Junction Box (BJB) (MKX)	Left side of engine compartment. See **Fig. 5**.
Fuel Pump Diode	In battery junction box (BJB). See **Fig. 1**.
Fuel Pump Diode	In battery junction box (BJB). See **Fig. 1**.
Smart Junction Box (SJB) (Edge)	Left rear corner of engine compartment. See **Fig. 3**.
Smart Junction Box (SJB) (MKX)	Left rear corner of engine compartment. See **Fig. 5**.

CONTROL UNITS

CONTROL UNITS LOCATION

Component	Location
ABS Control Module (Edge)	Left rear corner of engine compartment. See **Fig. 3**.
ABS Control Module (MKX)	Left rear corner of engine compartment. See **Fig. 5**.

All Wheel Drive (AWD) Module	Behind right kick panel. See **Fig. 14**.
Antenna Module	Behind right kick panel. See **Fig. 9**.
Climate Controlled Seat Backrest Module (Driver Side)	Under driver's seat. See **Fig. 19**.
Climate Controlled Seat Backrest Module (Passenger Side)	Under front passenger's seat. See **Fig. 20**.
Climate Controlled Seat Cushion Module (Driver Side)	Under driver's seat. See **Fig. 19**.
Climate Controlled Seat Cushion Module (Passenger Side)	Under front passenger's seat. See **Fig. 20**.
Climate Controlled Seat Module (Passenger Side)	Under front passenger's seat. See **Fig. 20**.
Cooling Fan Module (Edge)	Left front of engine compartment. See **Fig. 3**.
Cooling Fan Module (MKX)	Left front of engine compartment. See **Fig. 5**.
Driver Air Bag Module	In steering wheel. See **Fig. 11**.
Electronic Automatic Temperature Control (EATC) Module	Behind center of dash. See **Fig. 10**.
Front Blower Motor Speed Controller	On blower motor. See **Fig. 9**.
Fuel Pump Module	In fuel tank. See **Fig. 15**.
Heated Seat Module (Left Rear)	Under left rear seat. See **Fig. 21**.
Heated Seat Module (Passenger Side - Front)	Under front passenger's seat. See **Fig. 20**.
Manual Climate Control Module	Behind center of dash. See **Fig. 10**.
Memory Module	Under driver's seat. See **Fig. 19**.
Occupant Classification Sensor (OCS) Module	Under front passenger's seat. See **Fig. 20**.
Parking Aid Module (PAM)	Behind left rear quarterpanel. See **Fig. 15**.
Passenger Air Bag Module	Behind right side of dash. See **Fig. 10**.
Power Liftgate Module	In left "D" pillar. See **Fig. 15**.
Powertrain Control Module (PCM) (Edge)	Right front of engine. See **Fig. 3**.
Powertrain Control Module (PCM) (MKX)	Right front of engine. See **Fig. 5**.
Restraints Control Module	Under center console. See **Fig. 10**.
Side Air Bag Module (Left Front)	In left "B" pillar. See **Fig. 13**.
Side Air Bag Module (Right Front)	In right "B" pillar. See **Fig. 14**.
Side Air Curtain Module (Driver)	In left "D" pillar. See **Fig. 15**.
Side Air Curtain Module (Passenger)	In right "D" pillar. See **Fig. 16**.
Smart Wiper Module (Edge)	Left rear of engine compartment. See **Fig. 4**.
Smart Wiper Module (MKX)	Left rear of engine compartment. See **Fig. 6**.
Steering Angle Sensor Module (SASM)	On steering column. See **Fig. 31**.

MOTORS

MOTORS LOCATION

Component	Location

Blower Motor	Behind right side of dash. See **Fig. 9**.
Door Lock Actuator (Left Front)	Rear of driver's door. See **Fig. 22**.
Door Lock Actuator (Left Rear)	Rear of left rear door. See **Fig. 24**.
Door Lock Actuator (Right Front)	Rear of front passenger's door. See **Fig. 23**.
Door Lock Actuator (Right Rear)	Rear of right rear door. See **Fig. 25**.
Driver Seat Backrest Motor	Under driver's seat. See **Fig. 19**.
Driver Seat Front Height Motor	Under driver's seat. See **Fig. 19**.
Driver Seat Horizontal Motor	Under driver's seat. See **Fig. 19**.
Driver Seat Rear Height Motor	Under driver's seat. See **Fig. 19**.
Electronic Throttle Control (ETC) Motor	On throttle body. See **Fig. 8**.
Exterior Rear View Mirror (LH Side)	In driver's door. See **Fig. 22**.
Exterior Rear View Mirror (RH Side)	In front passenger's door. See **Fig. 23**.
Fresh/Recirculation Door Actuator	Middle of HVAC unit. See **Fig. 30**.
Liftgate Drive Unit	In left "D" pillar. See **Fig. 15**.
Lumbar Motor (Driver Seat)	Under driver's seat. See **Fig. 19**.
Lumbar Motor (Passenger Seat)	Under front passenger's seat. See **Fig. 20**.
Mode Door Actuator	Left side of HVAC unit. See **Fig. 30**.
Passenger Backrest Motor	Under front passenger's seat. See **Fig. 20**.
Passenger Seat Front Height Motor	Under front passenger's seat. See **Fig. 20**.
Passenger Seat Horizontal Motor	Under front passenger's seat. See **Fig. 20**.
Passenger Seat Rear Height Motor	Under front passenger's seat. See **Fig. 20**.
Power Window Motor (Driver Side Front)	Middle of driver's door. See **Fig. 22**.
Power Window Motor (Left Rear)	Middle of left rear door. See **Fig. 24**.
Power Window Motor (Passenger Side Front)	Middle of front passenger's door. See **Fig. 23**.
Power Window Motor (Right Rear)	Middle of right rear door. See **Fig. 25**.
Rear Window Wiper Motor (Edge)	In liftgate. See **Fig. 26**.
Rear Window Wiper Motor (MKX)	In liftgate. See **Fig. 27**.
Seat Release Actuator (Left Rear)	Under left rear seat. See **Fig. 15**.
Seat Release Actuator (Right Rear)	Under right rear seat. See **Fig. 16**.
Starter Motor (Edge)	Left rear of engine. See **Fig. 4**.
Starter Motor (MKX)	Left rear of engine. See **Fig. 6**.
Temperature Blend Door Actuator	Middle front of HVAC unit. See **Fig. 30**.
Temperature Blend Door Actuator (Driver)	Left side of HVAC unit. See **Fig. 30**.
Windshield Washer Pump Motor (Edge)	On washer fluid reservoir. See **Fig. 4**.
Windshield Washer Pump Motor (MKX)	On washer fluid reservoir. See **Fig. 6**.

SENDING UNITS & SENSORS

SENDING UNITS & SENSORS LOCATION

Component	**Location**
Accelerator Pedal Position (APP) Sensor (Edge)	Top of accelerator pedal. See **Fig. 3**.

Accelerator Pedal Position (APP) Sensor (MKX)	Top of accelerator pedal. See **Fig. 5**.
A/C Pressure Transducer Sensor (Edge)	Right front of engine compartment. See **Fig. 3**.
A/C Pressure Transducer Sensor (MKX)	Right front of engine compartment. See **Fig. 5**.
Camshaft Position Sensor 1	Rear of right cylinder bank. See **Fig. 7**.
Camshaft Position Sensor 2	Rear of left cylinder bank. See **Fig. 7**.
Crankshaft Position Sensor	Lower left rear of engine. See **Fig. 7**.
Crash Sensor (Left Rear)	Behind left rear quarterpanel. See **Fig. 15**.
Cylinder Head Temperature Sensor	Front of right cylinder bank. See **Fig. 8**.
Evaporator Discharge Air Temperature Sensor	Left side of HVAC unit. See **Fig. 30**.
Front Impact Sensor (Left) (Edge)	Left front of engine compartment. See **Fig. 3**.
Front Impact Sensor (Left) (MKX)	Left front of engine compartment. See **Fig. 5**.
Front Impact Sensor (Right) (Edge)	Right front of engine compartment. See **Fig. 3**.
Front Impact Sensor (Right) (MKX)	Right front of engine compartment. See **Fig. 5**.
Fuel Level Sensor	Top of fuel tank. See **Fig. 15**.
Fuel Tank Pressure Sensor	In fuel tank. See **Fig. 15**.
Heated Oxygen Sensor (HO2S) #11	Right rear side of engine. See **Fig. 8**.
Heated Oxygen Sensor (HO2S) #12	Right front side of engine. See **Fig. 8**.
Heated Oxygen Sensor (HO2S) #21	Left side of engine. See **Fig. 7**.
Heated Oxygen Sensor (HO2S) #22	Left rear side of engine. See **Fig. 7**.
In-Vehicle Temperature Sensor	Behind left side of dash. See **Fig. 10**.
Keyless Entry Keypad	Rear of driver's door. See **Fig. 22**.
Knock Sensor	Left rear of engine. See **Fig. 7**.
Liftgate Obstacle Detection Strip (Left)	Left side of liftgate. See **Fig. 27**.
Liftgate Obstacle Detection Strip (Right)	Right side of liftgate. See **Fig. 27**.
Light Sensor	Under top center of dash. See **Fig. 9**.
Mass Air Flow/Intake Air Temperature (MAF/IAT) Sensor (Edge)	On intake air duct. See **Fig. 4**.
Mass Air Flow/Intake Air Temperature (MAF/IAT) Sensor (MKX)	On intake air duct. See **Fig. 6**.
Occupant Classification Sensor (OCS) 1	Under right side of front passenger's seat. See **Fig. 20**.
Occupant Classification Sensor (OCS) 2	Under right side of front passenger's seat. See **Fig. 20**.
Occupant Classification Sensor (OCS) 3	Under left side of front passenger's seat. See **Fig. 20**.
Occupant Classification Sensor (OCS) 4	Under left side of front passenger's seat. See **Fig. 20**.
Outside Temperature Sensor (Edge)	Right front of engine compartment. See **Fig. 3**.
Outside Temperature Sensor (MKX)	Right front of engine compartment. See **Fig. 5**.
Parking Aid Sensor (Inner Left) (Edge)	Behind left side of rear bumper. See **Fig. 17**.
Parking Aid Sensor (Inner Left) (MKX)	Behind left side of rear bumper. See **Fig. 18**.

Parking Aid Sensor (Inner Right) (Edge)	Behind right side of rear bumper. See **Fig. 17**.
Parking Aid Sensor (Inner Right) (MKX)	Behind right side of rear bumper. See **Fig. 18**.
Parking Aid Sensor (Outer Left) (Edge)	Behind left end of rear bumper. See **Fig. 17**.
Parking Aid Sensor (Outer Left) (MKX)	Behind left end of rear bumper. See **Fig. 18**.
Parking Aid Sensor (Outer Right) (Edge)	Behind right end of rear bumper. See **Fig. 17**.
Parking Aid Sensor (Outer Right) (MKX)	Behind right end of rear bumper. See **Fig. 18**.
Passive Anti-Theft Transceiver	Behind left side of dash. See **Fig. 10**.
Seat Track Position Sensor (Left Front)	Under driver's seat. See **Fig. 19**.
Side Impact Sensor (Driver 1)	In left "B" pillar. See **Fig. 13**.
Side Impact Sensor (Passenger 1)	Base of right "B" pillar. See **Fig. 14**.
Side Impact Sensor (Right Rear)	Behind right rear quarterpanel. See **Fig. 16**.
Stability Control Sensor Cluster	Under right rear seat. See **Fig. 16**.
Steering Wheel Angle Sensor	On steering column. See **Fig. 10**.
Wheel Speed Sensor (Left Front) (Edge)	On left front wheel hub. See **Fig. 4**.
Wheel Speed Sensor (Left Front) (MKX)	On left front wheel hub. See **Fig. 6**.
Wheel Speed Sensor (Left Rear)	On left rear wheel hub. See **Fig. 16**.
Wheel Speed Sensor (Right Front) (Edge)	On right front wheel hub. See **Fig. 4**.
Wheel Speed Sensor (Right Front) (MKX)	On right front wheel hub. See **Fig. 6**.
Wheel Speed Sensor (Right Rear)	On right rear wheel hub. See **Fig. 16**.

SOLENOIDS & SOLENOID VALVES

SOLENOIDS & SOLENOID VALVES LOCATION

Component	Location
A/C Clutch Field Coil (Edge)	On A/C compressor. See **Fig. 4**.
A/C Clutch Field Coil (MKX)	On A/C compressor. See **Fig. 6**.
EVAP Canister Purge Valve (Edge)	Right rear of engine. See **Fig. 3**.
EVAP Canister Purge Valve (MKX)	Right rear of engine. See **Fig. 5**.
EVAP Canister Vent Control Solenoid	Under left side of vehicle. See **Fig. 13**.
Fuel Injector 1	Top right side of engine. See **Fig. 8**.
Fuel Injector 2	Top right side of engine. See **Fig. 8**.
Fuel Injector 3	Top right side of engine. See **Fig. 8**.
Fuel Injector 4	Top left side of engine. See **Fig. 7**.
Fuel Injector 5	Top left side of engine. See **Fig. 7**.
Fuel Injector 6	Top left side of engine. See **Fig. 7**.
Heated Positive Crankcase Ventilation (PCV) Valve	Top left side of engine. See **Fig. 8**.
Intelligent Torque Control Coupling (ITCC) Solenoid	Under right rear of vehicle. See **Fig. 16**.
Positive Crankcase Ventilation (PCV) Heated Fitting	Top right rear of engine. See **Fig. 8**.
Variable Camshaft Timing (VCT) Valve 1	Top front of right cylinder bank. See **Fig. 8**.

Variable Camshaft Timing (VCT) Valve 2	Top front of left cylinder bank. See **Fig. 7**.

SWITCHES

SWITCHES LOCATION

Component	Location
Anti-Theft Hood Switch	Right front of engine compartment. See **Fig. 5**.
Brake Fluid Level Switch (Edge)	On master cylinder reservoir. See **Fig. 4**.
Brake Fluid Level Switch (MKX)	On master cylinder reservoir. See **Fig. 6**.
Brake Pedal Position (BPP) Switch (Edge)	On brake pedal support bracket. See **Fig. 4**.
Brake Pedal Position (BPP) Switch (MKX)	On brake pedal support bracket. See **Fig. 6**.
Ignition Switch	On steering column. See **Fig. 31**.
Inertia Fuel Shutoff (IFS) Switch	In left "D" pillar. See **Fig. 15**.
Liftgate Ajar Switch (Edge)	Lower right side of liftgate. See **Fig. 26**.
Liftgate Ajar Switch (MKX)	Lower right side of liftgate. See **Fig. 27**.
Multifunction Switch	Top of steering column. See **Fig. 31**.
Oil Pressure Switch	Lower left side of engine. See **Fig. 7**.
Parking Brake Switch	Top of parking brake lever bracket. See **Fig. 13**.
Power Steering Pressure Switch (Edge)	Right front of engine. See **Fig. 4**.
Power Steering Pressure Switch (MKX)	Right front of engine. See **Fig. 6**.
Safety Belt Buckle Switch (Driver)	Integral to driver's seat belt buckle. See **Fig. 19**.
Safety Belt Buckle Switch (Passenger Side)	Integral to front passenger's seat belt buckle. See **Fig. 20**.
Washer Fluid Level Switch (Edge)	On washer fluid reservoir. See **Fig. 3**.
Washer Fluid Level Switch (MKX)	On washer fluid reservoir. See **Fig. 5**.

MISCELLANEOUS

MISCELLANEOUS LOCATION

Component	Location
ABS Test Connector (C126) (Edge)	Left side of engine compartment. See **Fig. 4**.
ABS Test Connector (C126) (MKX)	Left side of engine compartment. See **Fig. 6**.
A/C Compressor Clutch Diode	In battery junction box (BJB). See **Fig. 1**.
A/C Compressor Clutch Diode	In battery junction box (BJB). See **Fig. 1**.
Battery (Edge)	Left side of engine compartment. See **Fig. 3**.
Battery (MKX)	Left side of engine compartment. See **Fig. 5**.
Blower Motor Resistor	Behind right side of dash. See **Fig. 9**.
Clockspring	On steering column. See **Fig. 31**.
Coil On Plug (COP) 1	Top right side of engine. See **Fig. 8**.
Coil On Plug (COP) 2	Top right side of engine. See **Fig. 8**.
Coil On Plug (COP) 3	Top right side of engine. See **Fig. 8**.

Coil On Plug (COP) 4	Top left side of engine. See **Fig. 7**.
Coil On Plug (COP) 5	Top left side of engine. See **Fig. 7**.
Coil On Plug (COP) 6	Top left side of engine. See **Fig. 7**.
Data Link Connector (DLC)	Under left side of dash. See **Fig. 10**.
Fusible Link A (Edge)	Left side of engine compartment. See **Fig. 4**.
Fusible Link A (MKX)	Left side of engine compartment. See **Fig. 6**.
Generator (Edge)	Left front of engine. See **Fig. 4**.
Generator (MKX)	Left front of engine. See **Fig. 6**.
Horn (Edge)	Right front corner of engine compartment. See **Fig. 4**.
Horn (MKX)	Right front corner of engine compartment. See **Fig. 6**.
Ignition Transformer Capacitor 1	Right rear of engine. See **Fig. 8**.
Ignition Transformer Capacitor 2	Top left rear of engine. See **Fig. 7**.
Joint Connector 1 (Edge)	Left rear of luggage compartment. See **Fig. 17**.
Joint Connector 1 (MKX)	Left side of luggage compartment. See **Fig. 18**.
Joint Connector 2 (Edge)	Left rear of luggage compartment. See **Fig. 17**.
Joint Connector 2 (MKX)	Left side of luggage compartment. See **Fig. 18**.
Joint Connector 3	Behind right kick panel. See **Fig. 14**.
Joint Connector 4	Behind center of dash. See **Fig. 9**.
Joint Connector 5	Behind left side of dash. See **Fig. 9**.
Joint Connector 6	Behind left side of dash. See **Fig. 9**.
Joint Connector 7 (Edge)	Left rear of engine compartment. See **Fig. 3**.
Joint Connector 7 (MKX)	Left rear of engine compartment. See **Fig. 5**.
Joint Connector 8	In left "D" pillar. See **Fig. 15**.
Joint Connector 9	Behind right rear quarterpanel. See **Fig. 16**.
Safety Belt Buckle Pretensioner (Driver)	Base of seat belt buckle assembly. See **Fig. 20**.
Safety Belt Buckle Pretensioner (Passenger)	Base of seat belt buckle assembly. See **Fig. 20**.
Satellite Radio Receiver	Left rear of cargo area. See **Fig. 15**.
Seat Heater Element (Left Front)	In driver's seat cushion. See **Fig. 19**.
Seat Heater Element (Left Rear)	Under left rear seat. See **Fig. 21**.
Seat Heater Element (Right Front)	In front passenger's seat cushion. See **Fig. 20**.
THX Amplifier	Behind right rear quarterpanel. See **Fig. 16**.
Trailer Tow Connector (Edge)	Under center of rear bumper. See **Fig. 17**.
Trailer Tow Connector (MKX)	Under center of rear bumper. See **Fig. 18**.

CONNECTORS

CONNECTORS LOCATION

Component	Location
C110 (Edge) (8 Pin)	Left side of engine compartment. See **Fig. 4**.

C110 (MKX) (8 Pin)	Left side of engine compartment. See **Fig. 6**.
C134 (Edge) (20 Pin)	Left front of engine compartment. See **Fig. 4**.
C134 (MKX) (20 Pin)	Left front of engine compartment. See **Fig. 5**.
C139 (70 Pin)	Top left side of engine. See **Fig. 7**.
C140 (16 Pin)	Top left side of engine. See **Fig. 7**.
C192 (2 Pin)	Top front of engine. See **Fig. 8**.
C210 (16 Pin)	Base of left "A" pillar. See **Fig. 13**.
C211 (20 Pin)	Base of left "A" pillar. See **Fig. 13**.
C212 (Edge) (57 Pin)	Left rear of engine compartment. See **Fig. 3**.
C212 (MKX) (57 Pin)	Left rear of engine compartment. See **Fig. 5**.
C213 (57 Pin)	Behind left side of dash. See **Fig. 9**.
C214 (20 Pin)	Behind right kick panel. See **Fig. 14**.
C215 (30 Pin)	Behind left side of dash. See **Fig. 9**.
C260 (4 Pin)	Behind right side of dash. See **Fig. 9**.
C263 (6 Pin)	Behind right side of dash. See **Fig. 9**.
C264 (16 Pin)	Behind right side of dash. See **Fig. 9**.
C265 (16 Pin)	Behind right side of dash. See **Fig. 9**.
C300 (20 Pin)	Under left rear seat. See **Fig. 21**.
C311 (57 Pin)	Under driver's seat. See **Fig. 13**.
C312 (12 Pin)	Under driver's seat. See **Fig. 13**.
C313 (10 Pin)	Under center floor console. See **Fig. 14**.
C313 (10 Pin)	Under front of center floor console. See **Fig. 12**.
C314 (12 Pin)	Under front passenger's seat. See **Fig. 14**.
C315 (14 Pin)	Under front passenger's seat. See **Fig. 20**.
C316 (30 Pin)	Under front passenger's seat. See **Fig. 20**.
C316 (30 Pin)	Under front passenger's seat. See **Fig. 14**.
C327 (2 Pin)	Under front passenger's seat. See **Fig. 14**.
C328 (2 Pin)	Under driver's seat. See **Fig. 13**.
C405 (16 Pin)	Under left rear of vehicle. See **Fig. 15**.
C406 (edge) (16 Pin)	Behind center of rear bumper. See **Fig. 17**.
C406 (16 Pin)	Behind center of rear bumper. See **Fig. 18**.
C510 (54 Pin)	Behind left kick panel. See **Fig. 13**.
C610 (54 Pin)	Behind right kick panel. See **Fig. 14**.
C700 (14 Pin)	In left "B" pillar. See **Fig. 13**.
C800 (14 Pin)	In right "B" pillar. See **Fig. 14**.
C913 (Edge) (2 Pin)	Top of liftgate. See **Fig. 26**.
C913 (MKX) (2 Pin)	Top of liftgate. See **Fig. 27**.
C919 (8 Pin)	Top of left "D" pillar. See **Fig. 15**.
C922 (8 Pin)	Top of left "D" pillar. See **Fig. 15**.
C925 (4 Pin)	Top of left "D" pillar. See **Fig. 15**.
C934 (6 Pin)	Top of left "D" pillar. See **Fig. 15**.

GROUNDS

GROUNDS LOCATION

Component	Location
G100 (Edge)	Left side of engine compartment. See **Fig. 4**.
G100 (MKX)	Left side of engine compartment. See **Fig. 6**.
G101 (Edge)	Right rear of engine. See **Fig. 4**.
G101 (MKX)	Right rear of engine. See **Fig. 6**.
G102 (Edge)	Left side of engine compartment. See **Fig. 3**.
G102 (MKX)	Left side of engine compartment. See **Fig. 5**.
G103 (Edge)	Left side of engine compartment. See **Fig. 3**.
G103 (MKX)	Left side of engine compartment. See **Fig. 5**.
G104 (Edge)	Left front of engine compartment. See **Fig. 4**.
G104 (MKX)	Left front of engine compartment. See **Fig. 6**.
G105 (Edge)	Left front of engine compartment. See **Fig. 4**.
G105 (MKX)	Left front of engine compartment. See **Fig. 6**.
G106 (Edge)	Right front of engine compartment. See **Fig. 3**.
G106 (MKX)	Right front of engine compartment. See **Fig. 5**.
G107 (Edge)	Right front of engine compartment. See **Fig. 3**.
G107 (MKX)	Right front of engine compartment. See **Fig. 5**.
G108 (Edge)	Right rear of engine compartment. See **Fig. 3**.
G108 (MKX)	Right rear of engine compartment. See **Fig. 5**.
G109 (Edge)	Front of engine. See **Fig. 3**.
G109 (MKX)	Front of engine. See **Fig. 5**.
G110 (Edge)	Right front of engine. See **Fig. 4**.
G110 (MKX)	Right front of engine. See **Fig. 6**.
G111 (Edge)	Right rear of engine compartment. See **Fig. 4**.
G111 (MKX)	Right rear of engine compartment. See **Fig. 6**.
G200	Behind left kick panel. See **Fig. 13**.
G201	Behind left kick panel. See **Fig. 13**.
G202	Behind right kick panel. See **Fig. 14**.
G203	Behind right side of dash. See **Fig. 9**.
G204	Behind left side of dash. See **Fig. 9**.
G205	Behind left side of dash. See **Fig. 9**.
G206	Behind left side of dash. See **Fig. 9**.
G207	In steering wheel. See **Fig. 11**.
G300	Behind left rear seat. See **Fig. 15**.
G301	In left "B" pillar. See **Fig. 13**.
G302	In right "B" pillar. See **Fig. 14**.
G400	In left "D" pillar. See **Fig. 15**.
G401	In left "D" pillar. See **Fig. 15**.

G402	Behind right rear quarterpanel. See **Fig. 16**.
G403	Behind right rear quarterpanel. See **Fig. 16**.
G404	In right "D" pillar. See **Fig. 16**.

SPLICES

SPLICES LOCATION

Component	Location
S100 (Edge)	In dash panel wiring harness to headlight junction, near breakout to C110. See **Fig. 4**.
S100 (MKX)	In dash panel wiring harness to headlight junction, near breakout to C110. See **Fig. 6**.
S101 (Edge)	In dash panel wiring harness to headlight junction, near breakout to C110. See **Fig. 4**.
S101 (MKX)	In dash panel wiring harness to headlight junction, near breakout to C110. See **Fig. 6**.
S102 (Edge)	In battery wiring harness, near breakout to battery. See **Fig. 4**.
S102 (MKX)	In battery wiring harness, near breakout to battery. See **Fig. 6**.
S103 (Edge)	In battery wiring harness, near breakout to starter motor. See **Fig. 4**.
S103 (MKX)	In battery wiring harness, near breakout to starter motor. See **Fig. 6**.
S104 (Edge)	In dash panel wiring harness to headlight junction, near breakout to C110. See **Fig. 4**.
S104 (MKX)	In dash panel wiring harness to headlight junction, near breakout to C110. See **Fig. 6**.
S105 (Edge)	In dash panel wiring harness to headlight junction, near breakout to battery junction box. See **Fig. 4**.
S105 (MKX)	In dash panel wiring harness to headlight junction, near breakout to battery junction box. See **Fig. 6**.
S106 (Edge)	In dash panel wiring harness to headlight junction, near breakout to battery junction box. See **Fig. 4**.
S106 (MKX)	In dash panel wiring harness to headlight junction, near breakout to battery junction box. See **Fig. 6**.
S107	In dash panel wiring harness to headlight junction, near breakout to battery junction box. See **Fig. 6**.
S108	In dash panel wiring harness to headlight junction, near breakout to ABS test connector. See **Fig. 6**.
S109 (Edge)	In dash panel wiring harness to headlight junction, near breakout to ABS test connector. See **Fig. 4**.
S109 (MKX)	In dash panel wiring harness to headlight junction,

	near breakout to ABS test connector. See **Fig. 6**.
S110	In dash panel wiring harness to headlight junction, near breakout to left headlight. See **Fig. 6**.
S111 (Edge)	In dash panel wiring harness to headlight junction, near breakout to C134. See **Fig. 4**.
S111 (MKX)	In dash panel wiring harness to headlight junction, near breakout to C134. See **Fig. 6**.
S112 (Edge)	In dash panel wiring harness to headlight junction, near breakout to cooling fan module. See **Fig. 4**.
S112 (MKX)	In dash panel wiring harness to headlight junction, near breakout to cooling fan module. See **Fig. 6**.
S113 (Edge)	In dash panel wiring harness to headlight junction, near breakout to cooling fan module. See **Fig. 4**.
S113 (MKX)	In dash panel wiring harness to headlight junction, near breakout to cooling fan module. See **Fig. 6**.
S114 (Edge)	In dash panel wiring harness to headlight junction, near breakout to mass air flow/intake air temperature sensor. See **Fig. 4**.
S114 (MKX)	In dash panel wiring harness to headlight junction, near breakout to mass air flow/intake air temperature sensor. See **Fig. 6**.
S115 (Edge)	In dash panel wiring harness to headlight junction, near breakout to mass air flow/intake air temperature sensor. See **Fig. 4**.
S115 (MKX)	In dash panel wiring harness to headlight junction, near breakout to mass air flow/intake air temperature sensor. See **Fig. 6**.
S116 (Edge)	In dash panel wiring harness to headlight junction, near breakout to A/C pressure transducer sensor. See **Fig. 4**.
S116 (MKX)	In dash panel wiring harness to headlight junction, near breakout to A/C pressure transducer sensor. See **Fig. 6**.
S117 (Edge)	In dash panel wiring harness to headlight junction, near breakout to G108. See **Fig. 4**.
S117 (MKX)	In dash panel wiring harness to headlight junction, near breakout to G108. See **Fig. 6**.
S118 (Edge)	In dash panel wiring harness to headlight junction, near breakout to G110. See **Fig. 4**.
S118 (MKX)	In dash panel wiring harness to headlight junction, near breakout to G110. See **Fig. 6**.
S119	In dash panel wiring harness to headlight junction, near breakout to G109. See **Fig. 4**.
S120 (Edge)	In dash panel wiring harness to headlight junction,

	near breakout to G109. See **Fig. 4**.
S120 (MKX)	In dash panel wiring harness to headlight junction, near breakout to G109. See **Fig. 6**.
S121 (Edge)	In dash panel wiring harness to headlight junction, near breakout to powertrain control module. See **Fig. 4**.
S121 (MKX)	In dash panel wiring harness to headlight junction, near breakout to powertrain control module. See **Fig. 6**.
S122 (Edge)	In dash panel wiring harness to headlight junction, near breakout to powertrain control module. See **Fig. 4**.
S122 (MKX)	In dash panel wiring harness to headlight junction, near breakout to powertrain control module. See **Fig. 6**.
S123	In engine control sensor & fuel charge wiring harness, near breakout to coil on plug No. 3. See **Fig. 8**.
S124	In engine control sensor & fuel charge wiring harness, near breakout to ignition transformer capacitor No. 1. See **Fig. 8**.
S125	In engine control sensor & fuel charge wiring harness, near breakout to fuel injector No. 6. See **Fig. 7**.
S126	In engine control sensor & fuel charge wiring harness, near breakout to fuel injector No. 6. See **Fig. 7**.
S127	In engine control sensor & fuel charge wiring harness, near breakout to fuel injector No. 6. See **Fig. 7**.
S128	In engine control sensor & fuel charge wiring harness, near breakout to fuel injector No. 6. See **Fig. 7**.
S129	In engine control sensor & fuel charge wiring harness, near breakout to fuel injector No. 5. See **Fig. 7**.
S130	In engine control sensor & fuel charge wiring harness, near breakout to C139. See **Fig. 7**.
S131	In engine control sensor & fuel charge wiring harness, near breakout to camshaft position sensor No. 2. See **Fig. 7**.
S200	In body main wiring harness, near breakout to C510. See **Fig. 13**.
S201	In body main wiring harness, near breakout to C212. See **Fig. 13**.

S202	In body main wiring harness, near breakout to C212. See **Fig. 13**.
S203	In body main wiring harness, near breakout to C212. See **Fig. 13**.
S204	In body main wiring harness, near breakout to C214. See **Fig. 14**.
S205	In body main wiring harness, near breakout to restraints control module. See **Fig. 9**.
S206	In body main wiring harness, near breakout to restraints control module. See **Fig. 9**.
S207	In body main wiring harness, near breakout to audio unit. See **Fig. 9**.
S208	In body main wiring harness, near breakout to audio unit. See **Fig. 9**.
S209	In body main wiring harness, near breakout to in-vehicle temperature sensor. See **Fig. 9**.
S210	In body main wiring harness, near breakout to C210. See **Fig. 9**.
S211 (Edge)	In dash panel wiring harness to headlight junction, near breakout to joint connector No. 7. See **Fig. 4**.
S211 (MKX)	In dash panel wiring harness to headlight junction, near breakout to joint connector No. 7. See **Fig. 6**.
S212	In steering wheel jumper wiring harness, in breakout to left steering wheel switch. See **Fig. 11**.
S213	In steering wheel jumper wiring harness, in breakout to left steering wheel switch. See **Fig. 11**.
S214	In steering wheel jumper wiring harness, in breakout to right steering wheel switch. See **Fig. 11**.
S215	In steering wheel jumper wiring harness, in breakout to right steering wheel switch. See **Fig. 11**.
S216	In air conditioning wiring harness, near breakout to C263. See **Fig. 9**.
S217	In air conditioning wiring harness, near breakout to fresh/recirculation door actuator. See **Fig. 30**.
S218	In air conditioning wiring harness, near breakout to fresh/recirculation door actuator. See **Fig. 30**.
S219	In main wiring harness, near breakout to G205. See **Fig. 9**.
S300	In seat heated pad wiring harness, near breakout to C300. See **Fig. 21**.
S301	In seat heated pad wiring harness, near breakout to C300. See **Fig. 21**.
S302	In seat heated pad wiring harness, near breakout to left rear seat heater element. See **Fig. 21**.

S304	In body main wiring harness, near breakout to left rear side impact sensor. See **Fig. 15**.
S305	In body main wiring harness, near breakout to left rear side impact sensor. See **Fig. 15**.
S306	In body main wiring harness, near breakout to G300. See **Fig. 15**.
S307	In body main wiring harness, near breakout to C700. See **Fig. 13**.
S308	In body main wiring harness, near breakout to left front side impact sensor. See **Fig. 13**.
S309	In body main wiring harness, near breakout to left front side impact sensor. See **Fig. 13**.
S310	In body main wiring harness, near breakout to left front side impact sensor. See **Fig. 13**.
S311	In body main wiring harness, near breakout to G200. See **Fig. 13**.
S312	In body main wiring harness, near breakout to G200. See **Fig. 13**.
S313	In body main wiring harness, near breakout to G200. See **Fig. 13**.
S314	In body main wiring harness, near breakout to G200. See **Fig. 13**.
S315	In body main wiring harness, near breakout to G311. See **Fig. 13**.
S316	In body main wiring harness, near breakout to G311. See **Fig. 13**.
S317	In body main wiring harness, near breakout to G311. See **Fig. 19**.
S318	In body main wiring harness, near breakout to G311. See **Fig. 19**.
S319	In body main wiring harness, near breakout to G311. See **Fig. 19**.
S320	In power seats wiring harness, near breakout to driver side climate controlled seat cushion module. See **Fig. 19**.
S322	In power seats wiring harness, near breakout to driver's safety belt buckle pretensioner. See **Fig. 19**.
S323	In power seats wiring harness, near breakout to driver's safety belt buckle pretensioner. See **Fig. 19**.
S324	In power seats wiring harness, near breakout to driver's safety belt buckle pretensioner. See **Fig. 19**.
S325	In body main wiring harness, near breakout to C311. See **Fig. 13**.
	In body main wiring harness, near breakout to

S326	C313. See **Fig. 14**.
S327	In body main wiring harness, in breakout to C314. See **Fig. 14**.
S328	In body main wiring harness, in breakout to C314. See **Fig. 14**.
S329	In power seats wiring harness, in breakout to passenger's safety belt buckle pretensioner. See **Fig. 20**.
S330	In power seats wiring harness, near breakout to passenger's safety belt buckle pretensioner. See **Fig. 20**.
S331	In power seats wiring harness, near breakout to passenger side climate controlled seat module. See **Fig. 20**.
S332	In power seats wiring harness, near breakout to C327. See **Fig. 20**.
S333	In power seats wiring harness, near breakout to C327. See **Fig. 20**.
S334	In power seats wiring harness, near breakout to C327. See **Fig. 20**.
S335	In power seats wiring harness, in breakout to C316. See **Fig. 20**.
S336	In power seats wiring harness, in breakout to C314. See **Fig. 20**.
S337	In power seats wiring harness, in breakout to C314. See **Fig. 20**.
S338	In body main wiring harness, near breakout to C316. See **Fig. 14**.
S339	In body main wiring harness, near breakout to right rear side impact sensor. See **Fig. 16**.
S340	In body main wiring harness, near breakout to joint connector No. 9. See **Fig. 16**.
S341	In power seats wiring harness, in breakout to C311. See **Fig. 19**.
S342	In power seats wiring harness, in breakout to C311. See **Fig. 19**.
S343	In power seats wiring harness, in breakout to C316. See **Fig. 20**.
S344	In body main wiring harness, near breakout to C214. See **Fig. 14**.
S345	In body main wiring harness, near breakout to C214. See **Fig. 14**.
S400 (Edge)	In tailgate warning switch wiring harness, in breakout to liftgate ajar switch. See **Fig. 26**.

S400 (MKX)	In tailgate warning switch wiring harness, in breakout to liftgate/decklid switch. See **Fig. 27**.
S401	In tailgate warning switch wiring harness, in breakout to liftgate/decklid switch. See **Fig. 27**.
S402	In body main wiring harness, near breakout to cargo area power point. See **Fig. 15**.
S403 (Edge)	In back-up alarm wiring harness, near breakout to inner right parking aid sensor. See **Fig. 17**.
S403 (MKX)	In back-up alarm wiring harness, near breakout to inner right parking aid sensor. See **Fig. 18**.
S404	In back-up alarm wiring harness, near breakout to left license plate light. See **Fig. 18**.
S405 (Edge)	In back-up alarm wiring harness, near breakout to inner left parking aid sensor. See **Fig. 17**.
S405 (MKX)	In back-up alarm wiring harness, near breakout to inner left parking aid sensor. See **Fig. 18**.
S406	In back-up alarm wiring harness, near breakout to left license plate light. See **Fig. 18**.
S407	In body main wiring harness, near breakout to G402. See **Fig. 16**.
S408	In body main wiring harness, near breakout to right rear park/stop/turn light. See **Fig. 16**.
S409	In body main wiring harness, near breakout to power liftgate module. See **Fig. 15**.
S500	In left front window regulator wiring harness, near breakout to C510. See **Fig. 22**.
S501	In left front window regulator wiring harness, near breakout to left front tweeter. See **Fig. 22**.
S502	In left front window regulator wiring harness, near breakout to keyless entry keypad. See **Fig. 22**.
S503	In left front window regulator wiring harness, near breakout to keyless entry keypad. See **Fig. 22**.
S504	In left front window regulator wiring harness, near breakout to memory set switch. See **Fig. 22**.
S600	In right front window regulator wiring harness, near breakout to right front tweeter. See **Fig. 23**.
S601	In right front window regulator wiring harness, near breakout to right front tweeter. See **Fig. 23**.
S602	In right front window regulator wiring harness, near breakout to right front tweeter. See **Fig. 23**.
S603	In right front window regulator wiring harness, near breakout to right front door lock actuator. See **Fig. 23**.
	In right front window regulator wiring harness, near

S604	breakout to right front door lock actuator. See **Fig. 23**.
S605	In right front window regulator wiring harness, near breakout to right front door lock actuator. See **Fig. 23**.
S700	In left rear window regulator wiring harness, near breakout to left rear window adjust switch. See **Fig. 24**.
S701	In left rear window regulator wiring harness, near breakout to left rear speaker. See **Fig. 24**.
S800	In right rear window regulator wiring harness, near breakout to right rear window adjust switch. See **Fig. 25**.
S801	In right rear window regulator wiring harness, near breakout to right rear speaker. See **Fig. 25**.
S900 (Except Panoramic Vista Roof)	In interior lights wiring harness, near breakout to left vanity mirror light. See **Fig. 28**.
S900 (W/Panoramic Vista Roof)	In interior lights wiring harness, near breakout to left vanity mirror light. See **Fig. 29**.
S901 (Except Panoramic Vista Roof)	In interior lights wiring harness, near breakout to left vanity mirror light. See **Fig. 28**.
S901 (W/Panoramic Vista Roof)	In interior lights wiring harness, near breakout to left vanity mirror light. See **Fig. 29**.
S902 (Except Panoramic Vista Roof)	In interior lights wiring harness, near breakout to left vanity mirror light. See **Fig. 28**.
S902 (W/Panoramic Vista Roof)	In interior lights wiring harness, near breakout to left vanity mirror light. See **Fig. 29**.
S903 (Except Panoramic Vista Roof)	In interior lights wiring harness, near breakout to front interior lights. See **Fig. 28**.
S903 (W/Panoramic Vista Roof)	In interior lights wiring harness, near breakout to front interior lights. See **Fig. 29**.
S904 (Except Panoramic Vista Roof)	In interior lights wiring harness, near breakout to front interior lights. See **Fig. 28**.
S904 (W/Panoramic Vista Roof)	In interior lights wiring harness, near breakout to front interior lights. See **Fig. 29**.
S905 (Except Panoramic Vista Roof)	In interior lights wiring harness, near breakout to front interior lights. See **Fig. 28**.
S905 (W/Panoramic Vista Roof)	In interior lights wiring harness, near breakout to front interior lights. See **Fig. 29**.
S906 (Except Panoramic Vista Roof)	In interior lights wiring harness, near breakout to front interior lights. See **Fig. 28**.
S906 (W/Panoramic Vista Roof)	In interior lights wiring harness, near breakout to front interior lights. See **Fig. 29**.

COMPONENT LOCATION GRAPHICS

NOTE: **Figures may show multiple component locations. Refer to appropriate table for proper figure references.**

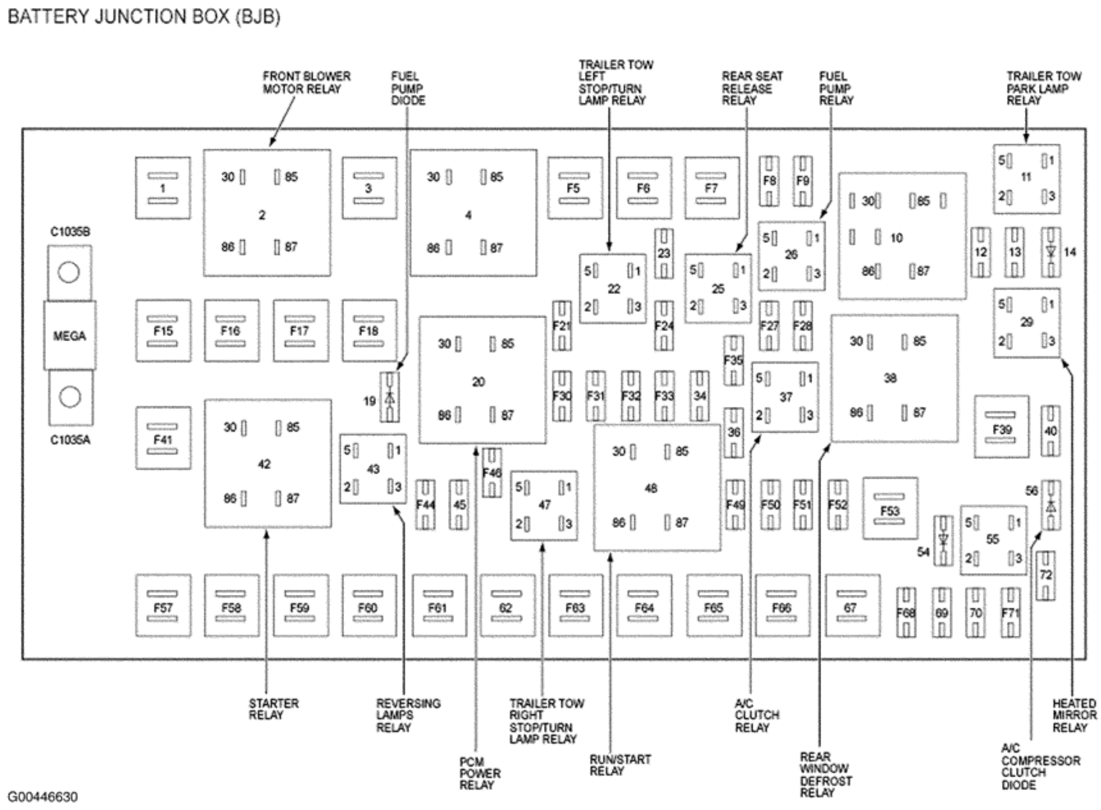


Fig. 1: Battery Junction Box (BJB)
Courtesy of FORD MOTOR CO.

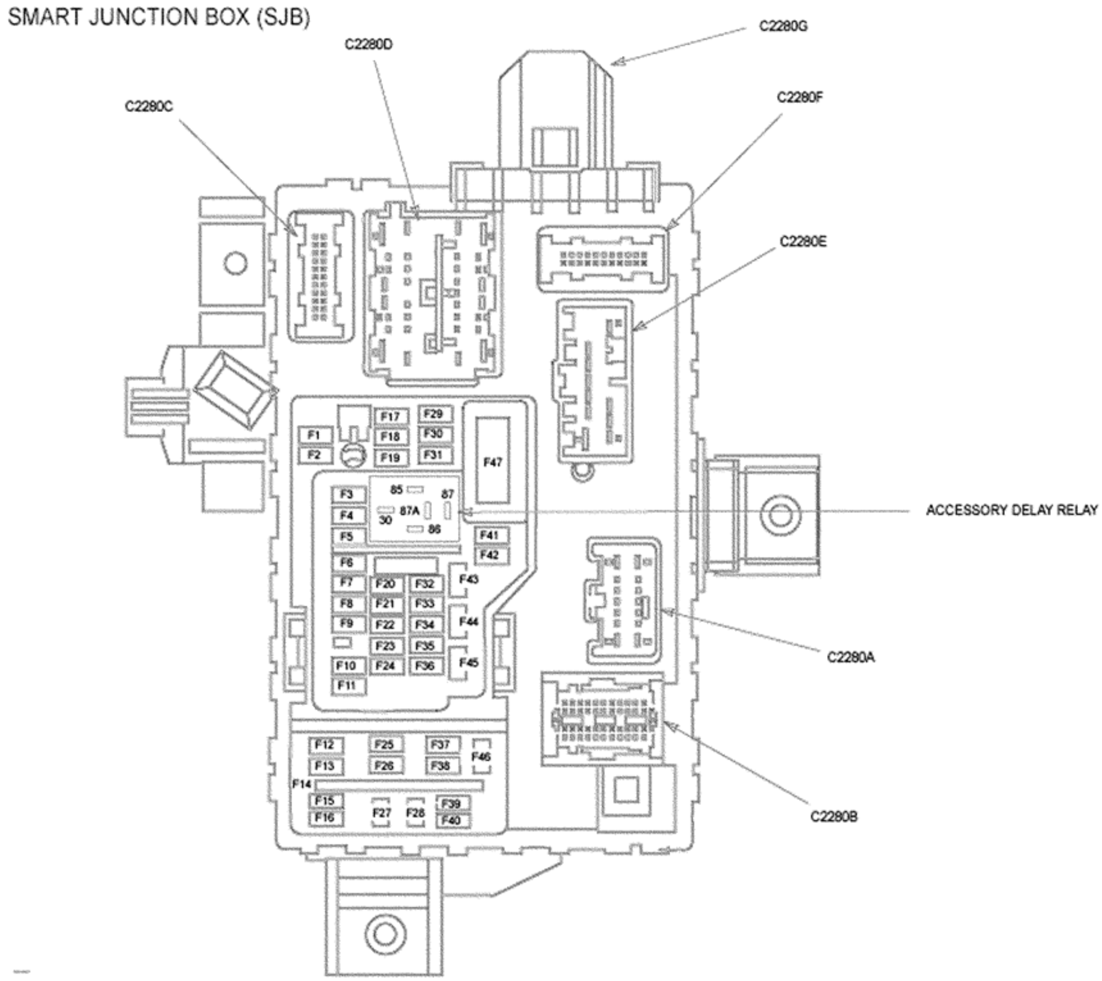


Fig. 2: Smart Junction Box (SJB)
Courtesy of FORD MOTOR CO.

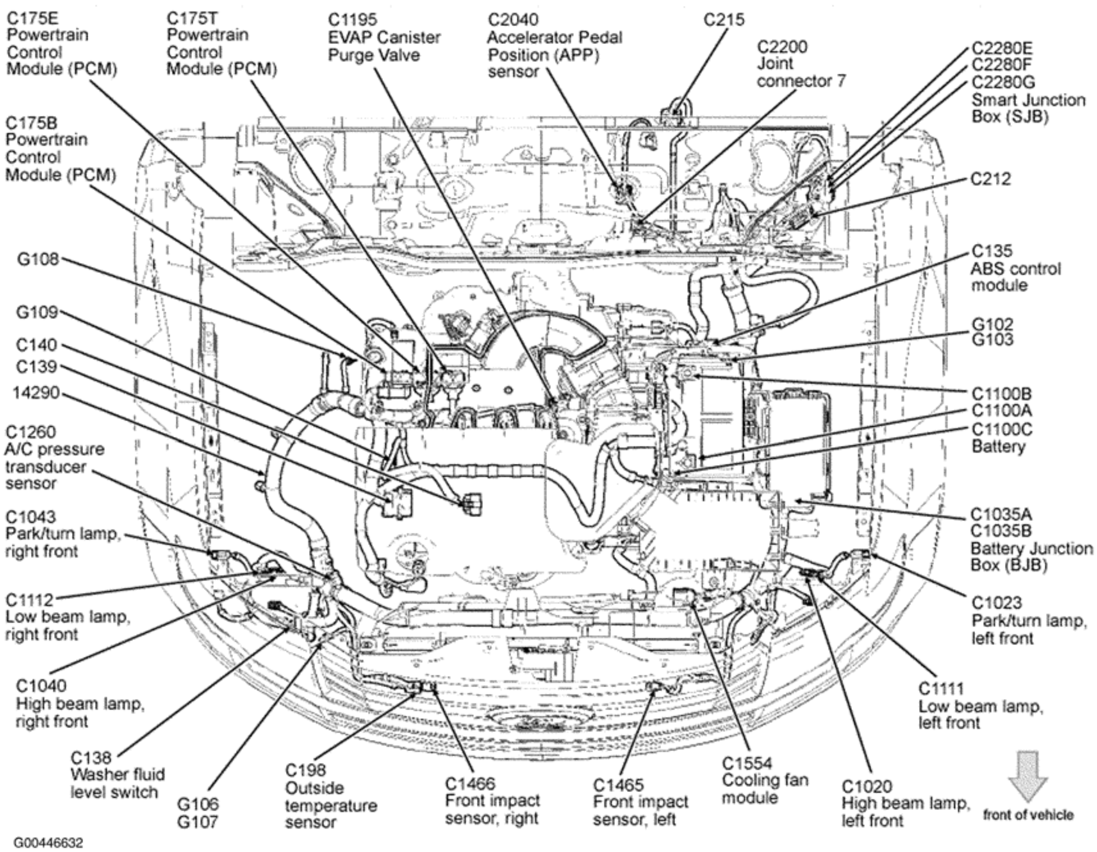


Fig. 3: Engine Compartment (Edge)
Courtesy of FORD MOTOR CO.

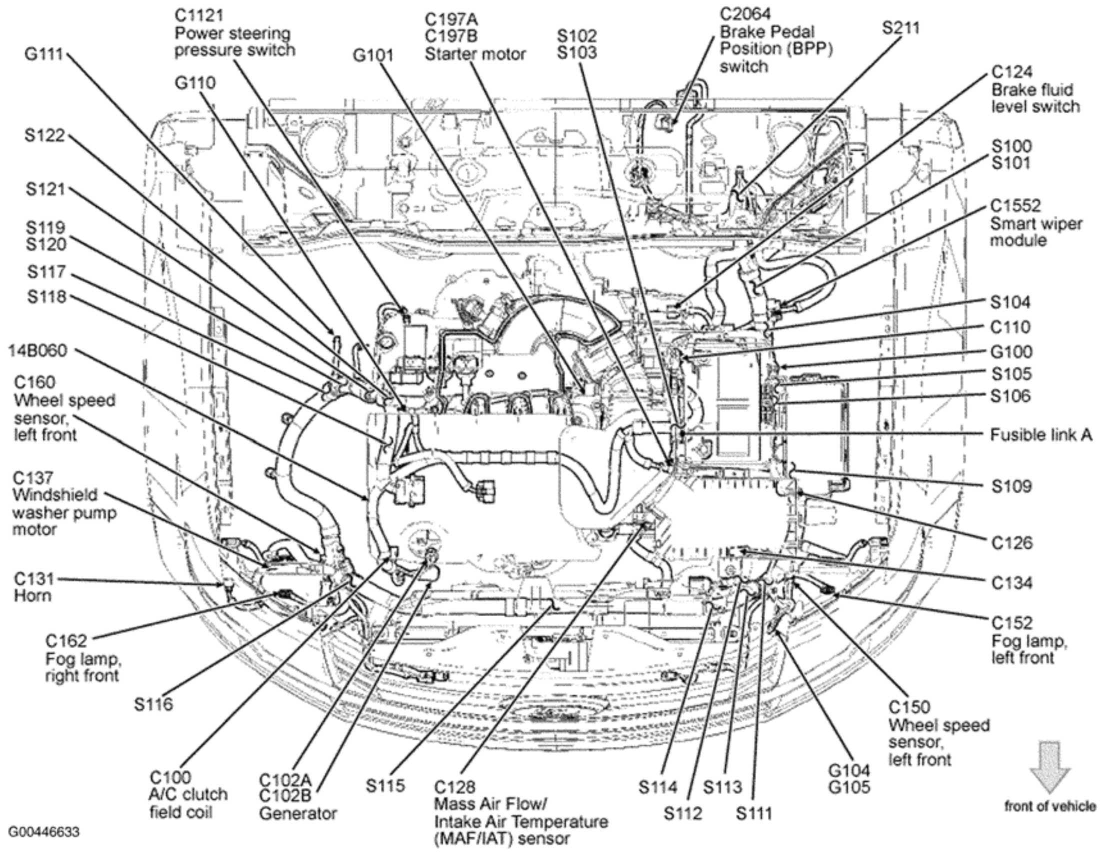


Fig. 4: Engine Compartment (Edge)
Courtesy of FORD MOTOR CO.

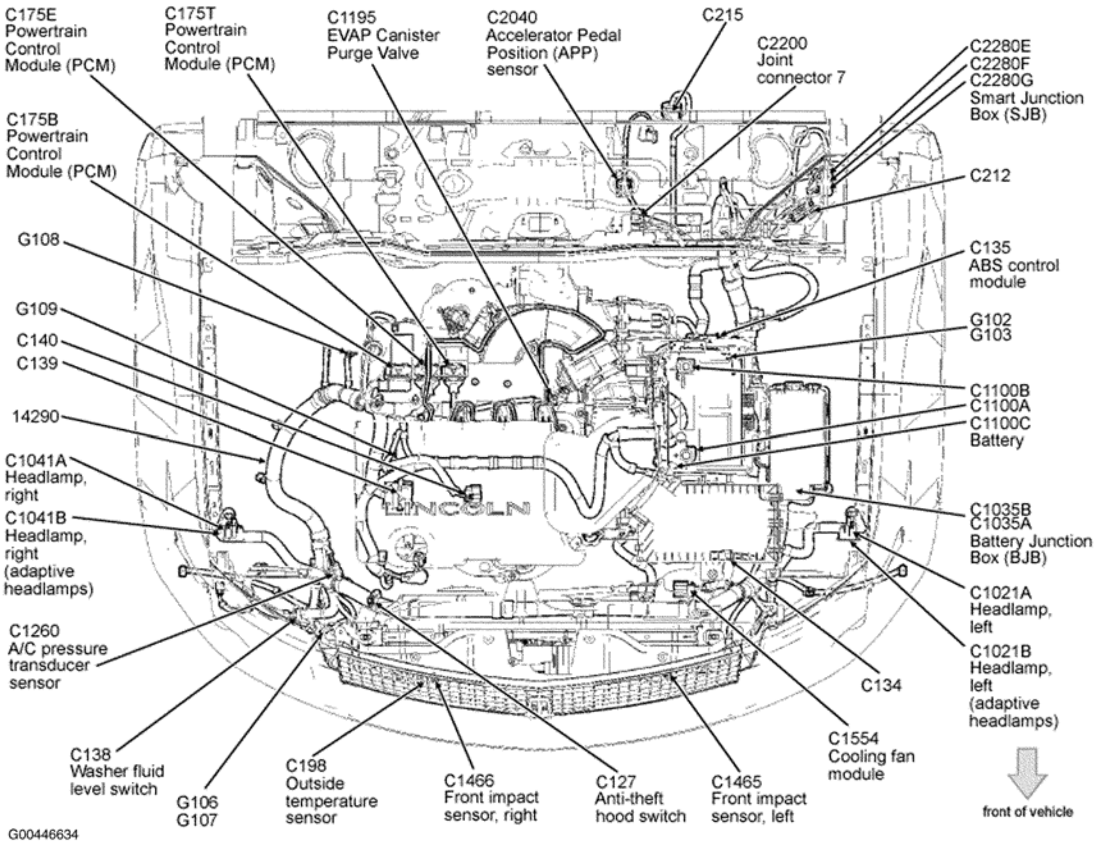


Fig. 5: Engine Compartment (MKX)
Courtesy of FORD MOTOR CO.

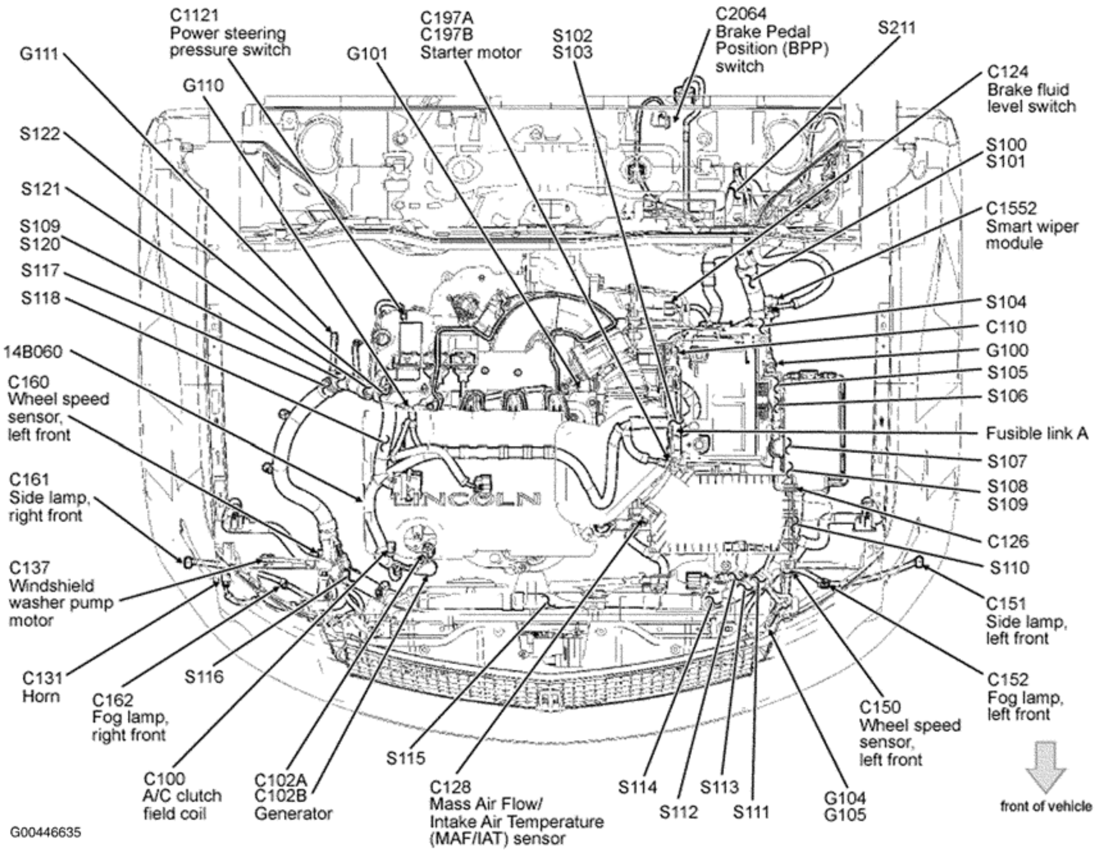


Fig. 6: Engine Compartment (MKX)
Courtesy of FORD MOTOR CO.

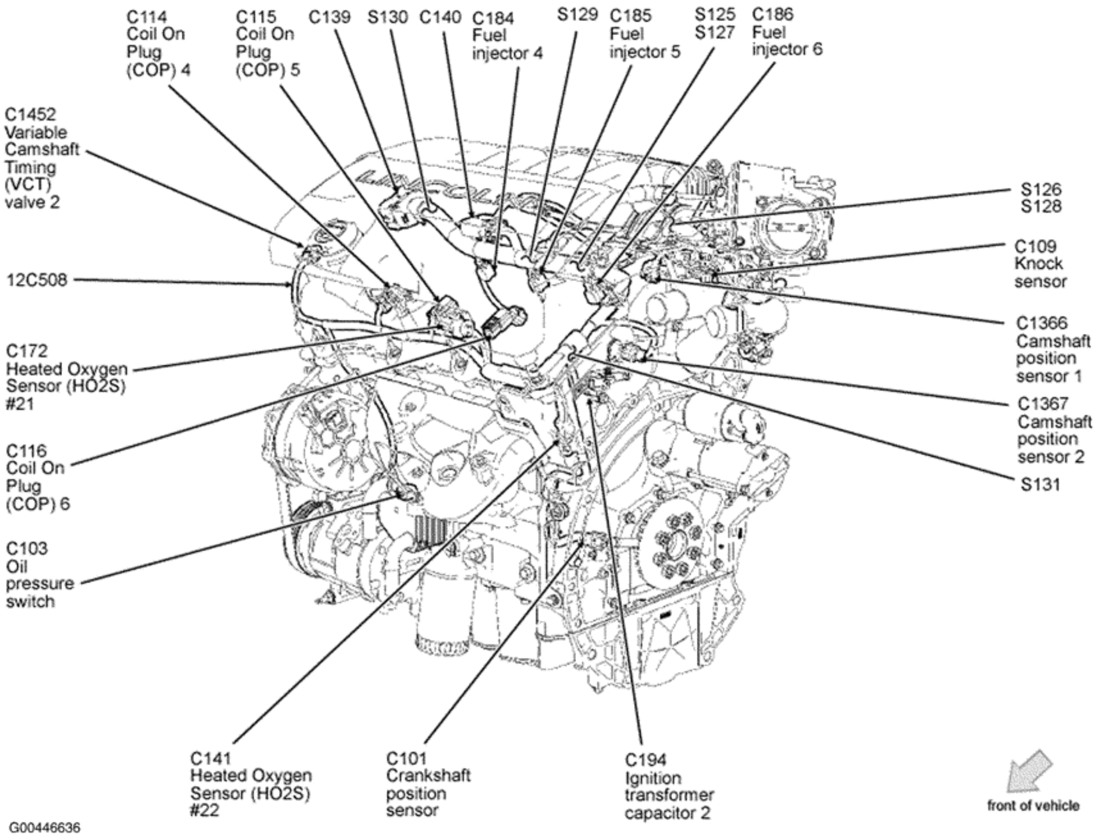


Fig. 7: Left Side Of Engine
Courtesy of FORD MOTOR CO.

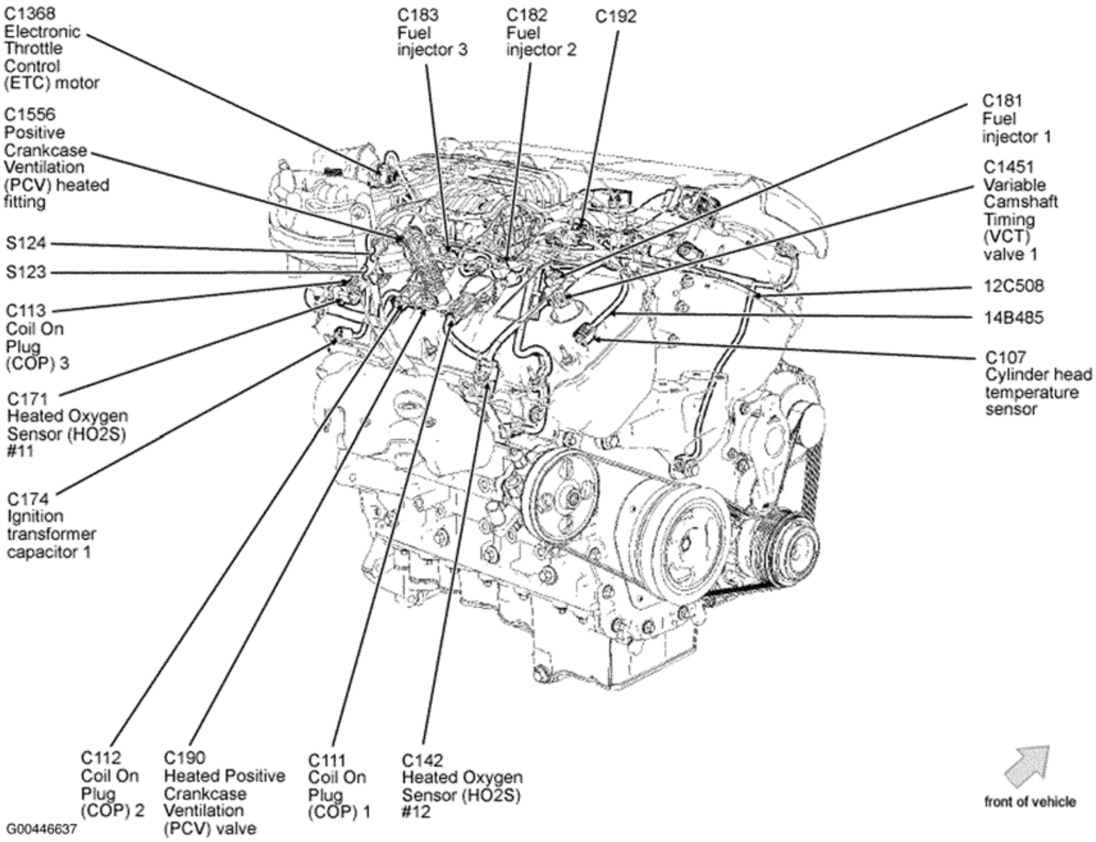


Fig. 8: Right Side Of Engine
Courtesy of FORD MOTOR CO.

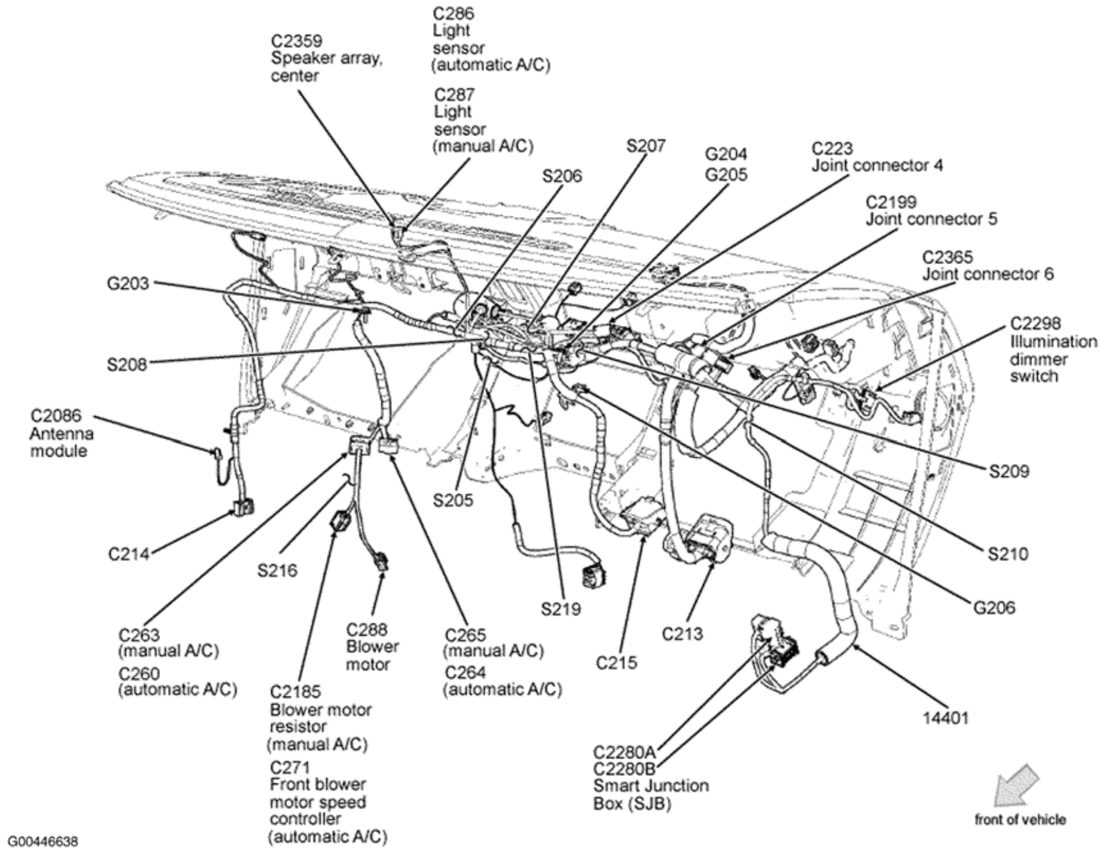


Fig. 9: Dash
Courtesy of FORD MOTOR CO.

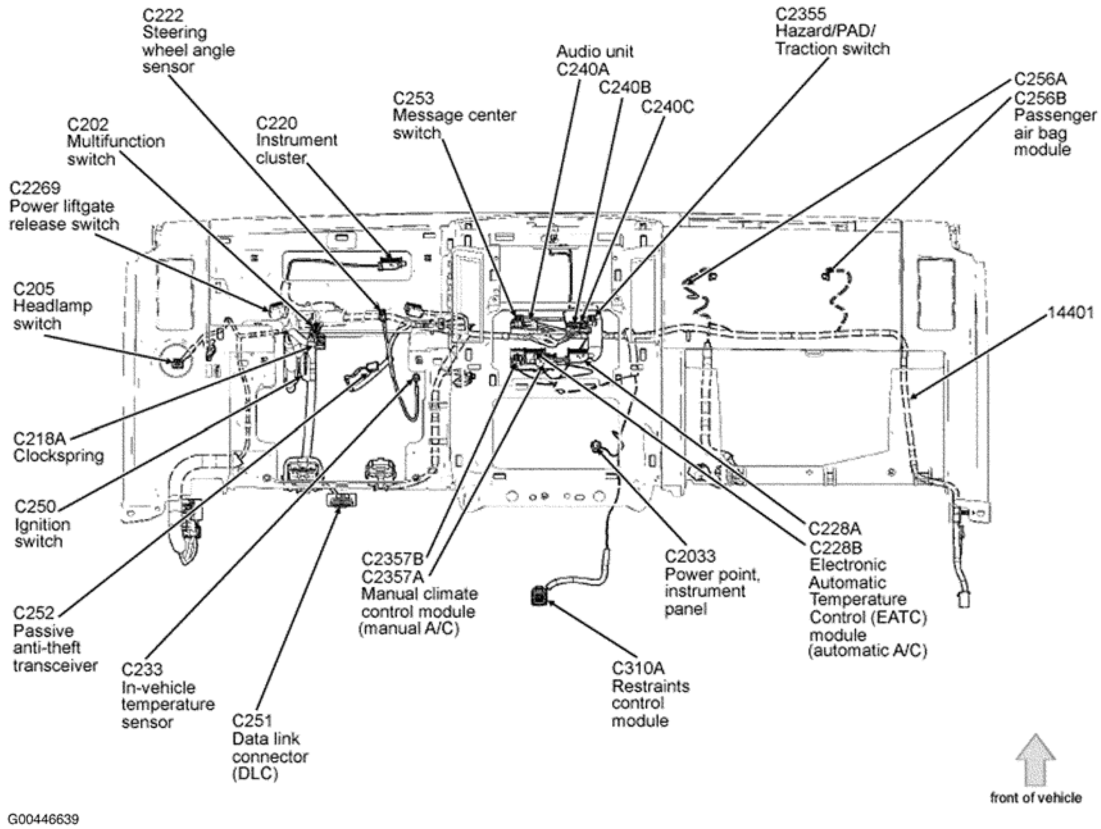


Fig. 10: Dash
Courtesy of FORD MOTOR CO.

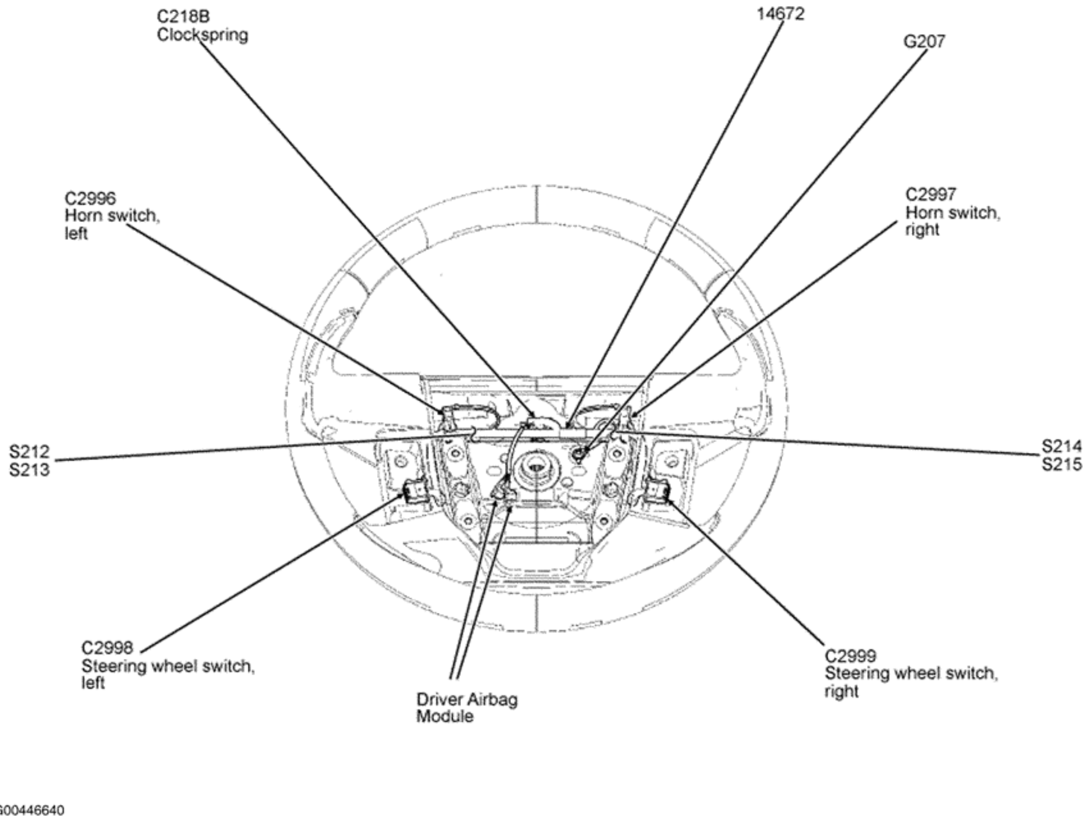


Fig. 11: Steering Wheel
Courtesy of FORD MOTOR CO.

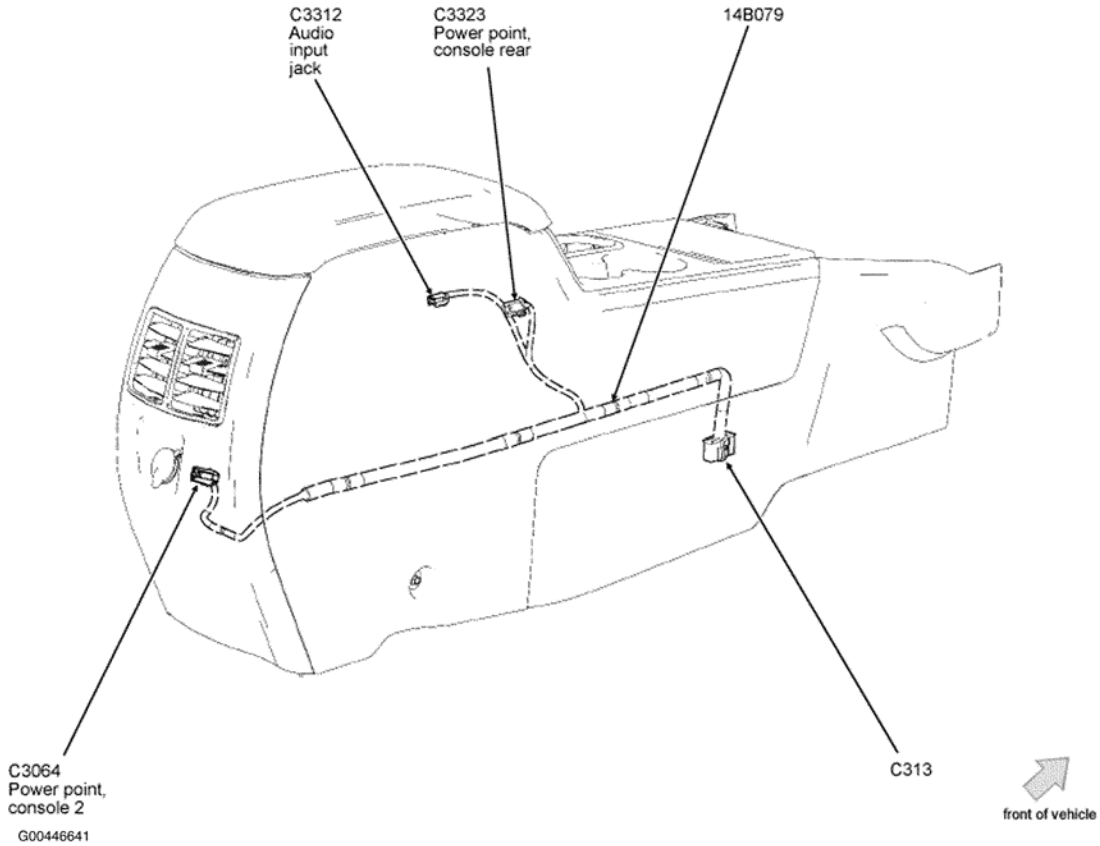


Fig. 12: Center Floor Console
Courtesy of FORD MOTOR CO.

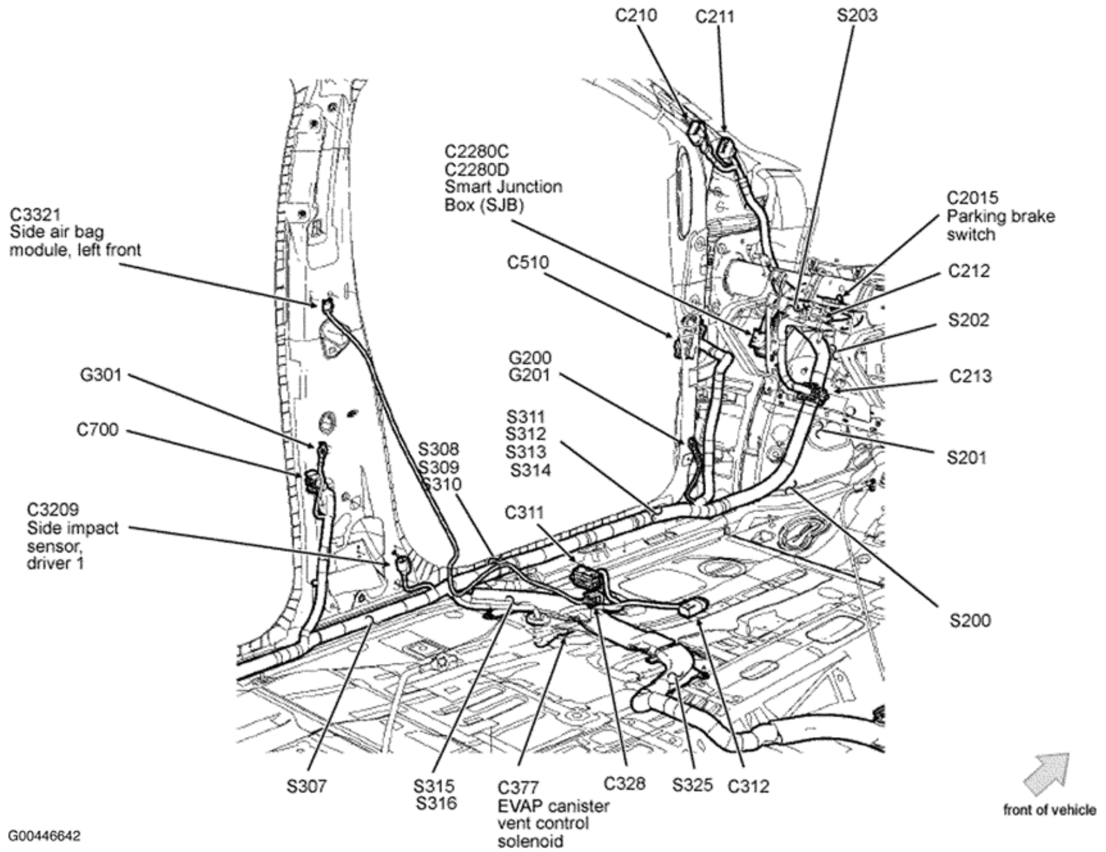


Fig. 13: Left Front Interior Of Vehicle
Courtesy of FORD MOTOR CO.

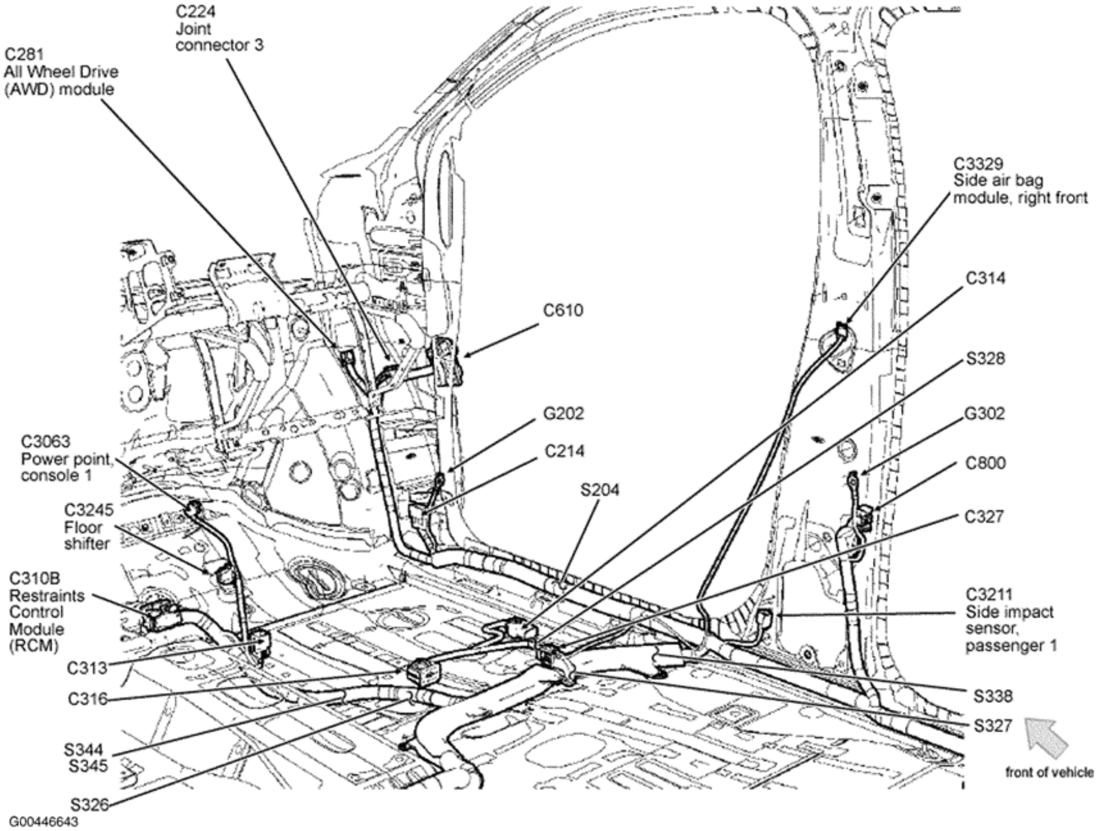


Fig. 14: Right Front Interior Of Vehicle
Courtesy of FORD MOTOR CO.

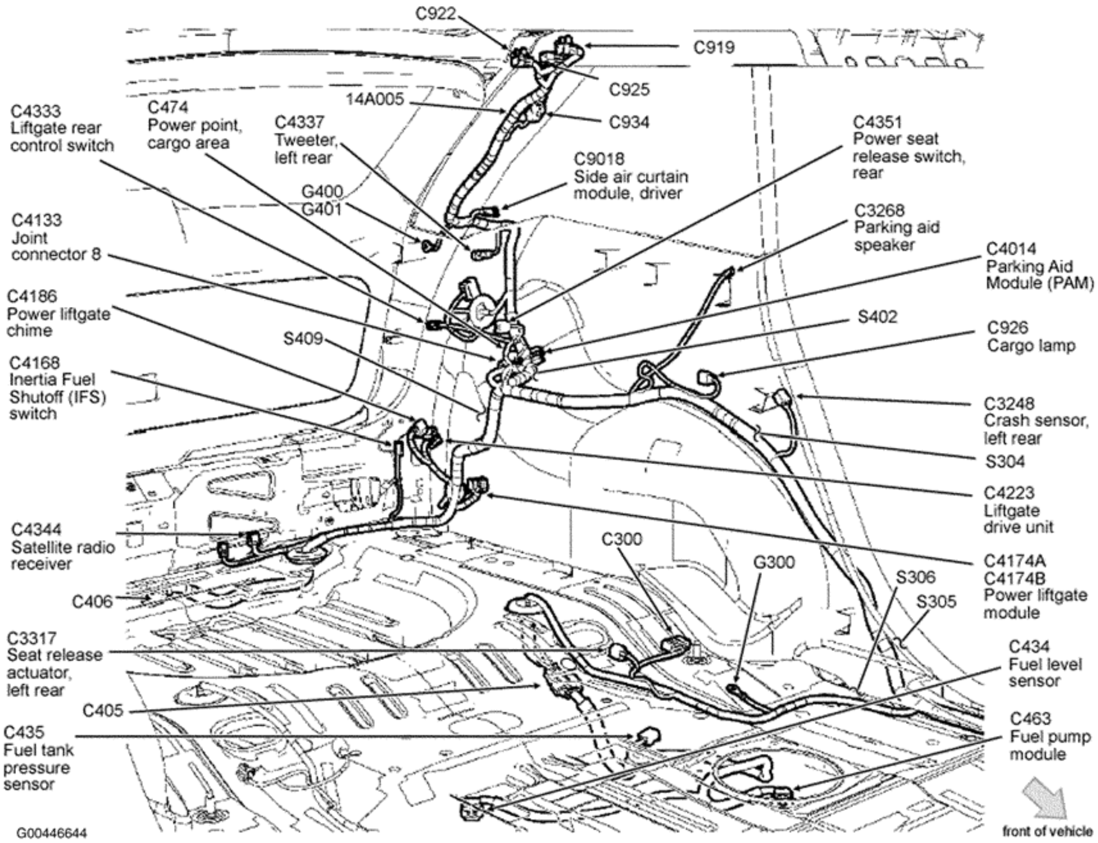


Fig. 15: Left Rear Interior Of Vehicle
Courtesy of FORD MOTOR CO.

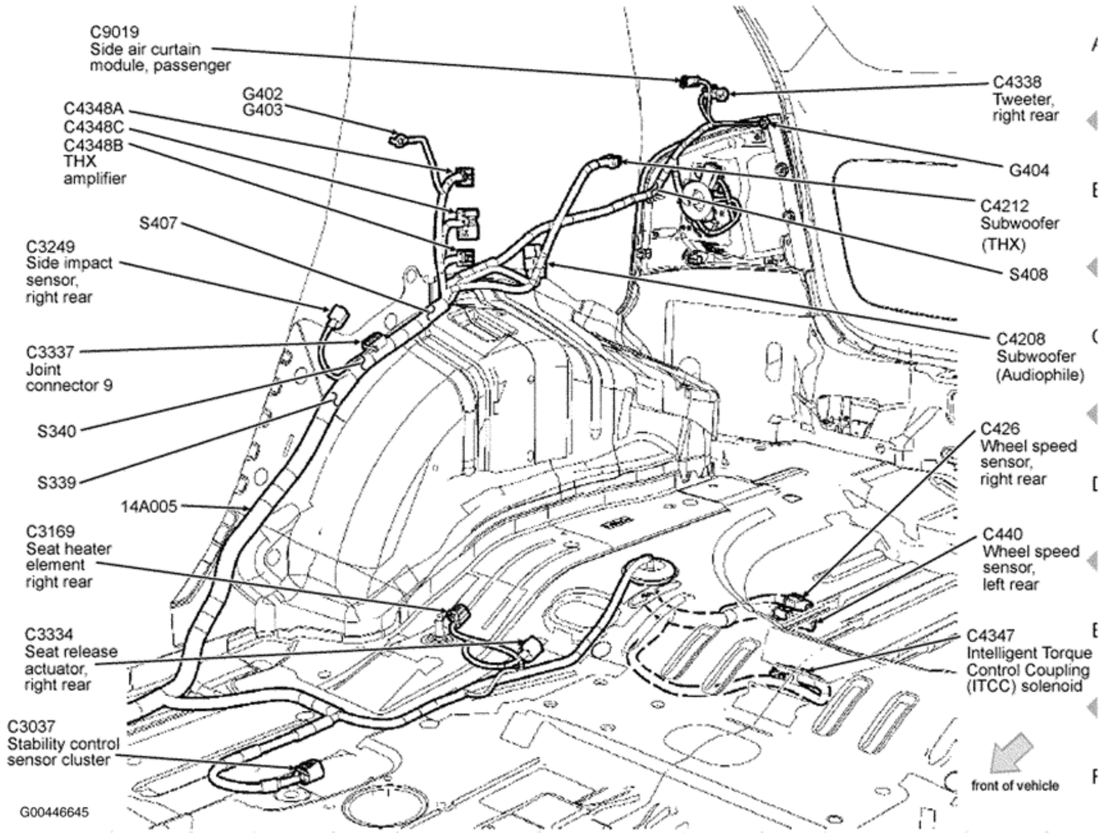


Fig. 16: Right Rear Interior Of Vehicle
Courtesy of FORD MOTOR CO.

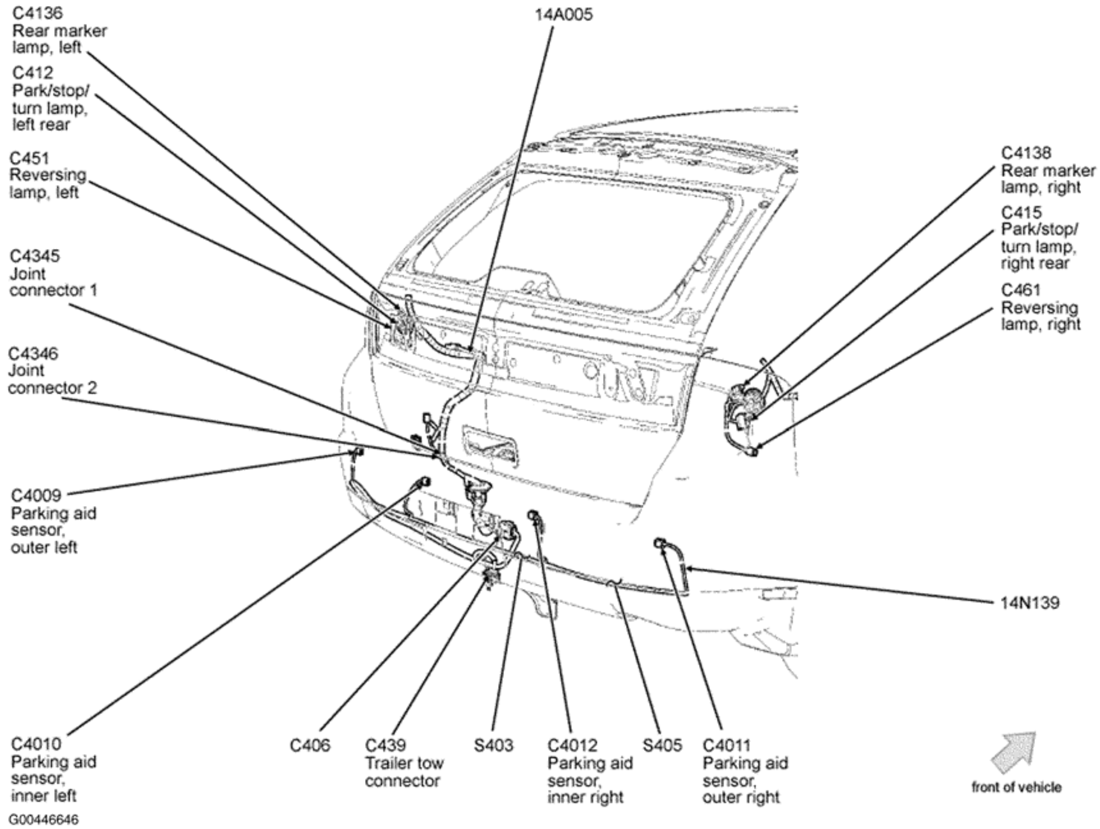
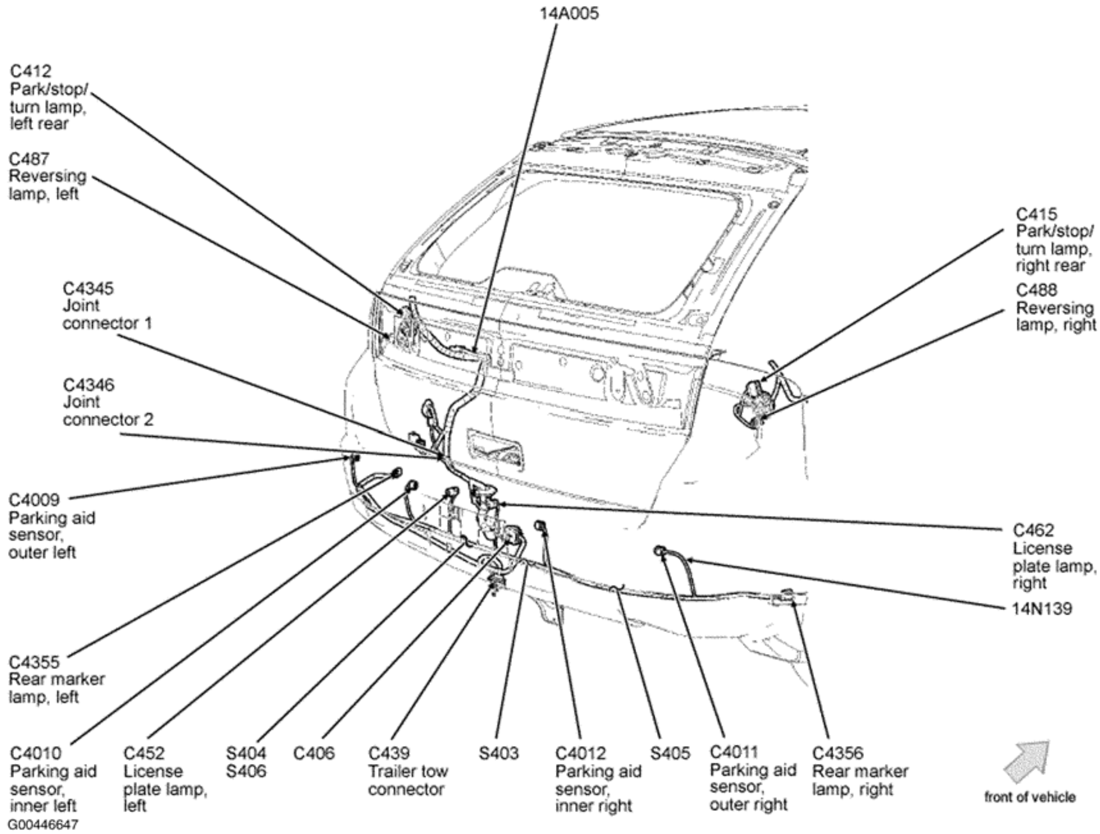


Fig. 17: Rear Of Vehicle (Edge)
Courtesy of FORD MOTOR CO.



<u>Fig. 18: Rear Of Vehicle (MKX)</u>
Courtesy of FORD MOTOR CO.

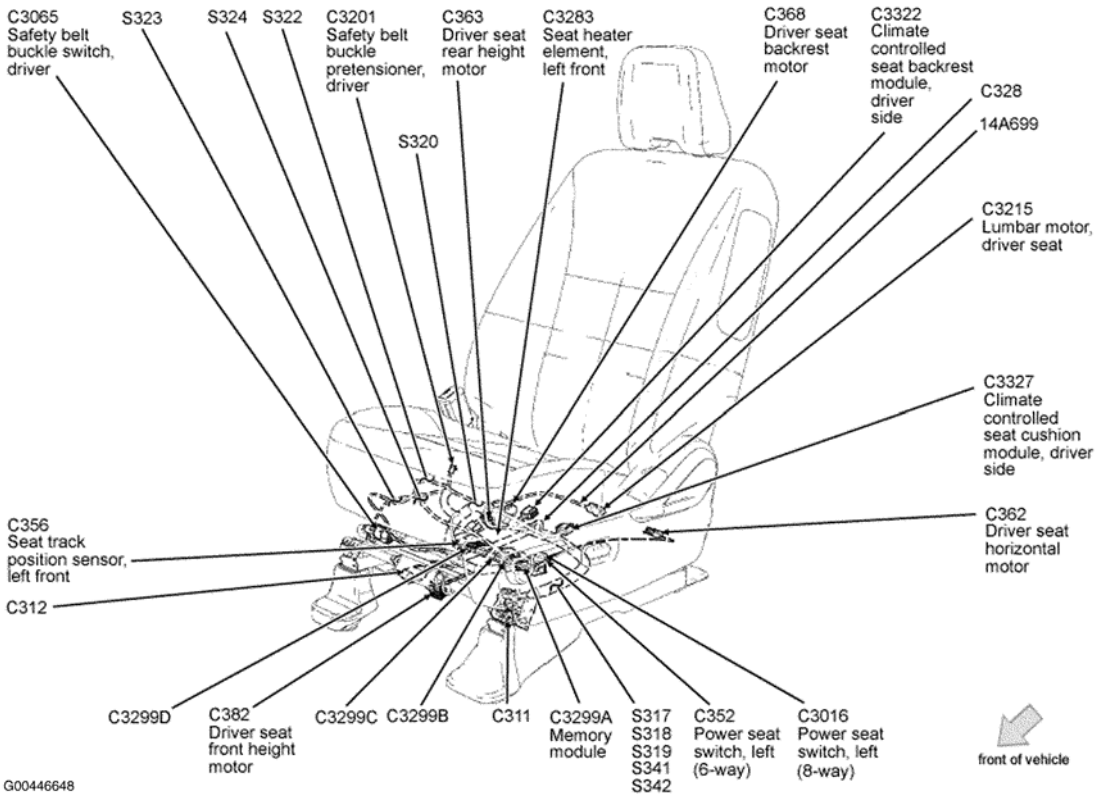


Fig. 19: Driver's Seat
Courtesy of FORD MOTOR CO.

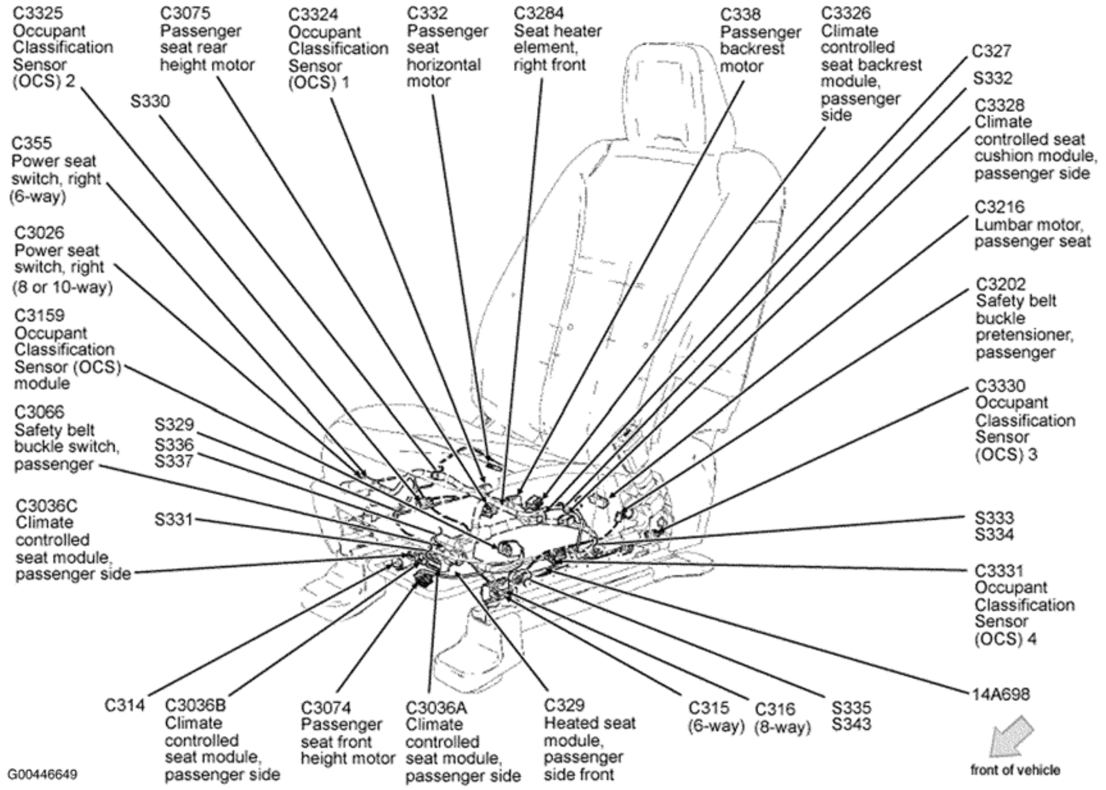


Fig. 20: Front Passenger's Seat
Courtesy of FORD MOTOR CO.

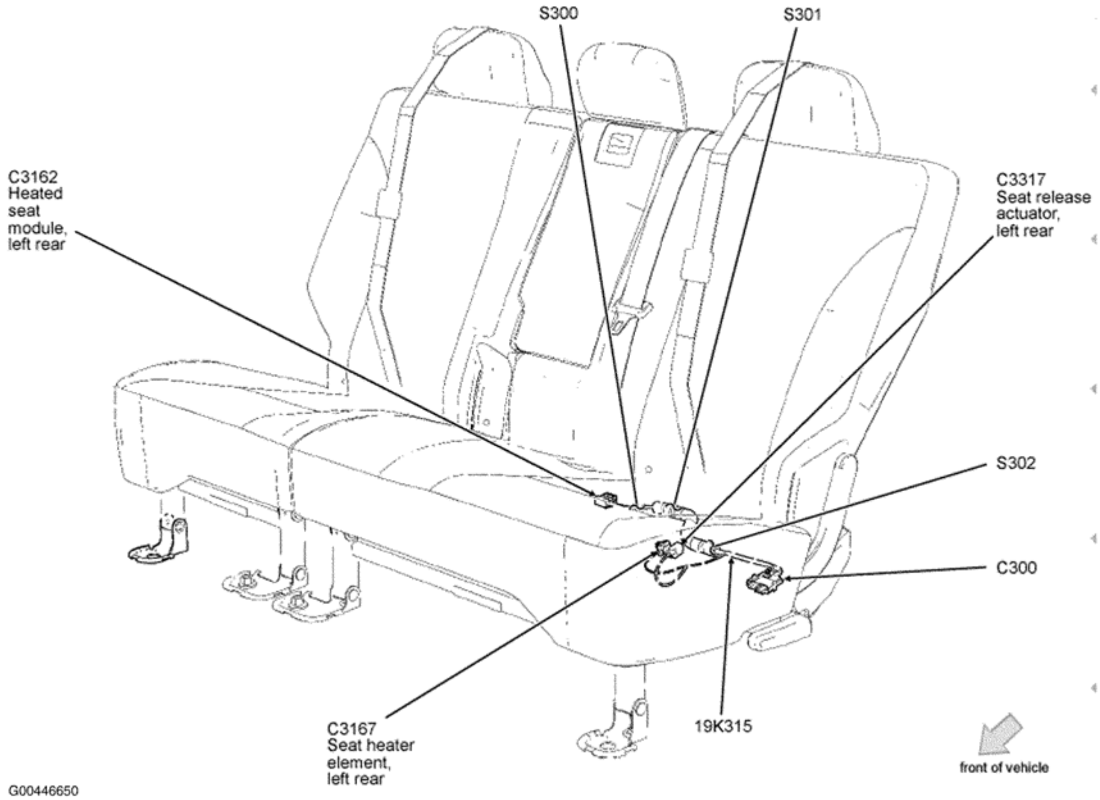


Fig. 21: Rear Seats
Courtesy of FORD MOTOR CO.

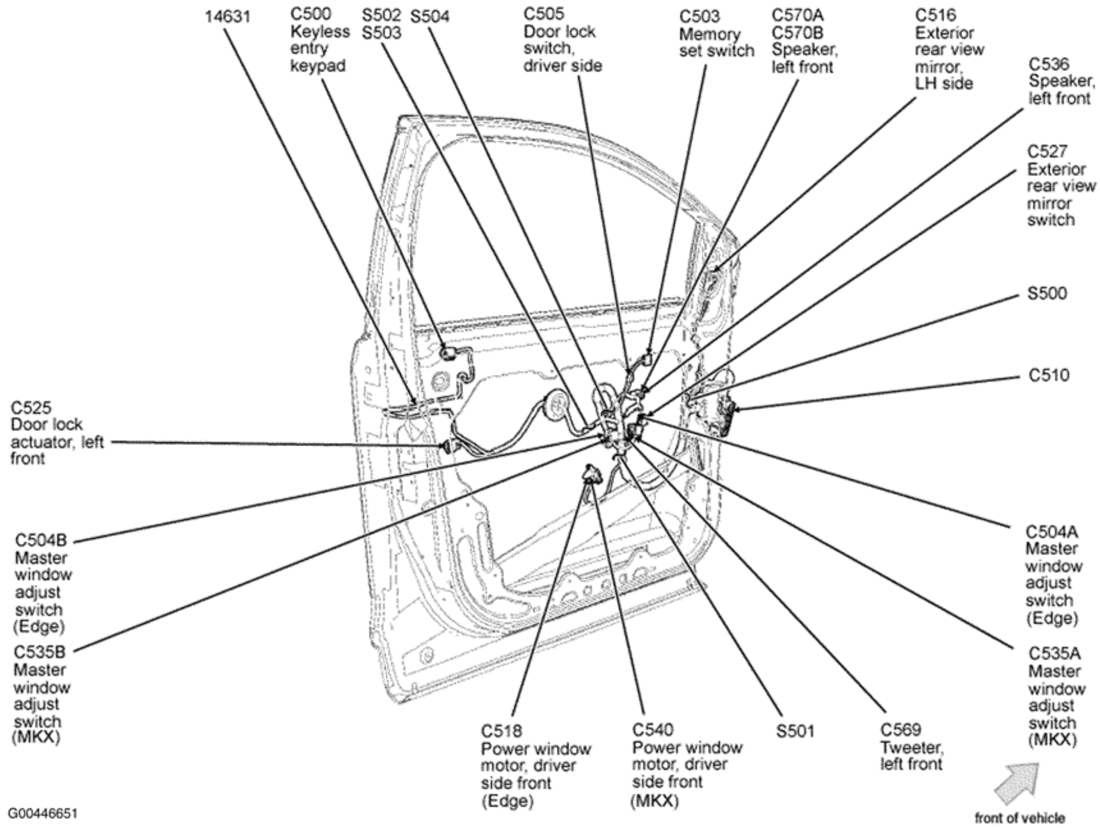


Fig. 22: Driver's Door
Courtesy of FORD MOTOR CO.

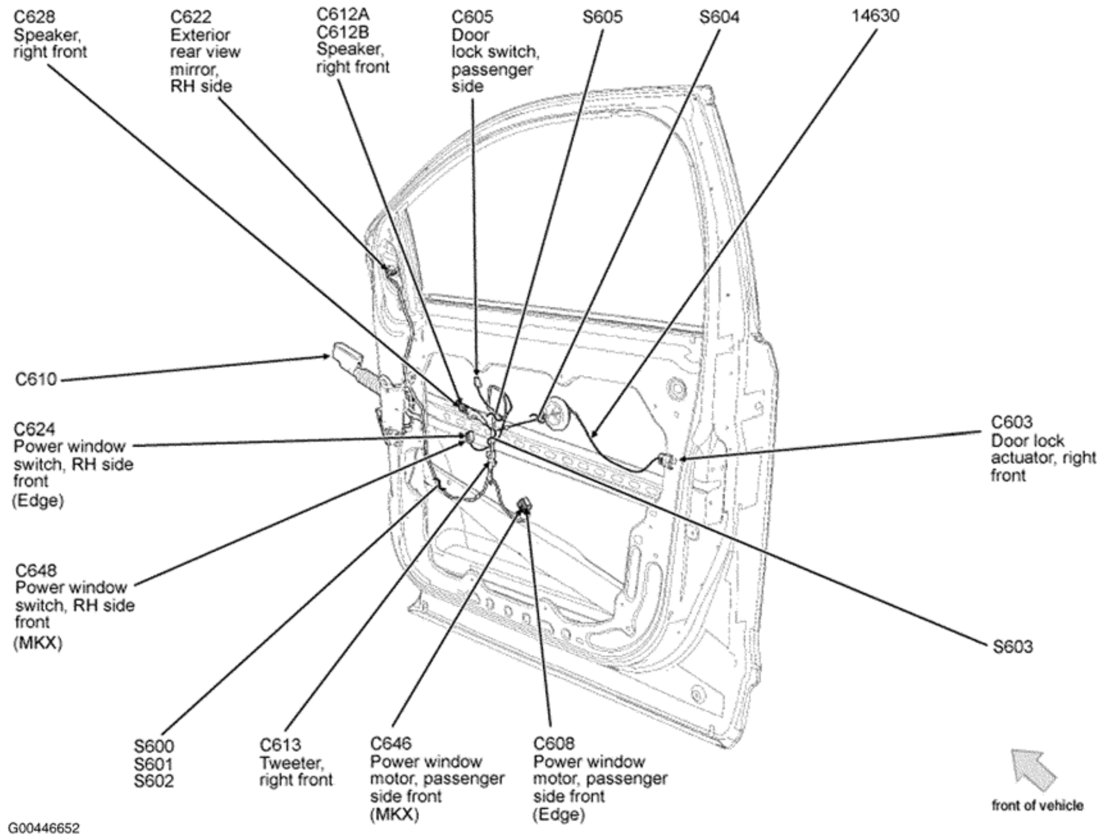


Fig. 23: Front Passenger's Door
Courtesy of FORD MOTOR CO.

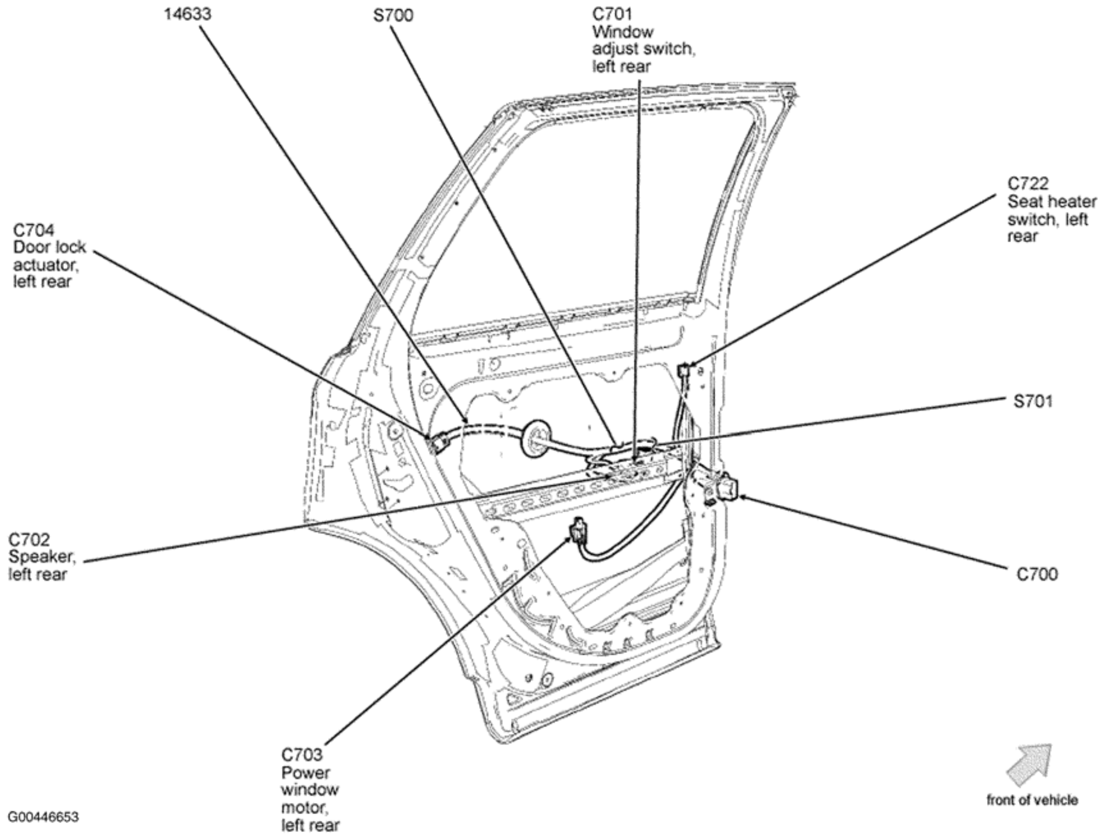


Fig. 24: Left Rear Door
Courtesy of FORD MOTOR CO.

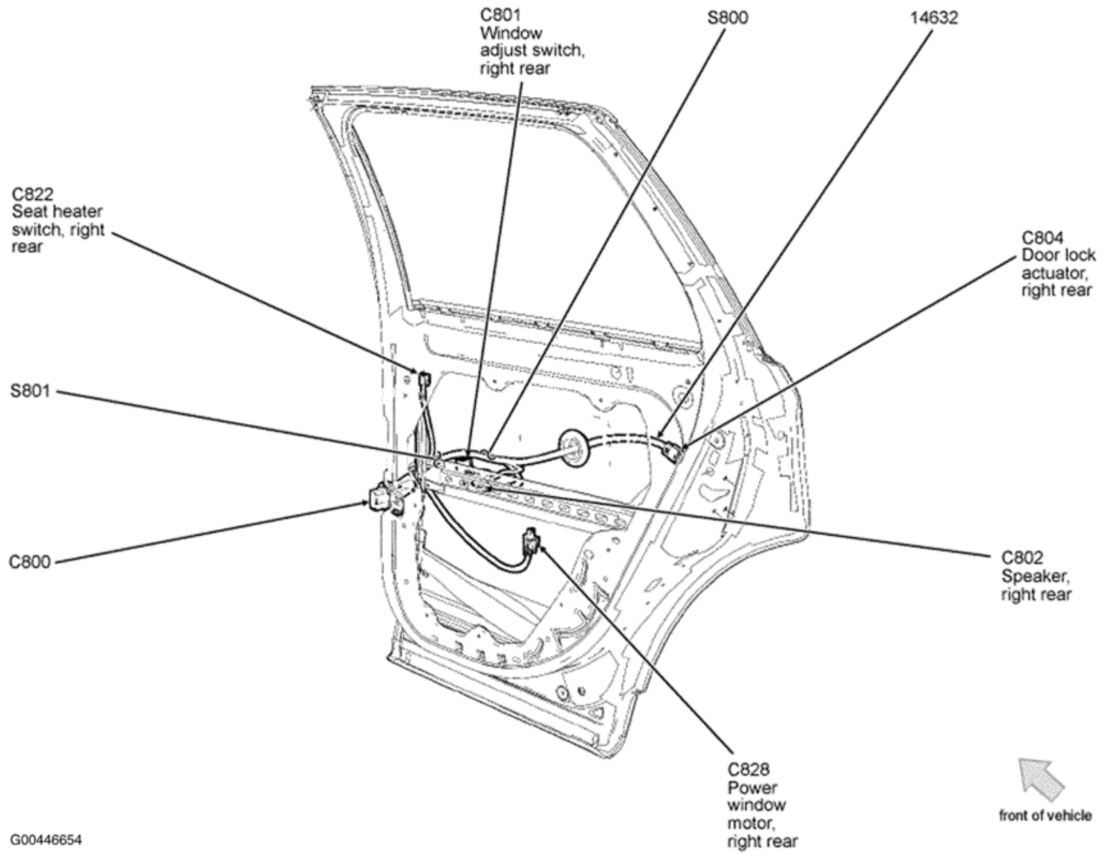


Fig. 25: Right Rear Door
Courtesy of FORD MOTOR CO.

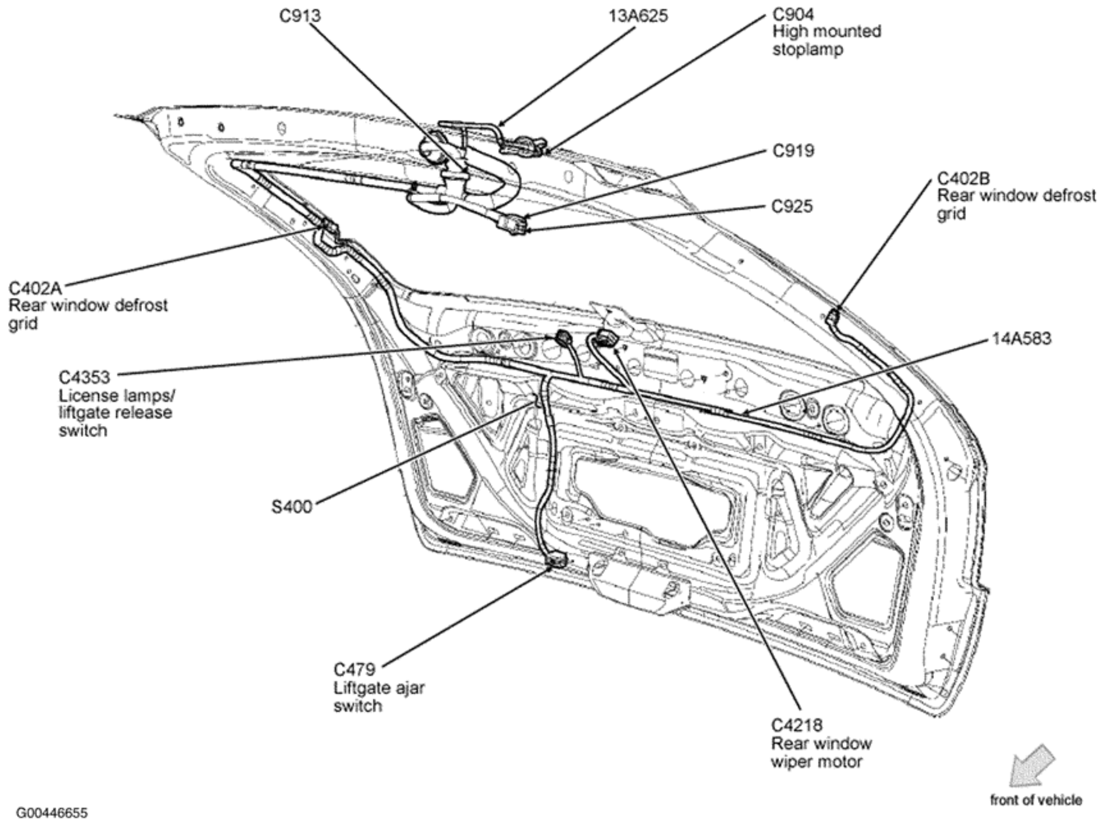


Fig. 26: Liftgate (Edge)
Courtesy of FORD MOTOR CO.

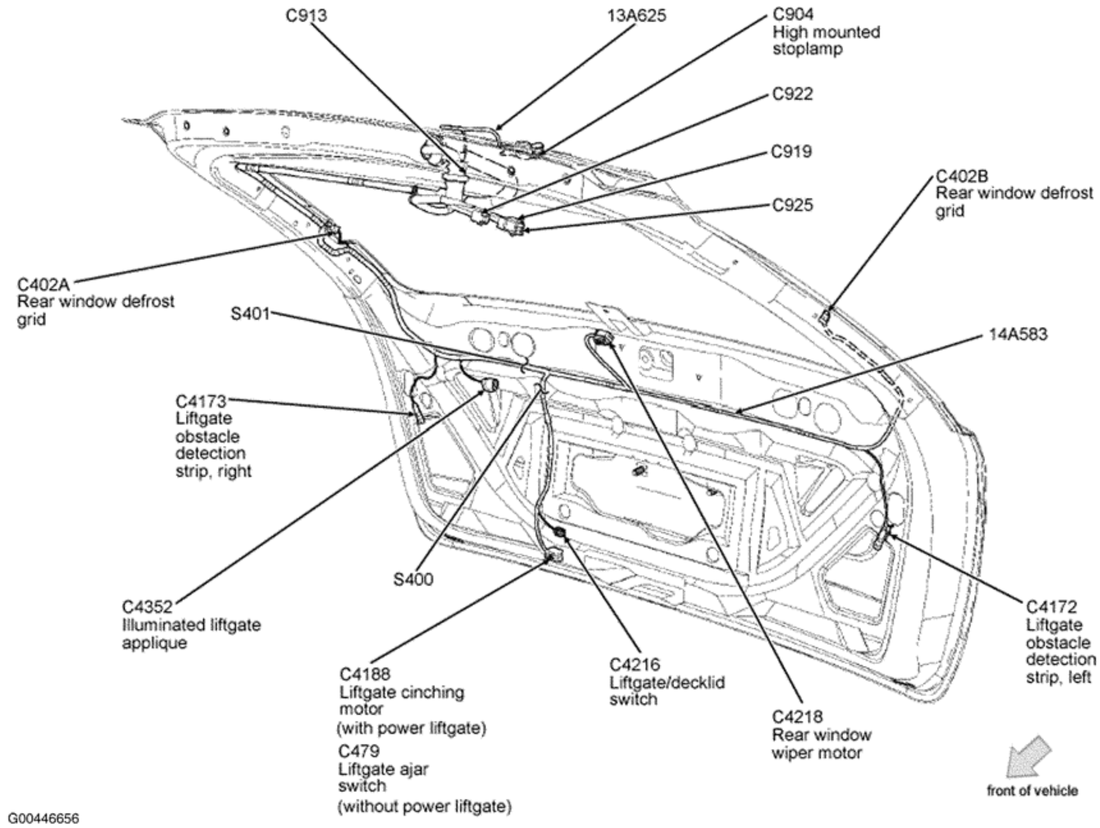


Fig. 27: Liftgate (MKX)
Courtesy of FORD MOTOR CO.

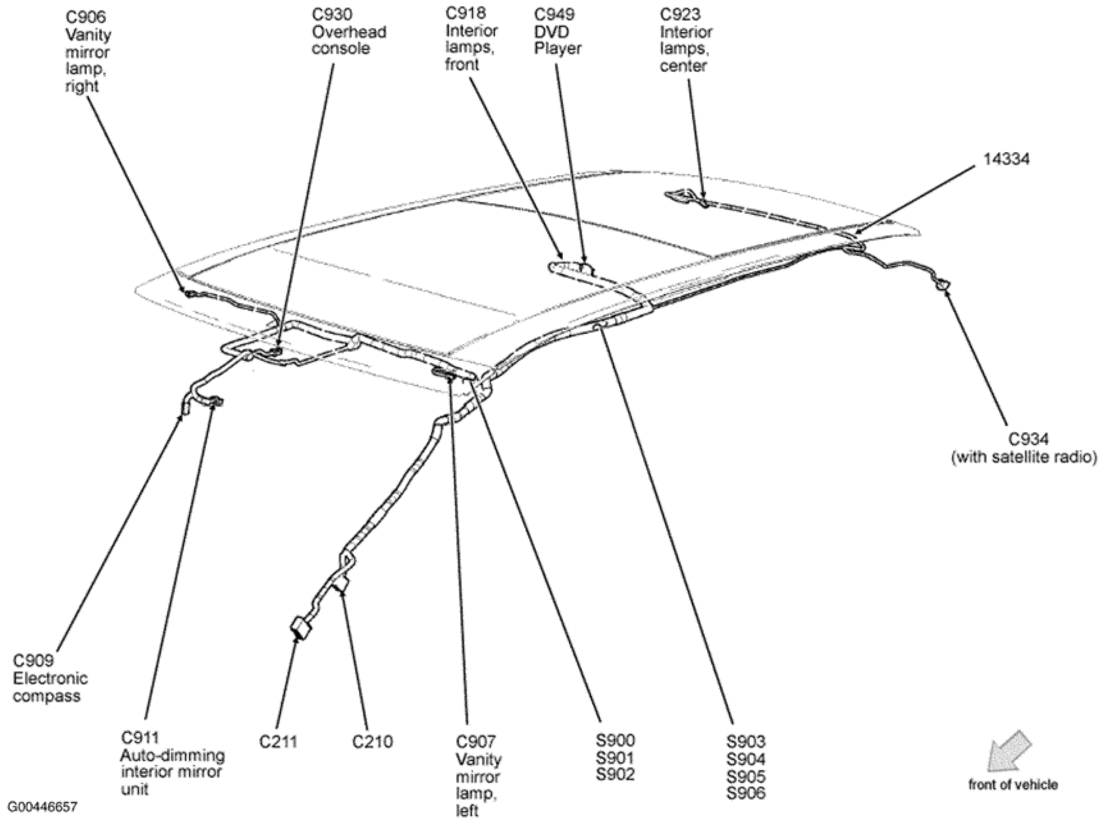


Fig. 28: Roof (Except Panoramic Vista Roof)
Courtesy of FORD MOTOR CO.

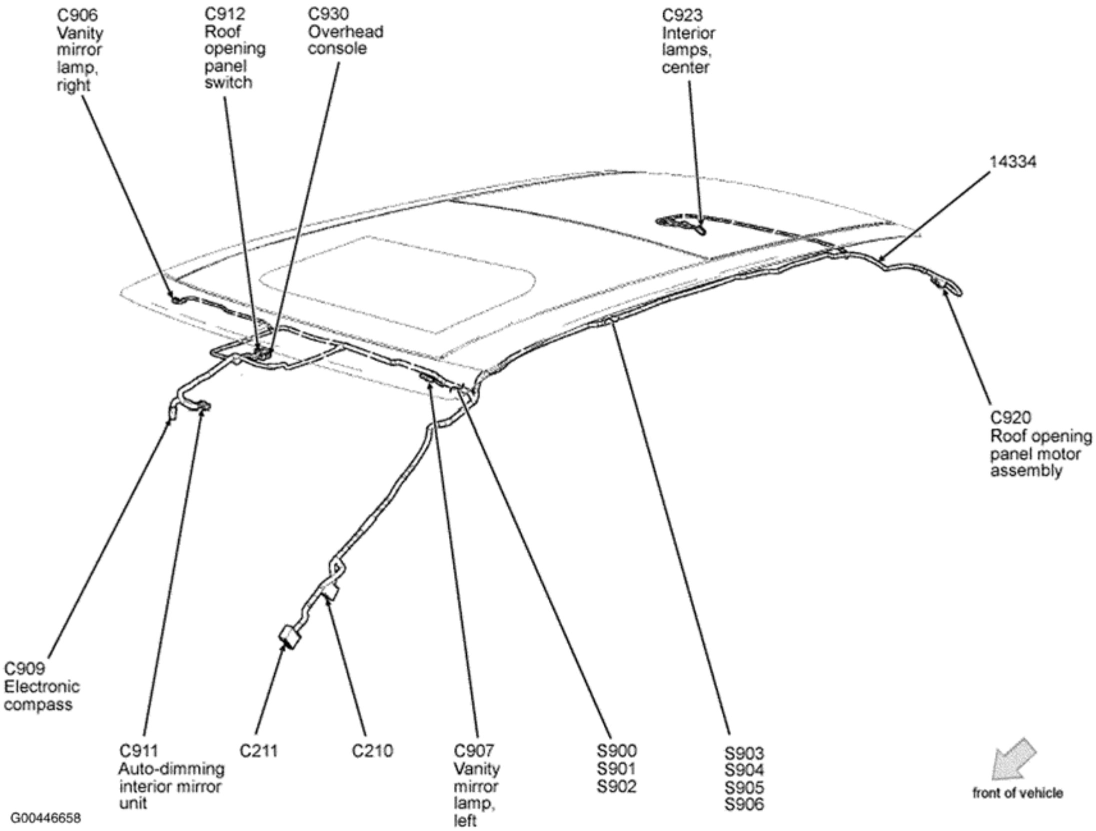


Fig. 29: Roof (W/Panoramic Vista Roof)
Courtesy of FORD MOTOR CO.

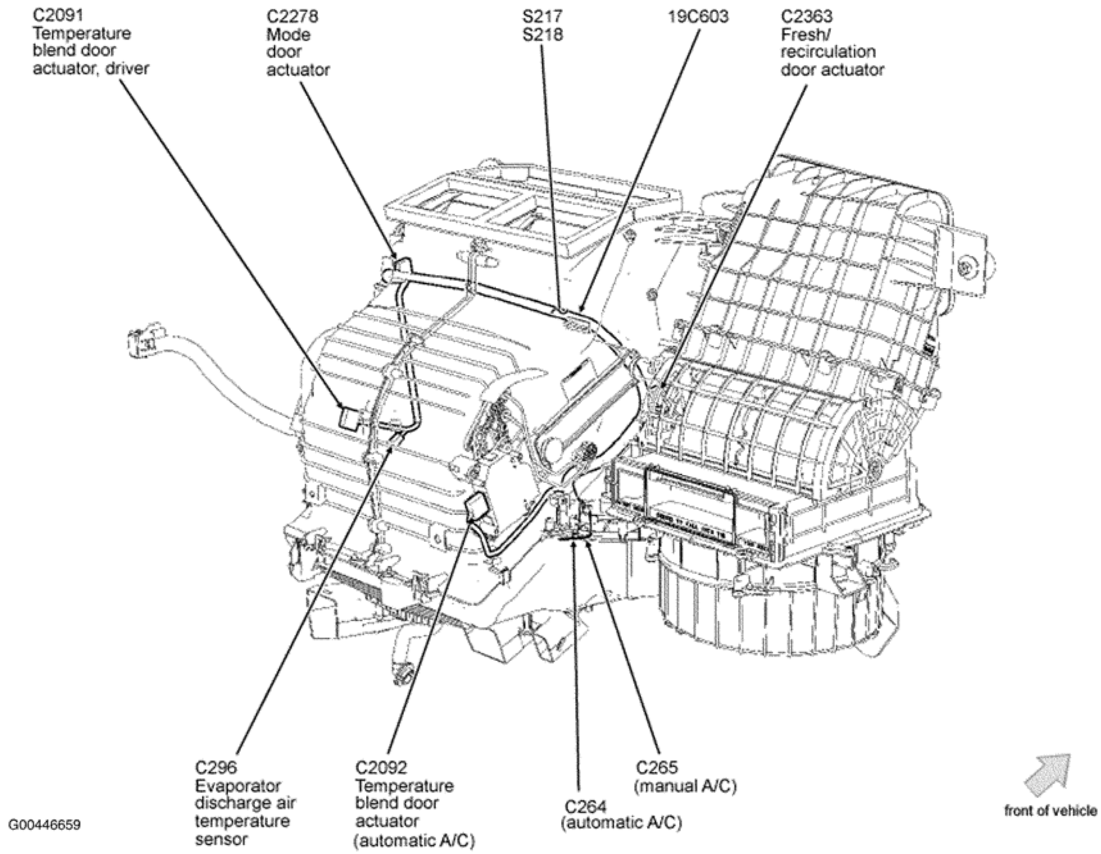


Fig. 30: HVAC Unit
Courtesy of FORD MOTOR CO.

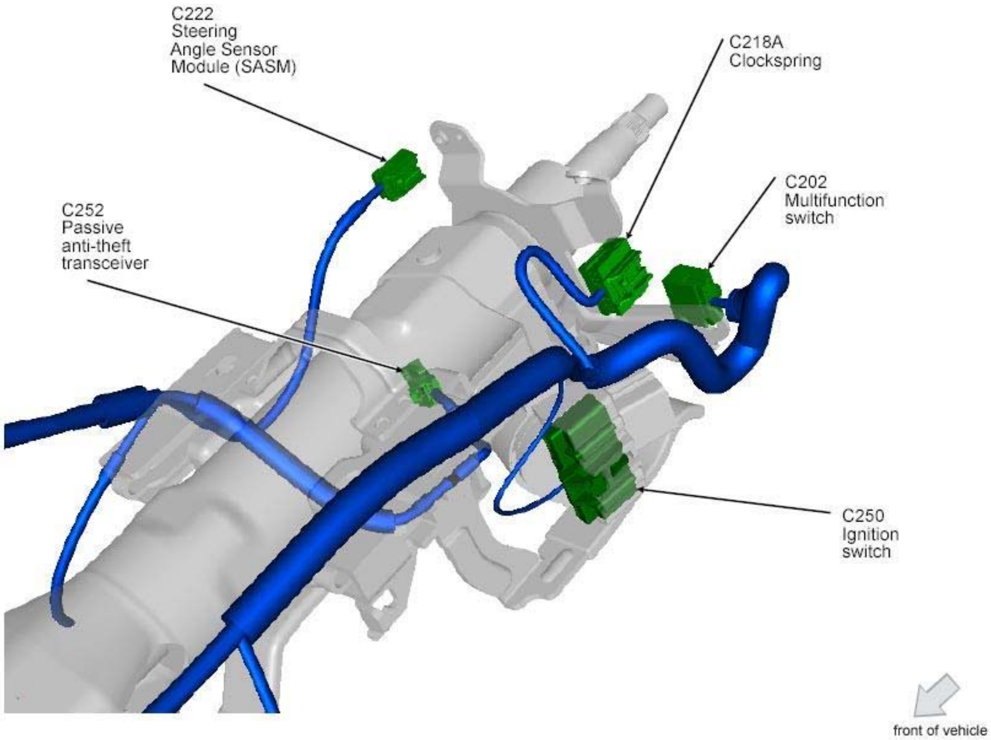


Fig. 31: Steering Column
Courtesy of FORD MOTOR CO.

2008 ENGINE PERFORMANCE

Electronic Engine Controls - Edge & MKX

SPECIFICATIONS

Material

Item	Specification	Fill Capacity
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A	-
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	-
Penetrating and Lock Lubricant XL-1 (US); CXC-51-A (Canada)	-	-

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Camshaft position (CMP) sensor bolt	10	-	89
Catalyst monitor sensor	48	35	-
Crankshaft position (CKP) sensor bolt	10	-	89
Cylinder head temperature (CHT) sensor	10	-	89
Heat shield bolt and nut	10	-	89
Heated oxygen sensor (HO2S)	48	35	-
Knock sensor (KS) bolt	20	15	-
Mass airflow (MAF) sensor screws	2	-	18
PCM nuts	5	-	44
Variable camshaft timing (VCT) oil control solenoid bolt	10	-	89

DESCRIPTION AND OPERATION

ELECTRONIC ENGINE CONTROLS

The electronic engine controls consist of the:

- PCM.
- cylinder head temperature (CHT) sensor.

- camshaft position (CMP) sensor.
- crankshaft position (CKP) sensor.
- mass air flow (MAF) sensor.
- heated oxygen sensor (HO2S).
- catalyst monitor sensor.
- variable camshaft timing (VCT) oil control solenoid.
- knock sensor (KS).

The PCM carries out the following functions:

- accepts input from various engine sensors to compute the fuel flow rate necessary to maintain a prescribed air/fuel ratio throughout the entire engine operational range.
- outputs a command to the fuel injectors to meter the appropriate quantity of fuel.

The CHT sensor:

- sends the PCM a signal indicating cylinder head temperature.
- resistance decreases as cylinder head temperature increases.

The CMP sensor:

- sends the PCM a signal indicating camshaft position used for fuel synchronization.

The CKP sensor:

- sends the PCM a signal indicating crankshaft position.
- is essential for calculating spark timing.

The MAF sensor:

- uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool.

The HO2S:

- creates a voltage signal dependent on exhaust oxygen content.
- provides feedback information to the PCM used to calculate fuel delivery.

The catalyst monitor sensor:

- monitors oxygen content after it flows through the catalytic converter.
- provides a voltage to the PCM used to calculate catalytic converter integrity.

The KS:

- is used to detect engine detonation.
- sends a voltage signal to the PCM.
- is able to provide a signal which retards the ignition timing, as necessary.

The VCT oil control solenoid:

- is an electrically controlled hydraulic valve that directs engine oil to the camshaft phaser. Once the PCM transmits a signal, the solenoid moves a valve spool, directing oil into the camshaft phaser cavity. This action changes valve timing by either inducing an advance or retard condition. The camshaft is, thereby repositioned in relation to crankshaft timing and allows for optimum engine performance and lower emissions.

DIAGNOSTIC TESTS

ELECTRONIC ENGINE CONTROLS

Refer to the **Introduction - Gasoline Engines** article.

REMOVAL AND INSTALLATION

CAMSHAFT POSITION (CMP) SENSOR

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

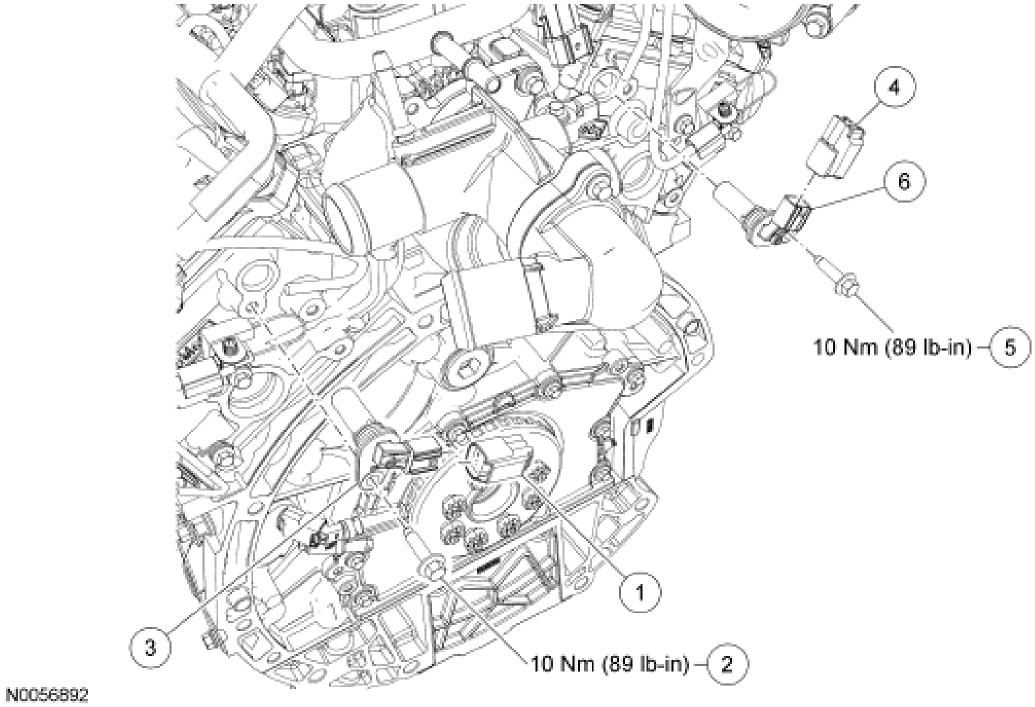


Fig. 1: Exploded View Of Camshaft Position (CMP) Sensor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	LH camshaft position sensor (CMP) electrical connector
2	W500214	LH CMP bolt
3	6B288	LH CMP
4	14A464	RH CMP electrical connector
5	W500214	RH CMP bolt
6	6B288	RH CMP

REMOVAL AND INSTALLATION

RH sensor

1. Remove the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.

   LH sensor

2. Remove the air cleaner assembly. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.

   Both sensors

3. Disconnect the camshaft position sensor (CMP) electrical connector.
4. Remove the bolt and the CMP sensor.
   - To install, tighten to 10 Nm (89 lb-in).

NOTE: Lubricate the CMP O-ring seal with clean engine oil.

5. To install, reverse the removal procedure.

CRANKSHAFT POSITION (CKP) SENSOR

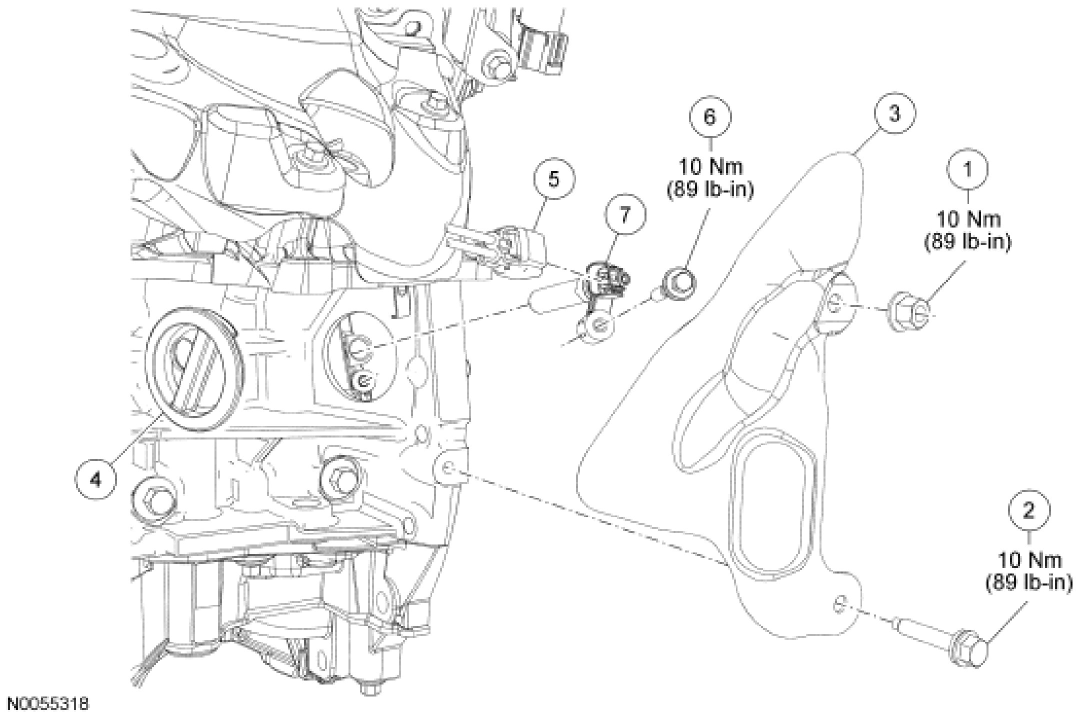


Fig. 2: Exploded View Of Crankshaft Position (CKP) Sensor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701542	Heat shield nut
2	W701669	Heat shield bolt
3	6K342	Heat shield
4	6C070	Rubber grommet cover
5	14A464	Crankshaft position (CKP) sensor electrical connector
6	6D327	CKP sensor bolt
7	6C315	CKP sensor

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the LH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.
3. Remove the bolt, nut and the heat shield.
   - To install, tighten to 10 Nm (89 lb-in).
4. Remove the rubber grommet cover.
5. Disconnect the crankshaft position (CKP) sensor electrical connector.
6. Remove the bolt and the CKP sensor.
   - To install, tighten to 10 Nm (89 lb-in).
7. To install, reverse the removal procedure.

POWERTRAIN CONTROL MODULE (PCM)

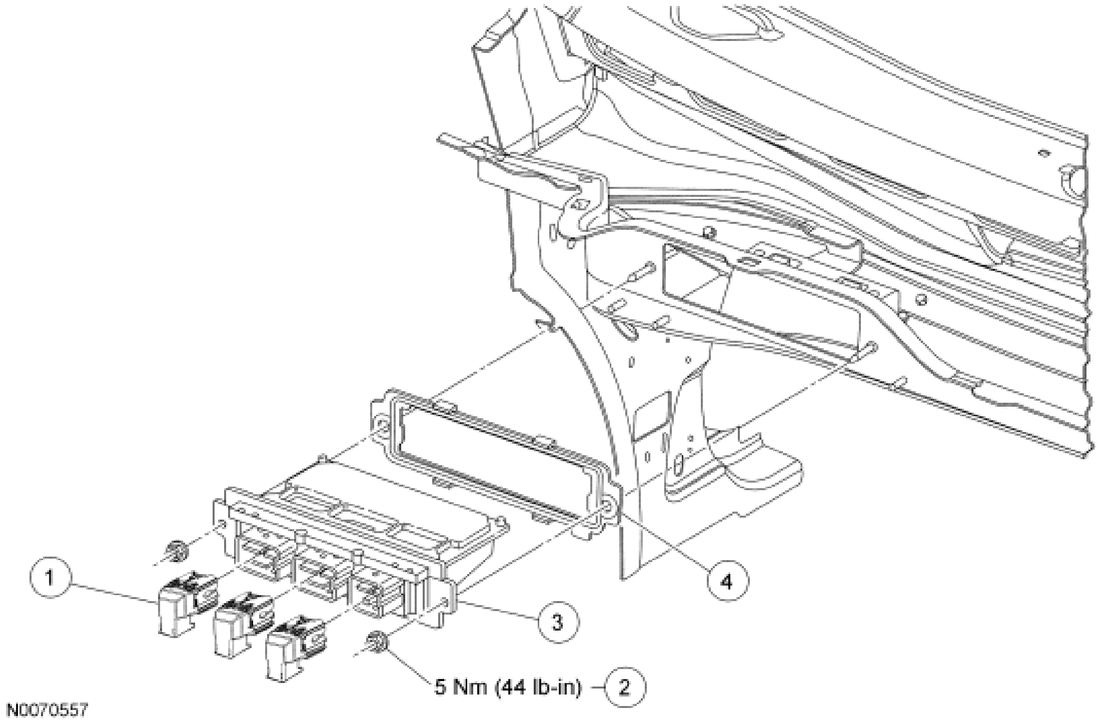


Fig. 3: Exploded View Of Powertrain Control Module (PCM) With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	PCM electrical connector (part of 12B637) (3 required)
2	N804795	PCM nut (2 required)
3	12A650	PCM
4	12A696	PCM gasket

REMOVAL

NOTE: PCM replacement DOES NOT require new keys or programming of keys.

1. Retrieve the module configuration. Carry out the module configuration retrieval steps of the Programmable Module Installation procedure. For additional information, refer to **MODULE CONFIGURATION** article.
2. Disconnect the 3 PCM electrical connectors.
3. Remove the 2 nuts and the PCM.
    - Remove the gasket.

INSTALLATION

1. Install the gasket and the PCM.
2. Install the 2 PCM nuts.
    - Tighten to 5 Nm (44 lb-in).
3. Connect the 3 PCM electrical connectors.
4. Restore the module configuration. Carry out the module configuration restore steps of the Programmable Module Installation procedure. For additional information, refer to **MODULE CONFIGURATION** article.
5. Reprogram the passive anti-theft system (PATS). Carry out the Parameter Reset procedure. For additional information, refer to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.

MASS AIR FLOW (MAF) SENSOR

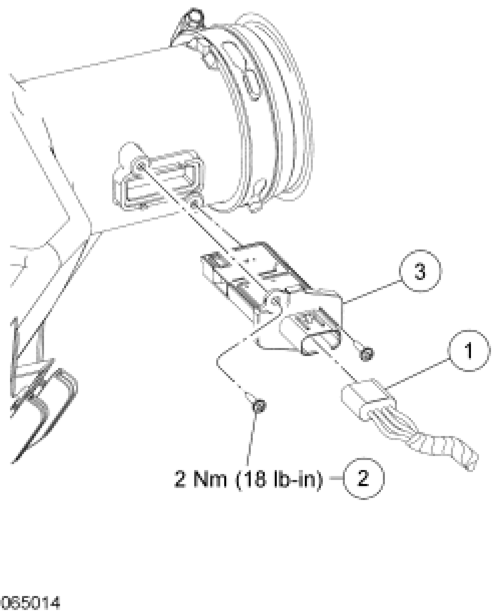


Fig. 4: Exploded View Of Mass Air Flow (MAF) Sensor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Mass air flow (MAF) sensor electrical connector
2	W709287	MAF sensor screw (2 required)
3	12B579	MAF sensor

REMOVAL AND INSTALLATION

1. Disconnect the mass air flow (MAF) sensor electrical connector.
2. Remove the 2 screws and the MAF sensor.
    - To install, tighten to 2 Nm (18 lb-in).
3. To install, reverse the removal procedure.

CYLINDER HEAD TEMPERATURE (CHT) SENSOR

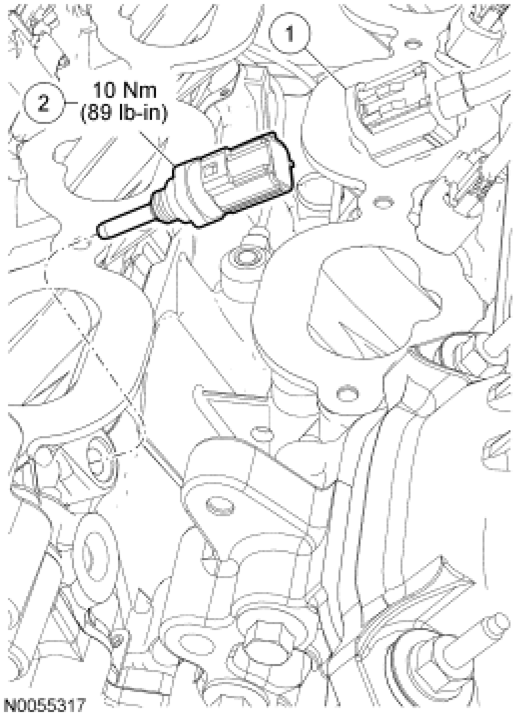


Fig. 5: Exploded View Of Cylinder Head Temperature (CHT) Sensor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Cylinder head temperature (CHT) sensor electrical connector
2	6G004	CHT sensor

REMOVAL AND INSTALLATION

1. Remove the lower intake manifold. For additional information, refer to **ENGINE - 3.5L** article.
2. Disconnect the cylinder head temperature (CHT) sensor electrical connector.
3. Remove and discard the CHT sensor.
    - To install, tighten to 10 Nm (89 lb-in).
4. To install, reverse the removal procedure.
    - Do not reuse the CHT sensor, install a new sensor.

HEATED OXYGEN SENSOR (HO2S) AND CATALYST MONITOR SENSOR - EXPLODED VIEW

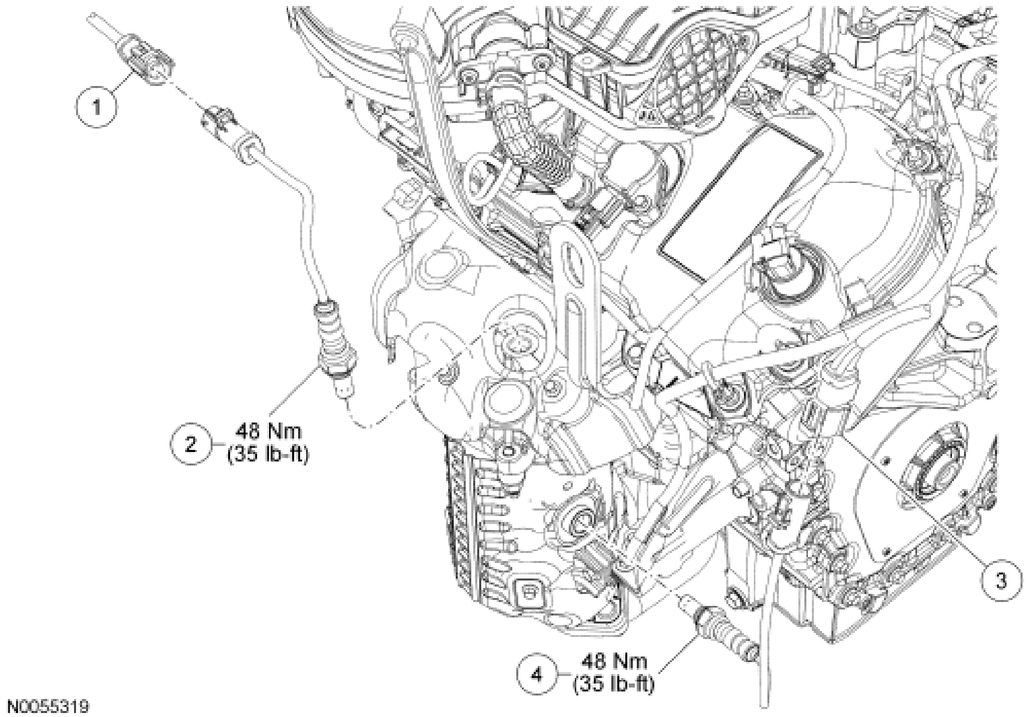


Fig. 6: Exploded View Of Heated Oxygen Sensor (HO2S) & Catalyst Monitor Sensor With Torque Specifications - RH Sensors
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Heated oxygen sensor (HO2S) electrical connector
2	9F472	HO2S
3	14A464	Catalyst monitor sensor electrical connector
4	9G444	Catalyst monitor sensor

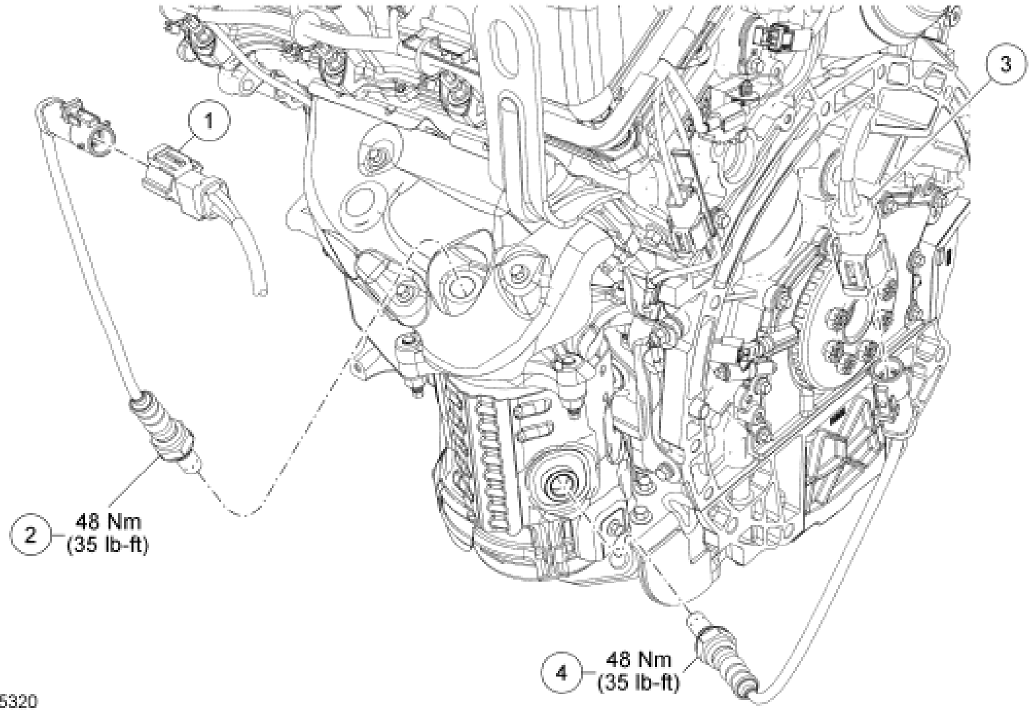


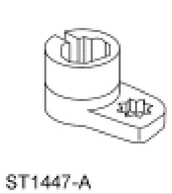
Fig. 7: Exploded View Of Heated Oxygen Sensor (HO2S) & Catalyst Monitor Sensor With Torque Specifications - LH Sensors
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Heated oxygen sensor (HO2S) electrical connector
2	9F472	HO2S
3	14A464	Catalyst monitor sensor electrical connector
4	9G444	Catalyst monitor sensor

1. For additional information, refer to the procedures in this article.

HEATED OXYGEN SENSOR (HO2S)

Special Tools

Illustration	Tool Name	Tool Number
	Socket, Exhaust Gas Oxygen Sensor	303-476 (T94P-9472-A)

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Penetrating and Lock Lubricant XL-1 (US); CXC-51-A (Canada)	-

REMOVAL AND INSTALLATION

RH sensor

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

   Both sensors

2. Disconnect the heated oxygen sensor (HO2S) electrical connector.

   NOTE: **If necessary, lubricate the sensor threads with penetrating and lock lubricant to assist in removal.**

3. Using the special tool, remove the HO2S.
   - To install, tighten to 48 Nm (35 lb-ft).

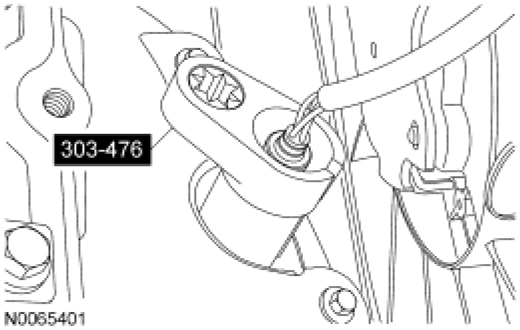


Fig. 8: Identifying Heated Oxygen Sensor (HO2S) & Special Tool (303-476)
Courtesy of FORD MOTOR CO.

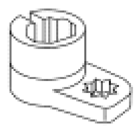
   NOTE: **Apply a light coat of anti-seize lubricant to the threads of the HO2S.**

4. To install, reverse the removal procedure.

CATALYST MONITOR SENSOR

Special Tools

Illustration	Tool Name	Tool Number

 ST1447-A	Socket, Exhaust Gas Oxygen Sensor	303-476 (T94P-9472-A)

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Penetrating and Lock Lubricant XL-1 (US); CXC-51-A (Canada)	-

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the catalyst monitor sensor electrical connector.

NOTE: If necessary, lubricate the sensor threads with penetrating and lock lubricant to assist in removal.

3. Using the special tool, remove the catalyst monitor sensor.
   - To install, tighten to 48 Nm (35 lb-ft).

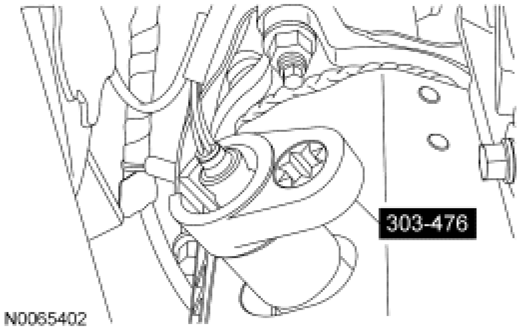


Fig. 9: Identifying Catalyst Monitor Sensor & Special Tool (303-476)
Courtesy of FORD MOTOR CO.

NOTE: Apply a light coat of anti-seize lubricant to the threads of the catalyst monitor sensor.

4. To install, reverse the removal procedure.

VARIABLE CAMSHAFT TIMING (VCT) OIL CONTROL SOLENOID

NOTE: LH shown, RH similar.

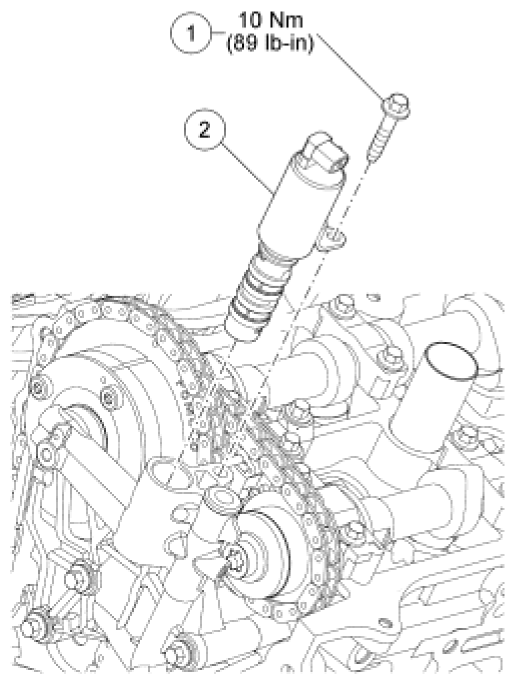


Fig. 10: Exploded View Of Variable Camshaft Timing (VCT) Oil Control Solenoid With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W500215	Variable camshaft timing (VCT) oil control solenoid bolt
2	6B297	VCT oil control solenoid

REMOVAL AND INSTALLATION

1. Remove the LH or RH valve cover. For additional information, refer to **ENGINE - 3.5L** article.
2. Remove the bolt and the variable camshaft timing (VCT) oil control solenoid.
   - To install, tighten to 10 Nm (89 lb-in).
3. To install, reverse the removal procedure.

KNOCK SENSOR (KS)

Material

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only)	WSS-M97B51-A1

VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	

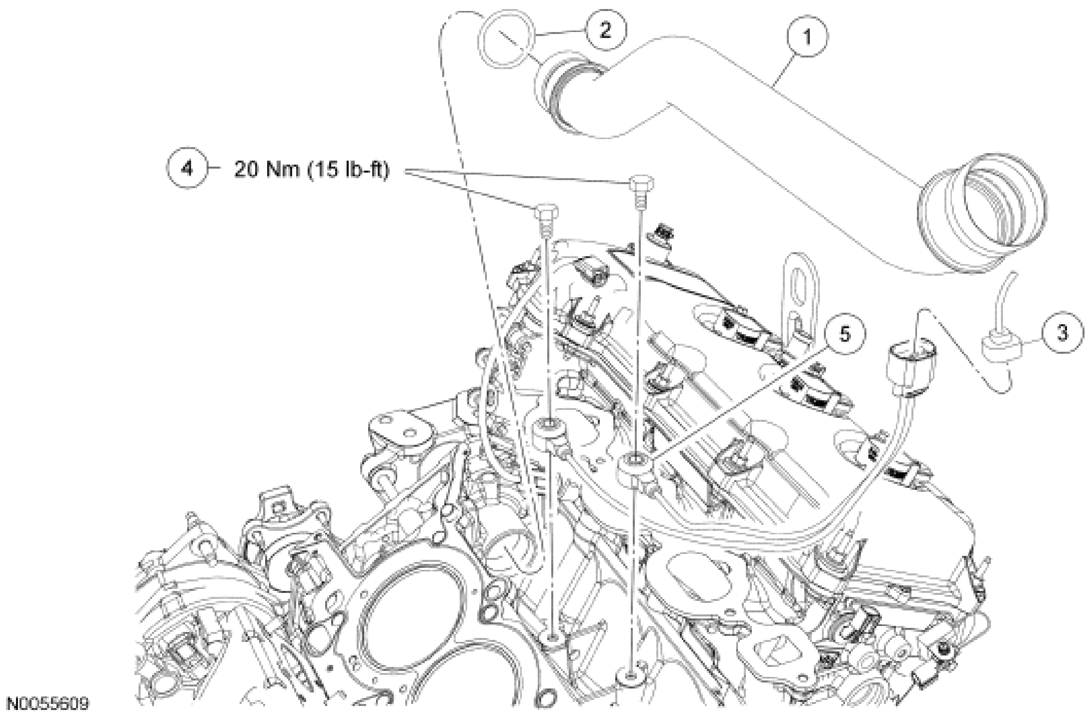


Fig. 11: Exploded View Of Knock Sensor (KS) With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	9N271	Coolant tube
2	8565	O-ring seal
3	14A464	Knock sensor (KS) electrical connector
4	W500310	KS bolts (2 required)
5	12A699	KS

REMOVAL AND INSTALLATION

1. Remove the thermostat housing. For additional information, refer to **ENGINE COOLING** article.
2. Remove the lower intake manifold. For additional information, refer to **ENGINE - 3.5L** article.
3. Remove the coolant tube.
    - Discard the O-ring seal.
4. Disconnect the knock sensor (KS) electrical connector.
5. Remove the 2 bolts and the KS.
    - To install, tighten to 20 Nm (15 lb-ft).
6. To install, reverse the removal procedure.

- Lubricate the new O-ring seal with clean engine coolant.

2008 ENGINE PERFORMANCE

Electronic Engine Controls - Edge & MKX

SPECIFICATIONS

Material

Item	Specification	Fill Capacity
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A	-
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	-
Penetrating and Lock Lubricant XL-1 (US); CXC-51-A (Canada)	-	-

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Camshaft position (CMP) sensor bolt	10	-	89
Catalyst monitor sensor	48	35	-
Crankshaft position (CKP) sensor bolt	10	-	89
Cylinder head temperature (CHT) sensor	10	-	89
Heat shield bolt and nut	10	-	89
Heated oxygen sensor (HO2S)	48	35	-
Knock sensor (KS) bolt	20	15	-
Mass airflow (MAF) sensor screws	2	-	18
PCM nuts	5	-	44
Variable camshaft timing (VCT) oil control solenoid bolt	10	-	89

DESCRIPTION AND OPERATION

ELECTRONIC ENGINE CONTROLS

The electronic engine controls consist of the:

- PCM.
- cylinder head temperature (CHT) sensor.

- camshaft position (CMP) sensor.
- crankshaft position (CKP) sensor.
- mass air flow (MAF) sensor.
- heated oxygen sensor (HO2S).
- catalyst monitor sensor.
- variable camshaft timing (VCT) oil control solenoid.
- knock sensor (KS).

The PCM carries out the following functions:

- accepts input from various engine sensors to compute the fuel flow rate necessary to maintain a prescribed air/fuel ratio throughout the entire engine operational range.
- outputs a command to the fuel injectors to meter the appropriate quantity of fuel.

The CHT sensor:

- sends the PCM a signal indicating cylinder head temperature.
- resistance decreases as cylinder head temperature increases.

The CMP sensor:

- sends the PCM a signal indicating camshaft position used for fuel synchronization.

The CKP sensor:

- sends the PCM a signal indicating crankshaft position.
- is essential for calculating spark timing.

The MAF sensor:

- uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool.

The HO2S:

- creates a voltage signal dependent on exhaust oxygen content.
- provides feedback information to the PCM used to calculate fuel delivery.

The catalyst monitor sensor:

- monitors oxygen content after it flows through the catalytic converter.
- provides a voltage to the PCM used to calculate catalytic converter integrity.

The KS:

- is used to detect engine detonation.
- sends a voltage signal to the PCM.
- is able to provide a signal which retards the ignition timing, as necessary.

The VCT oil control solenoid:

- is an electrically controlled hydraulic valve that directs engine oil to the camshaft phaser. Once the PCM transmits a signal, the solenoid moves a valve spool, directing oil into the camshaft phaser cavity. This action changes valve timing by either inducing an advance or retard condition. The camshaft is, thereby repositioned in relation to crankshaft timing and allows for optimum engine performance and lower emissions.

DIAGNOSTIC TESTS

ELECTRONIC ENGINE CONTROLS

Refer to the **Introduction - Gasoline Engines** article.

REMOVAL AND INSTALLATION

CAMSHAFT POSITION (CMP) SENSOR

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

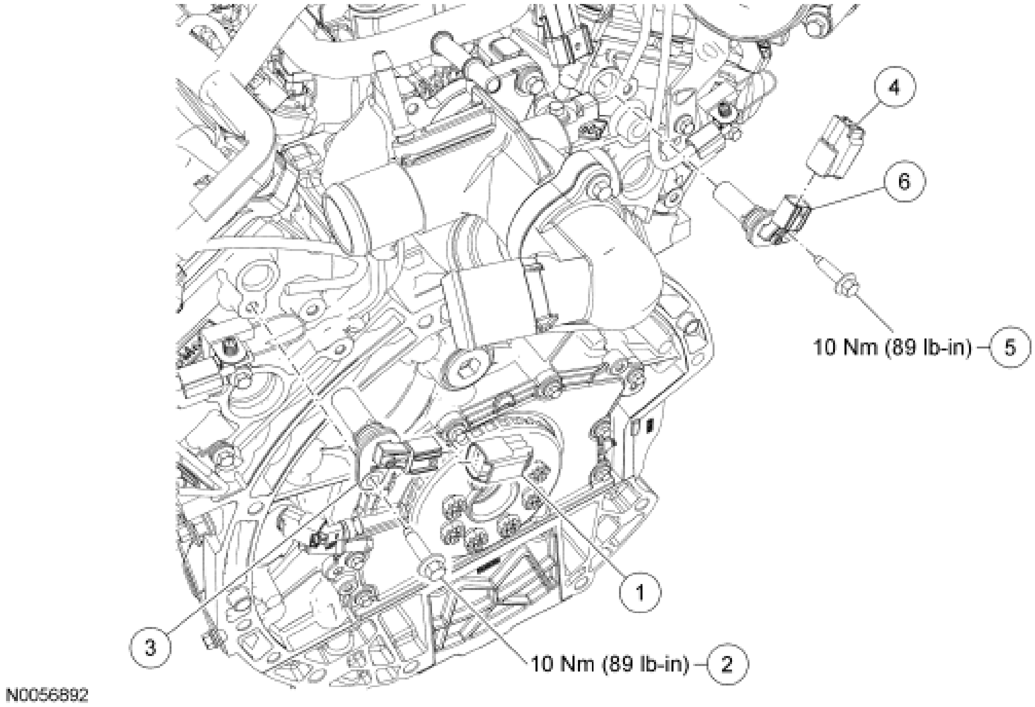


Fig. 1: Exploded View Of Camshaft Position (CMP) Sensor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	LH camshaft position sensor (CMP) electrical connector
2	W500214	LH CMP bolt
3	6B288	LH CMP
4	14A464	RH CMP electrical connector
5	W500214	RH CMP bolt
6	6B288	RH CMP

REMOVAL AND INSTALLATION

RH sensor

1. Remove the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.

   LH sensor

2. Remove the air cleaner assembly. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.

   Both sensors

3. Disconnect the camshaft position sensor (CMP) electrical connector.
4. Remove the bolt and the CMP sensor.
    - To install, tighten to 10 Nm (89 lb-in).

NOTE: Lubricate the CMP O-ring seal with clean engine oil.

5. To install, reverse the removal procedure.

CRANKSHAFT POSITION (CKP) SENSOR

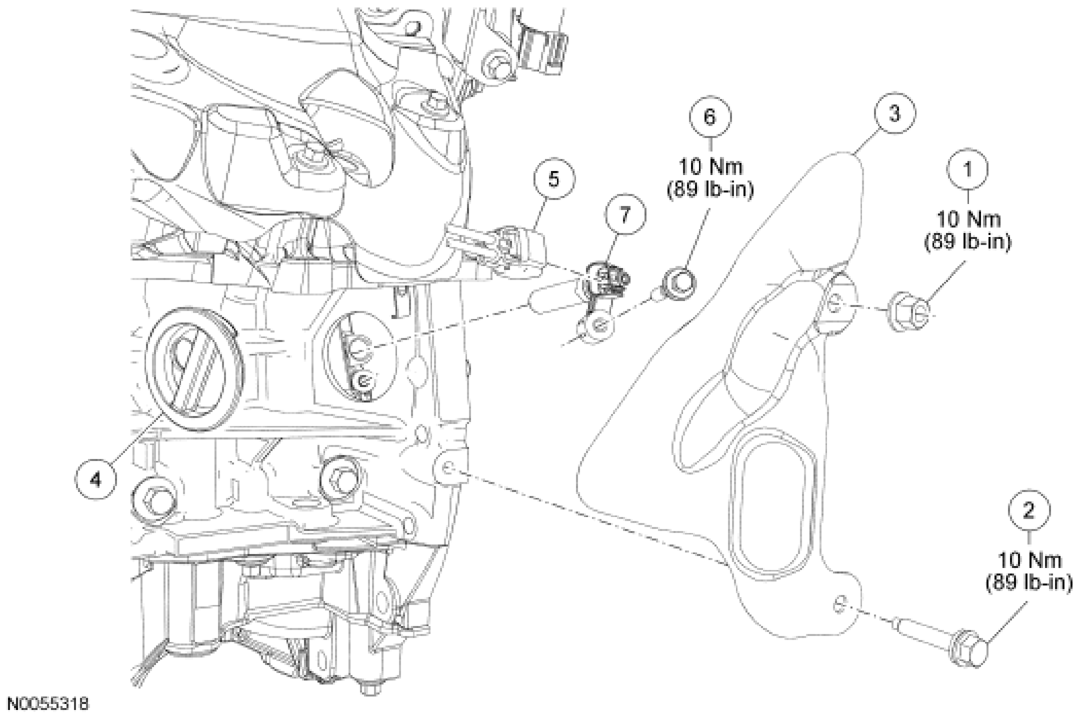


Fig. 2: Exploded View Of Crankshaft Position (CKP) Sensor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701542	Heat shield nut
2	W701669	Heat shield bolt
3	6K342	Heat shield
4	6C070	Rubber grommet cover
5	14A464	Crankshaft position (CKP) sensor electrical connector
6	6D327	CKP sensor bolt
7	6C315	CKP sensor

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the LH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.
3. Remove the bolt, nut and the heat shield.
    - To install, tighten to 10 Nm (89 lb-in).
4. Remove the rubber grommet cover.
5. Disconnect the crankshaft position (CKP) sensor electrical connector.
6. Remove the bolt and the CKP sensor.
    - To install, tighten to 10 Nm (89 lb-in).
7. To install, reverse the removal procedure.

POWERTRAIN CONTROL MODULE (PCM)

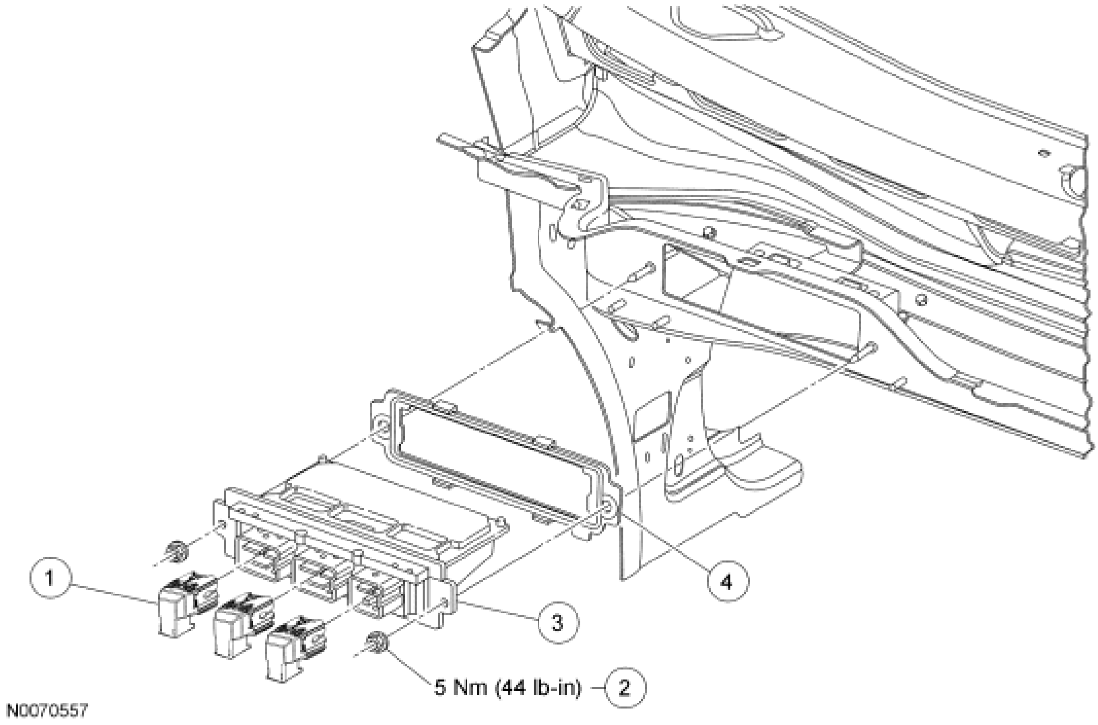


Fig. 3: Exploded View Of Powertrain Control Module (PCM) With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	PCM electrical connector (part of 12B637) (3 required)
2	N804795	PCM nut (2 required)
3	12A650	PCM
4	12A696	PCM gasket

REMOVAL

NOTE: PCM replacement DOES NOT require new keys or programming of keys.

1. Retrieve the module configuration. Carry out the module configuration retrieval steps of the Programmable Module Installation procedure. For additional information, refer to **MODULE CONFIGURATION** article.
2. Disconnect the 3 PCM electrical connectors.
3. Remove the 2 nuts and the PCM.
   - Remove the gasket.

INSTALLATION

1. Install the gasket and the PCM.
2. Install the 2 PCM nuts.
   - Tighten to 5 Nm (44 lb-in).
3. Connect the 3 PCM electrical connectors.
4. Restore the module configuration. Carry out the module configuration restore steps of the Programmable Module Installation procedure. For additional information, refer to **MODULE CONFIGURATION** article.
5. Reprogram the passive anti-theft system (PATS). Carry out the Parameter Reset procedure. For additional information, refer to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.

MASS AIR FLOW (MAF) SENSOR

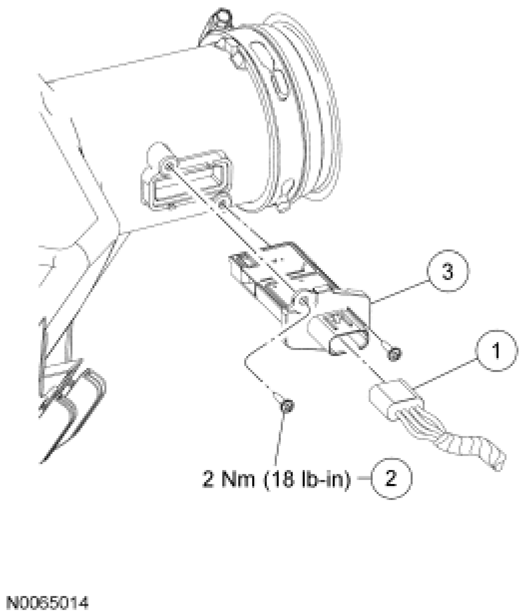


Fig. 4: Exploded View Of Mass Air Flow (MAF) Sensor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Mass air flow (MAF) sensor electrical connector
2	W709287	MAF sensor screw (2 required)
3	12B579	MAF sensor

REMOVAL AND INSTALLATION

1. Disconnect the mass air flow (MAF) sensor electrical connector.
2. Remove the 2 screws and the MAF sensor.
   - To install, tighten to 2 Nm (18 lb-in).
3. To install, reverse the removal procedure.

CYLINDER HEAD TEMPERATURE (CHT) SENSOR

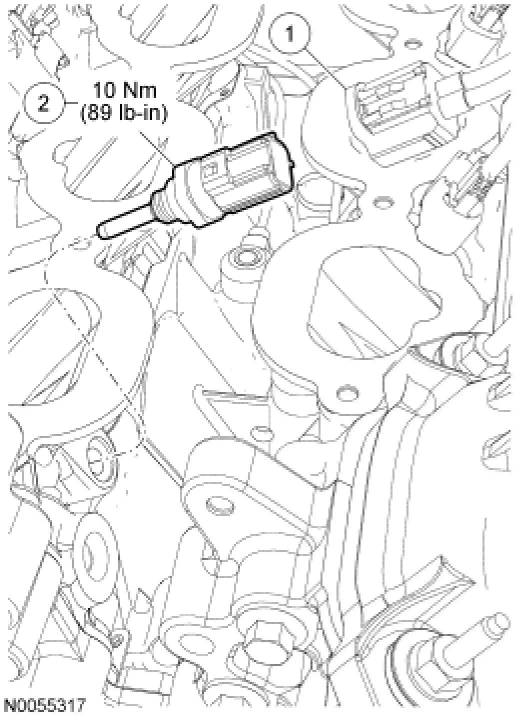


Fig. 5: Exploded View Of Cylinder Head Temperature (CHT) Sensor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Cylinder head temperature (CHT) sensor electrical connector
2	6G004	CHT sensor

REMOVAL AND INSTALLATION

1. Remove the lower intake manifold. For additional information, refer to **ENGINE - 3.5L** article.
2. Disconnect the cylinder head temperature (CHT) sensor electrical connector.
3. Remove and discard the CHT sensor.
    - To install, tighten to 10 Nm (89 lb-in).
4. To install, reverse the removal procedure.
    - Do not reuse the CHT sensor, install a new sensor.

HEATED OXYGEN SENSOR (HO2S) AND CATALYST MONITOR SENSOR - EXPLODED VIEW

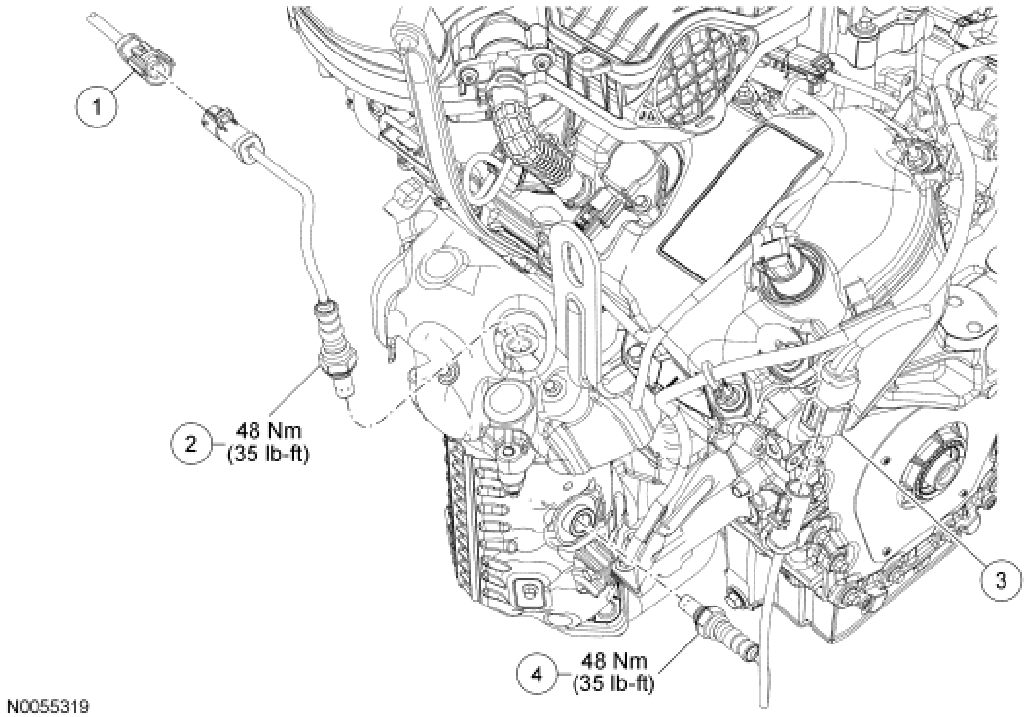


Fig. 6: Exploded View Of Heated Oxygen Sensor (HO2S) & Catalyst Monitor Sensor With Torque Specifications - RH Sensors
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Heated oxygen sensor (HO2S) electrical connector
2	9F472	HO2S
3	14A464	Catalyst monitor sensor electrical connector
4	9G444	Catalyst monitor sensor

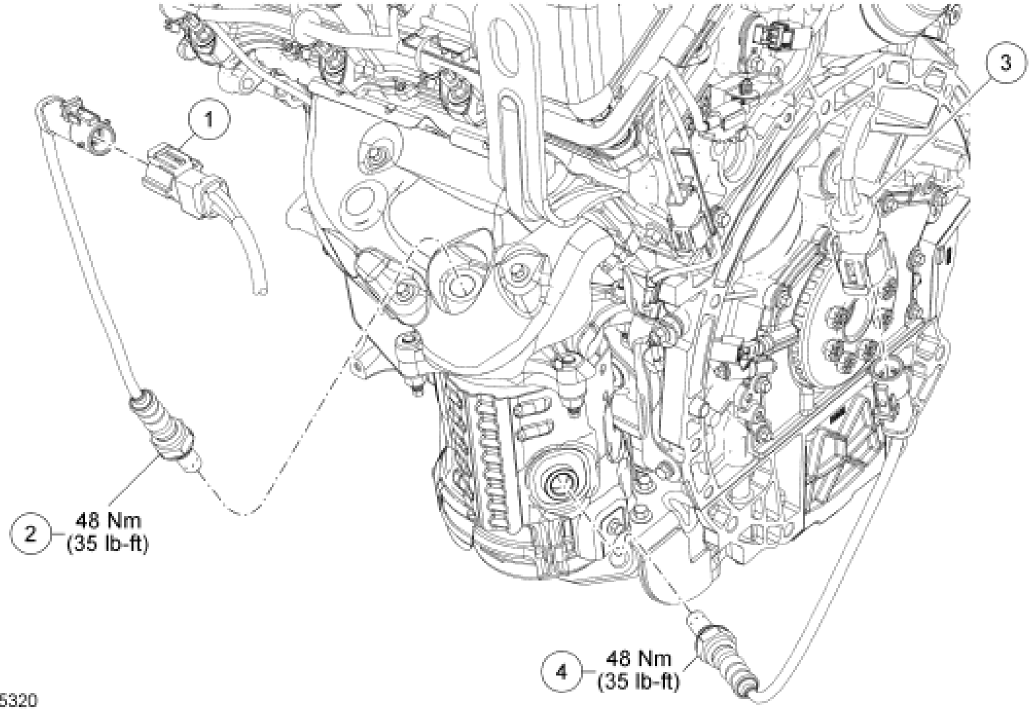


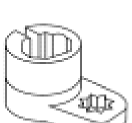
Fig. 7: Exploded View Of Heated Oxygen Sensor (HO2S) & Catalyst Monitor Sensor With Torque Specifications - LH Sensors
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Heated oxygen sensor (HO2S) electrical connector
2	9F472	HO2S
3	14A464	Catalyst monitor sensor electrical connector
4	9G444	Catalyst monitor sensor

1. For additional information, refer to the procedures in this article.

HEATED OXYGEN SENSOR (HO2S)

Special Tools

Illustration	Tool Name	Tool Number
 ST1447-A	Socket, Exhaust Gas Oxygen Sensor	303-476 (T94P-9472-A)

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Penetrating and Lock Lubricant XL-1 (US); CXC-51-A (Canada)	-

REMOVAL AND INSTALLATION

RH sensor

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

   Both sensors

2. Disconnect the heated oxygen sensor (HO2S) electrical connector.

   NOTE: If necessary, lubricate the sensor threads with penetrating and lock lubricant to assist in removal.

3. Using the special tool, remove the HO2S.
   - To install, tighten to 48 Nm (35 lb-ft).

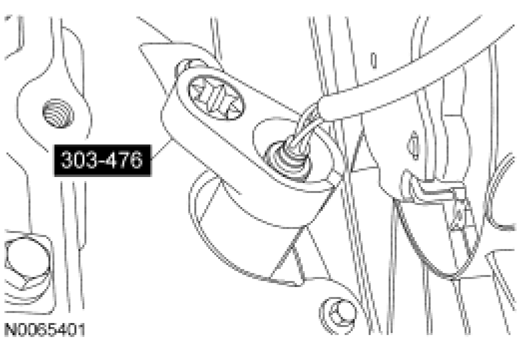


Fig. 8: Identifying Heated Oxygen Sensor (HO2S) & Special Tool (303-476)
Courtesy of FORD MOTOR CO.

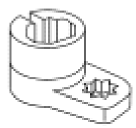
NOTE: Apply a light coat of anti-seize lubricant to the threads of the HO2S.

4. To install, reverse the removal procedure.

CATALYST MONITOR SENSOR

Special Tools

Illustration	Tool Name	Tool Number

 ST1447-A	Socket, Exhaust Gas Oxygen Sensor	303-476 (T94P-9472-A)

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Penetrating and Lock Lubricant XL-1 (US); CXC-51-A (Canada)	-

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the catalyst monitor sensor electrical connector.

NOTE: If necessary, lubricate the sensor threads with penetrating and lock lubricant to assist in removal.

3. Using the special tool, remove the catalyst monitor sensor.
    - To install, tighten to 48 Nm (35 lb-ft).

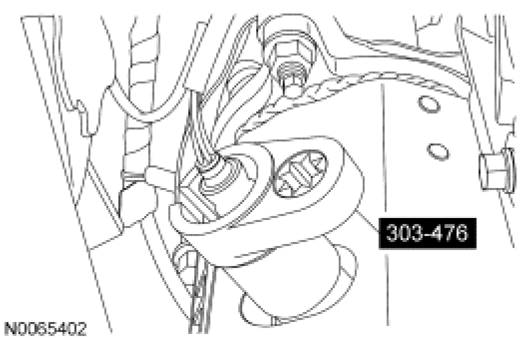


Fig. 9: Identifying Catalyst Monitor Sensor & Special Tool (303-476)
Courtesy of FORD MOTOR CO.

NOTE: Apply a light coat of anti-seize lubricant to the threads of the catalyst monitor sensor.

4. To install, reverse the removal procedure.

VARIABLE CAMSHAFT TIMING (VCT) OIL CONTROL SOLENOID

NOTE: **LH shown, RH similar.**

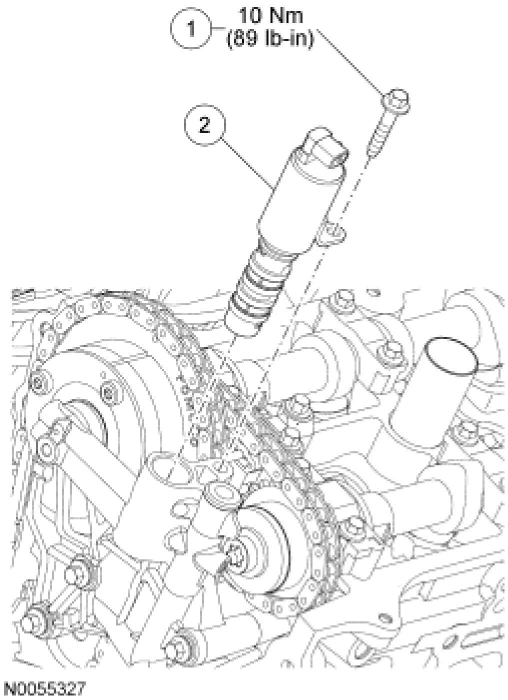


Fig. 10: Exploded View Of Variable Camshaft Timing (VCT) Oil Control Solenoid With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W500215	Variable camshaft timing (VCT) oil control solenoid bolt
2	6B297	VCT oil control solenoid

REMOVAL AND INSTALLATION

1. Remove the LH or RH valve cover. For additional information, refer to **ENGINE - 3.5L** article.
2. Remove the bolt and the variable camshaft timing (VCT) oil control solenoid.
   - To install, tighten to 10 Nm (89 lb-in).
3. To install, reverse the removal procedure.

KNOCK SENSOR (KS)

Material

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only)	WSS-M97B51-A1

VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	

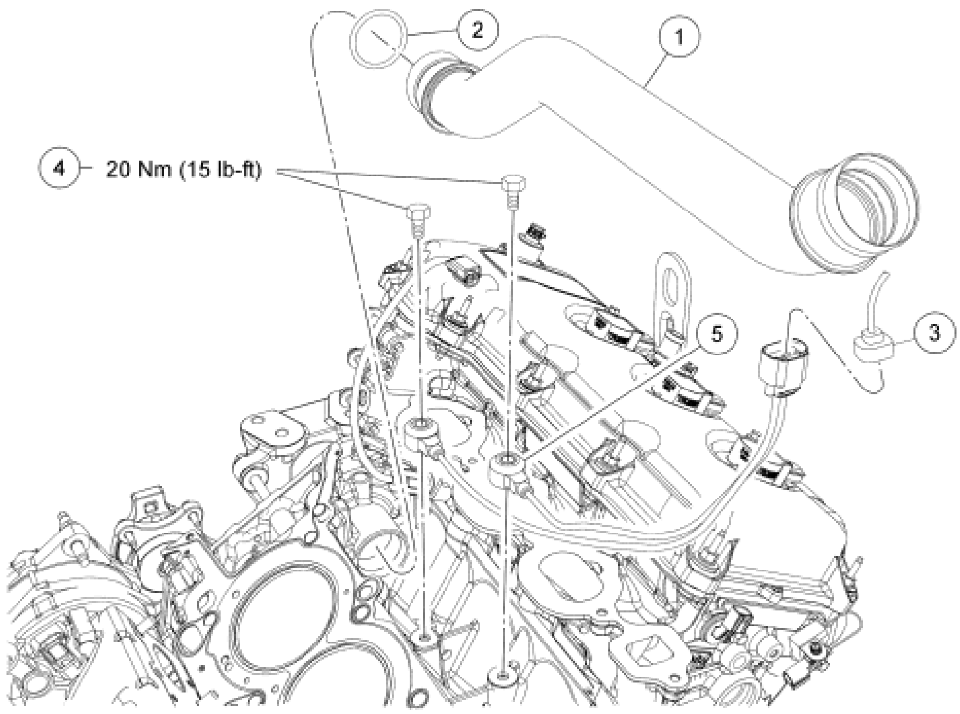


Fig. 11: Exploded View Of Knock Sensor (KS) With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	9N271	Coolant tube
2	8565	O-ring seal
3	14A464	Knock sensor (KS) electrical connector
4	W500310	KS bolts (2 required)
5	12A699	KS

REMOVAL AND INSTALLATION

1. Remove the thermostat housing. For additional information, refer to **ENGINE COOLING** article.
2. Remove the lower intake manifold. For additional information, refer to **ENGINE - 3.5L** article.
3. Remove the coolant tube.
   - Discard the O-ring seal.
4. Disconnect the knock sensor (KS) electrical connector.
5. Remove the 2 bolts and the KS.
   - To install, tighten to 20 Nm (15 lb-ft).
6. To install, reverse the removal procedure.

- Lubricate the new O-ring seal with clean engine coolant.

2008 ENGINE PERFORMANCE

Engine Emission Control - Edge & MKX

SPECIFICATIONS

Material

Item	Specification	Fill Capacity
Motorcraft SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A	-

TORQUE SPECIFICATIONS

Description	Nm	lb-in
PCV fitting screws	6	53

DESCRIPTION AND OPERATION

ENGINE EMISSION CONTROL

NOTE: **Do not permanently remove or render inoperative any part of the vehicle emission control system including related hardware. Failure to comply may violate applicable state and federal laws.**

The engine emission control system consists of the PCV system.

The PCV system consists of the:

- crankcase ventilation tube.
- PCV fitting.
- PCV valve.

The PCV system uses intake manifold vacuum to ventilate blow-by fumes from the crankcase and return the vapors to the intake manifold for combustion. The PCV valve varies the amount of blow-by gases returned to the intake manifold based on available engine vacuum. The PCV valve also prevents the entry of combustion backfiring into the crankcase.

Vehicle Emission Vacuum Routing

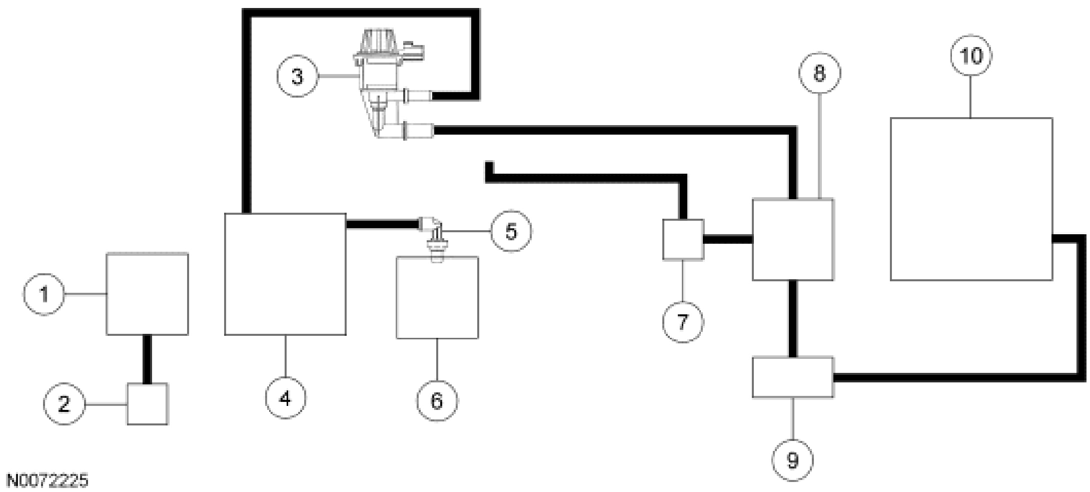


Fig. 1: Identifying Vehicle Emission Vacuum Routing
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6A505	LH valve cover
2	9F805	Air cleaner outlet pipe
3	9G641	Evaporative emission (EVAP) canister purge valve
4	9S455	Upper intake manifold
5	6A666	PCV valve
6	6582	RH valve cover
7	9G676	EVAP canister vent solenoid and dust separator assembly
8	9E857	EVAP canister
9	-	Fuel tank pressure (FTP) sensor (part of 9S284)
10	9K007	Fuel tank

DIAGNOSTIC TESTS

ENGINE EMISSION CONTROL

Refer to the **Introduction - Gasoline Engines** article.

REMOVAL AND INSTALLATION

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM COMPONENTS

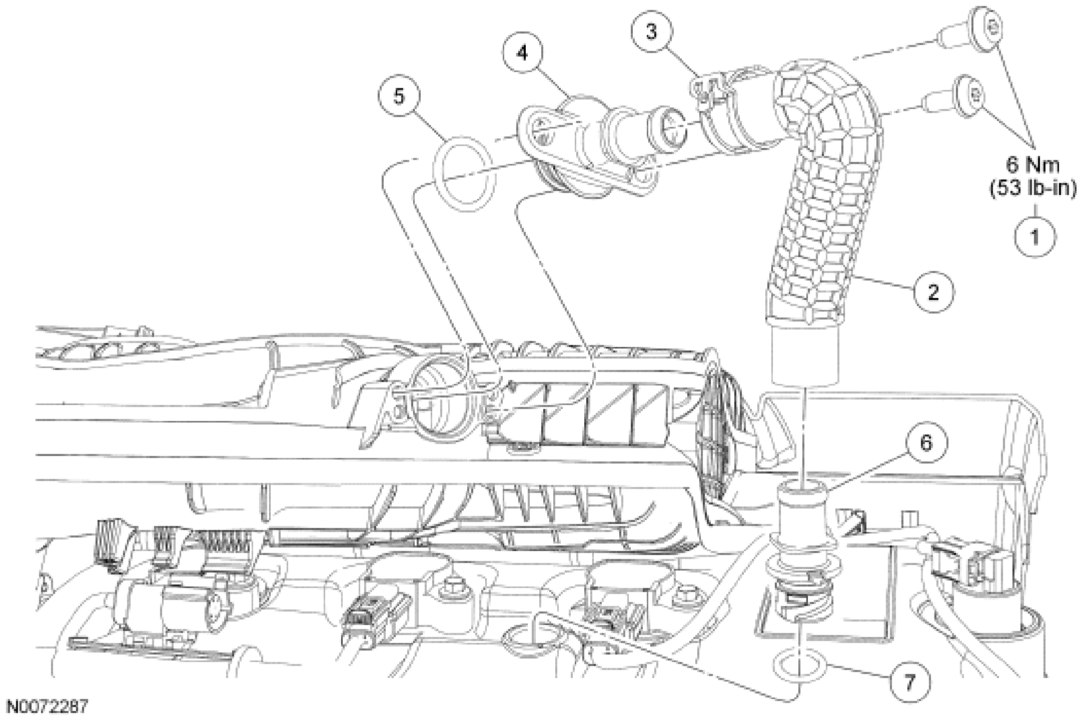


Fig. 2: Identifying Positive Crankcase Ventilation (PCV) System Components
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	PCV fitting screws (2 required)
2	6A664	Crankcase ventilation tube
3	-	Crankcase ventilation tube spring clamp (part of 6K817)
4	9F695	PCV fitting
5	9J469	PCV fitting O-ring seal
6	6A666	PCV valve
7	-	PCV valve O-ring seal (part of 6A666)

1. For additional information, refer to the procedures in this article.

POSITIVE CRANKCASE VENTILATION (PCV) VALVE

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

REMOVAL AND INSTALLATION

1. Disconnect the crankcase ventilation tube from the PCV valve.

CAUTION: A new positive crankcase ventilation (PCV) valve must be installed if removed from the valve cover. During removal, damage will occur to the locking mechanism on the PCV valve.

NOTE: To install, apply clean engine oil to the O-ring seal.

2. Rotate the PCV valve counterclockwise and remove from the valve cover.
    - Discard the PCV valve.
3. To install, reverse the removal procedure.

2008 GENERAL INFORMATION

Engine System - General Information - Edge & MKX

SPECIFICATIONS

MATERIAL

Item	Specification	Fill Capacity
Dye-Lite® Gasoline Engine Oil Leak Detection Dye 164-R3700 (Rotunda)	-	29.6 ml (1 oz)
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	-
Threadlock 262 TA-26	WSK-M2G351-A6	-

DESCRIPTION AND OPERATION

ENGINE

NOTE: When repairing engines, all parts must be contamination free. If contamination/foreign material is present when repairing an engine, premature engine failure may occur.

NOTE: Specifications show the expected minimum or maximum condition. Refer to the appropriate Engine article for the procedure.

NOTE: If a component fails to meet the specifications, it is necessary to refinish it or install a new component. Wear limits are provided as an aid to determine if the component can be refinished. A new component must be installed when any component fails to meet specifications and cannot be refinished.

NOTE: This service information contains information, steps and procedures that may not be specific to this engine.

This service information covers general procedures and diagnosis and testing of the engine system, except for exhaust emission control devices, which are covered in the **INTRODUCTION - GASOLINE ENGINES** article.

The engine incorporates the following features: Refer to the appropriate Engine article for the procedure.

- Crankcase ventilation or breather system
- Exhaust emission control system
- Evaporative Emission (EVAP) control system

Some engines incorporate a fail-safe cooling system. Refer to the appropriate Engine article for the procedure.

The engine, fuel system, ignition system, emissions system and exhaust system all affect exhaust emission levels and must be maintained according to the maintenance schedule. Refer to the scheduled Maintenance Guide.

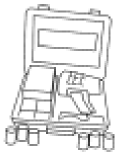
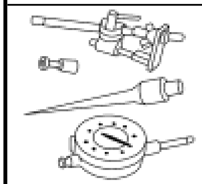
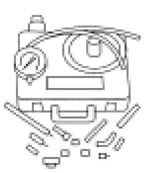
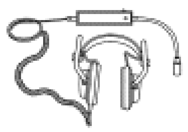
Correct engine identification is required to order parts. Refer to the appropriate Engine article for the procedure.

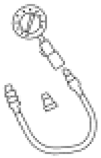
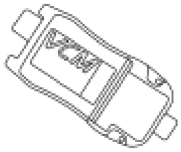
For complete vehicle and engine identification codes, refer to **IDENTIFICATION CODES** article.

DIAGNOSTIC TESTS

ENGINE

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST1300-A	12 Volt Master UV Diagnostic Inspection Kit	164-R0756 or equivalent (Leak Detector)
 ST1214-A	Dial Indicator Gauge with Holding Fixture	100-002 (TOOL-4201-C) or equivalent
 ST1296-A	Engine Cylinder Leak Detection/Air Pressurization Kit	014-00708 or equivalent
 ST2312-A	EngineEAR	107-R2100 or equivalent

 ST2311-A	EngineEAR/ChassisEAR	107-R2102 or equivalent
 ST1296-A	Oil Pressure Gauge	303-088 (T73L-6600-A)
 ST1299-A	Quick Disconnect Compression Tester	134-R0212 or equivalent
 ST1297-A	Vacuum/Pressure Tester	164-R0253 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

MATERIAL

Item	Specification
Dye-Lite® Gasoline Engine Oil Leak Detection Dye 164-R3700 (Rotunda)	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

There are 2 diagnostic paths that can be followed depending on the type of engine concern. Carry out Inspection and Verification - Engine Performance or Inspection and Verification - NVH.

Inspection and Verification - Engine Performance

1. Verify the customer concern by operating the engine to duplicate the condition.

2. Visually inspect for obvious signs of mechanical damage. Refer to the following chart.

VISUAL INSPECTION CHART

Mechanical
• Engine coolant leaks • Engine oil leaks • Fuel leaks • Damaged or severely worn parts • Loose mounting bolts, studs and nuts

3. If the inspection reveals obvious concerns that can be readily identified, repair as necessary.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

NOTE: The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
    - check the VCM connection to the vehicle.
    - check the scan tool connection to the VCM.
    - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no power to the scan tool.
6. If the scan tool does not communicate with the vehicle:
    - verify the ignition key is in the ON position.
    - verify the scan tool operation with a known good vehicle.
    - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM.
9. If the DTCs retrieved are related to the concern, go to the DTC Chart, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **SYMPTOM CHART - ENGINE** table.

Inspection and Verification - NVH

1. NVH symptoms should be identified using the diagnostic tools and techniques that are available. For a

list of these techniques, tools, an explanation of their uses and a glossary of common terms, refer to **NOISE, VIBRATION AND HARSHNESS** article.

2. Verify the customer concern by operating the engine to duplicate the condition.
3. Check the engine oil level and check the oil for contamination. Low engine oil level or contaminated oil are a common cause of engine noise. If the oil is contaminated, the source of the contamination must be identified and repaired as necessary.
4. Visually inspect for obvious signs of mechanical damage. Refer to the following chart.

VISUAL INSPECTION CHART

Mechanical
• Loose mounting bolts, studs and nuts • Damaged or leaking powertrain mounts • Damaged or disconnected vacuum hoses • Obstruction of cooling fan • Obstruction of Front End Accessory Drive (FEAD) • Damaged or disconnected air intake components

5. If the inspection reveals obvious concerns that can be readily identified, repair as necessary.

NOTE: Make sure to use the latest scan tool software release.

6. If the cause is not visually evident, connect the scan tool to the DLC.

NOTE: The VCM LED prove out confirms power and ground from the DLC are provided to the VCM.

7. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no power to the scan tool.
8. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
9. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
10. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM.

11. If the DTCs retrieved are related to the concern, go to the DTC Chart, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
12. If no DTCs related to the concern are retrieved, continue the inspection and verification if a noise concern is related to the engine. For vibration concerns and noise concerns such as powertrain mounts, air intake system and starter Go to **SYMPTOM CHART - NVH** table.

    In some cases, a noise may be a normal characteristic of that engine type. In other cases the noise may require further investigation. Comparing the noise to a similar year/model vehicle equipped with the same engine will aid in determining if the noise is normal or abnormal.

    Once a customer concern has been identified as an abnormal engine noise, it is critical to determine the location of the specific noise. Use the EngineEAR/ChassisEAR or stethoscope (the noise will always be louder closer to the noise source) to isolate the location of the noise to one of the following:

    - Fuel injector(s)
    - Upper end of engine
    - Lower end of engine
    - Front of engine
    - Rear of engine

    Fuel injector noise - A common source of an engine ticking noise can be related to the fuel injector(s). This is normal engine noise that can be verified by listening to another vehicle. If the injector noise is excessive or irregular, use the EngineEAR/ChassisEAR or stethoscope to isolate the noise to a specific fuel injector.

    Upper end engine noise - A common source of upper end engine noise (ticking, knocking or rattle) include the camshaft(s) and valve train. Upper end engine noise can be determined using the EngineEAR/ChassisEAR or stethoscope on the valve cover bolts. If the noise is loudest from the valve cover bolts, then the noise is upper end. The EngineEAR/ChassisEAR or stethoscope can be used to further isolate the noise to the specific cylinder bank and cylinder. Removal of the valve covers will be required to pinpoint the source of the noise.

    Lower end engine noise - A common source of lower end engine noise (ticking or knocking) include the crankshaft, connecting rod(s) and bearings. Lower end noises can be determined by using the oil pan or cylinder block lug bosses. If the noise is loudest from these areas, then the noise is lower end. If an engine noise is isolated to the lower end, some disassembly of the engine may be required to inspect for damage or wear.

    Front of engine noise - A common source of noise from the front of the engine (squeal, chirp, whine or hoot) is the Front End Accessory Drive (FEAD) components. To isolate FEAD noise, carry out the Engine Accessory Test, refer to **NOISE, VIBRATION AND HARSHNESS** article.

    Some other noises from the front of the engine (ticking, tapping or rattle) may be internal to the engine. Use the EngineEAR/ChassisEAR or stethoscope on the engine front cover to determine if the noise is internal to the engine. Removal of the engine front cover may be necessary to inspect internal engine components.

Rear of engine noise - A common source of noise from the rear of the engine (knocking) is the flywheel/flexplate. Inspection of the flywheel/flexplate will be necessary.

If equipped, the Rear End Accessory Drive (READ) can also be a source of noise from the rear of the engine (squeal or chirp). The READ consists of the coolant pump and belt.

Some engines have timing drive components at the rear of the engine and may be the source of noise (ticking, knocking or rattle). Use the EngineEAR/ChassisEAR or stethoscope on the rear of the engine if the noise is suspected to be internal to the engine. Some disassembly of the engine may be required to inspect for damage or wear.

13. After the noise is localized, note the characteristics of the noise, including type of noise, frequency and conditions when the noise occurs and Go to **SYMPTOM CHART - NVH** table.

Symptom Chart - Engine Performance

SYMPTOM CHART - ENGINE PERFORMANCE

Condition	Possible Sources	Action
• Difficult starting	• Inoperative or damaged ignition system • Air or vacuum leak • Inoperative or damaged fuel system • Inoperative or damaged starting system	• Refer to the appropriate Engine article for the procedure. REFER to the **Introduction - Gasoline Engines** article.
-	• Damaged charging system/battery	• REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
-	• Burnt valve	• INSTALL a new valve in the cylinder head. TEST the system for normal operation after the repair.
-	• Worn piston • Worn piston rings • Worn cylinder	• INSTALL a new short block. TEST the system for normal operation after the repair.
-	• Damaged head gasket	• INSTALL a new cylinder head gasket. TEST the system for normal operation after the repair.
-	• Inoperative or damaged cooling system	• REFER to **ENGINE COOLING** article.
-	• Fail-safe cooling invoked (if equipped)	• REFER to the **Introduction - Gasoline Engines** article.

• Poor idling	• Vacuum leaks	• Refer to the appropriate Engine article for the procedure. REFER to the **Introduction - Gasoline Engines** article.
-	• Inoperative or damaged ignition system	• REFER to **ENGINE IGNITION - 3.5L** article.
-	• Inoperative or damaged cooling system • Inoperative or damaged fuel system	• Refer to the appropriate Engine article for the procedure.
-	• Fail-safe cooling invoked (if equipped)	• REFER to the **Introduction - Gasoline Engines** article.
-	• Incorrect valve clearance	• ADJUST valve clearance. REFER to **ENGINE - 3.5L** article. TEST the system for normal operation after the repair.
-	• Incorrect valve-to-valve seat contact	• INSTALL a new cylinder head. TEST the system for normal operation after the repair.
-	• Damaged head gasket	• INSTALL a new cylinder head gasket. TEST the system for normal operation after the repair.
• Engine runs rough	• Inoperative or damaged fuel system • Air or vacuum leaks • Inoperative or damaged cooling system • Inoperative or damaged ignition system	• Refer to the appropriate Engine article for the procedure.
-	• Fail-safe cooling invoked (if equipped)	• REFER to the **Introduction - Gasoline Engines** article.
-	• Burnt or sticking valve	• INSTALL a new valve in the cylinder head. TEST the system for normal operation after the repair.
-	• Weak or broken valve spring	• INSTALL a new valve spring. TEST the system for normal operation after the repair.
-	• Carbon accumulation in combustion chamber	• ELIMINATE carbon buildup. TEST the system for normal operation after the repair.
• Excessive oil	• Leaking oil	• REPAIR oil leakage. TEST the system for

consumption		normal operation after the repair.
-	• Inoperative PCV system	• REPAIR or INSTALL new components as necessary. TEST the system for normal operation after the repair.
-	• Incorrect oil	• CHANGE oil to correct specification.
-	• Worn valve stem seal	• INSTALL a new valve stem seal. TEST the system for normal operation after the repair.
-	• Worn valve stem or valve guide	• INSTALL a new cylinder head. TEST the system for normal operation after the repair.
-	• Sticking piston rings • Worn piston ring groove • Worn piston or cylinder	• INSTALL a new short block. TEST the system for normal operation after the repair.
• Oil in coolant	• Leaking head gasket • Leaking oil cooler (if equipped) • Damaged cylinder block • Damaged cylinder head	• INSPECT the engine components. INSTALL new engine components as necessary. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
• Coolant in oil	• Leaking head gasket • Leaking oil cooler (if equipped) • Damaged cylinder block • Damaged cylinder head • Damaged coolant pump/seal/gasket	• INSPECT the engine components. INSTALL new engine components as necessary. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
• Insufficient power	• Inoperative or damaged ignition system • Air intake system blockage • Lubrication system blockage • Inoperative or damaged fuel system	• Refer to the appropriate Engine article for the procedure. REFER to the **Introduction - Gasoline Engines** article.
-	• Oil level too high	• DRAIN oil to correct level. TEST the system

		for normal operation after the repair.
-	• Incorrect engine oil	• INSTALL correct specification engine oil. TEST the system for normal operation after the repair.
-	• Excessive accessory drive belt loading • Inoperative or damaged cooling system	• Refer to the appropriate Engine article for the procedure.
-	• Fail-safe cooling invoked (if equipped)	• REFER to the **Introduction - Gasoline Engines** article.
-	• Damaged or plugged exhaust system	• INSPECT exhaust system.
-	• Incorrect tire size	• REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.
-	• Dragging brakes	• REFER to **BRAKE SYSTEM - GENERAL INFORMATION** article.
-	• Slipping transmission	• REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article.
-	• Incorrect valve clearance	• ADJUST valve clearance. REFER to **ENGINE - 3.5L** article. TEST the system for normal operation after the repair.
-	• Worn or damaged valve tappet	• INSTALL a new valve tappet. TEST the system for normal operation after the repair.
-	• Damaged valve guide • Compression leakage at valve seat • Seized valve stem	• INSTALL a new cylinder head assembly. TEST the system for normal operation after the repair.
-	• Weak or broken valve spring	• INSTALL a new valve spring. TEST the system for normal operation after the repair.
-	• Worn or damaged cam	• INSTALL a new camshaft. TEST the system for normal operation after the repair.
-	• Damaged head gasket	• INSTALL a new head gasket. TEST the system for normal operation after the repair.
-	• Cracked or distorted cylinder head	• INSTALL a new cylinder head assembly. TEST the system for normal operation after the repair.
-	• Damaged, worn or sticking piston ring(s)	• INSTALL a new short block. TEST the

	• Worn or damaged piston	system for normal operation after the repair.

Symptom Chart - NVH

NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible that any one of multiple systems may be the cause of the symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.

SYMPTOM CHART - NVH

Condition	Possible Sources	Action
• Drone type noise	• Powertrain mount(s)	• CARRY OUT the **Powertrain/Drivetrain Mount Neutralizing** procedure. TEST the system for normal operation after the repair.
• Drumming noise - occurs inside the vehicle during idle or high idle, hot or cold. Very low-frequency drumming is very RPM dependent	• Engine vibration excites the body resonances inducing interior noise	• CARRY OUT the **Powertrain/Drivetrain Mount Neutralizing** procedure. TEST the system for normal operation after the repair.
• Engine drumming noise - accompanied by vibration	• Powertrain mount(s)	• CARRY OUT the **Powertrain/Drivetrain Mount Neutralizing** procedure. TEST the system for normal operation after the repair.
• Rattle - occurs at idle or at light acceleration from a stop	• Powertrain mount(s)	• CHECK the powertrain mounts for damage. INSTALL new mounts as necessary. For engine, REFER to **ENGINE - 3.5L** article. For transaxle, REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article. TEST the system for normal operation after the repair.
• Whine/moan type noise - pitch increases or	• Powertrain mount(s)	• CHECK the powertrain mounts for damage. INSTALL new mounts as necessary. For engine, REFER to **ENGINE - 3.5L** article. For transaxle, REFER to

changes with vehicle speed		**AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article. TEST the system for normal operation after the repair.
• Clunk - occurs when shifting from PARK or between REVERSE and DRIVE	• Powertrain mount(s)	• CHECK the powertrain/drivetrain mounts for damage. INSTALL new mounts as necessary. For engine, REFER to **ENGINE - 3.5L** article. For transaxle, REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article. TEST the system for normal operation after the repair.
-	• Idle speed is too high	• CHECK for the correct idle speed.
• Accessory drive bearing hoot - occurs at idle or high idle in cold temperatures of approximately 4° C (40°F) or colder at the first start of the day	• Accessory drive idler or tensioner pulley bearing is experiencing stick/slip between ball bearings and the bearing race	• CARRY OUT the engine cold soak procedure. REFER to **NOISE, VIBRATION AND HARSHNESS** article. • PLACE the EngineEAR probe directly on the idler/tensioner center post or bolt to verify which bearing is making the noise. INSTALL new parts as necessary. REFER to **ACCESSORY DRIVE** article. TEST the system for normal operation after the repair.
• Accessory drive belt noise, squeal or chirping	• Defective/worn or incorrect accessory drive belt • Misaligned pulley(s) • Pulley runout • Damaged or worn accessory drive component or idler • Fluid contamination of the accessory drive belt or pulleys • Damaged or worn accessory drive belt tensioner • Damaged pulley grooves	• CARRY OUT the Engine Accessory Test. REFER to **NOISE, VIBRATION AND HARSHNESS** article. INSPECT components and INSTALL new parts as necessary. REFER to **ACCESSORY DRIVE** article. TEST the system for normal operation after the repair.
• Clunking noise	• Coolant pump has excessive end play or	• CHECK the coolant pump for excessive end play. INSPECT the coolant pump for imbalance with the drive belt off. INSTALL a new coolant pump as

	imbalance	necessary. REFER to **ENGINE COOLING** article. TEST the system for normal operation after the repair.
• Whine or moaning noise	• Air intake system	• CHECK the air cleaner and ducts for correct fit. INSPECT the air intake system for leaks or damage. REPAIR as necessary. TEST the system for normal operation after the repair.
• Whistling noise - normally accompanied with poor idle condition	• Air intake system	• CHECK the air intake ducts, air cleaner, throttle body and vacuum hoses for leaks and correct fit. REPAIR or ADJUST as necessary. TEST the system for normal operation after the repair.
• Hissing noise - occurs during idle or high idle that is apparent with the hood open	• Vacuum leak	• USE the Ultrasonic Leak Detector/EngineEAR to locate the source. SCAN the air intake system from the inlet to each cylinder intake port. DISCARD the leaking parts, and INSTALL a new component. TEST the system for normal operation after the repair.
-	• Vehicles with a plastic intake manifold	• Acceptable condition. Some plastic manifolds exhibit this noise, which is the effect of the plastic manifold.
• Grinding noise - occurs during engine cranking	• Incorrect starter motor mounting	• INSPECT the starter motor for correct mounting. REPAIR as necessary. REFER to **STARTING SYSTEM** article. TEST the system for normal operation after the repair.
-	• Starter motor	• CHECK the starter motor. INSTALL a new starter motor as necessary. REFER to **STARTING SYSTEM** article. TEST the system for normal operation after the repair.
-	• Incorrect starter motor drive engagement	• INSPECT the starter motor drive for wear or damage. INSTALL a new starter motor as necessary. REFER to **STARTING SYSTEM** article. TEST the system for normal operation after the repair. • INSPECT the flexplate for wear or damage. INSTALL a new flexplate as necessary. REFER to **ENGINE - 3.5L** article. TEST the system for normal operation after the repair.
• Engine noise,		• CHECK for obvious signs of damage or

front of engine - knocking noise from lower front of engine	• Damaged or separated crankshaft pulley/damper	wobble during operation. INSTALL new as necessary. REFER to **ENGINE - 3.5L** article. TEST the system for normal operation after the repair.
• Engine noise, front of engine - ticking, tapping or rattling noise from the front of the engine	• Timing drive components	• REMOVE the accessory drive belt. REFER to **ACCESSORY DRIVE** article. • USE the EngineEAR to isolate the noise to the engine front cover. • REMOVE the engine front cover and INSPECT the timing drive components. INSTALL new parts as necessary. REFER to **ENGINE - 3.5L** article. TEST the system for normal operation after the repair.
• Engine noise, upper end - ticking noise near the fuel rail and intake manifold	• Fuel rail clip	• CHECK for loose or damaged fuel rail clip (s). REPAIR as necessary. TEST the system for normal operation after the repair.
-	• Fuel injector	• USE the EngineEAR to isolate the noisy injector(s). INSTALL a new injector(s) as necessary. REFER to **FUEL CHARGING AND CONTROLS - 3.5L** article. TEST the system for normal operation after the repair.
• Engine noise, upper end - occurs mostly with a warm engine at light/medium acceleration	• Worn or damaged spark plugs	• REMOVE the spark plugs. INSPECT and INSTALL new as necessary. REFER to **ENGINE IGNITION - 3.5L** article. TEST the system for normal operation after the repair.
-	• Carbon accumulation in combustion chamber	• Bore scope the cylinder. ELIMINATE carbon buildup. TEST the system for normal operation after the repair.
• Engine noise, upper end - rattling noise from the valve train. Worse when the engine is cold	• Low oil level	• CHECK the oil level. FILL as necessary.
-	• Thin or diluted oil	• INSPECT the oil for contamination. If the oil is contaminated, CHECK for the source. REPAIR as necessary. CHANGE the oil and filter. TEST the system for normal

		operation after the repair.
-	• Low oil pressure	• CARRY OUT an oil pressure test. If not within specifications, REMOVE the engine oil pan. REFER to **ENGINE - 3.5L** article. INSPECT for a blocked oil pick up tube. TEST the system for normal operation after the repair.
-	• Worn valve train components	• CARRY OUT the Valve Train Analysis Component Test. INSTALL new parts as necessary. TEST the system for normal operation after the repair.
-	• Worn valve guides	• CARRY OUT the Valve Guide Inner Diameter procedure.
-	• Excessive runout of the valve seats on the valve face	• CARRY OUT the Valve Seat Inspection procedure.
• Engine noise, upper end - pinging noise	• Gasoline octane too low	• VERIFY with customer the type of gasoline used. CORRECT as necessary. TEST the system for normal operation after the repair.
-	• Knock Sensor (KS) operation	• CHECK the KS. INSTALL a new KS as necessary. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation after the repair.
-	• Incorrect spark timing	• CHECK the spark timing. REPAIR as necessary. TEST the system for normal operation after the repair.
-	• High operating temperature	• INSPECT the cooling system for leaks. CHECK the coolant level. REFILL as necessary. CHECK the coolant for the correct mix ratio. DRAIN and REFILL as needed. VERIFY the engine operating temperature is within specifications. REPAIR as necessary. TEST the system for normal operation after the repair.
-	• Spark plug	• CHECK the spark plugs. INSTALL new spark plugs as necessary. TEST the system for normal operation after the repair.
-	• Catalytic converter	• Acceptable noise.
• Engine noise, lower end - ticking or		• USE the EngineEAR to verify the oil pump as the source of the noise at low RPM.

knocking noise near the oil filter adapter	• Oil pump	REPAIR as necessary. REFER to **ENGINE - 3.5L** article. TEST the system for normal operation after the repair.
• Engine noise, lower end - light knocking noise, also described as piston slap. Noise is most noticeable when the engine is cold with light to medium acceleration. The noise disappears as the engine warms	• Excessive clearance between the piston and the cylinder wall	• INSTALL a new short block. REFER to **ENGINE - 3.5L** article. TEST the system for normal operation after the repair.
• Engine noise, lower end - light double knock or sharp rap sound. Occurs mostly with a warm engine at idle or low speeds in drive. Increases in relation to engine load. Associated with a poor lubrication history	• Excessive clearance between the piston and the piston pin	• INSTALL a new short block. REFER to **ENGINE - 3.5L** article. TEST the system for normal operation after the repair.
• Engine noise, lower end - light knocking noise. The noise is most noticeable when the engine is warm. The noise tends to decrease when the vehicle is coasting or in NEUTRAL	• Excessive clearance between the connecting rod bearings and the crankshaft	• INSTALL a new short block. REFER to **ENGINE - 3.5L** article. TEST the system for normal operation after the repair.
• Engine noise, lower end - deep knocking noise. The noise is most noticeable when the engine is	• Worn or damaged crankshaft main	• INSTALL a new short block. REFER to **ENGINE - 3.5L** article. TEST the system

warm, at lower RPM and under a light load and then at float	bearings	for normal operation after the repair.
• Engine noise, rear of engine - knocking noise at rear of engine	• Damaged flywheel/flexplate	• CARRY OUT the Flexplate Inspection procedure.
• Engine vibration - vibration felt at all times	• Excessive engine pulley runout	• CARRY OUT the Engine Accessory Test. REFER to **NOISE, VIBRATION AND HARSHNESS** article. INSTALL a new engine pulley as necessary. REFER to **ENGINE - 3.5L** article. TEST the system for normal operation after the repair.
-	• Damaged or worn accessory component	• CARRY OUT the Engine Accessory Test. REPAIR or INSTALL a new component as necessary. TEST the system for normal operation after the repair.
• Engine vibration - at idle, a low-frequency vibration (5-20 Hz) or mild shake that is felt through the seat/floorpan	• Cylinder misfire	• Using the scan tool, CARRY OUT the cylinder power balance and the relative compression test. REPAIR as necessary. REFER to **ENGINE - 3.5L** article. TEST the system for normal operation after the repair.
-	• Engine or torque converter out of balance	• VERIFY the torque converter-to-crankshaft pilot clearance is correct. REPAIR as necessary. RE-INDEX the torque converter on the flexplate by 120 degrees for a 3-bolt converter or 180 degrees for a 4-bolt converter. REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article for the transaxle. TEST the system for normal operation after the repair.
• Engine vibration - is felt with increases and decreases in engine RPM	• Powertrain mount(s)	• CHECK the powertrain mounts for damage. INSTALL new mounts as necessary. For engine, REFER to **ENGINE - 3.5L** article. For the transaxle, REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article. TEST the system for normal operation after the repair.
-	• Engine or transmission	• INSPECT the powertrain/drivetrain for correct clearances. REPAIR as necessary.

	grounded to chassis	TEST the system for normal operation after the repair.
• Engine vibration - increases intensity as the engine RPM is increased	• Engine out-of-balance	• CARRY OUT the Neutral Engine Run-Up (NERU) Test. REFER to **NOISE, VIBRATION AND HARSHNESS** article. ROTATE the torque converter, 120 degrees for 3-bolt or 180 degrees for 4-bolt. INSPECT the torque converter pilot outer diameter-to-crankshaft pilot inner diameter. REPAIR as necessary. REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article. TEST the system for normal operation after the repair.
• Engine vibration - mostly at coast/neutral coast. Condition improves with vehicle acceleration	• Combustion instability	• CHECK the ignition system. INSTALL new components as necessary. REFER to **ENGINE IGNITION - 3.5L** article. TEST the system for normal operation after the repair.
• Engine vibration or shudder - occurs with light to medium acceleration above 56 km/h (35 mph)	• Worn or damaged spark plugs	• INSPECT the spark plugs for cracks, high resistance or broken insulators. INSTALL a new spark plug(s) as necessary. REFER to **ENGINE IGNITION - 3.5L** article. TEST the system for normal operation after the repair.
-	• Plugged fuel injector	• REPAIR or INSTALL a new injector as necessary. REFER to **FUEL CHARGING AND CONTROLS - 3.5L** article. TEST the system for normal operation after the repair.
-	• Contaminated fuel	• INSPECT the fuel for contamination. DRAIN the fuel system and refill. REFER to **FUEL SYSTEM - GENERAL INFORMATION** article.

Component Tests

The following component tests are used to diagnose engine concerns.

Engine Oil Leaks

NOTE:	**When diagnosing engine oil leaks, the source of the leak must be positively identified prior to repair. If the vehicle is driven extensively between adding the**

fluorescent additive and performing the leak test, fan air or wind can spread the leaking oil and make identifying the location of the leak difficult.

Prior to carrying out this procedure, clean the cylinder block, cylinder heads, valve covers, oil pan and flywheel with a suitable solvent to remove all traces of oil.

Engine Oil Leaks - Fluorescent Oil Additive Method

Use the 12 Volt Master UV Diagnostic Inspection Kit to carry out the following procedure for oil leak diagnosis.

1. Add 29.6 ml (1 oz) of gasoline engine oil dye to a minimum of 0.47L (1/2 qt) and a maximum of 0.95L (1 qt) engine oil and fill through the engine oil fill. Thoroughly premix the gasoline engine oil dye or it will not have enough time to reach the crankcase, oil galleries and seal surfaces during this particular 15 minute test. The additive must be mixed well with oil and added through the oil fill. Check the level on the oil level indicator to determine what amount of oil to premix. If it is in the middle of the crosshatch area or below the full mark, use 0.95L (1 qt). If it is at the full mark, use 0.47L (1/2 qt).
2. Run the engine for 15 minutes. Stop the engine and inspect all seal and gasket areas for leaks using the 12 Volt Master UV Diagnostic Inspection Kit. A clear bright yellow or orange area will identify the leak. For extremely small leaks, several hours may be required for the leak to appear.
3. At the end of test, make sure the oil level is within the upper and lower oil indicator marks. Remove oil as necessary if it registers above the full mark.

Leakage Points - Underhood

Examine the following areas for oil leakage:

- Valve cover gaskets
- Cylinder head gaskets
- Oil cooler, if equipped
- Oil filter adapter
- Engine front cover
- Oil filter adapter and filter body
- Oil level indicator tube connection
- Engine Oil Pressure (EOP) switch

Leakage Points - Under Engine, With Vehicle on Hoist

Examine the following areas for oil leakage:

- Oil pan gaskets
- Oil pan sealer
- Engine front cover gasket

- Crankshaft front seal
- Crankshaft rear oil seal
- Oil filter adapter and filter body
- Oil cooler, if equipped

Leakage Points - With Transmission and Flywheel Removed

Examine the following areas for oil leakage:

- Crankshaft rear oil seal
- Rear main bearing cap parting line
- Flexplate mounting bolt holes (with flexplate installed)
- Pipe plugs at the end of oil passages

Oil leaks at crimped seams in sheet metal parts and cracks in cast or stamped parts can be detected when using the dye method.

Compression Test

1. Make sure the oil in the crankcase is of the correct viscosity and at the correct level and that the battery is correctly charged. Operate the vehicle until the engine is at normal operating temperature. Turn the ignition switch to the OFF position, then remove all the spark plugs.
2. Set the throttle plates in the wide-open position.
3. Install a compression gauge such as the Compression Tester in the No. 1 cylinder.
4. Install an auxiliary starter switch in the starting circuit. With the ignition switch in the OFF position, and using the auxiliary starter switch, crank the engine a minimum of 5 compression strokes and record the highest reading. Note the approximate number of compression strokes necessary to obtain the highest reading.
5. Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.

Compression Test - Test Results

The indicated compression pressures are considered within specification if the lowest reading cylinder is at least 75% of the highest reading. Refer to the COMPRESSION PRESSURE LIMIT CHART.

COMPRESSION PRESSURE LIMIT CHART

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
924 kPa (134 psi)	696 kPa (101 psi)	1,131 kPa (164 psi)	848 kPa (123 psi)	1,338 kPa (194 psi)	1,000 kPa (146 psi)	1,544 kPa (224 psi)	1,158 kPa (168 psi)
938 kPa (136 psi)	703 kPa (102 psi)	1,145 kPa (166 psi)	855 kPa (124 psi)	1,351 kPa (196 psi)	1,014 kPa (147 psi)	1,558 kPa (226 psi)	1,165 kPa (169 psi)

952 kPa (138 psi)	717 kPa (104 psi)	1,158 kPa (168 psi)	869 kPa (126 psi)	1,365 kPa (198 psi)	1,020 kPa (148 psi)	1,572 kPa (228 psi)	1,179 kPa (171 psi)
965 kPa (140 psi)	724 kPa (106 psi)	1,172 kPa (170 psi)	876 kPa (127 psi)	1,379 kPa (200 psi)	1,034 kPa (150 psi)	1,586 kPa (230 psi)	1,186 kPa (172 psi)
979 kPa (142 psi)	738 kPa (107 psi)	1,186 kPa (172 psi)	889 kPa (129 psi)	1,303 kPa (202 psi)	1,041 kPa (151 psi)	1,600 kPa (232 psi)	1,200 kPa (174 psi)
933 kPa (144 psi)	745 kPa (109 psi)	1,200 kPa (174 psi)	903 kPa (131 psi)	1,407 kPa (204 psi)	1,055 kPa (153 psi)	1,055 kPa (153 psi)	1,207 kPa (175 psi)
1,007 kPa (146 psi)	758 kPa (110 psi)	1,214 kPa (176 psi)	910 kPa (132 psi)	1,420 kPa (206 psi)	1,062 kPa (154 psi)	1,627 kPa (154 psi)	1,220 kPa (177 psi)
1,020 kPa (148 psi)	765 kPa (111 psi)	1,227 kPa (178 psi)	917 kPa (133 psi)	1,434 kPa (208 psi)	1,075 kPa (156 psi)	1,641 kPa (238 psi)	1,227 kPa (178 psi)
1,034 kPa (150 psi)	779 kPa (113 psi)	1,241 kPa (180 psi)	931 kPa (135 psi)	1,448 kPa (210 psi)	1,083 kPa (157 psi)	1,655 kPa (240 psi)	1,241 kPa (180 psi)
1,048 kPa (152 psi)	786 kPa (114 psi)	1,255 kPa (182 psi)	936 kPa (136 psi)	1,462 kPa (212 psi)	1,089 kPa (158 psi)	1,669 kPa (242 psi)	1,248 kPa (181 psi)
1,062 kPa (154 psi)	793 kPa (115 psi)	1,269 kPa (184 psi)	952 kPa (138 psi)	1,476 kPa (214 psi)	1,103 kPa (160 psi)	1,682 kPa (244 psi)	1,262 kPa (183 psi)
1,076 kPa (156 psi)	807 kPa (117 psi)	1,282 kPa (186 psi)	965 kPa (140 psi)	1,489 kPa (216 psi)	1,117 kPa (162 psi)	1,696 kPa (246 psi)	1,269 kPa (184 psi)
1,089 kPa (158 psi)	814 kPa (118 psi)	1,296 kPa (188 psi)	972 kPa (141 psi)	1,503 kPa (218 psi)	1,124 kPa (163 psi)	1,710 kPa (248 psi)	1,202 kPa (186 psi)
1,103 kPa (160 psi)	827 kPa (120 psi)	1,310 kPa (190 psi)	979 kPa (142 psi)	1,517 kPa (220 psi)	1,138 kPa (165 psi)	1,724 kPa (250 psi)	1,289 kPa (187 psi)
1,110 kPa (161 psi)	834 kPa (121 psi)	1,324 kPa (192 psi)	993 kPa (144 psi)	1,631 kPa (222 psi)	1,145 kPa (166 psi)	-	-

If one or more cylinders reads low, squirt approximately one tablespoon of engine oil meeting Ford specification on top of the pistons in the low-reading cylinders. Repeat the compression pressure check on these cylinders.

Compression Test - Interpreting Compression Readings

1. If compression improves considerably, piston rings are worn or damaged.
2. If compression does not improve, valves are sticking or not seating correctly.
3. If 2 adjacent cylinders indicate low compression pressures and squirting oil on each piston does not increase compression, the head gasket may be leaking between cylinders. Engine oil or coolant in cylinders could result from this condition.

   Use the Compression Pressure Limit Chart when checking cylinder compression so that the lowest reading is within 75% of the highest reading.

Cylinder Leakage Detection

When a cylinder produces a low reading, use of the Engine Cylinder Leak Detection/Air Pressurization Kit will be helpful in pinpointing the exact cause.

The leakage detector is inserted in the spark plug hole, the piston is brought up to Top Dead Center (TDC) on the compression stroke, and compressed air is admitted.

Once the combustion chamber is pressurized, a special gauge included in the kit will read the percentage of leakage. Leakage exceeding 20% is excessive.

While the air pressure is retained in the cylinder, listen for the hiss of escaping air. A leak at the intake valve will be heard in the Throttle Body (TB). A leak at the exhaust valve can be heard at the tailpipe. Leakage past the piston rings will be audible at the PCV connection. If air is passing through a blown head gasket to an adjacent cylinder, the noise will be evident at the spark plug hole of the cylinder into which the air is leaking. Cracks in the cylinder block or gasket leakage into the cooling system may be detected by a stream of bubbles in the radiator.

Excessive Engine Oil Consumption

Nearly all engines consume oil, which is essential for normal lubrication of the cylinder bore walls and pistons and rings. Determining the level of oil consumption may require testing by recording how much oil is being added over a given set of miles.

Customer driving habits greatly influence oil consumption. Mileage accumulated during towing or heavy loading generates extra heat. Frequent short trips, stop-and-go type traffic or extensive idling, prevent the engine from reaching normal operating temperature. This prevents component clearances from reaching specified operating ranges.

The following diagnostic procedure may be utilized to determine internal oil consumption. Make sure that the concern is related to internal oil consumption, and not external leakage, which also consumes oil. Verify there are no leaks before carrying out the test. Once verified, the rate of internal oil consumption can be tested.

A new engine may require extra oil in the early stages of operation. Internal piston-to-bore clearances and sealing characteristics improve as the engine breaks in. Engines are designed for close tolerances and do not require break-in oils or additives. Use the oil specified in the Owner's Literature. Ambient temperatures may determine the oil viscosity specification. Verify that the correct oil is being used for the vehicle in the geographic region in which it is driven.

Basic Pre-checks

1. For persistent complaints of oil consumption, interview the customer to determine the oil consumption characteristics. If possible, determine the brand and grade of oil currently in the oil pan. Look at the oil filter or oil-change station tags to determine if Ford-recommended maintenance schedules have been followed. Make sure that the oil has been changed at the specified mileage intervals. If vehicle mileage is past the first recommended drain interval, the OEM production filter should have been changed.
2. Ask how the most current mileage was accumulated. That is, determine whether the vehicle was driven under the following conditions:
   - Extended idling or curbside engine operation
   - Stop-and-go traffic or taxi operation

- Towing a trailer or vehicle loaded heavily
- Frequent short trips (engine not up to normal operating temperature)
- Excessive throttling or high engine-RPM driving

3. Verify that there are no external leaks. If necessary, review the diagnostic procedure under **ENGINE OIL LEAKS** in Diagnosis and Testing .
4. Inspect the crankcase ventilation system for:
   - disconnected hoses at the valve cover or TB.
   - loose or missing valve cover fill cap.
   - missing or incorrectly seated engine oil level indicator.
   - incorrect or dirty PCV valve.
   - a PCV valve grommet unseated in the valve cover (if so equipped).
5. Inspect for signs of sludge. Sludge affects PCV performance and can plug or restrict cylinder head drainback wells. It can also increase oil pressure by restricting passages and reducing the drainback capability of piston oil control rings. Sludge can result from either excessive water ingestion in the crankcase or operation at extremely high crankcase temperatures.
6. Inspect the air filter for dirt, sludge or damage. A hole in the filter element will allow unfiltered air to bypass into the air induction system. This can cause premature internal wear (engine dusting), allowing oil to escape past rings, pistons, valves and guides.
7. If the engine is hot or was recently shut down, wait at least 5 minutes to allow the oil to drain back. Ask the customer if this requirement has been followed. Adding oil without this wait period can cause an overfill condition, leading to excessive oil consumption and foaming, which may cause engine damage.
8. Make sure the oil level indicator (dipstick) is correctly and fully seated in the indicator tube. Remove the oil level indicator and record the oil level.

Detailed Pre-checks

1. Check the thermostat opening temperature to make sure that the cooling system is operating at the specified temperature. If it is low, internal engine parts are not running at specified internal operating clearances.
2. Verify the spark plugs are not oil saturated. Oil leaking into one or more cylinders will appear as an oil soaked condition on the plug. If a plug is saturated, a compression check may be necessary at the conclusion of the oil consumption test.

Oil Consumption Test

Once all of the previous conditions are met, carry out an oil consumption test.

1. Drain the engine oil and remove the oil filter. Install a new manufacturer-specified oil filter. Make sure the vehicle is positioned on a level surface. Refill the oil pan to a level **one liter (quart) less** than the specified fill level, using manufacturer-specified oil.
2. Run the engine for 3 minutes (if hot) or 10 minutes (if cold). Allow for a minimum 5-minute drainback period and then record the oil level shown on the oil level indicator. Place a mark on the backside of the oil level indicator noting the oil level location.

3. Add the final one liter (quart) to complete the normal oil fill. Restart the engine and allow it to idle for 2 minutes. Shut the engine down.
4. After a 5-minute drainback period, record the location of the oil level again. Mark the oil level indicator with the new oil level location. (Note: Both marks should be very close to the MIN-MAX upper and lower limits or the upper and lower holes on the oil level indicator. These marks will exactly measure the engine's use of oil, with a one quart differential between the new marks.) Demonstrate to the customer that the factory-calibrated marks on the oil level indicator are where the oil should fall after an oil change with the specified fill amount. Explain however, that this may vary slightly between MIN-MAX or the upper and lower holes on the oil level indicator.
5. Record the vehicle mileage.
6. Advise the customer that oil level indicator readings must be taken every 320 km (200 mi) or weekly, using the revised marks as drawn. Remind the customer that the engine needs a minimum 5-minute drainback for an accurate reading and that the oil level indicator must be firmly seated in the tube prior to taking the reading.
7. When the subsequent indicator readings demonstrate a full liter (quart) has been used, record the vehicle mileage. The mileage driven between the 2 readings should not be less than 2,414 km (1,500 mi). The drive cycle the vehicle has been operated under must be considered when making this calculation. It may be necessary to have the customer bring the vehicle in for a periodic oil level indicator reading to closely monitor oil usage.

Post Checks, Evaluation and Corrective Action

1. If test results indicate excessive oil consumption, carry out a cylinder compression test. The cylinder compression test should be carried out with a fully charged battery and all spark plugs removed. See the **COMPRESSION PRESSURE LIMIT CHART** for pressure range limits.
2. Compression should be consistent across all cylinders. Refer to **COMPRESSION TEST**. If compression tested within the specifications found in this service information, the excessive oil consumption may be due to wear on the valve guides, valves or valve seals.
3. A cylinder leak detection test can be carried out using an Engine Cylinder Leak Detection/Air Pressurization Kit. This can help identify valves, piston rings, or worn valve guides/valve stems, inoperative valve stem seals or other related areas as the source of oil consumption.

NOTE: **An oil-soaked appearance on the porcelain tips of the spark plugs also indicates excessive oil use. A typical engine with normal oil consumption will exhibit a light tan to brown appearance. See Spark Plug Analysis in this service information for details. A single or adjoining, multiple cylinder leak can be traced by viewing the tips.**

4. If an internal engine part is isolated as the root cause, determine if the repair will exceed cost limits and proceed with a repair strategy as required.
5. Once corrective action to engine is complete and verifying that all pre-check items were eliminated in the original diagnosis, repeat the Oil Consumption Test as described above and verify consumption results.

Intake Manifold Vacuum Test

Bring the engine to normal operating temperature. Connect the Vacuum/Pressure Tester to the intake manifold. Run the engine at the specified idle speed.

The vacuum gauge should read between 51-74 kPa (15-22 in-Hg) depending upon the engine condition and the altitude at which the test is conducted. Subtract 4.0193 kPa (1 in-Hg) from the specified reading for every 304.8 m (1,000 ft) of elevation above sea level.

The reading should be steady. If necessary, adjust the gauge damper control (where used) if the needle is fluttering rapidly. Adjust the damper until the needle moves easily without excessive flutter.

Intake Manifold Vacuum Test - Interpreting Vacuum Gauge Readings

A careful study of the vacuum gauge reading while the engine is idling will help pinpoint trouble areas. Always conduct other appropriate tests before arriving at a final diagnostic decision. Vacuum gauge readings, although helpful, must be interpreted carefully.

Most vacuum gauges have a normal band indicated on the gauge face.

The following are potential gauge readings. Some are normal; others should be investigated further.

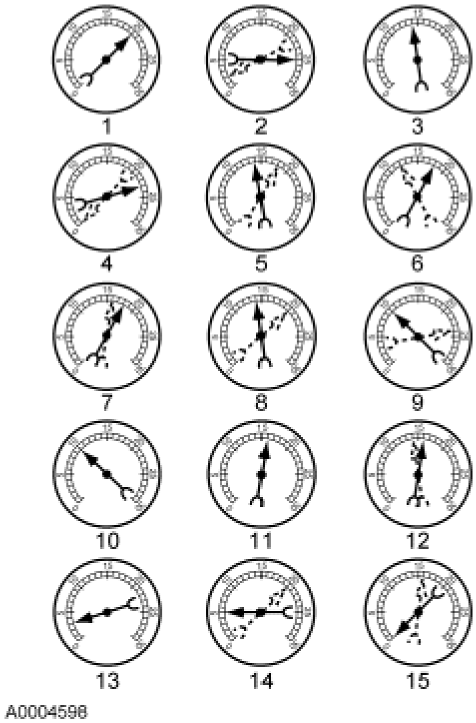


Fig. 1: Potential Vacuum Gauge Readings Chart
Courtesy of FORD MOTOR CO.

1. NORMAL READING: Needle between 51-74 kPa (15-22 in-Hg) and holding steady.
2. NORMAL READING DURING RAPID ACCELERATION AND DECELERATION: When the engine is rapidly accelerated (dotted needle), the needle will drop to a low reading (not to zero). When the

throttle is suddenly released, the needle will snap back up to a higher than normal figure.

3. NORMAL FOR HIGH-LIFT CAMSHAFT WITH LARGE OVERLAP: The needle will register as low as 51 kPa (15 in-Hg) but will be relatively steady. Some oscillation is normal.
4. WORN RINGS OR DILUTED OIL: When the engine is accelerated (dotted needle), the needle drops to 0 kPa (0 in-Hg). Upon deceleration, the needle runs slightly above 74 kPa (22 in-Hg).
5. STICKING VALVES: When the needle (dotted) remains steady at a normal vacuum but occasionally flicks (sharp, fast movement) down and back about 13 kPa (4 in-Hg), one or more valves may be sticking.
6. BURNED OR WARPED VALVES: A regular, evenly-spaced, downscale flicking of the needle indicates one or more burned or warped valves. Insufficient valve clearance will also cause this reaction.
7. POOR VALVE SEATING: A small but regular downscale flicking can mean one or more valves are not seating.
8. WORN VALVE GUIDES: When the needle oscillates over about a 13 kPa (4 in-Hg) range at idle speed, the valve guides could be worn. As engine speed increases, the needle will become steady if guides are responsible.
9. WEAK VALVE SPRINGS: When the needle oscillation becomes more violent as engine RPM is increased, weak valve springs are indicated. The reading at idle could be relatively steady.
10. LATE VALVE TIMING: A steady but low reading could be caused by late valve timing.
11. IGNITION TIMING RETARDING: Retarded ignition timing will produce a steady but somewhat low reading.
12. INSUFFICIENT SPARK PLUG GAP: When spark plugs are gapped too close, a regular, small pulsation of the needle can occur.
13. INTAKE LEAK: A low, steady reading can be caused by an intake manifold or throttle body gasket leak.
14. BLOWN HEAD GASKET: A regular drop of fair magnitude can be caused by a blown head gasket or warped cylinder head-to-cylinder block surface.
15. RESTRICTED EXHAUST SYSTEM: When the engine is first started and is idled, the reading may be normal, but as the engine RPM is increased, the back pressure caused by a clogged muffler, kinked tailpipe or other concerns will cause the needle to slowly drop to 0 kPa (0 in-Hg). The needle then may slowly rise. Excessive exhaust clogging will cause the needle to drop to a low point even if the engine is only idling.
16. When vacuum leaks are indicated, search out and correct the cause. Excess air leaking into the system will upset the fuel mixture and cause concerns such as rough idle, missing on acceleration or burned valves. If the leak exists in an accessory unit such as the power brake booster, the unit will not function correctly. Always fix vacuum leaks.

Oil Pressure Test

1. Disconnect and remove the oil pressure switch from the engine.
2. Connect the engine Oil Pressure Gauge to the oil pressure switch oil galley port.
3. Run the engine until normal operating temperature is reached.
4. Run the engine at the specified RPM and record the gauge reading.
5. The oil pressure should be within specifications; refer to the specification chart in the appropriate engine section.

6. If the pressure is not within specification, check the following possible sources:
   - Insufficient oil
   - Oil leakage
   - Worn or damaged oil pump
   - Oil pump screen cover and tube
   - Excessive main bearing clearance
   - Excessive connecting rod bearing clearance
   - Chain tensioner leak

Valve Train Analysis

The following component tests are used to diagnose valve train concerns.

Valve Train Analysis - Engine Off, Valve Cover Removed

Check for damaged or severely worn parts and correct assembly. Make sure correct parts are used with the static engine analysis as follows.

Valve Train Analysis - Camshafts and Valve Tappets

- Check for broken or damaged parts.
- Check for loose mounting bolts on camshaft caps.
- Check for worn or damaged valve tappets.

Valve Train Analysis - Valve Springs, Valve Tappets Removed

- Check for broken or damaged parts.

Valve Train Analysis - Valve Spring Retainer and Valve Spring Retainer Keys, Valve Tappets Removed

- Check for correct seating of the valve spring retainer key on the valve stem and in valve spring retainer.
- Check for correct seating on the valve stem.

Valve Train Analysis - Valves and Cylinder Head, Valve Tappets Removed

- Check for plugged oil drain-back holes.
- Check for worn or damaged valve tips.
- Check for missing or damaged valve stem seals or guide-mounted valve stem seal.
- Check for missing or worn valve spring seats.

Valve Train Analysis - Camshaft Lobe Lift

Check the lift of each camshaft lobe in consecutive order and make a note of the readings.

1. Remove the spark plugs. Refer to **ENGINE IGNITION - 3.5L** article.
2. Install the Dial Indicator Gauge with Holding Fixture so the rounded tip of the dial indicator is on top of the camshaft lobe and on the same plane as the valve tappet.
3. Rotate the crankshaft using a breaker bar and socket attached to the crankshaft pulley retainer bolt. Rotate the crankshaft until the base circle of the camshaft lobe is reached.

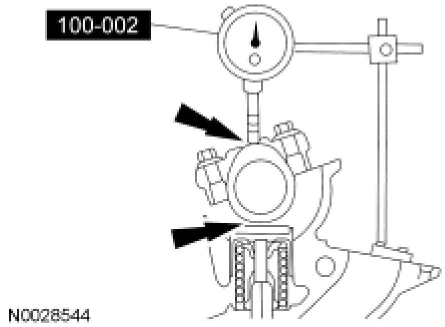


Fig. 2: Checking Camshaft Lobe Lift
Courtesy of FORD MOTOR CO.

4. Zero the dial indicator. Continue to rotate the crankshaft until the high-lift point of the camshaft lobe is in the fully-raised position (highest indicator reading).
5. To check the accuracy of the original dial indicator reading, continue to rotate crankshaft until the base circle is reached. The dial indicator reading should be zero. If zero reading is not obtained, repeat Steps 1 through 6.
6. If the lift on any lobe is below specified service limits, install a new camshaft and camshaft valve tappets.
7. Install the spark plugs. Refer to **ENGINE IGNITION - 3.5L** article.

GENERAL PROCEDURES

SPROCKETS

1. Inspect the sprockets for cracks and worn or chipped teeth.

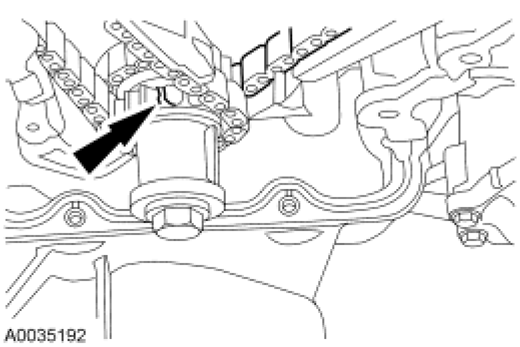


Fig. 3: Inspecting Sprockets For Damage
Courtesy of FORD MOTOR CO.

CAMSHAFT BEARING JOURNAL DIAMETER

NOTE: Refer to the appropriate service information for the specification.

1. Measure each camshaft journal diameter in 2 directions.

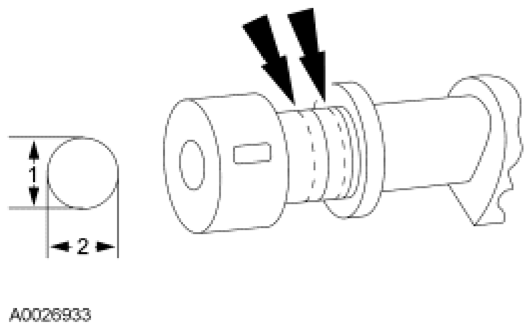


Fig. 4: Locating Areas For Measuring Camshaft Journal Diameter
Courtesy of FORD MOTOR CO.

CAMSHAFT JOURNAL TO BEARING CLEARANCE - OHC ENGINES

NOTE: Refer to the appropriate service information for the specification.

NOTE: The camshaft journals must meet specifications before checking camshaft journal clearance.

1. Measure each camshaft bearing in 2 directions.
   - Subtract the camshaft journal diameter from the camshaft bearing diameter.

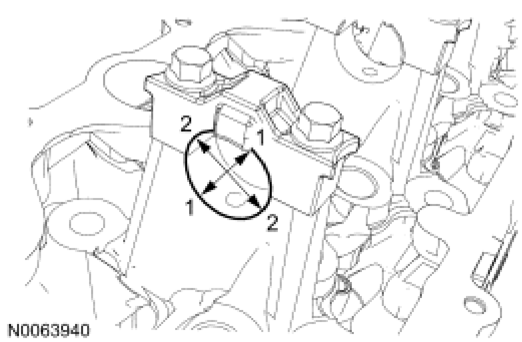
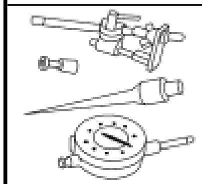


Fig. 5: Measuring Camshaft Bearing In 2 Directions
Courtesy of FORD MOTOR CO.

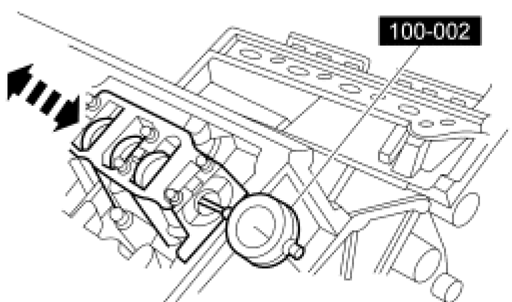
CAMSHAFT END PLAY - OHC ENGINES

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST1214-A	Dial Indicator Gauge with Holding Fixture	100-002 (TOOL-4201-C) or equivalent

NOTE: Refer to the appropriate service information for the specification.

1. Using the Dial Indicator Gauge with Holding Fixture, measure the camshaft end play.
2. Position the camshaft to the rear of the cylinder head.
3. Zero the Dial Indicator Gauge.
4. Move the camshaft to the front of the cylinder head. Note and record the camshaft end play.
   - If camshaft end play exceeds specifications, install a new camshaft and recheck end play.
   - If camshaft end play exceeds specification after camshaft installation, install a new cylinder head.

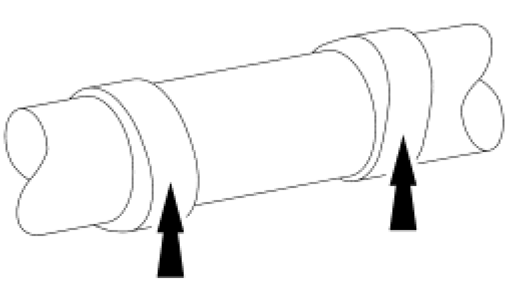


N0083449

Fig. 6: Recording Camshaft End Play
Courtesy of FORD MOTOR CO.

CAMSHAFT SURFACE INSPECTION

1. Inspect camshaft lobes for pitting or damage in the contact area. Minor pitting is acceptable outside the contact area.

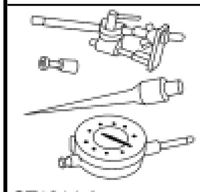


A0021430

Fig. 7: Inspecting Camshaft Lobes
Courtesy of FORD MOTOR CO.

CAMSHAFT LOBE LIFT

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST1214-A	Dial Indicator Gauge with Holding Fixture	100-002 (TOOL-4201-C) or equivalent

NOTE: Refer to the appropriate service information for the specification.

1. Use the Dial Indicator Gauge with Holding Fixture to measure camshaft intake/exhaust lobe lift.
    - Rotate the camshaft and subtract the lowest indicator reading from the highest indicator reading to figure the camshaft lobe lift.

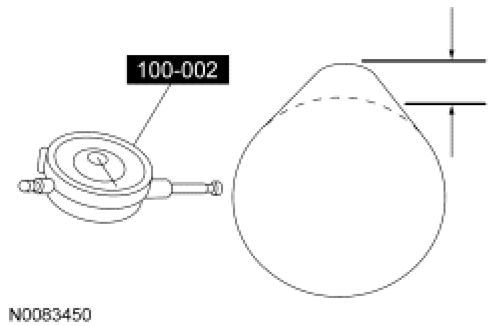
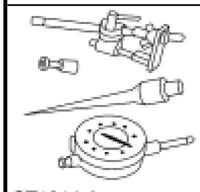


Fig. 8: Using Dial Indicator Gauge With Holding Fixture To Measure Camshaft Intake/Exhaust Lobe Lift
Courtesy of FORD MOTOR CO.

CAMSHAFT RUNOUT

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST1214-A	Dial Indicator Gauge with Holding Fixture	100-002 (TOOL-4201-C) or equivalent

NOTE: Refer to the appropriate service information for the specification.

NOTE: Camshaft journals must be within specifications before checking runout.

1. Using the Dial Indicator Gauge with Holding Fixture, measure the camshaft runout.
    - Rotate the camshaft and subtract the lowest indicator reading from the highest indicator reading.

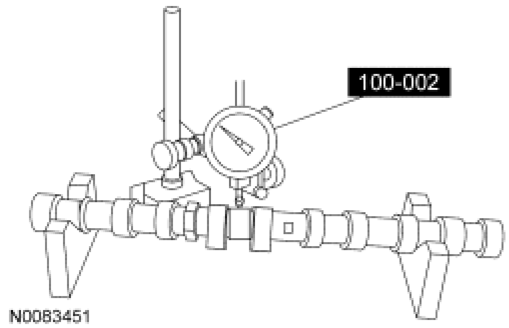
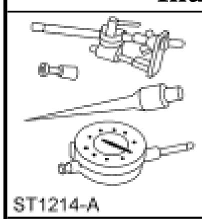


Fig. 9: Measuring Camshaft Runout Using Dial Indicator Gauge With Holding Fixture
Courtesy of FORD MOTOR CO.

CRANKSHAFT END PLAY

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
	Dial Indicator Gauge with Holding Fixture	100-002 (TOOL-4201-C) or equivalent

NOTE: Refer to the appropriate service information for the specification.

1. Install the Dial Indicator Gauge with Holding Fixture.
2. Position the crankshaft to the rear of the cylinder block.
3. Zero the Dial Indicator Gauge.
4. Move the crankshaft to the front of the cylinder block. Note and record the crankshaft end play.

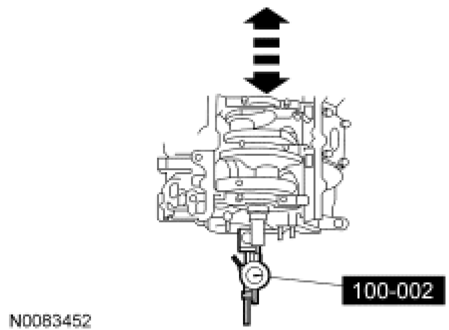


Fig. 10: Recording Crankshaft End Play
Courtesy of FORD MOTOR CO.

VALVE STEM DIAMETER

NOTE: Refer to the appropriate service information for the specification.

1. Measure the diameter of each intake and exhaust valve stem at the points shown in illustration. Verify the diameter is within specification.

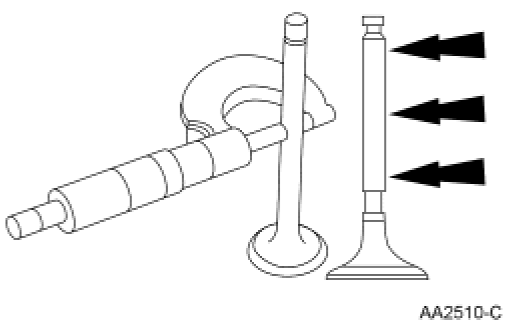


Fig. 11: Measuring Diameter Of Valve Stem
Courtesy of FORD MOTOR CO.

VALVE INSPECTION

1. Inspect the following valve areas:
    1. The end of the stem for grooves or scoring.
    2. The valve face and the edge for pits, grooves or scores.
    3. The valve head for signs of burning, erosion, warpage and cracking.
    4. The valve margin for wear.

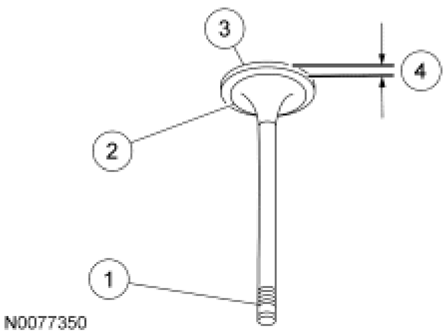


Fig. 12: Inspecting Valves
Courtesy of FORD MOTOR CO.

VALVE GUIDE INNER DIAMETER

NOTE: Refer to the appropriate service information for the specification.

NOTE: Valve guides tend to wear in an hourglass pattern. The ball gauge can be inserted into the combustion chamber side of the valve guide, if necessary.

1. Use a ball gauge to determine the inside diameter of the valve guides in 2 directions at the top, middle and bottom of the valve guide.

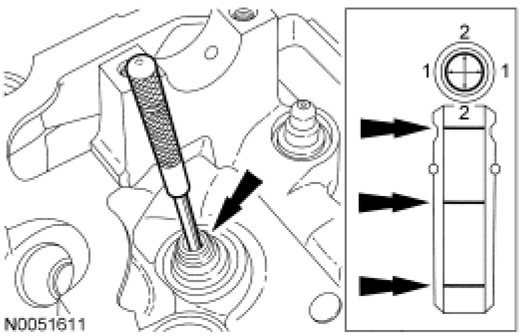


Fig. 13: Measuring Valve Guide Inner Diameter
Courtesy of FORD MOTOR CO.

2. Measure the ball gauge with a micrometer.

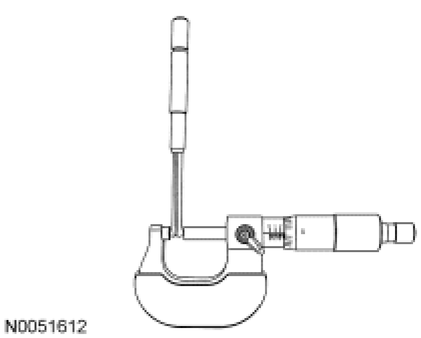


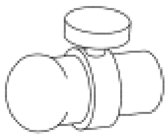
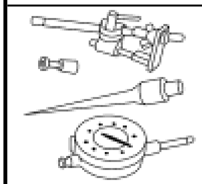
Fig. 14: Measuring Ball Gauge With Micrometer
Courtesy of FORD MOTOR CO.

3. If the valve guide is not within specifications, install a new cylinder head assembly.

VALVE STEM TO VALVE GUIDE CLEARANCE

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
	Clearance Gauge, Valve Guide	303-004 (TOOL-6505-E) or

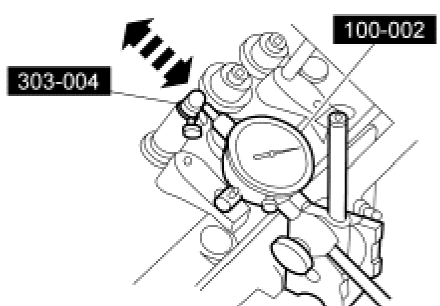
 ST1251-A		equivalent
 ST1214-A	Dial Indicator Gauge with Holding Fixture	100-002 (TOOL-4201-C) or equivalent

NOTE: Refer to the appropriate service information for the specification.

NOTE: The valve stem diameter must be within specifications before checking valve stem-to-valve guide clearance.

NOTE: If necessary, use a magnetic base.

1. Install a Valve Guide Clearance Gauge on the valve stem and install a Dial Indicator Gauge with Holding Fixture. Lower the valve until the clearance gauge contacts the upper surface of the valve guide.



N0083453

Fig. 15: Installing Valve Guide Clearance Gauge
Courtesy of FORD MOTOR CO.

2. Move the Valve Guide Clearance Gauge toward the Dial Indicator Gauge with Holding Fixture and zero the Dial Indicator Gauge. Move the Valve Guide Clearance Gauge away from the Dial Indicator Gauge with Holding Fixture and note the reading. The reading will be DOUBLE the valve stem-to-valve guide clearance.

VALVE SPRING INSTALLED LENGTH

NOTE: Refer to the appropriate service information for the specification.

1. Measure the installed length of each valve spring.

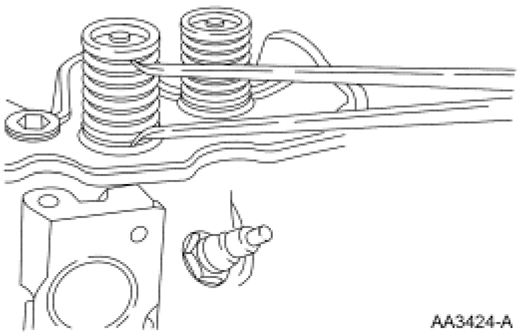


Fig. 16: Measuring Installed Length Of Valve Spring
Courtesy of FORD MOTOR CO.

VALVE SPRING FREE LENGTH

NOTE: Refer to the appropriate service information for the specification.

1. Measure the free length of each valve spring.

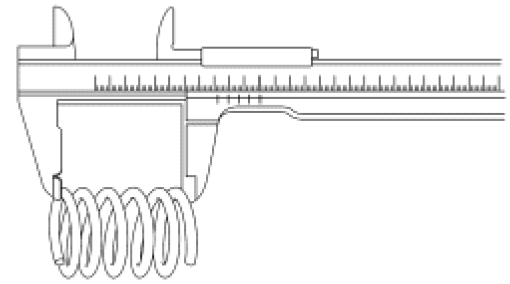


Fig. 17: Measuring Free Length Of Valve Spring
Courtesy of FORD MOTOR CO.

VALVE SPRING SQUARENESS

1. Measure the out-of-square on each valve spring.
   - Turn the valve spring and observe the space between the top of the valve spring and the square.

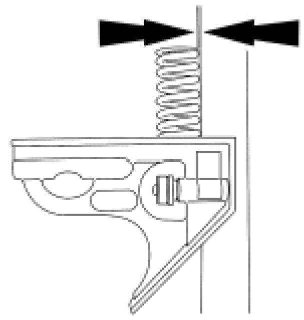
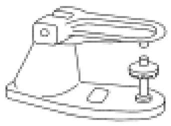


Fig. 18: Measuring Valve Spring Out-Of-Square
Courtesy of FORD MOTOR CO.

VALVE SPRING STRENGTH

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST1278-A	Pressure Gauge, Valve/Clutch Spring	303-006 (TOOL-6513-DD) or equivalent

NOTE: Refer to the appropriate service information for the specification.

1. Use the Valve/Clutch Spring Pressure Gauge to check the valve spring for correct strength at the specified valve spring length.

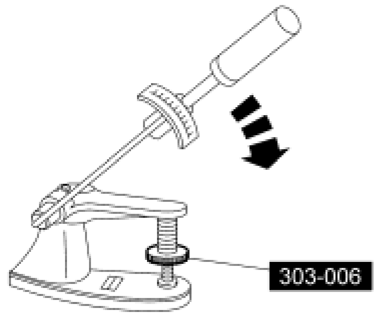


Fig. 19: Using Valve/Clutch Spring Pressure Gauge
Courtesy of FORD MOTOR CO.

VALVE SEAT INSPECTION

Valve and Seat Refacing Measurements

NOTE: Refer to the appropriate service information for the specification.

NOTE: After grinding valves or valve seats, check valve clearance.

1. Check the valve head and seat.
    - Check valve angles.
    - Check margin width.
    - Be sure margin width is within specification.

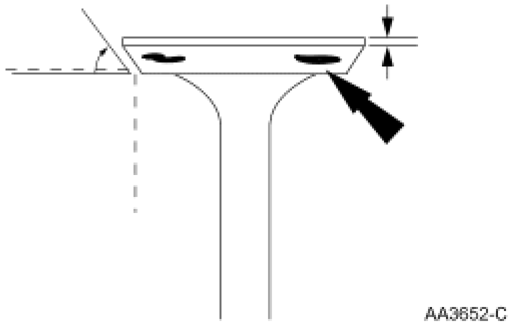


Fig. 20: Checking Valve Head And Seat
Courtesy of FORD MOTOR CO.

2. Inspect for abnormalities on the valve face and seat. Install a new cylinder head assembly if abnormalities are found.

VALVE SEAT WIDTH

NOTE: Refer to the appropriate service information for the specification.

1. Measure the valve seat width. If necessary, grind the valve seat to specification.
   - Measure the intake valve seat width.
   - Measure the exhaust valve seat width.
   - Recheck the valve spring installed length after the seats have been ground, and shim the valve springs as necessary to achieve the correct installed spring length.

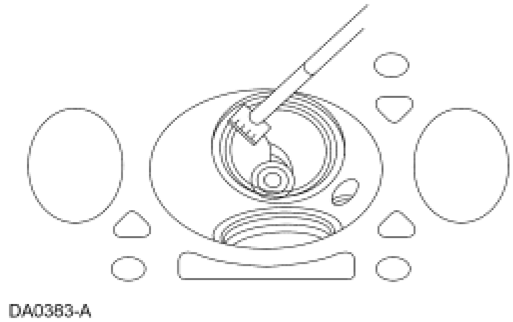


Fig. 21: Measuring Valve Seat Width
Courtesy of FORD MOTOR CO.

VALVE SEAT RUNOUT

NOTE: Refer to the appropriate service information for the specification.

1. Use a valve seat runout gauge to check valve seat runout.

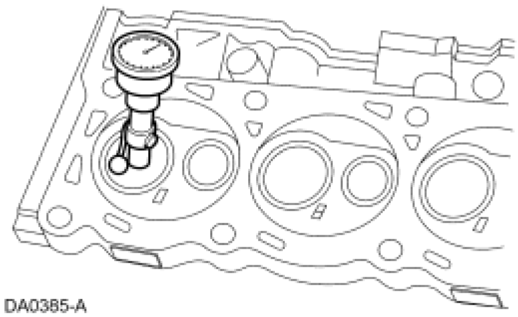


Fig. 22: Measuring Valve Seat Runout
Courtesy of FORD MOTOR CO.

FLEXPLATE INSPECTION

1. Inspect the flexplate for:
    1. any cracks.
    2. worn ring gear teeth.
    3. chipped or cracked ring gear teeth.

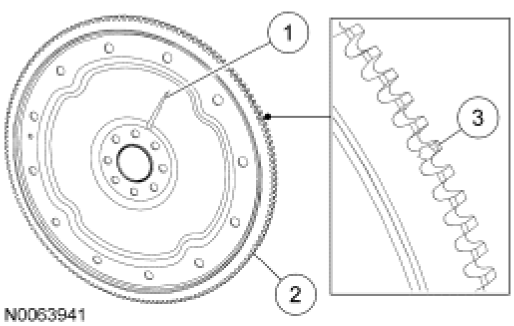
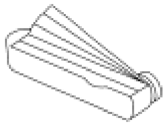


Fig. 23: Inspecting Flexplate
Courtesy of FORD MOTOR CO.

CYLINDER HEAD DISTORTION

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST1271-A	Feeler Gauge Set	303-D027 (D81L-4201-A) or equivalent

NOTE: **Refer to the appropriate service information for the specification.**

NOTE: **Make sure all cylinder head surfaces are clear of any gasket material, silicone sealant, oil and coolant. The cylinder head surface must be clean and dry before running a flatness check.**

NOTE: **Use a Straightedge that is calibrated by the manufacturer to be flat within 0.005 mm (0.0002 in) per running foot of length, such as Snap-On® GA438A or equivalent. For example, if the Straightedge is 61 cm (24 in) long, the machined edge must be flat within 0.010 mm (0.0004 in) from end to end.**

1. Using a Straightedge and a Feeler Gauge Set, inspect the cylinder head for flatness in the sequence shown in illustration.

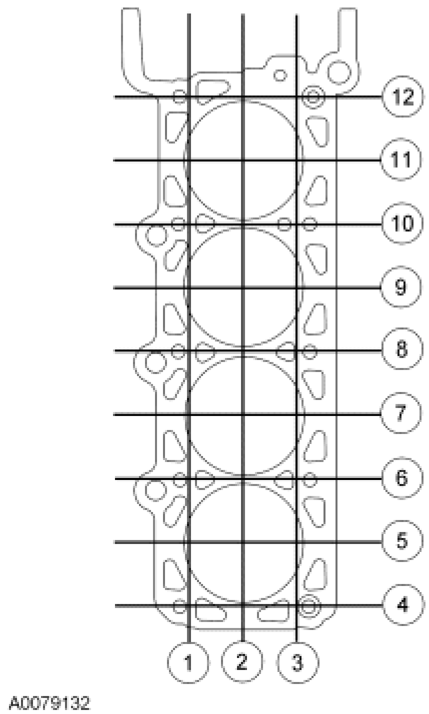
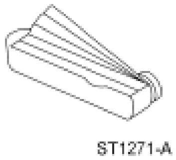


Fig. 24: Inspecting Cylinder Head For Flatness
Courtesy of FORD MOTOR CO.

CYLINDER BLOCK DISTORTION

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
	Feeler Gauge Set	303-D027 (D81L-4201-A) or equivalent

NOTE: Refer to the appropriate service information for the specification.

NOTE: Use a Straightedge that is calibrated by the manufacturer to be flat within 0.005 mm (0.0002 in) per running foot of length, such as Snap-On® GA438A or equivalent. For example, if the Straightedge is 61 cm (24 in) long, the machined edge must be flat within 0.010 mm (0.0004 in) from end to end.

1. Use a Straightedge and a Feeler Gauge Set to inspect the cylinder block for flatness.

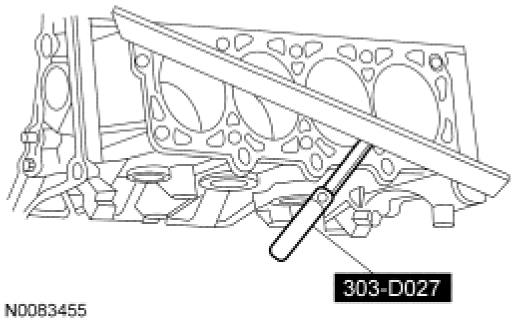
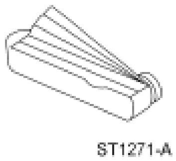


Fig. 25: Inspecting Cylinder Block For Flatness Using Straightedge & Feeler Gauge Set
Courtesy of FORD MOTOR CO.

EXHAUST MANIFOLD CLEANING AND INSPECTION

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
	Feeler Gauge Set	303-D027 (D81L-4201-A) or equivalent

1. Clean the exhaust manifold using a suitable solvent. Use a plastic scraping tool to clean the gasket sealing surfaces.

NOTE: New exhaust manifold gaskets, studs, nuts and/or bolts must be installed when an exhaust manifold is serviced.

NOTE: Use a Straightedge that is calibrated by the manufacturer to be flat within 0.005 mm (0.0002 in) per running foot of length, such as Snap-On® GA438A or equivalent. For example, if the Straightedge is 61 cm (24 in) long, the machined edge must be flat within 0.010 mm (0.0004 in) from end to end.

2. Using the Straightedge and a Feeler Gauge Set, check the exhaust manifold sealing surface for warpage. If the warpage is greater than 0.76 mm (0.0299 in), install a new exhaust manifold.

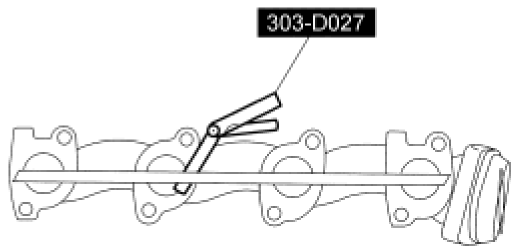


Fig. 26: Checking Exhaust Manifold Sealing Surface For Warpage
Courtesy of FORD MOTOR CO.

SPARK PLUG INSPECTION

1. Inspect the spark plug for a bridged gap.
   - Check for deposit build-up closing the gap between the electrodes. Deposits are caused by oil or carbon fouling.
   - Install a new spark plug.

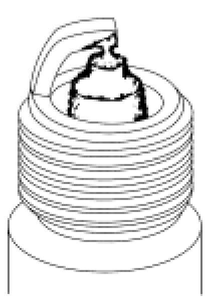
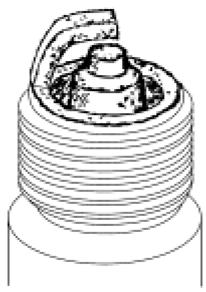


Fig. 27: Identifying Spark Plug With Bridged Gap
Courtesy of FORD MOTOR CO.

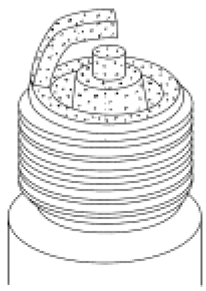
2. Check for oil fouling.
   - Check for wet, black deposits on the insulator shell bore electrodes, caused by excessive oil entering the combustion chamber through worn rings and pistons, excessive valve-to-guide clearance or worn or loose bearings.
   - Correct the oil leak concern.
   - Install a new spark plug.



AB0036-A

Fig. 28: Identifying Oil Fouled Spark Plug
Courtesy of FORD MOTOR CO.

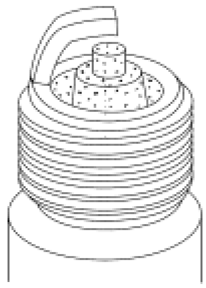
3. Inspect for carbon fouling. Look for black, dry, fluffy carbon deposits on the insulator tips, exposed shell surfaces and electrodes, caused by a spark plug with an incorrect heat range, dirty air cleaner, too rich a fuel mixture or excessive idling.
    - Install new spark plugs.



AB0040-A

Fig. 29: Identifying Spark Plug Carbon Fouling
Courtesy of FORD MOTOR CO.

4. Inspect for normal burning.
    - Check for light tan or gray deposits on the firing tip.



AB0039-A

Fig. 30: Identifying Normal Burning Spark Plug
Courtesy of FORD MOTOR CO.

5. Inspect for pre-ignition, identified by melted electrodes and a possibly damaged insulator. Metallic deposits on the insulator indicate engine damage. This may be caused by incorrect ignition timing, wrong type of fuel or the unauthorized installation of a heli-coil insert in place of the spark plug threads.
   - Install a new spark plug.

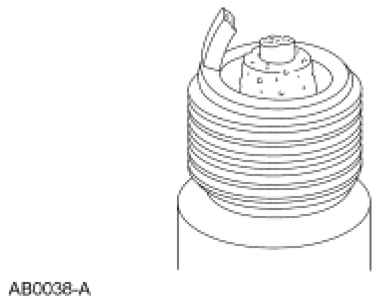


Fig. 31: Identifying Spark Plug With Pre-Ignition Condition
Courtesy of FORD MOTOR CO.

6. Inspect for overheating, identified by white or light gray spots and with a bluish-burnt appearance of electrodes. This is caused by engine overheating, wrong type of fuel, loose spark plugs, spark plugs with an incorrect heat range, low fuel pump pressure or incorrect ignition timing.
   - Install a new spark plug.

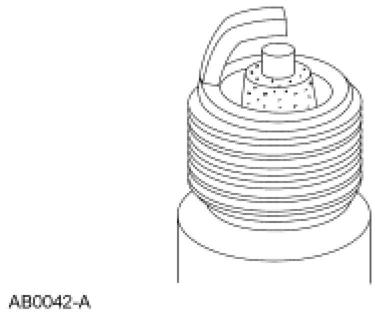


Fig. 32: Identifying Overheated Spark Plug
Courtesy of FORD MOTOR CO.

7. Inspect for fused deposits, identified by melted or spotty deposits resembling bubbles or blisters. These are caused by sudden acceleration.
   - Install new spark plugs.

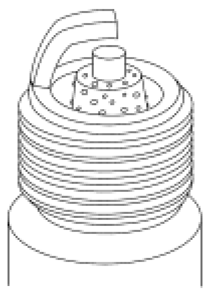


Fig. 33: Identifying Spark Plug With Fused Deposits
Courtesy of FORD MOTOR CO.

VALVE TAPPET INSPECTION

1. Inspect the valve tappet for damage, especially in the indicated areas. If any damage is evident, inspect the camshaft lobes and valves for damage. Install new components as necessary.

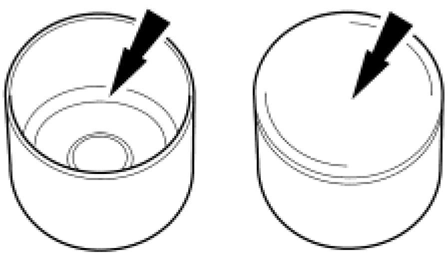


Fig. 34: Inspecting Valve Tappet
Courtesy of FORD MOTOR CO.

POWERTRAIN/DRIVETRAIN MOUNT NEUTRALIZING

NOTE: Refer to the appropriate service information and procedure for special instructions on loosening and tightening mount fasteners.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Loosen, but do not remove, the powertrain/drivetrain mount fasteners.
3. Lower the vehicle.

NOTE: Do not twist or strain the powertrain/drivetrain mounts or damage to the mounts may occur.

4. Start the vehicle and move it in forward 0.6-1.2 m (2-4 ft). Then move the vehicle in reverse the same distance.

5. Raise and support the vehicle.
6. Tighten the powertrain/drivetrain mount fasteners.
7. Lower the vehicle.
8. Test the system for normal operation.

2008 ENGINE

3.5L - Edge & MKX

SPECIFICATIONS

MATERIAL SPECIFICATIONS

Item	Specification	Fill Capacity
Motorcraft High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6	-
Motorcraft Metal Surface Prep ZC-31-A	-	-
Motorcraft Premium Gold Engine Coolant with Bittering Agent (bittered in US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	5.2L (5.5 qt) includes filter change
Silicone Gasket Remover ZC-30	-	-
Thread Sealant with PTFE TA-24	WSK-M2G350-A2	-

GENERAL SPECIFICATIONS

Item	Specification
Engine	
Displacement	3.5L (4V) (214 CID)
No. cylinders	6
Bore/stroke	92.5/86.7 mm (3.641/3.413 in)
Fire order	1-4-2-5-3-6
Oil pressure	Minimum 30 psi @ 1,500 rpm with engine at normal operating temperature
Spark plug	AYSF-22FM Gap = 1.29-1.45 mm (0.051-0.057 in)
Compression ratio	10.3:1
Engine weight (without accessory drive components)	161 kg (355 lb)
Engine and transaxle weight (without accessory	

drive components)	260.8 kg (575 lb)
Cylinder Head and Valve Train	
Cylinder head gasket surface flatness	a
Combustion chamber volume	55.84 cc (3.41 CI)
Valve tappet clearance - intake	0.15-0.25 mm (0.006-0.01 in)
Valve tappet clearance - exhaust	0.300-0.400 mm (0.0118-0.0157 in)
Valve guide bore inner diameter	5.519-5.549 mm (0.217-0.218 in)
Valve stem diameter - intake	5.479-5.497 mm (0.2157-0.2164 in)
Valve stem diameter - exhaust	5.466-5.484 mm (0.2151-0.2159 in)
Valve stem-to-guide clearance - intake	0.022-0.070 mm (0.0008-0.0027 in)
Valve stem-to-guide clearance - exhaust	0.035-0.083 mm (0.0013-0.032 in)
Valve head diameter - intake	36.82-37.18 mm (1.44-1.46 in)
Valve head diameter - exhaust	30.82-31.18 mm (1.21-1.22 in)
Valve face runout	0.05 mm (0.0001 in)
Valve face angle	90.50-91.50 degrees
Valve seat width - intake	1.3-1.5 mm (0.051-0.059 in)
Valve seat width - exhaust	1.4-1.6 mm (0.055-0.062 in)
Valve seat runout	0.04 mm (0.0001 in) MAX
Valve seat angle	89.0-91.0 degrees
Valve spring free length (approx.)	48.4 mm (1.90 in)
Valve spring compression pressure (N @ spec. length)	510 N @ 27.32 mm (115 lbs @ 1.08 in)
Valve spring installed height	37.0 mm (1.45 in)
Valve spring installed height pressure (N @ spec. length)	235 N @ 37.0 mm (53 lbs @ 1.45 in)
Valve spring installed pressure - service limit	10% force loss @ specified height
Camshaft	
Theoretical valve lift @ 0 lash	9.6798 mm (0.38 in)
Lobe lift - intake	9.6798 mm (0.38 in)
Lobe lift - exhaust	9.6798 mm (0.38 in)

Allowable lobe lift loss	0.062 mm (0.0024 in)
Camshaft journal bore inside diameter - 1st journal	31.0375-31.0625 mm (1.221-1.222 in)
Camshaft journal bore inside diameter - intermediate journals	25.9875-26.0125 mm (1.023-1.024 in)
Camshaft bearing outside diameter - 1st journal	30.993-31.013 mm (1.2202-1.2209 in)
Camshaft bearing outside diameter - intermediate journals	25.937-25.963 mm (1.021-1.022 in)
Camshaft journal-to-bearing clearance, 1st journal - service limit	0.070 mm (0.0027 in) MAX
Camshaft journal-to-bearing clearance, intermediate journals - service limit	0.0755 mm (0.0029 in) MAX
Runout	0.040 mm (0.0015 in) MAX
End play - standard	0.032-0.170 mm (0.0012-0.0066 in)
End play - service limit	0.190 mm (0.00748 in) MAX
Cylinder Block	
Cylinder bore diameter - grade 1	-
Cylinder bore diameter - grade 2	-
Cylinder bore diameter - grade 3	-
Cylinder bore maximum taper	-
Cylinder bore maximum out-of-round - limit	-
Cylinder bore maximum out-of-round - service limit	-
Main bearing bore inside diameter	72.400-72.424 mm (2.8503-2.8513 in)
Head gasket surface flatness	-
Head gasket surface finish	-
Crankshaft	
Main bearing journal diameter	67.5 mm (2.657 in)
Main bearing journal maximum taper	0.004 mm (0.00015 in)
Main bearing journal maximum out-of-round	0.006 mm (0.00023 in)
Main bearing journal-to-cylinder block clearance	-
Connecting rod journal diameter	55.983-56.003 mm (2.204-2.205 in)
Connecting rod journal maximum taper	0.004 mm (0.00015 in)
Connecting rod journal maximum out-of-round	0.006 mm (0.00023 in)
Crankshaft maximum end play	0.101-0.291 mm (0.0039-0.0114 in)
Piston and Connecting Rod	
Piston diameter - single grade	92.476-92.490 mm (3.6407-3.6413 in)
Piston-to-cylinder bore clearance	0.010 to 0.044 mm (0.0003-0.0017 in)
Piston ring end gap - compression (top, gauge	0.15-0.25 mm

diameter)	(0.0059-0.0098 in)
Piston ring end gap - compression (bottom, gauge diameter)	0.30-0.55 mm (0.0118-0.0216 in)
Piston ring end gap - oil ring (steel rail, gauge diameter)	0.15-0.45 mm (0.0059-0.0177 in)
Piston ring groove width - compression (top)	1.230-1.25 mm (0.0484-0.0492 in)
Piston ring groove width - compression (bottom)	1.530-1.55 mm (0.0602-0.0610 in)
Piston ring groove width - oil ring	2.53-2.55 mm (0.0996-0.1003 in)
Piston ring width - upper comp ring	1.17-1.19 mm (0.0460-0.0468 in)
Piston ring width - lower comp ring	1.47-1.49 mm (0.0578-0.0586 in)
Piston ring-to-groove clearance (upper and lower compression rings)	0.040-0.080 mm (0.0015-0.0031 in)
Piston pin bore diameter	23.002-23.006 mm (0.9055-0.9057 in)
Piston pin diameter	22.998-23.000 mm (0.9054-0.9055 in)
Piston pin length	55.975 mm (2.203 in)
Piston pin-to-piston fit	0.002 to 0.008 mm (0.00007-0.0003 in)
Piston-to-connecting rod clearance	2.7 mm (0.1 in)
Connecting rod-to-pin clearance - standard	0.007-0.021 mm (0.0002-0.0008 in)
Connecting rod-to-pin clearance - service limit	-
Connecting rod pin bore diameter	23.007-23.019 mm (0.905-0.906 in)
Connecting rod length (center-to-center)	152.68 mm (6.01 in)
Connecting rod maximum allowed bend	0.038 mm (0.0014 in)
Connecting rod maximum allowed twist	0.050 mm (0.0019 in)
Connecting rod bearing bore diameter - grade 1	59.866-59.872 mm (2.3569-2.3571 in)
Connecting rod bearing bore diameter - grade 2	59.873-59.879 mm (2.3572-2.3574 in)
Connecting rod bearing bore diameter - grade 3	59.880-59.886 mm (2.3574-2.3577 in)
Connecting rod bearing-to-crankshaft clearance	-
Connecting rod side clearance (assembled to crank) - standard	0.175-0.425 mm (0.0068-0.0167 in)
Connecting rod side clearance (assembled to crank)	-

- service limit	

[a] Refer to the appropriate procedure in this service information.

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
A/C compressor bolts and nut	25	18	-
A/C compressor stud	9	-	80
A/C pressure tube fitting nuts	8	-	71
A/C tube bracket bolt	8	-	71
Accessory drive belt tensioner bolts	11	8	-
Battery cable power feed cable nut	8	-	71
Block heater	40	30	-
Camshaft bearing cap bolts[a]	-	-	-
Camshaft position (CMP) sensor bolts	10	-	89
Camshaft sprocket bolts[a]	-	-	-
Catalytic converter bracket bolt	55	41	-
Catalytic converter bracket nut	40	30	-
Catalytic converter bracket-to-converter bolts	20	15	-
Catalytic converter bracket-to-engine block bolts	48	35	-
Catalytic converter nuts	40	30	-
Catalytic converter-to-exhaust manifold studs	25	18	-
Coolant pump bolts[a]	-	-	-
Crankshaft rear seal retainer plate bolts[a]	-	-	-
Crankshaft position (CKP) sensor bolt	10	-	89
CKP sensor heat shield nuts	10	-	89
Crankshaft pulley bolt[a]	-	-	-
Cylinder block drain plug (large)	40	30	-
Cylinder block drain plug (small)[b]	-	-	-
Cylinder head bolts[a]	-	-	-
Cylinder head temperature (CHT) sensor	10	-	89
Degas bottle bolts	9	-	80
Engine front cover bolts[a]	-	-	-
Engine lifting eye bolts	24	18	-
Engine mount brace bolt and nut	20	15	-
Engine mount bracket bolts[a]	-	-	-
Engine mount studs	18	13	-
Engine mount-to-engine nuts	63	46	-
Engine mount-to-frame bolts	90	66	-

Engine oil filter[c]	-	-	-
Engine oil pressure (EOP) switch	18	13	-
Engine roll-restrictor heat shield nut	11	8	-
Engine roll restrictor-to-subframe through bolt	103	76	-
Engine roll restrictor-to-transaxle through bolt	90	66	-
Exhaust manifold heat shield bolts	14	10	-
Exhaust manifold nuts[a]	-	-	-
Exhaust manifold studs	12	9	-
Exhaust pipe clamp	40	30	-
Exhaust Y-pipe nuts	40	30	-
Flexplate bolts	80	59	-
Front halfshaft nut	350	258	-
Fuel rail bolts	10	-	89
Generator bolt and nut	47	35	-
Generator B+ terminal nut	6	-	53
Ground wire-to-body bolt	10	-	89
Ground wire-to-engine bolt	10	-	89
Halfshaft carrier bearing bracket bolts - all wheel drive (AWD)	40	30	-
Halfshaft carrier bearing bracket bolts and stud bolt - front wheel drive (FWD)	55	41	-
Heated oxygen sensor (HO2S)	48	35	-
Heat shield nut and bolt	10	-	89
Ignition coil-on-plug bolts	7	-	62
Intermediate steering shaft bolt	23	17	-
Knock sensor (KS) bolts	20	15	-
Lower ball joint bolts	55	41	-
Lower bumper nuts	9	-	80
Lower intake manifold bolts[b]	-	-	-
Oil cooler bolts	10	-	89
Oil filter adapter large bolt	57	42	-
Oil filter adapter small bolt	10	-	89
Oil pan bolts[a]	-	-	-
Oil pan drain plug	27	20	-
Oil pan-to-transaxle bolts	48	35	-
Oil pump bolts	10	-	89
Oil pump screen and pickup tube bolts	10	-	89
Power steering cooler bracket bolt	9	-	80
Power steering pressure (PSP) tube bracket banjo bolt	48	35	-
Power steering pump bolts	24	18	-
Power steering reservoir nuts	8	-	71

Power transfer unit (PTU)	90	66	-
PTU bracket bolts	70	52	-
Radio interference capacitor-to-cowl nut	10	-	89
Radio interference capacitor-to-engine front cover nut	10	-	89
Rear driveshaft-to-PTU flange bolts	70	52	-
Spark plugs	15	11	-
Stabilizer bar link nuts	90	66	-
Starter bolt and stud bolt	27	20	-
Starter B+ terminal nut	12	9	-
Starter S-terminal nut	5	-	44
Subframe bracket bolts	90	66	-
Subframe nuts	133	98	-
Thermostat housing bolts	10	-	89
Tie-rod end nuts	48	35	-
Timing chain guide bolts	10	-	89
Timing chain tensioner bolts	10	-	89
Torque converter-to-flexplate bolts	55	41	-
Transaxle bracket bolts	90	66	-
Transaxle bracket plate bolts	90	66	-
Transaxle mount bracket nuts	63	46	-
Transaxle mount through bolt and nut	175	129	-
Transaxle-to-engine bolts	48	35	-
Upper intake manifold bolts[b]	-	-	-
Upper intake manifold bracket-to-engine bolt	10	-	89
Upper intake manifold-to-bracket bolt	10	-	89
Valve cover bolts and stud bolts[b]	-	-	-
Variable camshaft timing (VCT) assembly bolts[b]	-	-	-
VCT housing bolts[a]	-	-	-
VCT solenoid bolts	10	-	89
Wiring harness retainer bolt and stud bolt	10	-	89

[a] Refer to the appropriate procedure in this service information.

[b] Tighten to 20 Nm (15 lb-ft) plus an additional 180 degrees.

[c] Tighten to 5 Nm (44 lb-in) plus an additional 180 degrees.

DESCRIPTION AND OPERATION

ENGINE

The 3.5L (4V) is a V-6 engine with the following features:

- Dual overhead camshafts
- Four valves per cylinder
- Sequential multi-port fuel injection Sequential Multi-Port Fuel Injection (SFI)
- An aluminum lower intake manifold and a composite upper intake manifold
- Aluminum cylinder heads
- An aluminum, 60-degree V-cylinder block
- Timing chain driven coolant pump
- Variable Camshaft Timing (VCT) system
- The electronic ignition system with 6 ignition coils

Identification

For quick identification, refer to the safety certification decal.

- The decal is located on the LH front door lock face panel.
- An engine identification label is also attached to the engine.
- The symbol code on the identification tag identifies each engine for determining parts usage; for instance, engine displacement in liters or cubic inch displacement and model year.

Exhaust Emission Control System

Operation and required maintenance of the exhaust emission control devices used on this engine is covered in the **Introduction - Gasoline Engines** article.

Induction System

The SFI provides the fuel/air mixture needed for combustion in the cylinders. The 6 solenoid-operated fuel injectors:

- are mounted between the fuel rail and the intake manifold.
- meter fuel into the air intake stream in accordance with engine demand.
- are positioned so that their tips direct fuel just ahead of the engine intake valves.

Valve Train

The valve train uses direct acting mechanical buckets (DAMB). The camshaft lobes are positioned directly above mechanical buckets which are positioned on top of the valves.

Variable Camshaft Timing (VCT) System

The VCT system changes intake camshaft timing dependent on engine speed, load and oil temperature. Oil pressure advances and retards camshaft timing to improve low-speed and high-speed engine performance, engine idle quality and exhaust emissions.

PCV System

All engines are equipped with a closed-type PCV system recycling the crankcase vapors to the upper intake manifold.

Lubrication System

The engine lubrication system is of the force-feed type in which oil is supplied under full pressure to the crankshaft, connecting rod bearings, timing chain tensioners and VCT solenoids. The flow of oil to the valve tappets and valve train is controlled by a restricting orifice located in the head gaskets.

Oil Pump

The lubrication system is designed to provide optimum oil flow to critical components of the engine through its entire operating range.

The heart of the system is a positive displacement internal gear oil pump.

Generically, this design is known as a gerotor pump, which operates as follows:

- The oil pump is mounted on the front face of the cylinder block.
- The inner rotor is piloted on the crankshaft post and is driven through flats on the crankshaft.
- System pressure is limited by an integral, internally-vented relief valve which directs the bypassed oil back to the inlet side of the oil pump.
- Oil pump displacement has been selected to provide adequate volume to make sure of correct oil pressure both at hot idle and maximum speed.
- The relief valve calibration protects the system from excessive pressure during high-viscosity conditions.
- The relief valve is designed to provide adequate connecting rod bearing lubrication under high-temperature and high-speed conditions.

Cooling System

The engine cooling system includes the following:

- Radiator
- Timing chain driven coolant pump
- Electric fan assembly(s)
- Degas bottle (aids in maintaining the correct volume of engine coolant)
- Coolant thermostat
- Coolant hoses

Engine Cylinder Identification

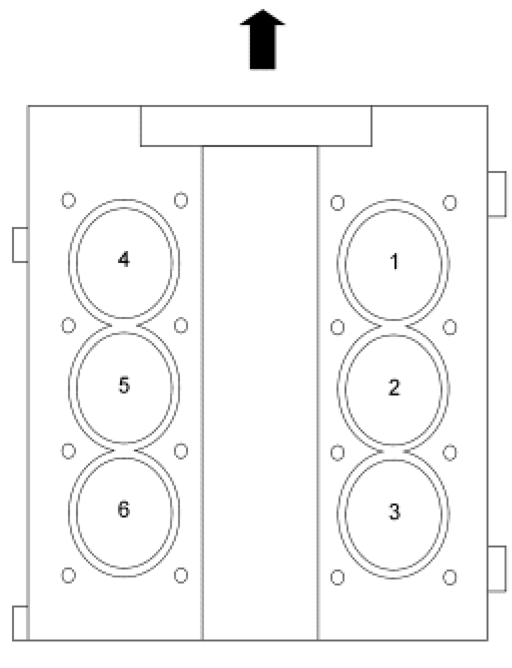


Fig. 1: Engine Cylinder Identification
Courtesy of FORD MOTOR CO.

DIAGNOSTIC TESTS

ENGINE

For basic engine mechanical concerns, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article. For driveability concerns, refer to the **Introduction - Gasoline Engines** article.

GENERAL PROCEDURES

VALVE CLEARANCE CHECK

1. Remove the valve covers. For additional information, refer to **Valve Cover - LH** and **Valve Cover - RH**.

   NOTE: The valve clearance must be measured with the camshaft at base circle. The engine will have to be rotated with the crankshaft pulley bolt to bring each valve to base circle.

2. Use a feeler gauge to measure the clearance of each valve and record its location. A midrange clearance is the most desirable:
   - Intake: 0.15-0.25 mm (0.006-0.01 in)
   - Exhaust: 0.300-0.400 mm (0.0118-0.0157 in)

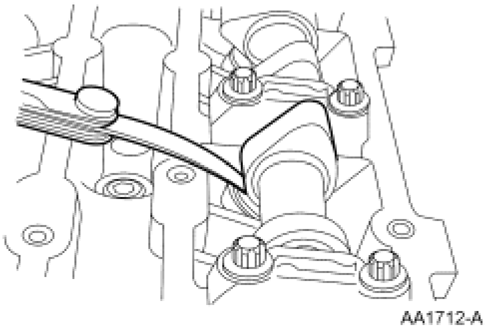


Fig. 2: Measuring Each Valve's Clearance Using A Feeler Gauge
Courtesy of FORD MOTOR CO.

NOTE:	**The number on the valve tappet reflects the thickness of the valve tappet. For example, a tappet with the number 3.310 has the thickness of 3.31 mm (0.13 in).**

3. If any of the valve clearances are out of specification, select new tappets using this formula: tappet thickness = measured clearance + the base tappet thickness - most desirable thickness.

   Select the tappets and mark the installation location.

4. If required, install the new selected valve tappets in the marked locations. For additional information, refer to **Valve Tappets**.

IN-VEHICLE SERVICING

UPPER INTAKE MANIFOLD

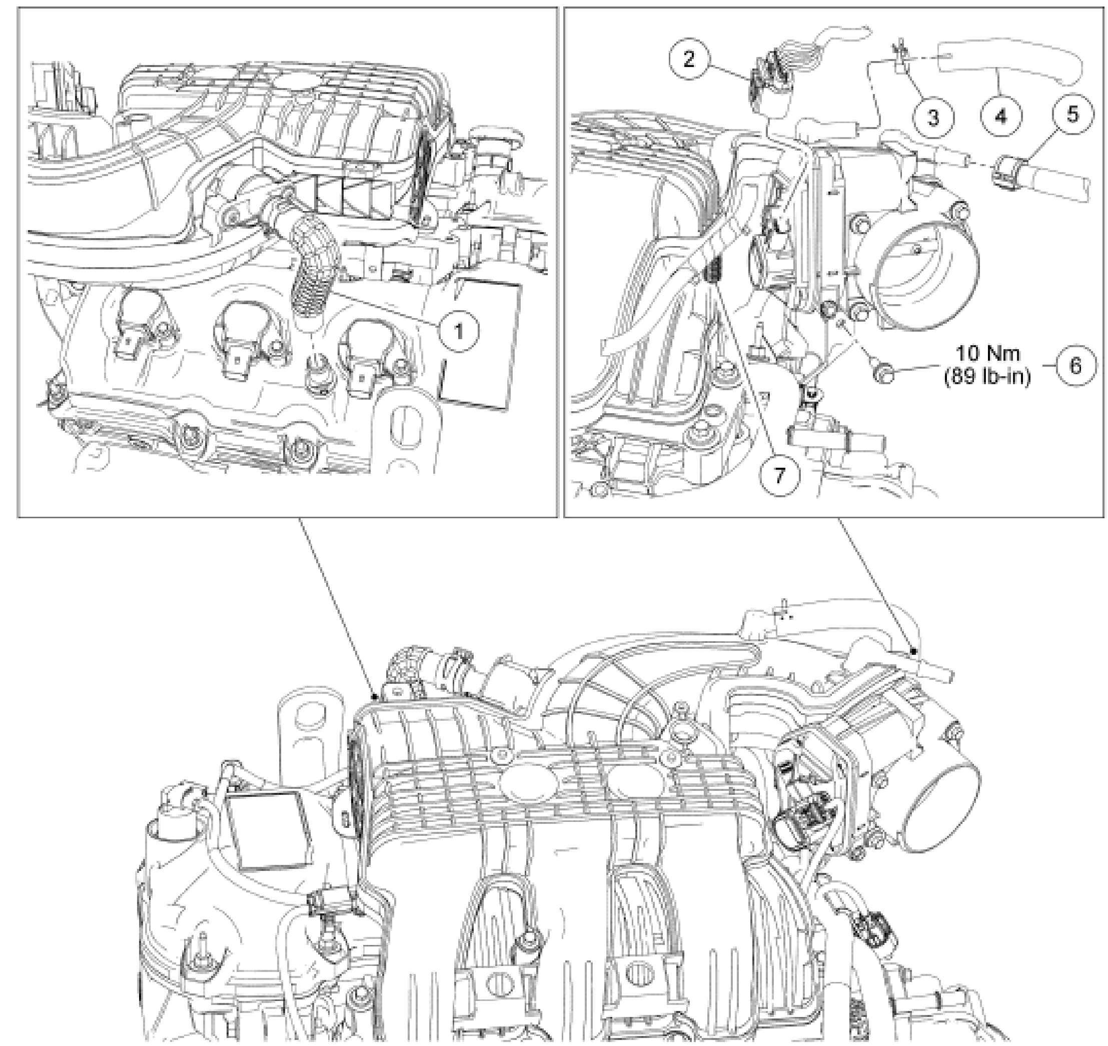


Fig. 3: Identifying Upper Intake Manifold With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6K817	PCV hose
2	14A464	Throttle body (TB) electrical connector (part of 12C508)
3	CS16140	Brake booster-to-intake manifold vacuum hose clamp
4	6K817	Brake booster-to-intake manifold vacuum hose
5	9D661	Evaporative emissions (EVAP)-to-intake manifold tube
6	W503274	Upper intake manifold support bracket

		bolt
7	-	Engine control wiring harness retainer (part of 12C508)

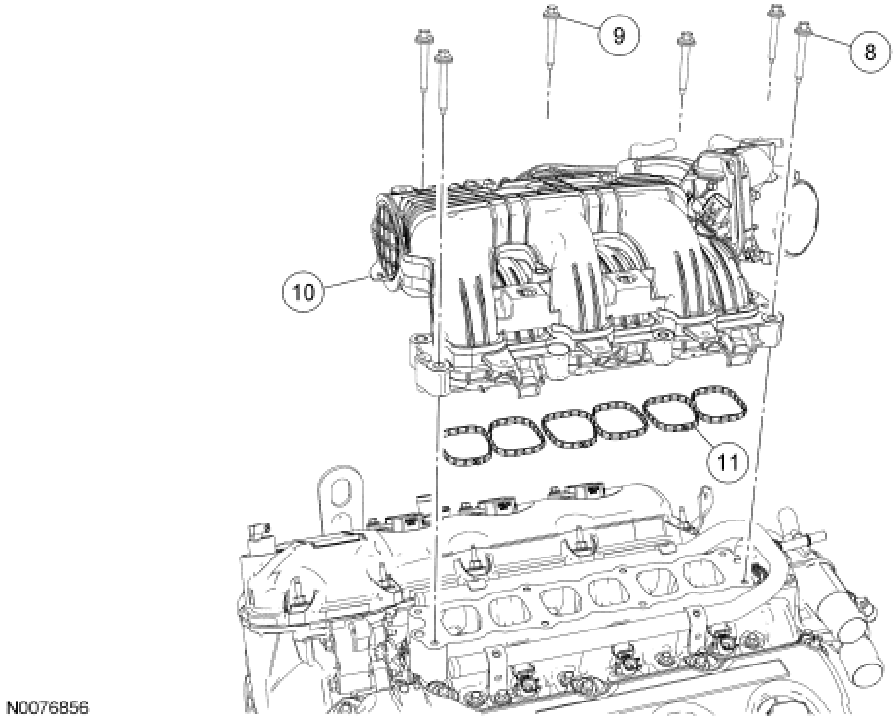


Fig. 4: Identifying Upper Intake Manifold
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
8	W503282	Upper intake manifold bolt (5 required)
9	W707083	Upper intake manifold bolt
10	9S455	Upper intake manifold
11	9H486	Upper intake manifold gasket (3 required)

REMOVAL

1. Remove the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION & FILTERING** article.
2. Disconnect the throttle body (TB) electrical connector.
3. Disconnect the evaporative emissions (EVAP) tube from the intake manifold.
4. Disconnect the brake booster vacuum hose from the intake manifold.
5. Disconnect the PCV tube from the PCV valve.
6. Detach the wiring harness retainers from the upper intake manifold.

7. Remove the upper intake manifold support bracket bolt.
8. Remove the 6 bolts and remove the upper intake manifold.
    - Remove and discard the gaskets.
    - Clean and inspect all of the sealing surfaces of the upper and lower intake manifold.

INSTALLATION

1. Using new gaskets, install the upper intake manifold and the 6 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

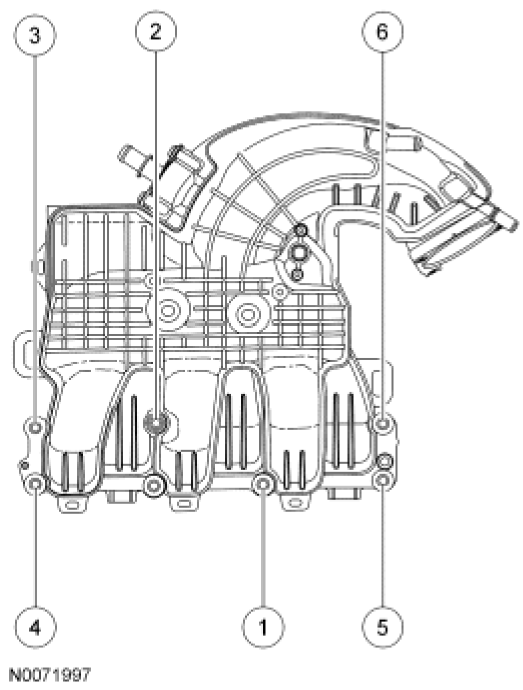


Fig. 5: Identifying Bolt Sequence
Courtesy of FORD MOTOR CO.

2. Install the upper intake manifold support bracket bolt.
    - Tighten to 10 Nm (89 lb-in).
3. Attach the wiring harness retainers to the upper intake manifold.
4. Connect the PCV tube to the PCV valve.
5. Connect the brake booster vacuum hose to the intake manifold.
6. Connect the EVAP tube to the intake manifold.
7. Connect the TB electrical connector.
8. Install the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION & FILTERING** article.

LOWER INTAKE MANIFOLD

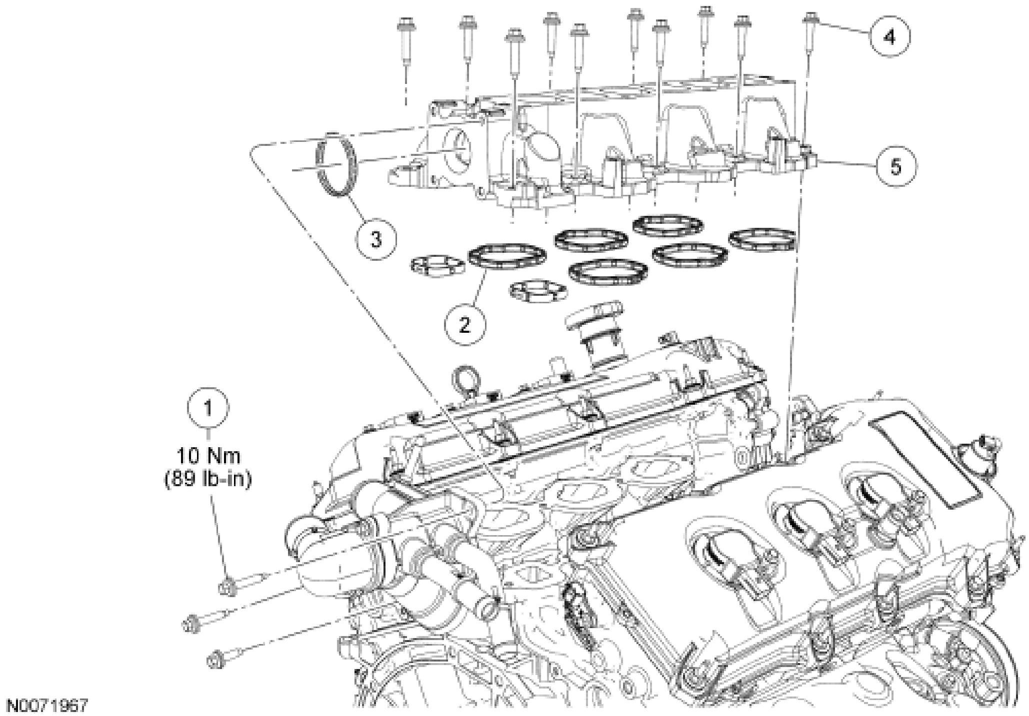


Fig. 6: Identifying Lower Intake Manifold With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W503279	Thermostat housing-to-lower intake manifold bolt (3 required)
2	9439	Lower intake manifold gasket (8 required)
3	8A571	Thermostat housing gasket
4	W503279	Lower intake manifold bolt (10 required)
5	9K461	Lower intake manifold

REMOVAL

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Drain the cooling system. For additional information, refer to **ENGINE COOLING** article.

3. Remove the fuel rail. For additional information, refer to **FUEL CHARGING & CONTROLS - 3.5L** article.
4. Remove the air cleaner assembly. For additional information, refer to **INTAKE AIR DISTRIBUTION & FILTERING** article.
5. Remove the 3 thermostat housing-to-lower intake manifold bolts.
6. Remove the 10 bolts and the lower intake manifold.
    - Remove and discard the intake manifold and thermostat housing gaskets.
    - Clean and inspect all sealing surfaces.

INSTALLATION

1. Using new intake manifold and thermostat housing gaskets, install the lower intake manifold and the 10 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

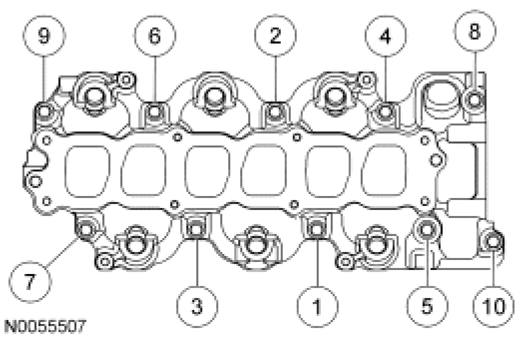


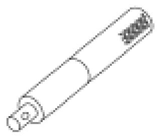
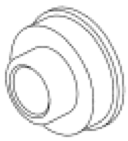
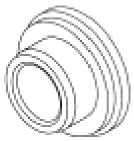
Fig. 7: Installing Lower Intake Manifold Bolts In Sequence
Courtesy of FORD MOTOR CO.

2. Install the 3 thermostat housing-to-lower intake manifold bolts.
    - Tighten to 10 Nm (89 lb-in).
3. Install the air cleaner assembly. For additional information, refer to **INTAKE AIR DISTRIBUTION & FILTERING** article.
4. Install the fuel rail. For additional information, refer to **FUEL CHARGING & CONTROLS - 3.5L** article.
5. Fill and bleed the cooling system. For additional information, refer to **ENGINE COOLING** article.

VALVE COVER - LH

Special Tools

Illustration	Tool Name	Tool Number
	Handle	205-153 (T80T-4000-W)

 ST1326-A		
 ST2983-A	Installer, Seal	303-1247/2
 ST2982-A	Remover, Seal	303-1247/1

Material

Item	Specification
Motorcraft High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft Metal Surface Prep ZC-31	-
Silicone Gasket Remover ZC-30	-

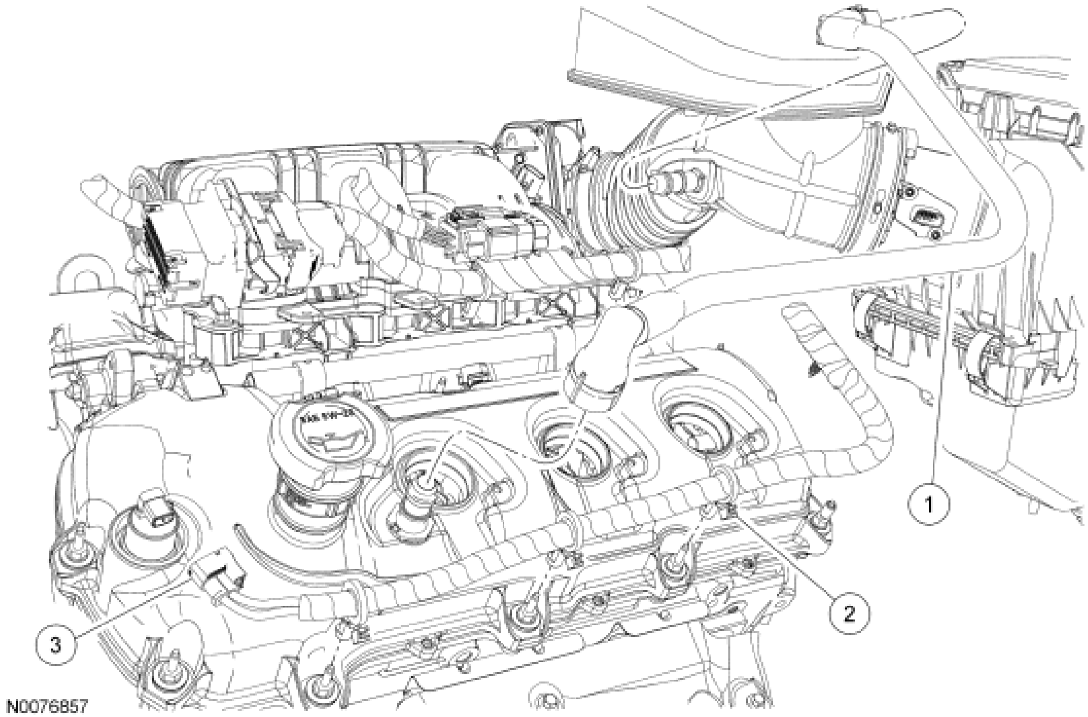


Fig. 8: Identifying Valve Cover - LH
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6853	Crankcase vent tube
2	W700497	Engine control wiring harness retainer (part of 12C508)
3	14A464	LH variable camshaft timing (VCT) electrical connector (part of 12C508)

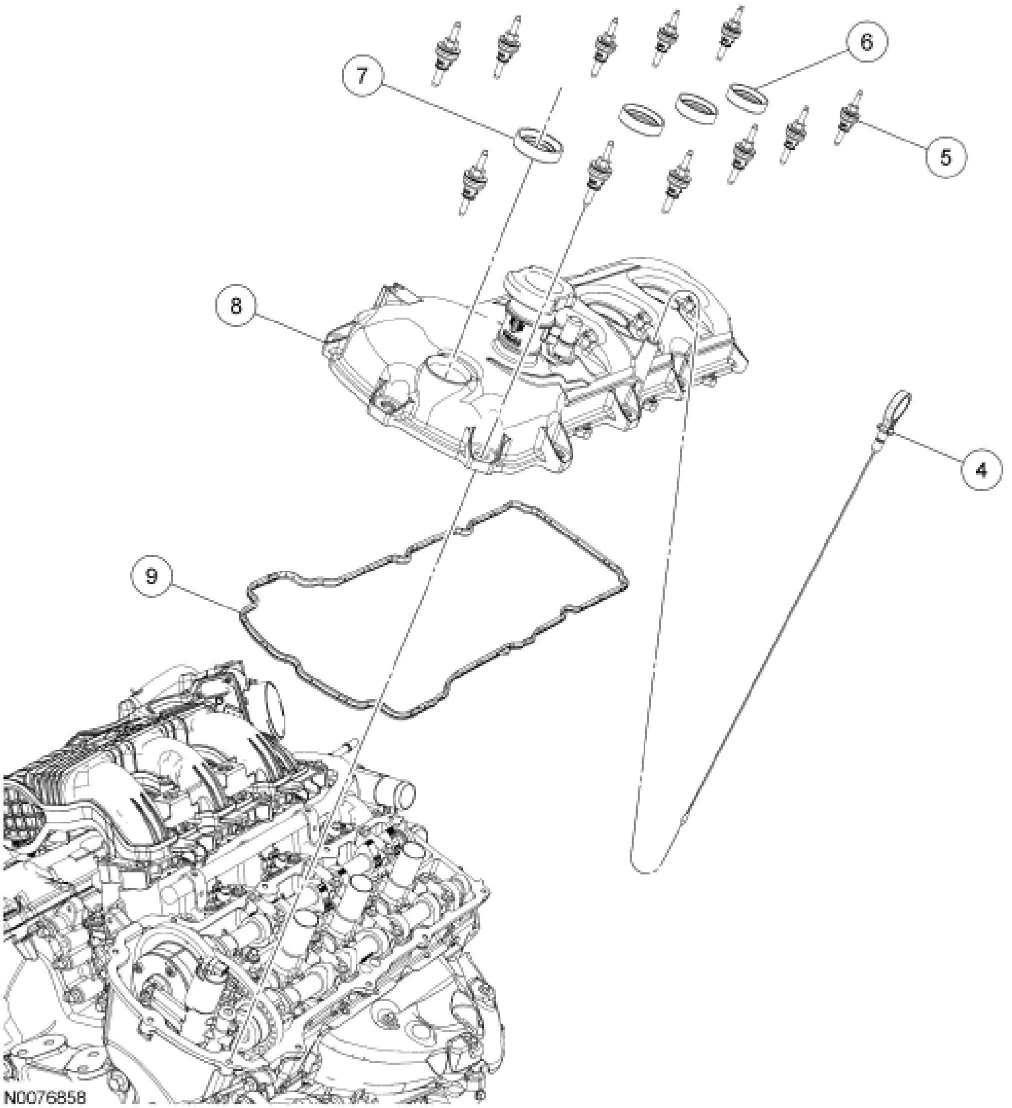


Fig. 9: Identifying Valve Cover Components - LH
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
4	6750	Oil level indicator
5	6C519	Valve cover stud bolt (11 required)
6	6C535	Spark plug tube seal (3 required)
7	6C535	VCT seal
8	6A505	LH valve cover
9	6A559	LH valve cover gasket

REMOVAL

CAUTION: During engine repair procedures, cleanliness is extremely important. Any

foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

1. Remove the crankcase vent tube.
2. Remove the LH ignition coils. For additional information, refer to **ENGINE IGNITION - 3.5L** article.
3. Remove the oil level indicator.
4. Disconnect the LH variable camshaft timing (VCT) solenoid electrical connector.
5. Detach all of the wiring harness retainers from the valve cover and the stud bolts.
6. Remove the 11 stud bolts and the LH valve cover.
   - Discard the gasket.

NOTE: VCT solenoid seal removal shown, spark plug tube seal removal similar.

7. Inspect the VCT solenoid seals and the spark plug tube seals. Remove any damaged seals.
   - Using the special tools, remove the seal(s).

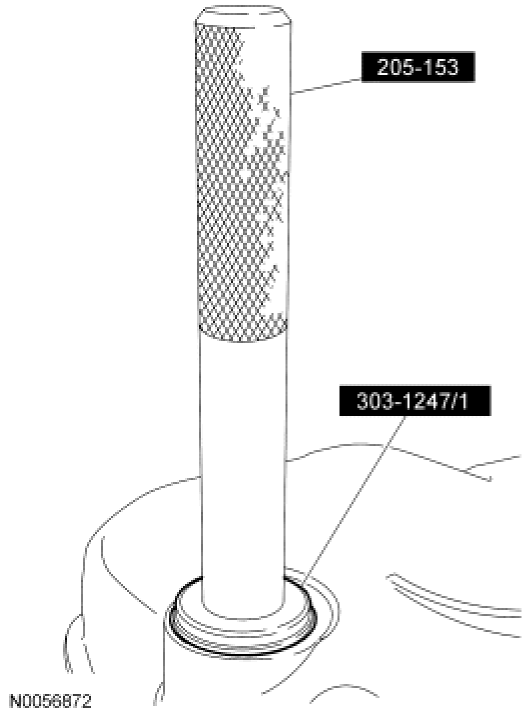


Fig. 10: Removing Seals Using Special Tools (205-153) & (303-1247/1)
Courtesy of FORD MOTOR CO.

8. Clean the valve cover, cylinder head and engine front cover sealing surfaces with metal surface cleaner.

INSTALLATION

NOTE: **Installation of new seals is only required if damaged seals were removed during disassembly of the engine.**

NOTE: **Spark plug tube seal installation shown, VCT seal installation similar.**

1. Using the special tools, install new VCT solenoid and/or spark plug tube seals.

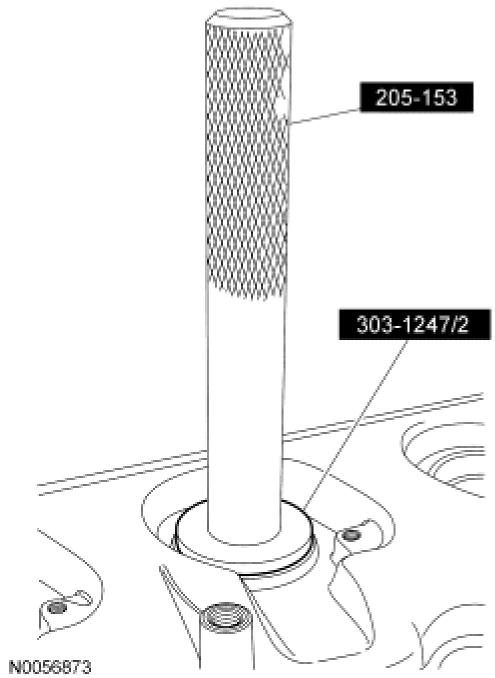


Fig. 11: Installing VCT Solenoid And/Or Spark Plug Tube Seals Using Special Tools (205-153) & (303-1247/2)
Courtesy of FORD MOTOR CO.

CAUTION: **Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.**

NOTE: **If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.**

2. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-LH cylinder head joints.

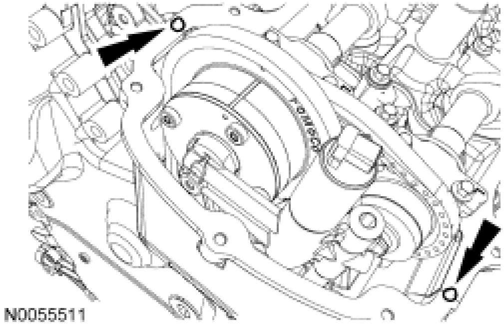


Fig. 12: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover-To-LH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

3. Using a new gasket, install the LH valve cover and 11 stud bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

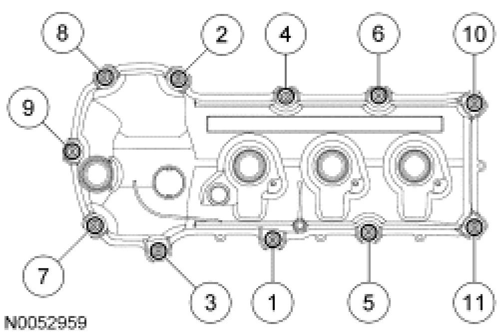
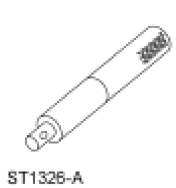


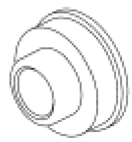
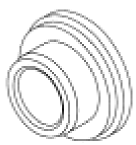
Fig. 13: Installing LH Valve Cover Stud Bolts In Sequence
Courtesy of FORD MOTOR CO.

4. Attach all of the wiring harness retainers to the valve cover and the stud bolts.
5. Connect the LH VCT solenoid electrical connector.
6. Install the oil level indicator.
7. Install the LH ignition coils. For additional information, refer to **ENGINE IGNITION - 3.5L** article.
8. Install the crankcase vent tube.

VALVE COVER - RH

Special Tools

Illustration	Tool Name	Tool Number
	Handle	205-153 (T80T-4000-W)

 ST2983-A	Installer, Seal	303-1247/2
 ST2982-A	Remover, Seal	303-1247/1

Material

Item	Specification
Motorcraft High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft Metal Surface Prep ZC-31	-
Silicone Gasket Remover ZC-30	-

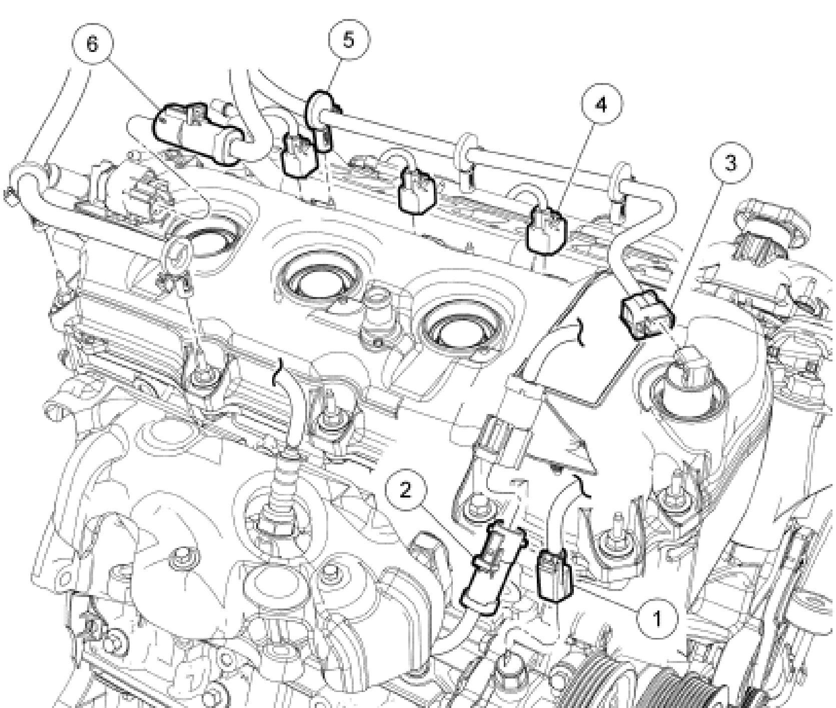


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Fig. 14: Identifying Valve Cover - RH
Courtesy of FORD MOTOR CO.

Item	Part Number	Description

1	14A464	Power steering pressure (PSP) switch electrical connector (part of 12C508)
2	14A464	RH catalyst monitor sensor electrical connector (part of 12C508)
3	14A464	RH variable camshaft timing (VCT) electrical connector (part of 12C508)
4	14A464	RH fuel injector electrical connector (3 required) (part of 12C508)
5	W700497	Engine control wiring harness retainer (part of 12C508)
6	14A464	RH heated oxygen sensor (HO2S) electrical connector (part of 12C508)

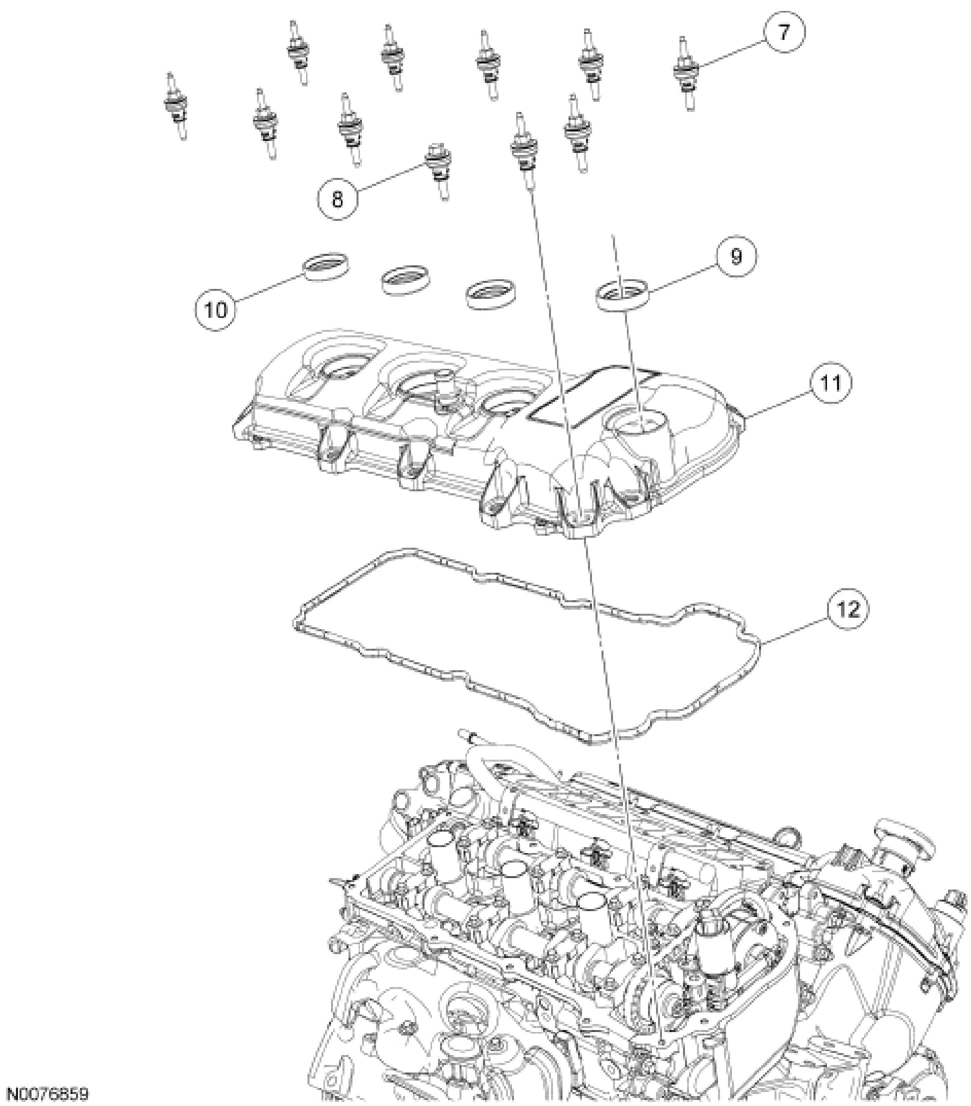


Fig. 15: Identifying Valve Cover Components - RH

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
7	6C519	Valve cover stud bolt (10 required)
8	6C520	Valve cover bolt
9	6C535	VCT seal
10	6C535	Spark plug tube seal (3 required)
11	6582	RH valve cover
12	6584	RH valve cover gasket

REMOVAL

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

1. Remove the RH ignition coils. For additional information, refer to **ENGINE IGNITION - 3.5L** article.
2. Disconnect the power steering pressure (PSP) switch electrical connector.
3. Disconnect the RH catalyst monitor sensor electrical connector and pin-type retainer.
4. Disconnect the RH heated oxygen sensor (HO2S) electrical connector.
5. Disconnect the RH variable camshaft timing (VCT) electrical connector.
6. Disconnect the 3 RH fuel injector electrical connectors.
7. Detach all of the wiring harness retainers from the RH valve cover and the stud bolts.
8. Remove the bolt, the 10 stud bolts and the RH valve cover.
   - Discard the gasket.

NOTE: VCT solenoid seal removal shown, spark plug tube seal removal similar.

9. Inspect the VCT solenoid seals and the spark plug tube seals. Remove any damaged seals.
   - Using the special tools, remove the seal(s).

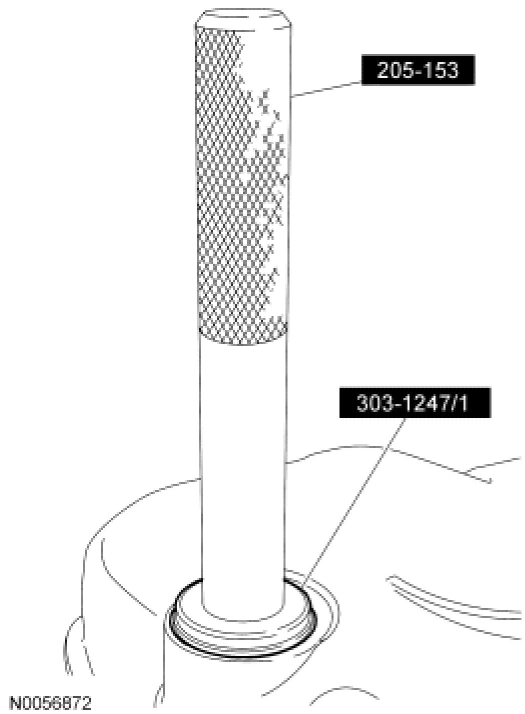


Fig. 16: Removing Seals Using Special Tools (205-153) & (303-1247/1)
Courtesy of FORD MOTOR CO.

10. Clean the valve cover, cylinder head and engine front cover sealing surfaces with metal surface cleaner.

INSTALLATION

NOTE: **Installation of new seals is only required if damaged seals were removed during disassembly of the engine.**

NOTE: **Spark plug tube seal installation shown, VCT seal installation similar.**

1. Using the special tools, install new VCT solenoid and/or spark plug tube seals.

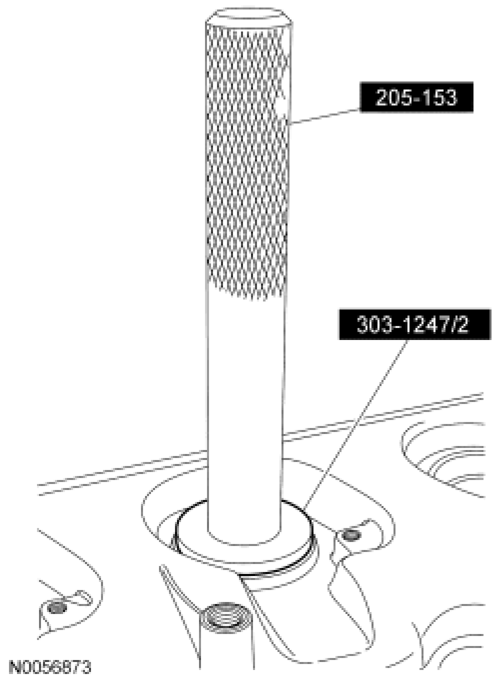


Fig. 17: Installing VCT Solenoid And/Or Spark Plug Tube Seals Using Special Tools (205-153) & (303-1247/2)
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

2. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-RH cylinder head joints.

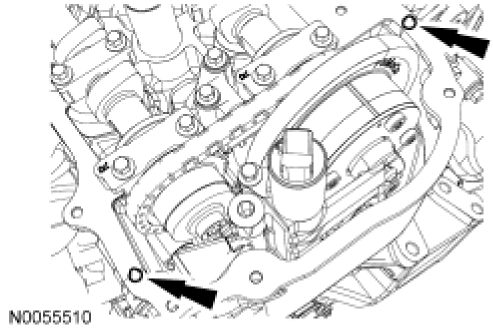


Fig. 18: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover-To-RH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

3. Using a new gasket, install the RH valve cover, bolt and the 10 stud bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

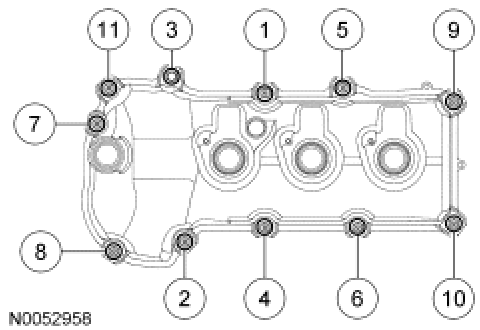


Fig. 19: Installing RH Valve Cover Stud Bolts In Sequence
Courtesy of FORD MOTOR CO.

4. Attach all of the wiring harness retainers to the valve cover and the stud bolts.
5. Connect the 3 RH fuel injector electrical connectors.
6. Connect the RH VCT electrical connector.
7. Connect the RH HO2S electrical connector.
8. Connect the RH catalyst monitor sensor electrical connector and pin-type retainer.
9. Connect the PSP switch electrical connector.
10. Install the RH ignition coils. For additional information, refer to **ENGINE IGNITION - 3.5L** article.

LOWER END COMPONENTS - EXPLODED VIEW, CRANKSHAFT PULLEY AND CRANKSHAFT FRONT SEAL

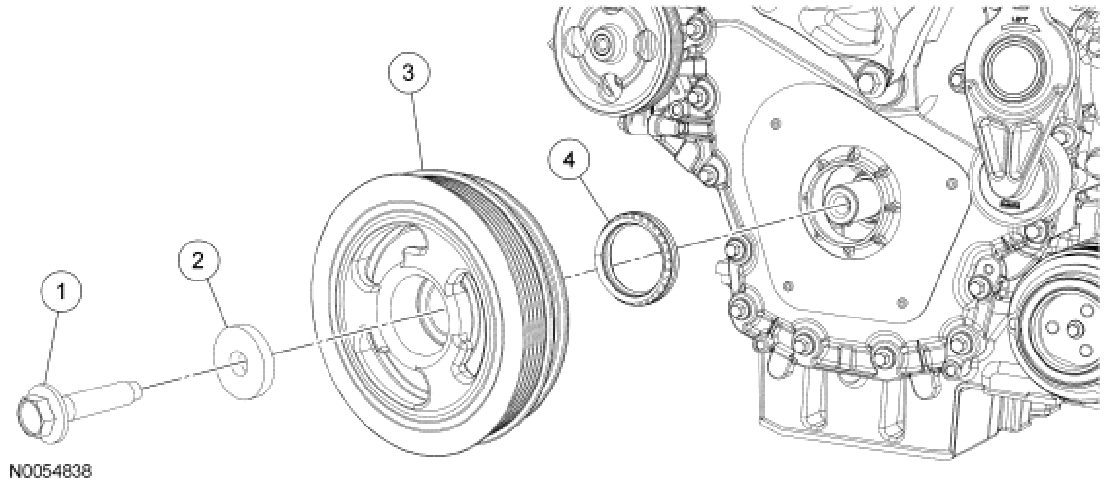


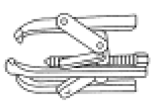
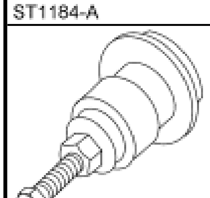
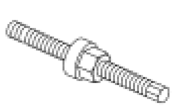
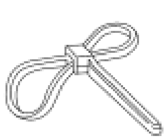
Fig. 20: Exploded View Of Crankshaft Pulley & Crankshaft Front Seal
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701512	Crankshaft pulley bolt
2	N806165	Washer
3	6316	Crankshaft pulley
4	6700	Crankshaft front seal

1. For additional information, refer to the appropriate procedures in this service information.

CRANKSHAFT PULLEY

Special Tools

Illustration	Tool Name	Tool Number
 ST1184-A	3-Jaw Puller	303-D121
 ST2296-A	Installer, Front Cover Oil Seal	303-335
 ST1287-A	Replacer, Crankshaft Damper	303-102 (T74P-6316-B)
 ST1438-A	Strap Wrench	303-D055 (D85L-6000-A)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12	WSS-M2C930-A

(Canada); or equivalent	

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the accessory drive belt and the power steering belt. For additional information, refer to **ACCESSORY DRIVE** article.
3. Using the special tool, remove the crankshaft bolt and washer.
    - Discard the bolt.

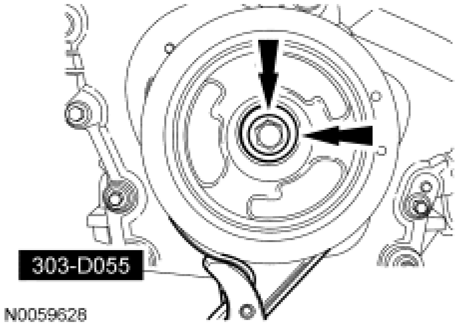


Fig. 21: Removing Crankshaft Bolt & Washer Using Special Tool (303-D055)
Courtesy of FORD MOTOR CO.

4. Using the special tool, remove the crankshaft pulley.

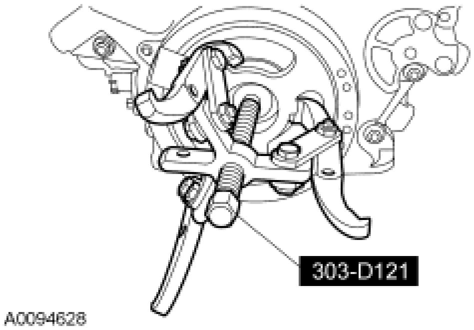


Fig. 22: Identifying Special Tools (303-D121) And Crankshaft Pulley
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Lubricate the crankshaft front seal inner lip with clean engine oil.

NOTE: Lubricate the outside diameter sealing surfaces with clean engine oil.

2. Using the special tools, install the crankshaft pulley.

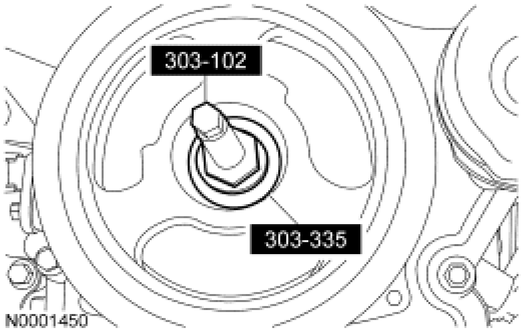


Fig. 23: Installing Crankshaft Pulley
Courtesy of FORD MOTOR CO.

3. Using the special tool, install the crankshaft pulley washer and new bolt and tighten in 4 stages.
    - Stage 1: Tighten to 120 Nm (89 lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten an additional 90 degrees.

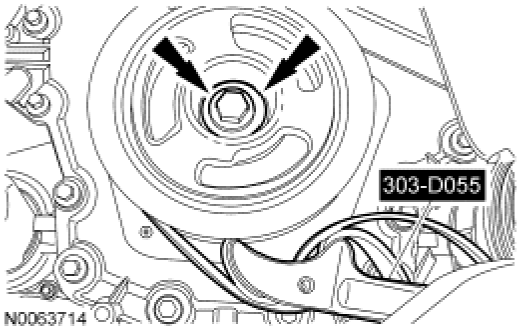
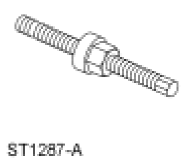


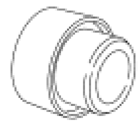
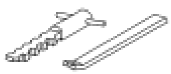
Fig. 24: Installing Crankshaft Pulley Washer & Bolt Using Special Tools (303-D055)
Courtesy of FORD MOTOR CO.

4. Install the accessory drive belt and the power steering belt. For additional information, refer to **ACCESSORY DRIVE** article.

CRANKSHAFT FRONT SEAL

Special Tools

Illustration	Tool Name	Tool Number
	Installer, Crankshaft Vibration Damper	303-102 (T74P-6316-B)

 ST2981-A	Installer, Front Crankshaft Seal	303-1251
 ST1385-A	Remover, Oil Seal	303-409 (T92C-6700CH)

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31-A	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the crankshaft pulley. For additional information, refer to **Crankshaft Pulley**.
3. Using the Oil Seal Remover, remove and discard the crankshaft front seal.
   - Clean all sealing surfaces with metal surface prep.

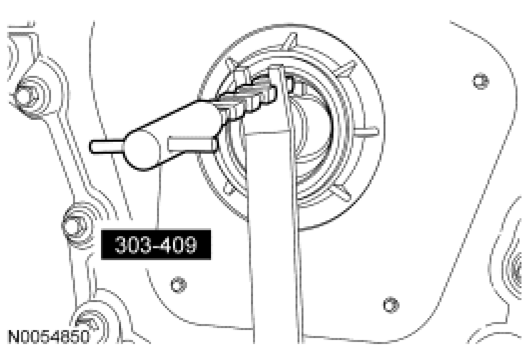


Fig. 25: Removing Crankshaft Front Seal Using Special Tool (303-409)
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: **Apply clean engine oil to the crankshaft front seal bore in the engine front cover.**

1. Using the Front Crankshaft Seal Installer and Crankshaft Vibration Damper Installer, install a new crankshaft front seal.

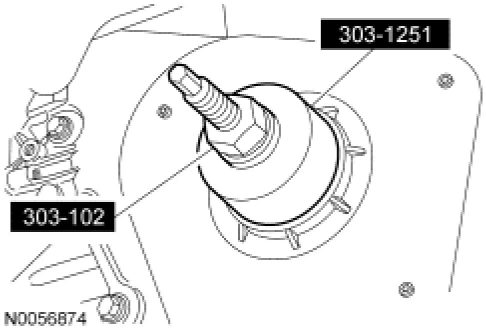


Fig. 26: Installing Crankshaft Front Seal Using Special Tools (303-102) & (303-1251)
Courtesy of FORD MOTOR CO.

2. Install the crankshaft pulley. For additional information, refer to **Crankshaft Pulley**.

LOWER END COMPONENTS - EXPLODED VIEW, FLEXPLATE AND CRANKSHAFT REAR SEAL

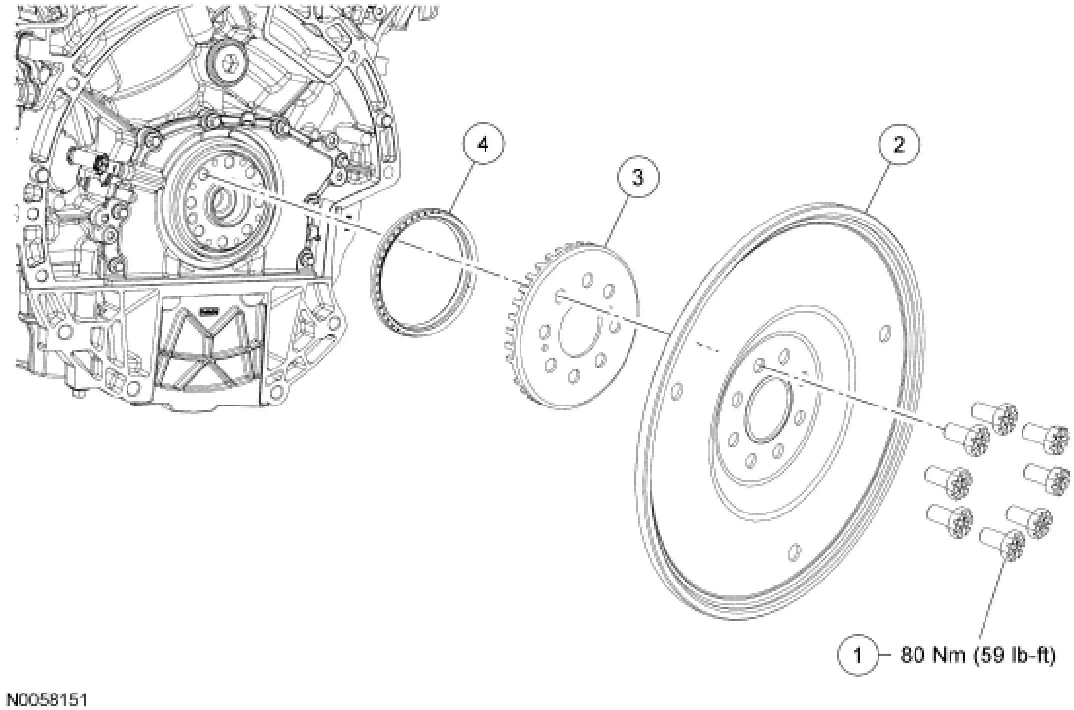


Fig. 27: Exploded View Of Flexplate & Crankshaft Rear Seal - Lower End Components With Torque Specification

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701559	Flexplate bolt (8 required)
2	6375	Flexplate
3	12A227	Crankshaft sensor ring
4	6701	Crankshaft rear seal

1. For additional information, refer to the appropriate procedures in this service information.

FLEXPLATE

REMOVAL AND INSTALLATION

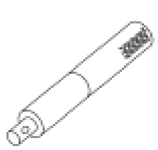
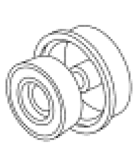
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the transaxle. For additional information, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article.

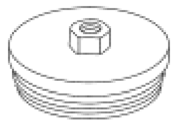
NOTE: One of the 8 flexplate holes are offset so the flexplate can only be installed in one position.

3. Remove the bolts and the flexplate.
   - To install, tighten to 80 Nm (59 lb-ft).
4. To install, reverse the removal procedure.

CRANKSHAFT REAR SEAL

Special Tools

Illustration	Tool Name	Tool Number
 ST1326-A	Handle	205-153 (T80T-4000-W)
 ST2980-A	Installer, Rear Main Seal	303-1250
	Remover, Crankshaft Rear Oil	303-519 (T95P-6701-EH)

 ST1382-A	Seal	
 ST1187-A	Slide Hammer	307-005 (T59L-100-B)

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31-A	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the flexplate. For additional information, refer to **Flexplate**.
3. Remove the crankshaft sensor ring.
4. Using the Crankshaft Rear Oil Seal Remover and Slide Hammer, remove and discard the crankshaft rear seal.
    - Clean all sealing surfaces with metal surface prep.

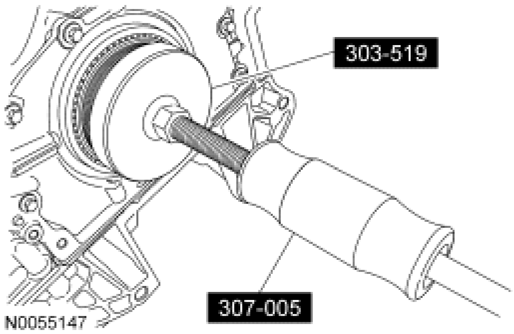


Fig. 28: Removing Crankshaft Rear Seal Using Special Tools (303-519) & (307-005)
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: Lubricate the seal lips and bore with clean engine oil prior to installation.

1. Position the Rear Main Seal Installer onto the end of the crankshaft and slide a new crankshaft rear seal onto the tool.

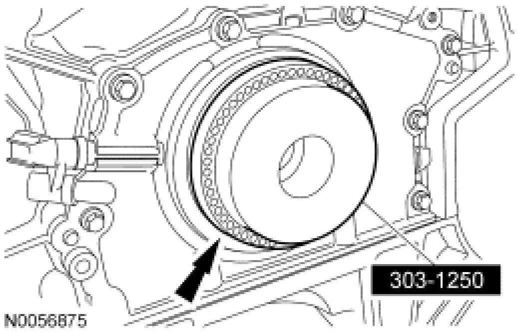


Fig. 29: Positioning Special Tool (303-1250) Onto End Of Crankshaft
Courtesy of FORD MOTOR CO.

2. Using the Rear Main Seal Installer and Handle, install the new crankshaft rear seal.

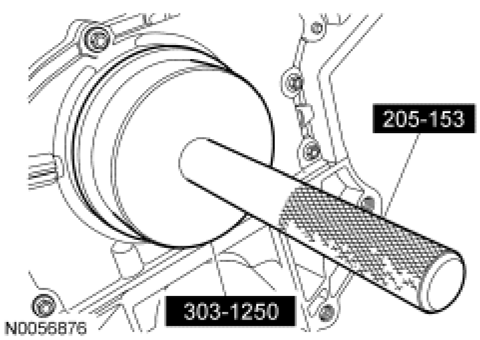


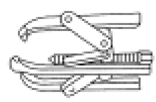
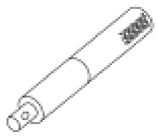
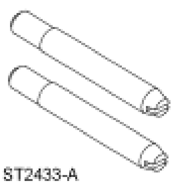
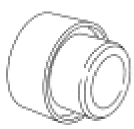
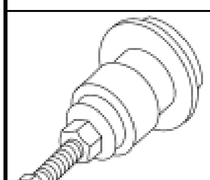
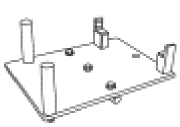
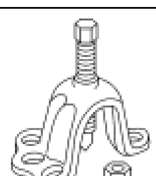
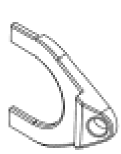
Fig. 30: Installing New Crankshaft Rear Seal Using Special Tools (303-1250) & (205-153)
Courtesy of FORD MOTOR CO.

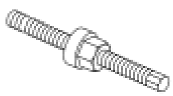
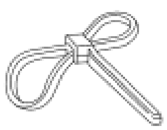
3. Install the crankshaft sensor ring.
4. Install the flexplate. For additional information, refer to **Flexplate**.

ENGINE FRONT COVER

Special Tools

Illustration	Tool Name	Tool Number
	3-Jaw Puller	303-D121

 ST1184-A		
 ST1326-A	Adapter for 205-529 (Handle)	205-153 (T80T-4000-W)
 ST2433-A	Alignment Pins	307-399
 ST2981-A	Installer, Crankshaft Front Seal	303-1251
 ST2296-A	Installer, Front Cover Seal	303-335 (T88T-6701-A)
 ST3034-A	Oil Pan Holding Fixture	303-1295
 ST2330-A	Remover, Front Hub	205-D070 (D93P-1175-B) or equivalent
 ST2666-A	Remover, Halfshaft	205-529

 ST1385-A	Remover, Oil Seal	303-409 (T92C-6700CH)
 ST1287-A	Replacer, Crankshaft Damper	303-102 (T74P-6312-B)
 ST1436-A	303-D055 (D85L-6000-A)	Strap Wrench

Material

Item	Specification
Motorcraft High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft Metal Surface Prep ZC-31	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket Remover ZC-30	-

REMOVAL

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Recover the A/C system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION & DIAGNOSTICS** article.
3. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING & CABLES** article.

4. Remove the accessory drive belt, tensioner and the power steering belt. For additional information, refer to **ACCESSORY DRIVE** article.
5. Using the special tool, remove the crankshaft bolt and washer.
    - Discard the bolt.

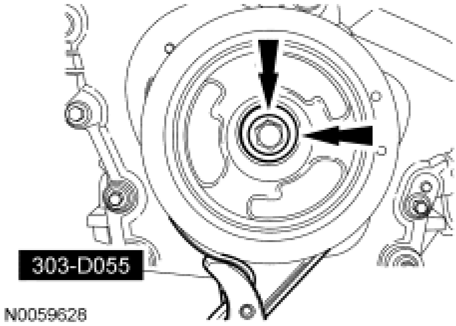


Fig. 31: Removing Crankshaft Bolt & Washer Using Special Tool (303-D055)
Courtesy of FORD MOTOR CO.

6. Using the special tool, remove the crankshaft pulley.

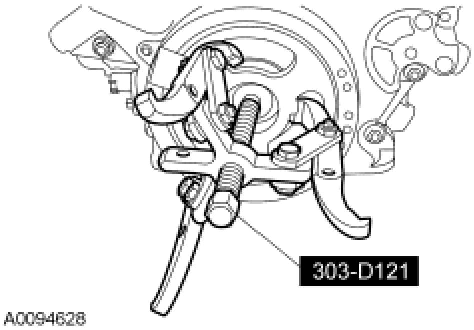


Fig. 32: Identifying Special Tools (303-D121) And Crankshaft Pulley
Courtesy of FORD MOTOR CO.

7. Using the special tool, remove and discard the crankshaft front seal.

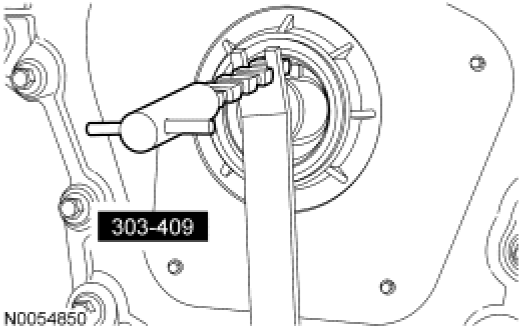


Fig. 33: Removing Crankshaft Front Seal Using Special Tool (303-409)

Courtesy of FORD MOTOR CO.

8. Loosen the exhaust flexible pipe clamp and disconnect the 2 exhaust hangers.

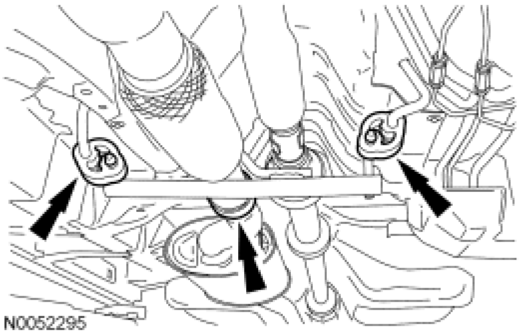


Fig. 34: Locating Exhaust Flexible Pipe Clamp & Exhaust Hangers
Courtesy of FORD MOTOR CO.

9. Remove the 4 nuts, the exhaust flexible pipe and the Y-pipe as an assembly.
    - Discard the nuts and the gasket.

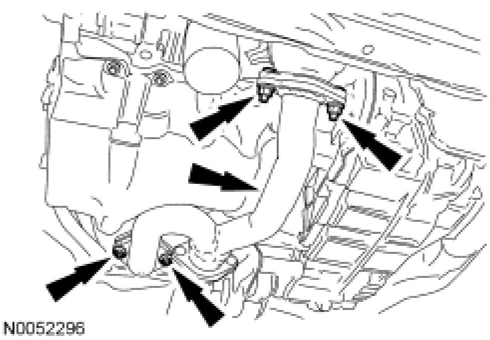


Fig. 35: Locating Exhaust Flexible Pipe, Y-Pipe & Nuts
Courtesy of FORD MOTOR CO.

10. Remove the 2 nuts and the roll restrictor heat shield.

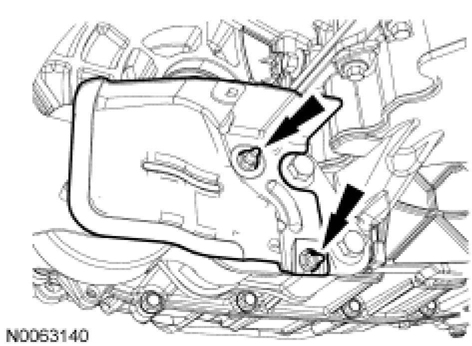


Fig. 36: Locating Roll Restrictor Heat Shield Nuts
Courtesy of FORD MOTOR CO.

11. Remove the roll restrictor through bolt and the 2 roll restrictor-to-transaxle bracket plate bolts.

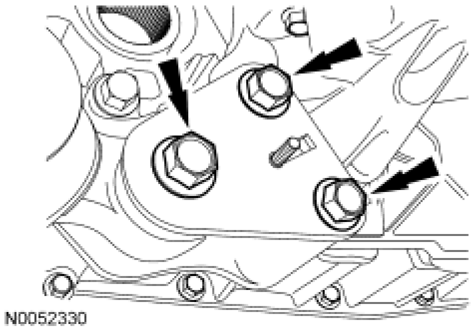


Fig. 37: Locating Roll Restrictor-To-Transaxle Bracket Plate Bolts
Courtesy of FORD MOTOR CO.

12. Loosen the roll restrictor-to-subframe through bolt.
    - Position the roll restrictor and transaxle bracket plate aside.

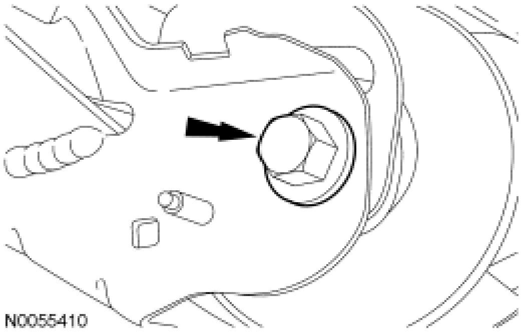


Fig. 38: Locating Roll Restrictor-To-Subframe Bolt
Courtesy of FORD MOTOR CO.

13. Remove the 3 bolts and the transaxle bracket.

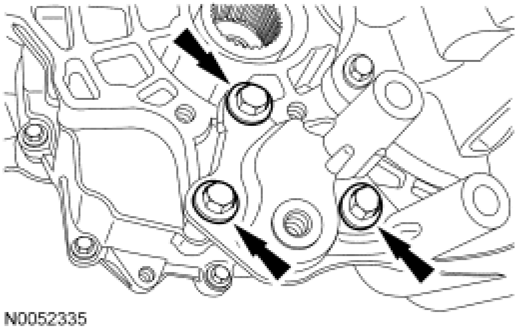


Fig. 39: Locating Transaxle Bracket Bolts
Courtesy of FORD MOTOR CO.

14. Remove and discard the RH front halfshaft nut.

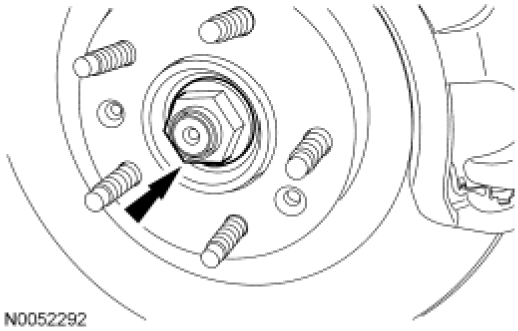


Fig. 40: Locating RH Front Halfshaft Nut
Courtesy of FORD MOTOR CO.

15. Remove the RH stabilizer link-to-lower control arm nut.

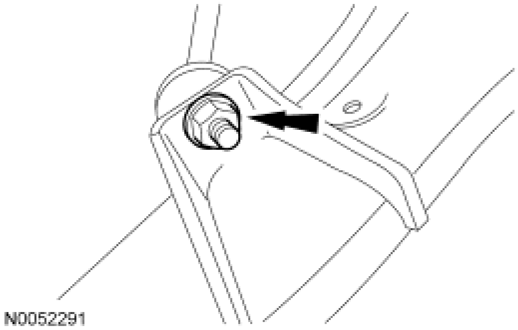


Fig. 41: Locating Stabilizer Bar Link Nut
Courtesy of FORD MOTOR CO.

16. Remove the RH lower control arm-to-knuckle pinch bolt.
    - Separate the lower control arm from the knuckle.

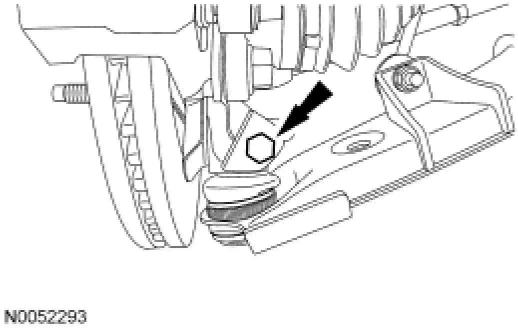


Fig. 42: Locating Ball Joint Pinch Bolt
Courtesy of FORD MOTOR CO.

17. Using the special tool, separate the RH halfshaft from the hub.

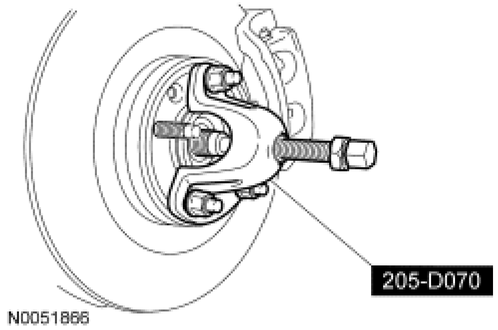


Fig. 43: Separating RH Halfshaft From Hub Using Special Tool (205-D070)
Courtesy of FORD MOTOR CO.

18. Using the special tools, separate the RH halfshaft from the intermediate shaft.
    - Remove the RH halfshaft.

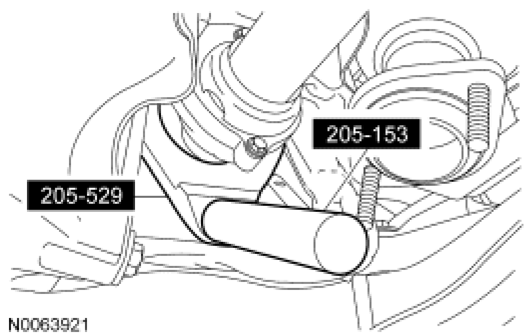


Fig. 44: Separating RH Halfshaft From Intermediate Shaft Using Special Tool (205-529) & (205-153)
Courtesy of FORD MOTOR CO.

19. Remove the drain plug and drain the engine oil.
    - Install the drain plug and tighten to 27 Nm (20 lb-ft).
20. If equipped, detach the engine block heater harness from the radiator support, the A/C suction tube and the engine wiring harness.

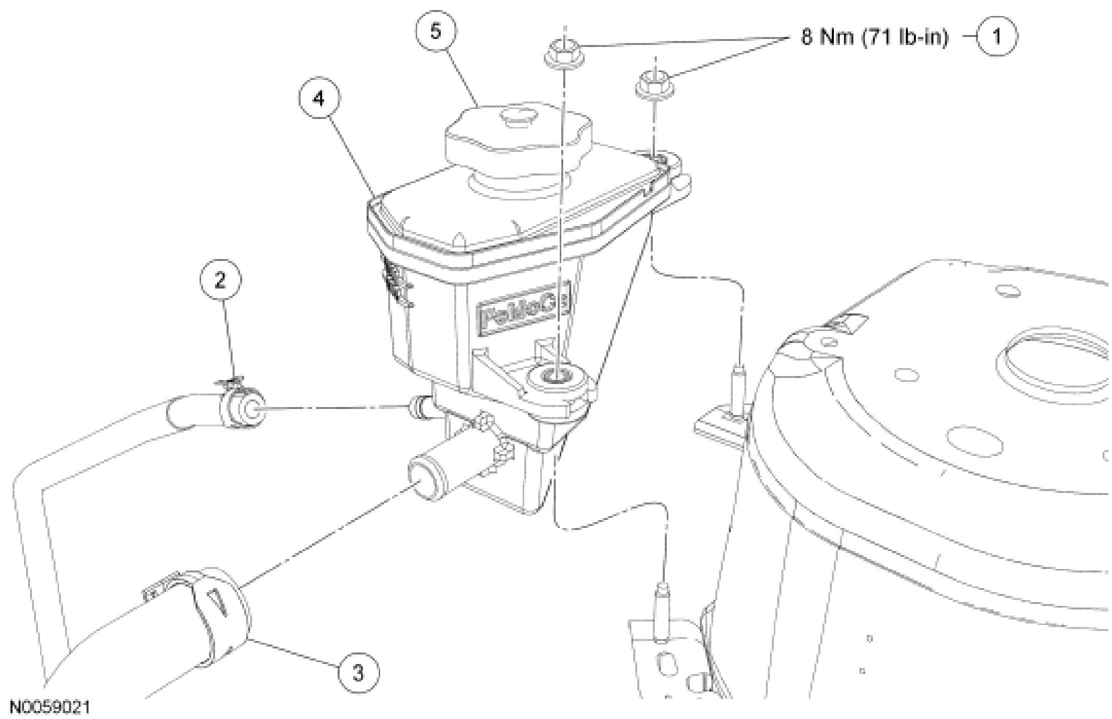


Fig. 45: Identifying Engine Block Heater Harness, Radiator Support, A/C Suction Tube & Engine Wiring Harness
Courtesy of FORD MOTOR CO.

21. Remove the engine air cleaner and air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION & FILTERING** article.
22. Remove the LH and RH valve covers. For additional information, refer to **Valve Cover - LH** and **Valve Cover - RH**.
23. Remove the safety clip from the A/C suction tube fitting.
    - Disconnect the A/C suction tube fitting and position the tube aside.

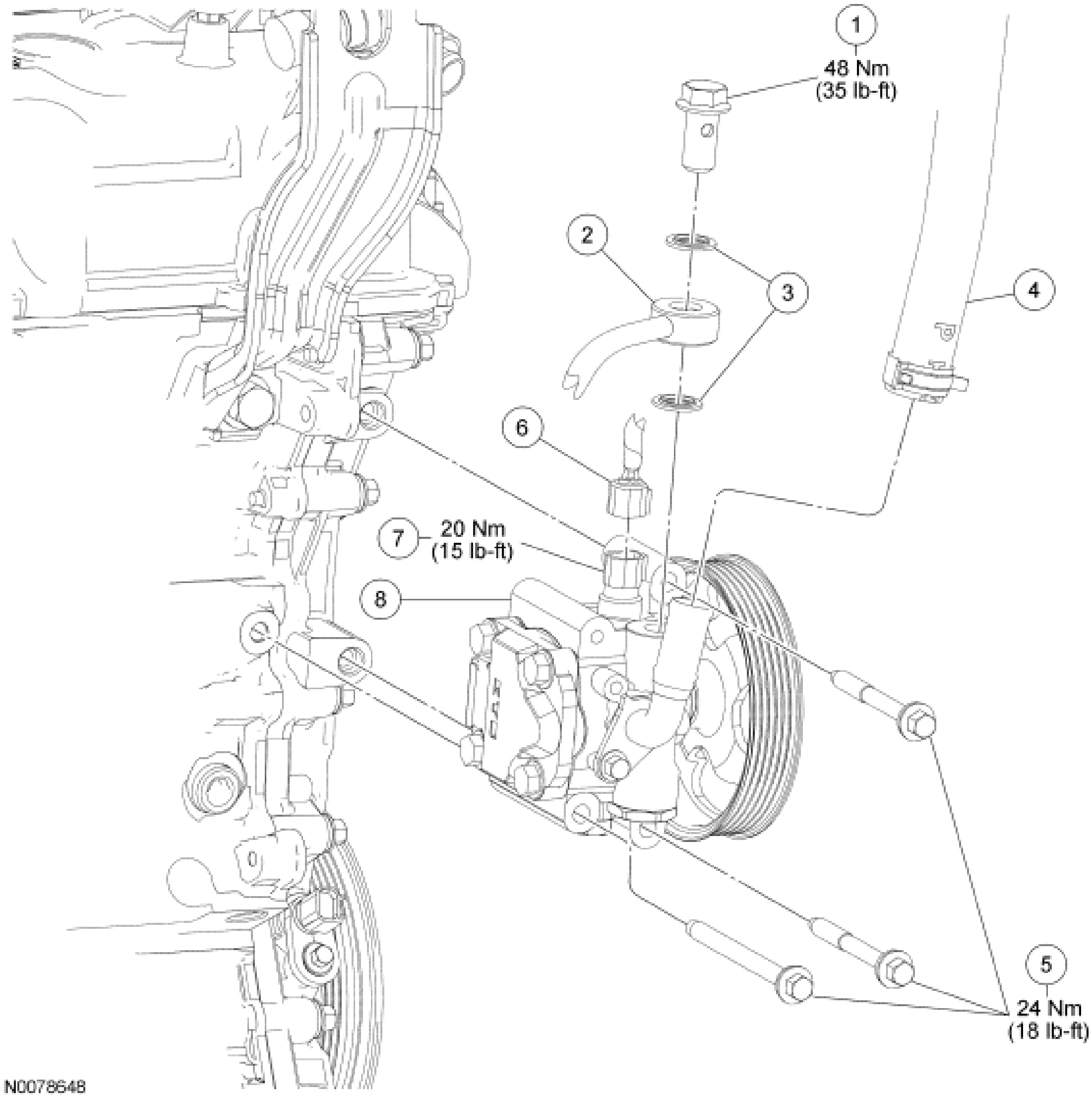


Fig. 46: Identifying Safety Clip On A/C Suction Tube Fitting
Courtesy of FORD MOTOR CO.

24. Remove the A/C pressure tube bracket bolt.

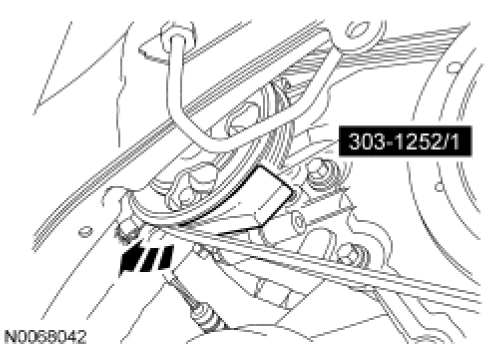


Fig. 47: Locating A/C Pressure Tube Bracket Bolt

Courtesy of FORD MOTOR CO.

25. Remove the nut and disconnect the A/C pressure tube fitting.
    - Discard the O-ring seal.
    - Position the A/C pressure tube aside.

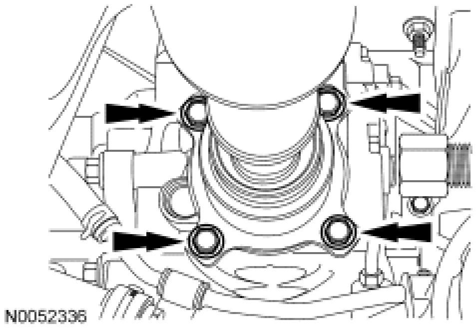


Fig. 48: Locating A/C Pressure Tube Fitting Nut
Courtesy of FORD MOTOR CO.

26. Disconnect the 2 engine wiring harness connectors.

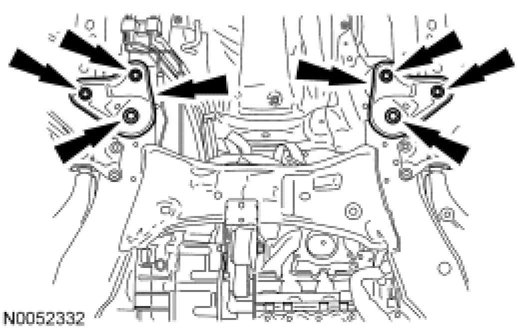


Fig. 49: Locating Engine Wiring Harness Connectors
Courtesy of FORD MOTOR CO.

27. Remove the bolt and the ground wire from the engine front cover.

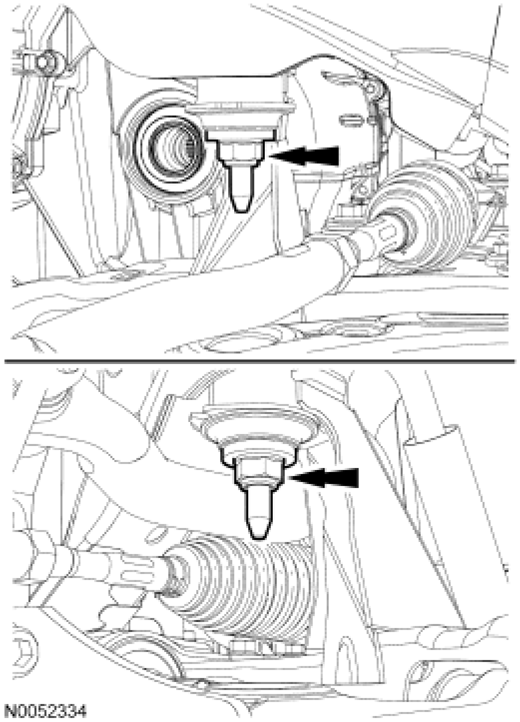


Fig. 50: Removing/Installing Bolt & Ground Wire From Engine Front Cover
Courtesy of FORD MOTOR CO.

28. Remove the nut, the ground wire and the radio interference capacitor wire from the engine front cover stud.

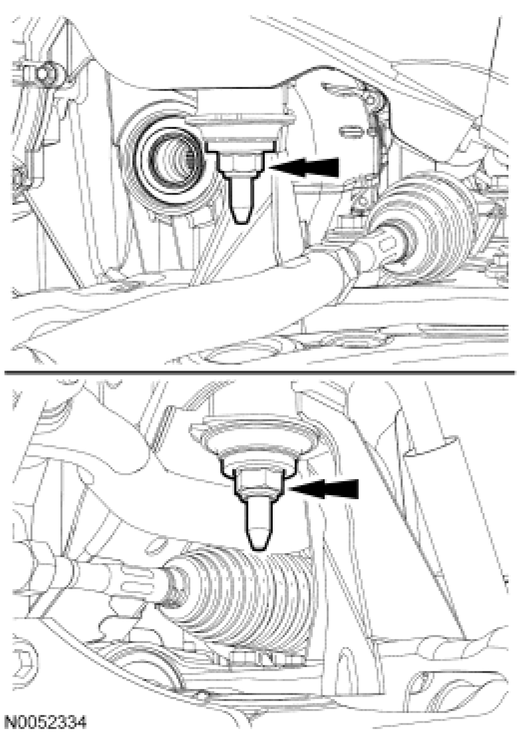


Fig. 51: Removing/installing Nut, Ground Wire & Radio Interference Capacitor Wire From Engine Front Cover Stud
Courtesy of FORD MOTOR CO.

29. Remove the nut, the ground wire and the radio interference capacitor from the cowl stud.

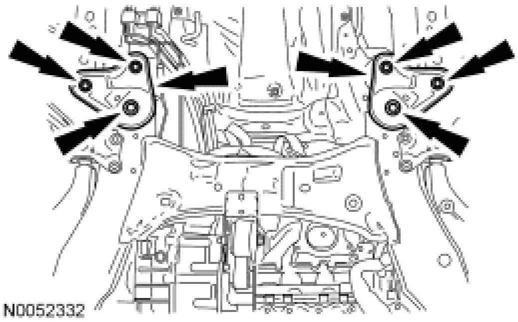


Fig. 52: Removing/Installing Nut, Ground Wire & Radio Interference Capacitor From Cowl Stud
Courtesy of FORD MOTOR CO.

30. Disconnect the purge valve electrical connector.

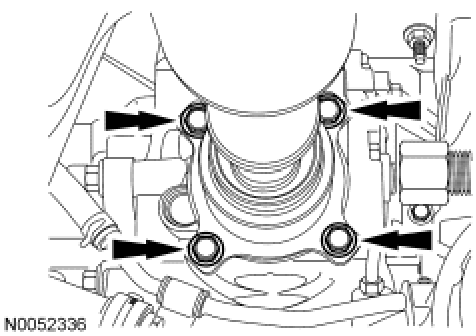


Fig. 53: Locating Purge Valve Electrical Connector
Courtesy of FORD MOTOR CO.

31. Disconnect the 3 PCM electrical connectors and position the wiring harness aside.

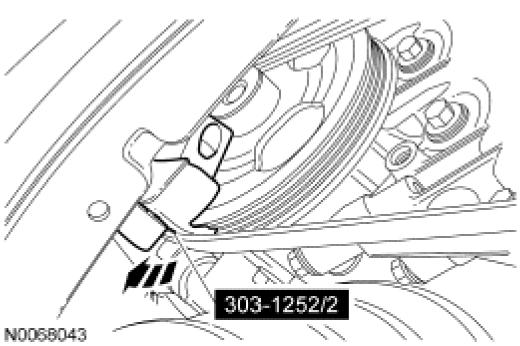


Fig. 54: Identifying PCM Electrical Connectors & Wiring Harness

Courtesy of FORD MOTOR CO.

32. Remove the 3 bolts and position the degas bottle aside.

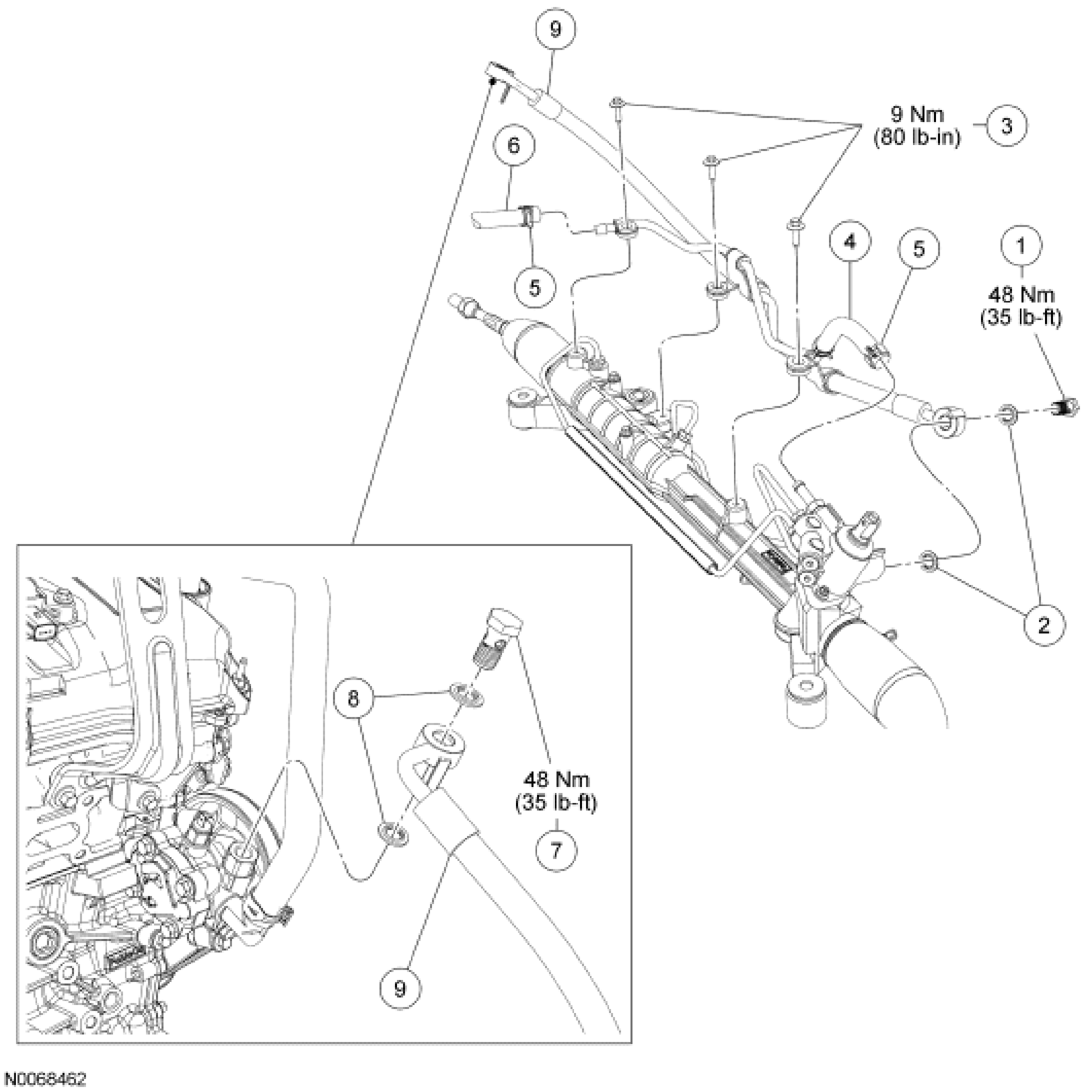


Fig. 55: Locating Coolant Reservoir Bolts
Courtesy of FORD MOTOR CO.

NOTE: **The area between the front of the engine and the body of the vehicle must be unobstructed in order to properly remove and install the engine front cover.**

33. Remove the 2 power steering reservoir nuts.
    - Support the power steering reservoir and hose away from the front of the engine with a length of mechanic's wire.

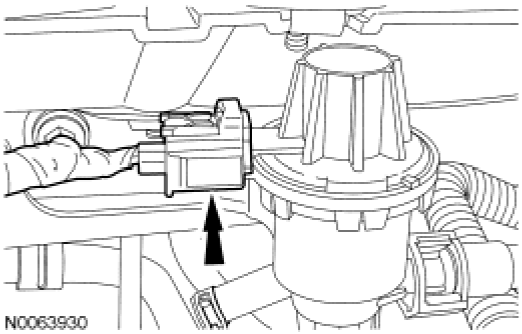


Fig. 56: Locating Power Steering Reservoir Nuts
Courtesy of FORD MOTOR CO.

34. Remove the 3 power steering pump bolts.
    - Support the power steering pump and hose away from the front of the engine with a length of mechanic's wire.

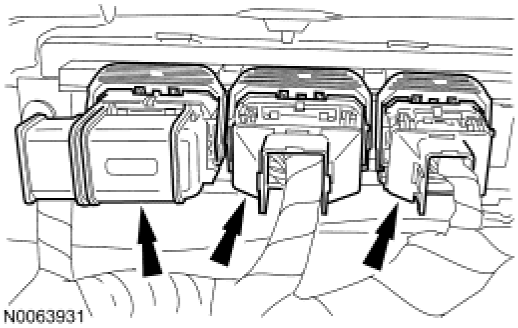


Fig. 57: Locating Power Steering Pump Bolts
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

35. Remove the bolts, the LH and the RH VCT solenoids.

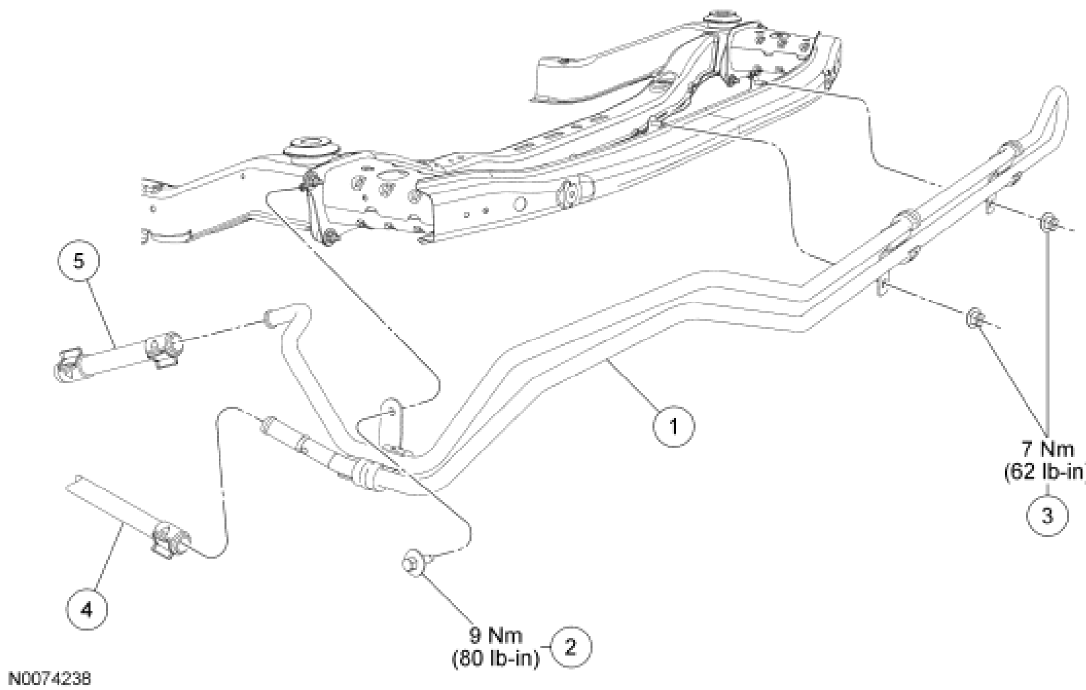


Fig. 58: Locating LH & RH VCT Solenoids Bolts
Courtesy of FORD MOTOR CO.

CAUTION: The special tool must be carefully aligned to the mounting bosses on the oil pan. Failure to follow these instructions may result in damage to the oil pan.

NOTE: The special tool and floor jack are used to raise and lower the engine to access the engine front cover and engine mount bracket fasteners.

36. Position a floor jack and the special tool under the oil pan.

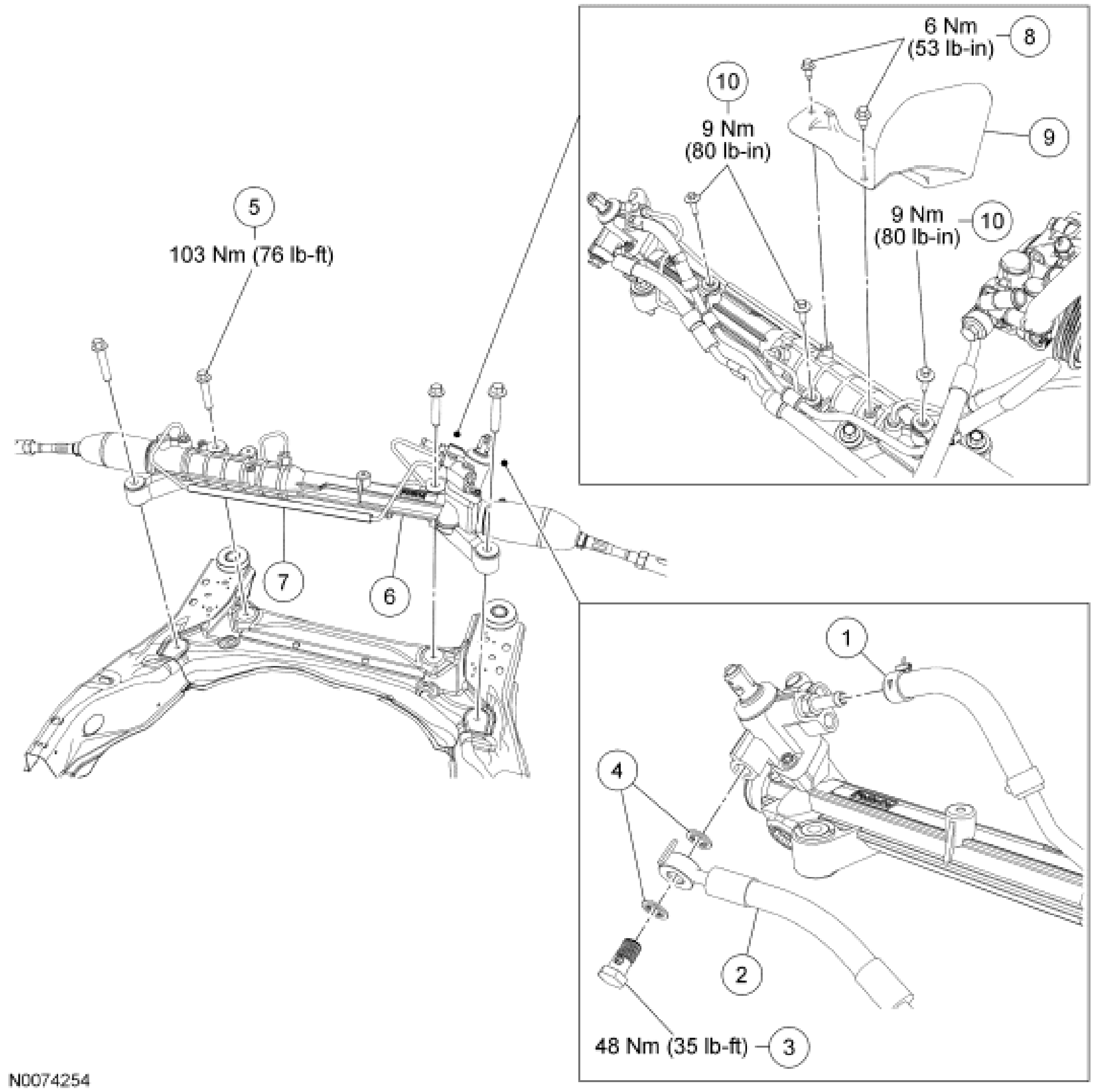


Fig. 59: Positioning Floor Jack & Special Tool (303-1295) Under Oil Pan
Courtesy of FORD MOTOR CO.

CAUTION: The transaxle through bolt must be loosened prior to removing the engine mount and lowering the front of the engine. Failure to follow these instructions may cause internal damage to the hydraulic transaxle mount and possible fluid leakage.

37. Loosen the transaxle mount through bolt.

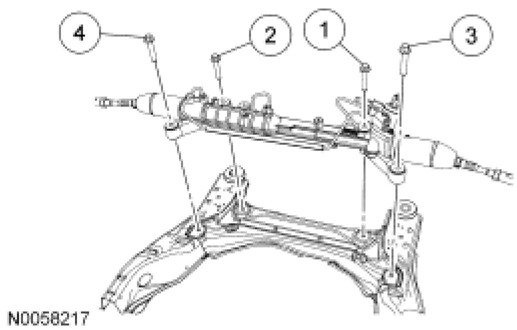


Fig. 60: Identifying Transaxle Mount Bolt
Courtesy of FORD MOTOR CO.

38. Remove the nut, bolt and engine mount brace.

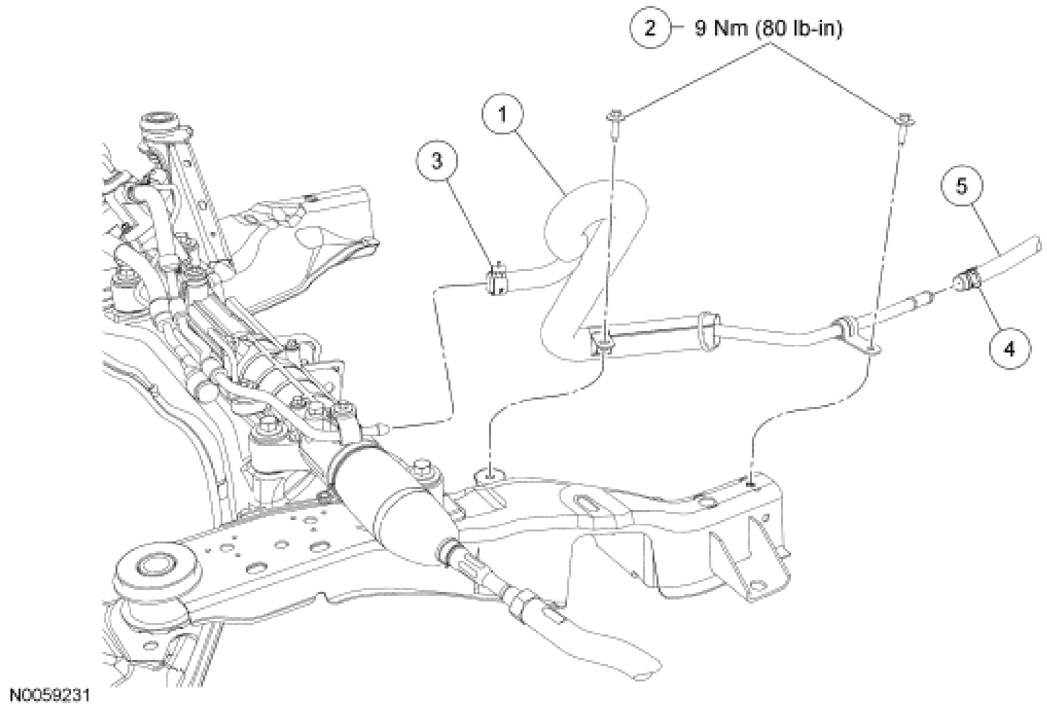


Fig. 61: Locating Nut, Bolt & Engine Mount Brace
Courtesy of FORD MOTOR CO.

39. Remove the 4 engine mount nuts.

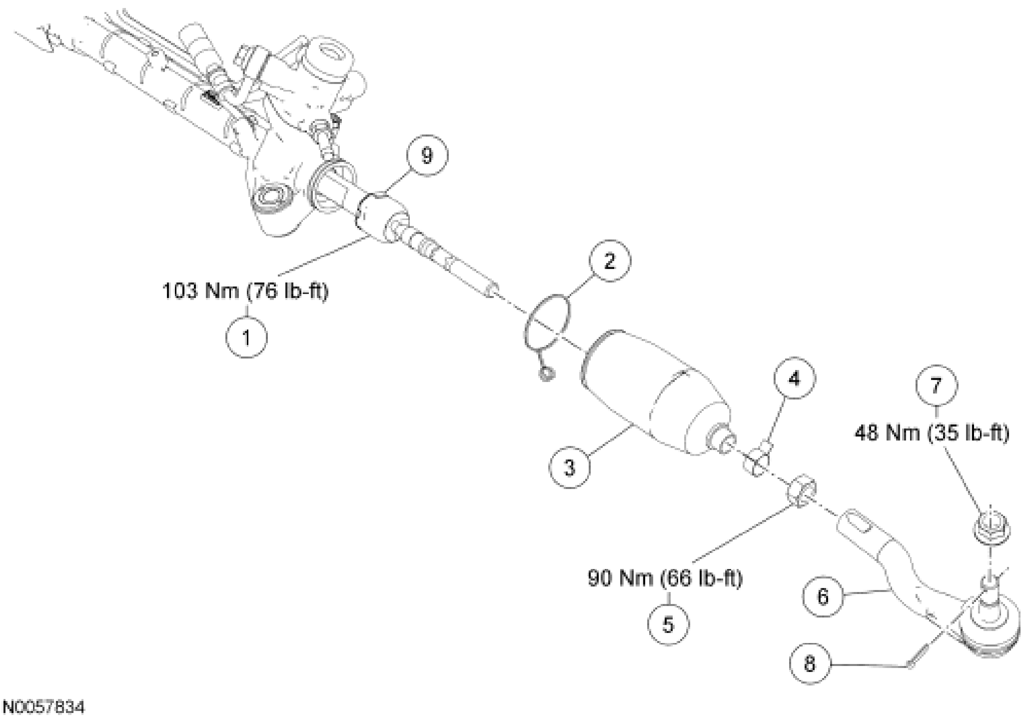


Fig. 62: Locating Engine Mount Nuts
Courtesy of FORD MOTOR CO.

40. Remove the 3 bolts and the engine mount.

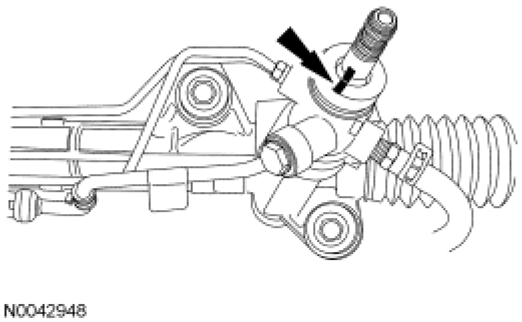


Fig. 63: Locating Engine Mount Bolts
Courtesy of FORD MOTOR CO.

41. Remove the 2 bolts and the engine mount bracket.

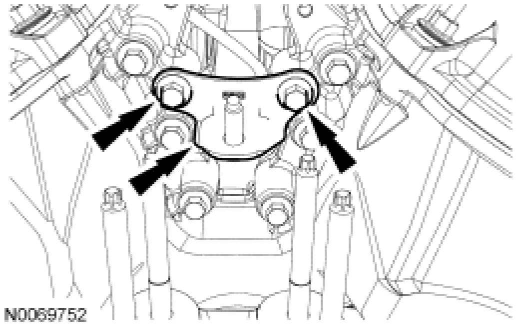


Fig. 64: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

42. Remove the 2 engine mount studs.

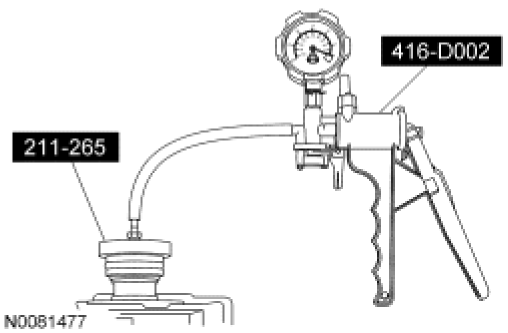


Fig. 65: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

43. Remove the 2 upper engine mount bracket bolts.

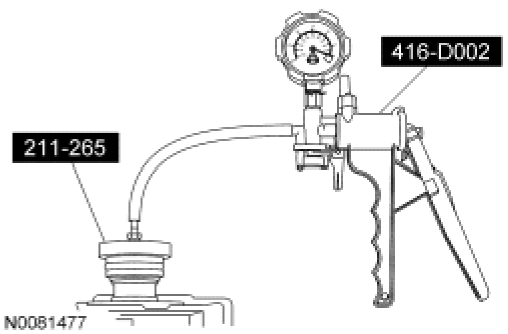


Fig. 66: Locating Upper Engine Mount Bracket Bolts
Courtesy of FORD MOTOR CO.

44. Lower the engine to access the lower engine mount bracket bolt.
45. Loosen the lower engine mount bracket bolt and remove the engine mount bracket and bolt as an assembly.

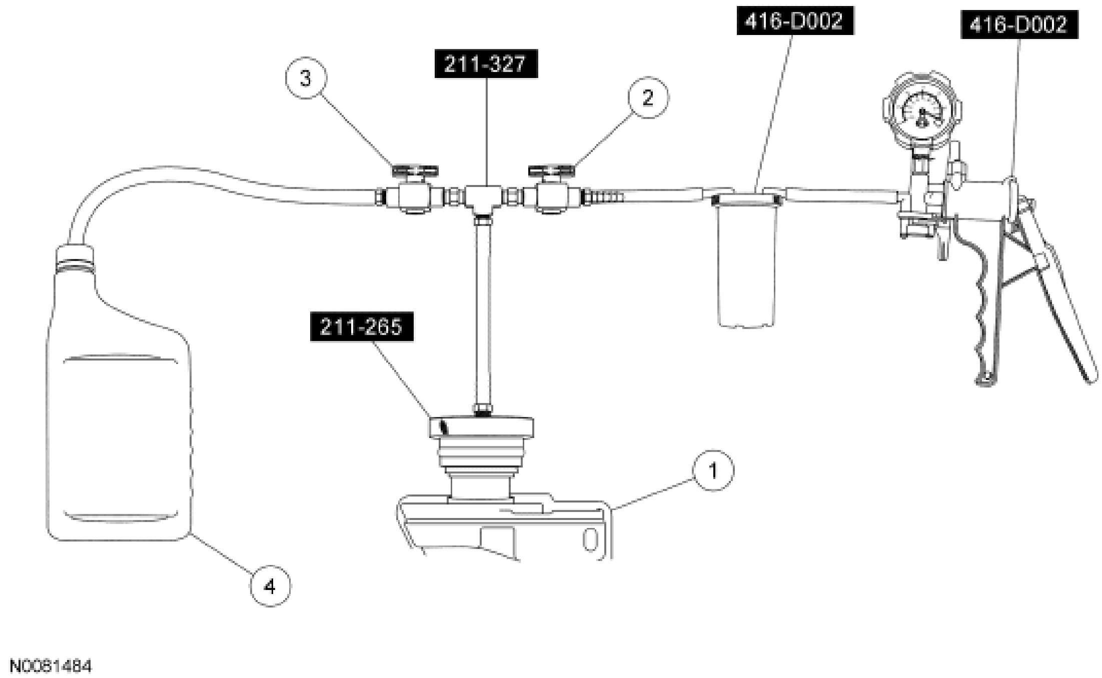


Fig. 67: Locating Lower Engine Mount Bracket Bolt
Courtesy of FORD MOTOR CO.

46. Remove the 22 engine front cover bolts.

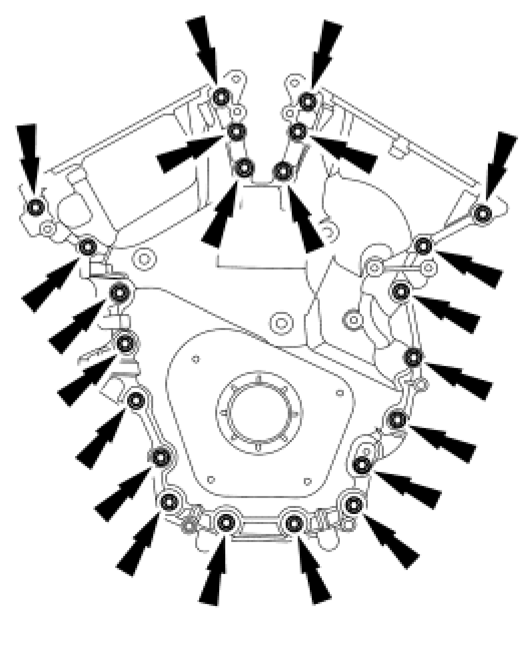


Fig. 68: Identifying Engine Front Cover Bolts

Courtesy of FORD MOTOR CO.

47. Install 6 of the engine front cover bolts (finger tight) into the 6 threaded holes in the engine front cover.
    - Tighten the bolts one turn at a time in a criss-cross pattern until the engine front cover-to-cylinder block seal is released.
        - Remove the engine front cover.

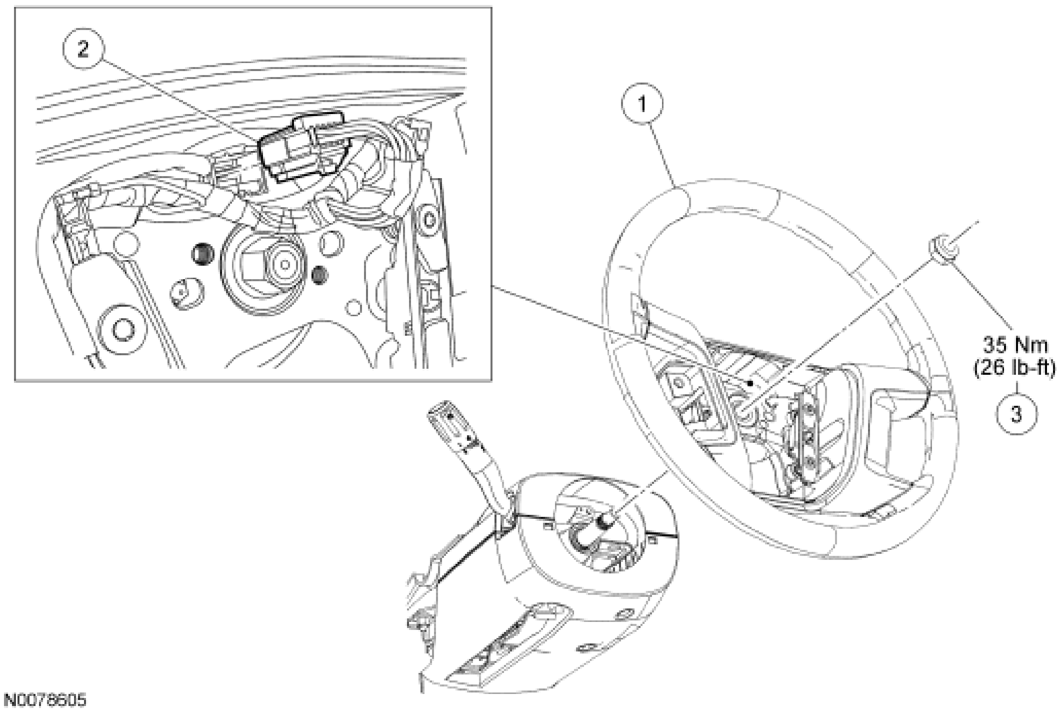


Fig. 69: Identifying Engine Front Cover Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Raise the engine to the installed position.

CAUTION: Only use a 3M Roloc® Bristle Disk, (2-in white, part number 07528) to clean the engine front cover. Do not use metal scrapers, wire brushes or any other power abrasive disk to clean the crankshaft rear seal retainer plate. These tools cause scratches and gouges that make leak paths.

2. Clean the engine front cover using a 3M Roloc® Bristle Disk (2-in white, part number 07528) in a suitable tool turning at the recommended speed of 15,000 rpm.
    - Thoroughly wash the engine front cover to remove any foreign material, including any abrasive particles created during the cleaning process.

CAUTION: Place clean, lint-free shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.

CAUTION: Do not use wire brushes, power abrasive discs or 3M Roloc® Bristle Disk (2-in white part number 07528) to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. They also cause contamination that will cause premature engine failure. Remove all traces of the gasket.

3. Clean the sealing surfaces of the cylinder heads, the cylinder block and the oil pan in the following sequence.
    1. Remove any large deposits of silicone or gasket material.
    2. Apply silicone gasket remover and allow to set for several minutes.
    3. Remove the silicone gasket remover. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep to remove any remaining traces of oil or coolant and to prepare the surfaces to bond. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.
    5. Make sure the 2 locating dowel pins are seated correctly in the cylinder block.
4. Install the special tools.

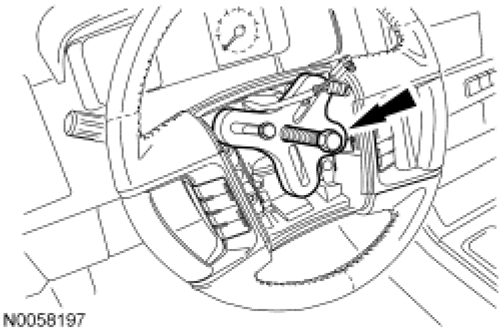


Fig. 70: Identifying Special Tool (307-399)
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The engine front cover and bolts 17, 18, 19 and 20 must be installed within 4 minutes of the initial sealant application. The remainder of the engine front cover bolts and the engine mount bracket bolts must be installed and

tightened within 35 minutes of the initial sealant application. If the time limits are exceeded, the sealant must be removed, the sealing area cleaned and sealant reapplied. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

5. Apply a 3.0 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover sealing surfaces including the 3 engine mount bracket bosses.
    - Apply a 5.5 mm (0.21 in) bead of Motorcraft High Performance Engine RTV Silicone to the oil pan-to-cylinder block joint and the cylinder head-to-cylinder block joint areas of the engine front cover in 5 places as indicated.

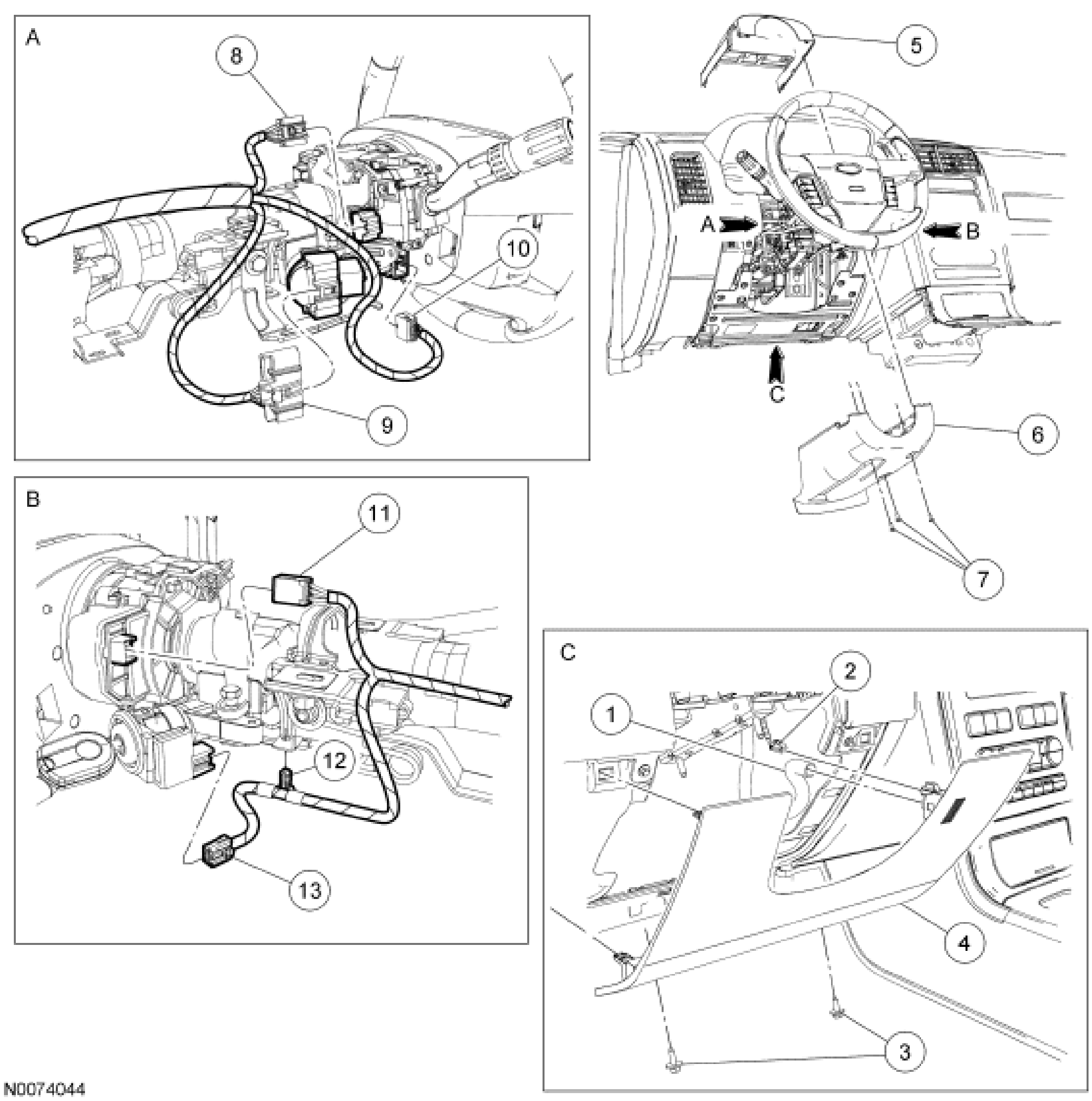


Fig. 71: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover Sealing Surfaces
Courtesy of FORD MOTOR CO.

NOTE: **Make sure the 2 locating dowel pins are seated correctly in the cylinder block.**

6. Install the engine front cover and bolts 17, 18, 19 and 20.
    - Tighten in sequence to 3 Nm (27 lb-in).

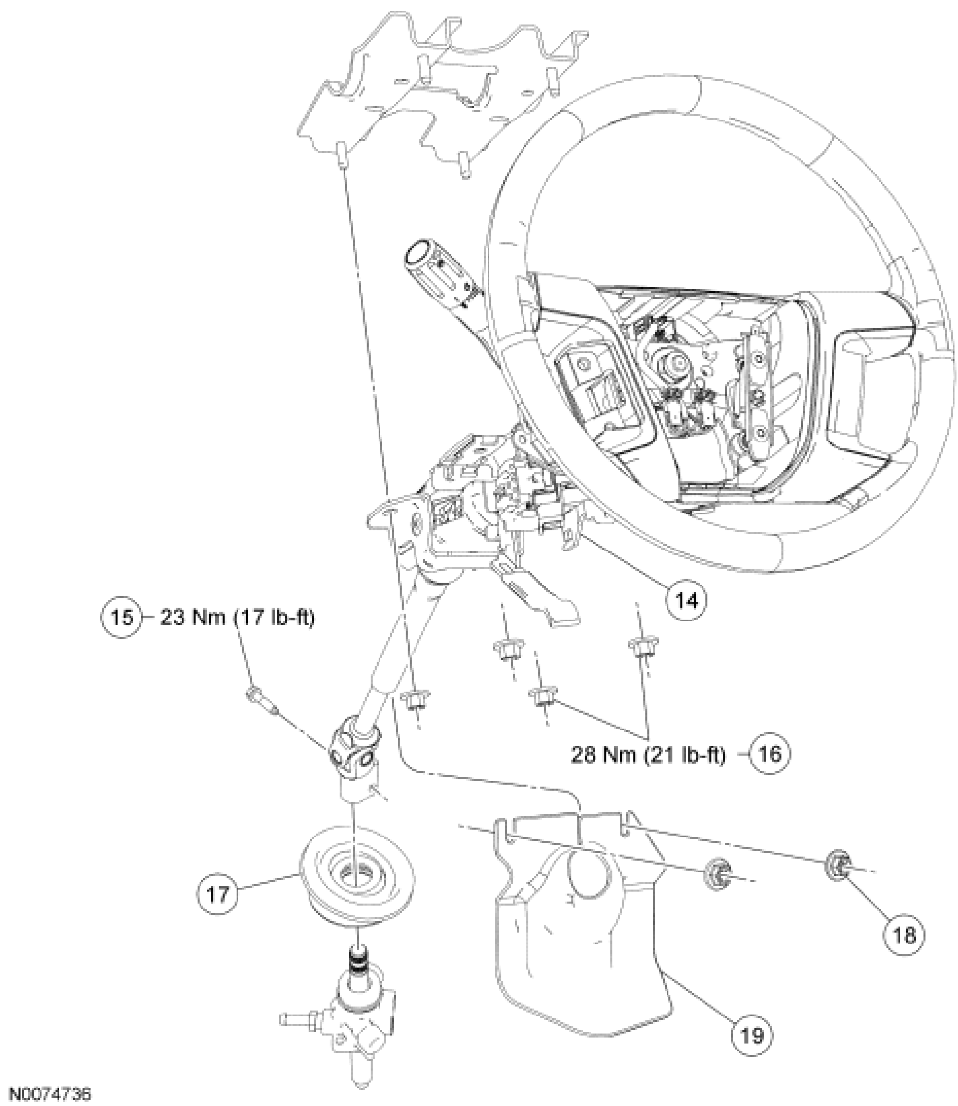


Fig. 72: Installing Engine Front Cover & Bolts In Sequence
Courtesy of FORD MOTOR CO.

7. Remove the special tools (alignment pins).

NOTE: **Do not tighten the bolt at this time.**

8. Lower the engine to allow installation of the engine mount bracket and lower bolt.

- Install the engine mount bracket and lower bolt as an assembly.

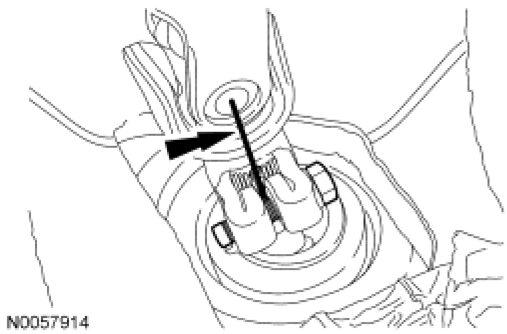


Fig. 73: Locating Lower Engine Mount Bracket Bolt
Courtesy of FORD MOTOR CO.

NOTE: Do not tighten the bolts at this time.

9. Raise the engine to the installed position.
   - Install the 2 upper engine mount bracket bolts.

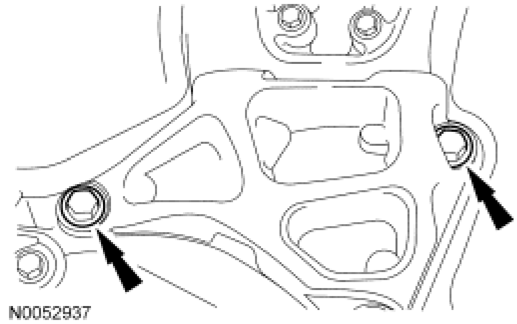


Fig. 74: Locating Upper Engine Mount Bracket Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Do not expose the Motorcraft High Performance Engine RTV Silicone to engine oil for at least 90 minutes after installing the engine front cover. Failure to follow this instruction may cause oil leakage.

10. Install the remaining engine front cover bolts. Tighten all of the engine front cover bolts and engine mount bracket bolts in the sequence shown in 2 stages:
    - Stage 1: Tighten bolts 1 thru 22 to 10 Nm (89 lb-in) and bolts 23, 24 and 25 to 15 Nm (11 lb-ft).
    - Stage 2: Tighten bolts 1 thru 22 to 24 Nm (18 lb-ft) and bolts 23, 24 and 25 to 75 Nm (55 lb-ft).

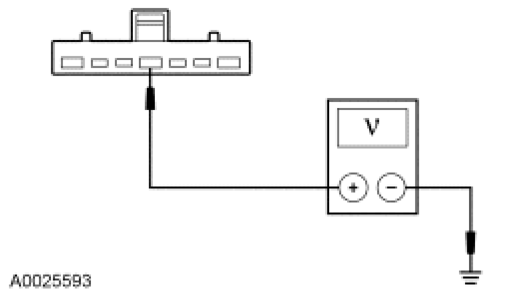


Fig. 75: Identifying Tightening Of Engine Front Cover Bolts & Engine Mount Bracket Bolts In Sequence
Courtesy of FORD MOTOR CO.

11. Install the 2 engine mount studs.
    - Tighten to 18 Nm (13 lb-ft).

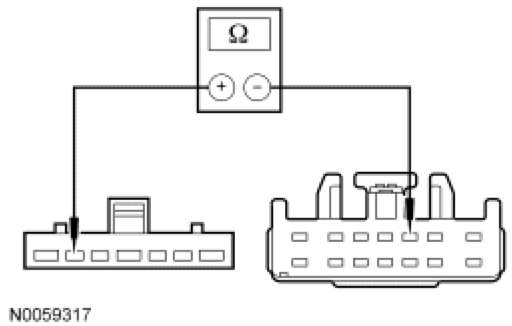


Fig. 76: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

12. Install the engine mount bracket and the 2 bolts.
    - Tighten to 24 Nm (18 lb-ft).

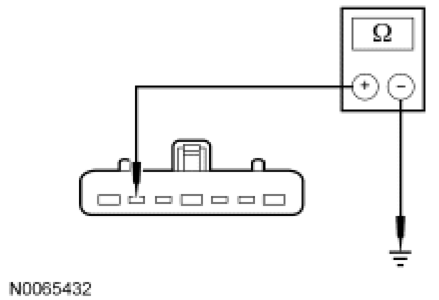


Fig. 77: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

13. Install the engine mount and the 3 bolts.

- Tighten to 90 Nm (66 lb-ft).

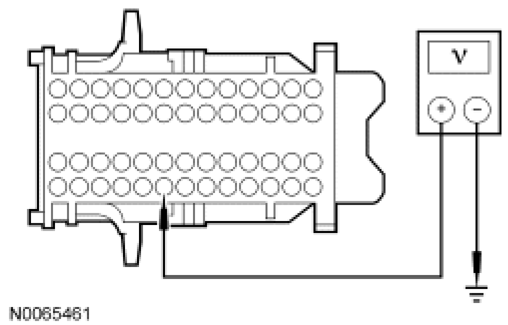


Fig. 78: Locating Engine Mount Bolts
Courtesy of FORD MOTOR CO.

14. Install the 4 engine mount nuts.
    - Tighten to 63 Nm (46 lb-ft).

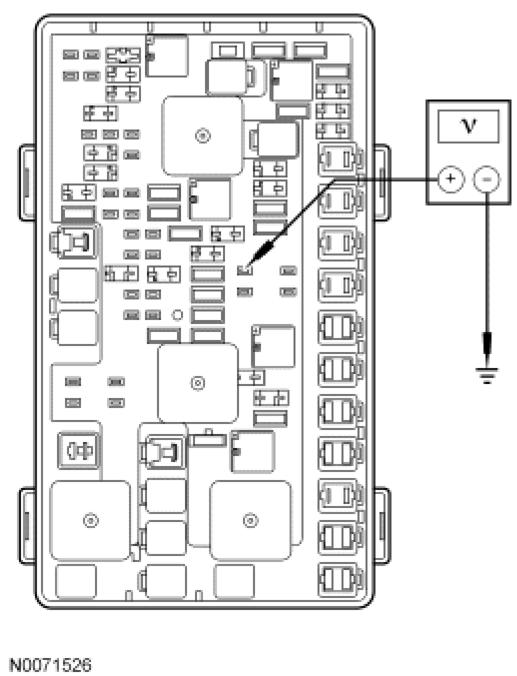


Fig. 79: Locating Engine Mount Nuts
Courtesy of FORD MOTOR CO.

15. Install the engine mount brace, nut and bolt.
    - Tighten to 20 Nm (15 lb-ft).

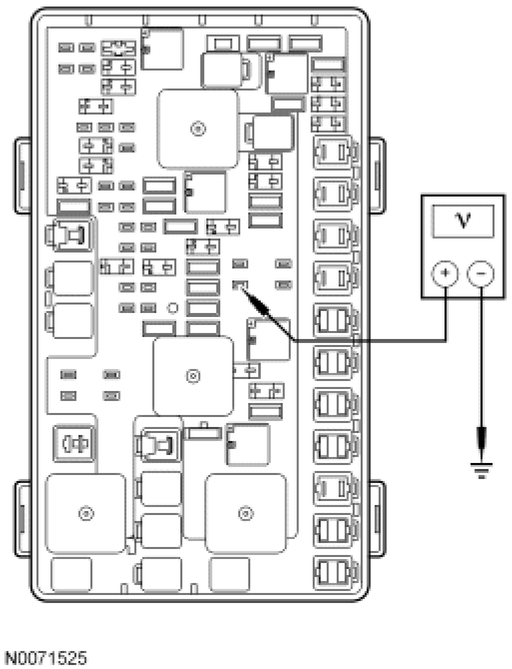


Fig. 80: Locating Nut, Bolt & Engine Mount Brace
Courtesy of FORD MOTOR CO.

16. Tighten the transaxle mount through bolt to 175 Nm (129 lb-ft).

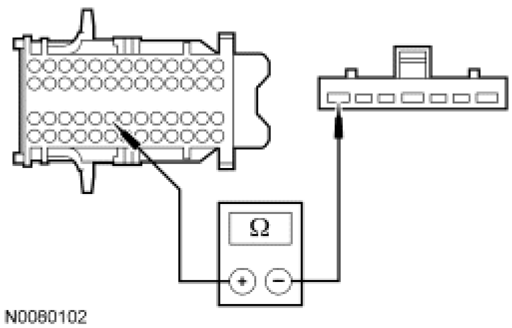


Fig. 81: Identifying Transaxle Mount Bolt
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

17. Install the LH and RH VCT solenoids and bolts.
    - Tighten to 10 Nm (89 lb-in).

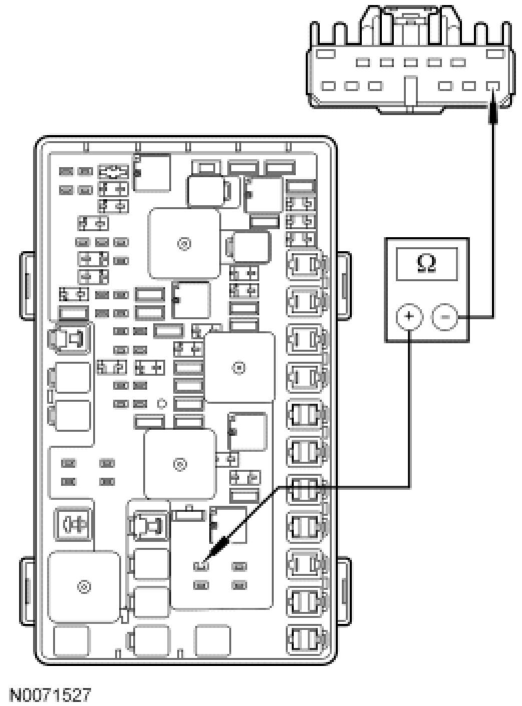


Fig. 82: Locating LH & RH VCT Solenoids Bolts
Courtesy of FORD MOTOR CO.

18. Install the power steering pump and the 3 bolts.
    - Tighten to 24 Nm (18 lb-ft).

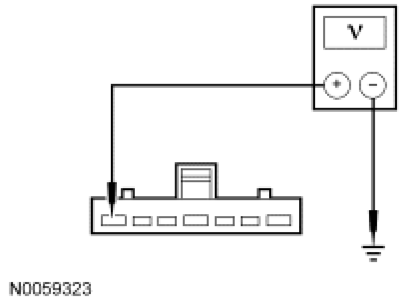


Fig. 83: Locating Power Steering Pump Bolts
Courtesy of FORD MOTOR CO.

19. Install the power steering reservoir and the 2 nuts.
    - Tighten to 8 Nm (71 lb-in).

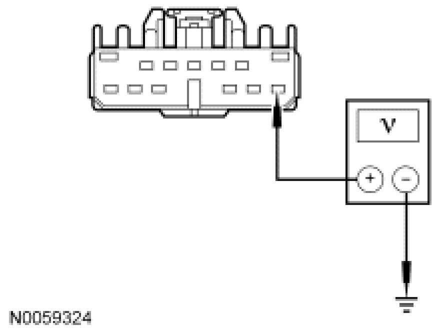


Fig. 84: Locating Power Steering Reservoir Nuts
Courtesy of FORD MOTOR CO.

20. Install the degas bottle and the 3 bolts.
    - Tighten to 9 Nm (80 lb-in).

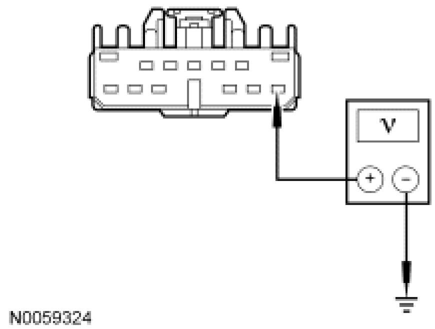


Fig. 85: Locating Coolant Reservoir Bolts
Courtesy of FORD MOTOR CO.

21. Connect the 3 PCM electrical connectors.

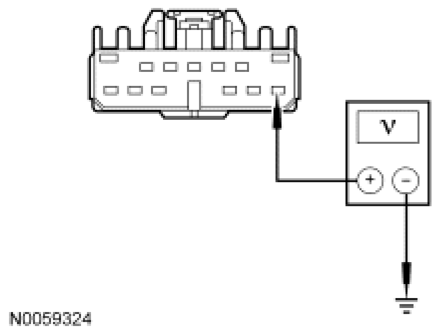


Fig. 86: Identifying PCM Electrical Connectors & Wiring Harness
Courtesy of FORD MOTOR CO.

22. Connect the purge valve electrical connector.

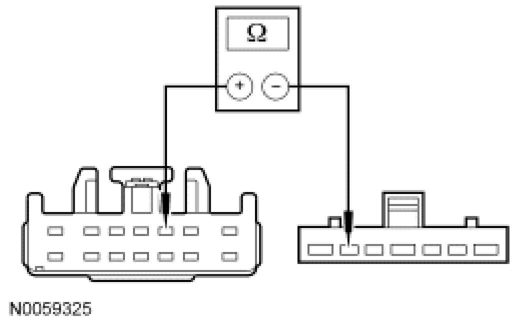


Fig. 87: Locating Purge Valve Electrical Connector
Courtesy of FORD MOTOR CO.

23. Install the radio interference capacitor, the ground wire and the nut to the cowl stud.
    - Tighten to 10 Nm (89 lb-in).

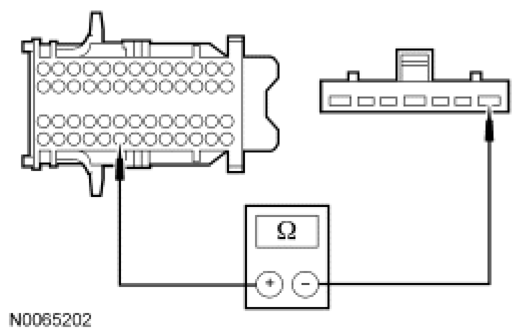


Fig. 88: Removing/Installing Nut, Ground Wire & Radio Interference Capacitor From Cowl Stud
Courtesy of FORD MOTOR CO.

24. Install the radio interference capacitor wire, the ground wire and the nut to the engine front cover stud.
    - Tighten to 10 Nm (89 lb-in).

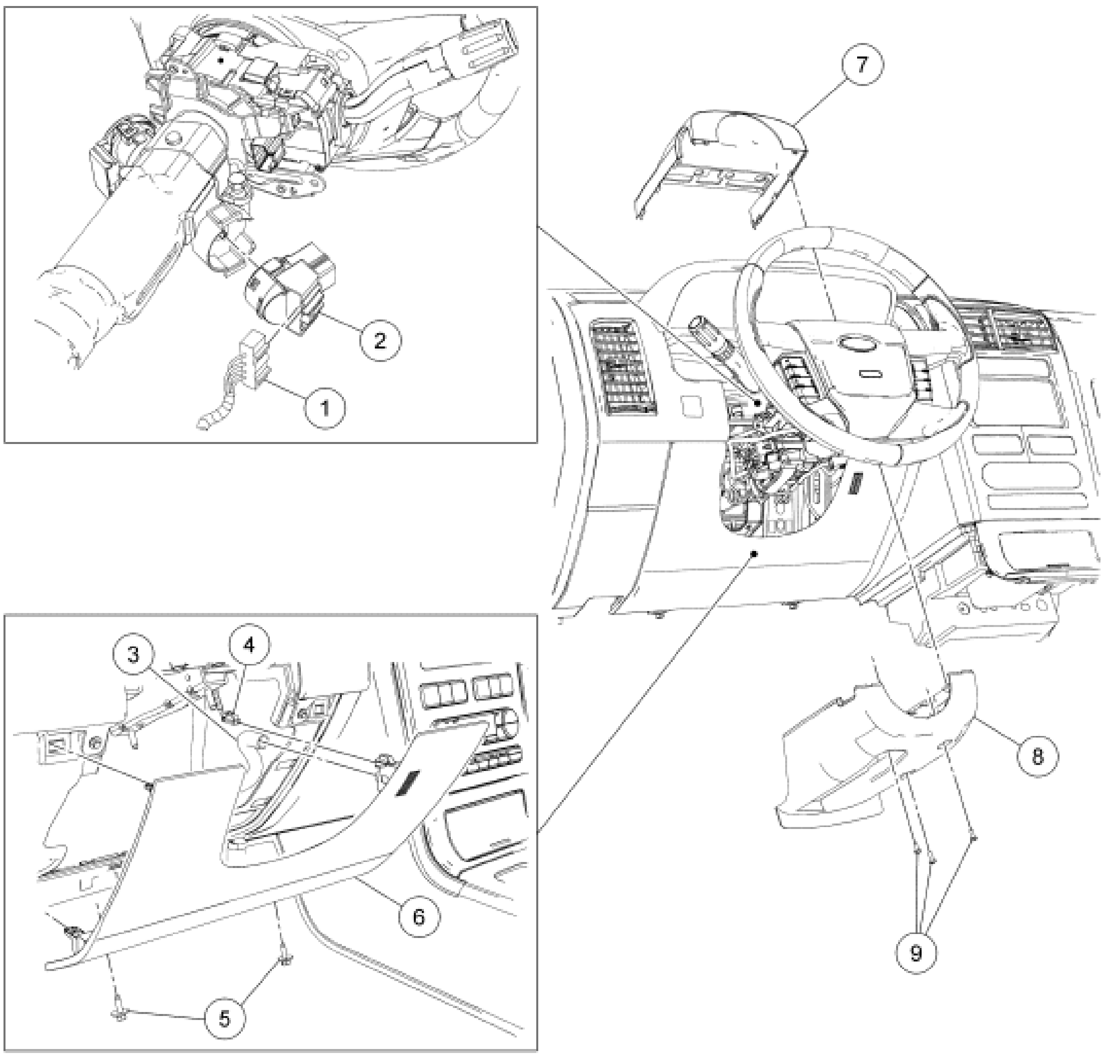


Fig. 89: Removing/installing Nut, Ground Wire & Radio Interference Capacitor Wire From Engine Front Cover Stud
Courtesy of FORD MOTOR CO.

25. Install the ground wire and bolt on the engine front cover.
    - Tighten to 10 Nm (89 lb-in).

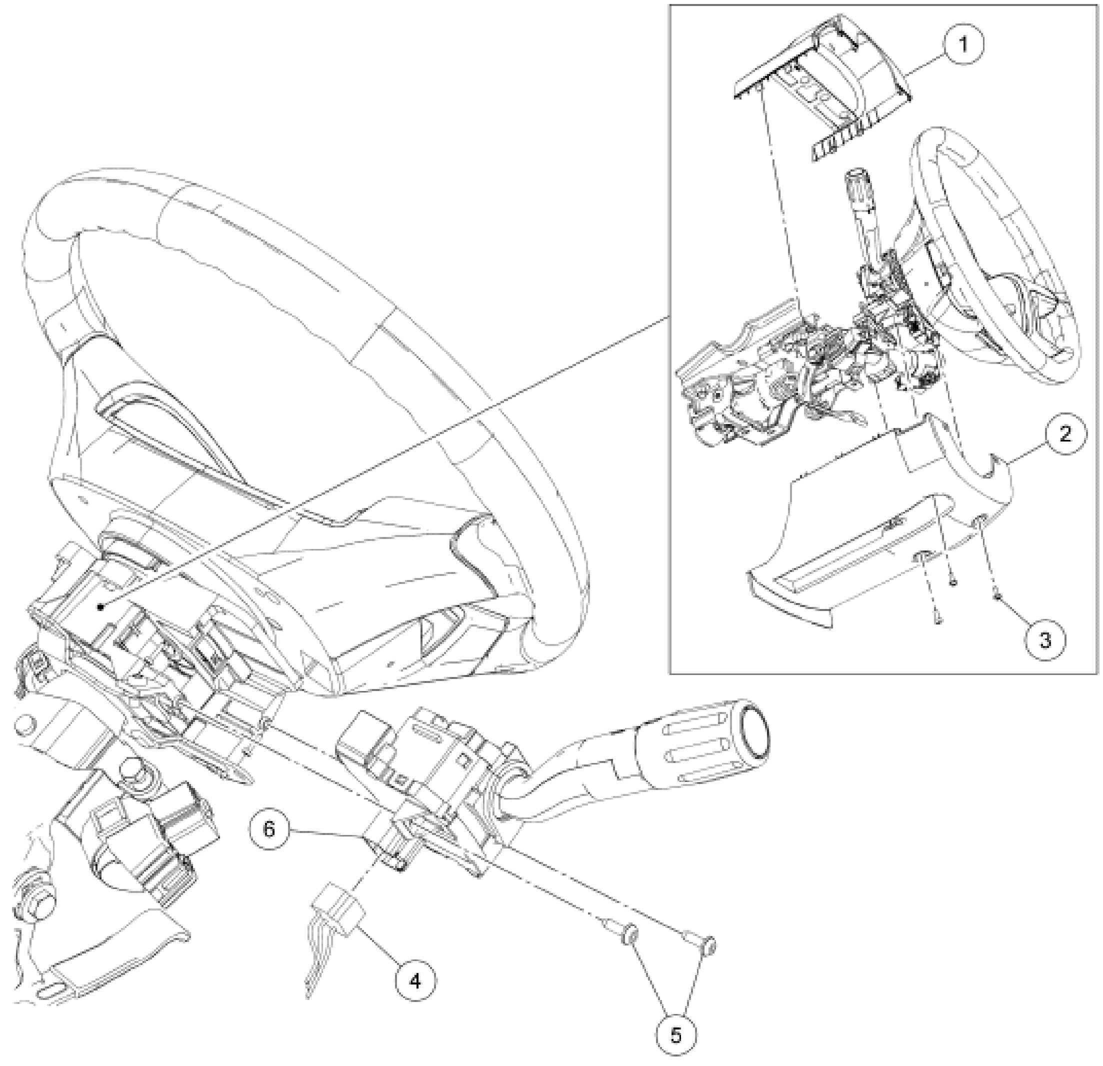


Fig. 90: Removing/Installing Bolt & Ground Wire From Engine Front Cover
Courtesy of FORD MOTOR CO.

26. Connect the 2 engine wiring harness connectors.

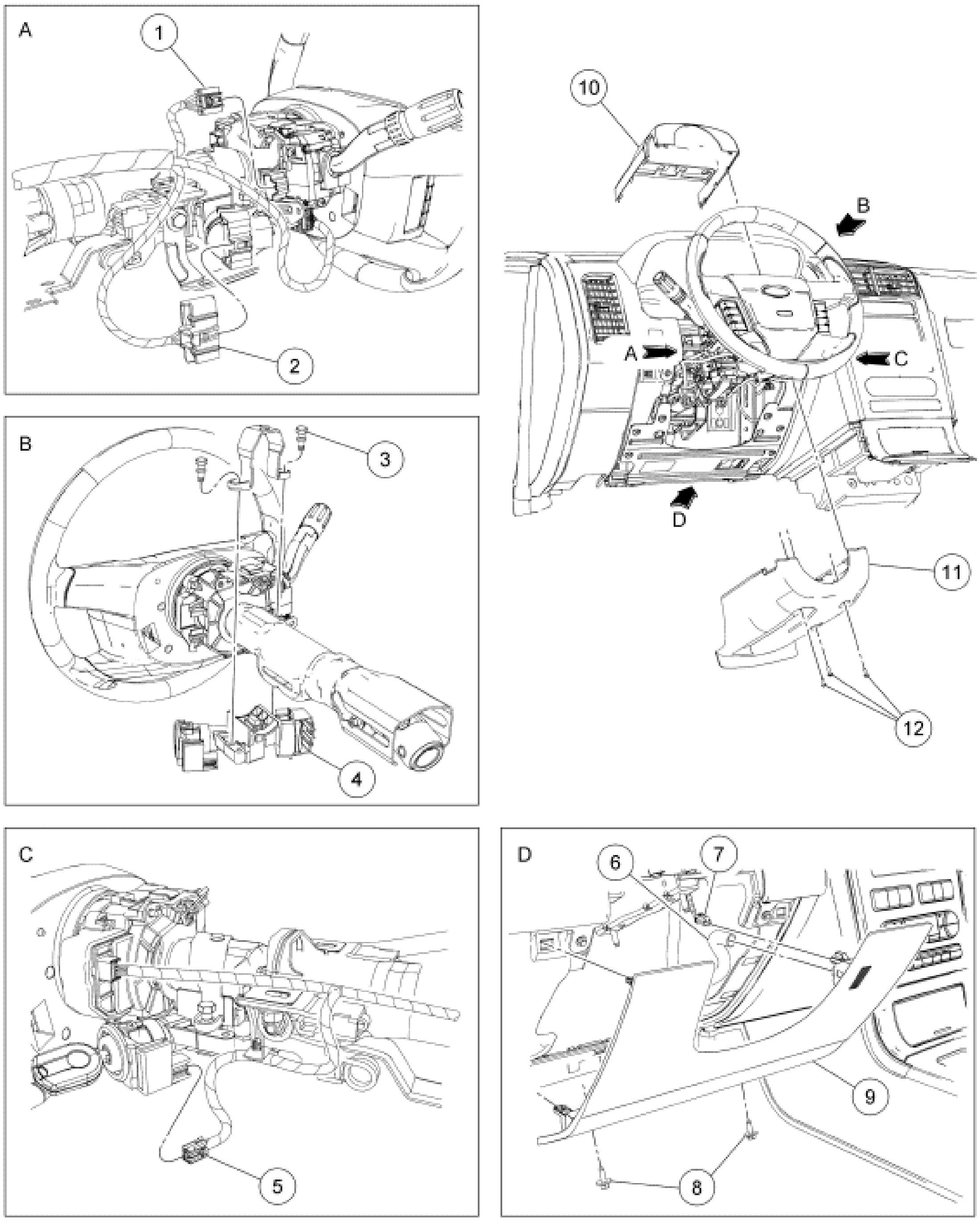


Fig. 91: Locating Engine Wiring Harness Connectors
Courtesy of FORD MOTOR CO.

27. Using a new O-ring seal, connect the A/C pressure tube fitting and install the nut.
    - Tighten to 8 Nm (71 lb-in).

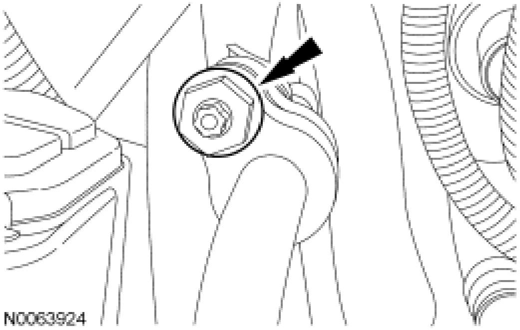


Fig. 92: Locating A/C Pressure Tube Fitting Nut
Courtesy of FORD MOTOR CO.

28. Install the A/C pressure tube bracket and bolt.
    - Tighten to 8 Nm (71 lb-in).

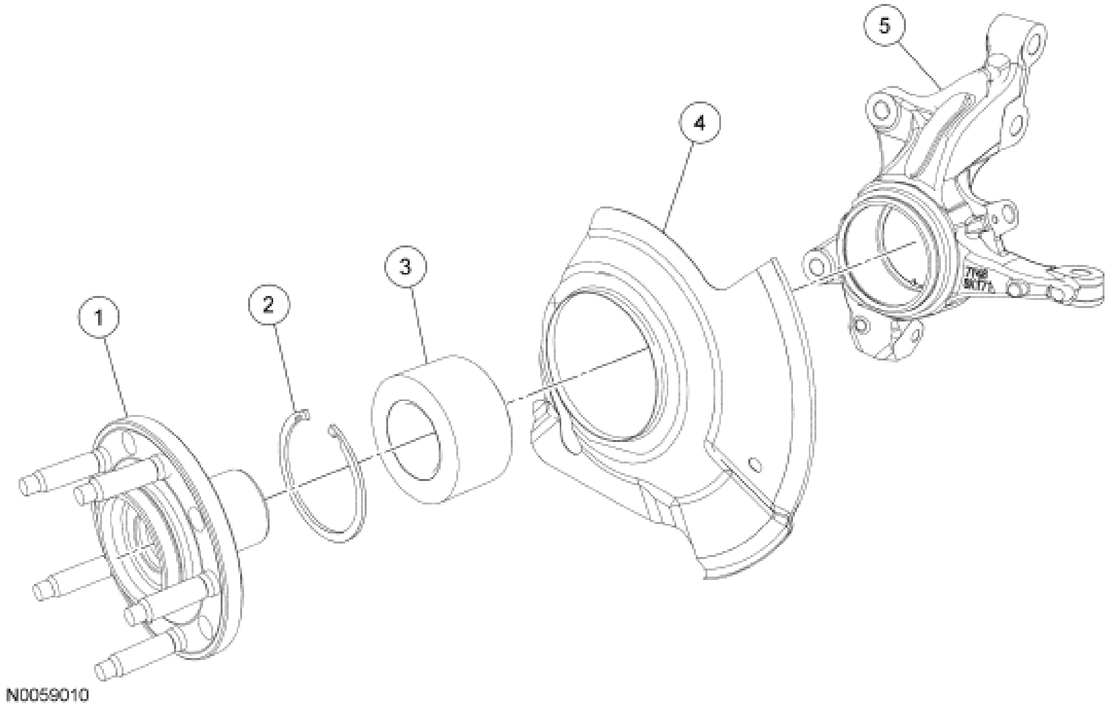


Fig. 93: Locating A/C Pressure Tube Bracket Bolt
Courtesy of FORD MOTOR CO.

29. Connect the A/C suction tube fitting.
    - Install the safety clip onto the fitting.

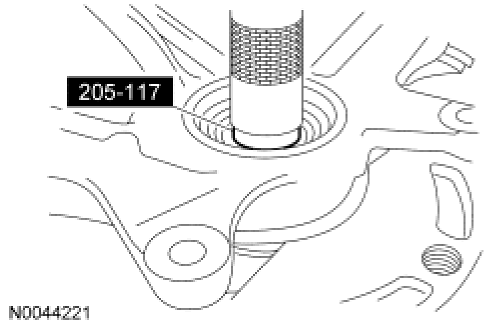


Fig. 94: Identifying Safety Clip On A/C Suction Tube Fitting
Courtesy of FORD MOTOR CO.

30. Install the LH and RH valve covers. For additional information, refer to **Valve Cover - LH** and **Valve Cover - RH**.
31. Install the engine air cleaner and air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION & FILTERING** article.
32. If equipped, attach the engine block heater harness to the radiator support, the A/C suction tube and the engine wiring harness.

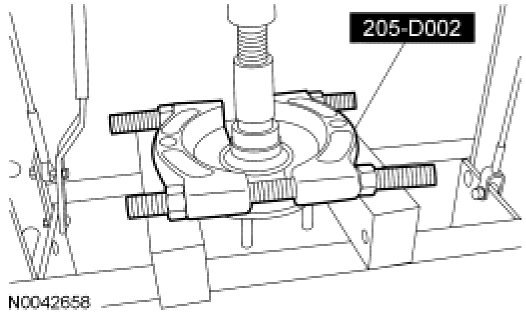


Fig. 95: Identifying Engine Block Heater Harness, Radiator Support, A/C Suction Tube & Engine Wiring Harness
Courtesy of FORD MOTOR CO.

33. Align the RH halfshaft splines with the intermediate shaft and push the halfshaft on until the circlip locks the shafts together.
    - Pull the inboard halfshaft outward to make sure the circlip is locked.

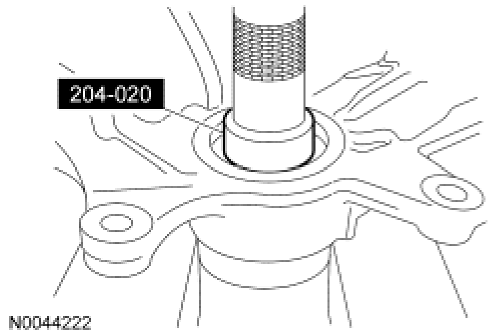


Fig. 96: Pushing Halfshaft On Until Circlip Locks Shafts Together
Courtesy of FORD MOTOR CO.

NOTE: Do not tighten the halfshaft nut at this time.

34. Install the RH halfshaft into the hub and install a new halfshaft nut.

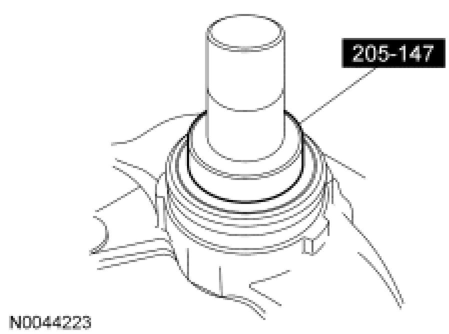


Fig. 97: Locating RH Front Halfshaft Nut
Courtesy of FORD MOTOR CO.

35. Install the RH lower ball joint into the steering knuckle and install the pinch bolt.
    - Tighten to 55 Nm (41 lb-ft).

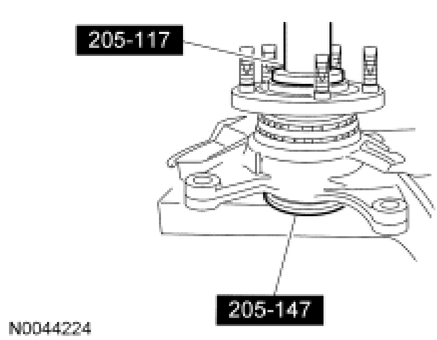


Fig. 98: Locating Ball Joint Pinch Bolt
Courtesy of FORD MOTOR CO.

36. Install the RH stabilizer bar link into the lower control arm and install the nut.

- Tighten to 90 Nm (66 lb-ft).

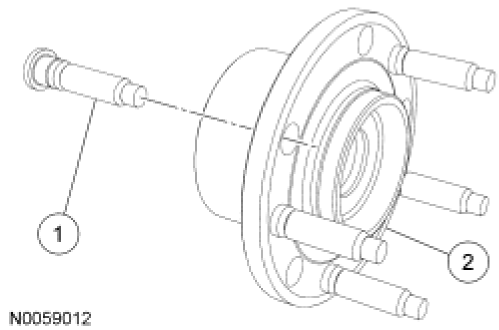


Fig. 99: Locating Stabilizer Bar Link Nut
Courtesy of FORD MOTOR CO.

NOTE: Apply the brake to keep the halfshaft from rotating.

37. Tighten the RH halfshaft nut to 350 Nm (258 lb-ft).

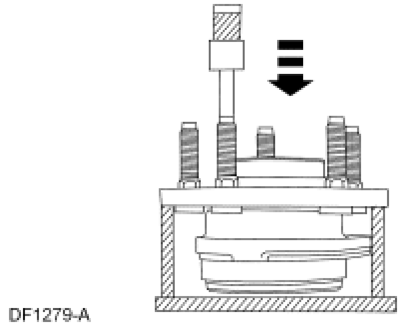


Fig. 100: Locating RH Front Halfshaft Nut
Courtesy of FORD MOTOR CO.

38. Install and the transaxle bracket and the 3 bolts.
    - Tighten to 90 Nm (66 lb-ft).

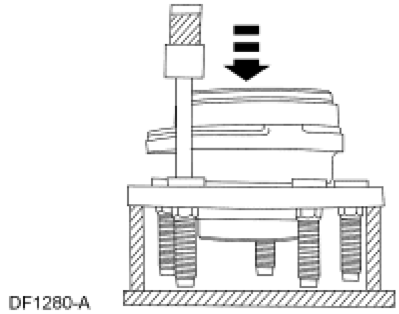


Fig. 101: Locating Transaxle Bracket Bolts

Courtesy of FORD MOTOR CO.

39. Position the roll restrictor and transaxle bracket plate and install the 3 bolts.
    - Tighten to 90 Nm (66 lb-ft).

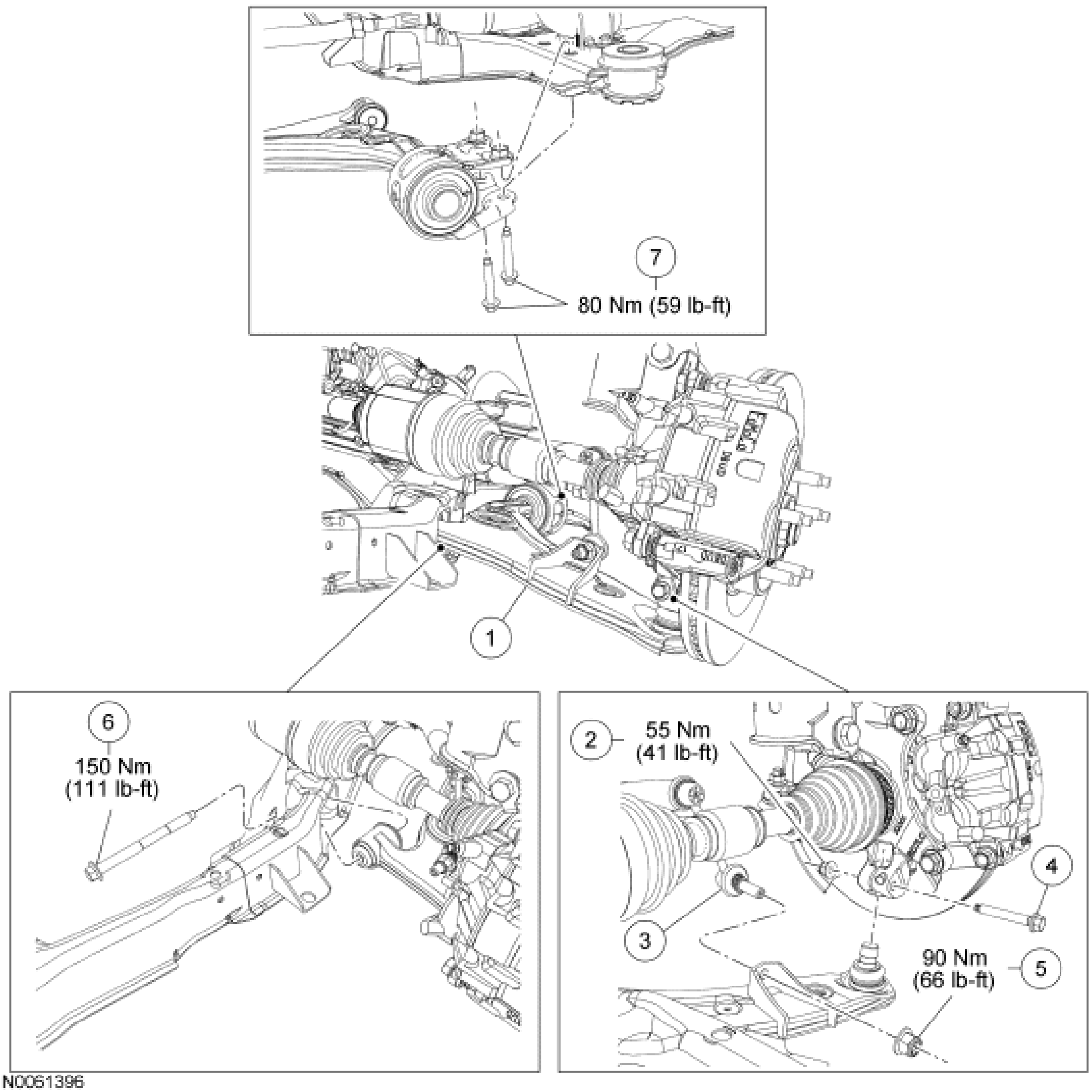


Fig. 102: Locating Roll Restrictor-To-Transaxle Bracket Plate Bolts
Courtesy of FORD MOTOR CO.

40. Tighten the engine roll restrictor-to-subframe through bolt to 103 Nm (76 lb-ft).

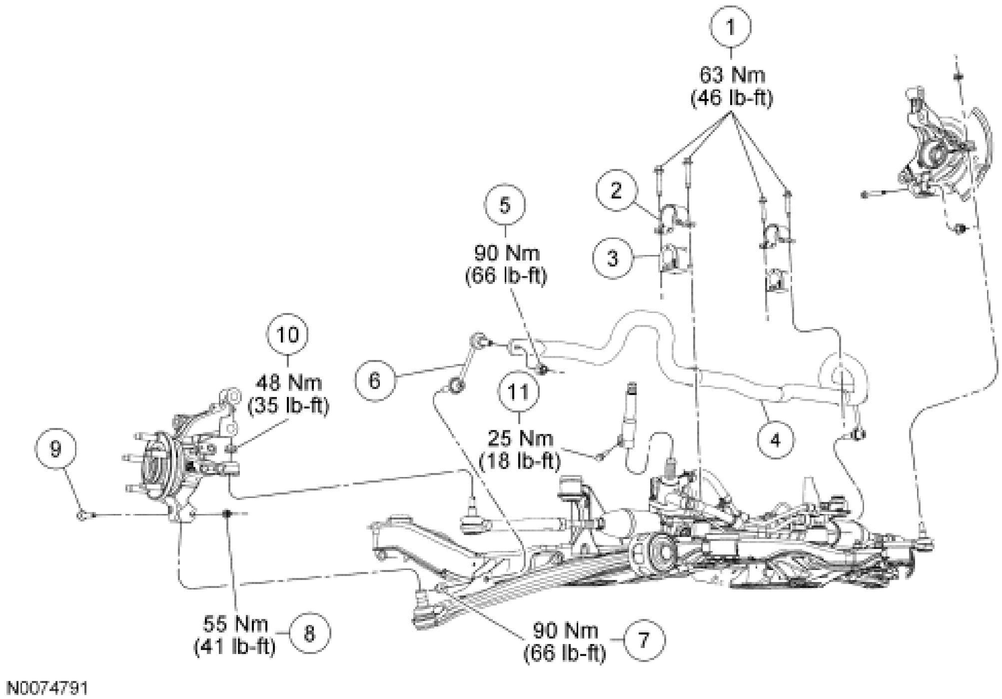


Fig. 103: Locating Roll Restrictor-To-Subframe Bolt
Courtesy of FORD MOTOR CO.

41. Install the roll restrictor heat shield and the 2 nuts.
    - Tighten to 11 Nm (8 lb-ft).

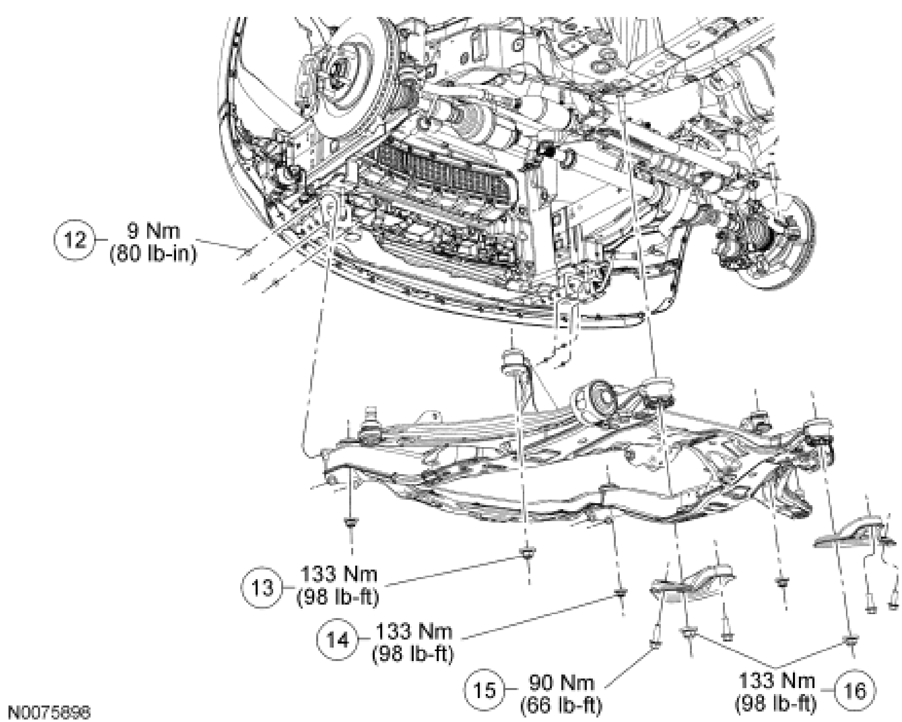


Fig. 104: Locating Roll Restrictor Heat Shield Nuts
Courtesy of FORD MOTOR CO.

42. Position the Y-pipe assembly in place and install the 4 nuts.
    - Tighten to 40 Nm (30 lb-ft).

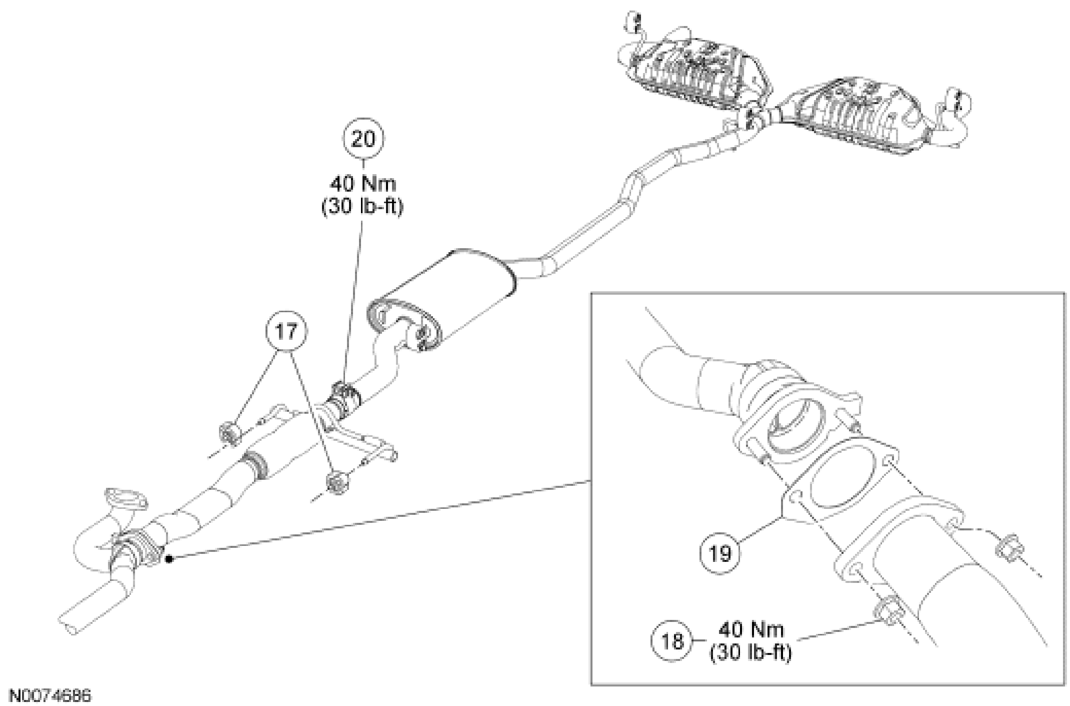


Fig. 105: Locating Exhaust Flexible Pipe, Y-Pipe & Nuts
Courtesy of FORD MOTOR CO.

43. Install the 2 exhaust hangers and tighten the exhaust clamp.
    - Tighten to 40 Nm (30 lb-ft).

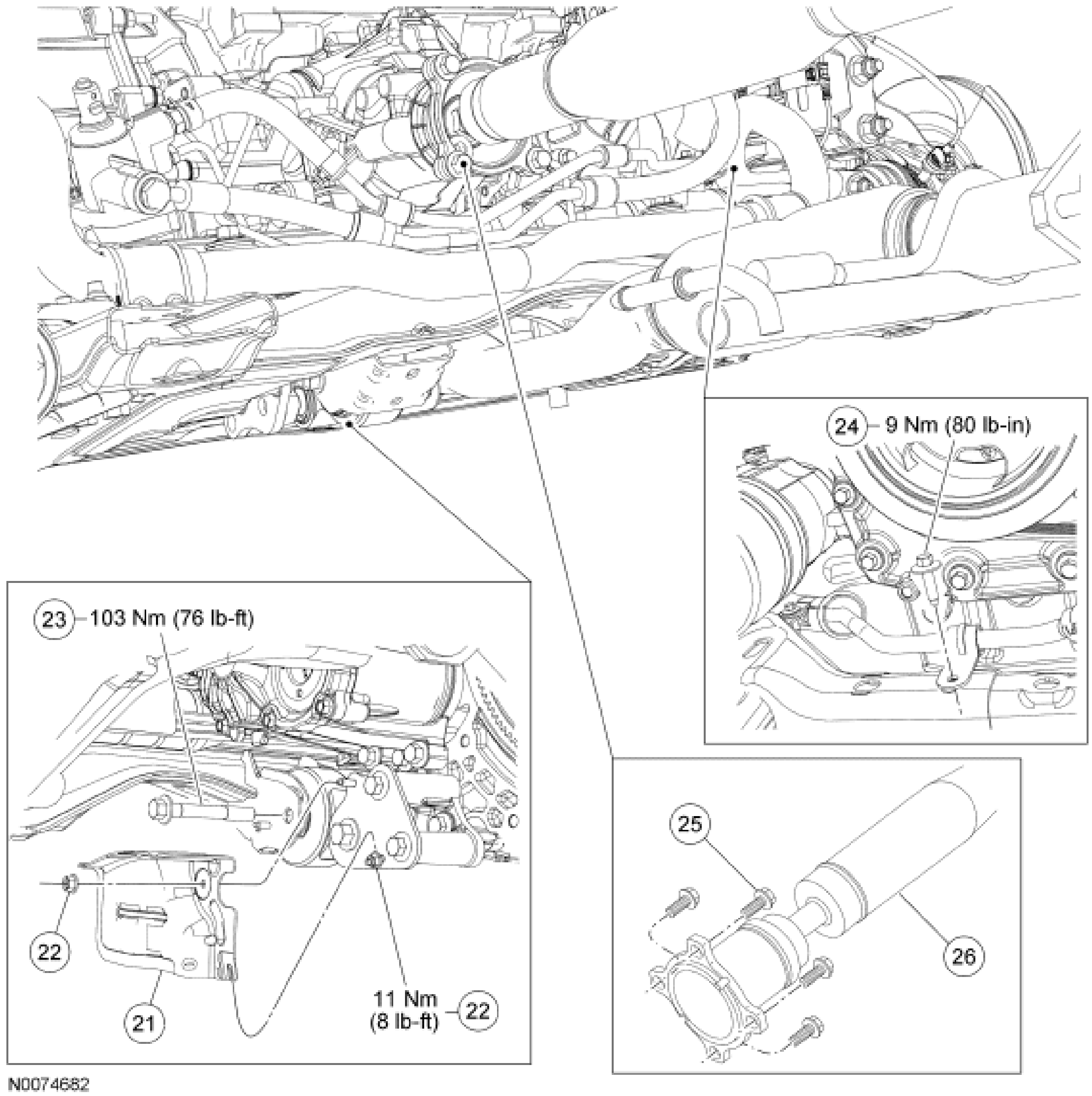


Fig. 106: Locating Exhaust Flexible Pipe Clamp & Exhaust Hangers
Courtesy of FORD MOTOR CO.

NOTE: Apply clean engine oil to the crankshaft front seal bore in the engine front cover.

44. Using the special tools, install a new crankshaft front seal.

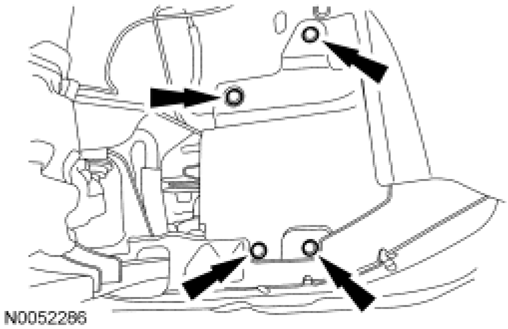


Fig. 107: Installing Crankshaft Front Seal Using Special Tools (303-102) & (303-1251)
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the outside diameter sealing surfaces with clean engine oil.

45. Using the special tools, install the crankshaft pulley.

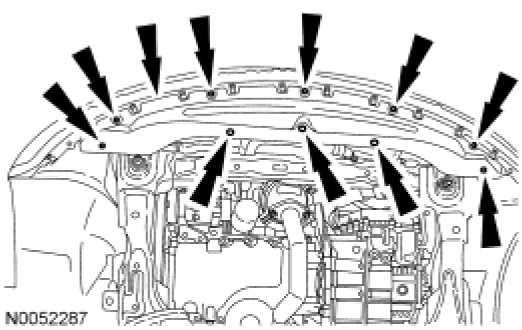


Fig. 108: Installing Crankshaft Pulley
Courtesy of FORD MOTOR CO.

46. Using the special tool, install the crankshaft pulley washer and new bolt and tighten in 4 stages.
    - Stage 1: Tighten to 120 Nm (89 lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten an additional 90 degrees.

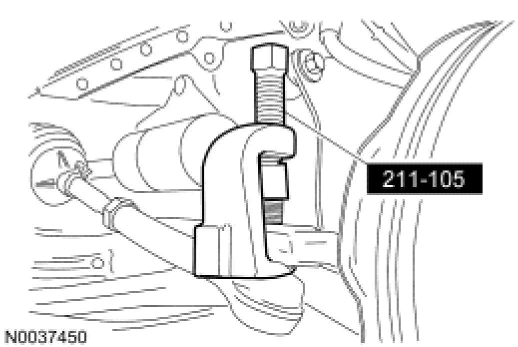


Fig. 109: Installing Crankshaft Pulley Washer & Bolt Using Special Tools (303-D055)
Courtesy of FORD MOTOR CO.

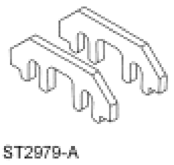
47. Install the accessory drive belt, tensioner and the power steering belt. For additional information, refer to **ACCESSORY DRIVE** article.

CAUTION: Do not expose the Motorcraft High Performance Engine RTV Silicone to engine oil for at least 90 minutes after installing the engine front cover. Failure to follow this instruction may cause oil leakage.

48. Fill the engine with clean engine oil.
49. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING & CABLES** article.
50. Evacuate and recharge the A/C system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION & DIAGNOSTICS** article.

TIMING DRIVE COMPONENTS

Special Tools

Illustration	Tool Name	Tool Number
	Camshaft Alignment Tool	303-1248

REMOVAL

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan may cause engine failure.

1. Remove the engine front cover. For additional information, refer to **Engine Front Cover**.
2. Rotate the crankshaft clockwise and align the timing marks on the variable camshaft timing (VCT) assemblies as shown.

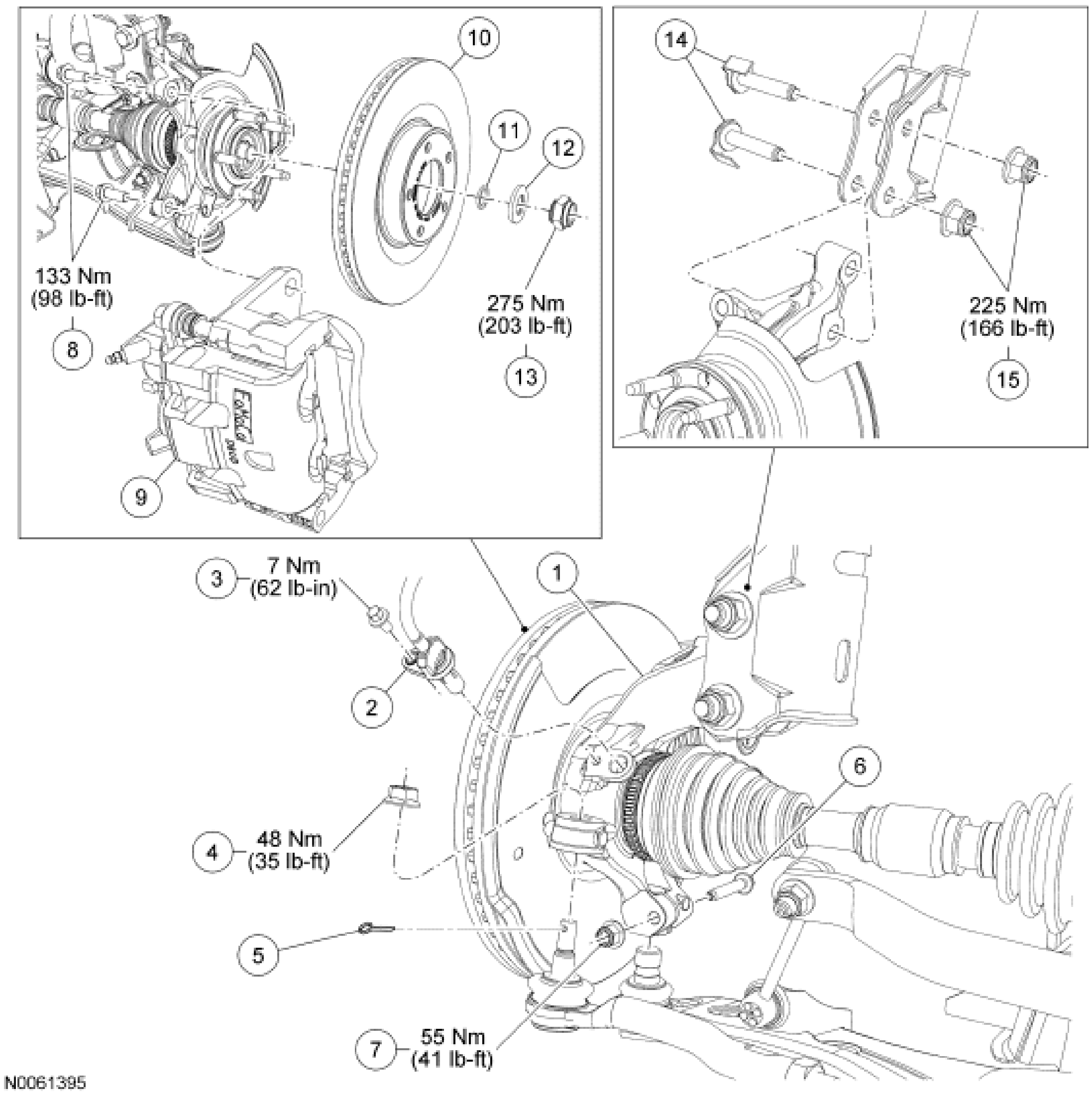


Fig. 110: Aligning Timing Marks On Variable Camshaft Timing (VCT) Assemblies
Courtesy of FORD MOTOR CO.

NOTE: The special tool will hold the camshafts in the top dead center (TDC) position.

3. Install the special tool onto the flats of the LH camshafts.

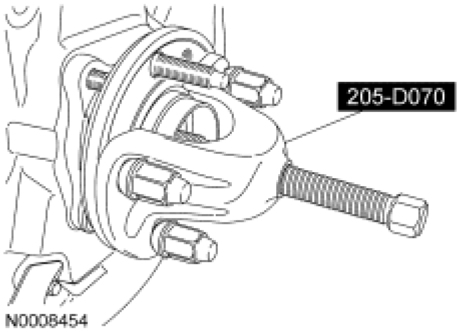


Fig. 111: Installing Special Tool (303-1248) Onto Flats Of LH Camshafts
Courtesy of FORD MOTOR CO.

NOTE: The special tool will hold the camshafts in the TDC position.

4. Install the special tool onto the flats of the RH camshafts.

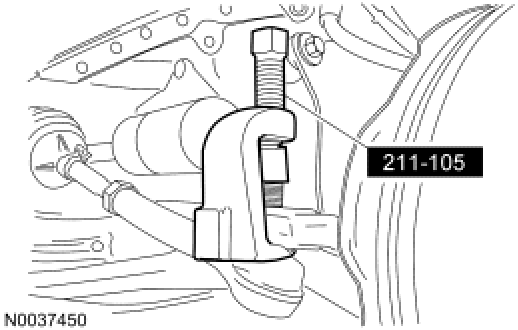


Fig. 112: Installing Special Tool (303-1248) Onto Flats Of RH Camshafts
Courtesy of FORD MOTOR CO.

5. Remove the 3 bolts and the RH VCT housing.

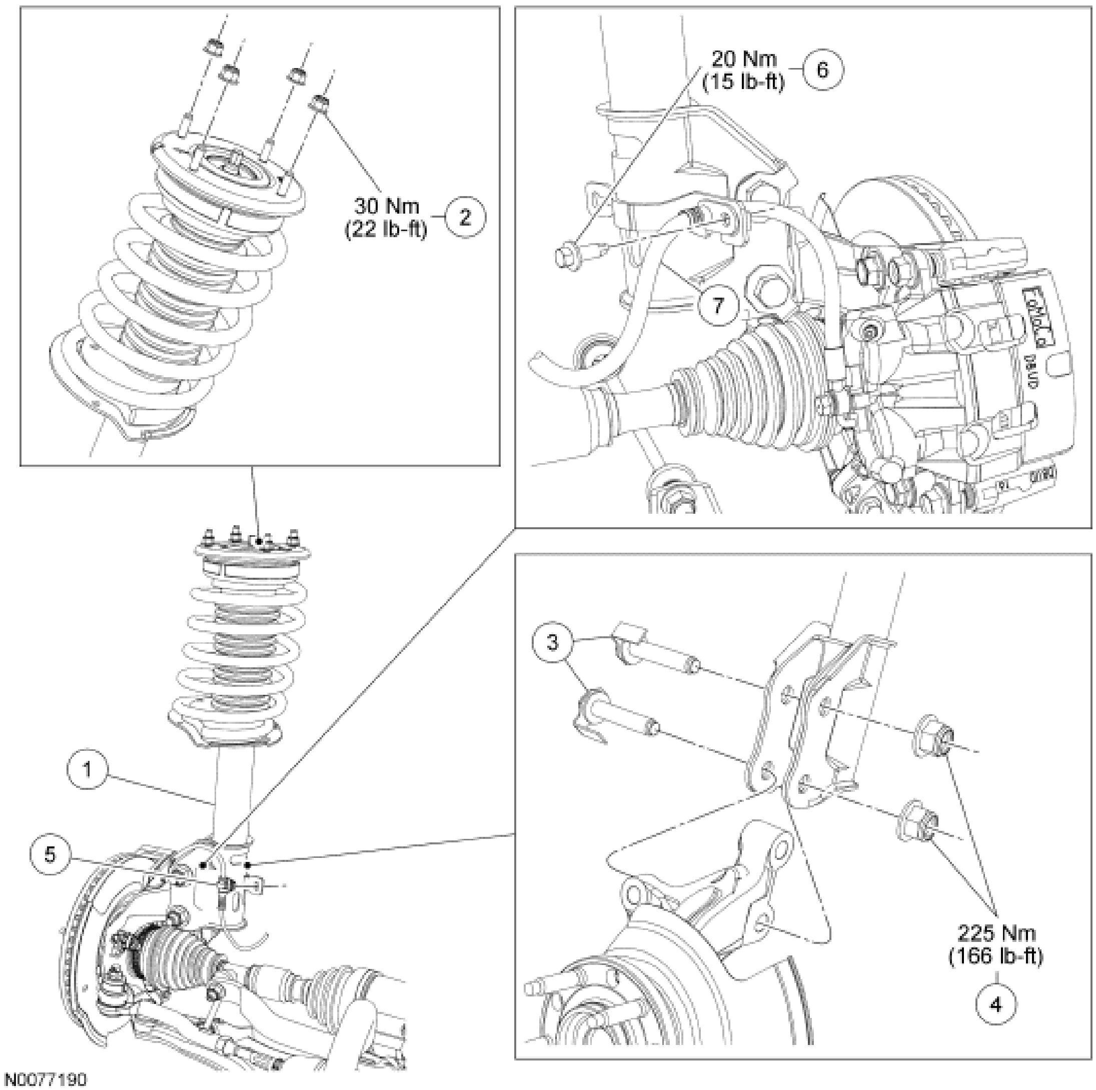


Fig. 113: Locating RH VCT Housing
Courtesy of FORD MOTOR CO.

6. Remove the 3 bolts and the LH VCT housing.

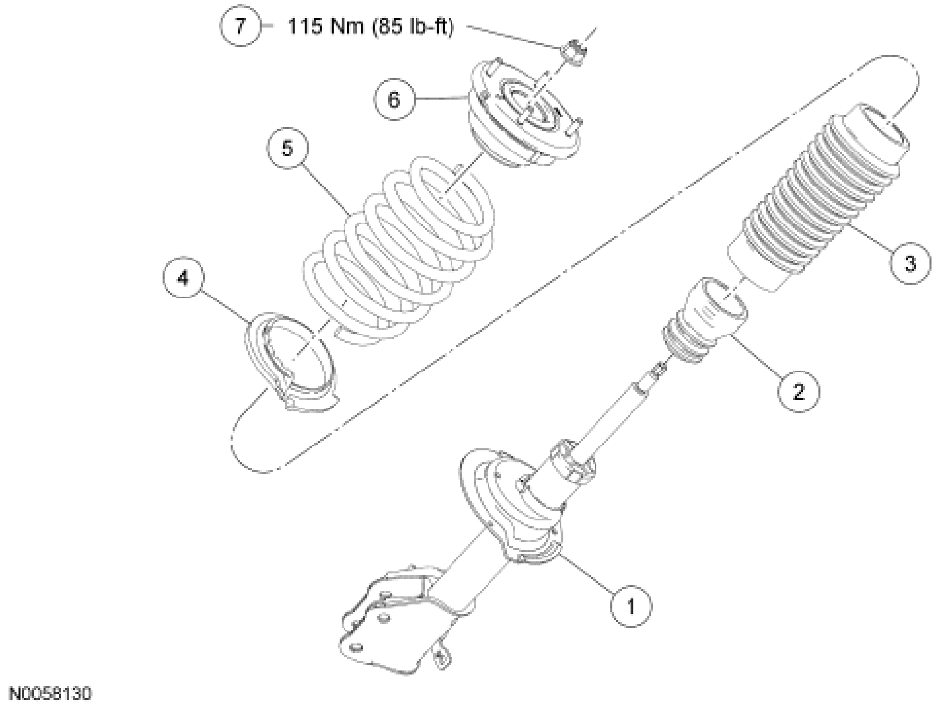


Fig. 114: Locating LH VCT Housing
Courtesy of FORD MOTOR CO.

7. Remove and discard the VCT housing seals.

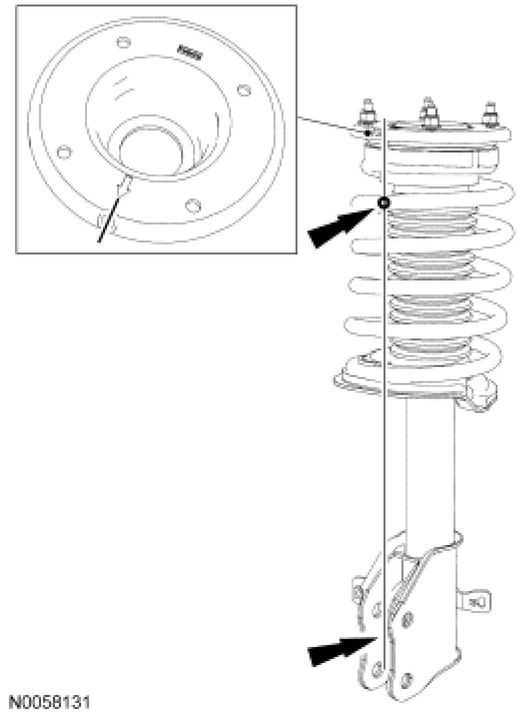


Fig. 115: Locating VCT Housing Seals

Courtesy of FORD MOTOR CO.

8. Remove the 2 bolts and the primary timing chain tensioner.

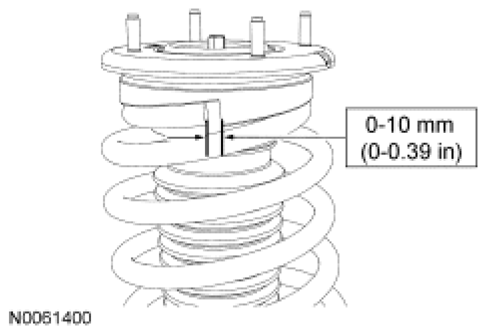


Fig. 116: Locating Primary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

9. Remove the primary timing chain tensioner arm.

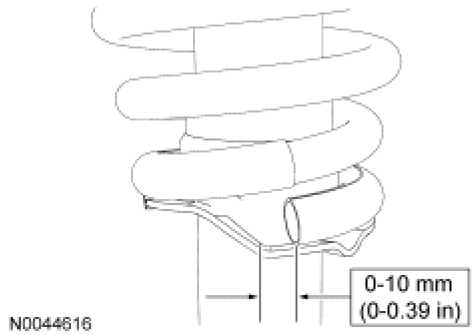
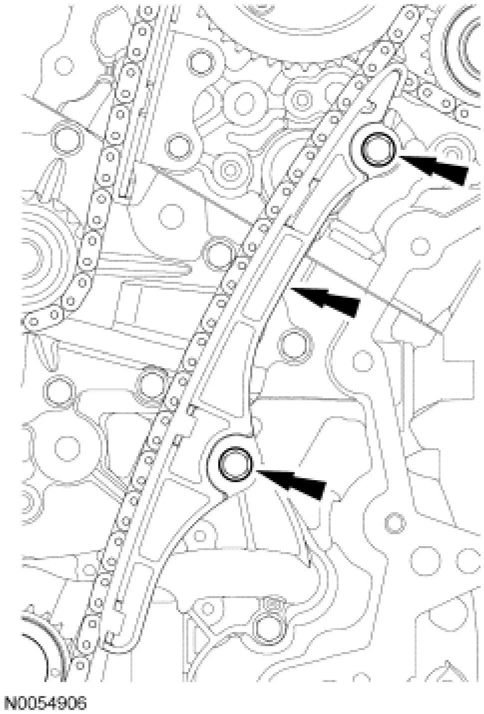


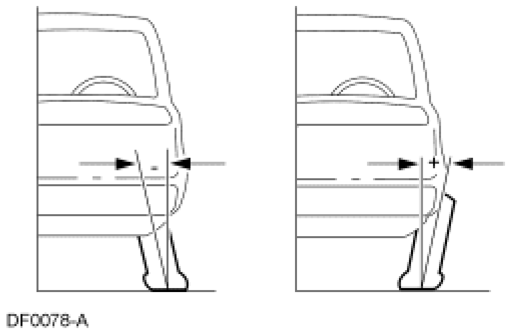
Fig. 117: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

10. Remove the 2 bolts and the lower LH primary timing chain guide.



<u>Fig. 118: Locating Lower LH Primary Timing Chain Guide Bolts</u>
Courtesy of FORD MOTOR CO.

11. Remove the primary timing chain.



<u>Fig. 119: Locating Primary Timing Chain</u>
Courtesy of FORD MOTOR CO.

12. Remove the crankshaft timing chain sprocket.

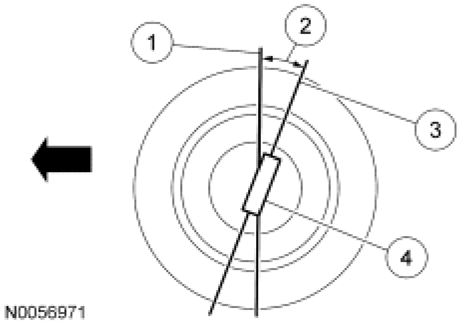


Fig. 120: Locating Crankshaft Timing Chain Sprocket
Courtesy of FORD MOTOR CO.

13. Remove the 2 bolts and the upper LH primary timing chain guide.

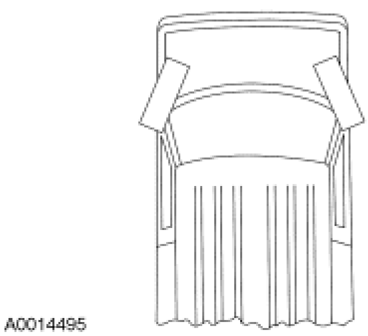


Fig. 121: Locating Upper LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

14. Compress the LH secondary timing chain tensioner and install a suitable lockpin to retain the tensioner in the collapsed position.

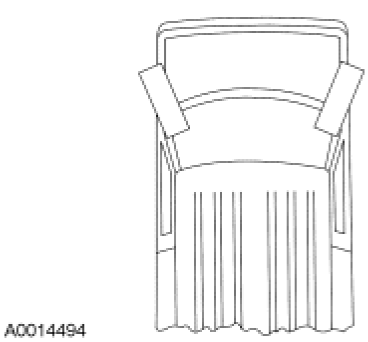


Fig. 122: Compressing LH Secondary Timing Chain Tensioner & Installing Suitable Lock Pin To Retain Tensioner In Collapsed Position
Courtesy of FORD MOTOR CO.

NOTE: **The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.**

15. Remove and discard the LH VCT assembly bolt and the LH exhaust camshaft sprocket bolt.
    - Remove the LH VCT assembly, secondary timing chain and the LH exhaust camshaft sprocket as an assembly.

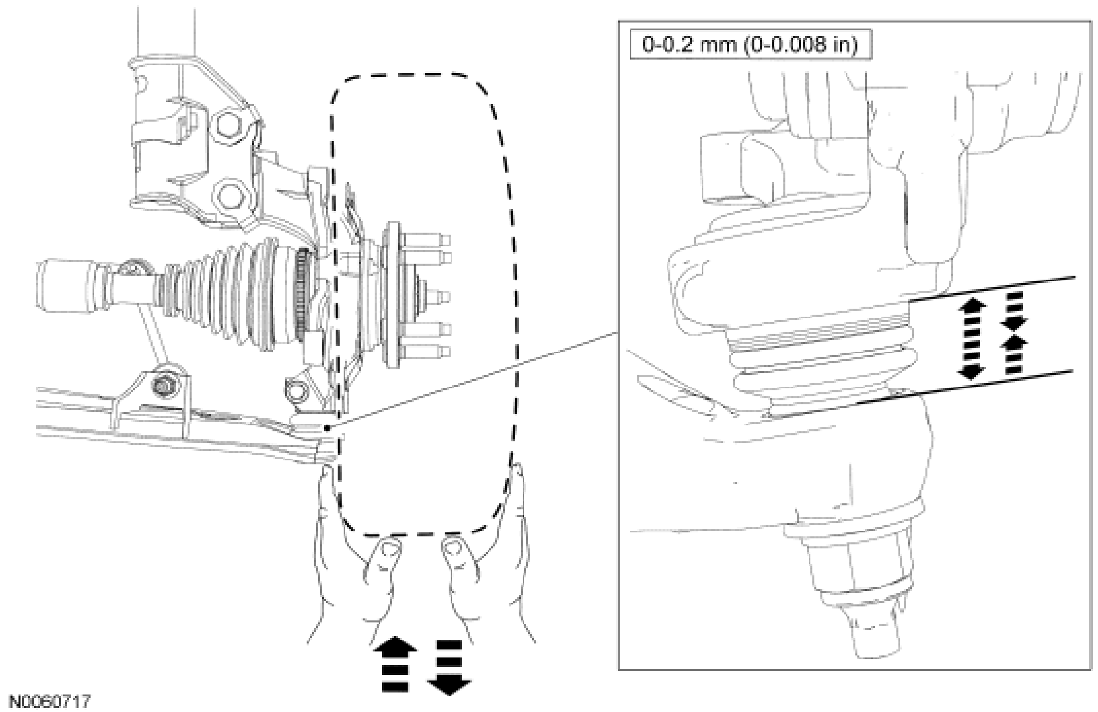


Fig. 123: Locating LH VCT Assembly Bolt & LH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

NOTE: **It is necessary to tilt the special tool toward the rear of the engine to access the rearmost secondary timing chain tensioner bolt.**

16. Remove the 2 bolts and the LH secondary timing chain tensioner.

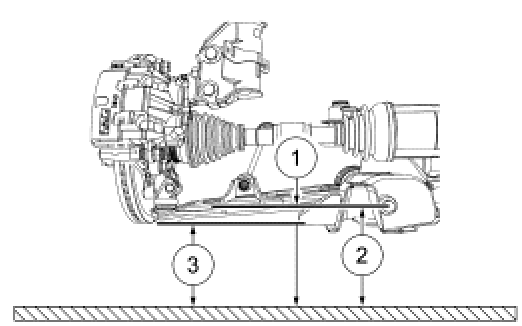


Fig. 124: Locating LH Secondary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

17. Compress the RH secondary timing chain tensioner and install a suitable lockpin to retain the tensioner in the collapsed position.

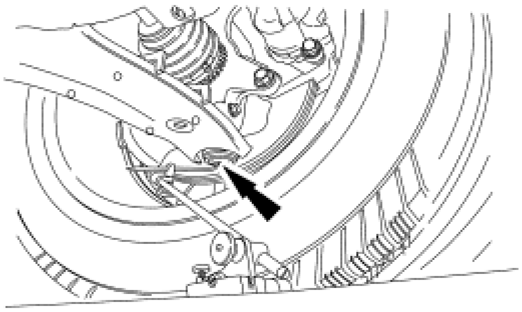


Fig. 125: Compressing RH Secondary Timing Chain Tensioner & Installing Suitable Lock Pin To Retain Tensioner In Collapsed Position
Courtesy of FORD MOTOR CO.

NOTE: The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.

18. Remove and discard the RH VCT assembly bolt and the RH exhaust camshaft sprocket bolt.
    - Remove the RH VCT assembly, secondary timing chain and the RH exhaust camshaft sprocket as an assembly.

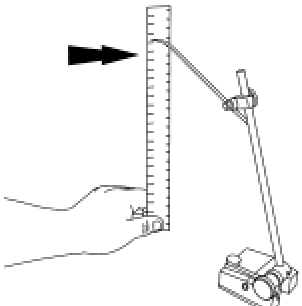


Fig. 126: Locating RH VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

NOTE: It is necessary to tilt the special tool toward the rear of the engine to access the rearmost secondary timing chain tensioner bolt.

19. Remove the 2 bolts and the RH secondary timing chain tensioner.

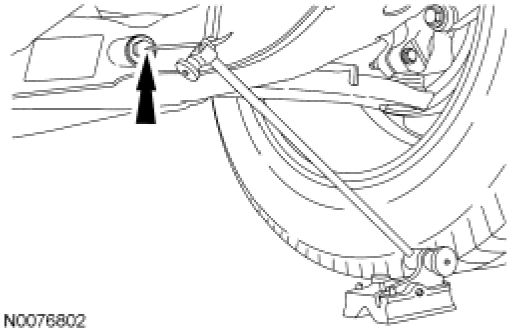


Fig. 127: Locating RH Secondary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

20. Remove the 2 bolts and the RH primary timing chain guide.

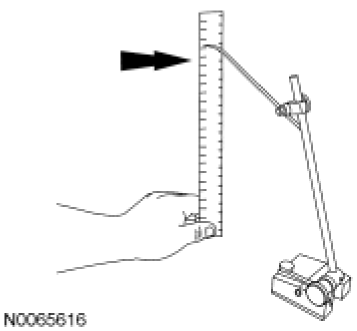


Fig. 128: Locating RH Primary Timing Chain Guide Lower Bolt
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Install the RH primary timing chain guide and the 2 bolts.
   - Tighten to 10 Nm (89 lb-in).

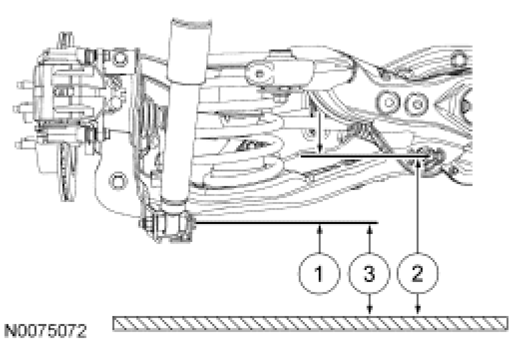


Fig. 129: Locating RH Primary Timing Chain Guide Lower Bolt
Courtesy of FORD MOTOR CO.

NOTE: It is necessary to tilt the special tool toward the rear of the engine to

access the rearmost secondary timing chain tensioner bolt.

2. Install the RH secondary timing chain tensioner and the 2 bolts.
   - Tighten to 10 Nm (89 lb-in).

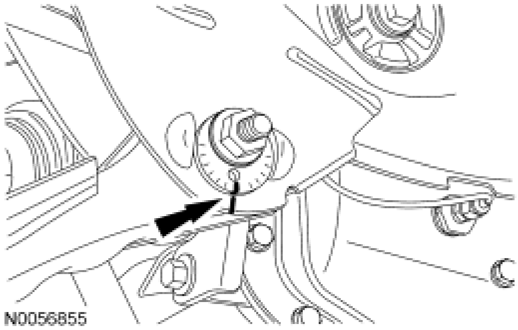


Fig. 130: Locating RH Secondary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

3. Assemble the RH VCT assembly, the RH exhaust camshaft sprocket and the RH secondary timing chain.
   - Align the colored links with the timing marks.

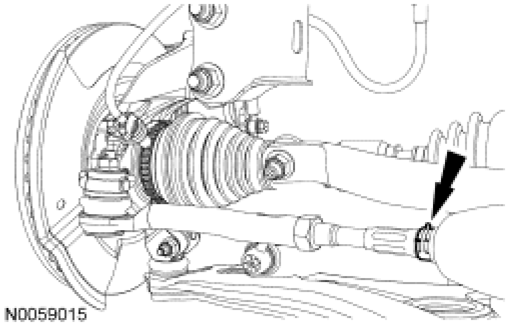


Fig. 131: Aligning RH Exhaust Camshaft Sprocket & RH Secondary Timing Chain Colored Links With Timing Marks
Courtesy of FORD MOTOR CO.

4. Position the RH secondary timing assembly onto the camshafts.

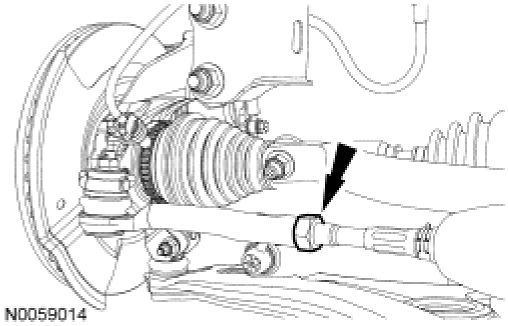


Fig. 132: Positioning RH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

5. Install the new VCT bolt and new exhaust camshaft bolt and the original washers. Tighten in 4 stages.
   - Stage 1: Tighten to 40 Nm (30 lb-ft).
   - Stage 2: Loosen one full turn.
   - Stage 3: Tighten to 10 Nm (89 lb-in).
   - Stage 4: Tighten 90 degrees.

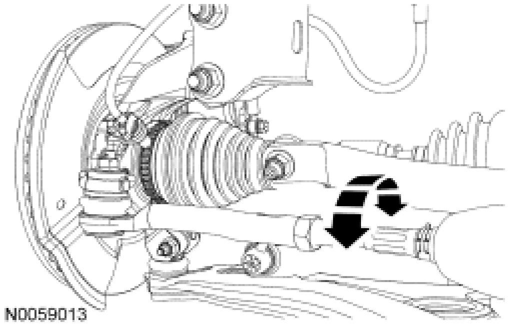


Fig. 133: Locating RH VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

6. Remove the lockpin from the RH secondary timing chain tensioner.

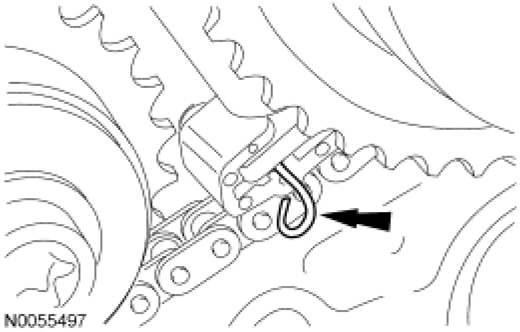


Fig. 134: Identifying Lock Pin On RH Secondary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

NOTE: **It is necessary to tilt the special tool toward the rear of the engine to access the rearmost secondary timing chain tensioner bolt.**

7. Install the LH secondary timing chain tensioner and the 2 bolts.
   - Tighten to 10 Nm (89 lb-in).

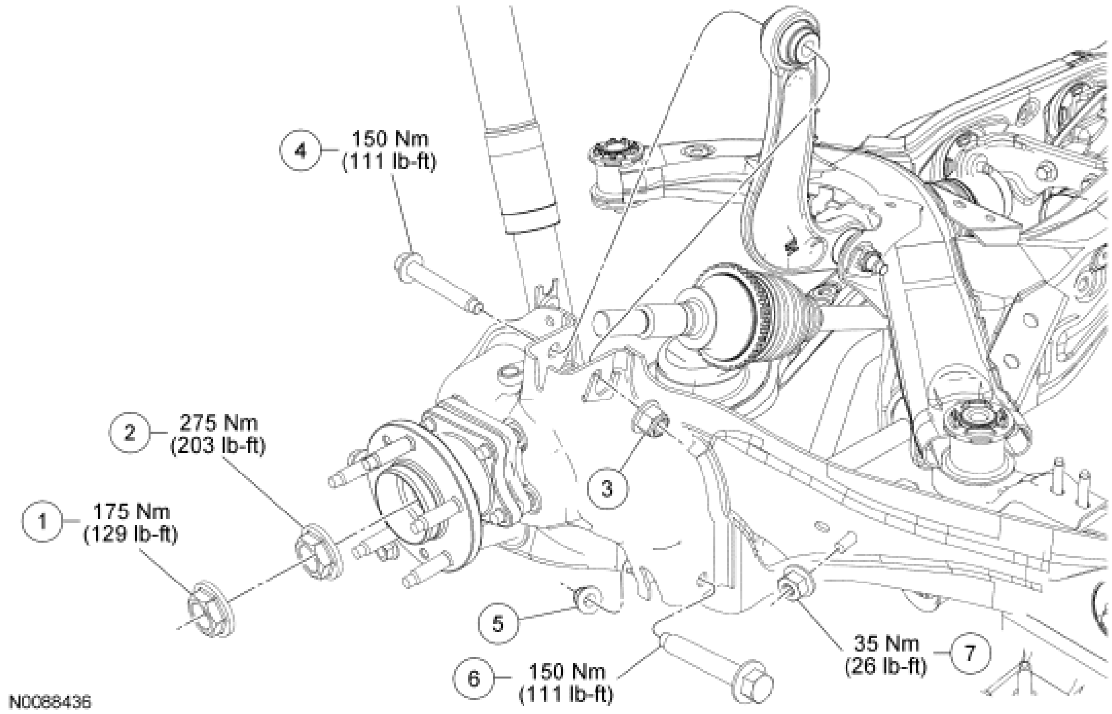


Fig. 135: Locating LH Secondary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

8. Assemble the LH VCT assembly, the LH exhaust camshaft sprocket and the LH secondary timing chain.
   - Align the colored links with the timing marks.

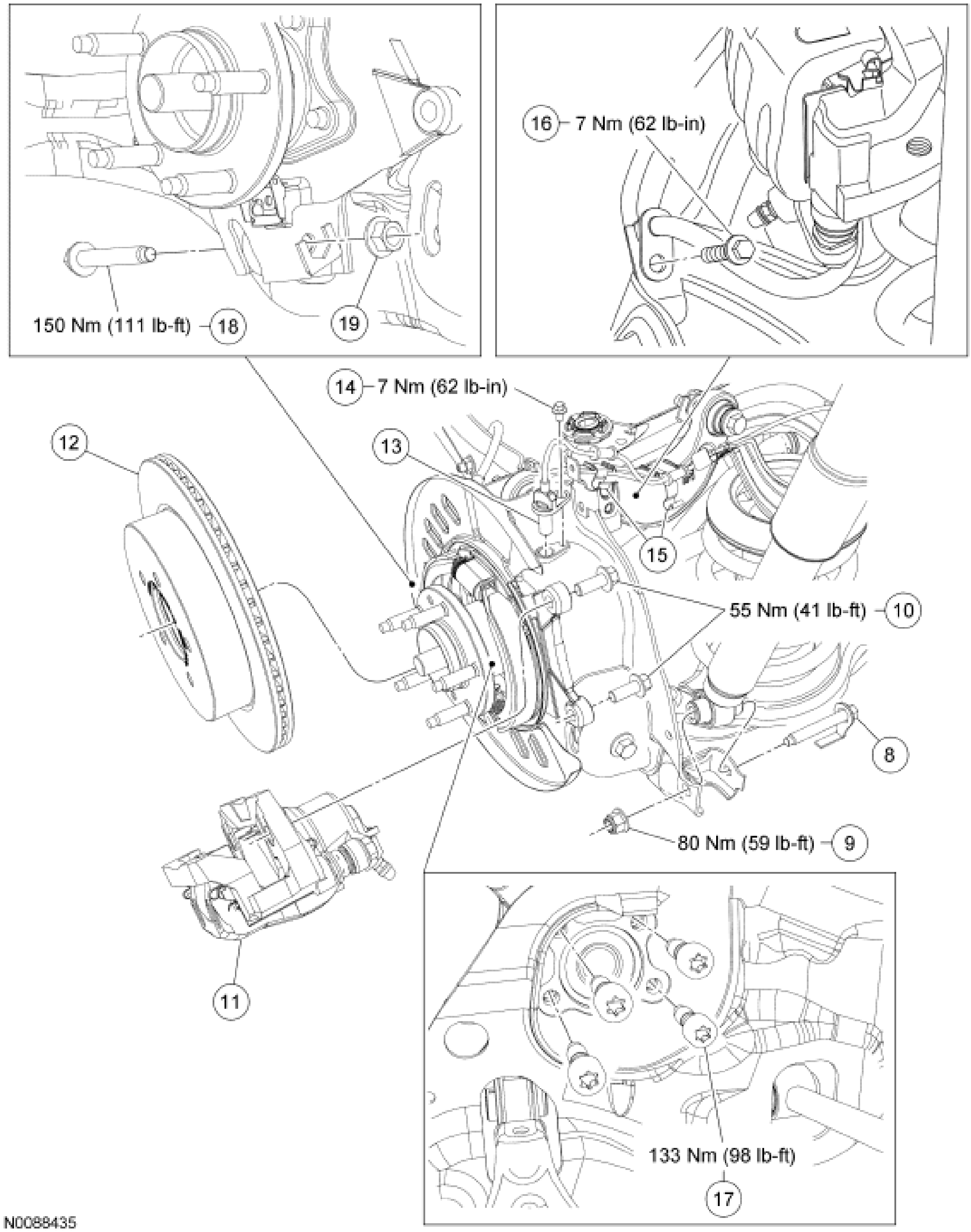


Fig. 136: Aligning LH Exhaust Camshaft Sprocket & LH Secondary Timing Chain Colored Links With Timing Marks
Courtesy of FORD MOTOR CO.

9. Position the LH secondary timing assembly onto the camshafts.

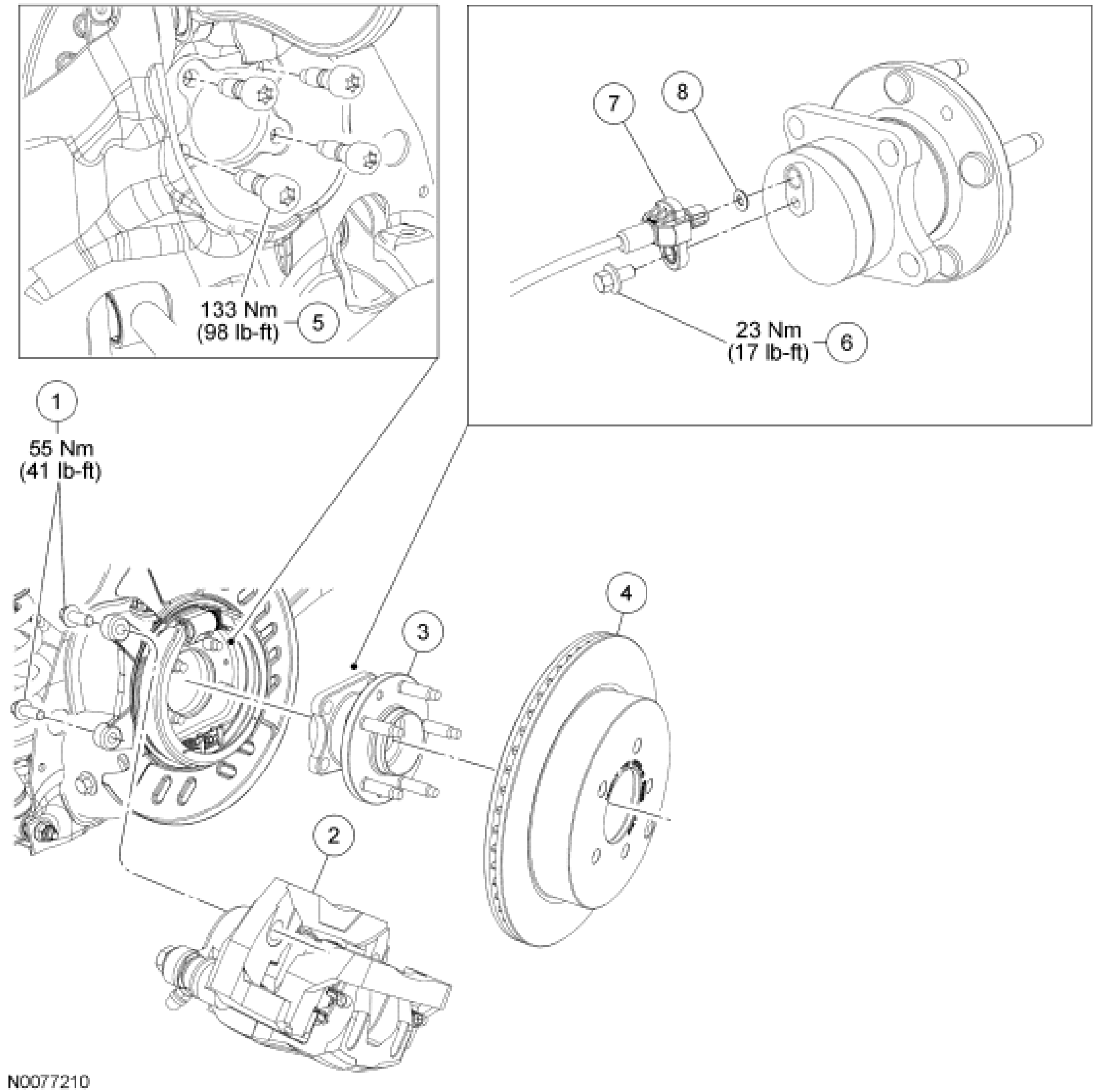


Fig. 137: Positioning LH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

10. Install the new VCT bolt and new exhaust camshaft bolt and the original washers. Tighten in 4 stages.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 10 Nm (89 lb-in).
    - Stage 4: Tighten 90 degrees.

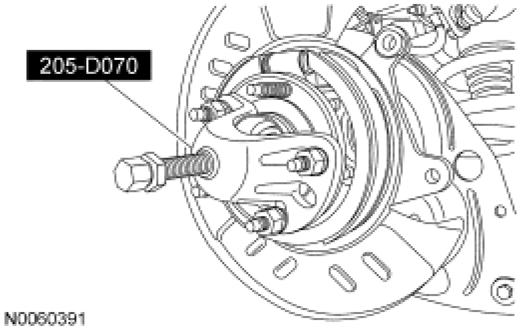


Fig. 138: Locating LH VCT Assembly Bolt & LH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

11. Remove the lockpin from the LH secondary timing chain tensioner.

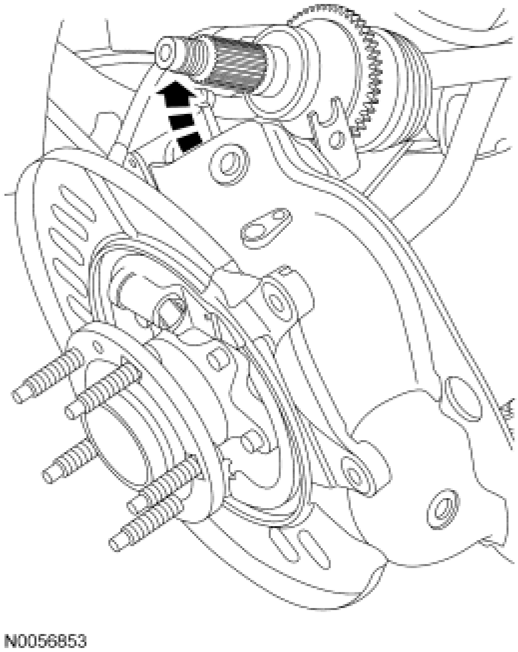


Fig. 139: Locating Lock Pin On LH Secondary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

12. Install the crankshaft timing chain sprocket.

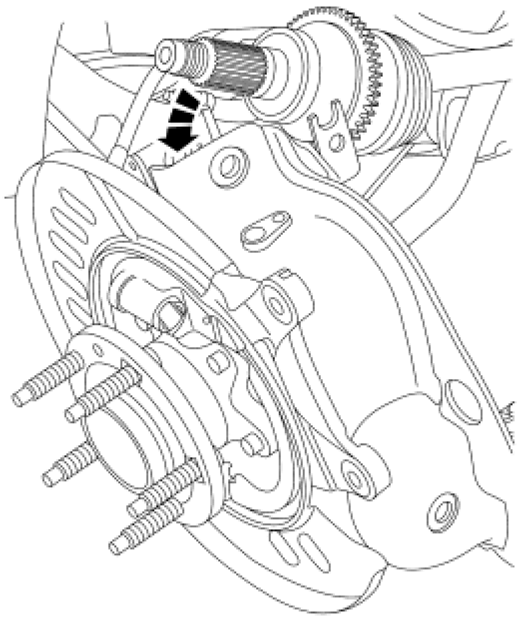


Fig. 140: Locating Crankshaft Timing Chain Sprocket
Courtesy of FORD MOTOR CO.

13. Install the primary timing chain with the colored links aligned with the timing marks on the VCT assemblies and the crankshaft sprocket.

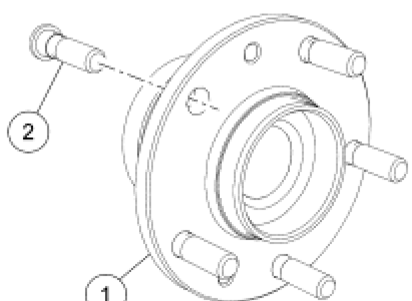


Fig. 141: Aligning Timing Marks On VCT Assemblies & Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

14. Install the upper LH primary timing chain guide and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

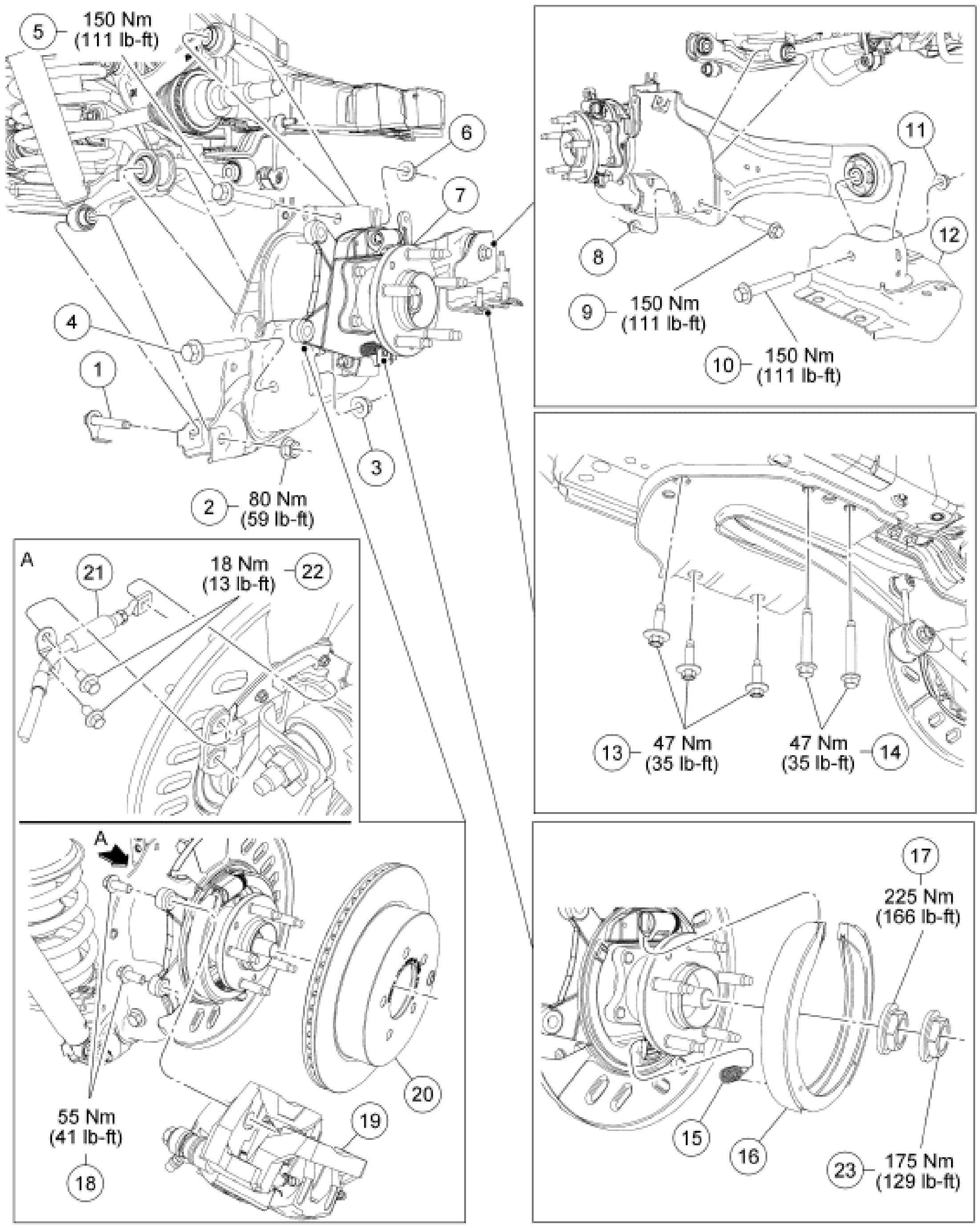


Fig. 142: Locating Upper LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

15. Install the lower LH primary timing chain guide and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

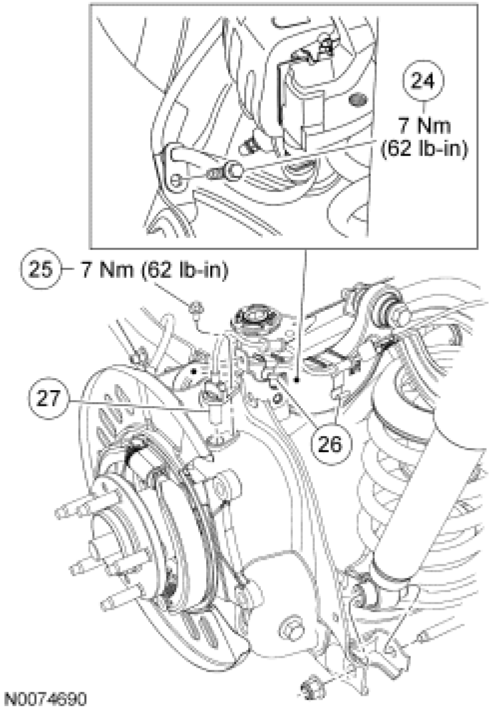


Fig. 143: Locating Lower LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

16. Install the primary timing chain tensioner arm.

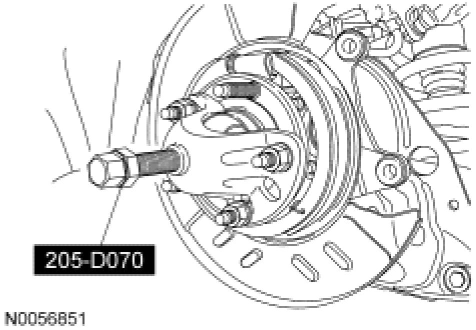


Fig. 144: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

17. Reset the primary timing chain tensioner.
    - Rotate the lever counterclockwise.
    - Using a soft-jawed vise, compress the plunger.
    - Align the hole in the lever with the hole in the tensioner housing.
    - Install a suitable lockpin.

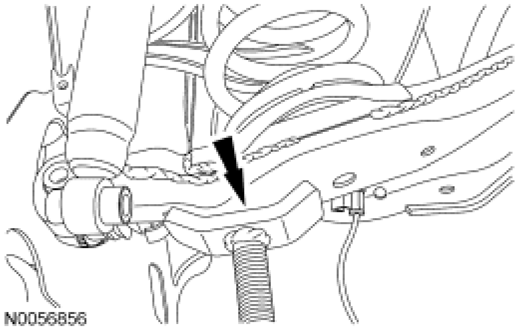


Fig. 145: Compressing Plunger Using A Soft-Jawed Vise
Courtesy of FORD MOTOR CO.

NOTE: It may be necessary to rotate the crankshaft slightly to remove slack from the timing chain and install the tensioner.

18. Install the primary tensioner and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).
    - Remove the lockpin.

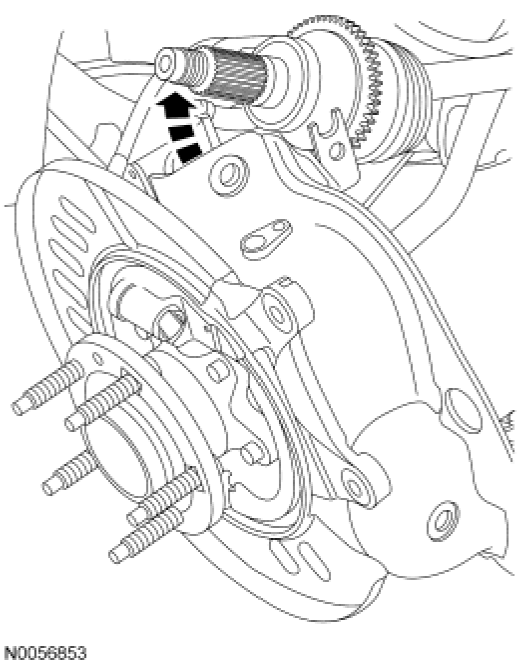


Fig. 146: Locating Primary Tensioner Bolts
Courtesy of FORD MOTOR CO.

19. As a post-check, verify correct alignment of all timing marks.

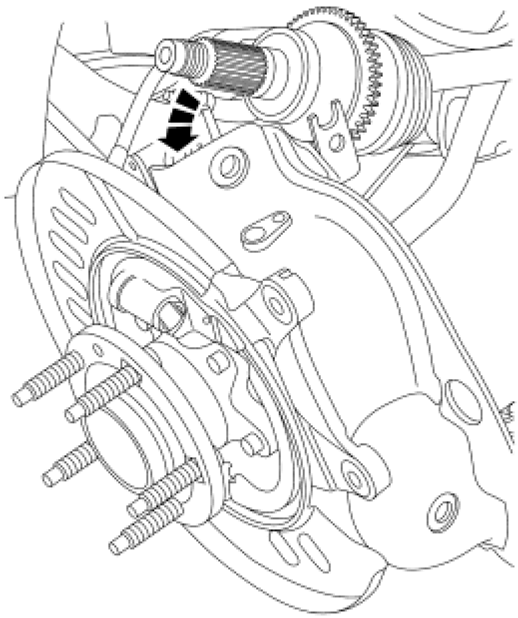


Fig. 147: Verifying Correct Alignment Of All Timing Marks
Courtesy of FORD MOTOR CO.

20. Install new VCT housing seals.

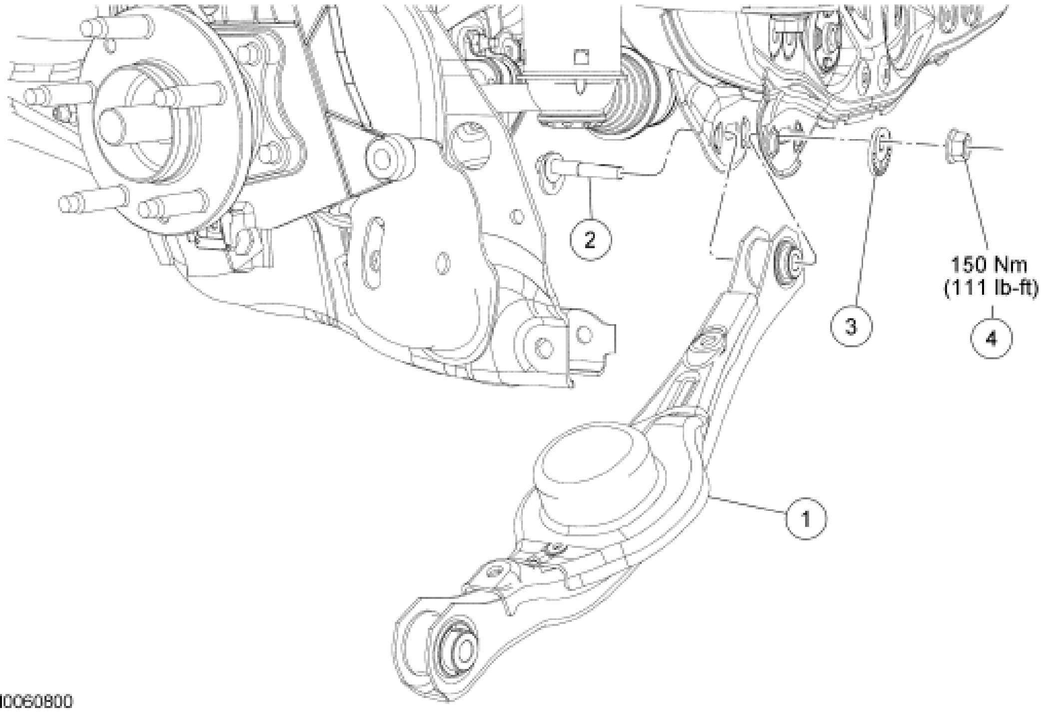


Fig. 148: Locating VCT Housing Seals

Courtesy of FORD MOTOR CO.

NOTE:	**Make sure the dowels on the variable camshaft timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.**

21. Install the LH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

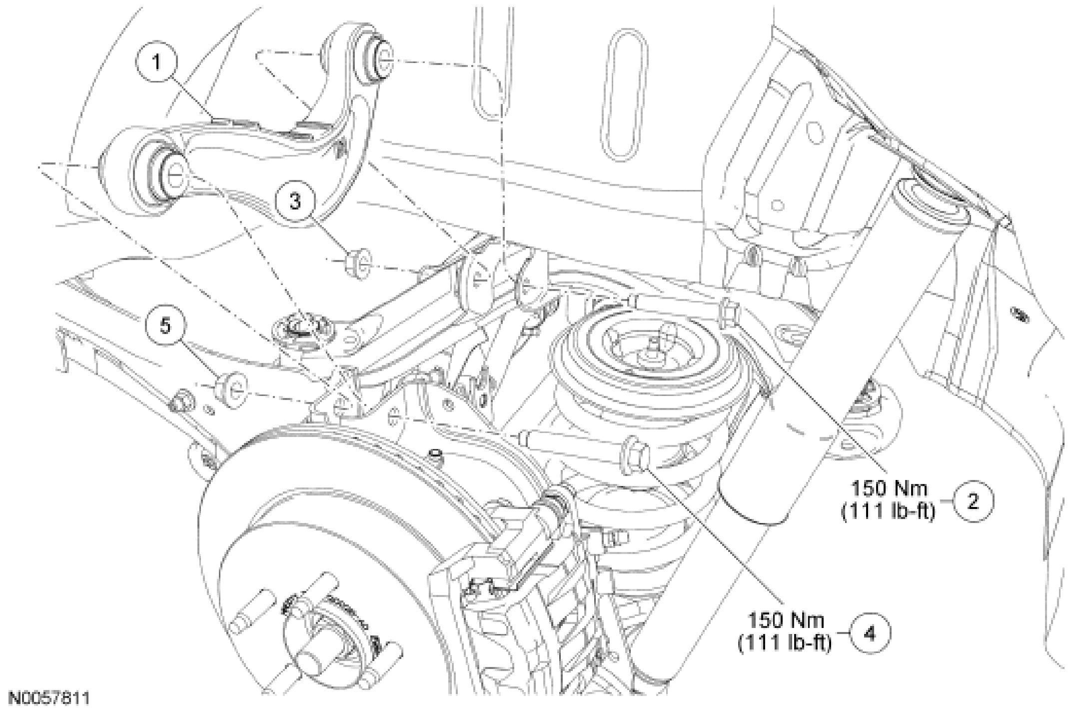


Fig. 149: Identifying LH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

NOTE:	**Make sure the dowels on the variable camshaft timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.**

22. Install the RH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

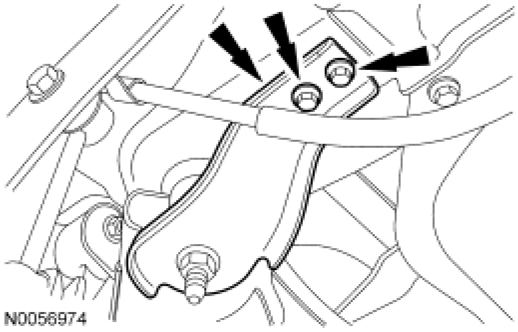


Fig. 150: Identifying RH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

23. Install the engine front cover. For additional information, refer to **Engine Front Cover**.

OIL COOLER

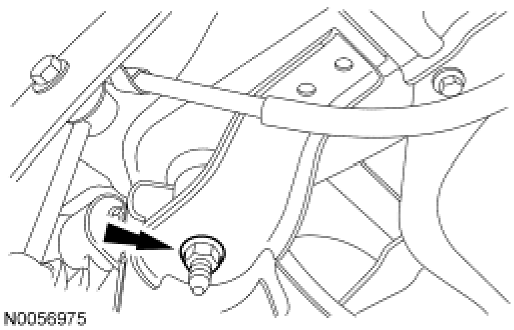


Fig. 151: Exploded View Of Oil Cooler With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W503277	Oil cooler bolt (6 required)
2	15161	Coolant hose clamp
3	8N021	Coolant hose
4	8B274	Coolant hose
5	15161	Coolant hose clamp
6	6A642	Oil cooler
7	6A636	Oil cooler gasket (2 required)

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Drain the cooling system. For additional information, refer to **ENGINE COOLING** article.
3. Remove the LH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.

4. Disconnect the 2 coolant hoses from the oil cooler.

CAUTION: If metal or aluminum material is present in the oil cooler, mechanical concerns exist. Failure to correct these concerns may cause engine failure. To diagnose mechanical concerns, refer to ENGINE SYSTEM - GENERAL INFORMATION article.

5. Remove the 6 bolts and the oil cooler.
   - Discard the gaskets.
   - Inspect the oil cooler.
   - Clean and inspect all sealing surfaces.

INSTALLATION

1. Using new gaskets, install the oil cooler and the 6 bolts.
   - Tighten to 10 Nm (89 lb-in).
2. Connect the 2 coolant hoses to the oil cooler.
3. Install the LH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.
4. Fill and bleed the cooling system. For additional information, refer to **ENGINE COOLING** article.

OIL FILTER ADAPTER

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

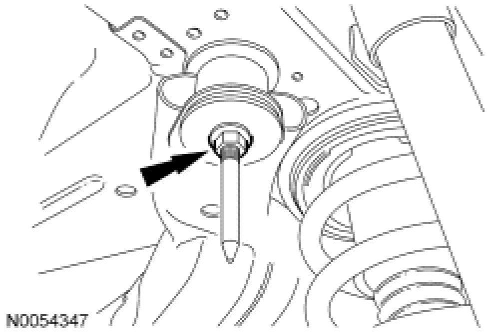


Fig. 152: Exploded View Of Engine With Oil Cooler With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description

1	6714	Engine oil filter
2	W708607	Oil filter adapter bolt
3	6895	Oil filter adapter bolt
4	6K649	O-ring seal
5	6881	Oil filter adapter
6	6A636	Oil filter adapter gasket

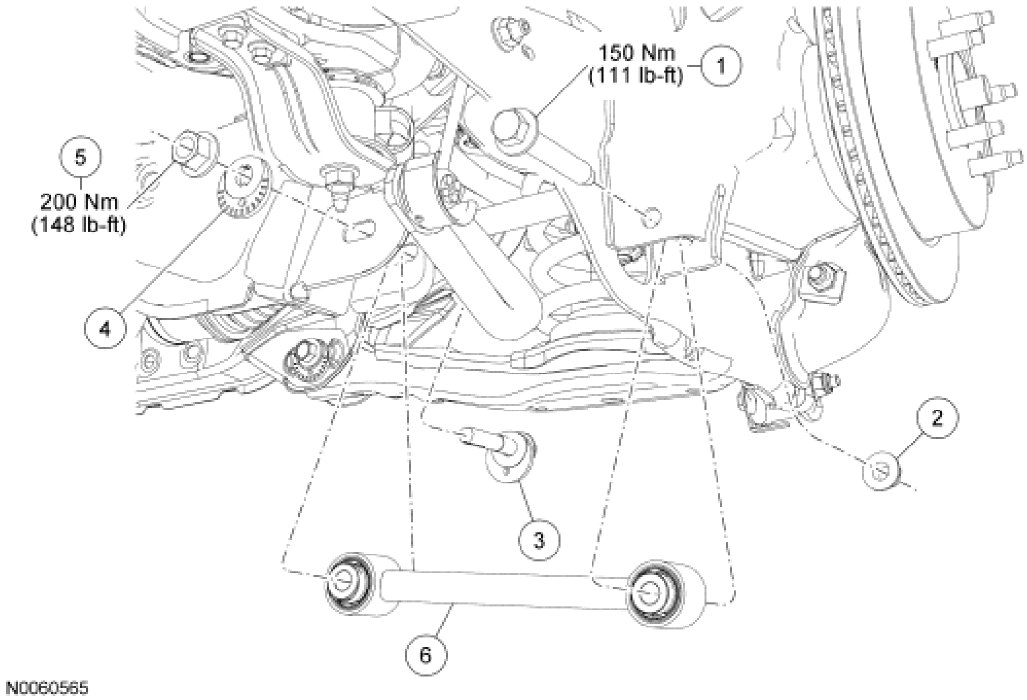


Fig. 153: Exploded View Of Oil Filter Adapter With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6714	Engine oil filter
2	W708607	Oil filter adapter bolt
3	6895	Oil filter adapter bolt
4	6K649	O-ring seal
5	6881	Oil filter adapter
6	6A636	Oil filter adapter gasket

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove and discard the engine oil filter.
3. If equipped, remove the engine oil cooler. For additional information, refer to **Oil Cooler**

4. Remove the 2 bolts and the oil filter adapter.
   - Discard the gasket and O-ring seal.
   - Clean and inspect all sealing surfaces.

INSTALLATION

1. Using a new gasket and O-ring seal, install the oil filter adapter.
   - Tighten the large bolt to 57 Nm (42 lb-ft).
   - Tighten the small bolt to 10 Nm (89 lb-in).

NOTE: Lubricate the engine oil filter gasket with clean engine oil prior to installing the oil filter.

2. Install a new engine oil filter.
   - Tighten to 5 Nm (44 lb-in) and then rotate an additional 180 degrees.
3. If equipped, install the engine oil cooler. For additional information, refer to **Oil Cooler**.

ENGINE OIL PRESSURE (EOP) SWITCH

Material

Item	Specification
Thread Sealant with PTFE TA-24	WSK-M2G350-A2

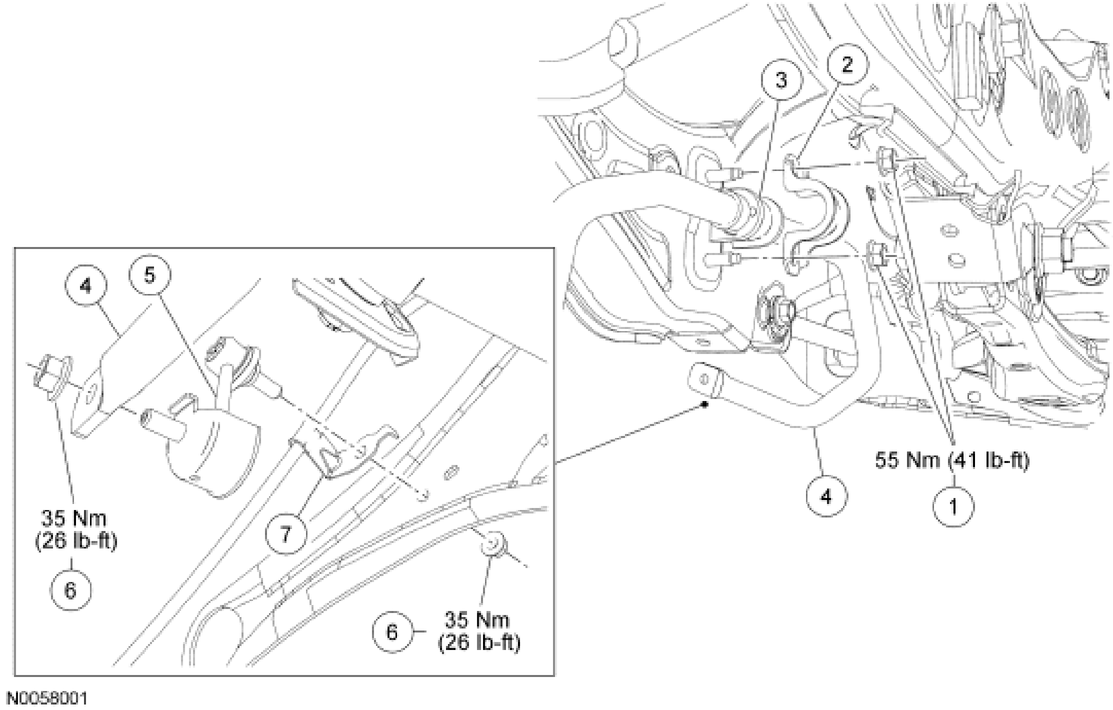


Fig. 154: Exploded View Of Engine Oil Pressure (EOP) Switch With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Engine oil pressure (EOP) switch electrical connector (part of 12C508)
2	9278	EOP switch

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the cooling fan assembly. For additional information, refer to **ACCESSORY DRIVE** article.
3. Disconnect the engine oil pressure (EOP) switch electrical connector.
4. Remove the EOP switch.
   - To install, tighten to 18 Nm (13 lb-ft).
5. To install, reverse the removal procedure.
   - Apply thread sealant with PTFE to the EOP switch threads prior to installation.

EXHAUST MANIFOLD - LH

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	-

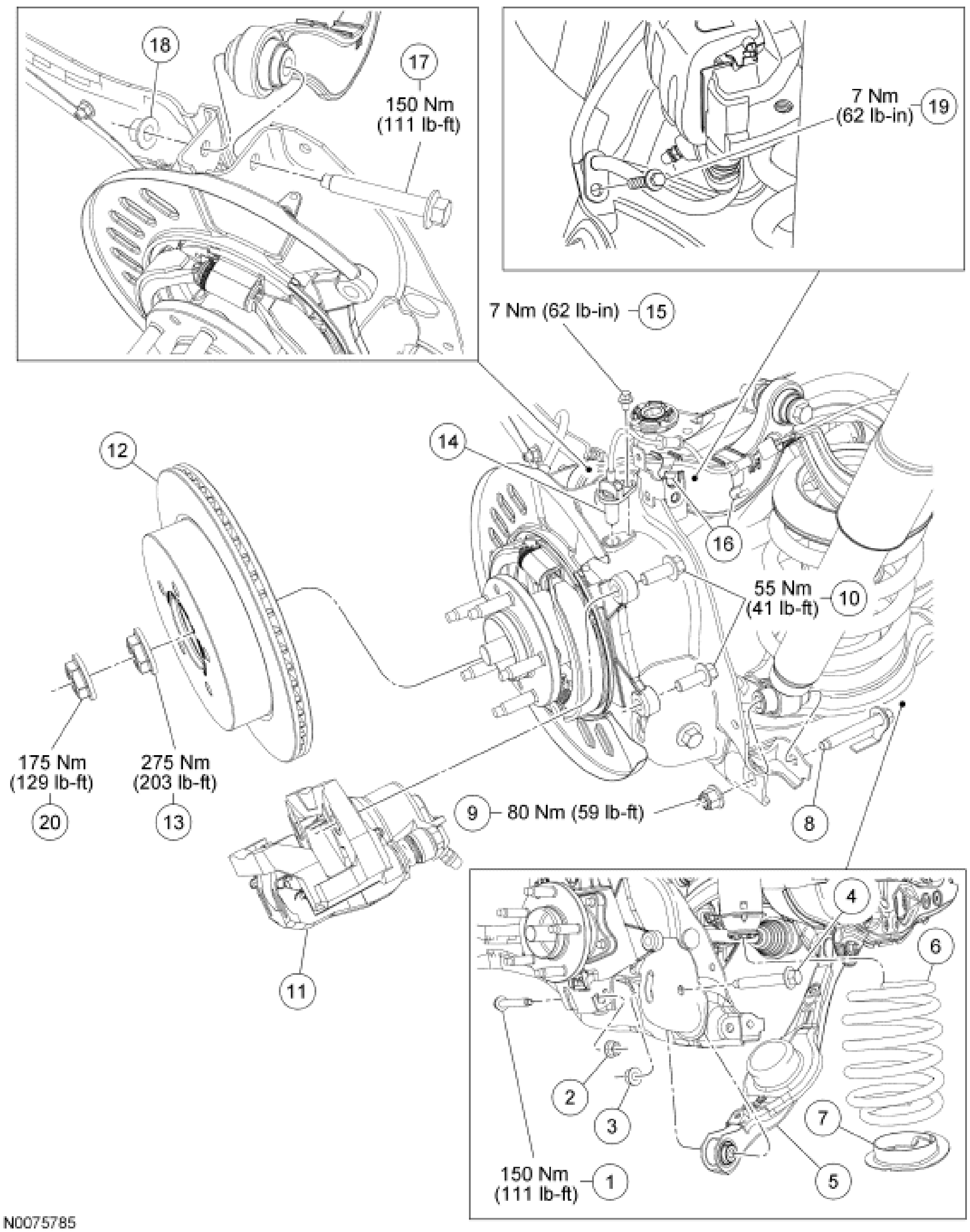


Fig. 155: Exploded View Of Exhaust Manifold With Torque Specifications - LH
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W713299	LH exhaust manifold heat shield bolt (3 required)
2	9Y427	LH exhaust manifold heat shield

3	W701706	LH exhaust manifold nut (6 required)
4	9431	LH exhaust manifold
5	9448	LH exhaust manifold gasket
6	W701732	LH exhaust manifold stud (6 required)

REMOVAL

1. Remove the LH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.
2. Remove the LH heated oxygen sensor (HO2S). For additional information, refer to **ELECTRONIC ENGINE CONTROLS** article.
3. Remove the 3 bolts and the LH exhaust manifold heat shield.
4. Remove the 6 nuts and the LH exhaust manifold.
   - Discard the nuts and gasket.
5. Clean and inspect the LH exhaust manifold. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
6. Remove and discard the 6 LH exhaust manifold studs.

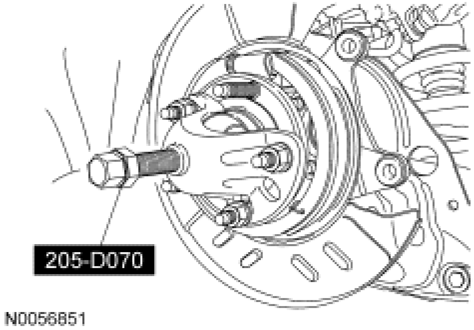


Fig. 156: Locating LH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

NOTE: **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These may cause scratches and gouges resulting in leak paths. Use a plastic scraper to clean the sealing surfaces.**

7. Clean the exhaust manifold mating surface of the cylinder head with metal surface prep. Follow the directions on the packaging.

INSTALLATION

1. Install 6 new LH exhaust manifold studs.
   - Tighten to 12 Nm (9 lb-ft).

NOTE: **Failure to tighten the exhaust manifold nuts to specification a second time**

will cause the exhaust manifold to develop an exhaust leak.

2. Using a new gasket, install the LH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown:
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten to 20 Nm (15 lb-ft).

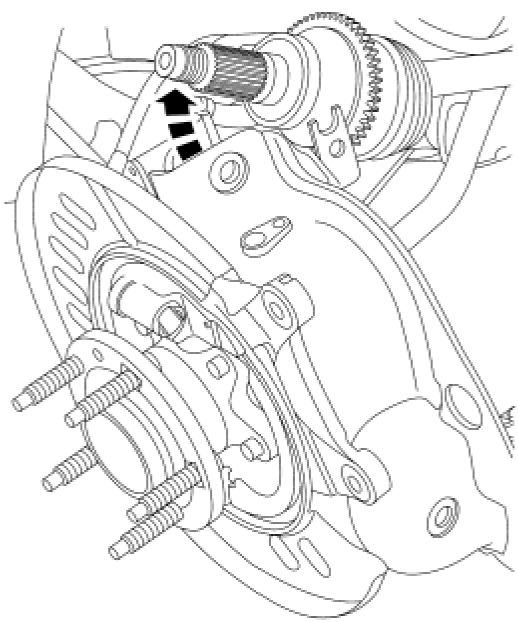


Fig. 157: Installing LH Exhaust Manifold Nuts In Sequence
Courtesy of FORD MOTOR CO.

3. Install the LH exhaust manifold heat shield and the 3 bolts.
    - Tighten to 14 Nm (10 lb-ft).
4. Install the LH HO2S. For additional information, refer to **ELECTRONIC ENGINE CONTROLS** article.
5. Install the LH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.

EXHAUST MANIFOLD - RH

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	-

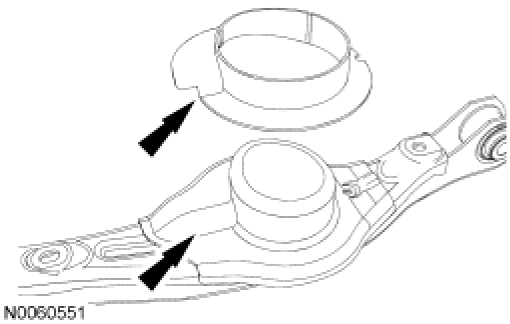


Fig. 158: Exploded View Of Exhaust Manifold - RH With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	RH heated oxygen sensor (HO2S) electrical connector
2	W701706	RH exhaust manifold nut (6 required)
3	9430	RH exhaust manifold
4	9448	RH exhaust manifold gasket
5	W701732	RH exhaust manifold stud (6 required)

REMOVAL

1. Remove the RH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.
2. Disconnect the RH heated oxygen sensor (HO2S) electrical connector.
3. Remove the 6 nuts and the RH exhaust manifold.
   - Discard the nuts and gasket.
4. Clean and inspect the RH exhaust manifold. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
5. Remove and discard the 6 RH exhaust manifold studs.

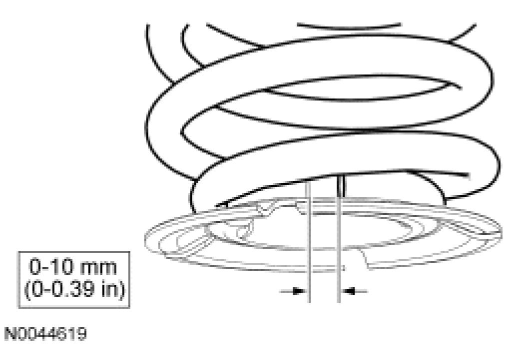


Fig. 159: Locating RH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

NOTE: Do not use metal scrapers, wire brushes, power abrasive discs or other

abrasive means to clean the sealing surfaces. These may cause scratches and gouges resulting in leak paths. Use a plastic scraper to clean the sealing surfaces.

6. Clean the exhaust manifold mating surface of the cylinder head with metal surface prep. Follow the directions on the packaging.

INSTALLATION

1. Install 6 new RH exhaust manifold studs.
    - Tighten to 12 Nm (9 lb-ft).

NOTE: Failure to tighten the exhaust manifold nuts to specification a second time will cause the exhaust manifold to develop an exhaust leak.

2. Using a new gasket, install the RH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown:
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten to 20 Nm (15 lb-ft).

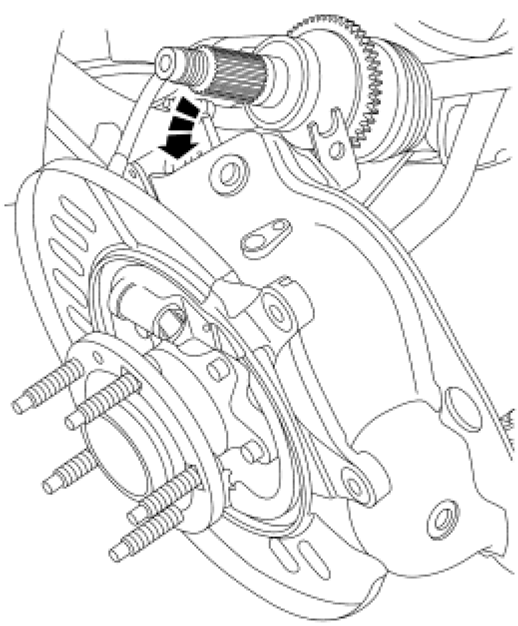
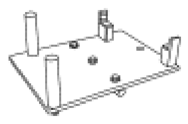


Fig. 160: Installing RH Exhaust Manifold Nuts In Sequence
Courtesy of FORD MOTOR CO.

3. Connect the RH HO2S electrical connector.
4. Install the RH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.

ENGINE MOUNT

Special Tools

Illustration	Tool Name	Tool Number
 ST3034-A	Oil Pan Holding Fixture	303-1295

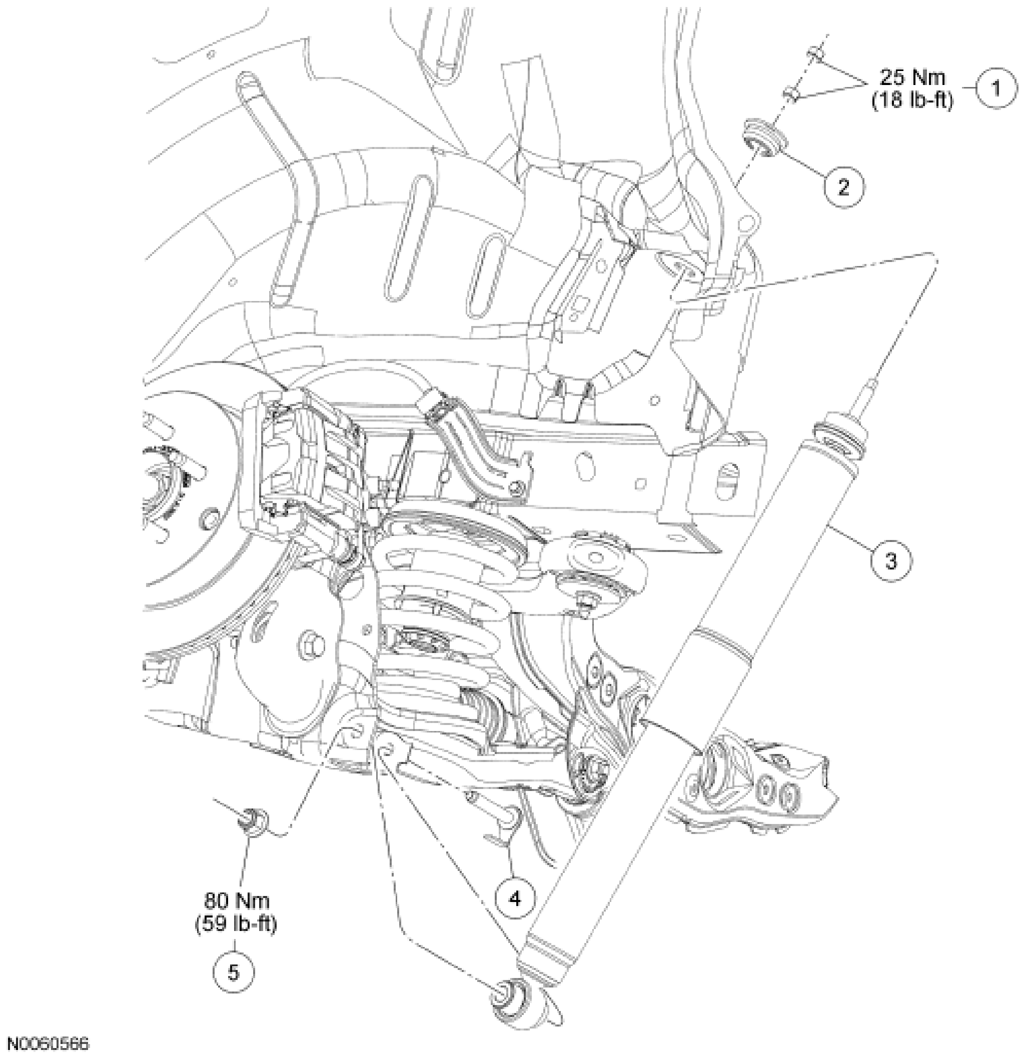


Fig. 161: Identifying Engine Mount Components With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description

1	W807658	Degas bottle-to-fender bolt (2 required)
2	W709603	Degas bottle-to-washer bottle bolt
3	8A080	Degas bottle
4	W520102	Engine mount brace nut
5	6K075	Engine mount brace
6	W712334	Engine mount-to-engine nut (4 required)
7	W712511	Engine mount brace bolt
8	W712507	Engine mount-to-frame bolt (3 required)
9	6F012	Engine mount

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Loosen the exhaust flexible pipe clamp and disconnect the 2 exhaust hangers.
   - To install, tighten to 40 Nm (30 lb-ft).

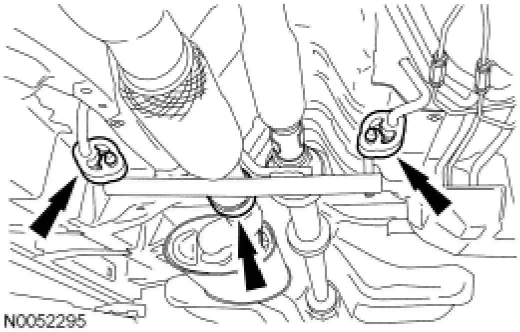


Fig. 162: Locating Exhaust Flexible Pipe Clamp & Exhaust Hangers
Courtesy of FORD MOTOR CO.

3. Remove the 4 nuts, the exhaust flexible pipe and the Y-pipe as an assembly.
   - Discard the nuts and the gasket.
   - To install, tighten to 40 Nm (30 lb-ft).

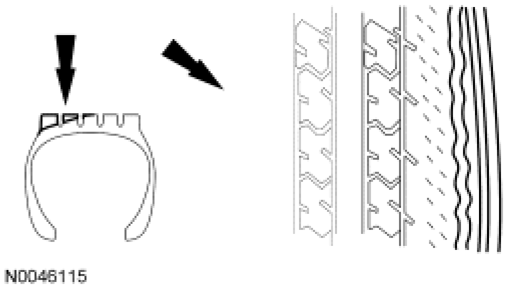


Fig. 163: Locating Exhaust Flexible Pipe, Y-Pipe & Nuts

Courtesy of FORD MOTOR CO.

4. Remove the 2 nuts and the roll restrictor heat shield.
    - To install, tighten to 11 Nm (8 lb-ft).

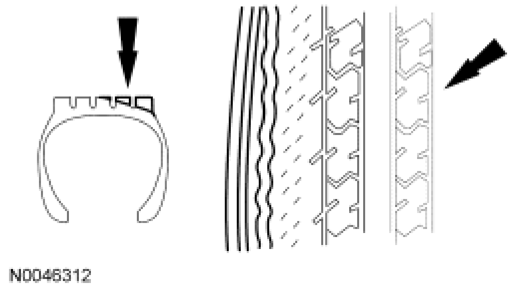


Fig. 164: Locating Roll Restrictor Heat Shield Nuts
Courtesy of FORD MOTOR CO.

5. Loosen the roll restrictor-to-subframe through bolt.
    - To install, tighten to 103 Nm (76 lb-ft).

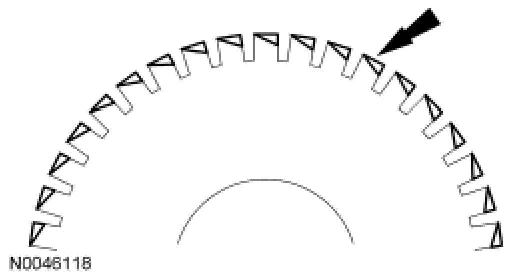


Fig. 165: Locating Roll Restrictor-To-Subframe Bolt
Courtesy of FORD MOTOR CO.

6. Remove the roll restrictor through bolt and the 2 roll restrictor-to-transaxle bracket plate bolts.
    - To install, tighten to 90 Nm (66 lb-ft).

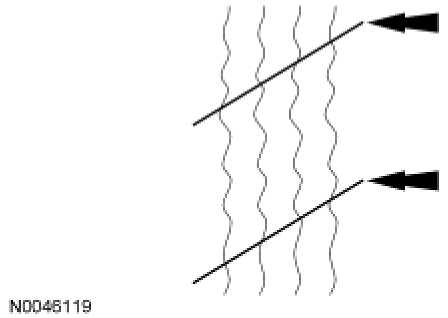


Fig. 166: Locating Roll Restrictor-To-Transaxle Bracket Plate Bolts
Courtesy of FORD MOTOR CO.

7. Remove the 3 bolts and the transaxle bracket.
    - To install, tighten to 90 Nm (66 lb-ft).

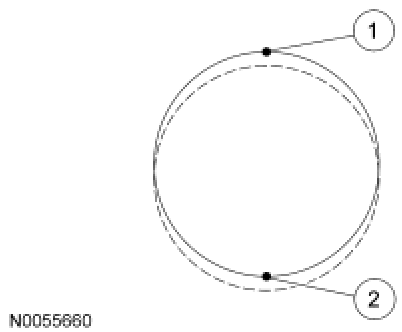


Fig. 167: Locating Transaxle Bracket Bolts
Courtesy of FORD MOTOR CO.

CAUTION: The special tool must be carefully aligned to the mounting bosses on the oil pan. Failure to follow these instructions may result in damage to the oil pan.

8. Position a floor jack and the special tool under the oil pan.

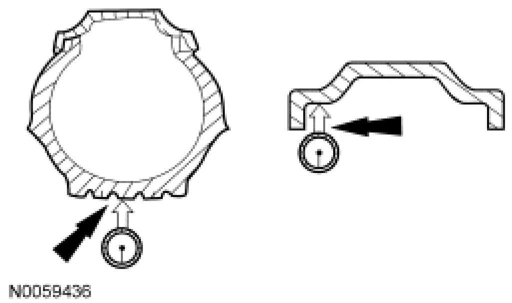


Fig. 168: Positioning Floor Jack & Special Tool (303-1295) Under Oil Pan
Courtesy of FORD MOTOR CO.

9. Remove the 3 bolts and position the engine coolant degas bottle aside.
    - To install, tighten to 9 Nm (80 lb-in).
10. Remove the nut, bolt and engine mount brace.
    - To install, tighten to 20 Nm (15 lb-ft).

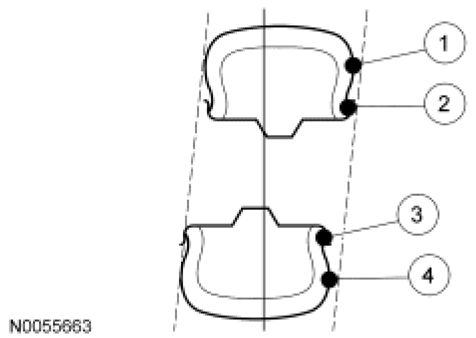


Fig. 169: Locating Nut, Bolt & Engine Mount Brace
Courtesy of FORD MOTOR CO.

11. Remove the 4 engine mount nuts.
    - To install, tighten to 63 Nm (46 lb-ft).

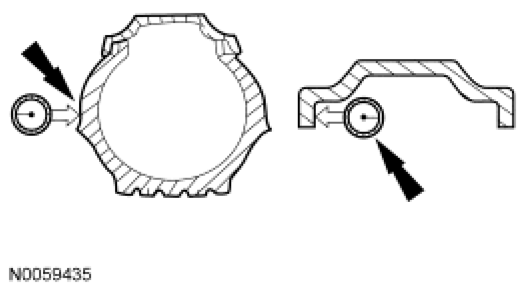


Fig. 170: Locating Engine Mount Nuts
Courtesy of FORD MOTOR CO.

12. Remove the 3 bolts and the engine mount.
    - To install, tighten to 90 Nm (66 lb-ft).

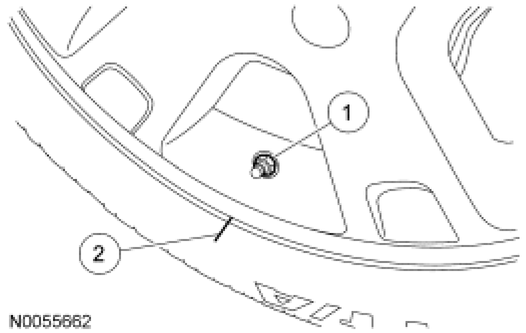
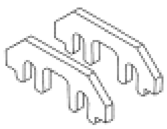


Fig. 171: Locating Engine Mount Bolts
Courtesy of FORD MOTOR CO.

13. To install, reverse the removal procedure.

OIL PUMP

Special Tools

Illustration	Tool Name	Tool Number
	Camshaft Alignment Tool	303-1248

REMOVAL

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan may cause engine failure.

1. Remove the engine front cover. For additional information, refer to **Engine Front Cover**.
2. Rotate the crankshaft clockwise and align the timing marks on the variable camshaft timing (VCT) assemblies as shown.

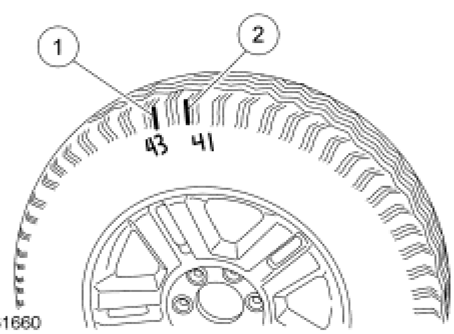


Fig. 172: Aligning Timing Marks On Variable Camshaft Timing (VCT) Assemblies
Courtesy of FORD MOTOR CO.

NOTE: The special tool will hold the camshafts in the top dead center (TDC) position.

3. Install the special tool onto the flats of the LH camshafts.

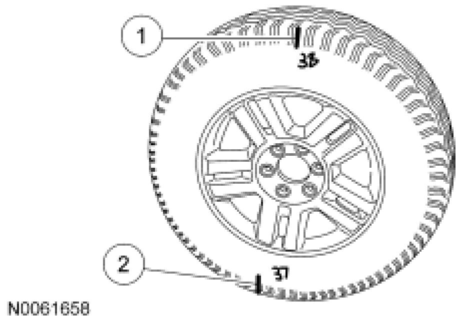


Fig. 173: Installing Special Tool (303-1248) Onto Flats Of LH Camshafts
Courtesy of FORD MOTOR CO.

NOTE: The special tool will hold the camshafts in the TDC position.

4. Install the special tool onto the flats of the RH camshafts.

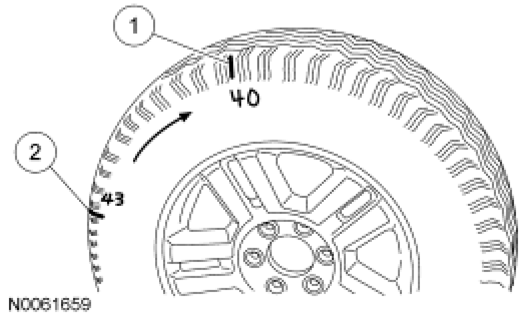


Fig. 174: Installing Special Tool (303-1248) Onto Flats Of RH Camshafts
Courtesy of FORD MOTOR CO.

5. Remove the 3 bolts and the RH VCT housing.

Table 1. Use Table to Adjust Tire Pressure Inside Garage for Colder Outside Temperature[1]

** Do Not Inflate Tire Higher than Maximum Pressure Stamped on Tire Sidewall. **

Table is based on a Garage Temperature of 70°F. Max Pressure Adjustment is 7 psi.

Outside Temperature (°F)	Tire Placard Pressure (PSI)																	
	30	32	34	35	38	40	41	42	45	50	55	60	65	70	75	80	85	90
70	30	32	34	35	38	40	41	42	45	50	55	60	65	70	75	80	85	90
60	31	33	35	36	39	41	42	43	46	51	56	61	67	72	77	82	87	92
50	32	34	36	37	40	42	43	44	47	53	58	63	68	73	79	84	89	94
40	33	35	37	38	41	43	44	45	49	54	59	64	70	75	80	86	91	96
30	34	36	38	39	42	44	46	47	50	55	61	66	72	77	82	87	92	97
20	35	37	39	40	43	46	47	48	51	57	62	67	72	77	82	87	92	97
10	36	38	40	41	45	47	48	49	52	57	62	67	72	77	82	87	92	97
0	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-10	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-20	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-30	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-40	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97

Table 2. Use Table to Adjust Tire Pressure Inside Garage for Colder Outside Temperature (Metric Units)[1]

** Do Not Inflate Tire Higher than Maximum Pressure Stamped on Tire Sidewall. **

Table is based on a Garage Temperature of 21°C. Max Pressure Adjustment is 50 kPa.

Outside Temperature (°C)	Tire Placard Pressure (kPa)																	
	205	220	235	240	260	275	285	290	310	345	380	415	450	485	515	550	585	620
21	205	220	235	240	260	275	285	290	310	345	380	415	450	485	515	550	585	620
16	215	230	240	250	270	285	290	295	315	350	385	420	460	495	530	565	600	635
10	220	235	250	255	275	290	295	305	325	365	400	435	470	505	545	580	615	650
4	230	240	255	260	285	295	305	310	340	370	405	440	485	515	550	595	625	660
-1	235	250	260	270	290	305	315	325	345	380	420	455	495	530	565	600	635	670
-7	240	255	270	275	295	315	325	330	350	395	425	460	495	530	565	600	635	670
-12	250	260	275	285	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-18	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-23	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-29	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-34	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-40	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670

[1]When Outside (Ambient) Temperature is greater than 21°C (70°F), Inflate tires to placard pressure.

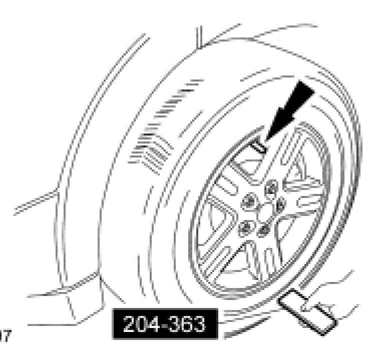
[1]Use the table to adjust tire pressure for P-metric and LT tires only.

[1]Do NOT use table for Commercial Truck Tires (i.e. 19.5 inch tires for F450 & F550). See F-Super Duty Service Manual for tire inflation procedure.

N0057700

Fig. 175: Locating RH VCT Housing
Courtesy of FORD MOTOR CO.

6. Remove the 3 bolts and the LH VCT housing.



N0037897

Fig. 176: Locating LH VCT Housing

Courtesy of FORD MOTOR CO.

7. Remove and discard the VCT housing seals.

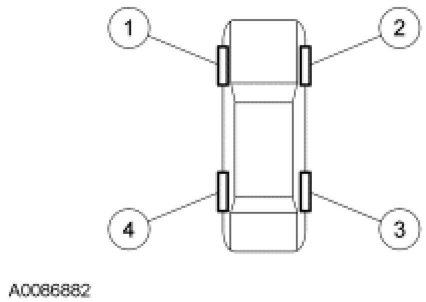


Fig. 177: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

8. Remove the 2 bolts and the primary timing chain tensioner.

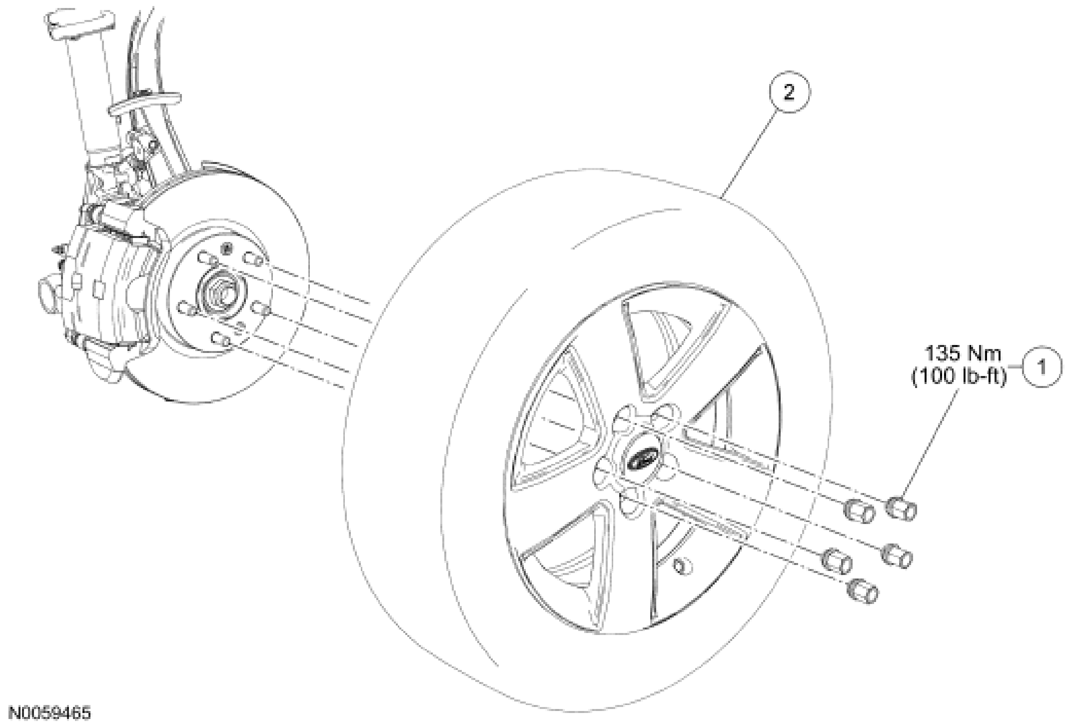


Fig. 178: Locating Primary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

9. Remove the primary timing chain tensioner arm.

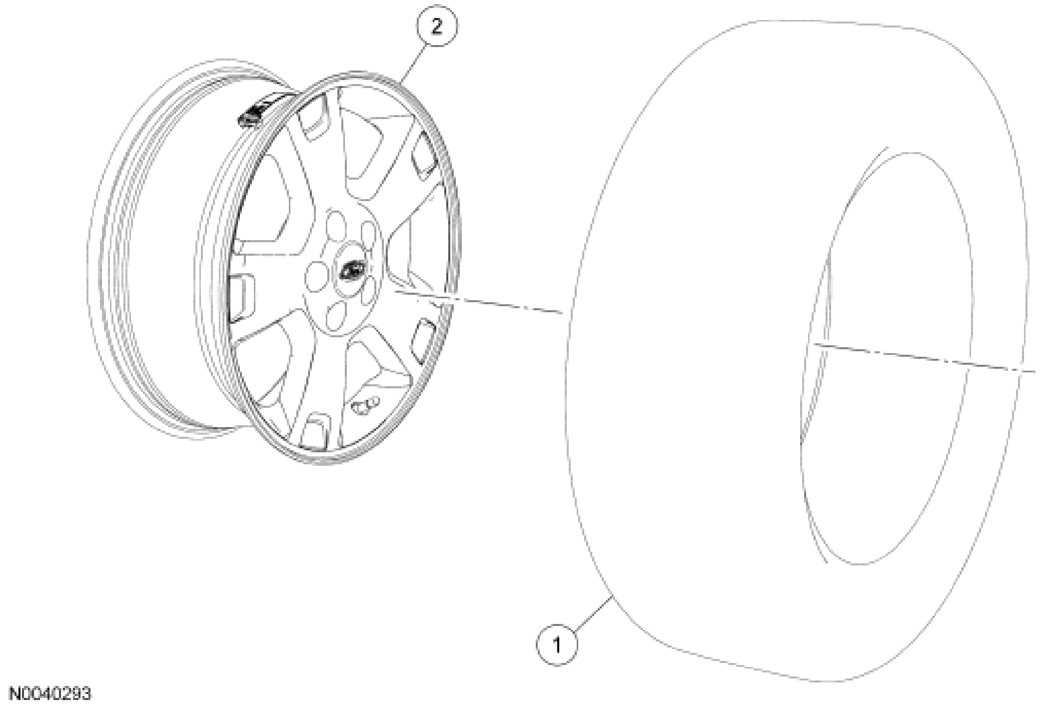


Fig. 179: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

10. Remove the 2 bolts and the lower LH primary timing chain guide.

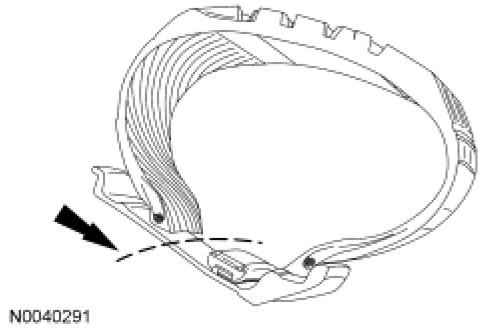


Fig. 180: Locating Lower LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

11. Remove the primary timing chain.

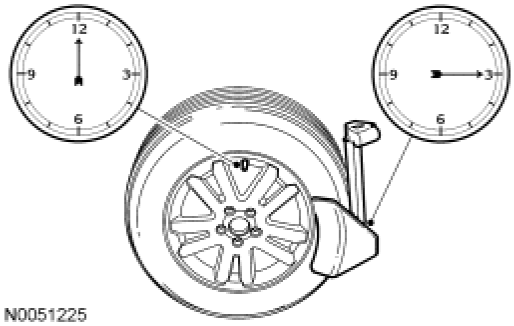


Fig. 181: Locating Primary Timing Chain
Courtesy of FORD MOTOR CO.

12. Remove the crankshaft timing chain sprocket.

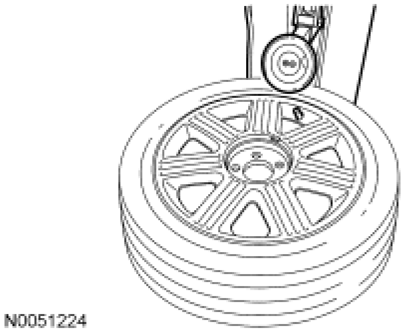


Fig. 182: Locating Crankshaft Timing Chain Sprocket
Courtesy of FORD MOTOR CO.

13. Remove the 2 oil pump screen and pickup tube bolts.

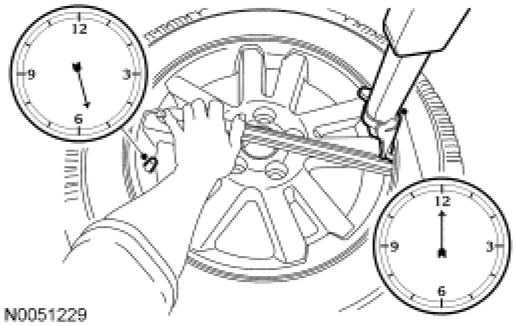


Fig. 183: Locating Oil Pump Screen & Pickup Tube Bolts & Rotating Oil Pump Clockwise
Courtesy of FORD MOTOR CO.

14. Remove the 3 oil pump bolts.
    - Rotate the oil pump clockwise and separate the oil pump from the oil pump screen and pickup tube.
    - Remove the oil pump.

- Discard the oil pump screen and pickup tube O-ring seal.

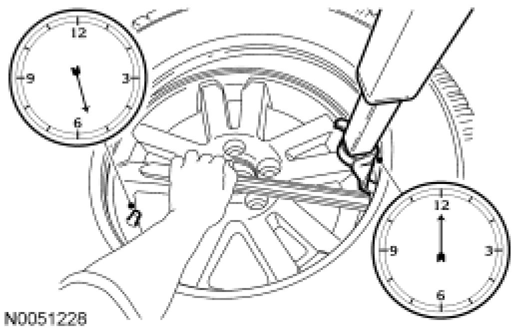


Fig. 184: Locating Oil Pump Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: **Install a new oil pump screen and pickup tube O-ring seal prior to installing the oil pump.**

1. Position the oil pump onto the crankshaft and rotate counterclockwise to position the pump onto the oil pump screen and pickup tube.
    - Install the 3 bolts and tighten to 10 Nm (89 lb-in).

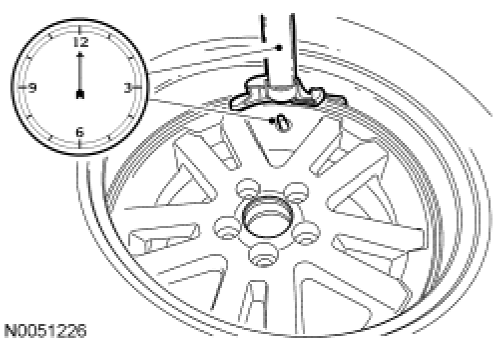


Fig. 185: Locating Oil Pump Screen & Pickup Tube Bolts & Rotating Oil Pump Counterclockwise
Courtesy of FORD MOTOR CO.

2. Install the 2 oil pump screen and pickup tube bolts.
    - Tighten to 10 Nm (89 lb-in).

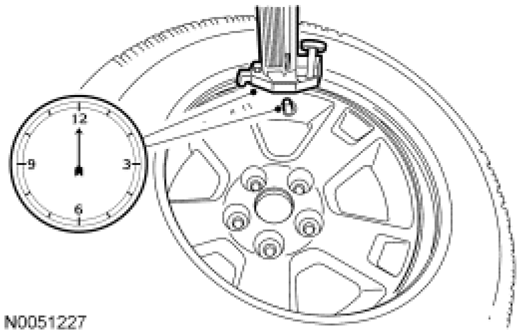


Fig. 186: Locating Oil Pump Screen & Pickup Tube Bolts & Rotating Oil Pump Clockwise
Courtesy of FORD MOTOR CO.

3. Install the crankshaft timing chain sprocket.

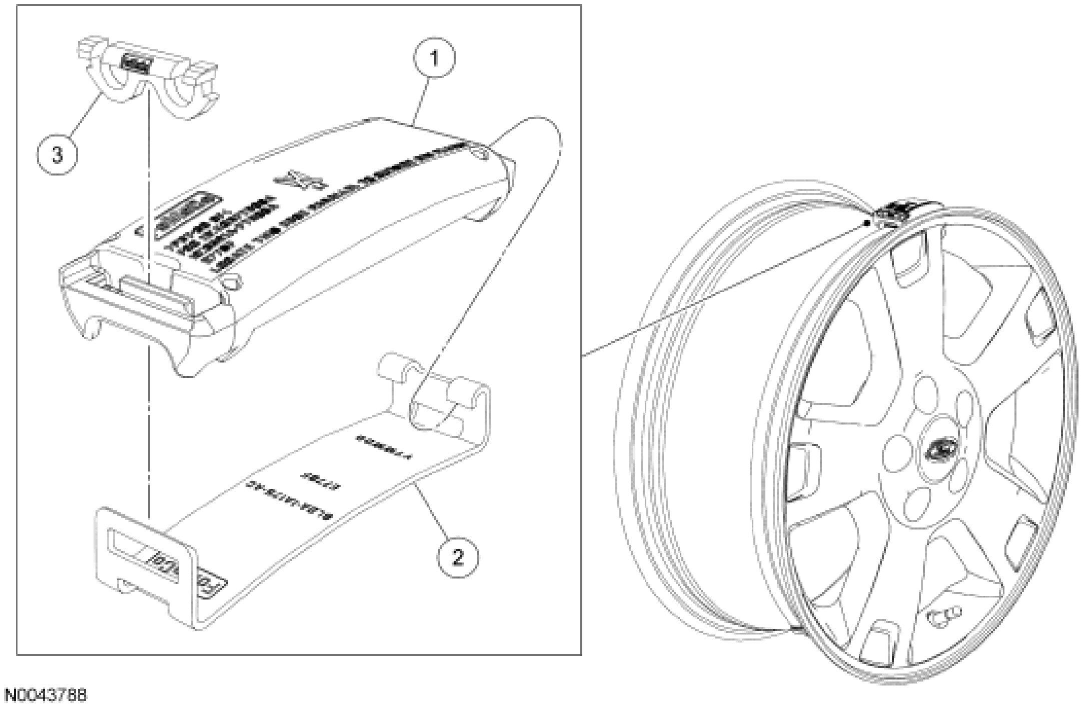


Fig. 187: Locating Crankshaft Timing Chain Sprocket
Courtesy of FORD MOTOR CO.

4. Install the primary timing chain with the colored links aligned with the timing marks on the VCT assemblies and the crankshaft sprocket.

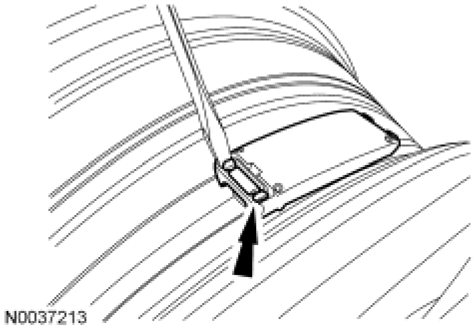


Fig. 188: Aligning Timing Marks On VCT Assemblies & Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

5. Install the LH primary timing chain guide and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

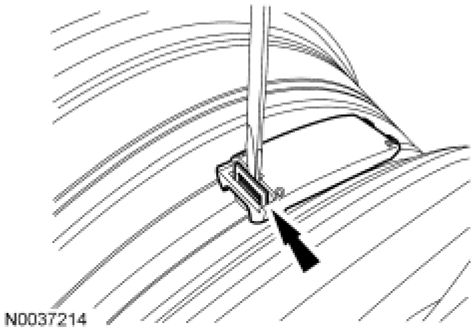


Fig. 189: Locating Lower LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

6. Install the primary timing chain tensioner arm.

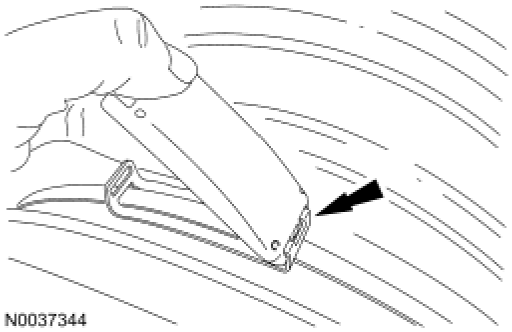


Fig. 190: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

7. Reset the primary timing chain tensioner.
    - Rotate the lever counterclockwise.

- Using a soft-jawed vise, compress the plunger.
- Align the hole in the lever with the hole in the tensioner housing.
- Install a suitable lockpin.

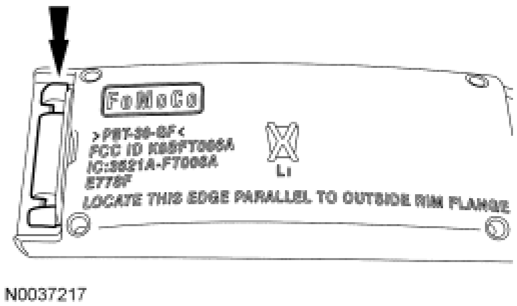


Fig. 191: Compressing Plunger Using A Soft-Jawed Vise
Courtesy of FORD MOTOR CO.

NOTE: It may be necessary to rotate the crankshaft slightly to remove slack from the timing chain and install the tensioner.

8. Install the primary tensioner and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).
    - Remove the lockpin.

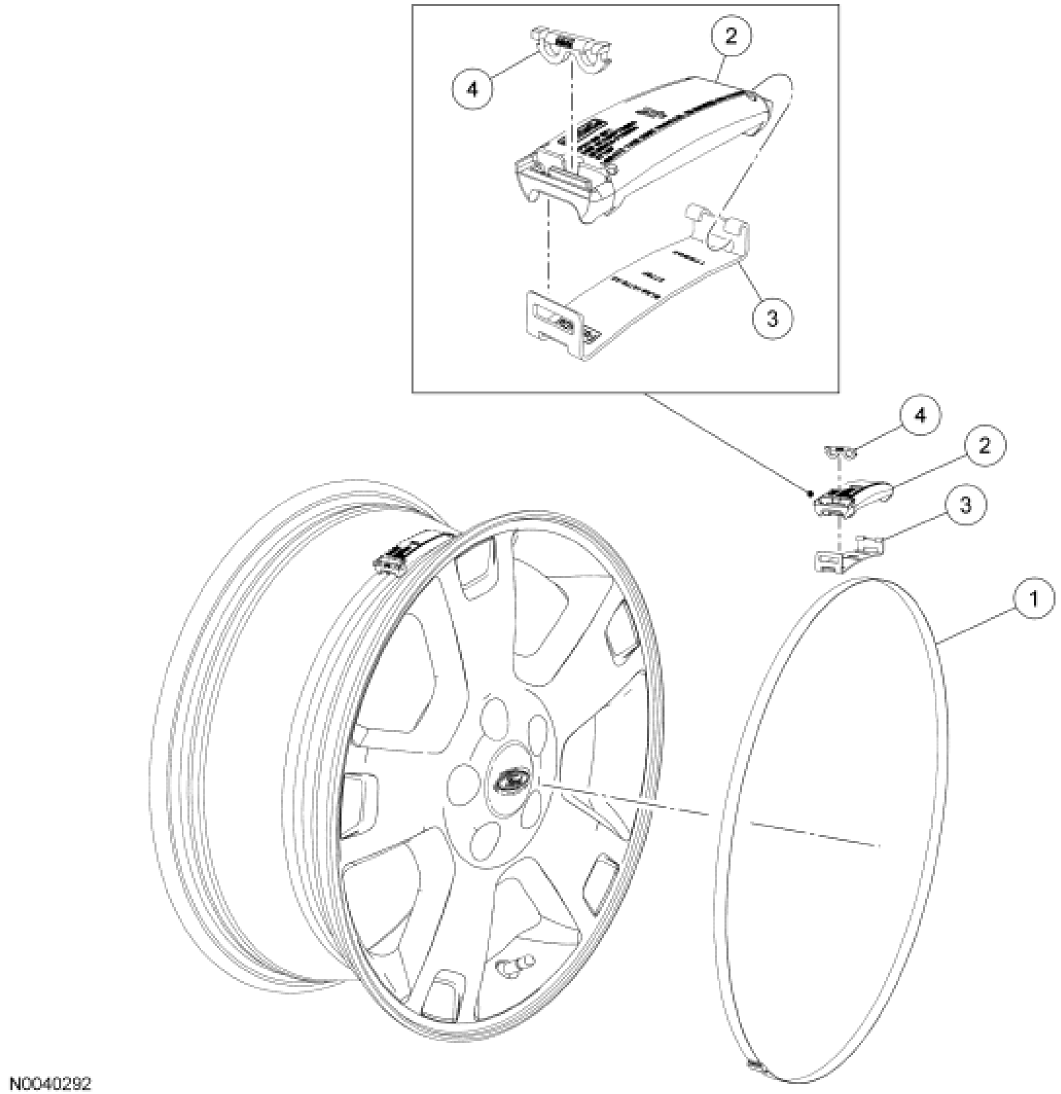


Fig. 192: Locating Primary Tensioner Bolts
Courtesy of FORD MOTOR CO.

9. As a post-check, verify correct alignment of all timing marks.

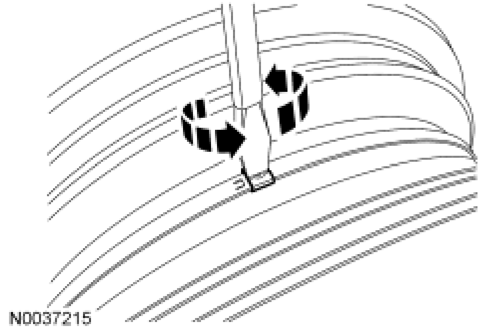


Fig. 193: Verifying Correct Alignment Of All Timing Marks

Courtesy of FORD MOTOR CO.

10. Install new VCT housing seals.

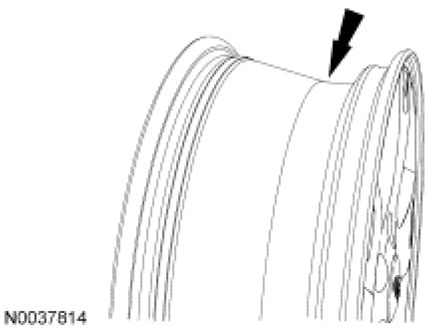


Fig. 194: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

NOTE:	**Make sure the dowels on the variable camshaft timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.**

11. Install the LH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

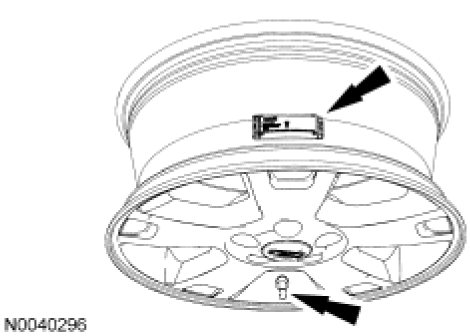


Fig. 195: Identifying LH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

NOTE:	**Make sure the dowels on the variable camshaft timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.**

12. Install the RH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

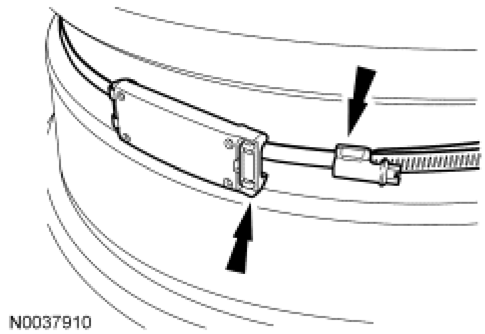


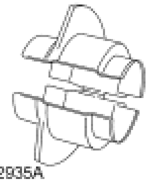
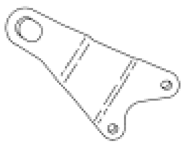
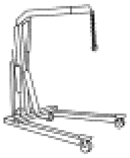
Fig. 196: Identifying RH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

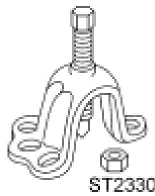
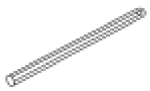
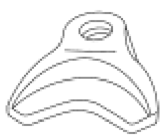
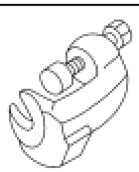
13. Install the engine front cover. For additional information, refer to **Engine Front Cover**.

REMOVAL

ENGINE

Special Tools

Illustration	Tool Name	Tool Number
	Disconnect Tool, Transmission Cooler Tube	307-569
	Engine Lifting Bracket	303-1245
	Heavy Duty Floor Crane	014-00071 or equivalent
	Powertrain Lift	014-00765
		205-D070 (D93P-1175-B) or

 ST2330-A	Remover, Front Hub	equivalent
 ST2939-A	Remover, Halfshaft (Extension)	205-243 (T89P-3415-A)
 ST2038-A	Remover, Halfshaft (Plate)	205-290 (T89P-3415-B)
 ST1185-A	Slide Hammer	100-001 (T50T-100-A)
 ST1602-A	Spreader Bar	303-D089 (D93P-6001-A3) or equivalent
 ST1408-A	Tie-Rod End Remover	211-105
 ST2743A	Universal Adapter Brackets	014-0001

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Recover the air conditioning system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION & DIAGNOSTICS** article.
3. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
4. Drain the engine cooling system. For additional information, refer to **ENGINE COOLING** article.
5. Remove the accessory drive belt and the power steering belt. For additional information, refer to **ACCESSORY DRIVE** article.
6. Disconnect the power steering cooler hose and drain the power steering fluid into a suitable drain pan.

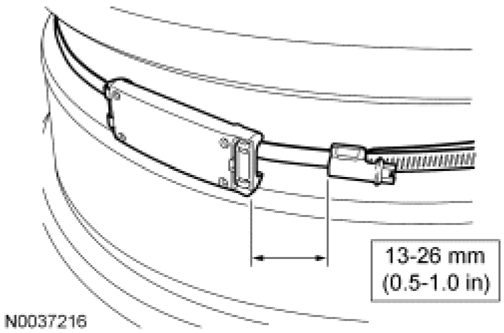


Fig. 197: Identifying Power Steering Cooler Hose
Courtesy of FORD MOTOR CO.

7. Remove the degas bottle. For additional information, refer to **ENGINE COOLING** article.
8. Remove the engine air cleaner and air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION & FILTERING** article.
9. Remove the battery tray. For additional information, refer to **BATTERY, MOUNTING & CABLES** article.
10. Disconnect the battery harness electrical connector.

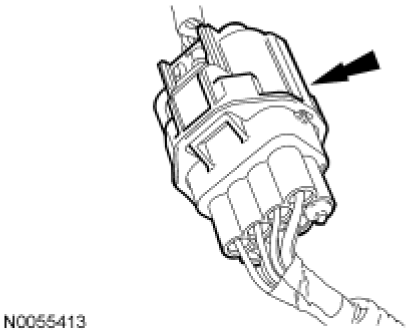


Fig. 198: Identifying Battery Harness Electrical Connector
Courtesy of FORD MOTOR CO.

11. Remove the nut and disconnect the power feed from the battery terminal.

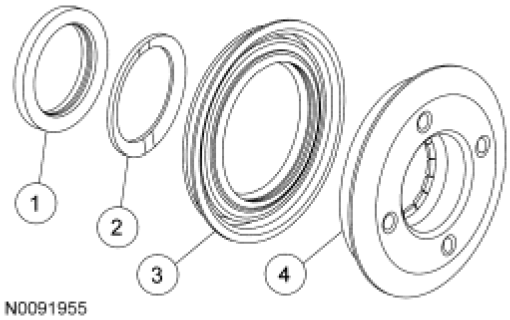


Fig. 199: Locating Power Feed To Battery Terminal And Nut
Courtesy of FORD MOTOR CO.

12. Remove the bolt and the ground wire.
    - Detach the 2 wiring harness retainers from the cowl.

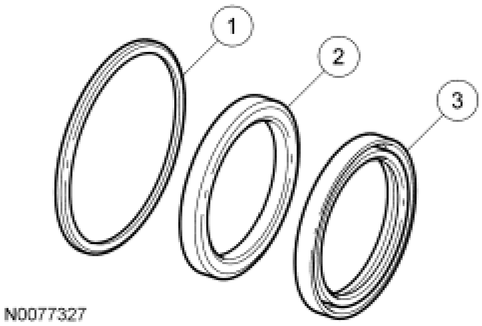


Fig. 200: Identifying Wiring Harness Retainers From Cowl
Courtesy of FORD MOTOR CO.

13. Disconnect the vacuum hose from the upper intake manifold.

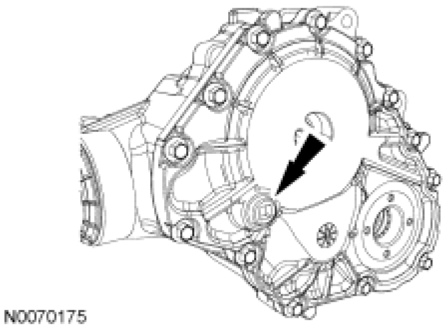


Fig. 201: Identifying Vacuum Hose From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

14. Disconnect the upper evaporative emissions (EVAP) tube quick connect coupling from the purge valve. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

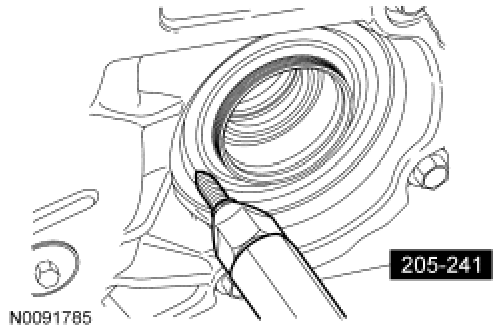


Fig. 202: Locating Upper Evaporative Emissions (EVAP) Tube Quick Connect Coupling
Courtesy of FORD MOTOR CO.

15. Disconnect the upper radiator hose, lower radiator hose and 2 heater hoses from the thermostat housing.

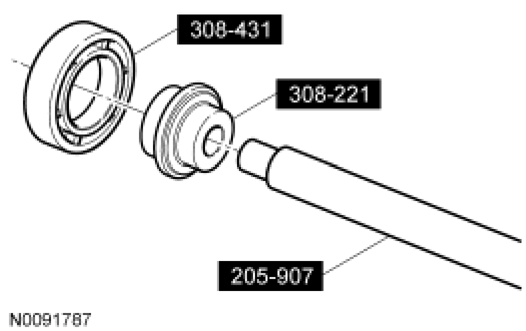


Fig. 203: Locating Upper Radiator Hose, Lower Radiator Hose & Heater Hoses
Courtesy of FORD MOTOR CO.

16. Detach the wiring harness retainer from the transaxle control cable bracket.

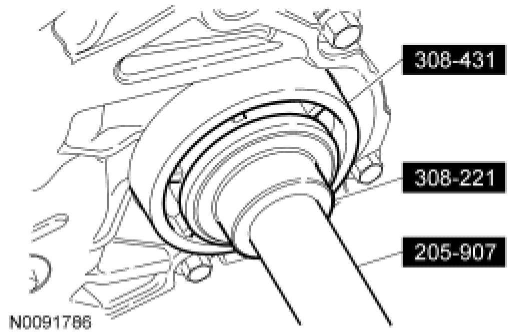


Fig. 204: Locating Wiring Harness Retainer From Transaxle Control Cable Bracket
Courtesy of FORD MOTOR CO.

17. Disconnect the transaxle control cable from the control lever.
    - Detach the control cable from the bracket.

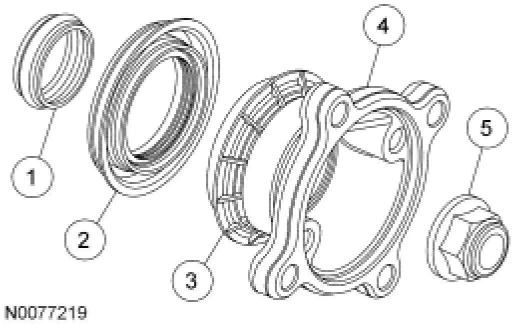


Fig. 205: Locating Transaxle Control Cable From Control Lever
Courtesy of FORD MOTOR CO.

18. Disconnect the transaxle control electrical connector.

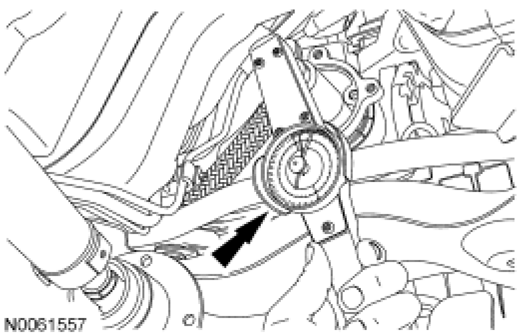


Fig. 206: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

19. If equipped, detach the engine block heater harness retainers from the radiator support and the A/C suction tube.

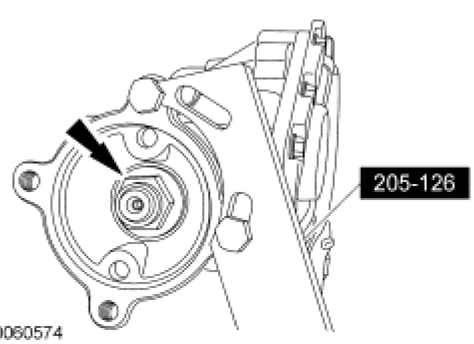


Fig. 207: Identifying Engine Block Heater Harness, Radiator Support, A/C Suction Tube & Engine Wiring Harness
Courtesy of FORD MOTOR CO.

20. Remove the nut and disconnect the A/C pressure tube fitting.
    - Discard the O-ring seal.

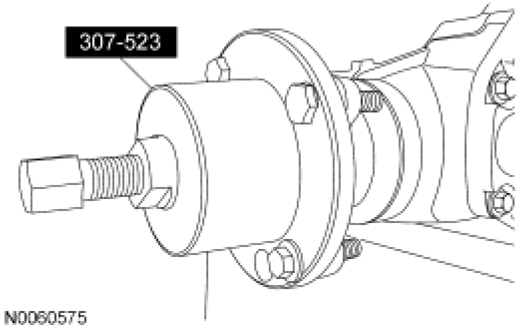


Fig. 208: Identifying A/C Pressure Tube Fitting Nut
Courtesy of FORD MOTOR CO.

21. Remove the safety clip from the A/C fitting.
    - Disconnect the A/C suction tube fitting.

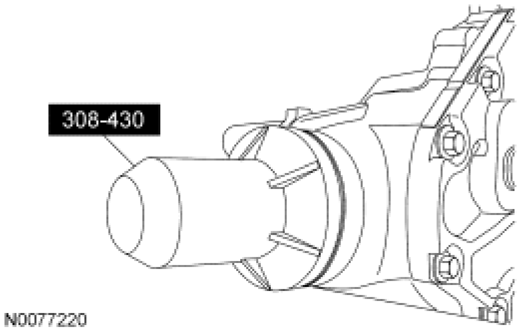


Fig. 209: Identifying Safety Clip On A/C Suction Tube Fitting
Courtesy of FORD MOTOR CO.

22. Disconnect the hose from the power steering reservoir.

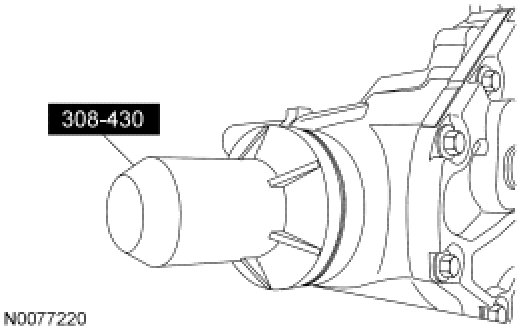


Fig. 210: Disconnecting Hose From Power Steering Reservoir
Courtesy of FORD MOTOR CO.

23. Disconnect the fuel supply tube. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

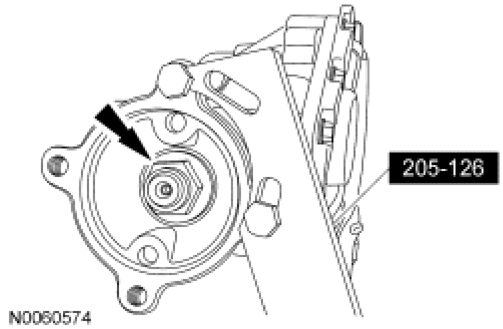


Fig. 211: Identifying Fuel Supply Tube
Courtesy of FORD MOTOR CO.

24. Disconnect the fuel hose routing clip from the transaxle stud and position the fuel hose aside.

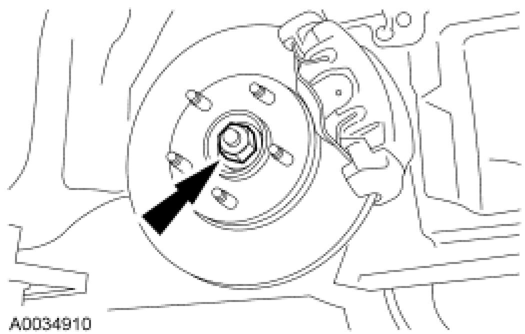


Fig. 212: Identifying Fuel Hose Routing Clip From Transaxle Stud
Courtesy of FORD MOTOR CO.

25. Disconnect the 2 engine wiring harness electrical connectors.
    - Detach the electrical connector from the LH valve cover.

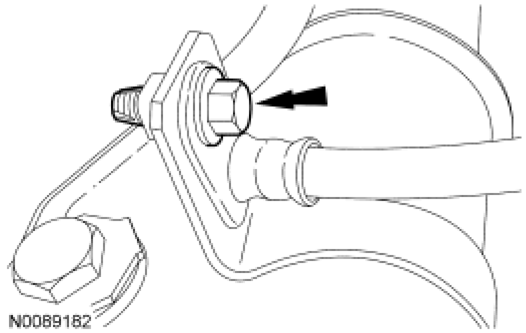


Fig. 213: Identifying Engine Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

26. Remove the oil level indicator.

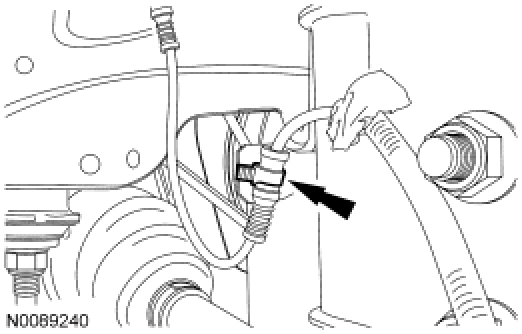


Fig. 214: Identifying Oil Level Indicator
Courtesy of FORD MOTOR CO.

27. Detach the wiring harness retainer from the RH valve cover stud bolt.

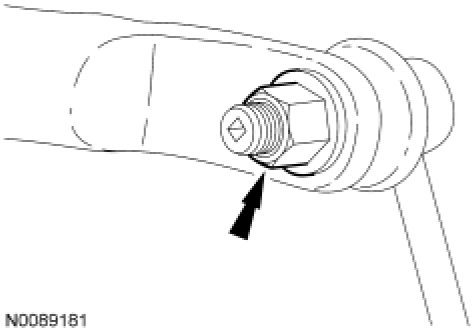


Fig. 215: Identifying Wiring Harness Retainer From RH Valve Cover Stud Bolt
Courtesy of FORD MOTOR CO.

28. Remove the bolt and the ground wire from the engine front cover.

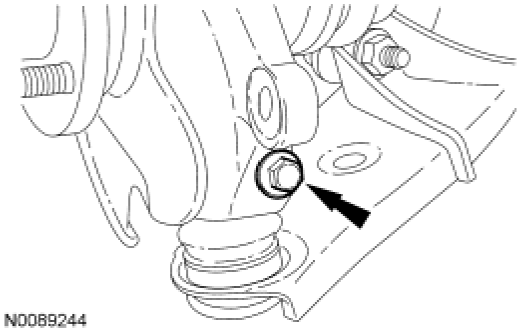


Fig. 216: Removing/Installing Bolt & Ground Wire From Engine Front Cover
Courtesy of FORD MOTOR CO.

29. Remove the nut, the ground wire and the radio interference capacitor wire from the engine front cover stud.

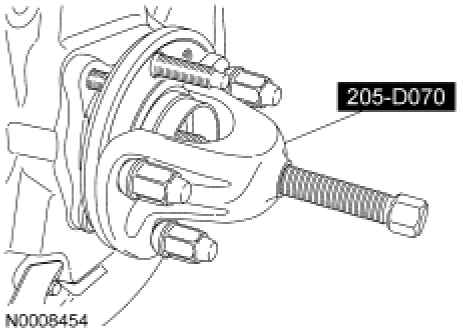


Fig. 217: Removing/installing Nut, Ground Wire & Radio Interference Capacitor Wire From Engine Front Cover Stud
Courtesy of FORD MOTOR CO.

30. Loosen the exhaust flexible pipe clamp and disconnect the 2 exhaust hangers.

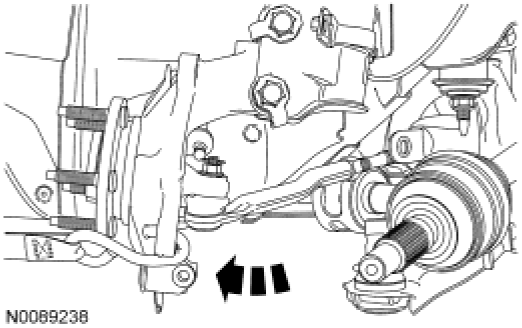


Fig. 218: Locating Exhaust Flexible Pipe Clamp & Exhaust Hangers
Courtesy of FORD MOTOR CO.

31. Remove the 4 nuts and the exhaust flexible pipe and Y-pipe as an assembly.
    - Discard the nuts and the gasket.

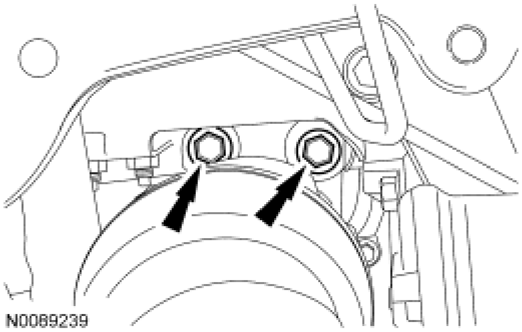


Fig. 219: Locating Exhaust Flexible Pipe, Y-Pipe & Nuts
Courtesy of FORD MOTOR CO.

32. Remove the 3 pin-type retainers, the 7 screws and the radiator splash shield.

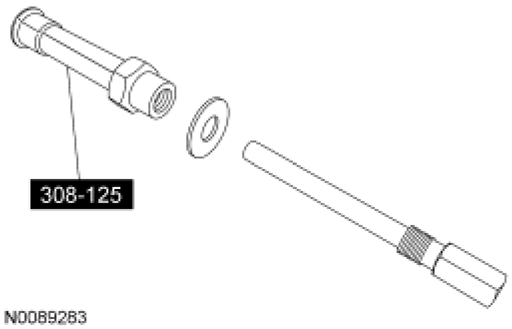


Fig. 220: Locating Push Pin Fasteners & Front Splash Shield Screws
Courtesy of FORD MOTOR CO.

33. Remove the LH inner splash shield. For additional information, refer to **FRONT END BODY PANELS** article.
34. Remove the 2 secondary latches from the transmission fluid cooler tubes.

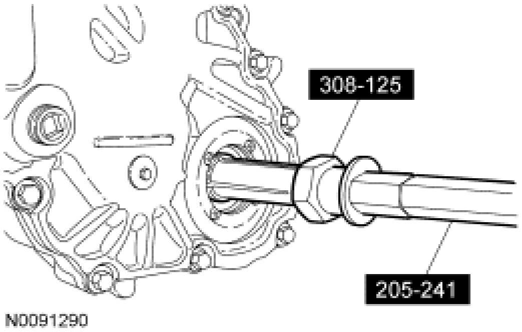


Fig. 221: Locating Secondary Latches On Transmission Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

35. Using the special tool, disconnect the transmission cooling tubes.

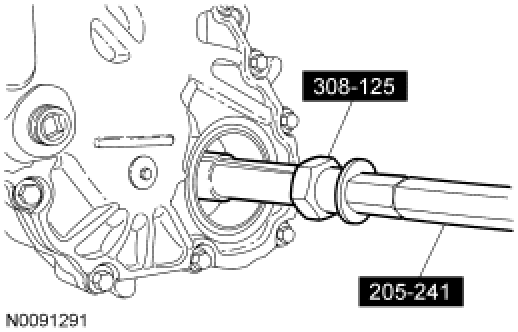


Fig. 222: Disconnecting Transmission Cooling Tubes Using Special Tool (307-569)
Courtesy of FORD MOTOR CO.

36. Remove the 4 oil pan-to-transaxle bolts.

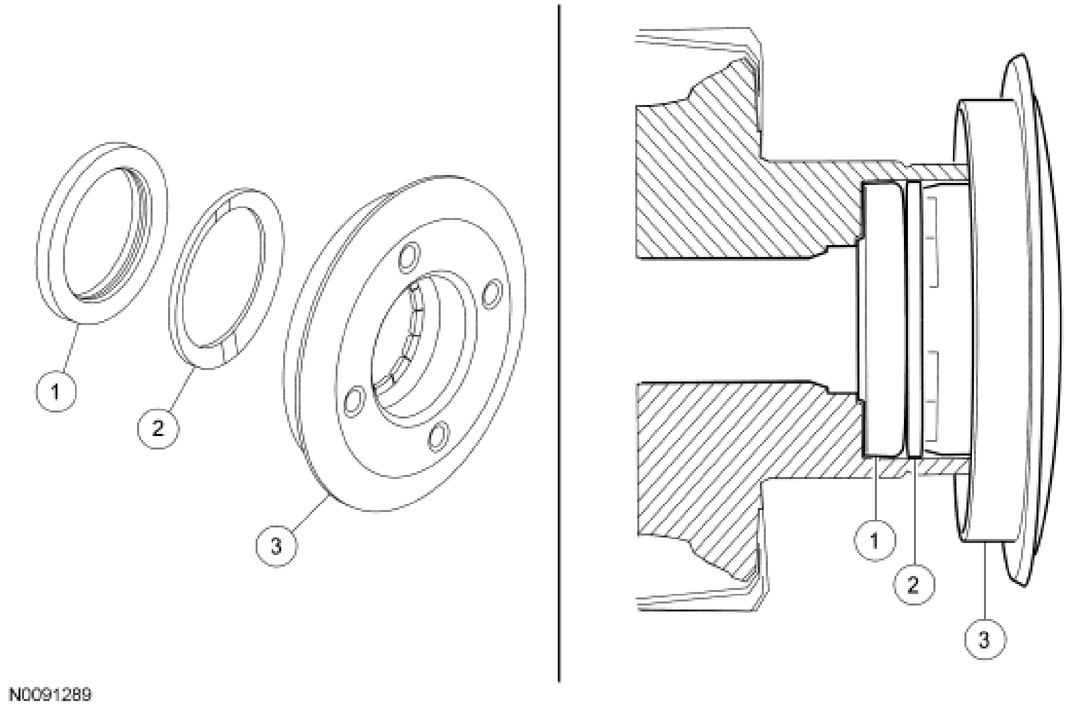


Fig. 223: Locating Oil Pan-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

37. Remove the 2 fasteners and the inspection cover.

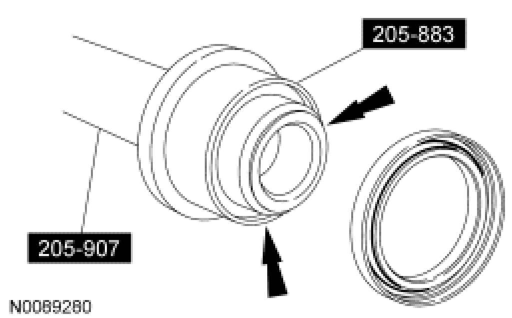


Fig. 224: Locating Oil Fasteners On Inspection Cover
Courtesy of FORD MOTOR CO.

38. Remove and discard the 3 torque converter bolts.

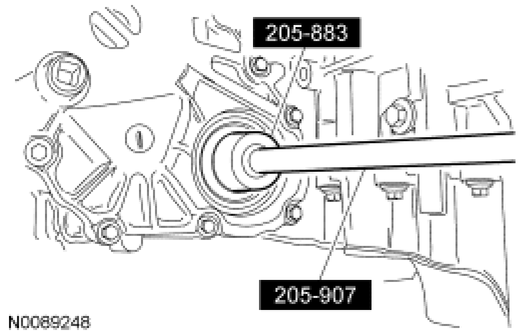


Fig. 225: Locating Torque Converter Bolts
Courtesy of FORD MOTOR CO.

39. Remove the drain plug and drain the engine oil.
    - Install the drain plug and tighten to 27 Nm (20 lb-ft).

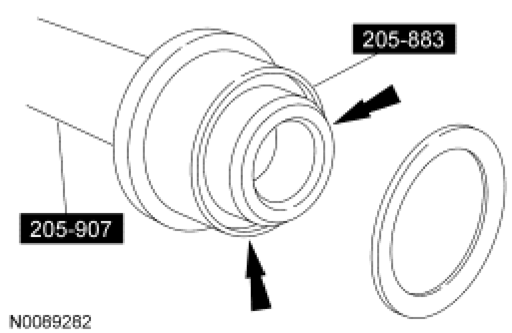


Fig. 226: Locating Drain Plug
Courtesy of FORD MOTOR CO.

40. Remove and discard the engine oil filter.

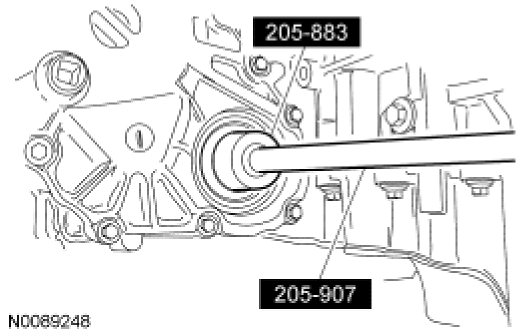


Fig. 227: Identifying Engine Oil Filter
Courtesy of FORD MOTOR CO.

41. Remove the power steering cooler bracket bolt from the RH side of the subframe.

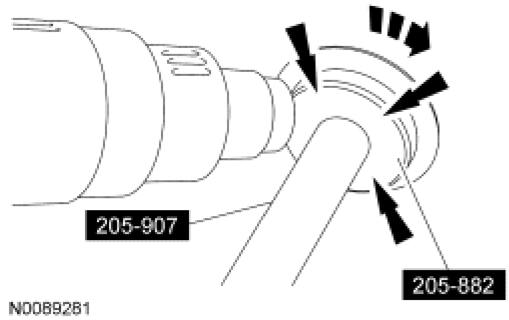


Fig. 228: Identifying Power Steering Cooler Bracket Bolt
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

NOTE: **Index-mark the driveshaft for installation.**

42. Remove the 4 bolts and support the driveshaft with a length of mechanic's wire.

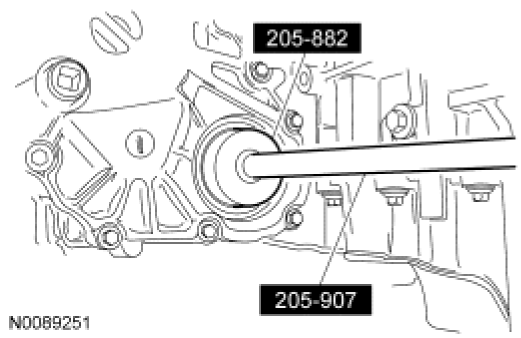


Fig. 229: Locating Driveshaft Aside Bolts
Courtesy of FORD MOTOR CO.

All vehicles

43. Remove and discard the RH front halfshaft nut.

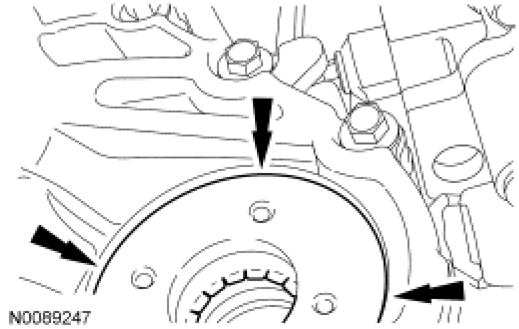


Fig. 230: Locating RH Front Halfshaft Nut

Courtesy of FORD MOTOR CO.

44. Remove the 2 nuts and the roll restrictor heat shield.

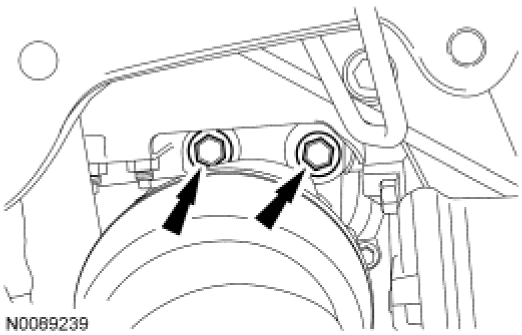


Fig. 231: Locating Roll Restrictor Heat Shield Nuts
Courtesy of FORD MOTOR CO.

45. Remove the engine roll restrictor-to-subframe through bolt.

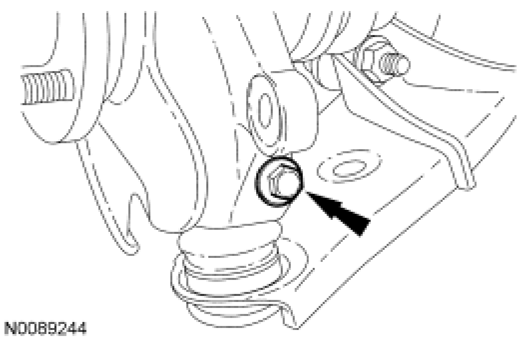


Fig. 232: Locating Roll Restrictor-To-Subframe Bolt
Courtesy of FORD MOTOR CO.

46. Remove and discard the power steering pressure (PSP) tube-to-pump banjo bolt and the 2 seals.

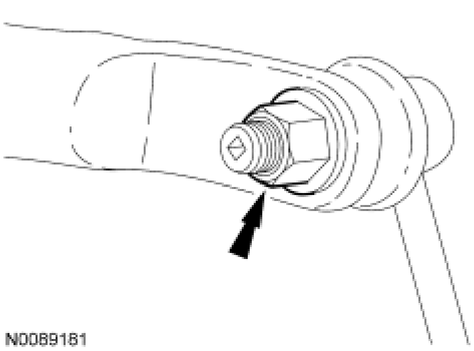


Fig. 233: Locating Power Steering Pressure (PSP) Tube-To-Pump Banjo Bolt & Seals
Courtesy of FORD MOTOR CO.

CAUTION: Do not allow the intermediate shaft to rotate while it is disconnected from the gear or damage to the clockspring can occur. If there is evidence that the intermediate shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to SUPPLEMENTAL RESTRAINT SYSTEM article.

47. Remove and discard the steering intermediate shaft bolt.
    - Separate the steering intermediate shaft from the steering gear.

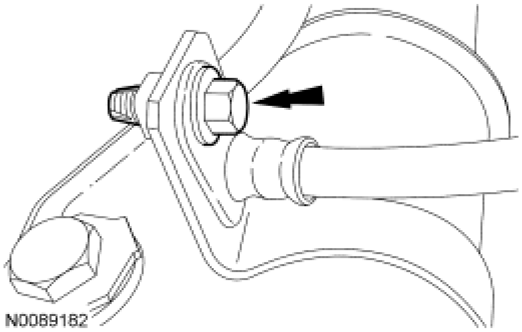


Fig. 234: Identifying Steering Intermediate Shaft Bolt
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

48. Remove and discard the cotter pins and tie-rod end nuts.
    - Using the special tool, separate the tie-rod ends from the wheel knuckles.

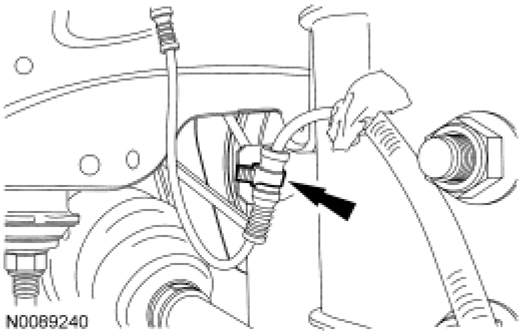


Fig. 235: Separating Tie-Rod Ends From Wheel Knuckles Using Special Tool (211-105)
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

49. Remove the 2 stabilizer link-to-lower control arm nuts and separate the stabilizer bar links from the lower control arms.

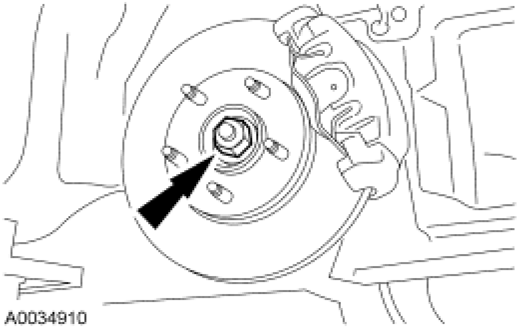


Fig. 236: Locating Stabilizer Bar Link Nut
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

50. Remove the lower control arm-to-knuckle pinch bolts and separate the lower control arms from the knuckles.

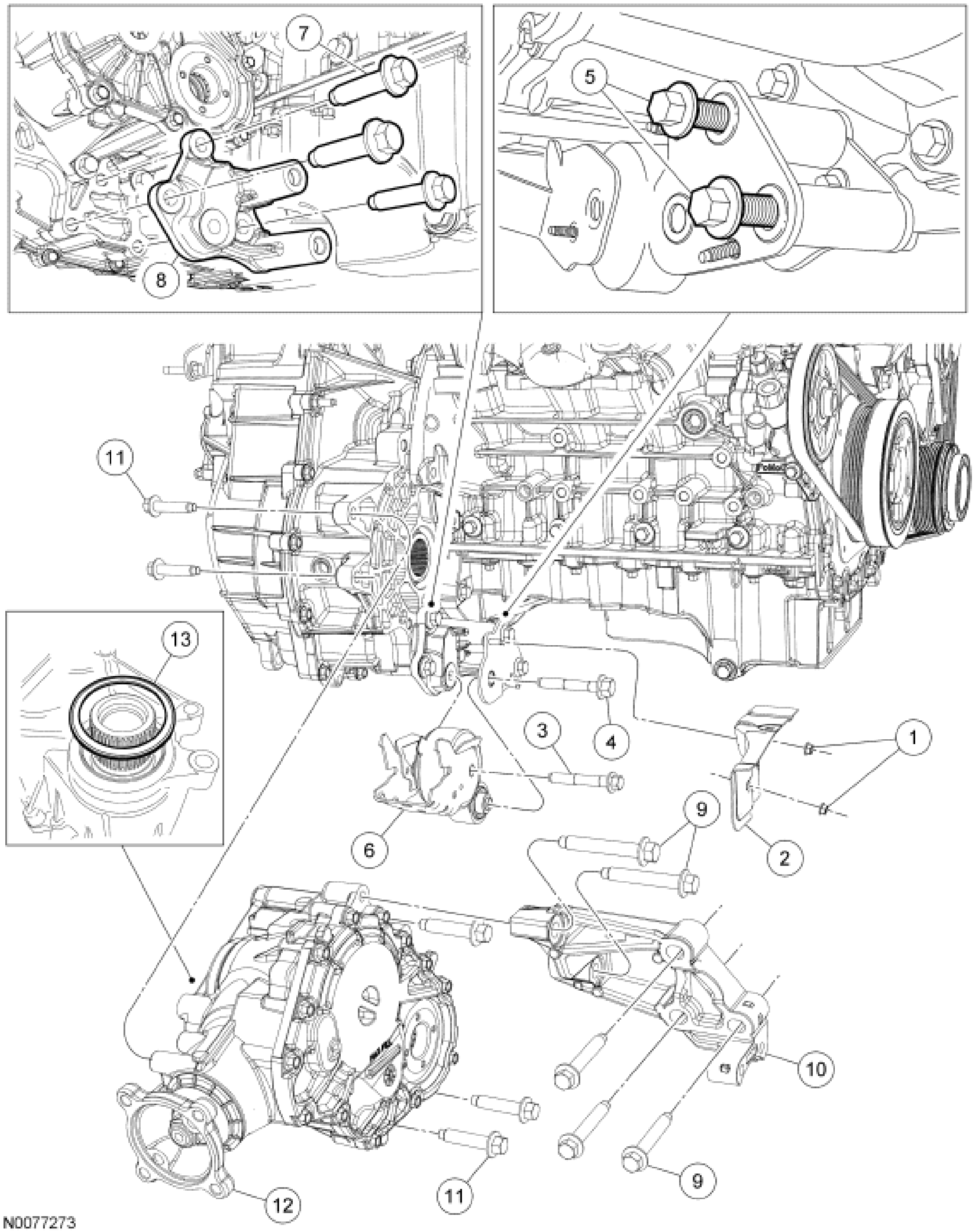


Fig. 237: Locating Ball Joint Pinch Bolt
Courtesy of FORD MOTOR CO.

51. Remove the 3 RH subframe-to-lower bumper nuts.

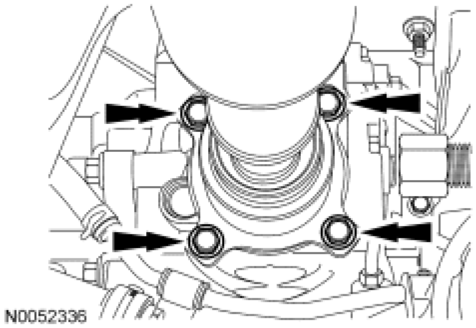


Fig. 238: Locating RH Subframe-To-Lower Bumper Nuts
Courtesy of FORD MOTOR CO.

52. Remove the 3 LH subframe-to-lower bumper nuts and separate the lower bumper from the subframe.

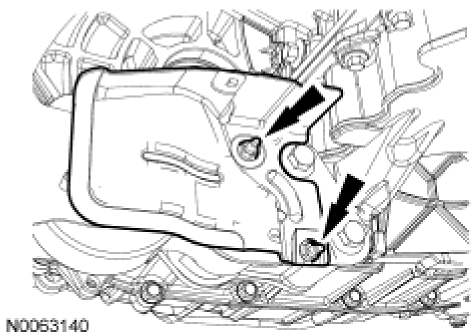


Fig. 239: Locating LH Subframe-To-Lower Bumper Nuts
Courtesy of FORD MOTOR CO.

53. Position the special tool under the subframe assembly.

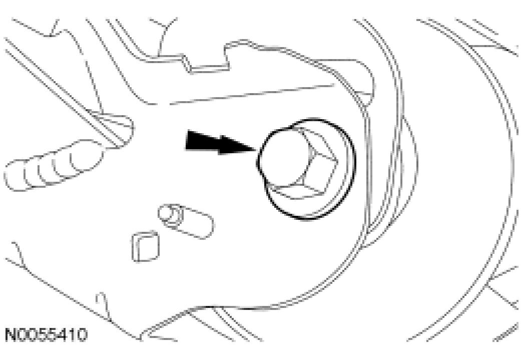


Fig. 240: Positioning Special Tool (014-00765) Under Subframe Assembly
Courtesy of FORD MOTOR CO.

54. Remove the 2 nuts, 4 bolts and the subframe support brackets.

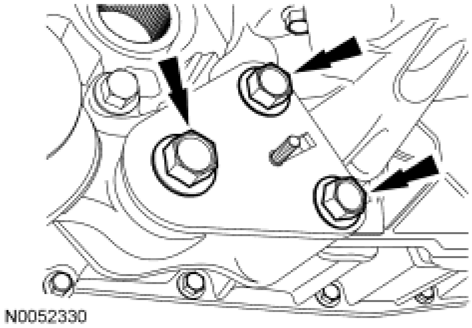


Fig. 241: Locating Subframe Support Brackets, Nuts & Bolts
Courtesy of FORD MOTOR CO.

55. Remove the 2 front subframe nuts.

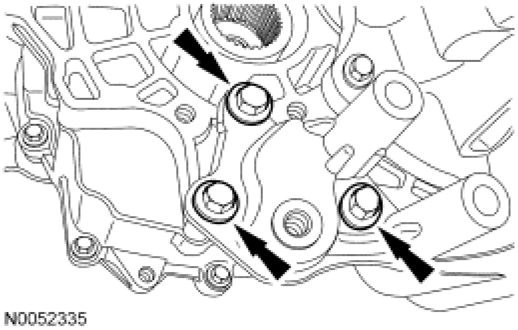


Fig. 242: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

56. Remove the 2 middle subframe nuts.

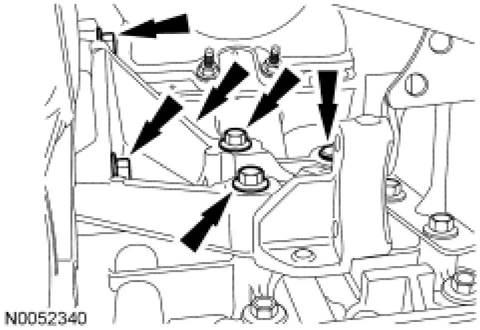


Fig. 243: Locating Middle Subframe Nuts
Courtesy of FORD MOTOR CO.

57. Using the special tool, lower the subframe assembly from the vehicle.

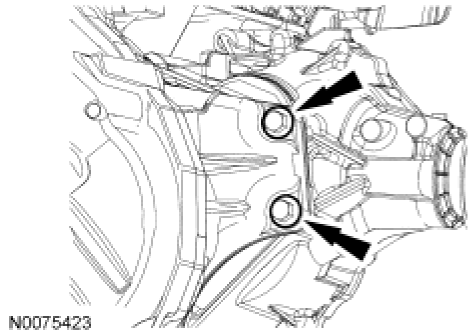


Fig. 244: Positioning Special Tool (014-00765) Under Subframe Assembly
Courtesy of FORD MOTOR CO.

58. If equipped, disconnect the oil cooler coolant hoses.

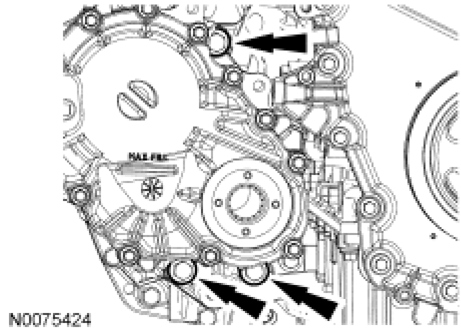


Fig. 245: Locating Oil Cooler Coolant Hoses
Courtesy of FORD MOTOR CO.

59. Using the special tools, separate the LH halfshaft from the transaxle and support the halfshaft with a length of mechanic's wire.

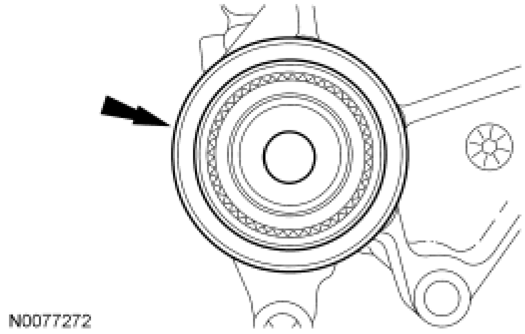


Fig. 246: Separating LH Halfshaft From Transaxle Using Special Tools (100-001), (205-243) & (205-290)
Courtesy of FORD MOTOR CO.

60. Remove the 2 RH catalytic converter support bracket bolts.

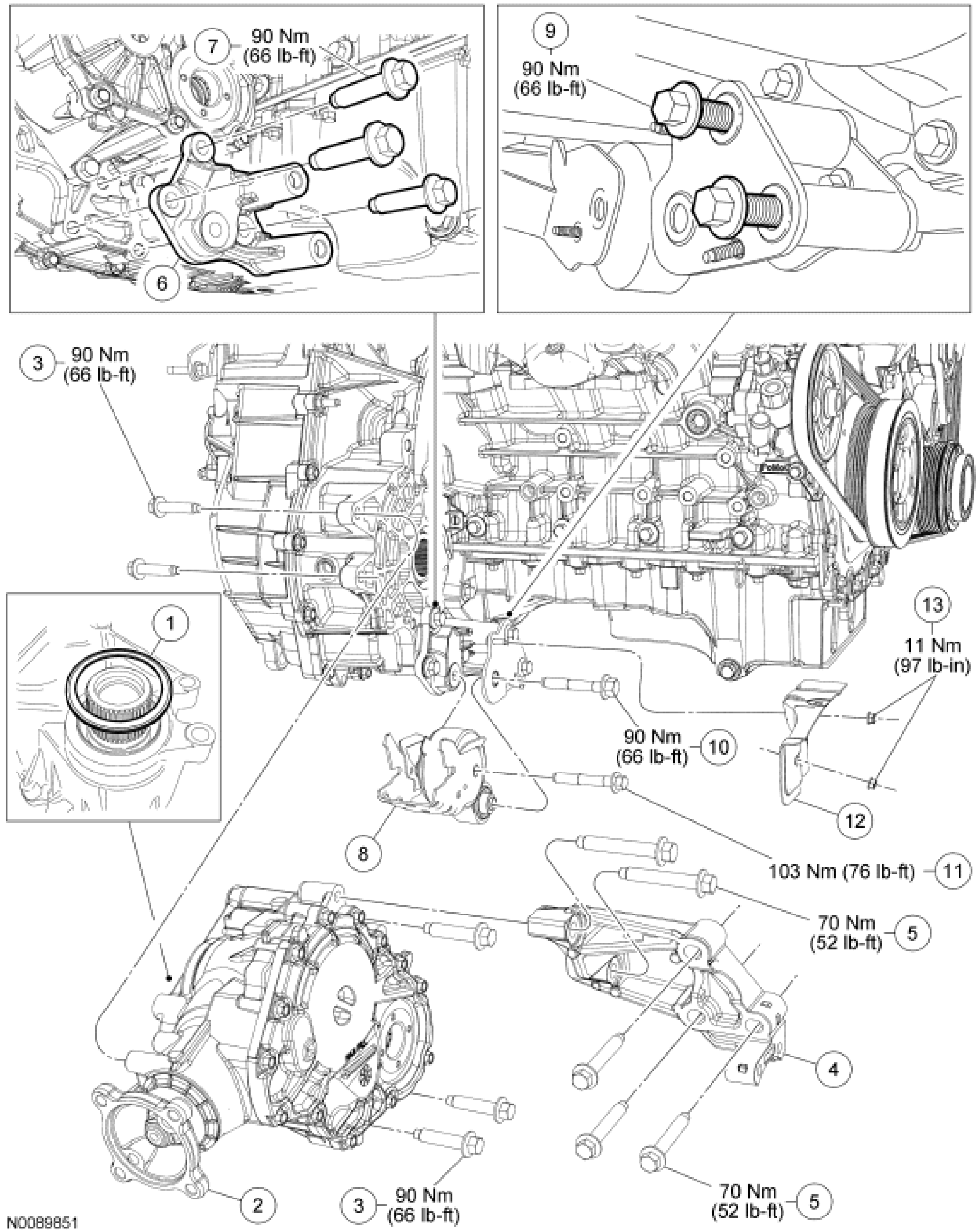


Fig. 247: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

61. Using the special tool, separate the RH halfshaft from the hub.

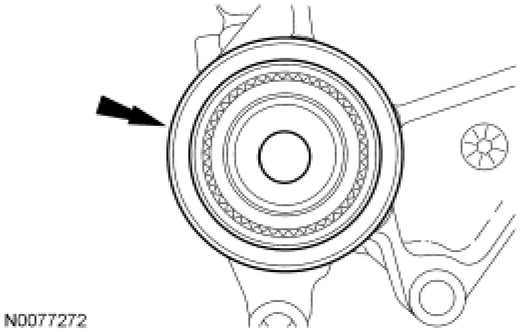


Fig. 248: Separating RH Halfshaft From Hub Using Special Tool (205-D070)
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

62. Remove the bolt, the nut and the RH catalytic converter support bracket.

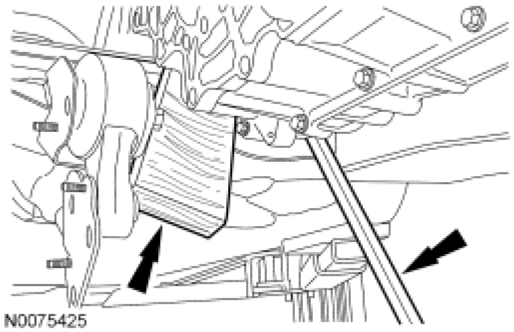


Fig. 249: Identifying RH Catalytic Converter Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

63. Remove the 2 stud bolts and the RH halfshaft/intermediate shaft assembly.

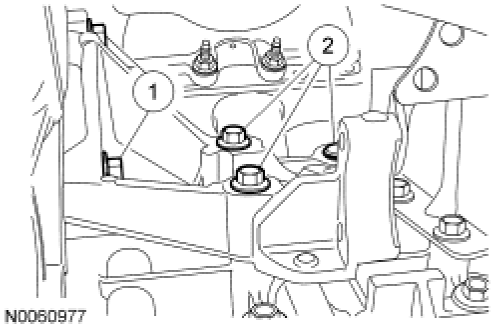


Fig. 250: Locating Stud Bolts & RH Halfshaft/Intermediate Shaft Assembly
Courtesy of FORD MOTOR CO.

AWD vehicles

64. Remove the 2 RH halfshaft bearing support bracket bolts and the RH halfshaft/intermediate shaft assembly.

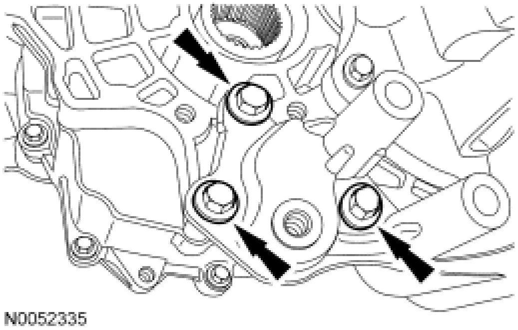


Fig. 251: Locating RH Halfshaft Bearing Support Bracket Bolts
Courtesy of FORD MOTOR CO.

65. Disconnect the RH catalyst monitor electrical connector.

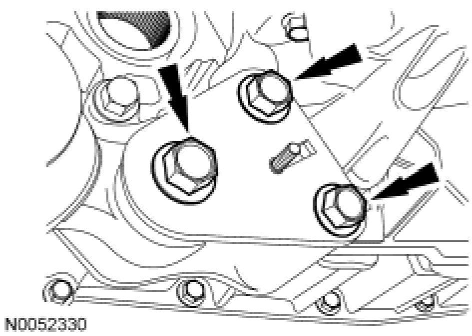


Fig. 252: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

66. Remove the 4 nuts and the RH catalytic converter.
    - Discard the gasket and the nuts.

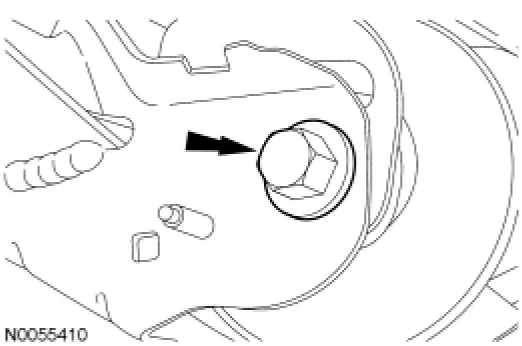


Fig. 253: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

67. Remove the 5 bolts and the power transfer unit (PTU) support bracket.

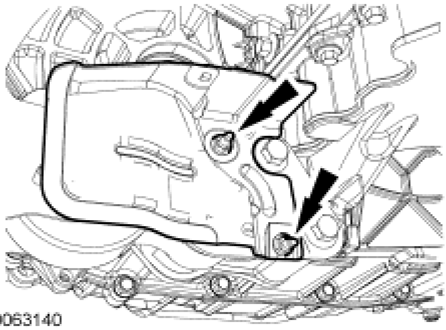


Fig. 254: Locating Power Transfer Unit (PTU) Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

68. Remove the 5 bolts and the PTU.

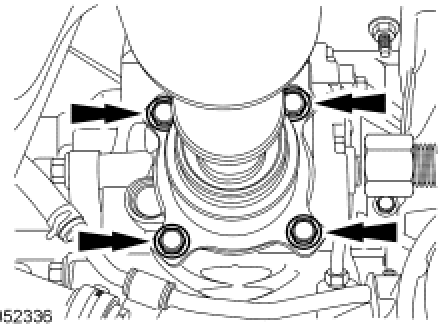


Fig. 255: Identifying PTU & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: **Position a block of wood under the transaxle.**

69. Install the special tools.

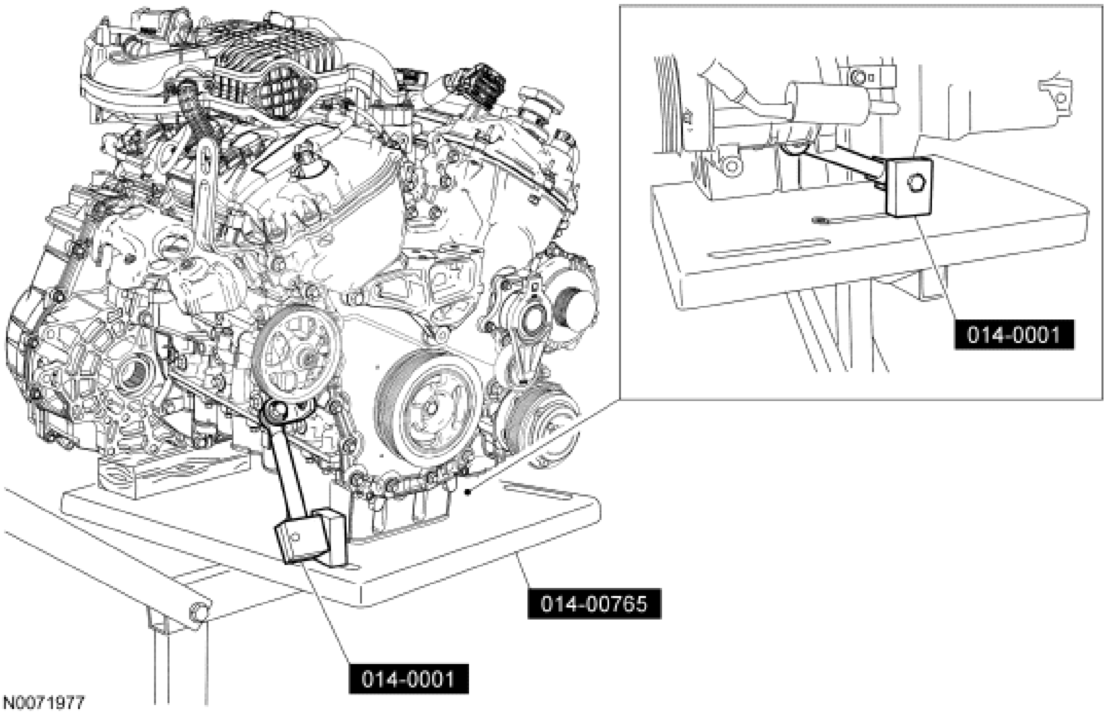


Fig. 256: Positioning A Block Of Wood Under Transaxle Using Special Tools (014-0001) & (014-00765)
Courtesy of FORD MOTOR CO.

70. Remove the transaxle support insulator through bolt and nut.

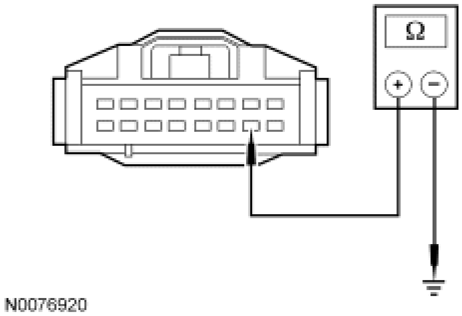
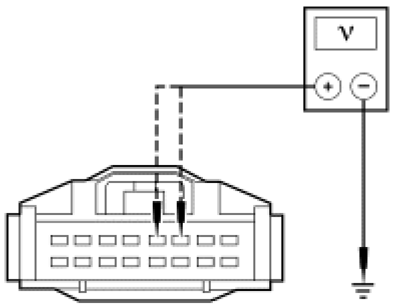


Fig. 257: Identifying Transaxle Support Insulator Bolt
Courtesy of FORD MOTOR CO.

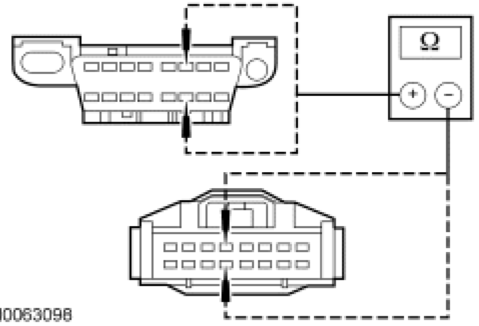
71. Remove the 3 nuts, the bolt and the transaxle support insulator bracket.



N0076919

Fig. 258: Identifying Transaxle Support Insulator Bracket, Nuts & Bolts
Courtesy of FORD MOTOR CO.

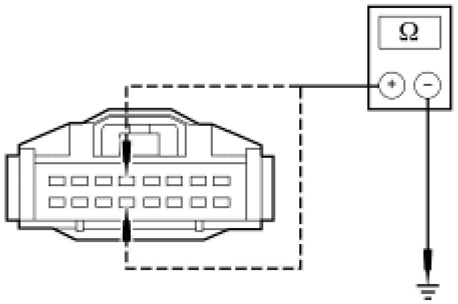
72. Remove the nut, bolt and engine mount brace.



N0063098

Fig. 259: Locating Nut, Bolt & Engine Mount Brace
Courtesy of FORD MOTOR CO.

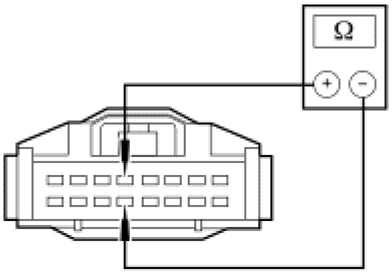
73. Remove the 4 engine mount nuts.



N0063097

Fig. 260: Locating Engine Mount Nuts
Courtesy of FORD MOTOR CO.

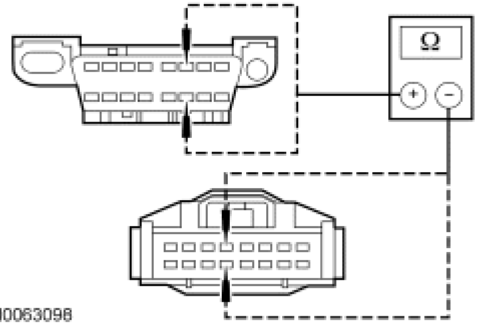
74. Remove the 3 bolts and the engine mount.



N0063099

Fig. 261: Locating Engine Mount Bolts
Courtesy of FORD MOTOR CO.

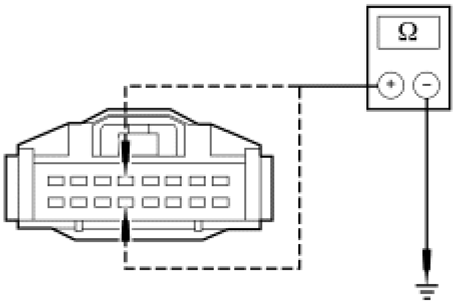
75. Lower the engine and transaxle assembly from the vehicle.
76. Position the starter cable boot back and remove the 2 nuts.
    - Detach the 2 wire terminals from the starter.



N0063098

Fig. 262: Identifying Wire Terminals From Starter
Courtesy of FORD MOTOR CO.

77. Disconnect the wiring harness retainer from the starter motor stud bolt.



N0063097

Fig. 263: Identifying Wiring Harness Retainer From Starter Motor Stud Bolt
Courtesy of FORD MOTOR CO.

78. Remove the bolt, stud bolt and the starter.

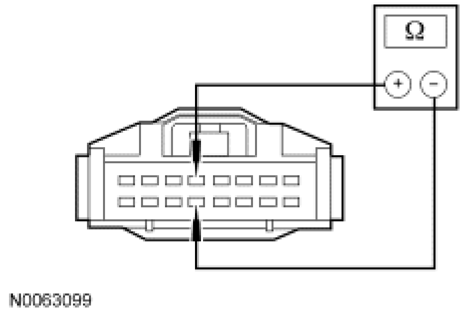


Fig. 264: Identifying Bolt, Stud Bolt & Starter
Courtesy of FORD MOTOR CO.

79. Install the special tool on the LH cylinder head.

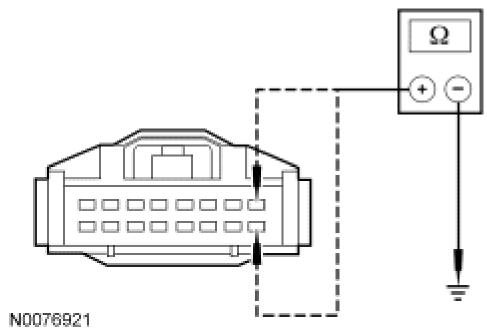


Fig. 265: Installing Special Tool (303-1245) On LH Cylinder Head
Courtesy of FORD MOTOR CO.

80. Using the special tools and a suitable engine crane, remove the engine and transaxle from the lift table.

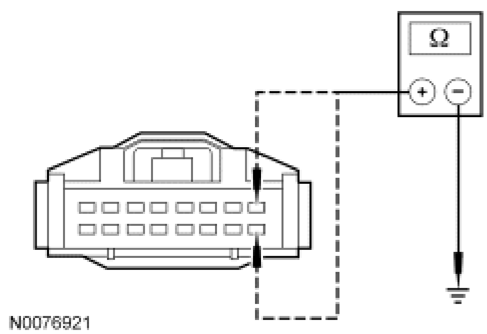


Fig. 266: Removing Engine & Transaxle From Lift Table Using Special Tools (303-D089, 014-00071) & Suitable Engine Crane
Courtesy of FORD MOTOR CO.

81. Remove the 2 engine-to-transaxle bolts.

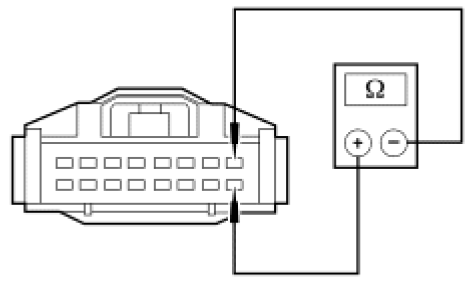


Fig. 267: Locating Engine-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

82. Remove the 5 transaxle-to-engine bolts.
    - Separate the transaxle from the engine.

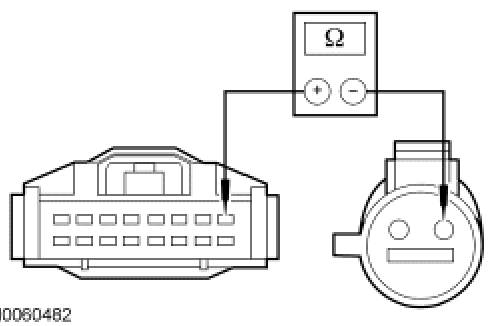
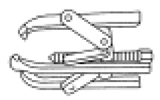
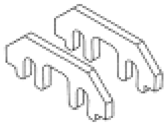
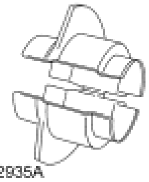
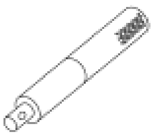
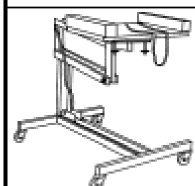
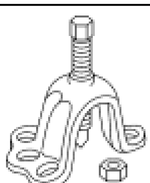
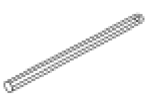
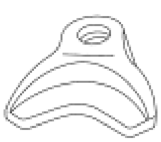
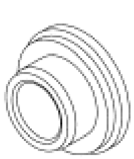


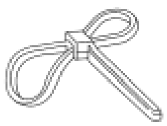
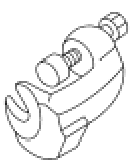
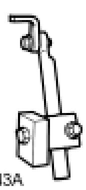
Fig. 268: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

CAMSHAFT

Special Tools

Illustration	Tool Name	Tool Number
	3-Jaw Puller	303-D121
	Camshaft Alignment Tool	303-1248

 ST2935A	Disconnect Tool, Transmission Cooler Tube	307-569
 ST1326-A	Handle	205-153 (T80T-4000-W)
 ST1293-A	Powertrain Lift	014-00765
 ST2330-A	Remover, Front Hub	205-D070 (D93P-1175-B) or equivalent
 ST2939-A	Remover, Halfshaft (Extension)	205-243 (T89P-3415-A)
 ST2038-A	Remover, Halfshaft (Plate)	205-290 (T89P-3415-B)
 ST1385-A	Remover, Oil Seal	303-409 (T92C-6700CH)
 ST2982-A	Seal Remover	303-1247/1

 ST1185-A	Slide Hammer	100-001 (T50T-100-A)
 ST1438-A	Strap Wrench	303-D055 (D85L-6000-A)
 ST1408-A	Tie-Rod End Remover	211-105
 ST2743A	Universal Adapter Brackets	014-0001

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31-A	-
Silicone Gasket Remover ZC-30	-

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.

2. Recover the A/C system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION & DIAGNOSTICS** article.
3. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
4. Drain the engine cooling system. For additional information, refer to **ENGINE COOLING** article.
5. Remove the accessory drive belt and the power steering belt. For additional information, refer to **ACCESSORY DRIVE** article.
6. Disconnect the power steering cooler hose and drain the power steering fluid into a suitable drain pan.

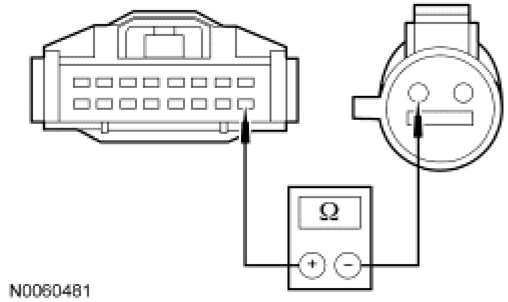


Fig. 269: Identifying Power Steering Cooler Hose
Courtesy of FORD MOTOR CO.

7. Remove the degas bottle. For additional information, refer to **ENGINE COOLING** article.
8. Remove the engine air cleaner and air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION & FILTERING** article.
9. Remove the battery tray. For additional information, refer to **BATTERY, MOUNTING & CABLES** article.
10. Disconnect the battery harness electrical connector.

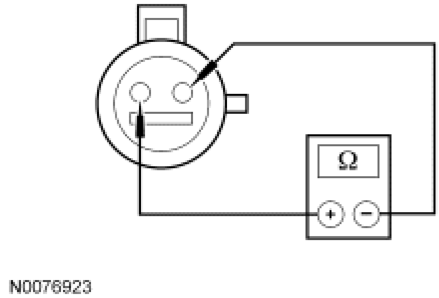
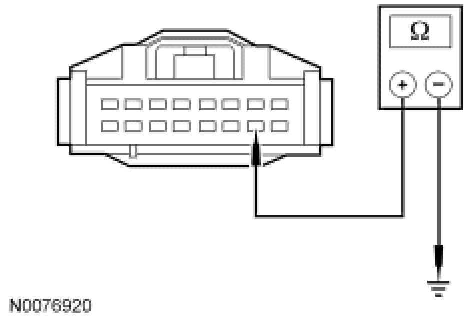


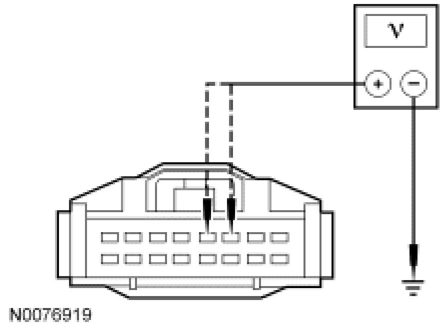
Fig. 270: Identifying Battery Harness Electrical Connector
Courtesy of FORD MOTOR CO.

11. Remove the nut and disconnect the power feed from the battery terminal.



<u>Fig. 271: Locating Power Feed To Battery Terminal And Nut</u>
Courtesy of FORD MOTOR CO.

12. Remove the bolt and the ground wire.
    - Detach the 2 wiring harness retainers from the cowl.



<u>Fig. 272: Identifying Wiring Harness Retainers From Cowl</u>
Courtesy of FORD MOTOR CO.

13. Disconnect the vacuum hose from the upper intake manifold.

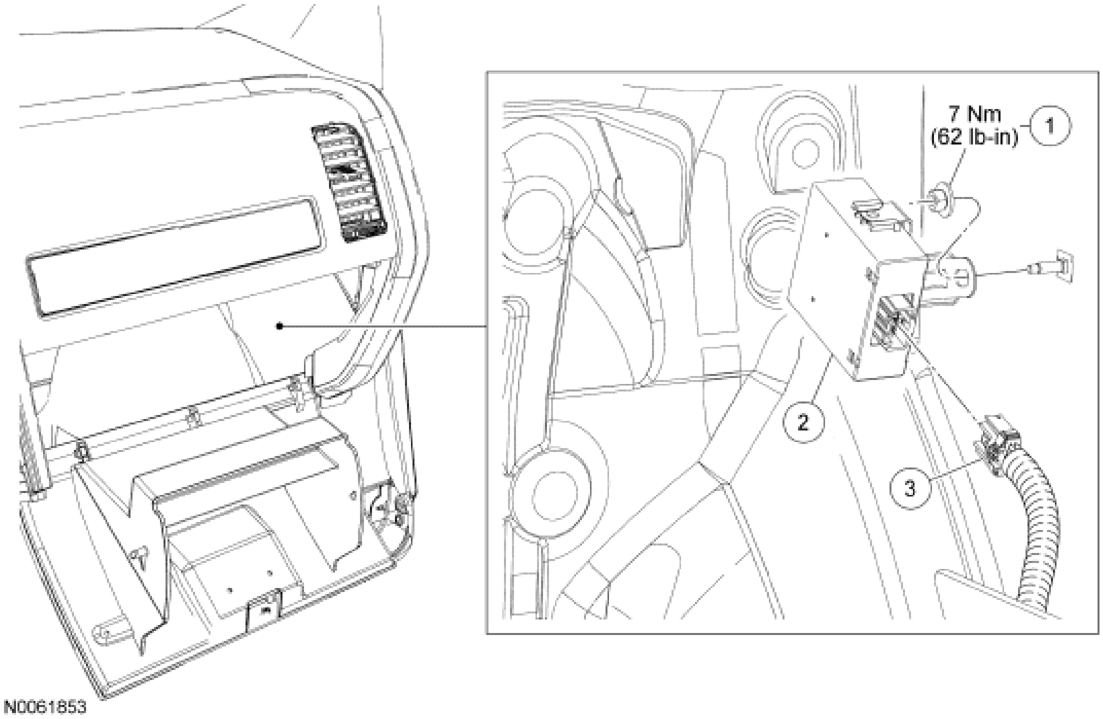


Fig. 273: Identifying Vacuum Hose From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

14. Disconnect the upper evaporative emissions (EVAP) tube quick connect coupling from the purge valve. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

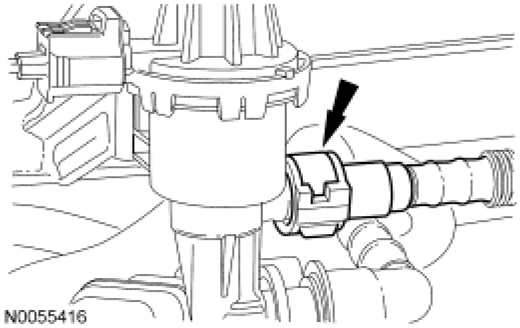


Fig. 274: Locating Upper Evaporative Emissions (EVAP) Tube Quick Connect Coupling
Courtesy of FORD MOTOR CO.

15. Disconnect the upper radiator hose, lower radiator hose and 2 heater hoses from the thermostat housing.

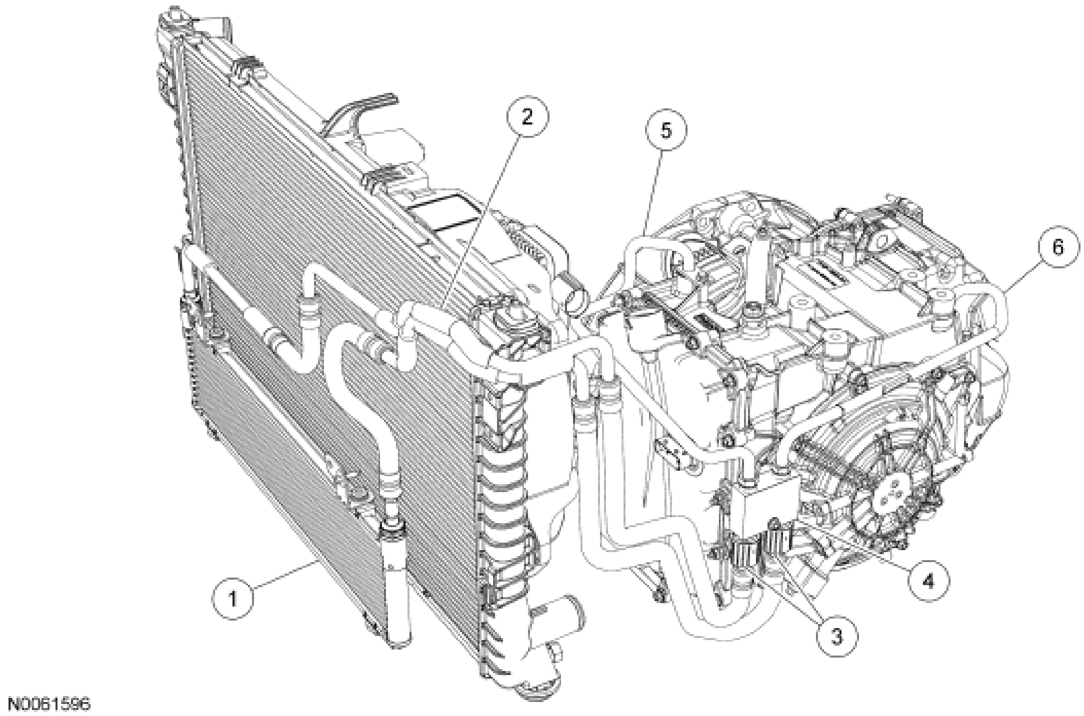


Fig. 275: Locating Upper Radiator Hose, Lower Radiator Hose & Heater Hoses
Courtesy of FORD MOTOR CO.

16. Detach the wiring harness retainer from the transaxle control cable bracket.

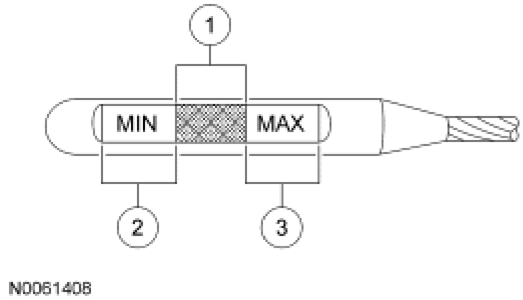
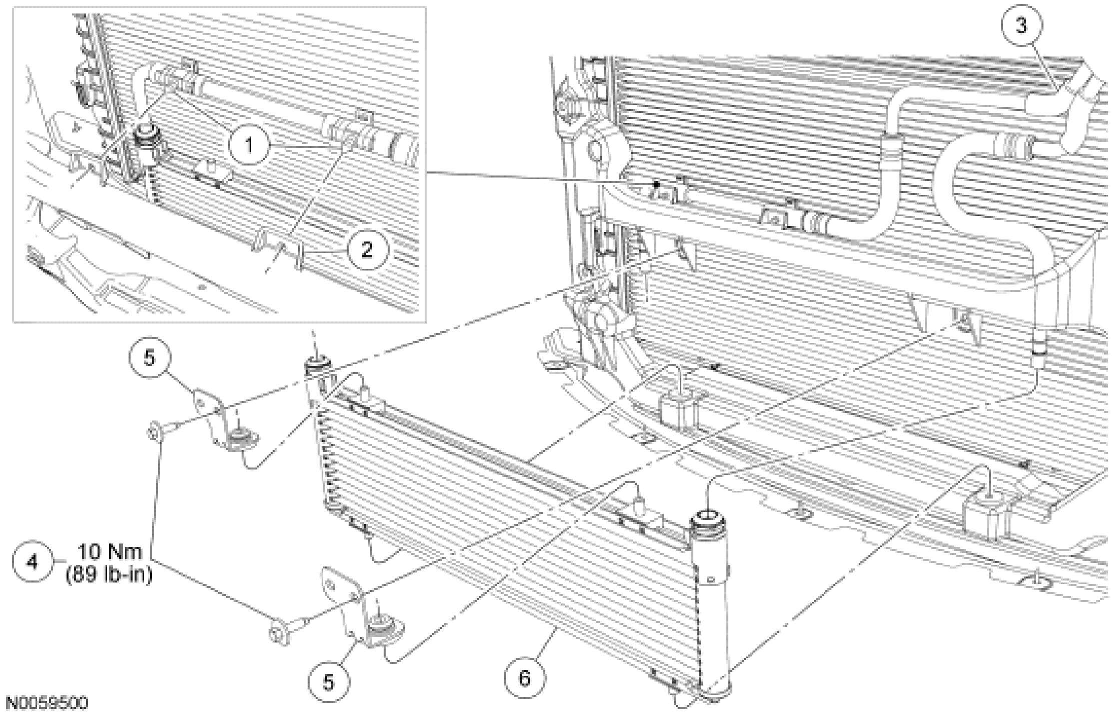


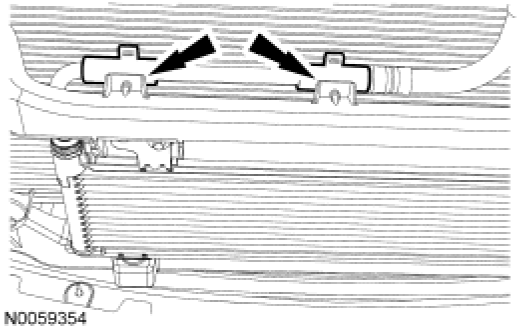
Fig. 276: Locating Wiring Harness Retainer From Transaxle Control Cable Bracket
Courtesy of FORD MOTOR CO.

17. Disconnect the transaxle control cable from the control lever.
    - Detach the control cable from the bracket.



<u>Fig. 277: Locating Transaxle Control Cable From Control Lever</u>
Courtesy of FORD MOTOR CO.

18. Disconnect the transaxle control electrical connector.



<u>Fig. 278: Identifying Transaxle Control Electrical Connector</u>
Courtesy of FORD MOTOR CO.

19. If equipped, detach the engine block heater harness retainers from the radiator support and the A/C suction tube.

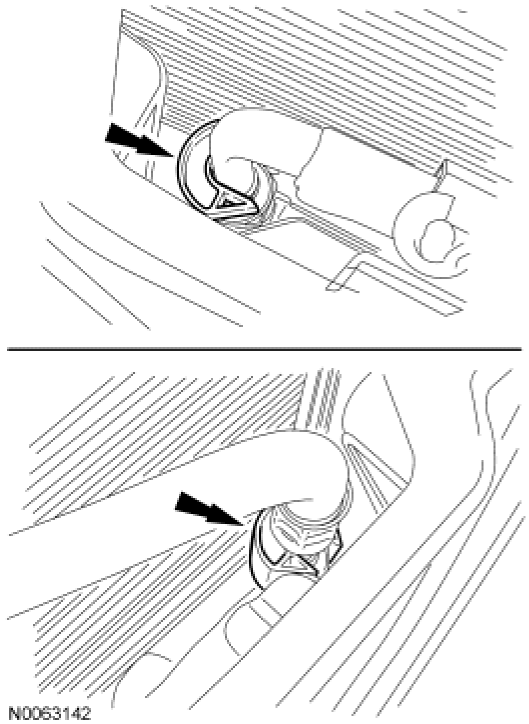


Fig. 279: Identifying Engine Block Heater Harness, Radiator Support, A/C Suction Tube & Engine Wiring Harness
Courtesy of FORD MOTOR CO.

20. Remove the nut and disconnect the A/C pressure tube fitting.
    - Discard the O-ring seal.

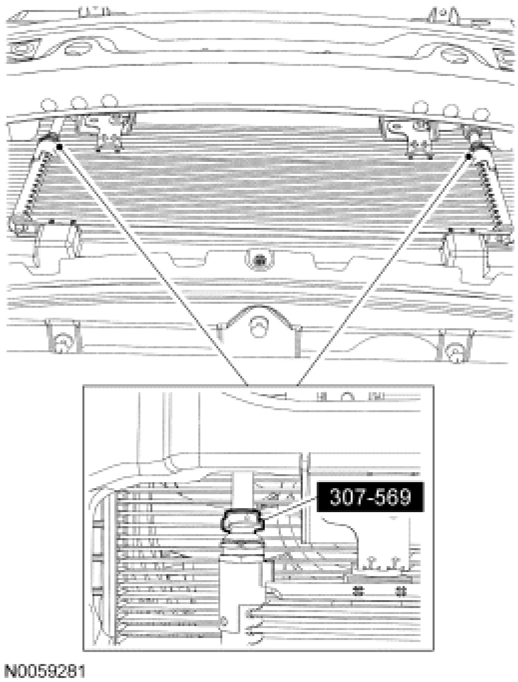


Fig. 280: Identifying A/C Pressure Tube Fitting Nut
Courtesy of FORD MOTOR CO.

21. Remove the safety clip from the A/C fitting.
    - Disconnect the A/C suction tube fitting.

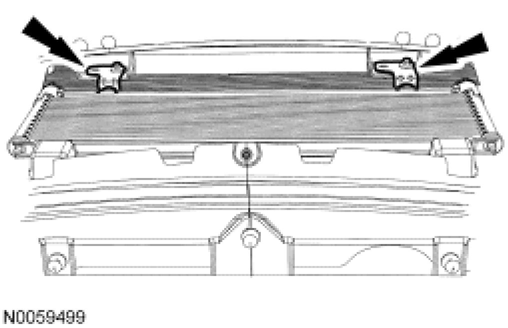


Fig. 281: Identifying Safety Clip On A/C Suction Tube Fitting
Courtesy of FORD MOTOR CO.

22. Disconnect the hose from the power steering reservoir.

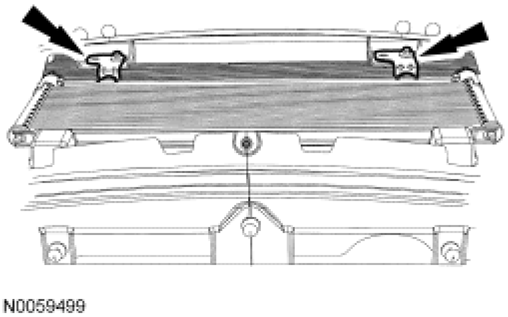


Fig. 282: Disconnecting Hose From Power Steering Reservoir
Courtesy of FORD MOTOR CO.

23. Disconnect the fuel supply tube. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

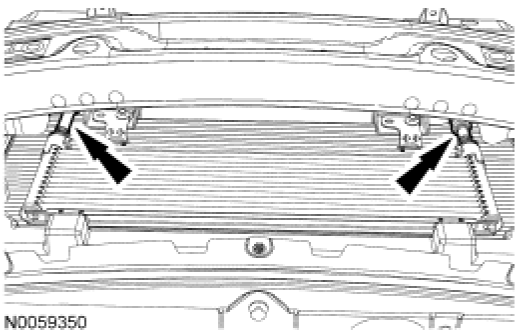


Fig. 283: Identifying Fuel Supply Tube
Courtesy of FORD MOTOR CO.

24. Disconnect the fuel hose routing clip from the transaxle stud and position the fuel hose aside.

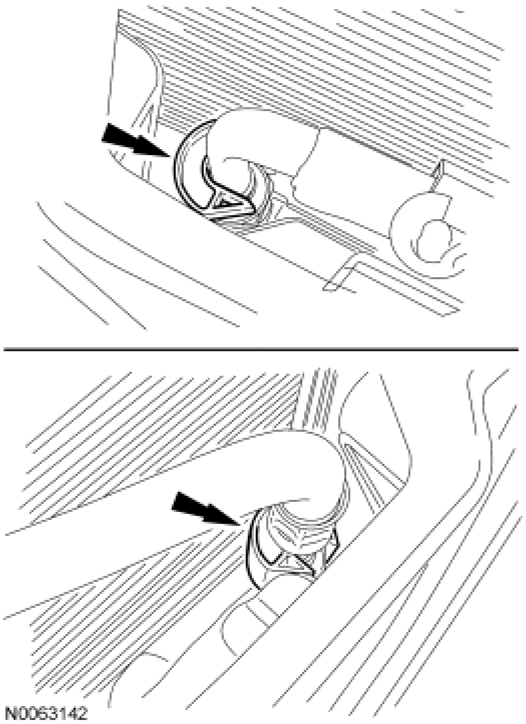


Fig. 284: Identifying Fuel Hose Routing Clip From Transaxle Stud
Courtesy of FORD MOTOR CO.

25. Disconnect the 2 engine wiring harness electrical connectors.
    - Detach the electrical connector from the LH valve cover.

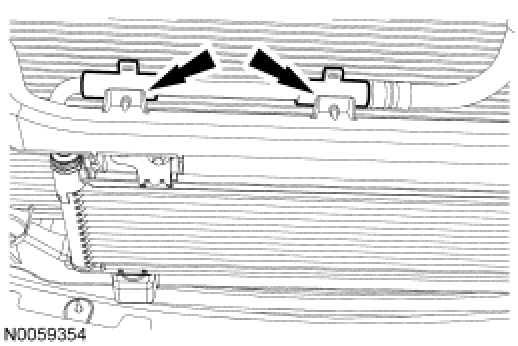


Fig. 285: Identifying Engine Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

26. Remove the oil level indicator.

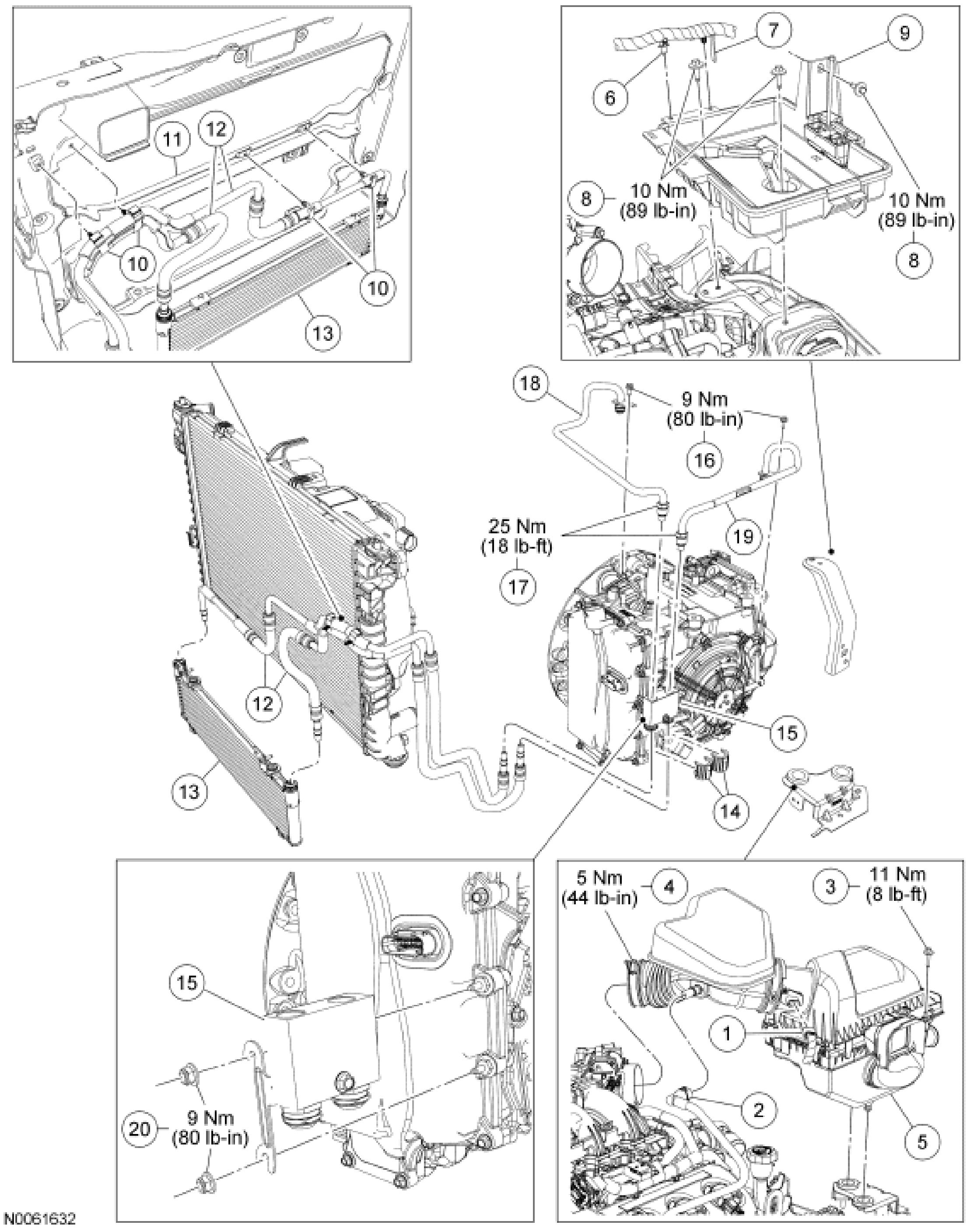


Fig. 286: Identifying Oil Level Indicator
Courtesy of FORD MOTOR CO.

27. Detach the wiring harness retainer from the RH valve cover stud bolt.

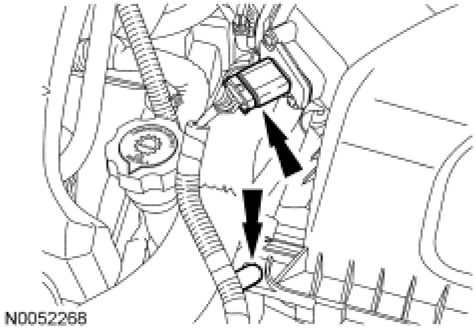


Fig. 287: Identifying Wiring Harness Retainer From RH Valve Cover Stud Bolt
Courtesy of FORD MOTOR CO.

28. Remove the bolt and the ground wire from the engine front cover.

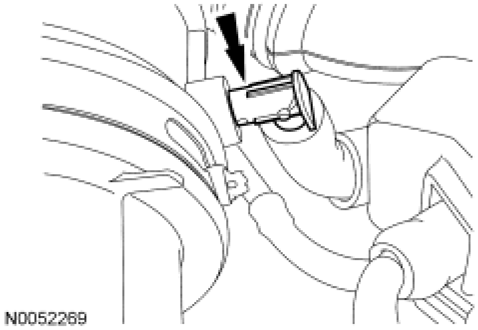


Fig. 288: Removing/Installing Bolt & Ground Wire From Engine Front Cover
Courtesy of FORD MOTOR CO.

29. Remove the nut, the ground wire and the radio interference capacitor wire from the engine front cover stud.

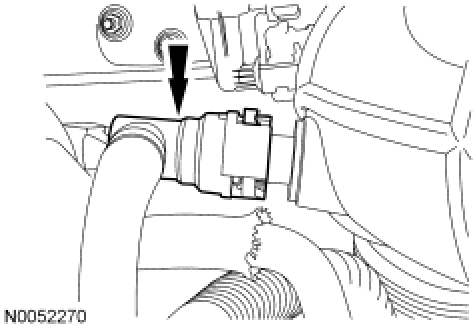


Fig. 289: Removing/installing Nut, Ground Wire & Radio Interference Capacitor Wire From Engine Front Cover Stud
Courtesy of FORD MOTOR CO.

30. Loosen the exhaust flexible pipe clamp and disconnect the 2 exhaust hangers.

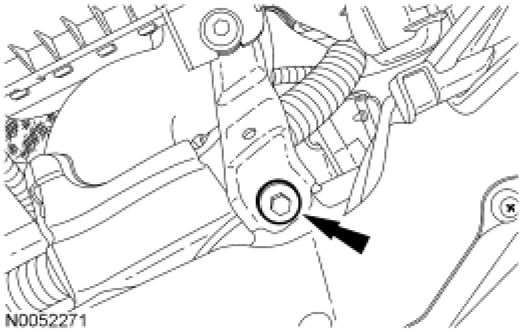


Fig. 290: Locating Exhaust Flexible Pipe Clamp & Exhaust Hangers
Courtesy of FORD MOTOR CO.

31. Remove the 4 nuts and the exhaust flexible pipe and Y-pipe as an assembly.
    - Discard the nuts and the gasket.

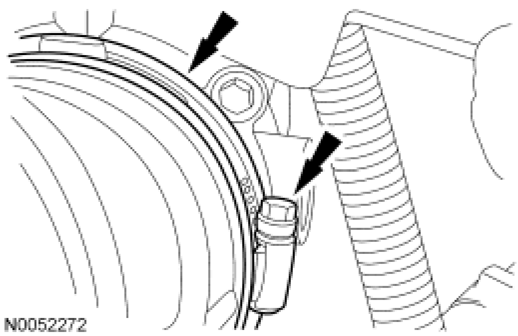


Fig. 291: Locating Exhaust Flexible Pipe, Y-Pipe & Nuts
Courtesy of FORD MOTOR CO.

32. Remove the 3 pin-type retainers, the 7 screws and the radiator splash shield.

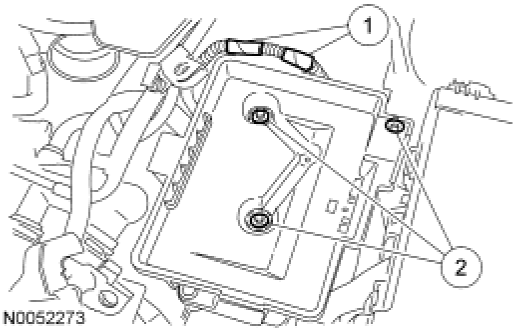


Fig. 292: Locating Push Pin Fasteners & Front Splash Shield Screws
Courtesy of FORD MOTOR CO.

33. Remove the LH inner splash shield. For additional information, refer to **FRONT END BODY PANELS** article.
34. Remove the 2 secondary latches from the transmission fluid cooler tubes.

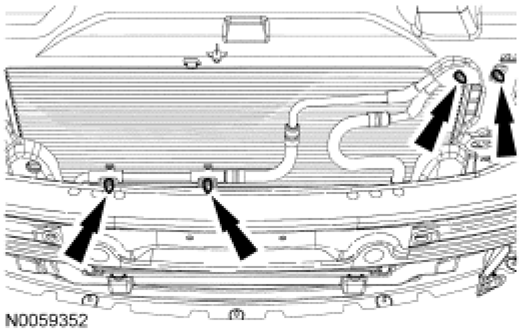


Fig. 293: Locating Secondary Latches On Transmission Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

35. Using the special tool, disconnect the transmission cooling tubes.

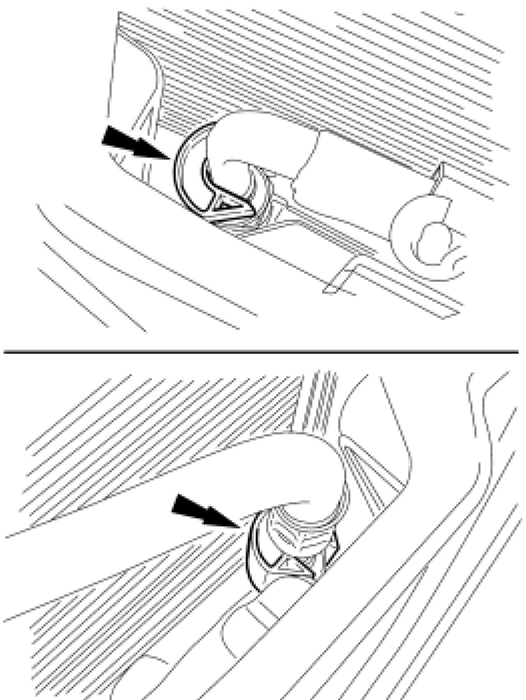


Fig. 294: Disconnecting Transmission Cooling Tubes Using Special Tool (307-569)
Courtesy of FORD MOTOR CO.

36. Remove the drain plug and drain the engine oil.
    - Install the drain plug and tighten to 27 Nm (20 lb-ft).

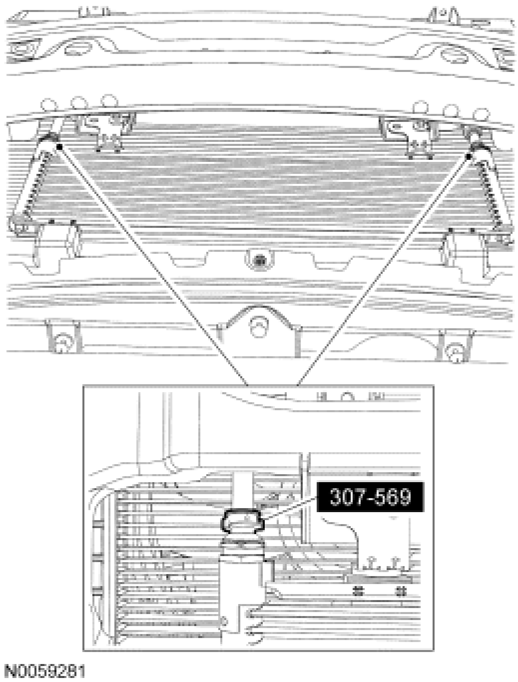


Fig. 295: Locating Drain Plug
Courtesy of FORD MOTOR CO.

37. Remove and discard the engine oil filter.

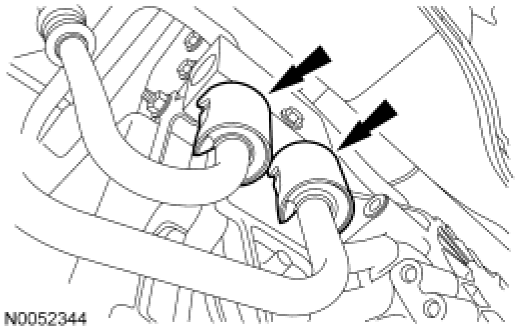


Fig. 296: Identifying Engine Oil Filter
Courtesy of FORD MOTOR CO.

38. Remove the power steering cooler bracket bolt from the RH side of the subframe.

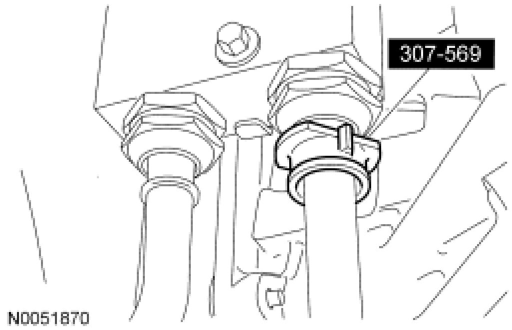


Fig. 297: Identifying Power Steering Cooler Bracket Bolt
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

NOTE: **Index-mark the driveshaft for installation.**

39. Remove the 4 bolts and support the driveshaft with a length of mechanic's wire.

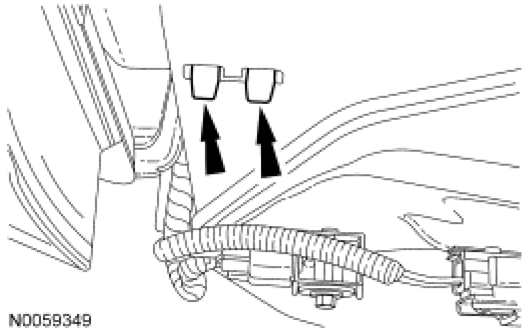


Fig. 298: Locating Driveshaft Aside Bolts
Courtesy of FORD MOTOR CO.

All vehicles

40. Remove and discard the RH front halfshaft nut.

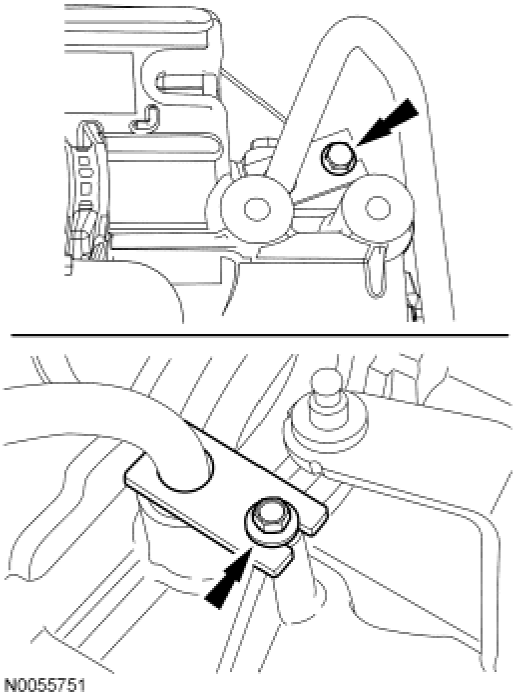


Fig. 299: Locating RH Front Halfshaft Nut
Courtesy of FORD MOTOR CO.

41. Remove the 2 nuts and the roll restrictor heat shield.

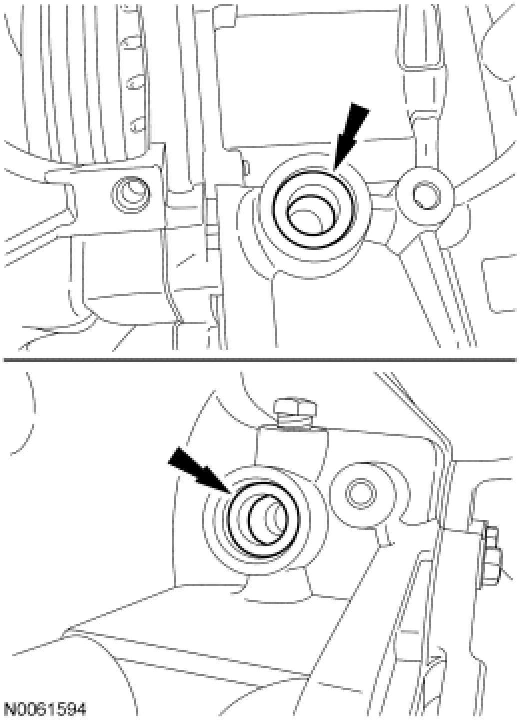


Fig. 300: Locating Roll Restrictor Heat Shield Nuts

Courtesy of FORD MOTOR CO.

42. Remove the engine roll restrictor-to-subframe through bolt.

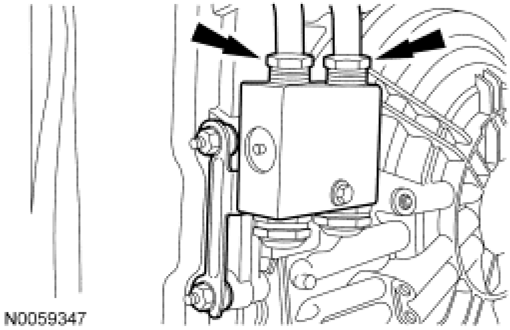


Fig. 301: Locating Roll Restrictor-To-Subframe Bolt
Courtesy of FORD MOTOR CO.

43. Remove and discard the power steering pressure (PSP) tube-to-pump banjo bolt and the 2 seals.

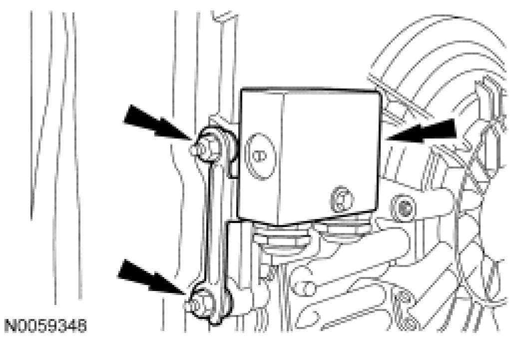


Fig. 302: Locating Power Steering Pressure (PSP) Tube-To-Pump Banjo Bolt & Seals
Courtesy of FORD MOTOR CO.

CAUTION: Do not allow the intermediate shaft to rotate while it is disconnected from the gear or damage to the clockspring can occur. If there is evidence that the intermediate shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to SUPPLEMENTAL RESTRAINT SYSTEM article.

44. Remove and discard the steering intermediate shaft bolt.
    - Separate the steering intermediate shaft from the steering gear.

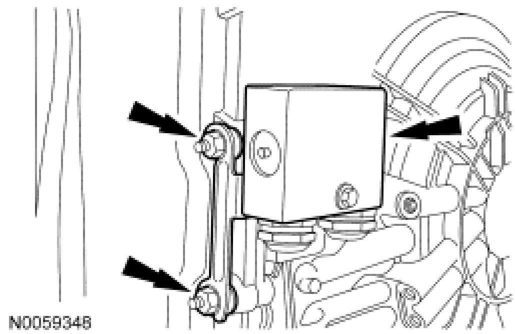


Fig. 303: Identifying Steering Intermediate Shaft Bolt
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

45. Remove and discard the cotter pins and tie-rod end nuts.
    - Using the special tool, separate the tie-rod ends from the wheel knuckles.

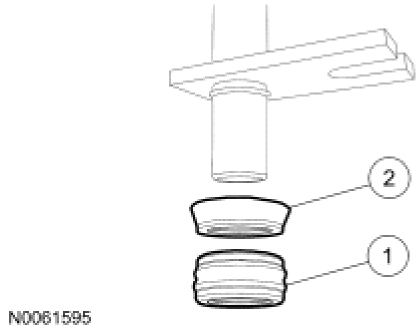


Fig. 304: Separating Tie-Rod Ends From Wheel Knuckles Using Special Tool (211-105)
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

46. Remove the 2 stabilizer link-to-lower control arm nuts and separate the stabilizer bar links from the lower control arms.

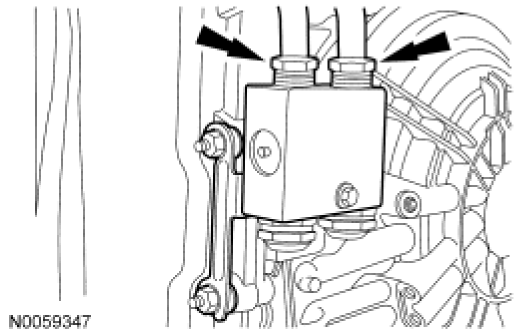


Fig. 305: Locating Stabilizer Bar Link Nut
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

47. Remove the lower control arm-to-knuckle pinch bolts and separate the lower control arms from the knuckles.

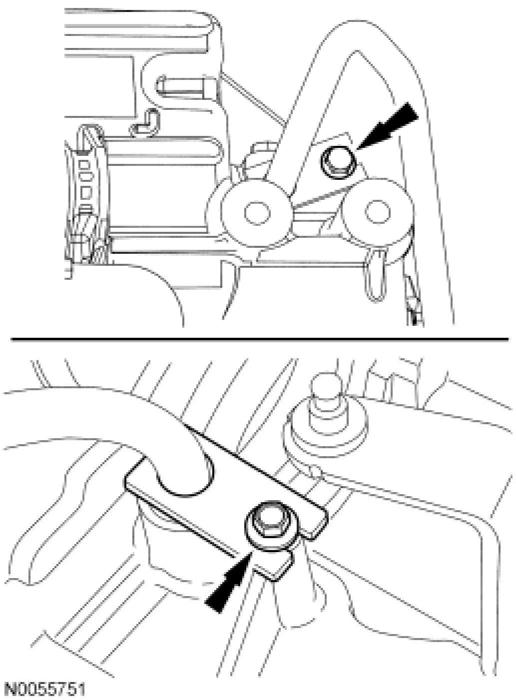


Fig. 306: Locating Ball Joint Pinch Bolt
Courtesy of FORD MOTOR CO.

48. Remove the 3 RH subframe-to-lower bumper nuts.

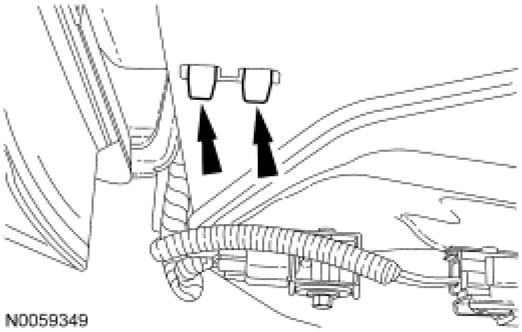


Fig. 307: Locating RH Subframe-To-Lower Bumper Nuts
Courtesy of FORD MOTOR CO.

49. Remove the 3 LH subframe-to-lower bumper nuts and separate the lower bumper from the subframe.

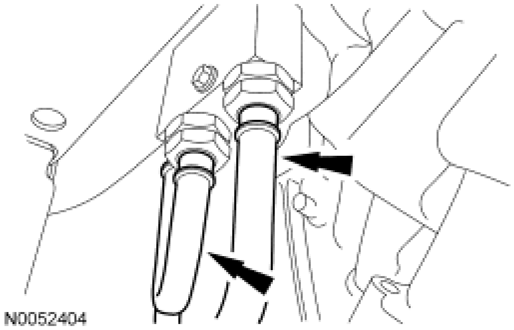


Fig. 308: Locating LH Subframe-To-Lower Bumper Nuts
Courtesy of FORD MOTOR CO.

50. Position the special tool under the subframe assembly.

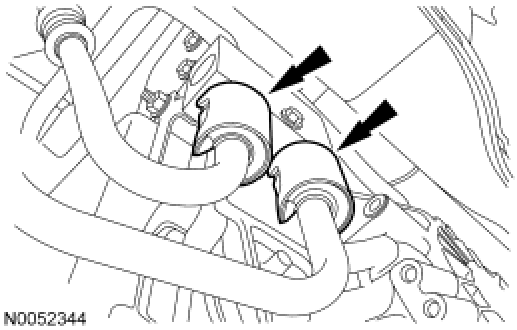


Fig. 309: Positioning Special Tool (014-00765) Under Subframe Assembly
Courtesy of FORD MOTOR CO.

51. Remove the 2 nuts, 4 bolts and the subframe support brackets.

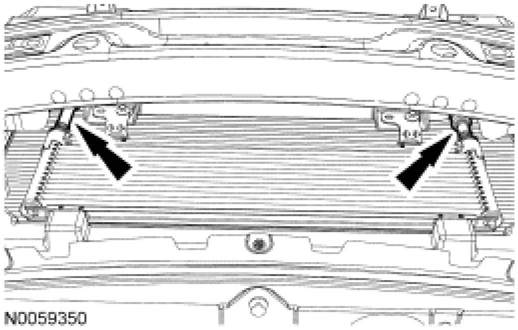


Fig. 310: Locating Subframe Support Brackets, Nuts & Bolts
Courtesy of FORD MOTOR CO.

52. Remove the 2 front subframe nuts.

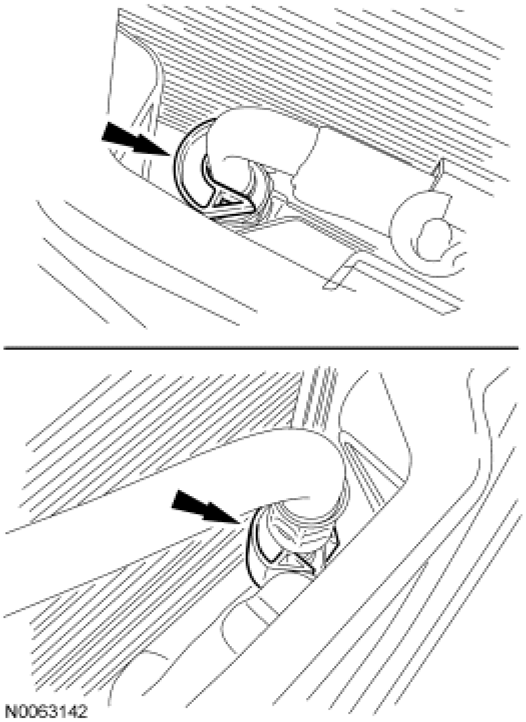


Fig. 311: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

53. Remove the 2 middle subframe nuts.

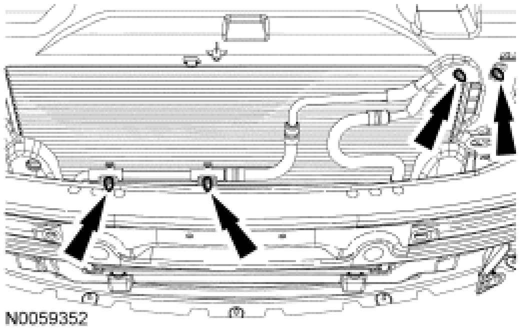


Fig. 312: Locating Middle Subframe Nuts
Courtesy of FORD MOTOR CO.

54. Using the special tool, lower the subframe assembly from the vehicle.

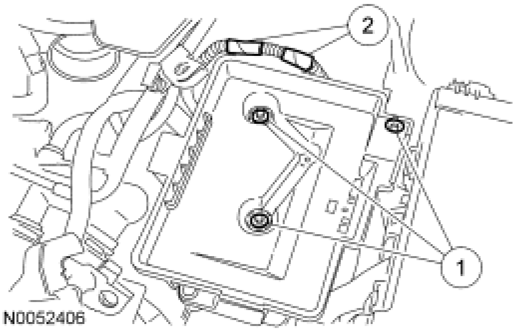


Fig. 313: Positioning Special Tool (014-00765) Under Subframe Assembly
Courtesy of FORD MOTOR CO.

55. If equipped, disconnect the oil cooler coolant hoses.

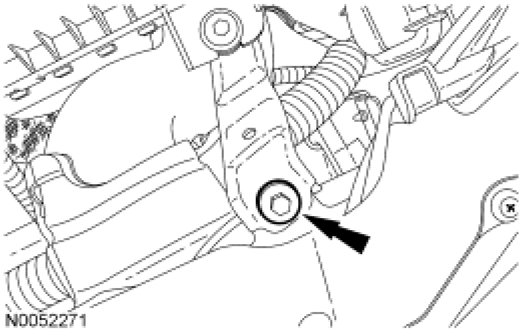


Fig. 314: Locating Oil Cooler Coolant Hoses
Courtesy of FORD MOTOR CO.

56. Using the special tools, separate the LH halfshaft from the transaxle and support the halfshaft with a length of mechanic's wire.

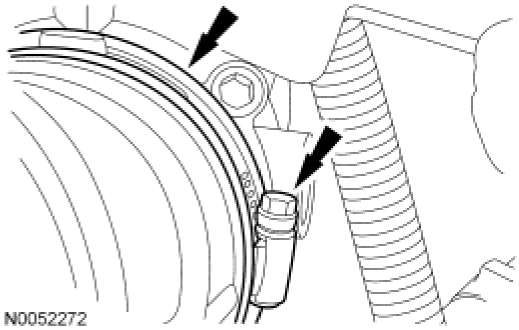


Fig. 315: Separating LH Halfshaft From Transaxle Using Special Tools (100-001), (205-243) & (205-290)
Courtesy of FORD MOTOR CO.

57. Using the special tool, separate the RH halfshaft from the hub.

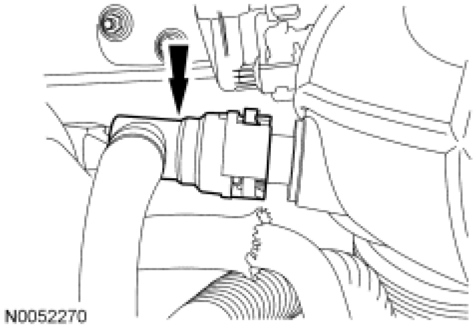


Fig. 316: Separating RH Halfshaft From Hub Using Special Tool (205-D070)
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

58. Remove the 2 RH catalytic converter support bracket bolts.

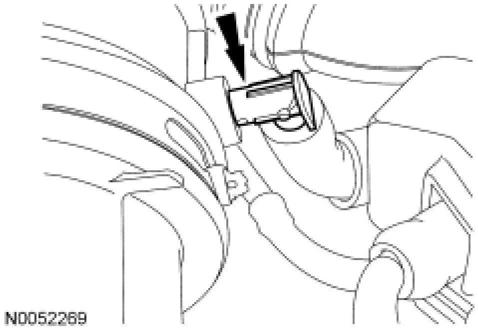


Fig. 317: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

59. Remove the bolt, the nut and the RH catalytic converter support bracket.

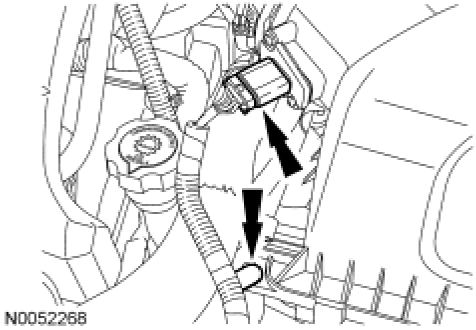


Fig. 318: Identifying RH Catalytic Converter Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

60. Remove the 2 stud bolts and the RH halfshaft/intermediate shaft assembly.

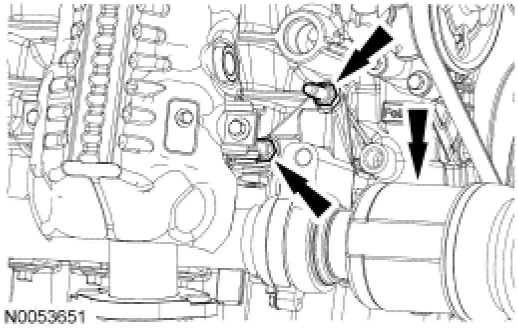


Fig. 319: Locating Stud Bolts & RH Halfshaft/Intermediate Shaft Assembly
Courtesy of FORD MOTOR CO.

AWD vehicles

61. Remove the 2 RH halfshaft bearing support bracket bolts and the RH halfshaft/intermediate shaft assembly.

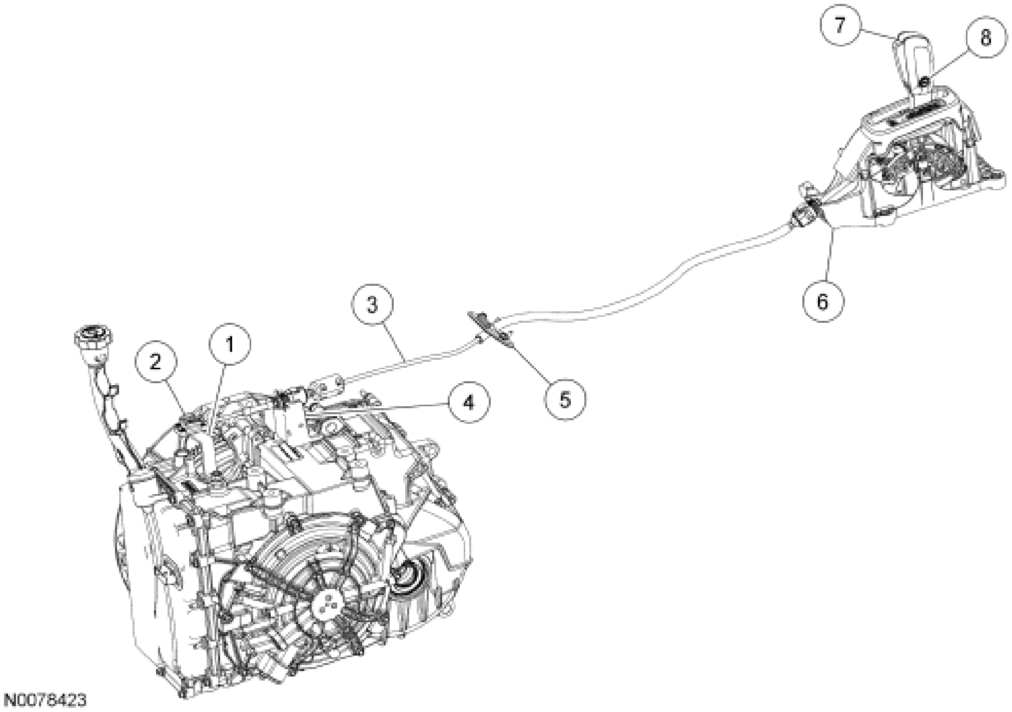


Fig. 320: Locating RH Halfshaft Bearing Support Bracket Bolts
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: Position a block of wood under the transaxle.

62. Install the special tools.

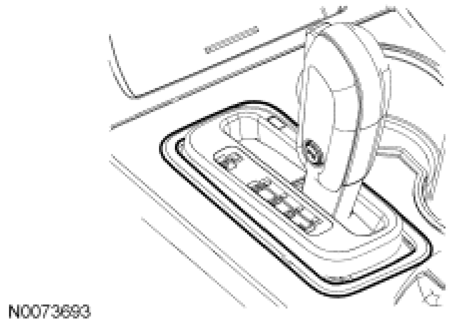


Fig. 321: Positioning A Block Of Wood Under Transaxle Using Special Tools (014-0001) & (014-00765)
Courtesy of FORD MOTOR CO.

63. Remove the transaxle support insulator through bolt and nut.

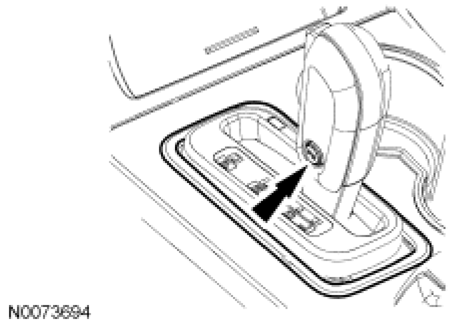


Fig. 322: Identifying Transaxle Support Insulator Bolt
Courtesy of FORD MOTOR CO.

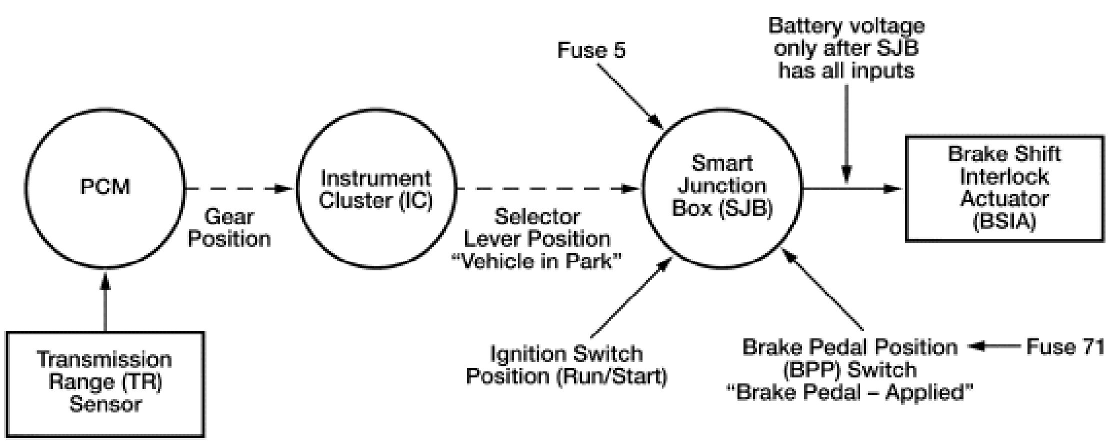
64. Remove the 3 nuts, the bolt and the transaxle support insulator bracket.

MANUAL LEVER POSITION	TRANSAXLE GEAR OPERATION	DESCRIPTION
P	Park	Forward or reverse gears available. Final drive is held to the transaxle case.
R	Reverse	Transaxle allows reverse only.
N	Neutral	Forward or reverse gears not available. Final drive moves freely.
D	1⇆2⇆3⇆4⇆5⇆6	6 forward gears are available. Gears are dependent on vehicle speed and throttle position with coast braking.
D (O/D cancelled)	1⇆2⇆3⇆4⇆5←6	1st through 5th gears are available. Transaxle shifts to 5th gear if button is pressed when the transaxle is in 6th gear. Transaxle provides engine braking.
L	1←2←3←4←5←6	1st gear hold with engine braking, the transaxle downshifts to 1st gear when L is selected above a calibrated speed under minimum to moderate accelerator pedal position.

N0080201

Fig. 323: Identifying Transaxle Support Insulator Bracket, Nuts & Bolts
Courtesy of FORD MOTOR CO.

65. Remove the nut, bolt and engine mount brace.



N0083447

Fig. 324: Locating Nut, Bolt & Engine Mount Brace
Courtesy of FORD MOTOR CO.

66. Remove the 4 engine mount nuts.

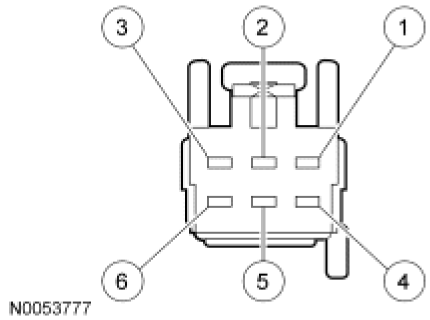


Fig. 325: Locating Engine Mount Nuts
Courtesy of FORD MOTOR CO.

67. Remove the 3 bolts and the engine mount.

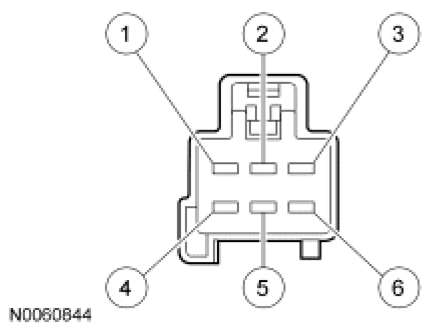


Fig. 326: Locating Engine Mount Bolts
Courtesy of FORD MOTOR CO.

68. Lower the engine and transaxle assembly from the vehicle.
69. If equipped, detach the engine block heater wiring harness retainers and position the harness aside.
70. Disconnect the PCV hose from the PCV valve.

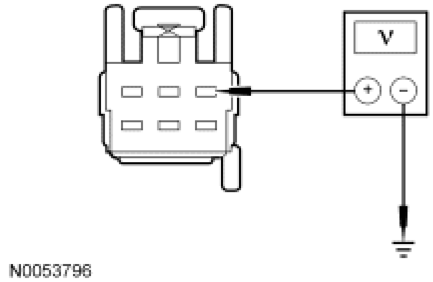


Fig. 327: Identifying PCV Hose
Courtesy of FORD MOTOR CO.

71. Disconnect the throttle body (TB) electrical connector.

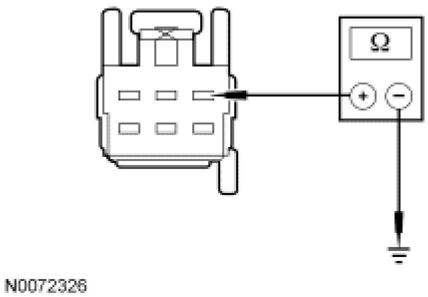


Fig. 328: Locating Throttle Body Electrical Connector
Courtesy of FORD MOTOR CO.

72. Detach the wiring harness retainers from the upper intake manifold.

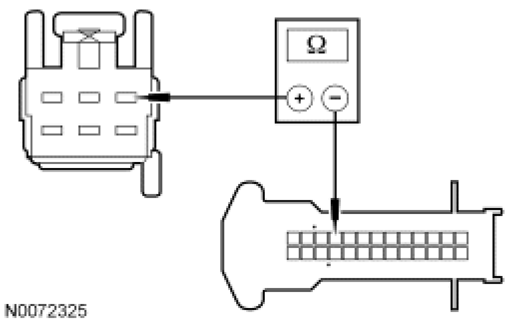


Fig. 329: Locating Wiring Harness Retainers From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

73. Remove the upper intake manifold support bracket bolt.

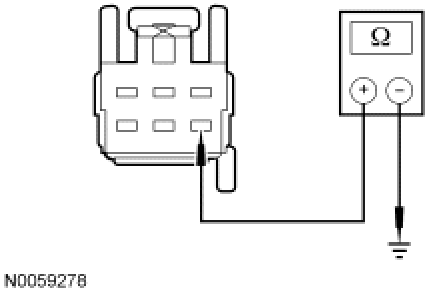


Fig. 330: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

74. Remove the 6 bolts and the upper intake manifold in the following sequence.
    - Discard the gaskets.

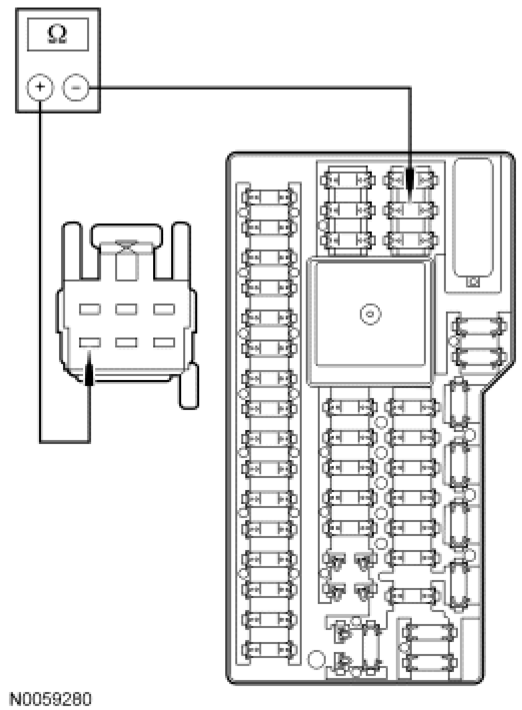


Fig. 331: Identifying Bolt Sequence
Courtesy of FORD MOTOR CO.

75. Disconnect the RH catalyst monitor electrical connector.

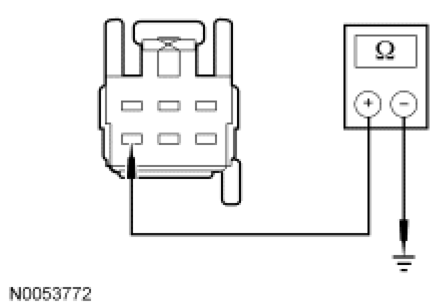


Fig. 332: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

76. Disconnect the PSP switch electrical connector.

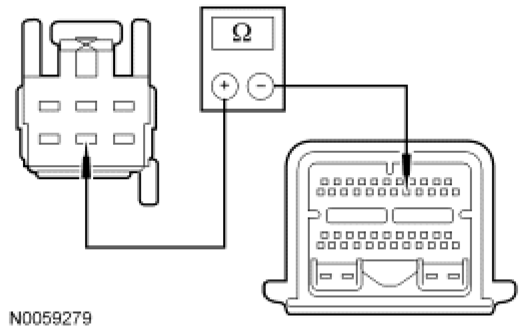


Fig. 333: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

77. Disconnect the RH variable camshaft timing (VCT) solenoid electrical connector.

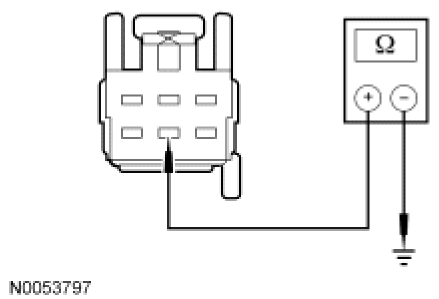


Fig. 334: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

78. Disconnect the 3 RH coil-on-plug electrical connectors.

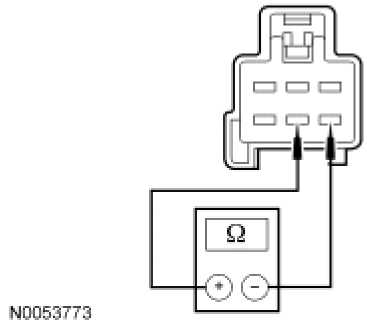


Fig. 335: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

79. Detach all of the wiring harness retainers from the RH valve cover and stud bolts.
80. Disconnect the LH VCT solenoid electrical connector.

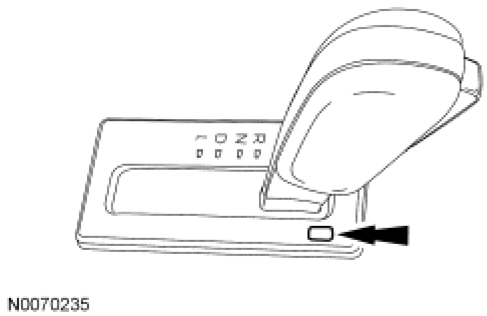


Fig. 336: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

81. Disconnect the 3 LH coil-on-plug electrical connectors.

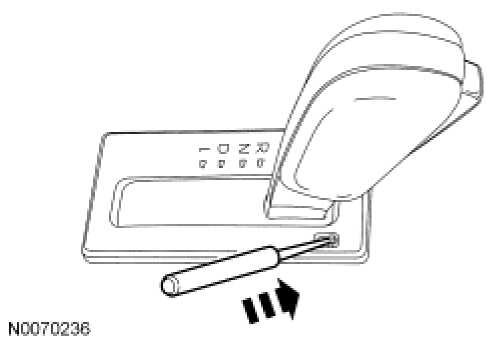


Fig. 337: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

82. Detach all of the wiring harness retainers from the LH valve cover and stud bolts.

NOTE: LH shown, RH similar.

83. Remove the 6 bolts and the 6 coil-on-plugs.

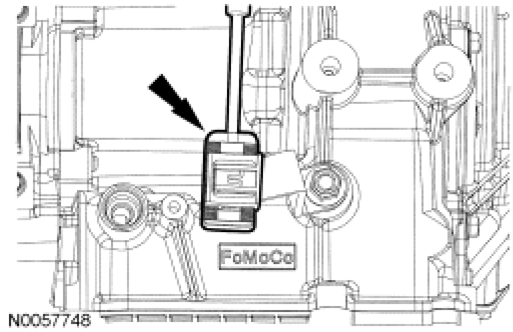


Fig. 338: Locating Coil-On-Plugs & Bolts
Courtesy of FORD MOTOR CO.

84. Remove the 11 stud bolts and the LH valve cover.
    - Discard the gasket.

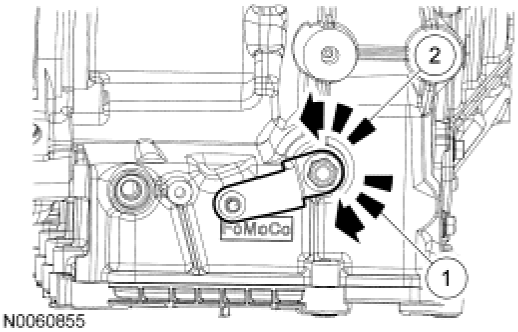


Fig. 339: Locating LH Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

85. Remove the bolt, the 10 stud bolts and the RH valve cover.
    - Discard the gasket.

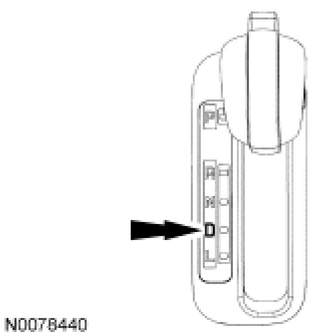


Fig. 340: Locating RH Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

NOTE: VCT solenoid seal removal shown, spark plug tube seal removal similar.

86. Inspect the VCT solenoid seals and the spark plug tube seals. Install new seals if damaged.
    - Using the special tools, remove the seal(s).

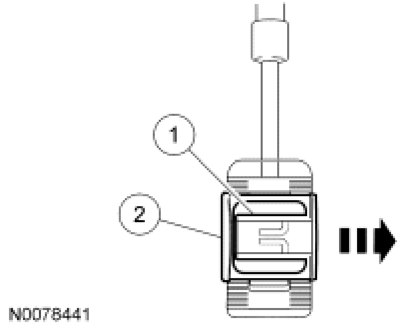


Fig. 341: Removing Seals Using Special Tools (205-153) & (303-1247/1)
Courtesy of FORD MOTOR CO.

87. Remove the 3 bolts and the power steering pump.

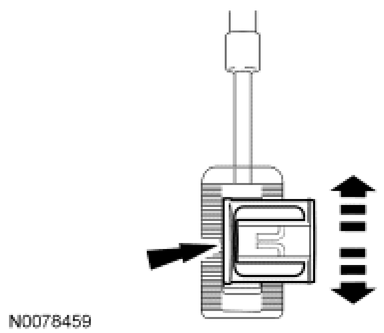


Fig. 342: Locating Power Steering Pump Bolts
Courtesy of FORD MOTOR CO.

88. Remove the 3 bolts and the accessory drive belt tensioner.

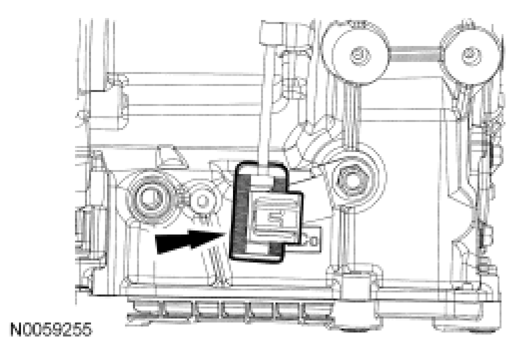


Fig. 343: Locating Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

89. Using the special tool, remove the crankshaft bolt and washer.
    - Discard the bolt.

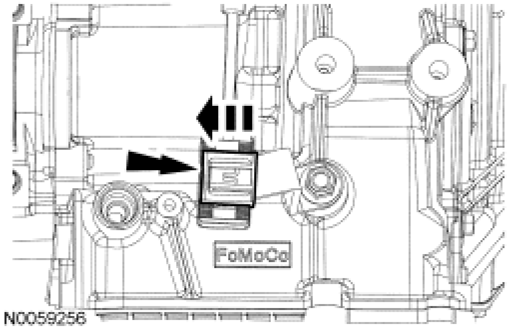


Fig. 344: Removing Crankshaft Bolt & Washer Using Special Tool (303-D055)
Courtesy of FORD MOTOR CO.

90. Using the special tool, remove the crankshaft pulley.

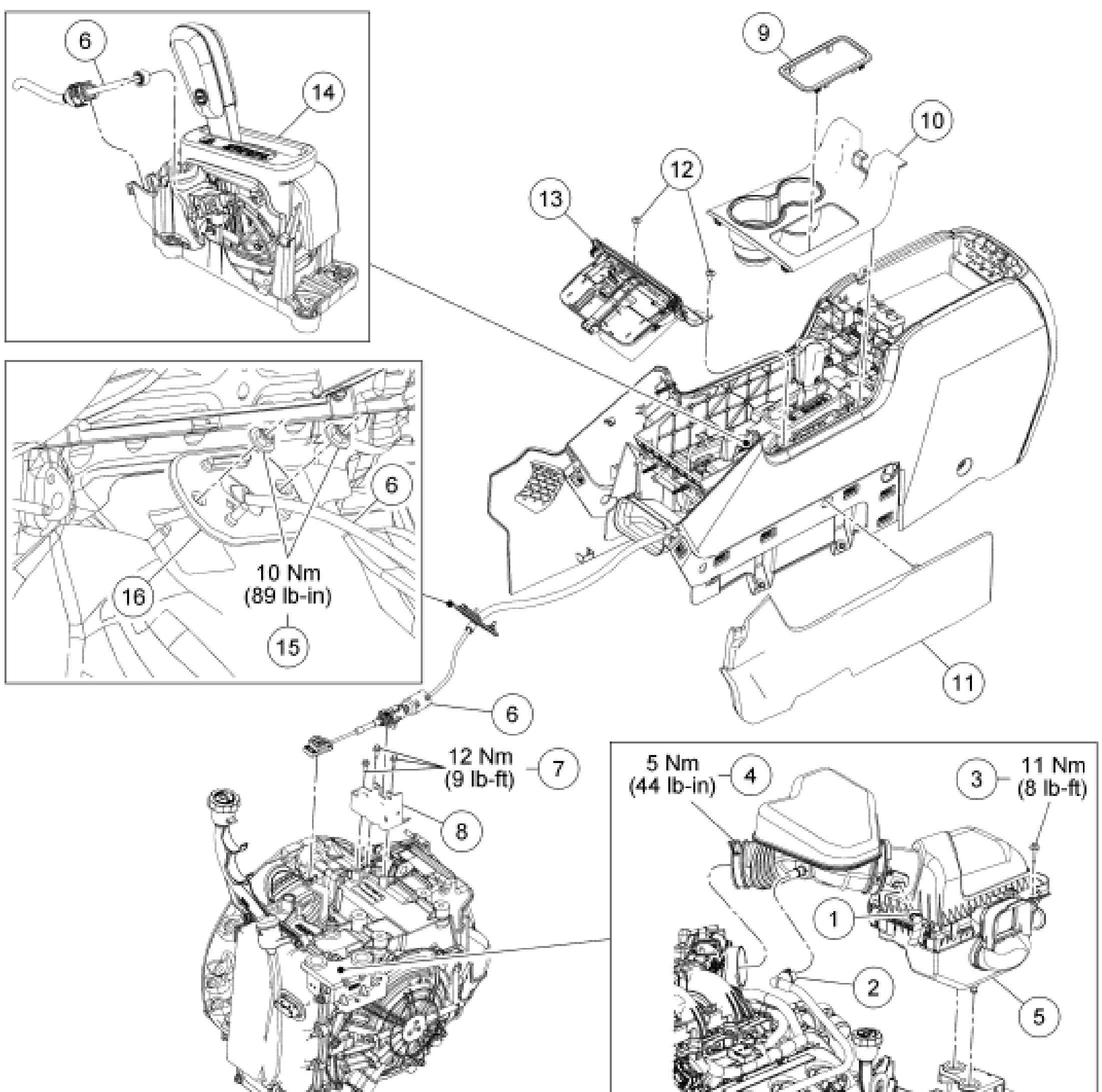


Fig. 345: Identifying Special Tools (303-D121) And Crankshaft Pulley

Courtesy of FORD MOTOR CO.

91. Using the special tool, remove and discard the crankshaft front seal.

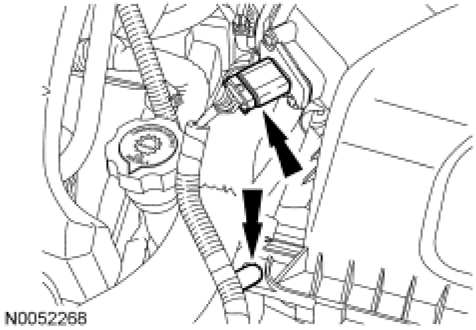


Fig. 346: Removing Crankshaft Front Seal Using Special Tool (303-409)
Courtesy of FORD MOTOR CO.

92. Remove the 2 bolts and the engine mount bracket.

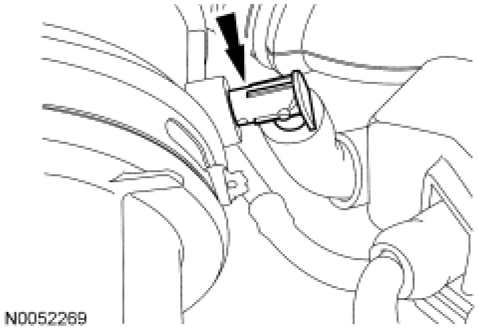


Fig. 347: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

93. Remove the 2 engine mount studs.

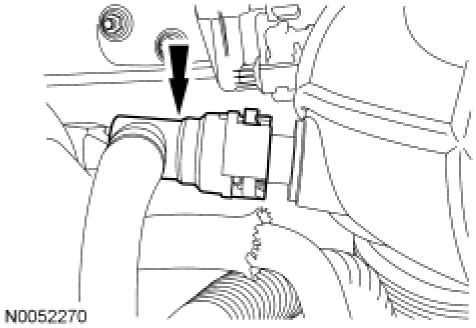


Fig. 348: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

94. Remove the 3 bolts and the engine mount bracket.

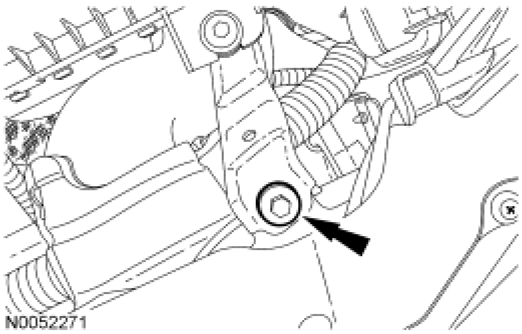


Fig. 349: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

95. Remove the 22 engine front cover bolts.

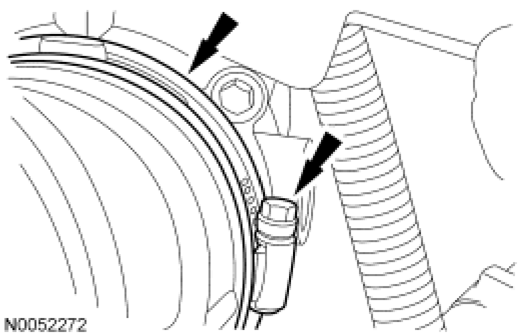


Fig. 350: Identifying Engine Front Cover Bolts
Courtesy of FORD MOTOR CO.

96. Install 6 of the engine front cover bolts (finger tight) into the 6 threaded holes in the engine front cover.
    - Tighten the bolts one turn at a time in a criss-cross pattern until the engine front cover-to-cylinder block seal is released.
        - Remove the engine front cover.

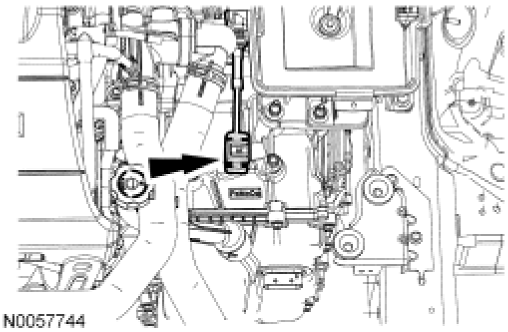


Fig. 351: Identifying Engine Front Cover Bolts

Courtesy of FORD MOTOR CO.

CAUTION: **Only use a 3M Roloc® Bristle Disk (2-in white, part number 07528) to clean the engine front cover. Do not use metal scrapers, wire brushes or any other power abrasive disk to clean the engine front cover. These tools cause scratches and gouges that make leak paths.**

97. Clean the engine front cover using a 3M Roloc® Bristle Disk (2-in white, part number 07528) in a suitable tool turning at the recommended speed of 15,000 rpm.
    - Thoroughly wash the engine front cover to remove any foreign material, including any abrasive particles created during the cleaning process.

CAUTION: **Place clean, lint-free shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.**

CAUTION: **Do not use wire brushes, power abrasive discs or 3M Roloc® Bristle Disk (2-in white part number 07528) to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. They also cause contamination that will cause premature engine failure. Remove all traces of the gasket.**

98. Clean the sealing surfaces of the cylinder block in the following sequence.
    1. Remove any large deposits of silicone or gasket material.
    2. Apply silicone gasket remover and allow to set for several minutes.
    3. Remove the silicone gasket remover. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep to remove any remaining traces of oil or coolant and to prepare the surfaces to bond. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.
    5. Make sure the 2 locating dowel pins are seated correctly in the cylinder block.
99. Rotate the crankshaft clockwise and align the timing marks on the variable camshaft timing (VCT) assemblies as shown.

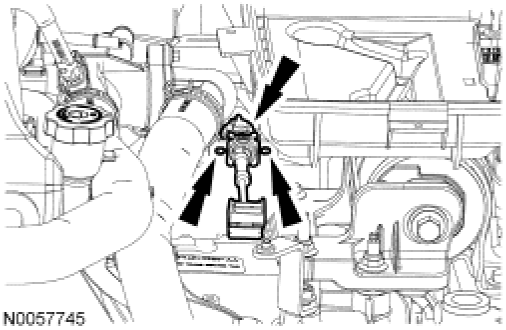


Fig. 352: Aligning Timing Marks On Variable Camshaft Timing (VCT) Assemblies
Courtesy of FORD MOTOR CO.

NOTE:	**The special tool will hold the camshafts in the top dead center (TDC) position.**

100. Install the special tool onto the flats of the LH camshafts.

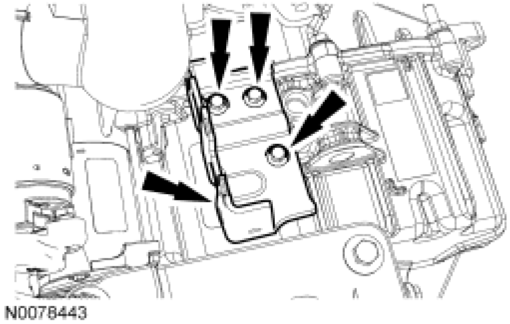


Fig. 353: Installing Special Tool (303-1248) Onto Flats Of LH Camshafts
Courtesy of FORD MOTOR CO.

NOTE:	**The special tool will hold the camshafts in the TDC position.**

101. Install the special tool onto the flats of the RH camshafts.

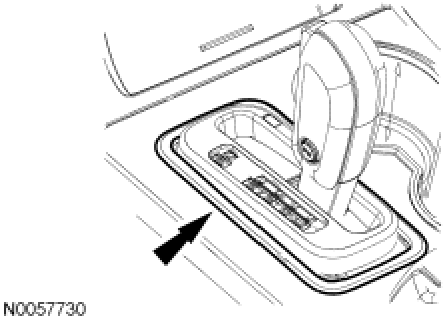


Fig. 354: Installing Special Tool (303-1248) Onto Flats Of RH Camshafts
Courtesy of FORD MOTOR CO.

102. Remove the 3 bolts and the RH VCT housing.

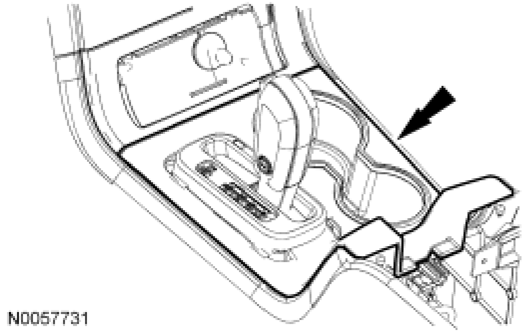


Fig. 355: Locating RH VCT Housing
Courtesy of FORD MOTOR CO.

103. Remove the 3 bolts and the LH VCT housing.

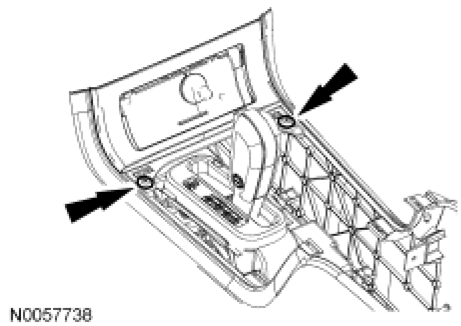


Fig. 356: Locating LH VCT Housing
Courtesy of FORD MOTOR CO.

104. Remove and discard the VCT housing seals.

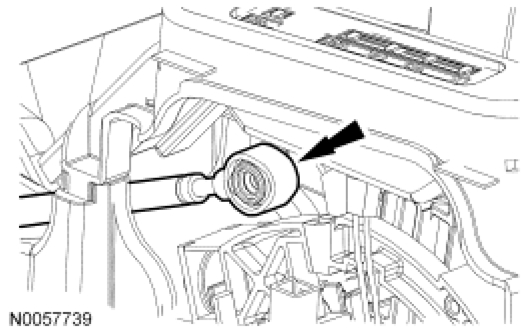


Fig. 357: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

105. Remove the 2 bolts and the primary timing chain tensioner.

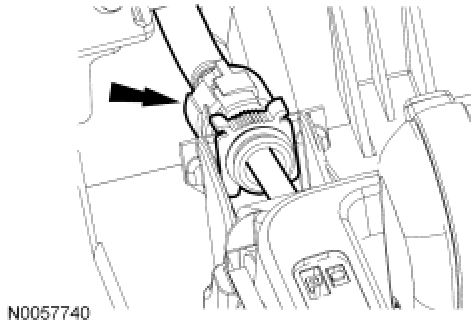


Fig. 358: Locating Primary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

106. Remove the primary timing chain tensioner arm.

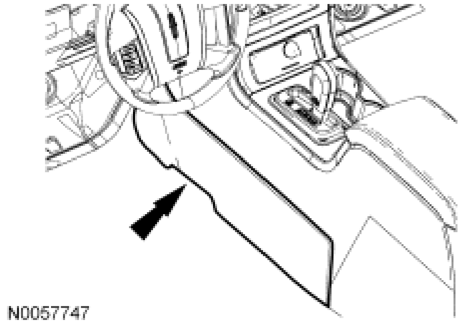


Fig. 359: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

107. Remove the 2 bolts and the lower LH primary timing chain guide.

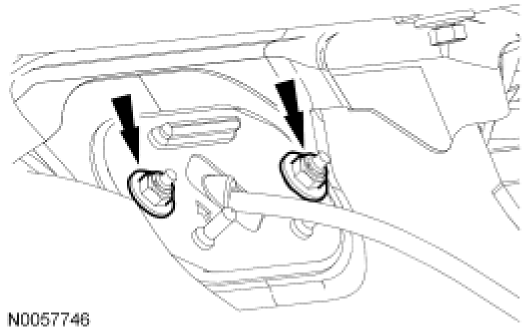


Fig. 360: Locating Lower LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

108. Remove the primary timing chain.

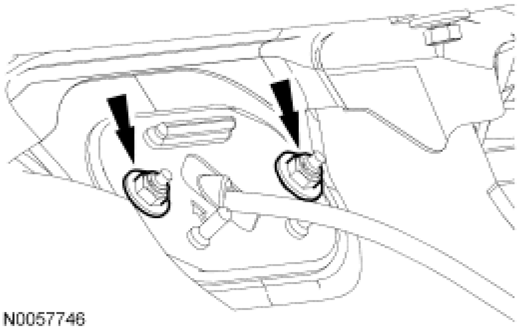


Fig. 361: Locating Primary Timing Chain
Courtesy of FORD MOTOR CO.

LH camshafts

109. Compress the LH secondary timing chain tensioner and install a suitable lockpin to retain the tensioner in the collapsed position.

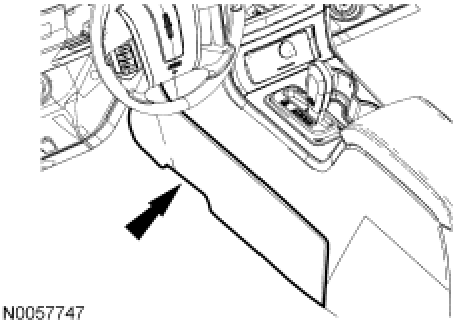


Fig. 362: Compressing LH Secondary Timing Chain Tensioner & Installing Suitable Lock Pin To Retain Tensioner In Collapsed Position
Courtesy of FORD MOTOR CO.

NOTE: **The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.**

110. Remove and discard the LH VCT assembly bolt and the LH exhaust camshaft sprocket bolt.
    - Remove the LH VCT assembly, secondary timing chain and the LH exhaust camshaft sprocket as an assembly.

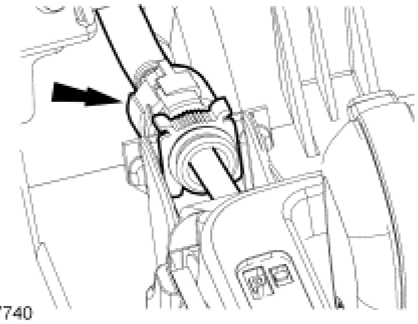

N0057740

Fig. 363: Locating LH VCT Assembly Bolt & LH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

NOTE: When the special tool is removed, valve spring pressure will rotate the LH camshafts approximately 3 degrees to a neutral position.

111. Remove the special tool from the LH camshafts.

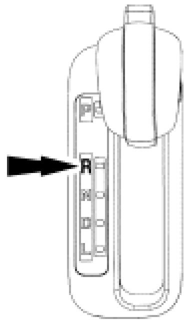

N0078444

Fig. 364: Removing Special Tool (303-1248) From LH Camshafts
Courtesy of FORD MOTOR CO.

CAUTION: The camshafts must remain in the neutral position during removal or engine damage may occur.

112. Verify the LH camshafts are in the neutral position.

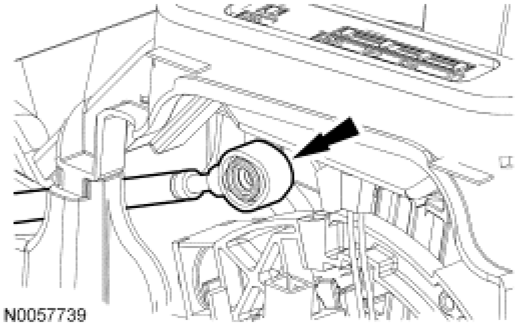

N0057739

Fig. 365: Verifying LH Camshafts Are In Neutral Position
Courtesy of FORD MOTOR CO.

NOTE: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions.

113. Remove the bolts and the LH camshaft bearing caps.
    - Remove the LH camshafts.

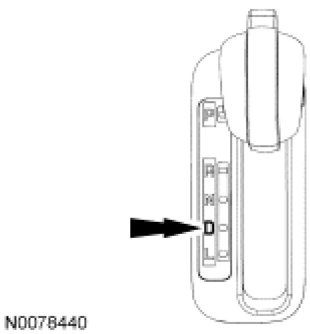


Fig. 366: Identifying LH Camshafts Bolts
Courtesy of FORD MOTOR CO.

RH camshafts

114. Compress the RH secondary timing chain tensioner and install a suitable lockpin to retain the tensioner in the collapsed position.

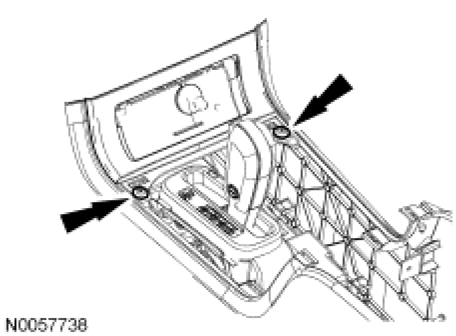


Fig. 367: Compressing RH Secondary Timing Chain Tensioner & Installing Suitable Lock Pin To Retain Tensioner In Collapsed Position
Courtesy of FORD MOTOR CO.

NOTE: The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.

115. Remove and discard the RH VCT assembly bolt and the RH exhaust camshaft sprocket bolt.
    - Remove the RH VCT assembly, secondary timing chain and the RH exhaust camshaft sprocket as

an assembly.

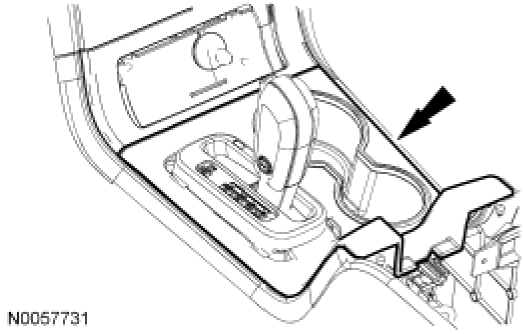


Fig. 368: Locating RH VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

116. Remove the special tool from the RH camshafts.

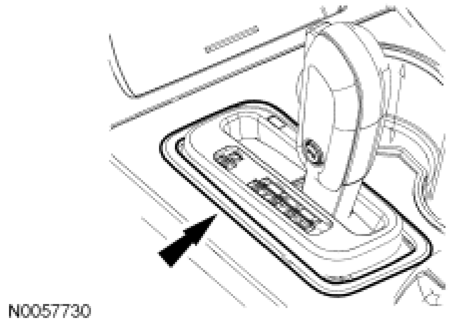


Fig. 369: Removing Special Tool (303-1248) From RH Camshafts
Courtesy of FORD MOTOR CO.

CAUTION: The camshafts must remain in the neutral position during removal or engine damage may occur.

117. Rotate the RH camshafts counterclockwise to the neutral position.

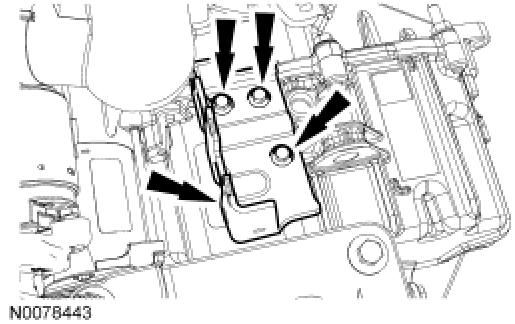


Fig. 370: Rotating RH Camshafts Counterclockwise To Neutral Position

Courtesy of FORD MOTOR CO.

NOTE: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions.

118. Remove the bolts and the RH camshaft bearing caps.
   - Remove the RH camshafts.

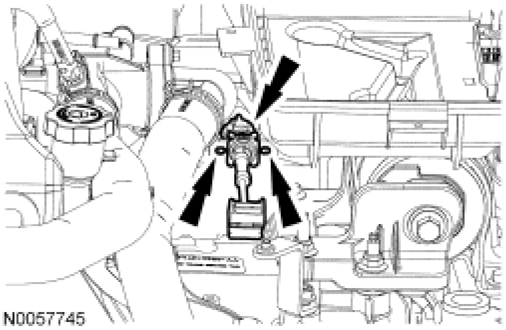


Fig. 371: Identifying RH Camshafts Bolts
Courtesy of FORD MOTOR CO.

VALVE TAPPETS

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.

1. Depending on the valve tappets being serviced, remove the LH and/or the RH camshafts. For additional information, refer to **Camshaft**.

NOTE: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

2. Remove the valve tappets from the cylinder head.

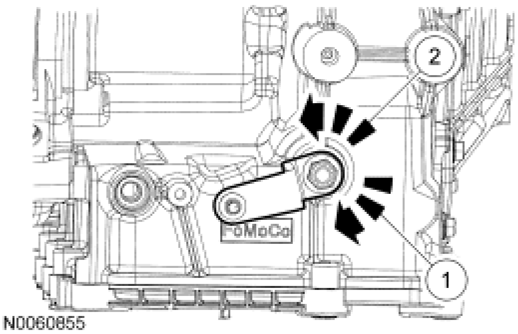
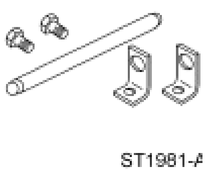
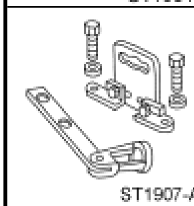
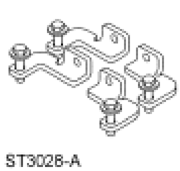


Fig. 372: Identifying Valve Tappets From Cylinder Head
Courtesy of FORD MOTOR CO.

VALVE SPRING, RETAINER AND SEAL

Special Tools

Illustration	Tool Name	Tool Number
	Compressor, Valve Spring	303-300 (T87C-6565-A)
	Compressor, Valve Spring	303-350 (T89P-6565-A)
	Compressor, Valve Spring	303-1249

NOTE: **During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.**

1. Remove the valve tappets from the cylinder being serviced. For additional information, refer to **Valve Tappets**.
2. Rotate the crankshaft until the piston for the valve being serviced is at the top of its stroke.

NOTE: **If air pressure has forced the piston to the bottom of the cylinder, any loss of air pressure will allow the valve to fall into the cylinder. If air pressure**

must be removed, support the valve prior to removal or engine damage may occur.

NOTE: **If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.**

NOTE: **If a valve drops into the cylinder, remove the cylinder head. For additional information, refer to Cylinder Head - RH or Cylinder Head - LH in this service information.**

3. Pressurize the cylinder using compressed air.
4. Using the Valve Spring Compressors, remove the keys, retainer and spring.

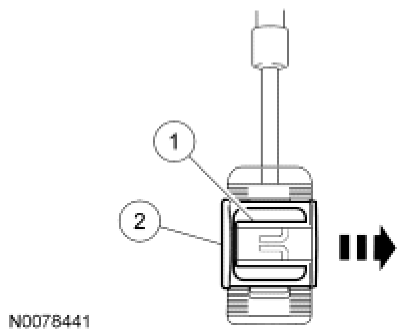


Fig. 373: Removing Keys, Retainer & Spring Using Special Tools (303-1249, 303-350, 303-300)
Courtesy of FORD MOTOR CO.

5. Remove and discard the valve stem seal.

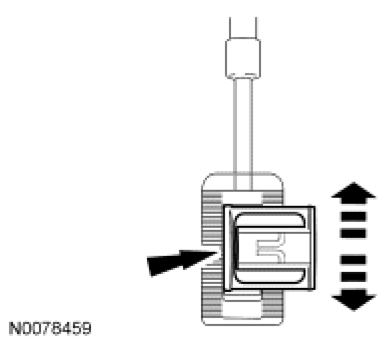


Fig. 374: Identifying Valve Stem Seal
Courtesy of FORD MOTOR CO.

CYLINDER HEAD - RH

Material

Item	Specification

Motorcraft Metal Surface Prep ZC-31-A	-
Silicone Gasket Remover ZC-30	-

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

All vehicles

1. Remove the RH camshafts. For additional information, refer to **Camshaft**.
2. If equipped, remove the heat shield and disconnect the block heater electrical connector.
   - Remove the block heater wiring harness from the engine.

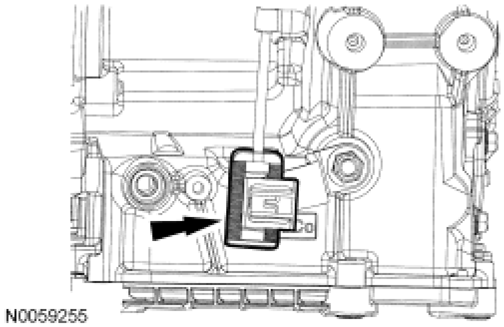


Fig. 375: Identifying Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

3. Disconnect the RH heated oxygen sensor (HO2S) electrical connector.

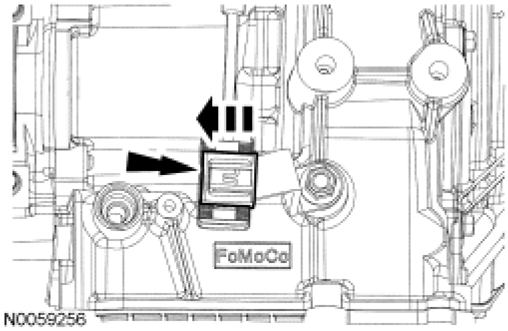


Fig. 376: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

4. Disconnect the RH camshaft position (CMP) sensor electrical connector.

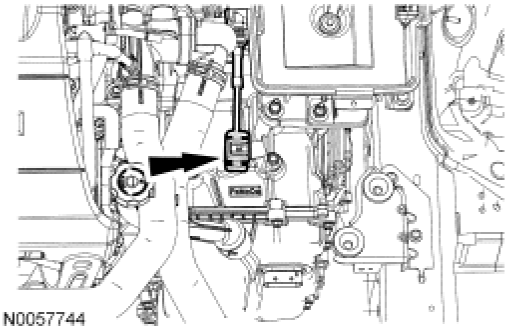


Fig. 377: Locating RH Camshaft Position (CMP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

5. Remove the bolt and the ground cable from the RH cylinder.

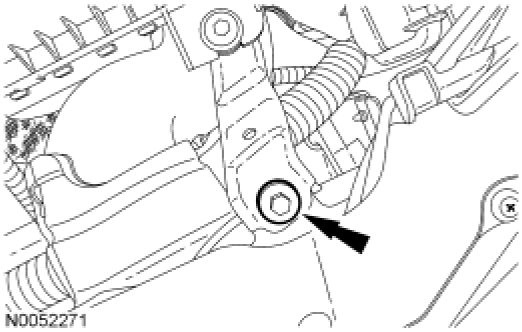


Fig. 378: Locating Ground Cable From RH Cylinder
Courtesy of FORD MOTOR CO.

6. Disconnect the 6 fuel injector electrical connectors (3 shown).

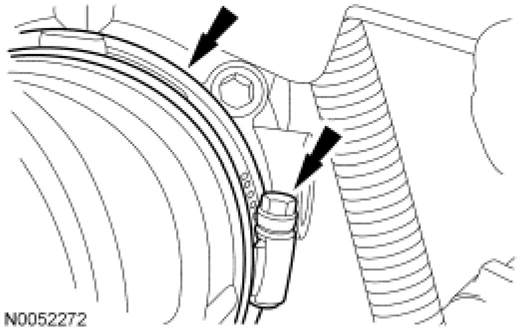


Fig. 379: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

7. Disconnect the cylinder head temperature (CHT) sensor electrical connector.

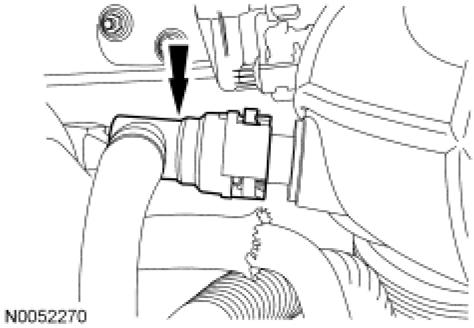


Fig. 380: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

8. Disconnect the LH catalyst monitor sensor electrical connector.

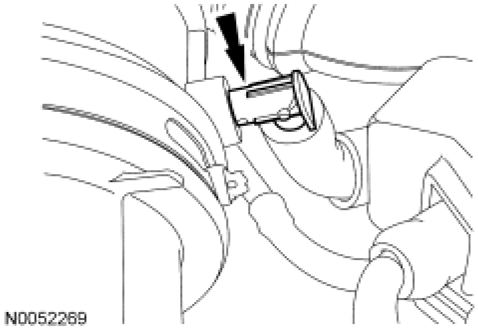


Fig. 381: Identifying LH Catalyst Monitor Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

9. Remove the 2 LH catalytic converter bracket bolts.

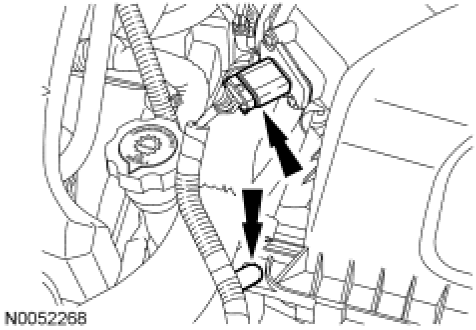


Fig. 382: Locating LH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

10. Remove the 4 nuts (3 shown) and the LH catalytic converter.
    - Discard the nuts and the gasket.

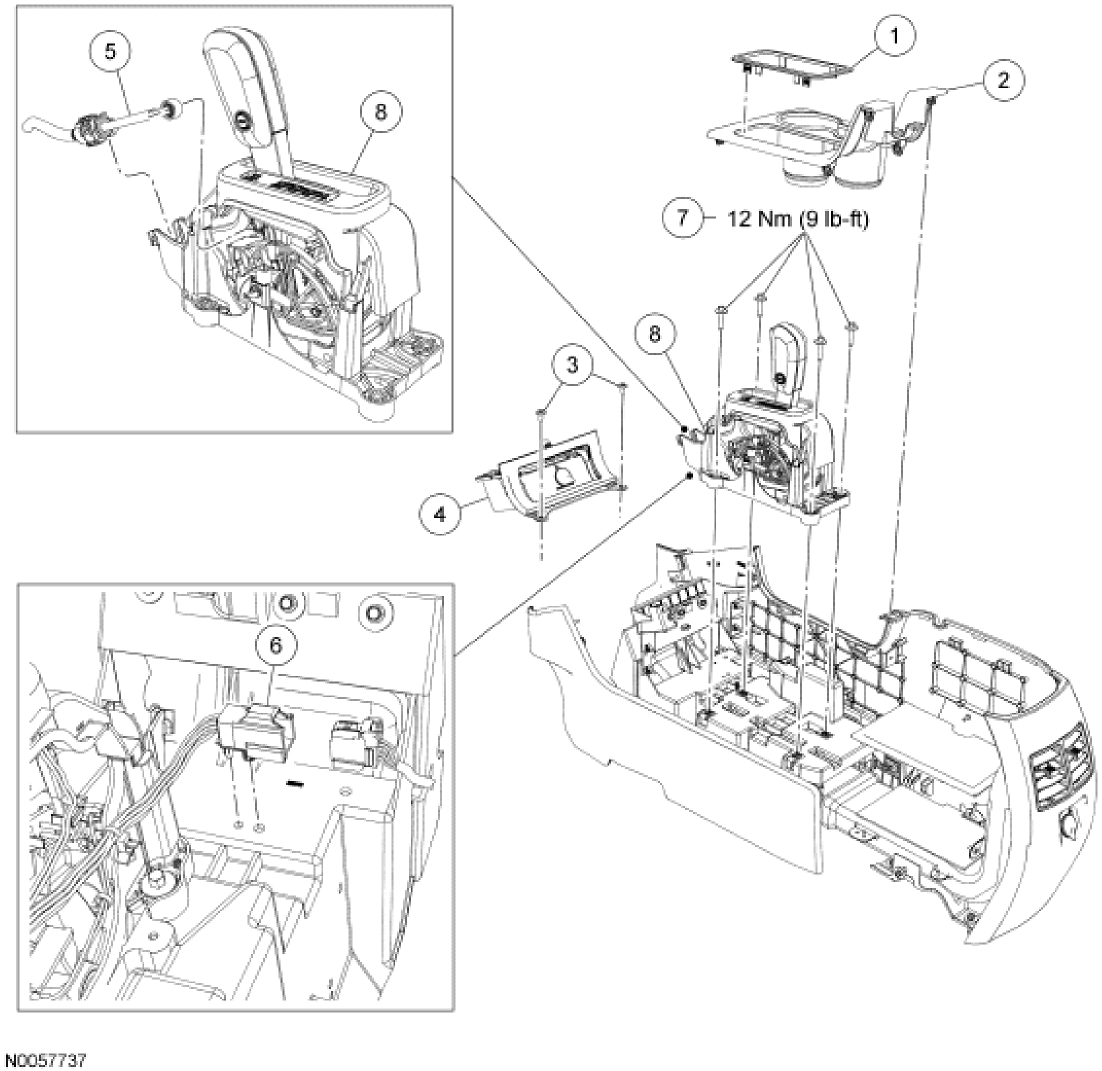


Fig. 383: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

11. Remove the LH cylinder block drain plug.
    - Allow coolant to drain from the cylinder block.

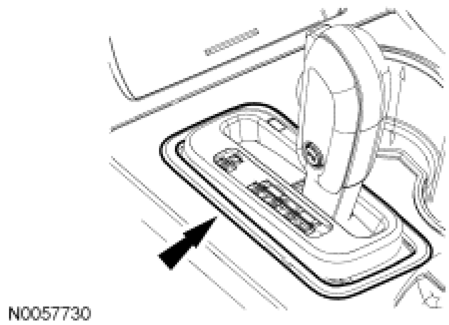


Fig. 384: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

12. Remove the 2 RH catalytic converter bracket bolts.

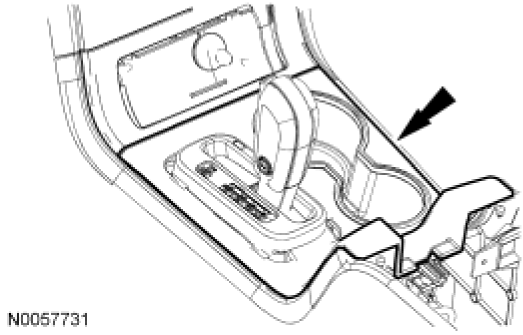


Fig. 385: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

All vehicles

13. Remove the 4 nuts and the RH catalytic converter.
    - Discard the nuts and the gasket.

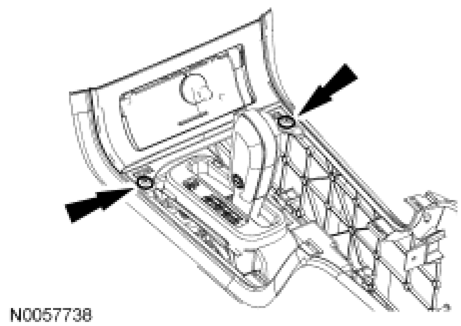


Fig. 386: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

14. Remove the RH cylinder block drain plug or, if equipped, the block heater.
    - Allow coolant to drain from the cylinder block.

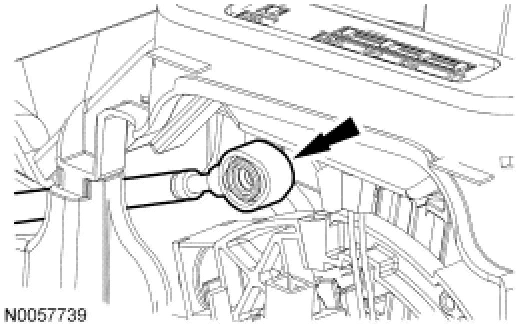


Fig. 387: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

15. Remove the 3 bolts and the RH exhaust manifold heat shield.

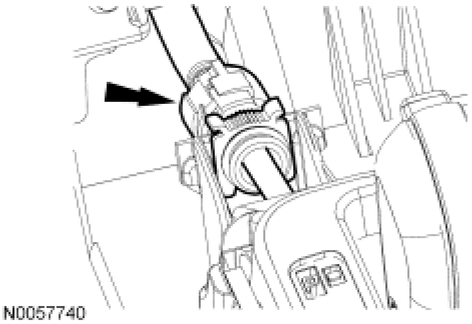


Fig. 388: Locating RH Exhaust Manifold Heat Shield & Nuts
Courtesy of FORD MOTOR CO.

16. Remove the 6 nuts and the RH exhaust manifold.
    - Discard the nuts and exhaust manifold gaskets.

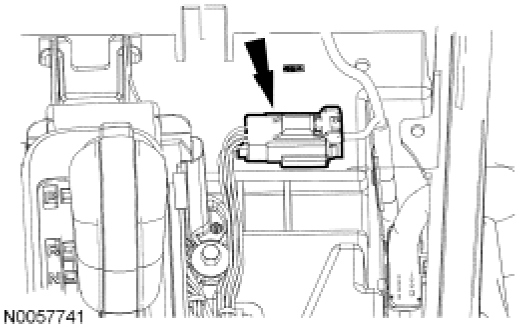


Fig. 389: Locating RH Exhaust Manifold & Nuts
Courtesy of FORD MOTOR CO.

17. Clean and inspect the RH exhaust manifold. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
18. Remove and discard the 6 RH exhaust manifold studs.

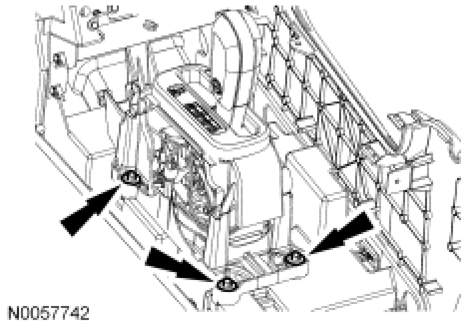


Fig. 390: Locating RH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

19. Remove the 2 bolts and the RH primary timing chain guide.

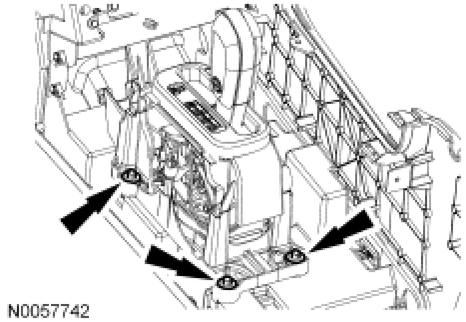


Fig. 391: Locating RH Primary Timing Chain Guide Lower Bolt
Courtesy of FORD MOTOR CO.

20. Remove the 2 bolts and the RH secondary timing chain tensioner.

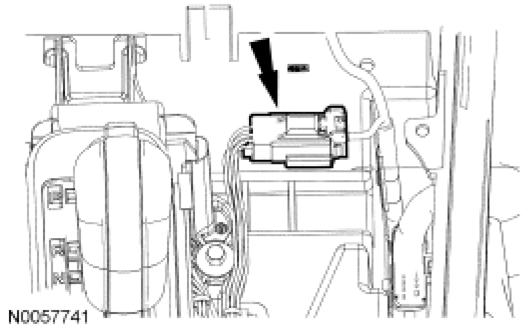


Fig. 392: Locating RH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

21. Remove the 2 bolts and the engine lifting eye.

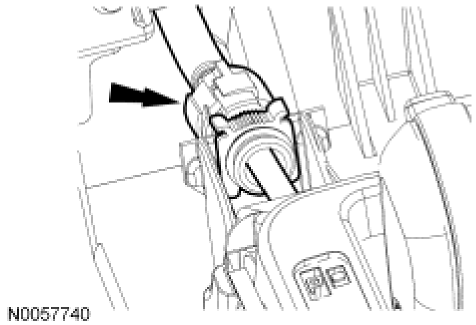


Fig. 393: Locating Engine Lifting Eye & Bolts
Courtesy of FORD MOTOR CO.

NOTE: Index-mark the location of the bracket on the cylinder head for installation.

22. Remove the bolt and the upper intake manifold bracket.

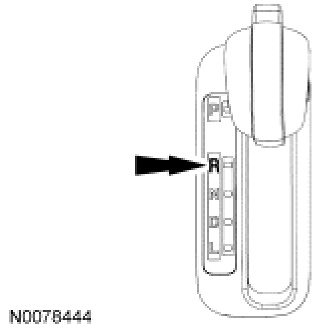


Fig. 394: Locating Upper Intake Manifold Bracket & Bolt
Courtesy of FORD MOTOR CO.

23. Remove the bolt and the RH CMP sensor.

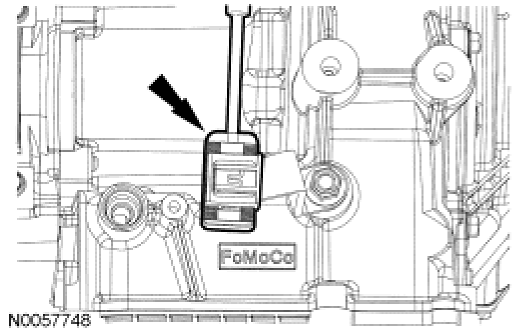


Fig. 395: Locating RH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

24. Remove the 4 bolts and the fuel rail and injectors as an assembly.

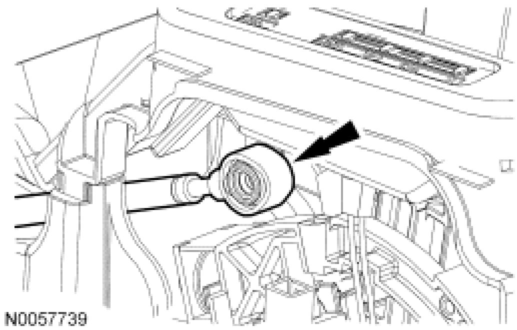


Fig. 396: 4 Bolts And Fuel Rail
Courtesy of FORD MOTOR CO.

25. Remove the 3 thermostat housing-to-lower intake manifold bolts.
    - Remove the thermostat housing and discard the gasket and O-ring seal.

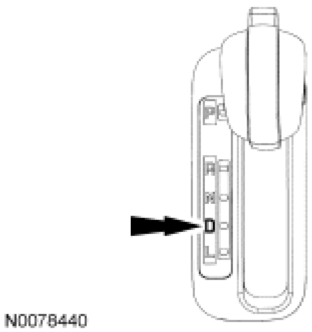


Fig. 397: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

26. Remove the 10 bolts and the lower intake manifold.
    - Discard the gaskets.

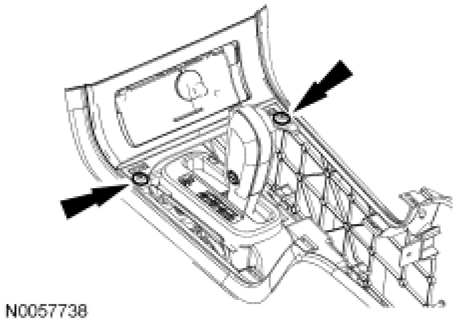


Fig. 398: Locating Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

27. Disconnect and remove the CHT sensor jumper harness.

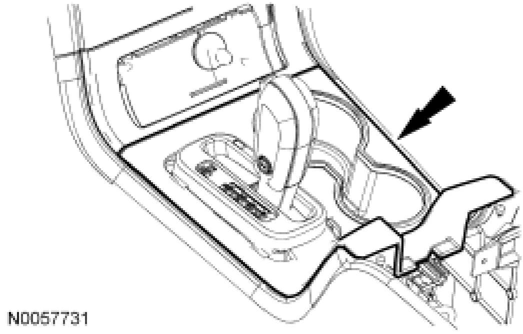


Fig. 399: Identifying CHT Sensor Jumper Harness
Courtesy of FORD MOTOR CO.

NOTE: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

28. Remove the valve tappets from the cylinder head.

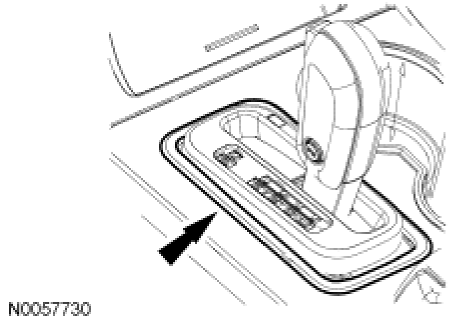


Fig. 400: Identifying Valve Tappets From Cylinder Head
Courtesy of FORD MOTOR CO.

29. Remove and discard the M6 bolt.

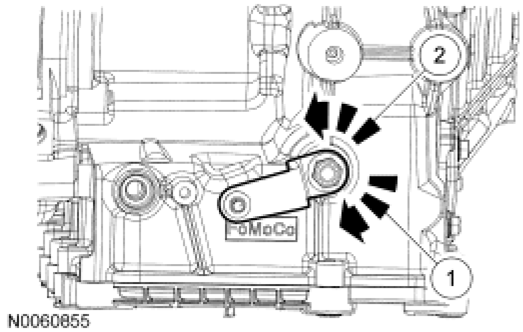


Fig. 401: Identifying M6 Bolt

Courtesy of FORD MOTOR CO.

CAUTION: Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.

CAUTION: Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface.

NOTE: The cylinder head bolts must be discarded and new bolts must be installed. They are a tighten-to-yield designed and cannot be reused.

30. Remove and discard the 8 bolts from the cylinder head.
    - Remove the cylinder head.
    - Discard the cylinder head gasket.

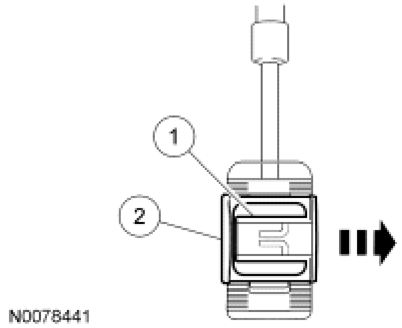


Fig. 402: Identifying Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.

NOTE: Observe all warnings or cautions and follow all application directions contained on the packaging of the silicone gasket remover and the metal surface prep.

NOTE: If there is no residual gasket material present, metal surface prep can be used to clean and prepare the surfaces.

31. Clean the cylinder head-to-cylinder block mating surfaces of both the cylinder heads and the cylinder

block in the following sequence.

1. Remove any large deposits of silicone or gasket material with a plastic scraper.
2. Apply silicone gasket remover, following package directions, and allow to set for several minutes.
3. Remove the silicone gasket remover with a plastic scraper. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
4. Apply metal surface prep, following package directions, to remove any remaining traces of oil or coolant and to prepare the surfaces to bond with the new gasket. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.

32. Support the cylinder head on a bench with the head gasket side up.

NOTE: The straightedge used must be flat within 0.0051 mm (0.0002 in) per foot of tool length.

33. Inspect all areas of the deck face with a straightedge and feeler gauge. The cylinder head must not have depressions deeper than 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area, or scratches more than 0.0254 mm (0.001 in).

CYLINDER HEAD - LH

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31-A	-
Silicone Gasket Remover ZC-30	-

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

All vehicles

1. Remove the LH camshafts. For additional information, refer to **Camshaft**.
2. If equipped, remove the heat shield and disconnect the block heater electrical connector.
   - Remove the block heater wiring harness from the engine.

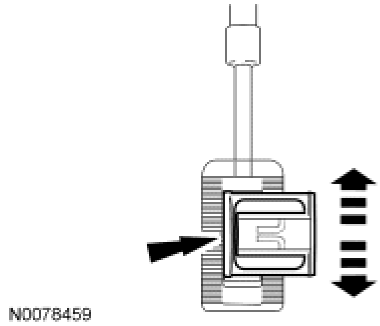


Fig. 403: Identifying Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

3. Disconnect the 6 fuel injector electrical connectors (3 shown).

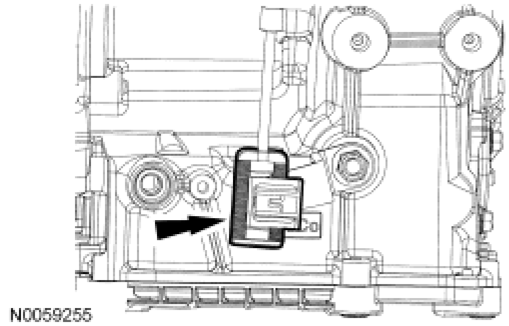


Fig. 404: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

4. Disconnect the cylinder head temperature (CHT) sensor electrical connector.

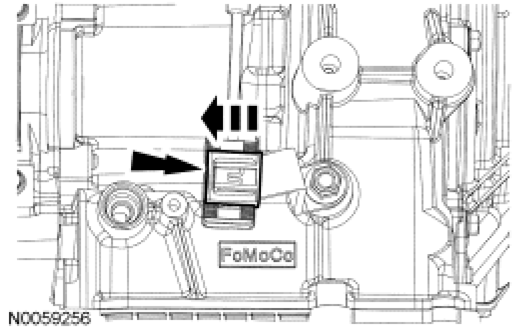


Fig. 405: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

5. Disconnect the LH camshaft position (CMP) sensor electrical connector.

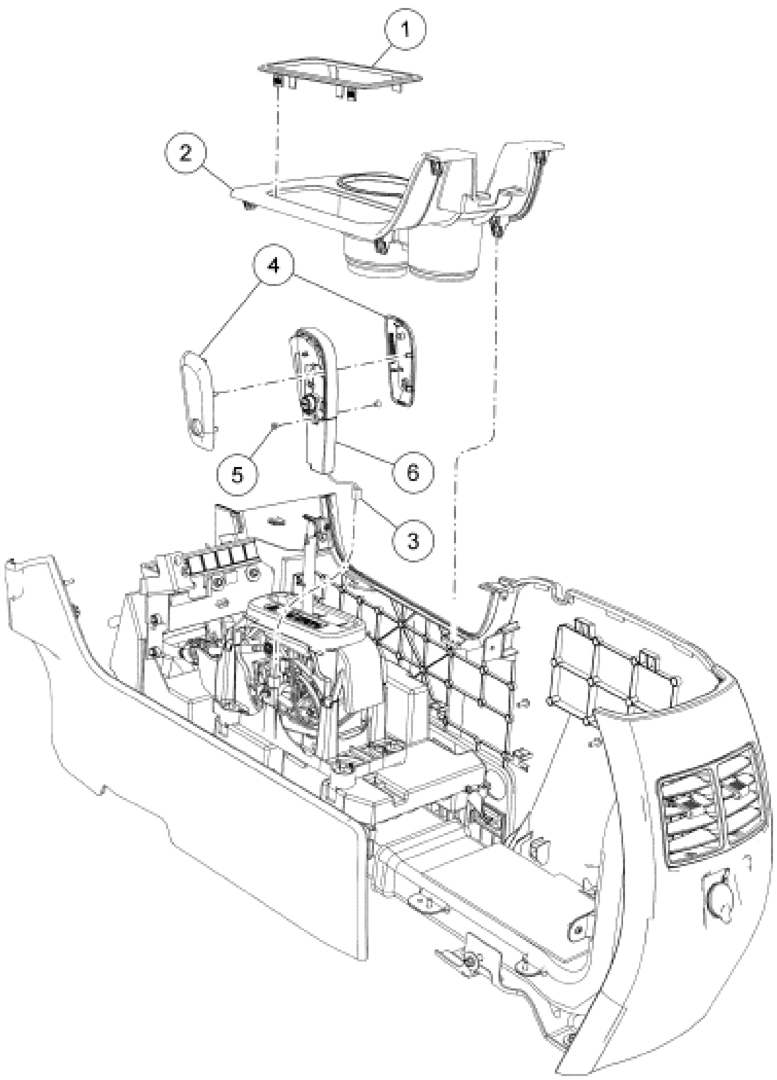


Fig. 406: Locating LH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

6. Disconnect the LH heated oxygen sensor (HO2S) electrical connector.

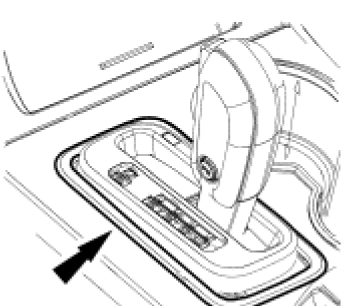


Fig. 407: Locating LH Heated Oxygen Sensor (HO2S) Electrical Connector

Courtesy of FORD MOTOR CO.

7. Disconnect the LH catalyst monitor sensor electrical connector.

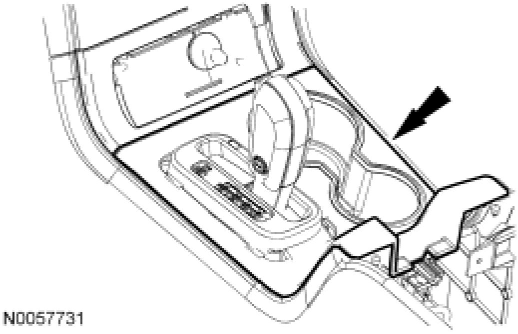


Fig. 408: Identifying LH Catalyst Monitor Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

8. Remove the wiring harness retainer bolt from the rear of the LH cylinder head.

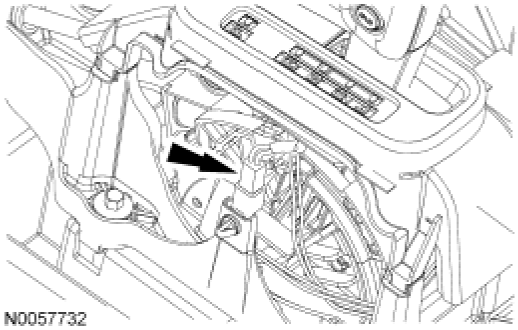


Fig. 409: Identifying Wiring Harness Retainer Bolt From Rear Of LH Cylinder Head
Courtesy of FORD MOTOR CO.

9. Disconnect the A/C compressor electrical connector.

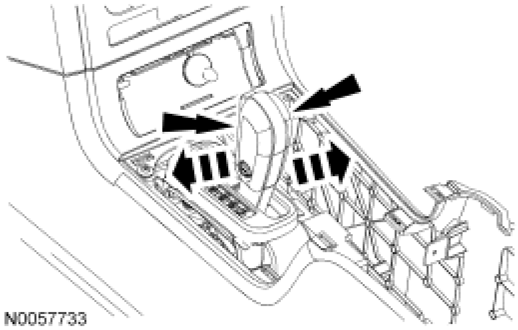


Fig. 410: Identifying A/C Compressor Electrical Connector
Courtesy of FORD MOTOR CO.

10. Remove the nut and disconnect the generator B+ cable.

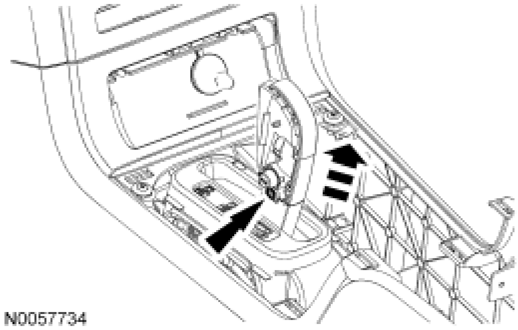


Fig. 411: Identifying Generator B+ Cable & Nut
Courtesy of FORD MOTOR CO.

11. Disconnect the generator electrical connector.

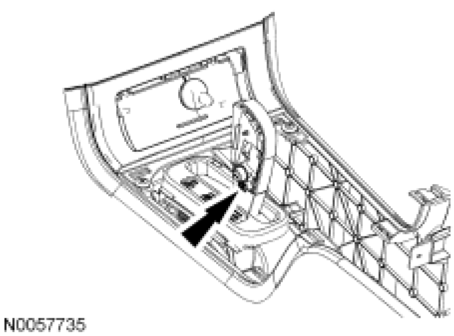


Fig. 412: Identifying Generator Electrical Connector
Courtesy of FORD MOTOR CO.

12. Detach the wiring harness retainer from the generator.

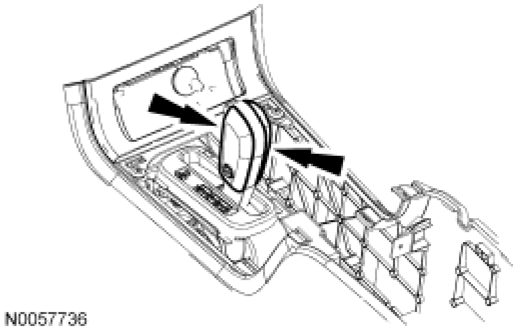
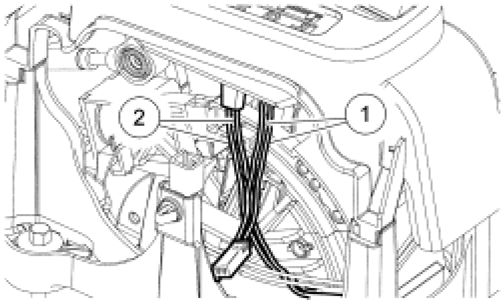


Fig. 413: Identifying Wiring Harness Retainer From Generator
Courtesy of FORD MOTOR CO.

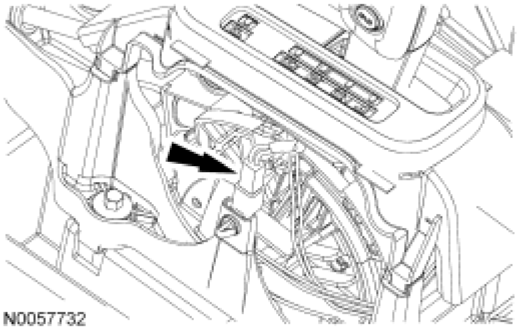
13. Disconnect the engine oil pressure (EOP) switch electrical connector and the wiring harness pin-type retainer.



N0078445

Fig. 414: Locating Engine Oil Pressure (EOP) Switch Electrical Connector & Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

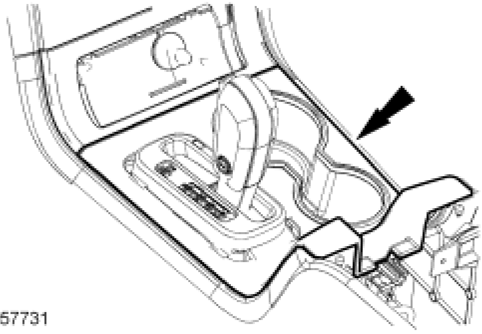
14. Remove the nut, 2 bolts and the A/C compressor.



N0057732

Fig. 415: Locating A/C Compressor, Bolts & Nuts
Courtesy of FORD MOTOR CO.

15. Remove the nut, bolt and the generator.



N0057731

Fig. 416: Locating Generator, Bolts & Nuts
Courtesy of FORD MOTOR CO.

16. Remove the 2 LH catalytic converter bracket bolts.

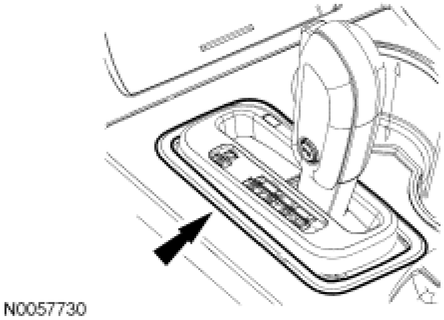


Fig. 417: Locating LH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

17. Remove the 4 nuts (3 shown) and the LH catalytic converter.
    - Discard the nuts and the gasket.

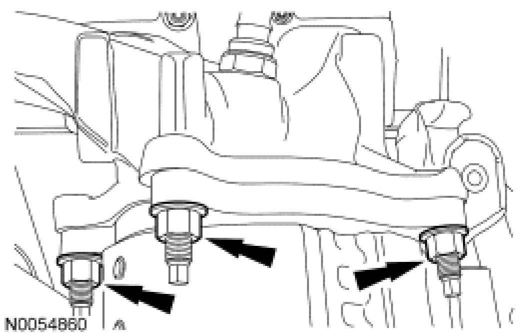


Fig. 418: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

18. Remove the 3 bolts and the LH exhaust manifold heat shield.

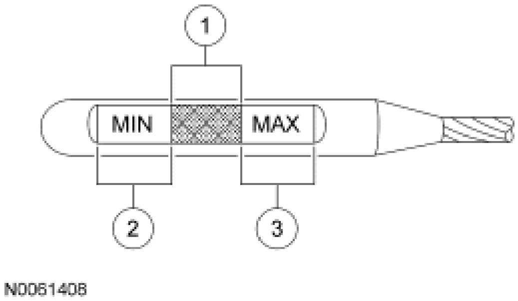


Fig. 419: Locating LH Exhaust Manifold Heat Shield & Nuts
Courtesy of FORD MOTOR CO.

19. Remove the 6 nuts and the LH exhaust manifold.
    - Discard the nuts and the exhaust manifold gasket.

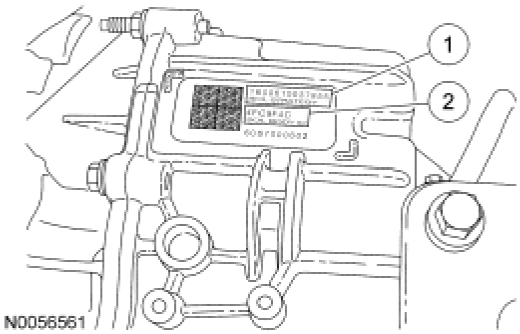


Fig. 420: Locating LH Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

20. Clean and inspect the LH exhaust manifold. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
21. Remove and discard the 6 LH exhaust manifold studs.

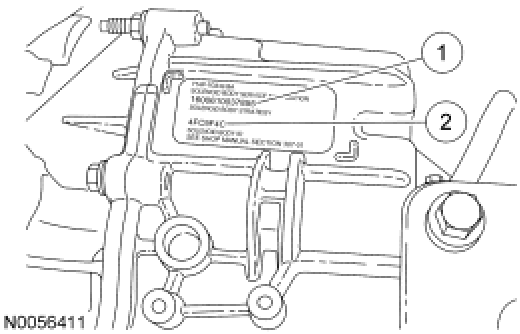


Fig. 421: Locating LH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

22. Remove the LH cylinder block drain plug.
    - Allow coolant to drain from the cylinder block.

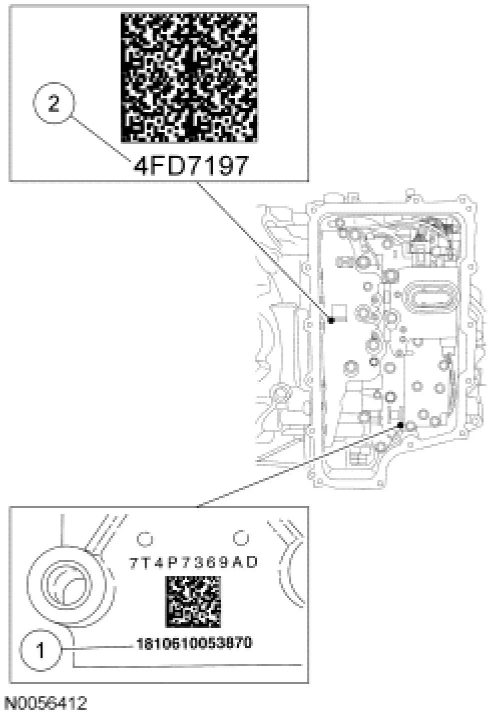


Fig. 422: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

23. Remove the 2 RH catalytic converter bracket bolts.

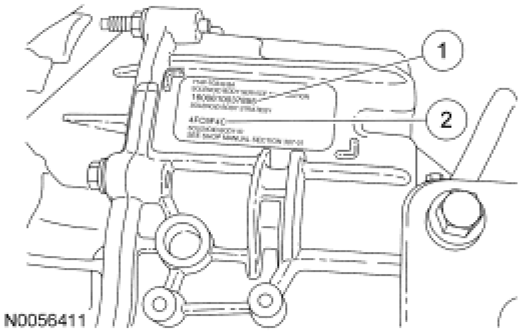


Fig. 423: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

All vehicles

24. Remove the 4 nuts and the RH catalytic converter.
    - Discard the nuts and the gasket.

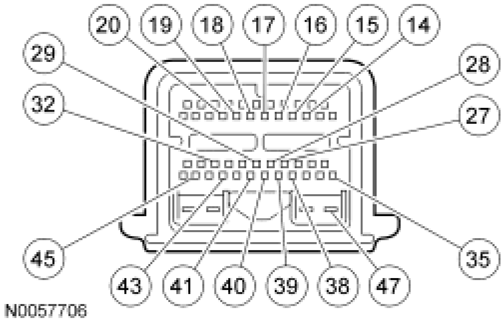


Fig. 424: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

25. Remove the RH cylinder block drain plug or, if equipped, the block heater.
    - Allow coolant to drain from the cylinder block.

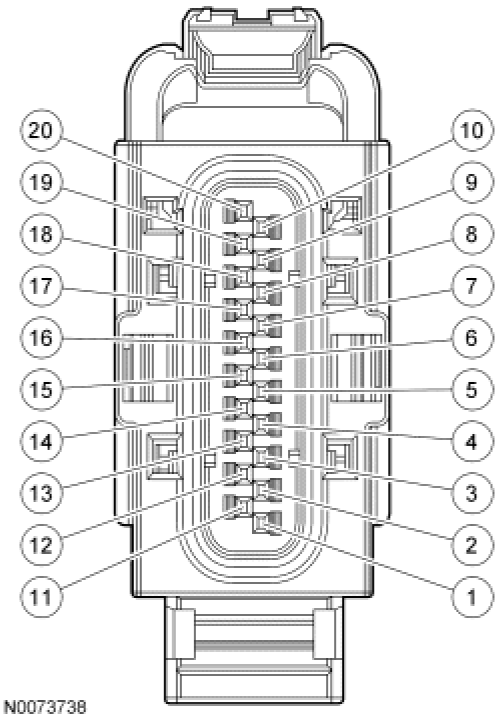


Fig. 425: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

26. Remove the 4 bolts and the fuel rail and injectors as an assembly.

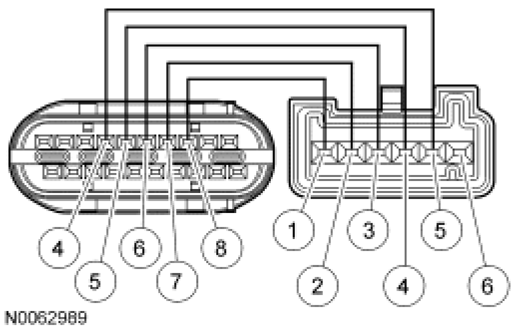


Fig. 426: Identifying 4 Bolts And Fuel Rail
Courtesy of FORD MOTOR CO.

27. Remove the 3 thermostat housing-to-lower intake manifold bolts.
    - Remove the thermostat housing and discard the gasket and O-ring seal.

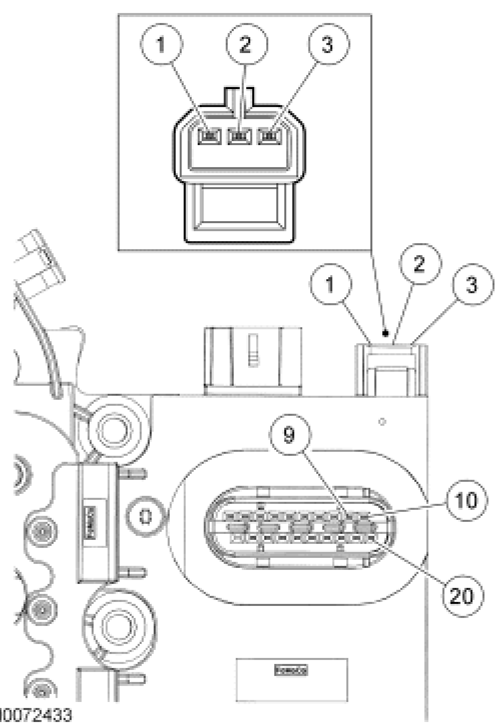


Fig. 427: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

28. Remove the 10 bolts and the lower intake manifold.
    - Discard the gaskets.

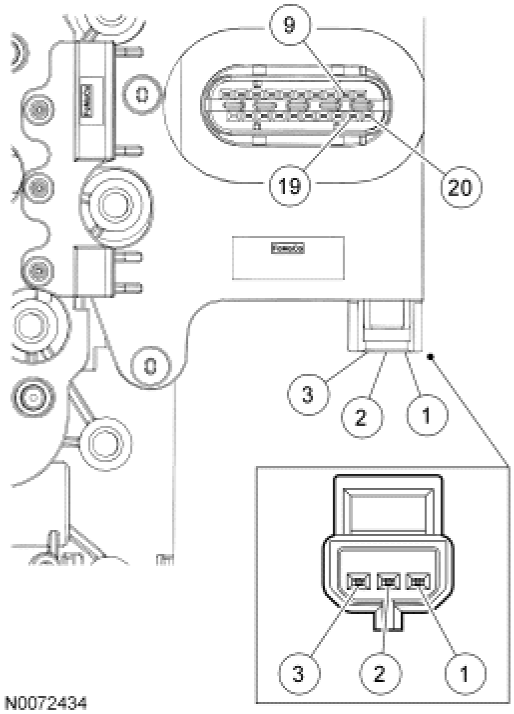


Fig. 428: Locating Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

29. Remove the bolt and the LH CMP sensor.

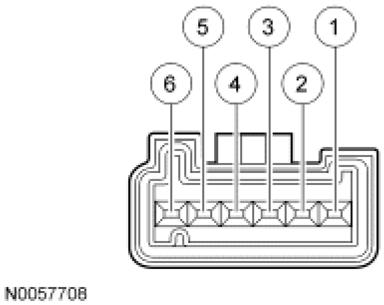


Fig. 429: Locating LH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

30. Remove the 2 bolts and the upper LH primary timing chain guide.

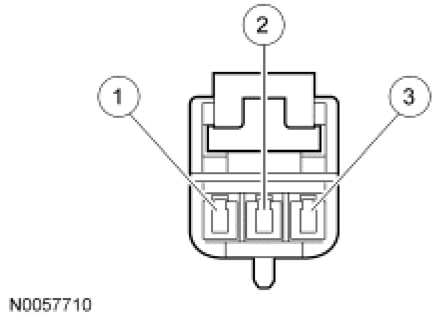


Fig. 430: Locating Upper LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

31. Remove the 2 bolts and the LH secondary timing chain tensioner.

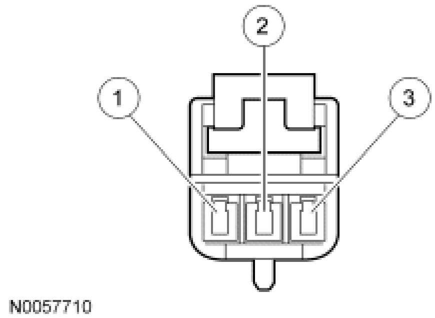


Fig. 431: Locating LH Secondary Timing Chain Tensioner & Bolt
Courtesy of FORD MOTOR CO.

NOTE:	**If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.**

32. Remove the valve tappets from the cylinder head.

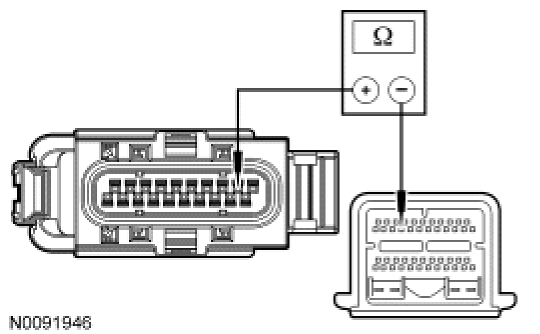


Fig. 432: Identifying Valve Tappets From Cylinder Head
Courtesy of FORD MOTOR CO.

33. Remove and discard the M6 bolt.

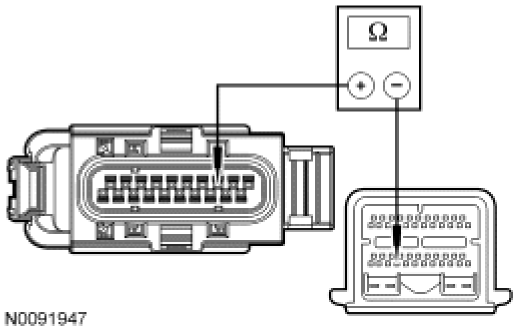


Fig. 433: Identifying M6 Bolt
Courtesy of FORD MOTOR CO.

CAUTION: Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.

CAUTION: Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface.

NOTE: The cylinder head bolts must be discarded and new bolts must be installed. They are a tighten-to-yield designed and cannot be reused.

34. Remove and discard the 8 bolts from the cylinder head.
    - Remove the cylinder head.
    - Discard the cylinder head gasket.

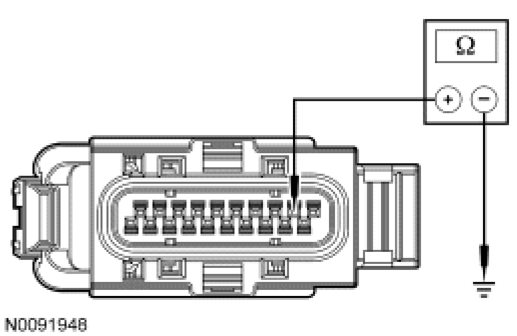


Fig. 434: Identifying Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or

other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.

CAUTION: Observe all warnings or cautions and follow all application directions contained on the packaging of the silicone gasket remover and the metal surface prep.

NOTE: If there is no residual gasket material present, metal surface prep can be used to clean and prepare the surfaces.

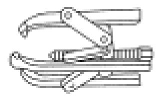
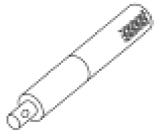
35. Clean the cylinder head-to-cylinder block mating surfaces of both the cylinder heads and the cylinder block in the following sequence.
    1. Remove any large deposits of silicone or gasket material with a plastic scraper.
    2. Apply silicone gasket remover, following package directions, and allow to set for several minutes.
    3. Remove the silicone gasket remover with a plastic scraper. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep, following package directions, to remove any remaining traces of oil or coolant and to prepare the surfaces to bond with the new gasket. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.
36. Support the cylinder head on a bench with the head gasket side up.

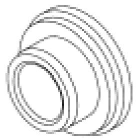
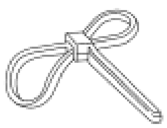
NOTE: The straightedge used must be flat within 0.0051 mm (0.0002 in) per foot of tool length.

37. Inspect all areas of the deck face with a straightedge and feeler gauge. The cylinder head must not have depressions deeper than 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area, or scratches more than 0.0254 mm (0.001 in).

OIL PAN

Special Tools

Illustration	Tool Name	Tool Number
 ST1184-A	3-Jaw Puller	303-D121
 ST1326-A	Handle	205-153 (T80T-4000-W)

 ST1385-A	Remover, Oil Seal	303-409 (T92C-6700CH)
 ST2982-A	Seal Remover	303-1247/1
 ST1436-A	Strap Wrench	303-D055 (D85L-6000-A)

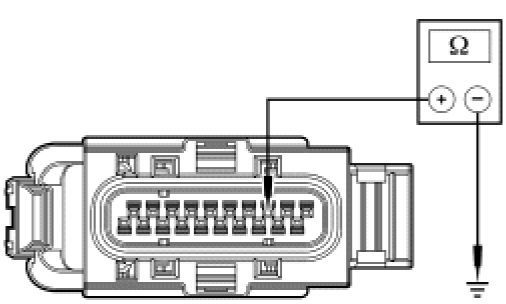
Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31-A	-
Silicone Gasket Remover ZC-30	-

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

All vehicles

1. Remove the engine from the vehicle. For additional information, refer to **Engine**.
2. Remove the 8 bolts and the flexplate.



N0091949

Fig. 435: Identifying Flexplate & Bolts
Courtesy of FORD MOTOR CO.

3. Remove the crankshaft sensor ring.

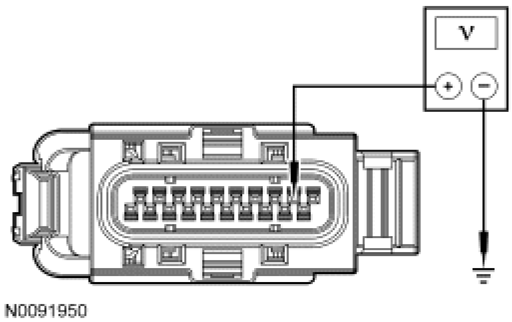


Fig. 436: Identifying Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

NOTE: Install the engine stand bolts into the cylinder block only. Do not install the bolts into the oil pan.

4. Mount the engine on a suitable engine stand.
5. If equipped, remove the heat shield and disconnect the block heater electrical connector.
   - Detach all of the engine block heater harness retainers and remove the harness.

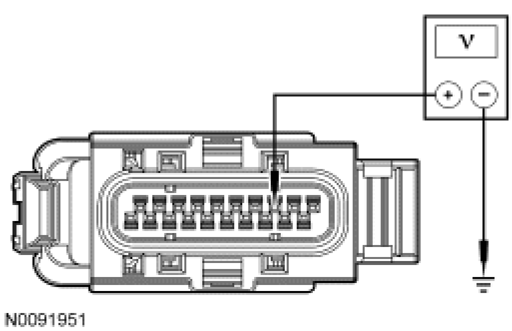


Fig. 437: Identifying Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

6. Disconnect the PCV hose from the PCV valve.

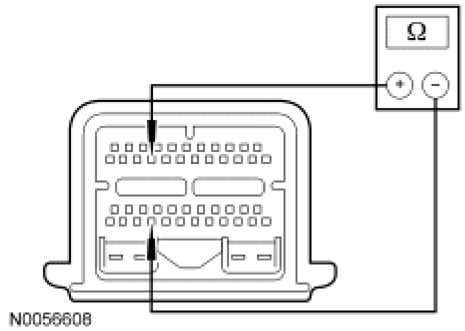


Fig. 438: Identifying PCV Hose
Courtesy of FORD MOTOR CO.

7. Disconnect the throttle body (TB) electrical connector.

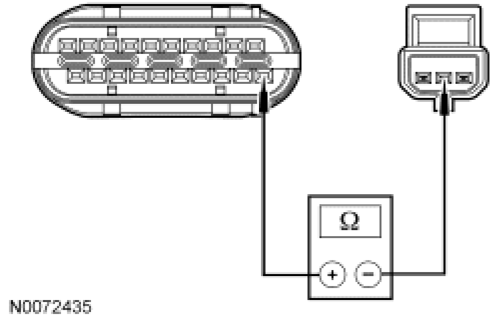


Fig. 439: Locating Throttle Body Electrical Connector
Courtesy of FORD MOTOR CO.

8. Detach the wiring harness retainers from the upper intake manifold.

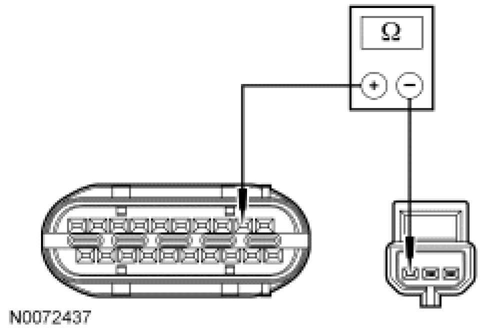


Fig. 440: Locating Wiring Harness Retainers From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

9. Remove the upper intake manifold support bracket bolt.

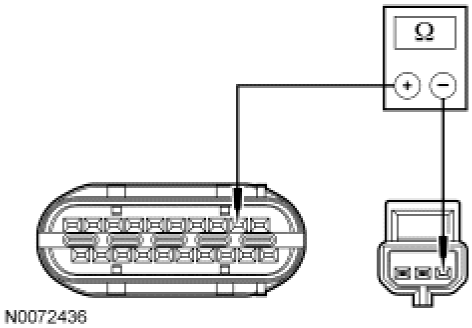


Fig. 441: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

10. Remove the 6 bolts and the upper intake manifold in the following sequence.
    - Discard the gaskets.

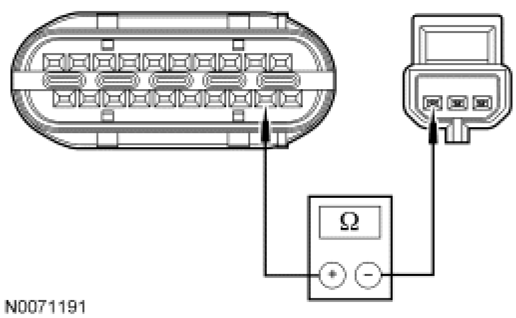


Fig. 442: Identifying Bolt Sequence
Courtesy of FORD MOTOR CO.

11. Disconnect the power steering pressure (PSP) switch electrical connector.

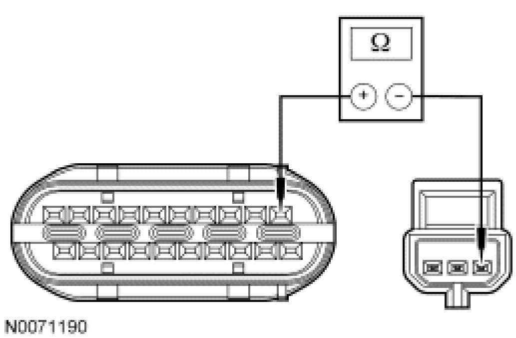


Fig. 443: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

12. Disconnect the RH catalyst monitor sensor electrical connector.

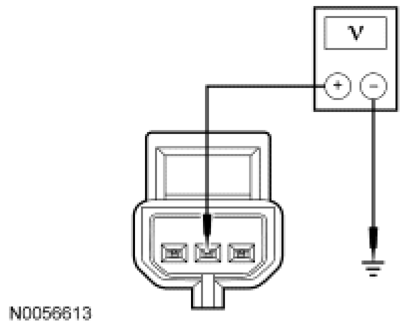


Fig. 444: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

13. Disconnect the RH variable camshaft timing (VCT) solenoid electrical connector.

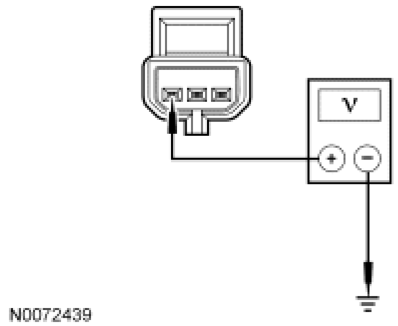


Fig. 445: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

14. Disconnect the 3 RH coil-on-plug electrical connectors.

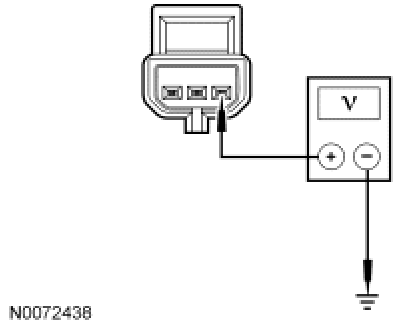


Fig. 446: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

15. Detach all of the wiring harness retainers from the RH valve cover and stud bolts.
16. Disconnect the LH catalyst monitor sensor electrical connector.

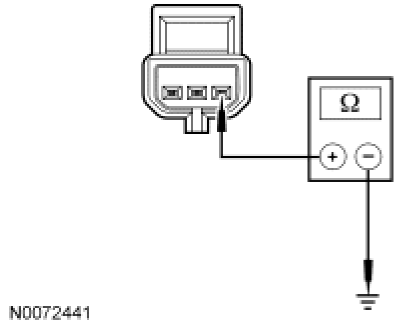


Fig. 447: Identifying LH Catalyst Monitor Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

17. Disconnect the LH VCT solenoid electrical connector.

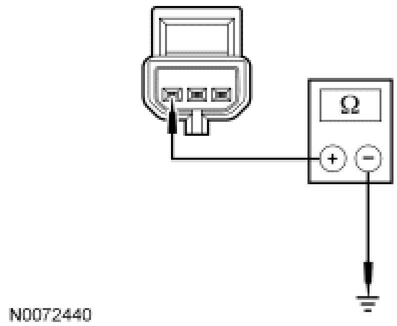


Fig. 448: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

18. Disconnect the 3 LH coil-on-plug electrical connectors.

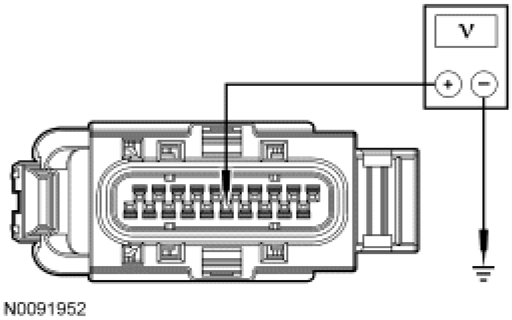


Fig. 449: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

19. Detach all of the wiring harness retainers from the LH valve cover and stud bolts.

NOTE:	**The A/C compressor must remain bolted to the engine block prior to installing the oil pan.**

20. Remove the A/C compressor nut and stud.

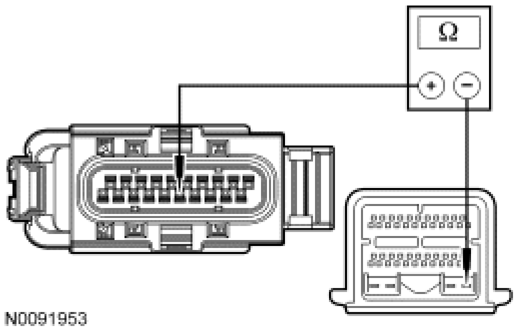


Fig. 450: Locating A/C Compressor Nut & Stud
Courtesy of FORD MOTOR CO.

21. Remove the 3 bolts and the power steering pump.

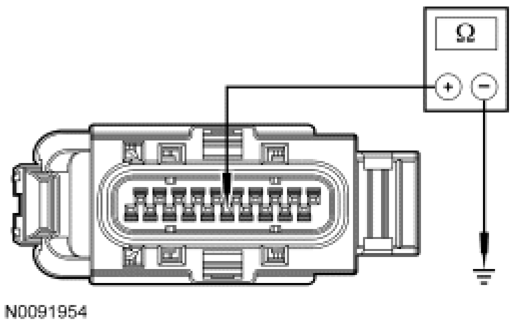


Fig. 451: Locating Power Steering Pump Bolts
Courtesy of FORD MOTOR CO.

22. Remove the 3 bolts and the accessory drive belt tensioner.

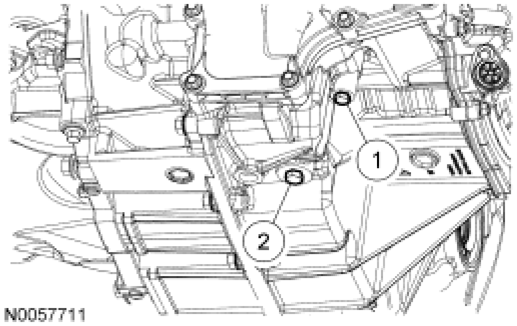


Fig. 452: Locating Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

23. Remove the 4 nuts (3 shown) and the LH catalytic converter.
    - Discard the nuts and the gasket.

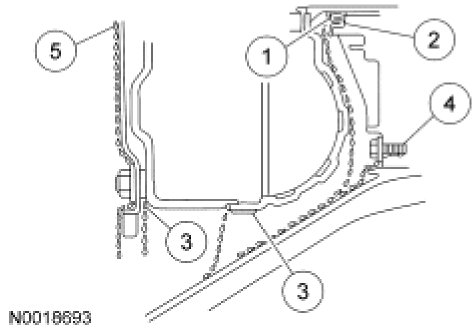


Fig. 453: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

FWD vehicles

24. Remove the 4 nuts and the RH catalytic converter.
    - Discard the nuts and the gasket.

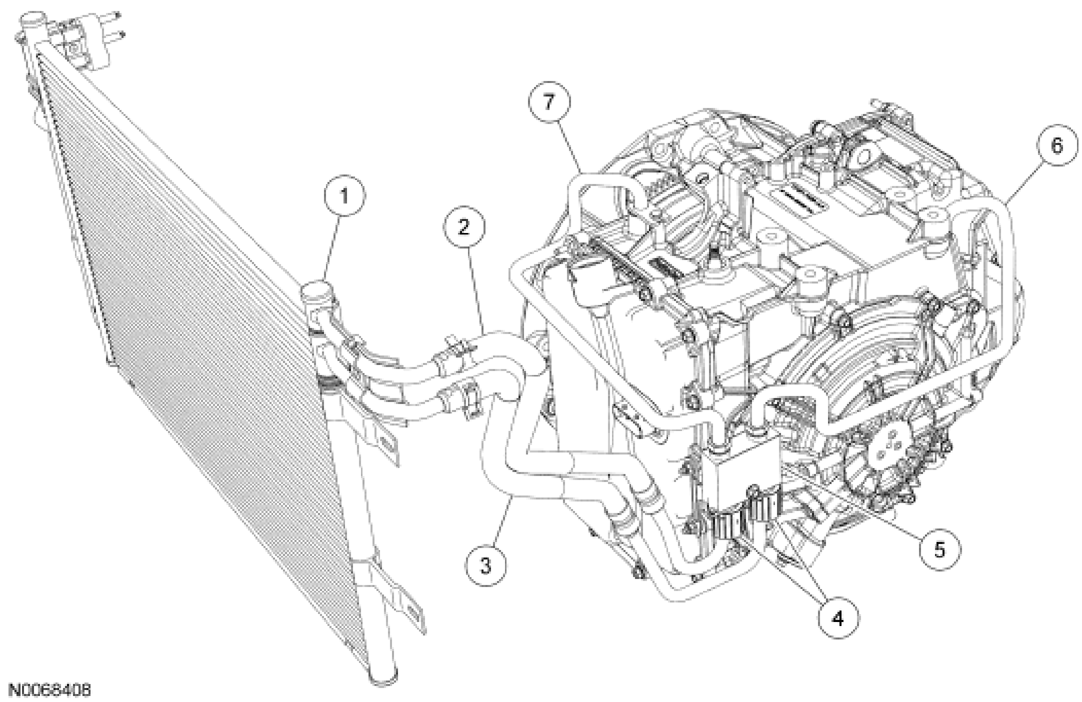


Fig. 454: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

All vehicles

25. Remove the RH cylinder block drain plug or, if equipped, the block heater.
    - Allow coolant to drain from the cylinder block.

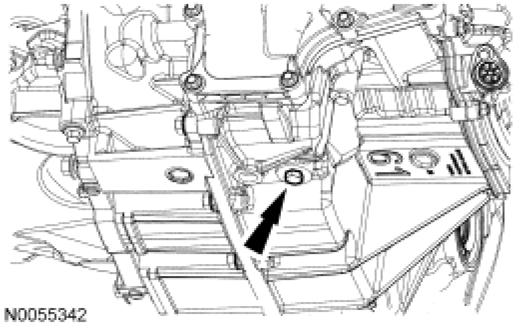


Fig. 455: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

26. Remove the LH cylinder block drain plug.
    - Allow coolant to drain from the cylinder block.

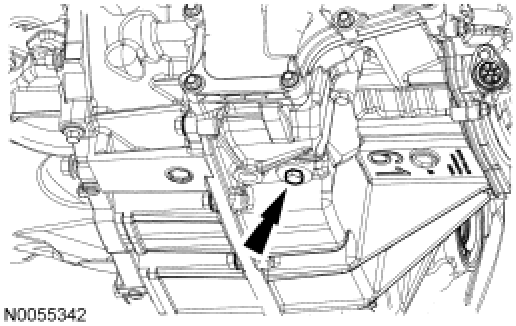


Fig. 456: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

27. Remove the 6 bolts and the 6 coil-on-plugs.

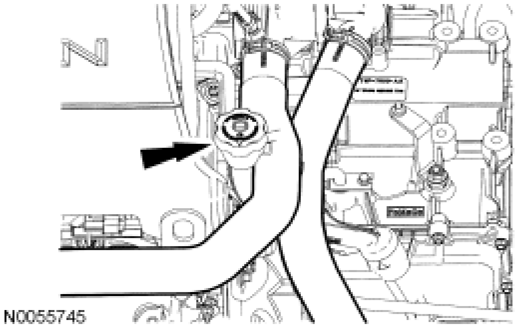


Fig. 457: Locating Coil-On-Plugs & Bolts
Courtesy of FORD MOTOR CO.

28. Remove the 11 stud bolts and the LH valve cover.

- Discard the gasket.

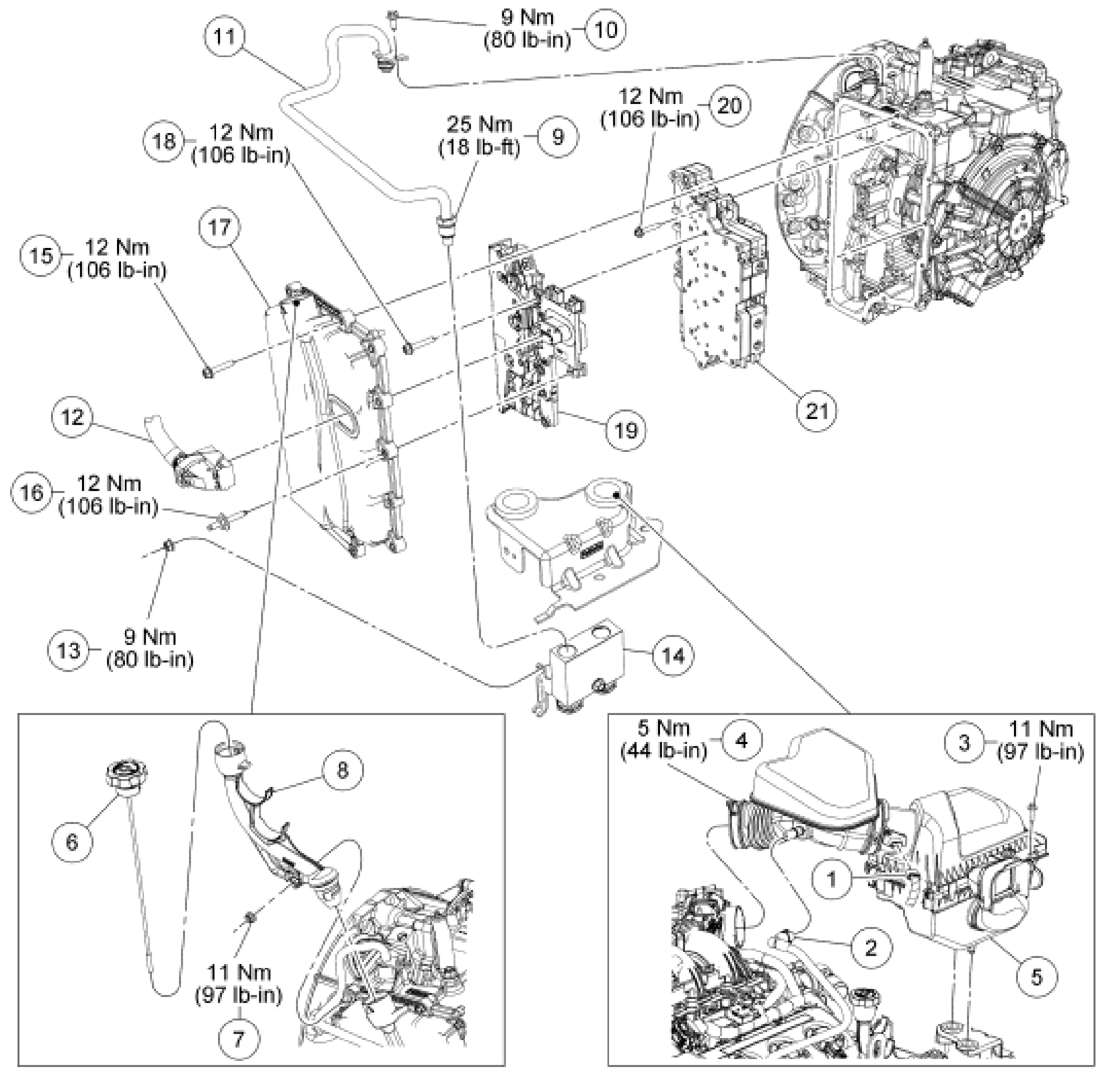


Fig. 458: Locating LH Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

29. Remove the bolt, the 10 stud bolts and the RH valve cover.
    - Discard the gasket.

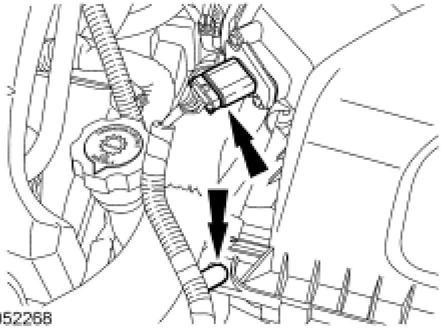

N0052268

Fig. 459: Locating RH Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

NOTE: VCT solenoid seal removal shown, spark plug tube seal removal similar.

30. Inspect the VCT solenoid seals and the spark plug tube seals. Remove any damaged seals.
    - Using the special tools, remove the seal(s).

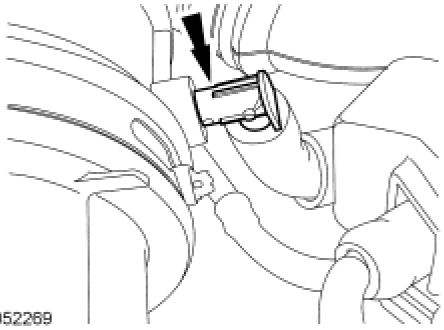

N0052269

Fig. 460: Removing Seals Using Special Tools (205-153) & (303-1247/1)
Courtesy of FORD MOTOR CO.

31. Using the special tool, remove the crankshaft bolt and washer.
    - Discard the bolt.

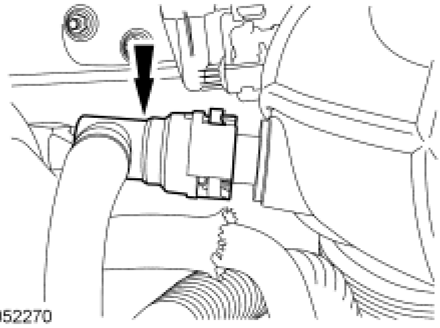

N0052270

Fig. 461: Removing Crankshaft Bolt & Washer Using Special Tool (303-D055)
Courtesy of FORD MOTOR CO.

32. Using the special tool, remove the crankshaft pulley.

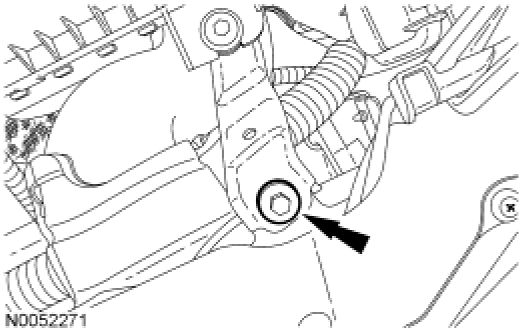


Fig. 462: Identifying Special Tools (303-D121) And Crankshaft Pulley
Courtesy of FORD MOTOR CO.

33. Using the special tool, remove and discard the crankshaft front seal.

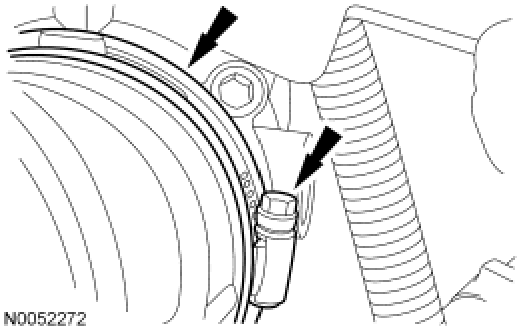


Fig. 463: Removing Crankshaft Front Seal Using Special Tool (303-409)
Courtesy of FORD MOTOR CO.

34. Remove the 2 bolts and the engine mount bracket.

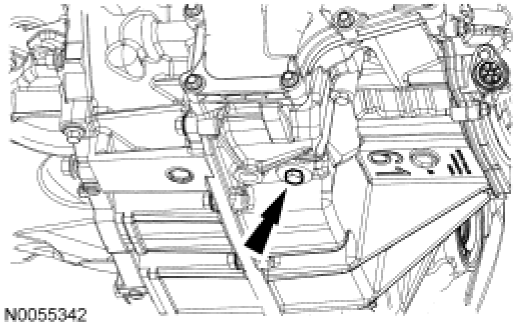


Fig. 464: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

35. Remove the 2 engine mount studs.

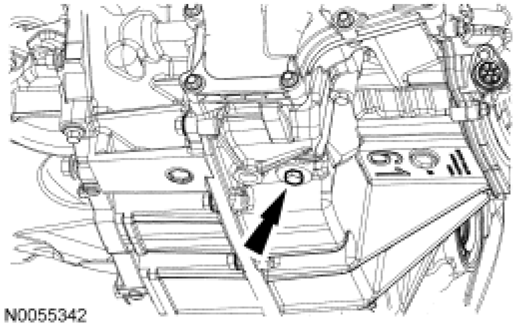


Fig. 465: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

36. Remove the 3 bolts and the engine mount bracket.

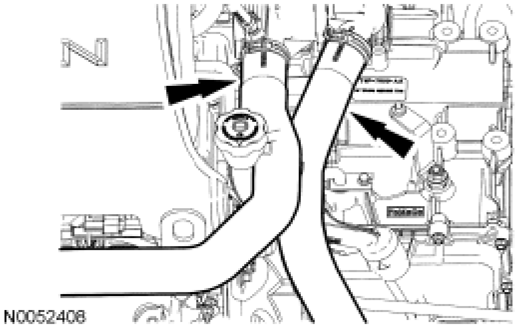


Fig. 466: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

37. Remove the 22 engine front cover bolts.

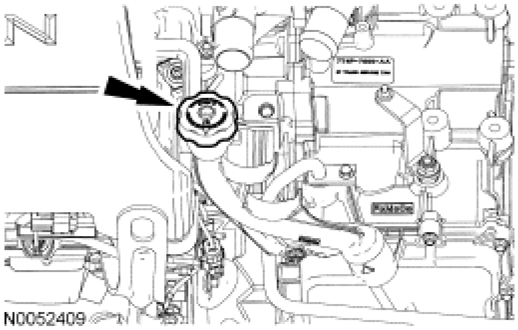


Fig. 467: Identifying Engine Front Cover Bolts
Courtesy of FORD MOTOR CO.

38. Install 6 of the engine front cover bolts (finger tight) into the 6 threaded holes in the engine front cover.
    - Tighten the bolts one turn at a time in a criss-cross pattern until the engine front cover-to-cylinder block seal is released.
        - Remove the engine front cover.

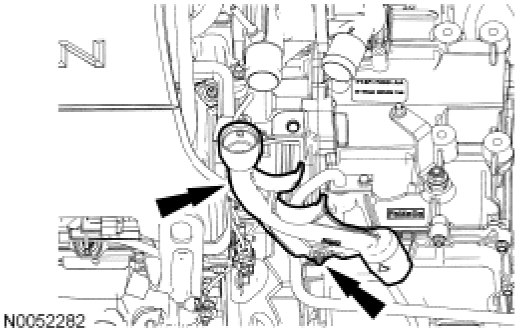


Fig. 468: Identifying Engine Front Cover Bolts
Courtesy of FORD MOTOR CO.

39. Remove the 16 oil pan bolts.

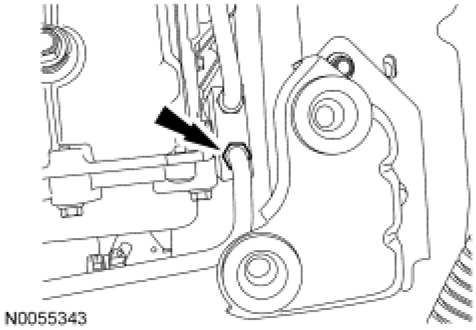


Fig. 469: Identifying Oil Pan Bolts
Courtesy of FORD MOTOR CO.

40. Install 2 of the oil pan bolts (finger tight) into the 2 threaded holes in the oil pan.
    - Alternately tighten the 2 bolts one turn at a time until the oil pan-to-cylinder block seal is released.
        - Remove the oil pan.

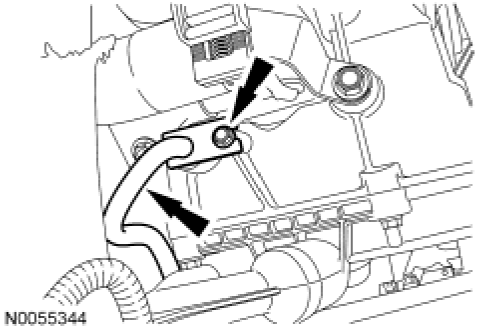


Fig. 470: Installing 2 Of Oil Pan Bolts (Finger Tight) Into 2 Threaded Holes In Oil Pan
Courtesy of FORD MOTOR CO.

CAUTION: Only use a 3M Roloc® Bristle Disk (2-in white, part number 07528) to

clean the engine front cover and oil pan. Do not use metal scrapers, wire brushes or any other power abrasive disk to clean the engine front cover. These tools cause scratches and gouges that make leak paths.

41. Clean the engine front cover and oil pan using a 3M Roloc® Bristle Disk (2-in white, part number 07528) in a suitable tool turning at the recommended speed of 15,000 rpm.
    - Thoroughly wash the engine front cover and oil pan to remove any foreign material, including any abrasive particles created during the cleaning process.

CAUTION: Place clean, lint-free shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.

CAUTION: Do not use wire brushes, power abrasive discs or 3M Roloc® Bristle Disk (2-in white part number 07528) to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. They also cause contamination that will cause premature engine failure. Remove all traces of the gasket.

42. Clean the sealing surfaces of the cylinder block in the following sequence.
    1. Remove any large deposits of silicone or gasket material.
    2. Apply silicone gasket remover and allow to set for several minutes.
    3. Remove the silicone gasket remover. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep to remove any remaining traces of oil or coolant and to prepare the surfaces to bond. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.
    5. Make sure the 2 locating dowel pins are seated correctly in the cylinder block.

OIL PUMP SCREEN AND PICKUP TUBE

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.

1. Remove the oil pan. For additional information, refer to **Oil Pan**.
2. Remove the 3 bolts and the oil pump screen and pickup tube.
    - Discard the O-ring seal.

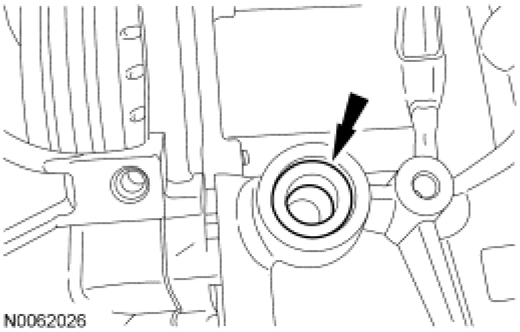
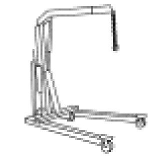
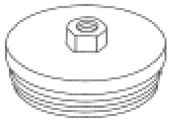
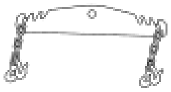


Fig. 471: Identifying Oil Pump Screen, Pickup Tube & Bolts
Courtesy of FORD MOTOR CO.

CRANKSHAFT REAR SEAL WITH RETAINER PLATE

Special Tools

Illustration	Tool Name	Tool Number
	Heavy Duty Floor Crane	014-00071 or equivalent
	Remover, Crankshaft Rear Oil Seal	303-519 (T95P-6701-EH)
	Slide Hammer	307-005 (T59L-100-B)
	Spreader Bar	303-D089 (D93P-6001-A3) or equivalent

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31-A	-
Silicone Gasket Remover	-

ZC-30	

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.

NOTE: This procedure is for removal of the crankshaft rear seal and retainer plate and requires removal of the oil pan. If only removing the crankshaft rear seal, refer to Crankshaft Rear Seal.

1. Remove the oil pan. For additional information, refer to **Oil Pan**.
2. Using the Heavy Duty Floor Crane and Spreader Bar, remove the engine from the stand.

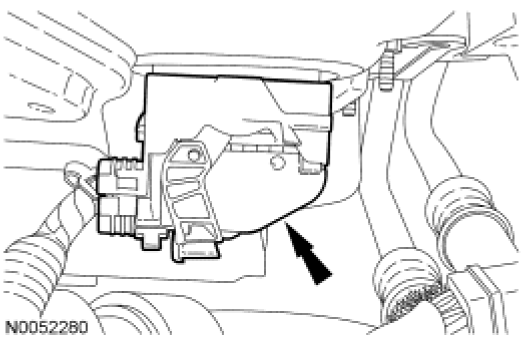


Fig. 472: Identifying Heavy Duty Floor Crane and Spreader Bar
Courtesy of FORD MOTOR CO.

3. Disconnect the Crankshaft Position (CKP) sensor electrical connector.

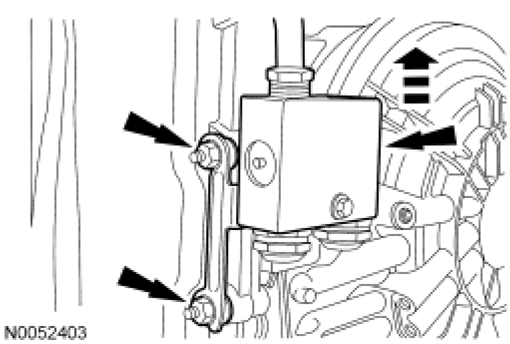


Fig. 473: Identifying Crankshaft Position (CKP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

4. Remove the bolt and the CKP sensor.

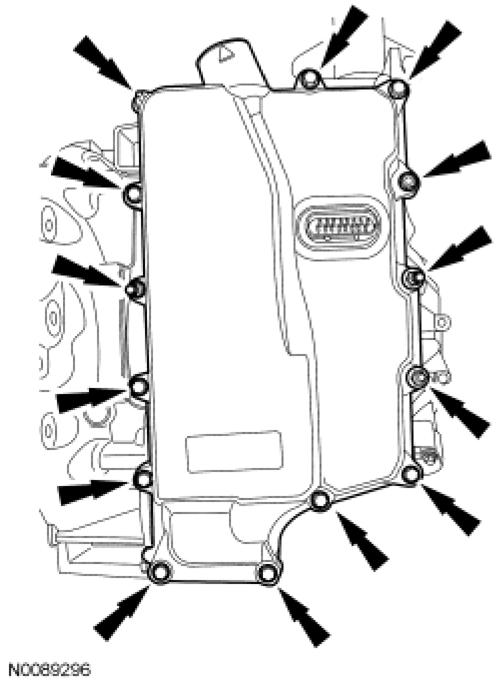


Fig. 474: Identifying CKP Sensor & Bolt
Courtesy of FORD MOTOR CO.

5. Using the Crankshaft Rear Oil Seal Remover and Slide Hammer, remove and discard the rear crankshaft seal.

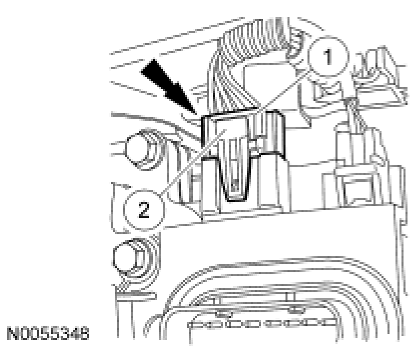


Fig. 475: Removing Crankshaft Rear Seal Using Special Tools (303-519) & (307-005)
Courtesy of FORD MOTOR CO.

6. Remove the 8 crankshaft rear seal retainer bolts.

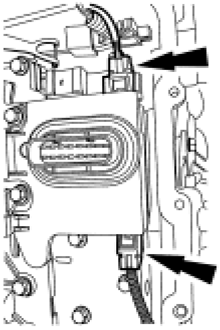

N0055349

Fig. 476: Locating Crankshaft Rear Seal Retainer Bolts
Courtesy of FORD MOTOR CO.

7. Install the 2 M6 oil pan bolts (finger tight) into the 2 threaded holes in the crankshaft rear seal retainer.
    - Alternately tighten the 2 bolts one turn at a time until the crankshaft rear seal retainer-to-cylinder block seal is released.
        - Remove the crankshaft rear seal retainer.

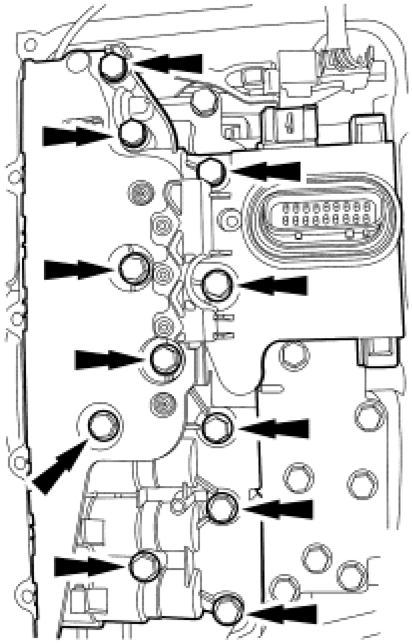

N0055350

Fig. 477: Identifying M6 Oil Pan Bolts
Courtesy of FORD MOTOR CO.

NOTE:	**Only use a 3M Roloc® Bristle Disk, (2-in white, part number 07528) to clean the crankshaft rear seal retainer plate. Do not use metal scrapers, wire brushes or any other power abrasive disk to clean the crankshaft rear seal retainer plate. These tools cause scratches and gouges that make leak paths.**

8. Clean the crankshaft rear seal retainer plate using a 3M Roloc® Bristle Disk, (2-in white, part number 07528) in a suitable tool turning at the recommended speed of 15,000 rpm.
    - Thoroughly wash the crankshaft rear seal retainer plate to remove any foreign material, including any abrasive particles created during the cleaning process.

NOTE: **Place clean, lint-free shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.**

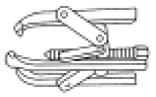
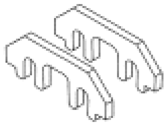
NOTE: **Do not use wire brushes, power abrasive discs or 3M Roloc® Bristle Disk (2-in white, part number 07528) to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. They also cause contamination that will cause premature engine failure. Remove all traces of the gasket.**

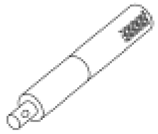
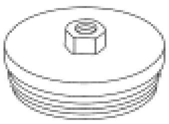
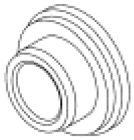
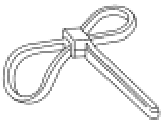
9. Clean the sealing surfaces of the cylinder block in the following sequence.
    1. Remove any large deposits of silicone or gasket material.
    2. Apply silicone gasket remover and allow to set for several minutes.
    3. Remove the silicone gasket remover. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep to remove any remaining traces of oil or coolant and to prepare the surfaces to bond. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.

DISASSEMBLY

ENGINE

Special Tools

Illustration	Tool Name	Tool Number
 ST1184-A	3-Jaw Puller	303-D121
 ST2979-A	Camshaft Alignment Tool	303-1248

 ST1326-A	Handle	205-153 (T80T-4000-W)
 ST1382-A	Remover, Crankshaft Rear Oil Seal	303-519 (T95P-6701-EH)
 ST1385-A	Remover, Oil Seal	303-409 (T92C-6700CH)
 ST2982-A	Remover, Seal	303-1247/1
 ST1187-A	Slide Hammer	307-005 (T59L-100-B)
 ST1438-A	Strap Wrench	303-D055 (D85L-6000-A)

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31-A	-
Silicone Gasket Remover ZC-30	-

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

NOTE: **For additional information, refer to the exploded view under the assembly procedure in this service information.**

All vehicles

1. Remove the 8 bolts and the flexplate.

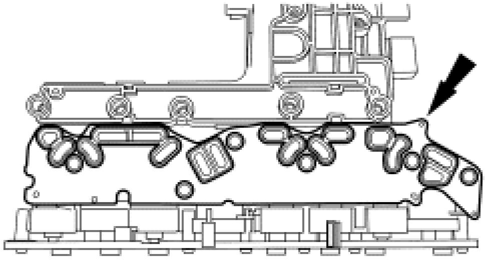

N0055016

Fig. 478: Identifying Flexplate & Bolts
Courtesy of FORD MOTOR CO.

2. Remove the crankshaft sensor ring.

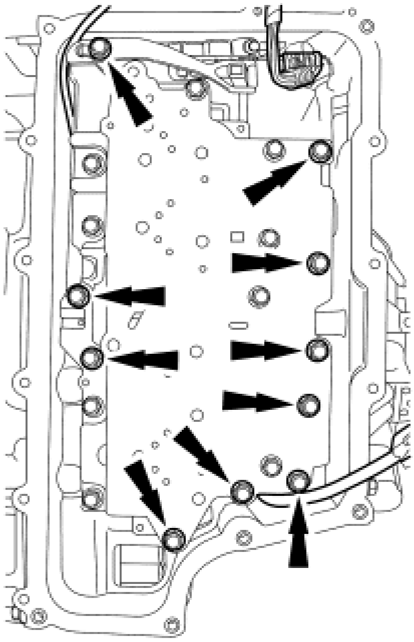

N0057465

Fig. 479: Identifying Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

3. Using the special tools, remove and discard the rear crankshaft seal.

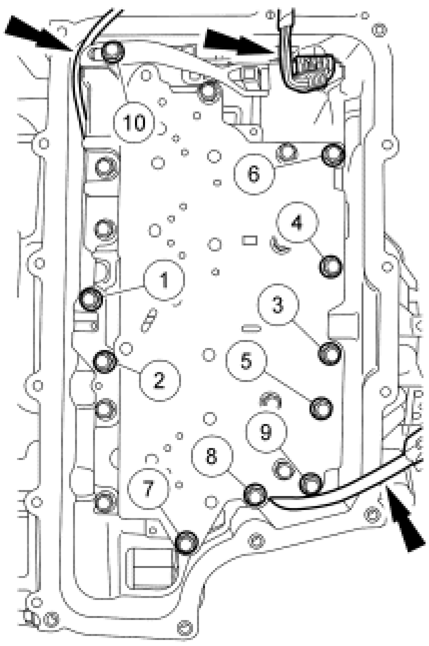


Fig. 480: Removing Crankshaft Rear Seal Using Special Tools (303-519) & (307-005)
Courtesy of FORD MOTOR CO.

CAUTION: Install the engine stand bolts into the cylinder block only. Do not install the bolts into the oil pan.

4. Mount the engine on a suitable engine stand.
5. If equipped, remove the heat shield and disconnect the block heater electrical connector.
   - Detach all of the engine block heater harness retainers and remove the harness.

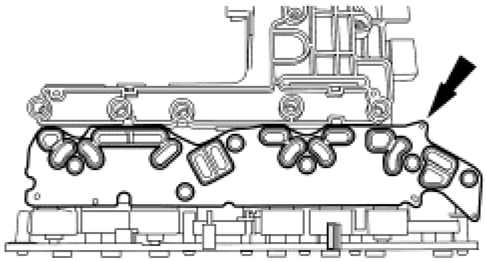


Fig. 481: Identifying Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

6. Disconnect the PCV hose from the PCV valve.

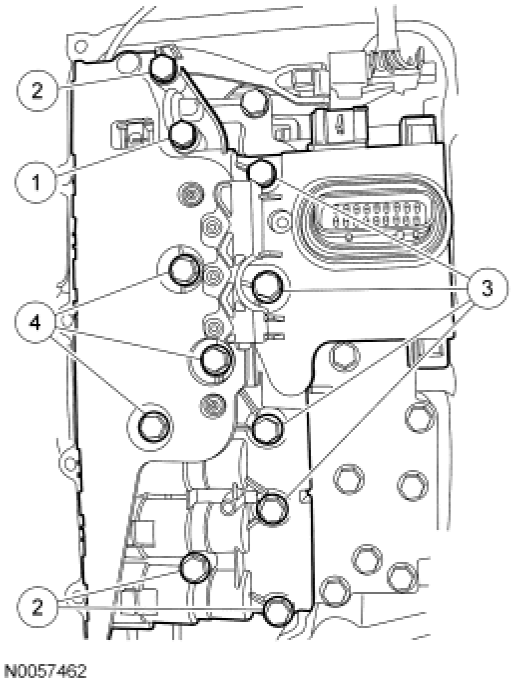


Fig. 482: Identifying PCV Hose
Courtesy of FORD MOTOR CO.

7. Disconnect the throttle body (TB) electrical connector.

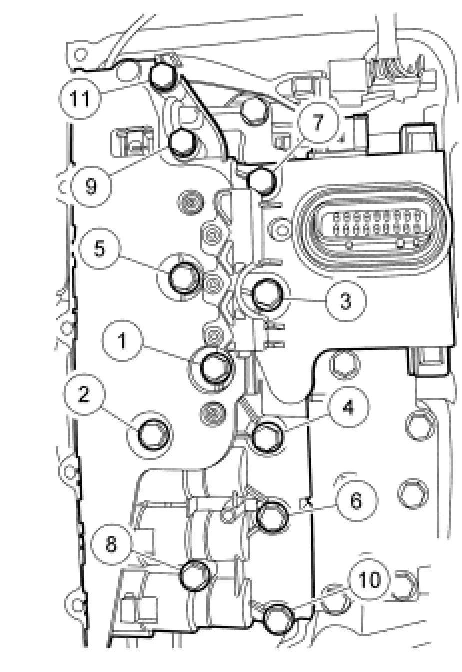


Fig. 483: Locating Throttle Body Electrical Connector

Courtesy of FORD MOTOR CO.

8. Detach the wiring harness retainers from the upper intake manifold.

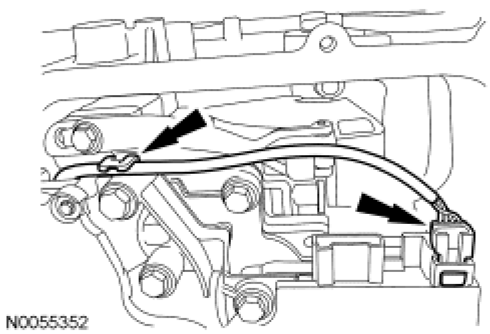


Fig. 484: Locating Wiring Harness Retainers From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

9. Remove the upper intake manifold support bracket bolt.

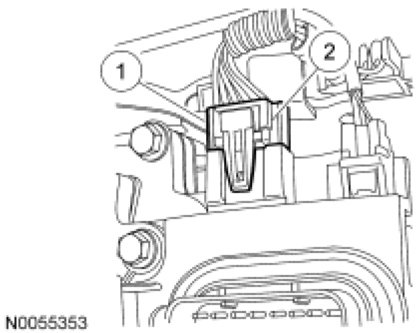


Fig. 485: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

10. Remove the 6 bolts and the upper intake manifold in the following sequence.
    - Discard the gaskets.

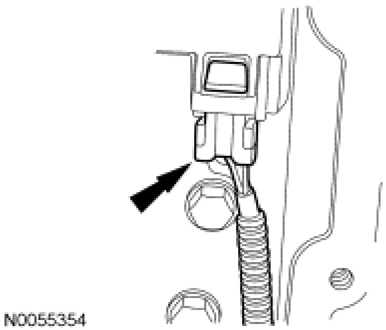


Fig. 486: Identifying Bolt Sequence
Courtesy of FORD MOTOR CO.

11. Disconnect the power steering pressure (PSP) switch electrical connector.

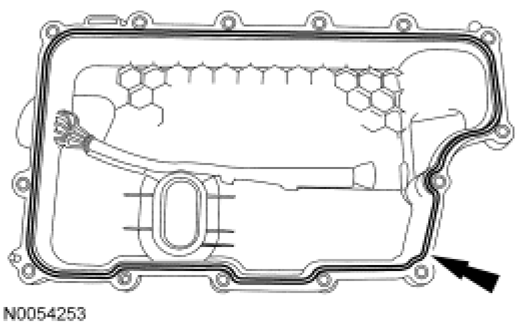


Fig. 487: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

12. Disconnect the RH catalyst monitor sensor electrical connector.

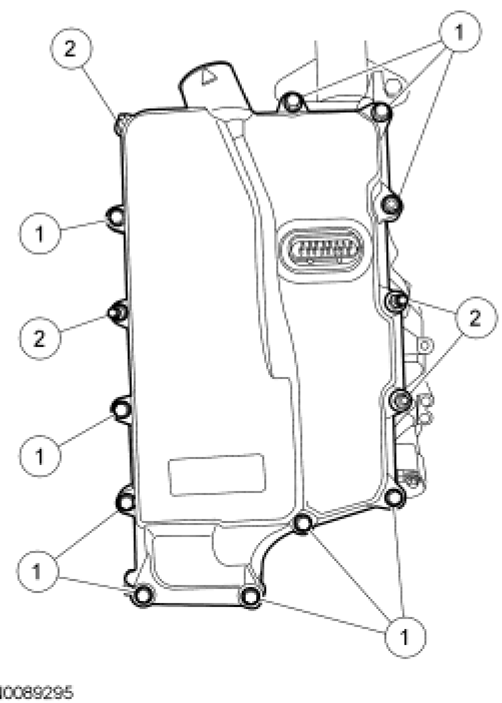


Fig. 488: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

13. Disconnect the RH heated oxygen sensor (HO2S) electrical connector.

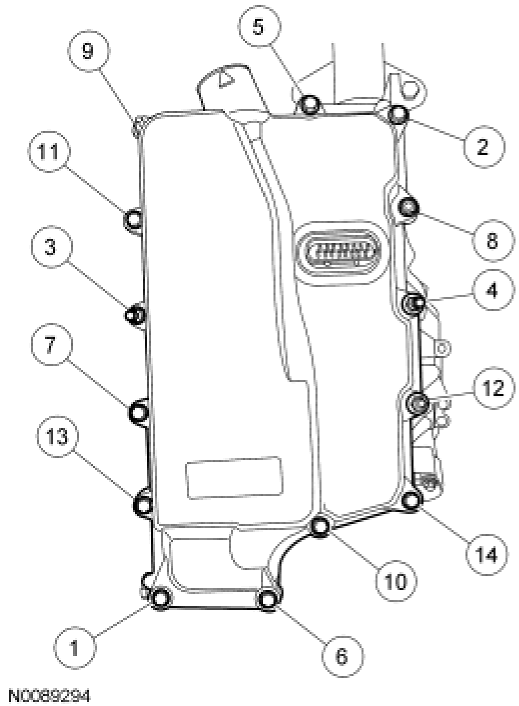


Fig. 489: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

14. Disconnect the RH variable camshaft timing (VCT) solenoid electrical connector.

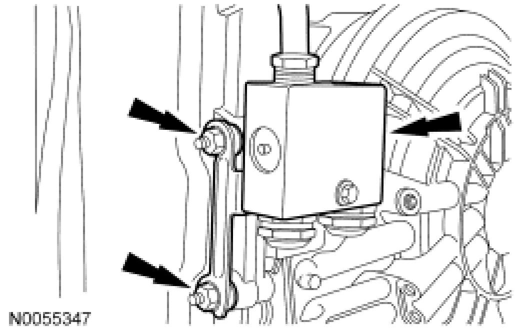


Fig. 490: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

15. Disconnect the 3 RH coil-on-plug electrical connectors.

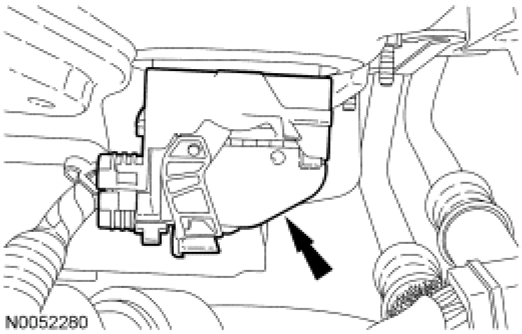


Fig. 491: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

16. Detach all of the wiring harness retainers from the RH valve cover and stud bolts.
17. Disconnect the RH camshaft position (CMP) sensor electrical connector.

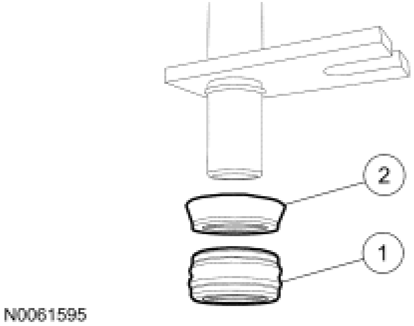


Fig. 492: Locating RH Camshaft Position (CMP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

18. Disconnect the knock sensor (KS) electrical connector.

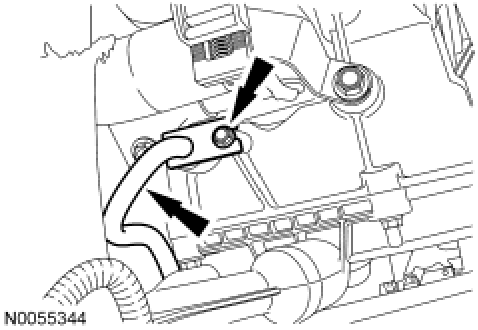


Fig. 493: Locating Knock Sensor (KS) Electrical Connector
Courtesy of FORD MOTOR CO.

19. Remove the bolt and the ground cable from the RH cylinder.

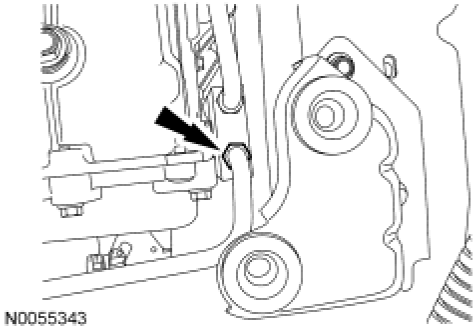


Fig. 494: Locating Ground Cable From RH Cylinder
Courtesy of FORD MOTOR CO.

20. Disconnect the 6 fuel injector electrical connectors (3 shown).

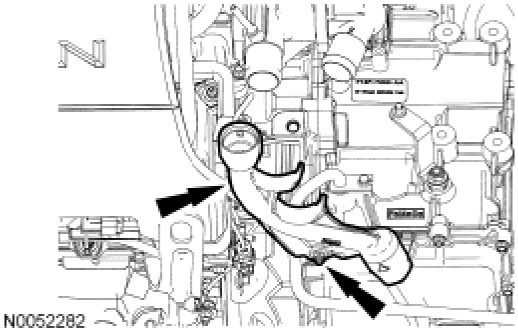


Fig. 495: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

21. Disconnect the cylinder head temperature (CHT) sensor electrical connector.

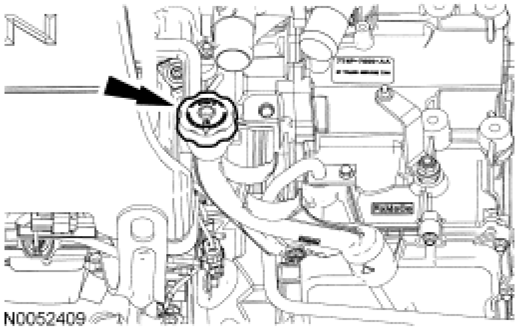


Fig. 496: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

22. Disconnect the LH CMP sensor electrical connector.

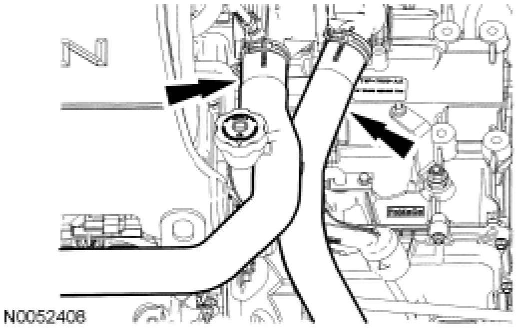


Fig. 497: Locating LH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

23. Disconnect the LH catalyst monitor sensor electrical connector.

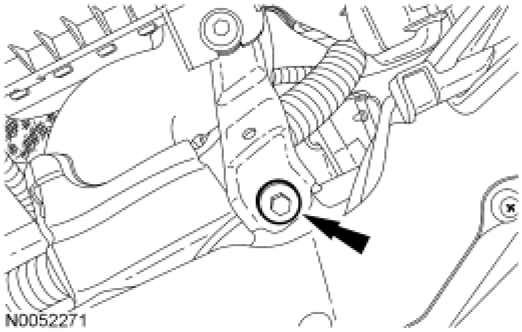


Fig. 498: Identifying LH Catalyst Monitor Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

24. Disconnect the LH HO2S electrical connector.

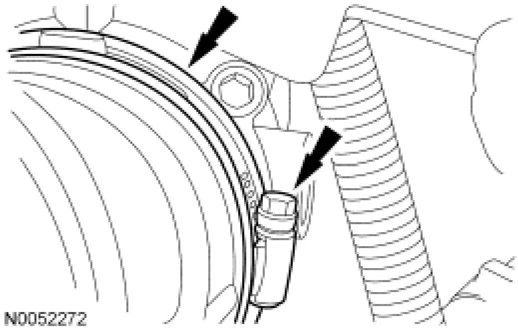


Fig. 499: Locating LH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

25. Disconnect the 3 LH coil-on-plug electrical connectors.

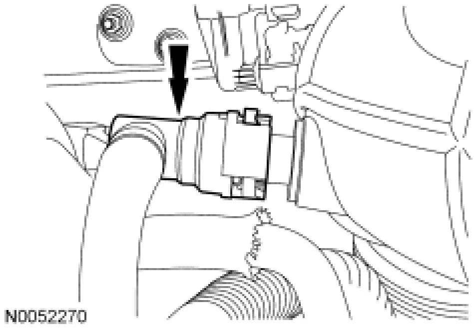


Fig. 500: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

26. Disconnect the LH VCT solenoid electrical connector.

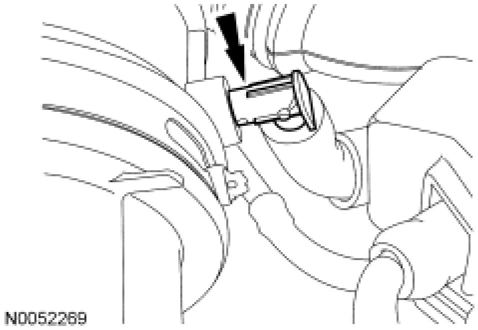


Fig. 501: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

27. Detach all of the wiring harness retainers from the LH valve cover and stud bolts.
28. Remove the wiring harness retainer bolt from the rear of the LH cylinder head.

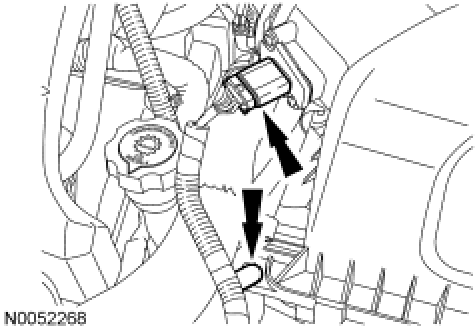


Fig. 502: Identifying Wiring Harness Retainer Bolt From Rear Of LH Cylinder Head
Courtesy of FORD MOTOR CO.

29. Remove the nut, the bolt and the heat shield.

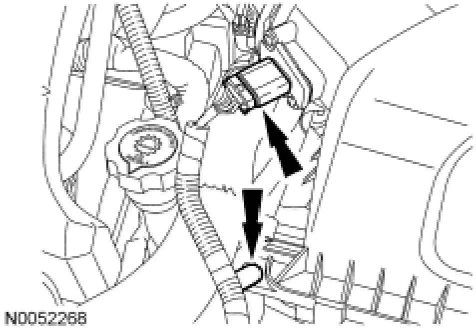


Fig. 503: Identifying Heat Shield, Nut & Bolt
Courtesy of FORD MOTOR CO.

30. Remove the wiring harness retainer stud bolt.

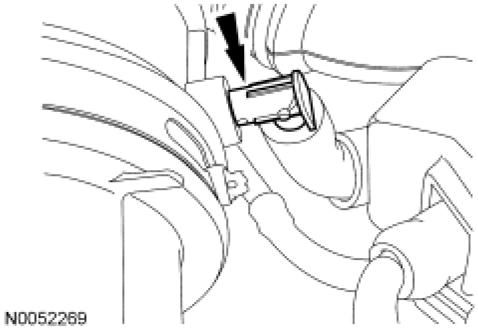


Fig. 504: Identifying Wiring Harness Retainer Stud Bolt
Courtesy of FORD MOTOR CO.

31. Remove the wiring harness grommet.

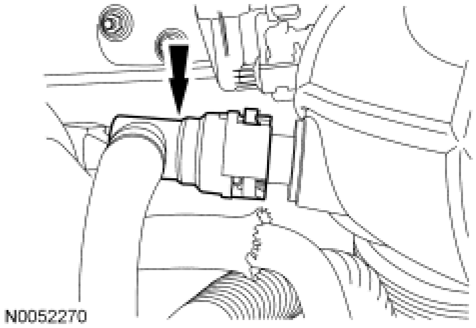


Fig. 505: Identifying Wiring Harness Grommet
Courtesy of FORD MOTOR CO.

32. Disconnect the crankshaft position (CKP) sensor electrical connector.

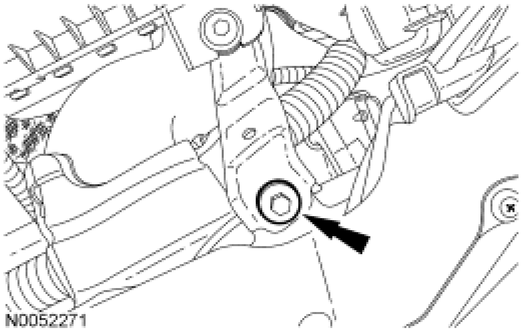


Fig. 506: Identifying Crankshaft Position (CKP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

33. Disconnect the A/C compressor electrical connector.

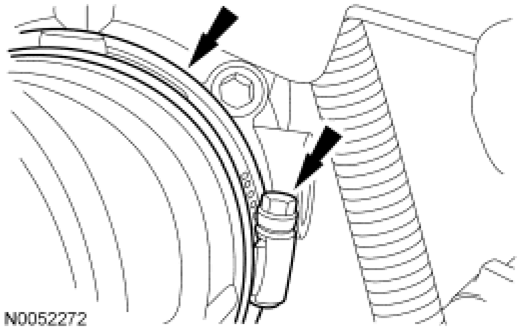


Fig. 507: Identifying A/C Compressor Electrical Connector
Courtesy of FORD MOTOR CO.

34. Remove the nut and disconnect the generator B+ cable.

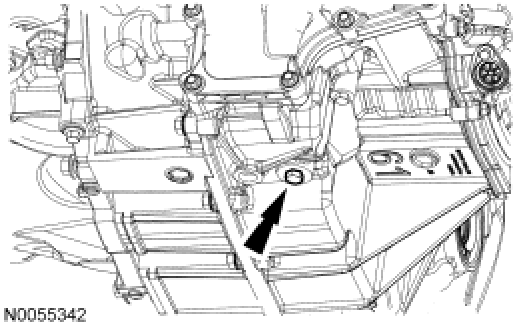


Fig. 508: Identifying Generator B+ Cable & Nut
Courtesy of FORD MOTOR CO.

35. Disconnect the generator electrical connector.

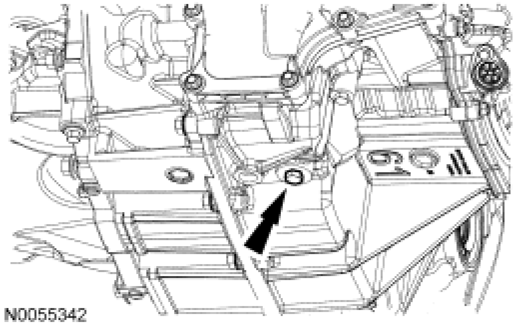


Fig. 509: Identifying Generator Electrical Connector
Courtesy of FORD MOTOR CO.

36. Detach the wiring harness retainer from the generator.

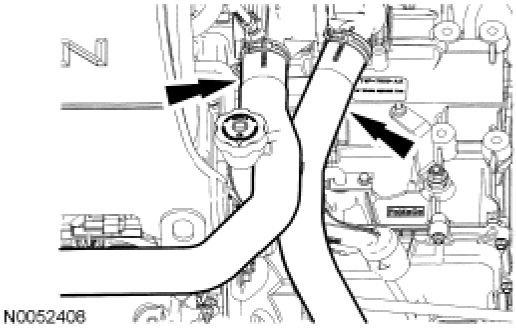


Fig. 510: Identifying Wiring Harness Retainer From Generator
Courtesy of FORD MOTOR CO.

37. Disconnect the engine oil pressure (EOP) switch electrical connector and the wiring harness pin-type retainer.
    - Remove the wiring harness from the engine.

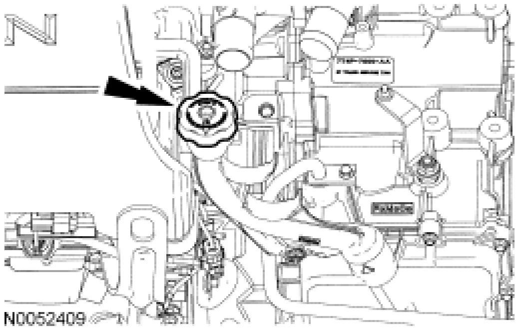


Fig. 511: Locating Engine Oil Pressure (EOP) Switch Electrical Connector & Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

38. Remove the nut, 2 bolts and the A/C compressor.

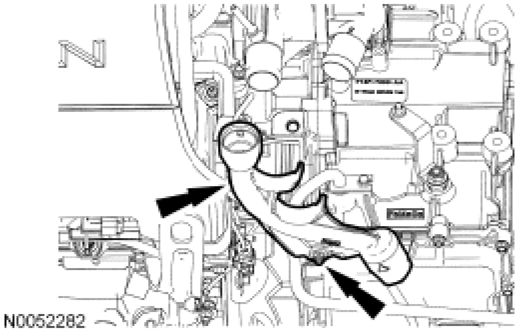


Fig. 512: Locating A/C Compressor, Bolts & Nuts
Courtesy of FORD MOTOR CO.

39. Remove the A/C compressor mounting stud from the oil pan.

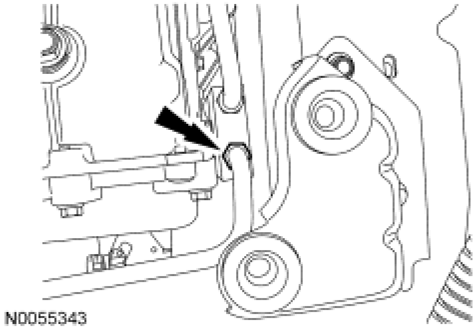


Fig. 513: Locating A/C Compressor Mounting Stud
Courtesy of FORD MOTOR CO.

40. Remove the nut, bolt and the generator.

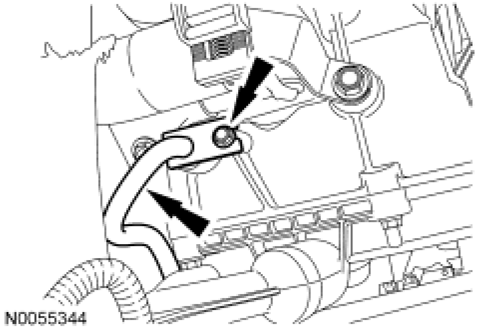


Fig. 514: Locating Generator, Bolts & Nuts
Courtesy of FORD MOTOR CO.

41. Remove the 3 bolts and the power steering pump.

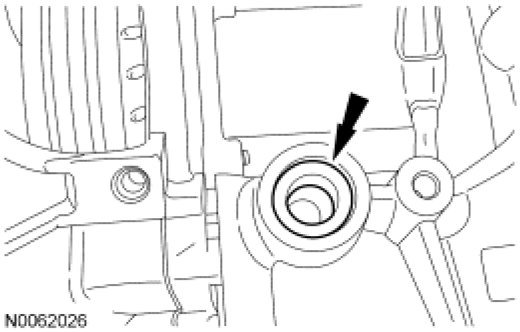


Fig. 515: Locating Power Steering Pump Bolts
Courtesy of FORD MOTOR CO.

42. Remove the 3 bolts and the accessory drive belt tensioner.

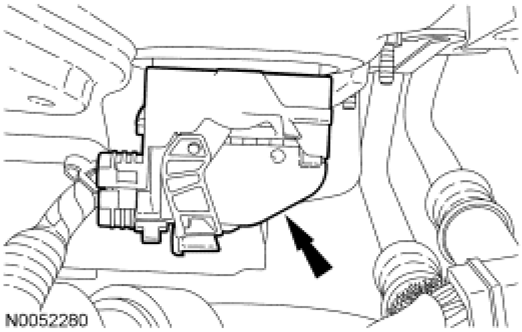


Fig. 516: Locating Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

43. Remove the 4 nuts (3 shown) and the LH catalytic converter.
    - Discard the nuts and the gasket.

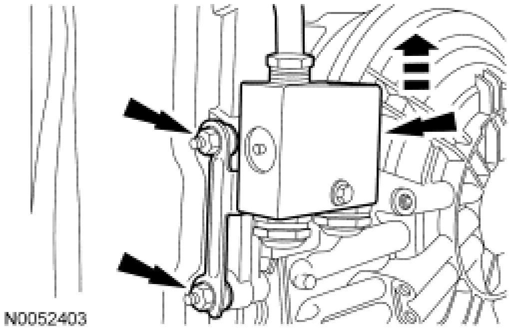


Fig. 517: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

44. Remove the 3 bolts and the LH exhaust manifold heat shield.

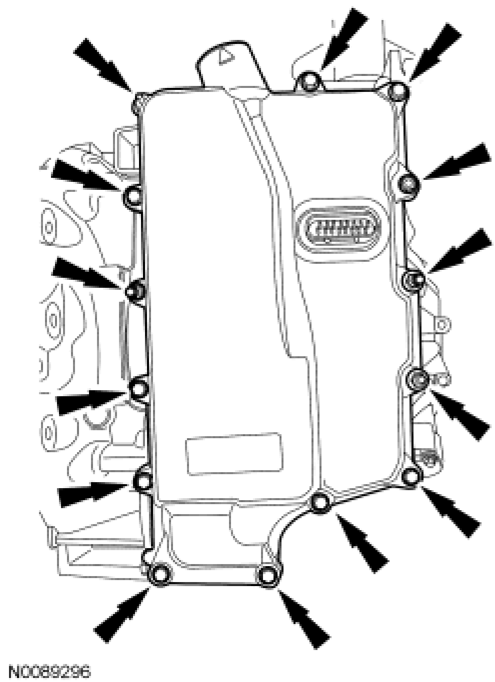


Fig. 518: Locating LH Exhaust Manifold Heat Shield & Nuts
Courtesy of FORD MOTOR CO.

45. Remove the 6 nuts and the LH exhaust manifold.
    - Discard the nuts and exhaust manifold gaskets.

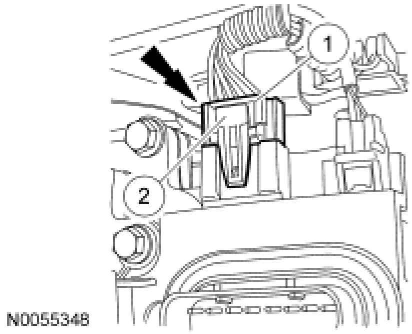


Fig. 519: Locating LH Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

46. Clean and inspect the LH exhaust manifold. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
47. Remove and discard the 6 LH exhaust manifold studs.

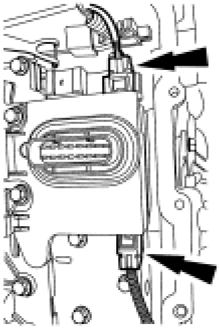

N0055349

Fig. 520: Locating LH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

FWD vehicles

48. Remove the 4 nuts and the RH catalytic converter.
    - Discard the nuts and the gasket.

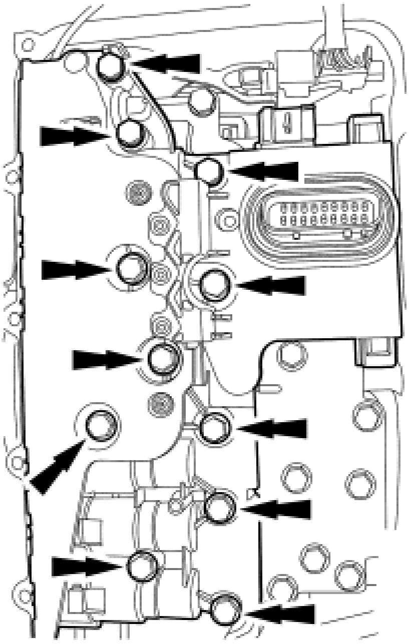
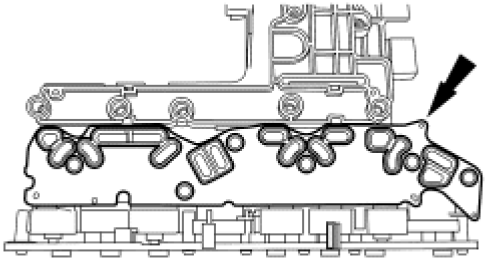

N0055350

Fig. 521: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

All vehicles

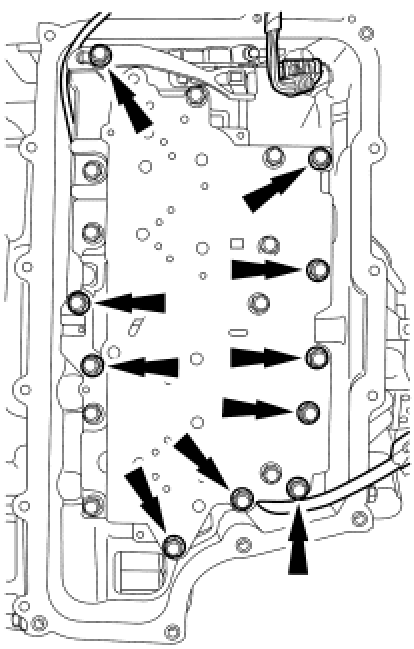
49. Remove the 3 bolts and the RH exhaust manifold heat shield.



N0055016

Fig. 522: Locating RH Exhaust Manifold Heat Shield & Nuts
Courtesy of FORD MOTOR CO.

50. Remove the 6 nuts and the RH exhaust manifold.
    - Discard the nuts and exhaust manifold gaskets.



N0057465

Fig. 523: Locating RH Exhaust Manifold & Nuts
Courtesy of FORD MOTOR CO.

51. Clean and inspect the RH exhaust manifold. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
52. Remove and discard the 6 RH exhaust manifold studs.

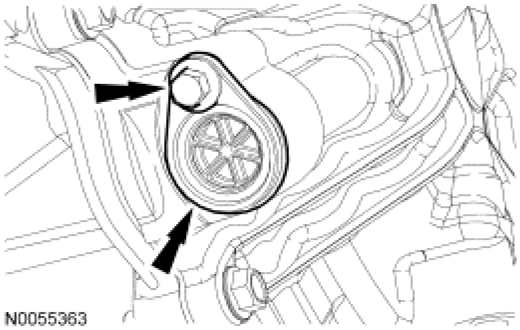


Fig. 524: Locating RH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

53. Remove the RH cylinder block drain plug or, if equipped, the block heater.
    - Allow coolant to drain from the cylinder block.

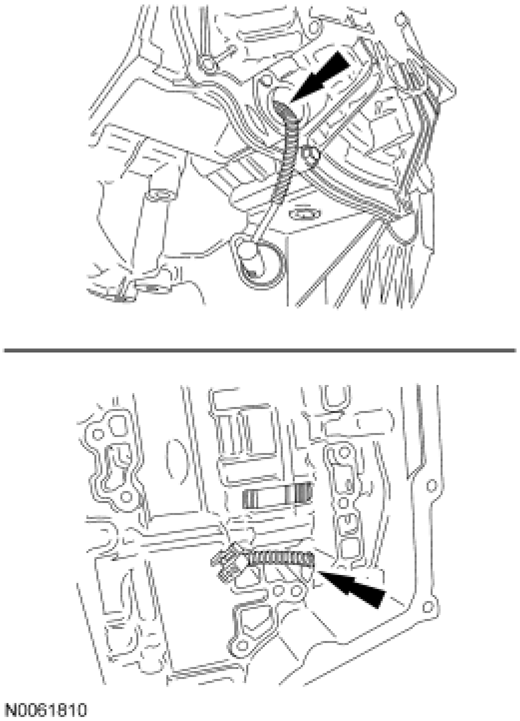


Fig. 525: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

54. Remove the LH cylinder block drain plug.
    - Allow coolant to drain from the cylinder block.

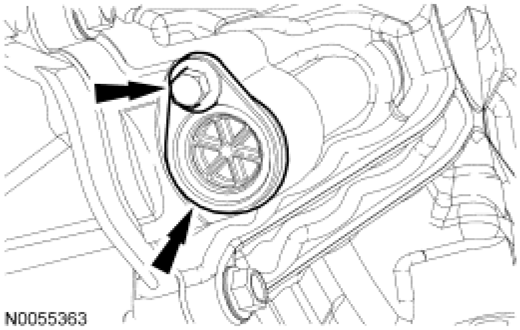


Fig. 526: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

55. Remove the pin-type retainer and the cover.

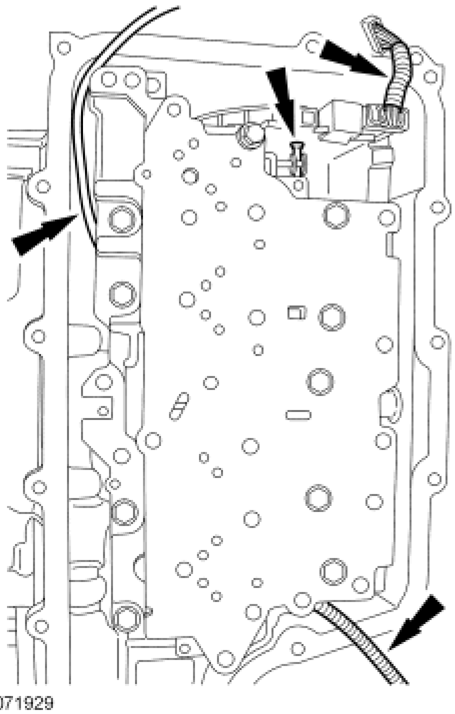


Fig. 527: Locating Pin-Type Retainer & Cover
Courtesy of FORD MOTOR CO.

56. Remove the 2 bolts and the engine lifting eye.

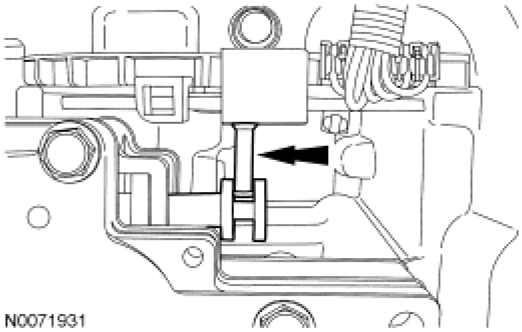


Fig. 528: Locating Engine Lifting Eye & Bolts
Courtesy of FORD MOTOR CO.

57. Remove the bolt and the upper intake manifold bracket.

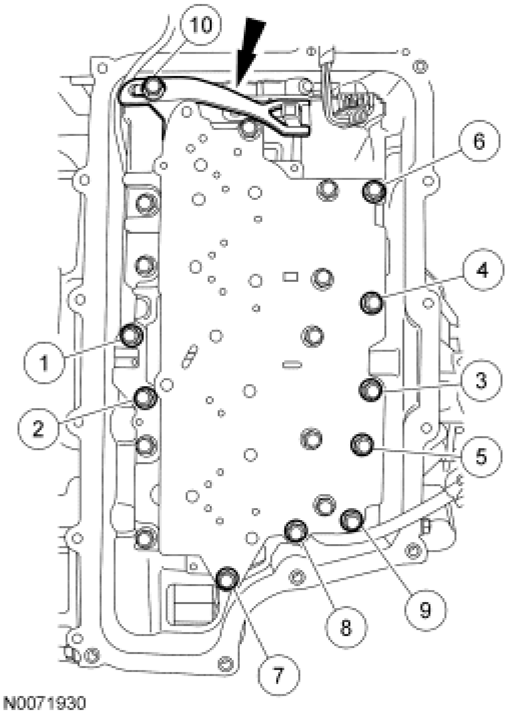


Fig. 529: Locating Upper Intake Manifold Bracket & Bolt
Courtesy of FORD MOTOR CO.

58. Remove the bolt and the RH CMP sensor.

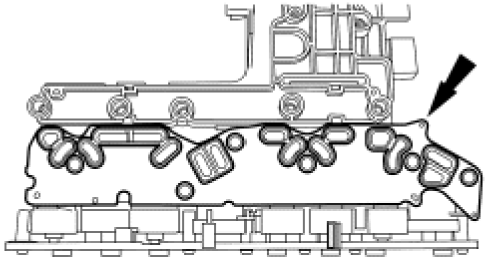


Fig. 530: Locating RH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

59. Remove the 2 bolts and the catalytic converter bracket.

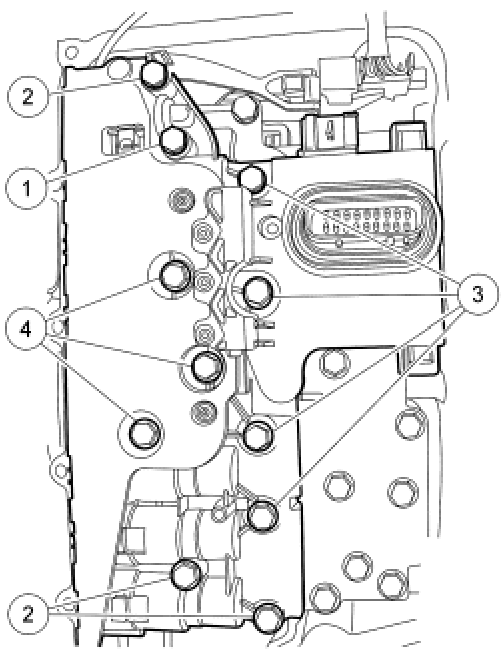


Fig. 531: Locating Catalytic Converter Bracket & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

60. Remove the 4 bolts and the fuel rail and injectors as an assembly.

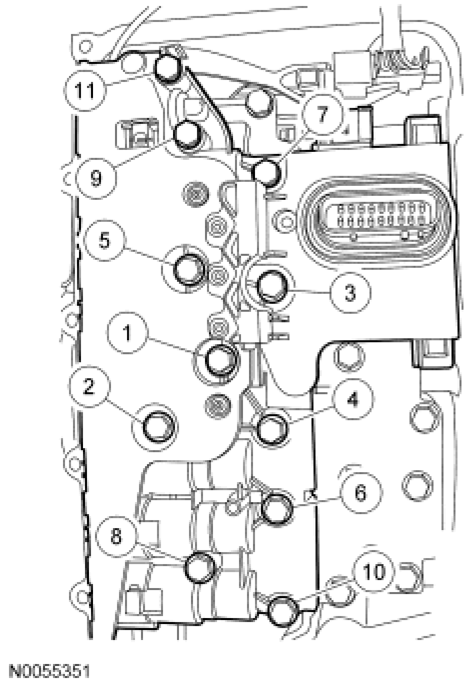


Fig. 532: Identifying 4 Bolts And Fuel Rail
Courtesy of FORD MOTOR CO.

61. Remove the 3 thermostat housing-to-lower intake manifold bolts.
    - Remove the thermostat housing and discard the gasket.

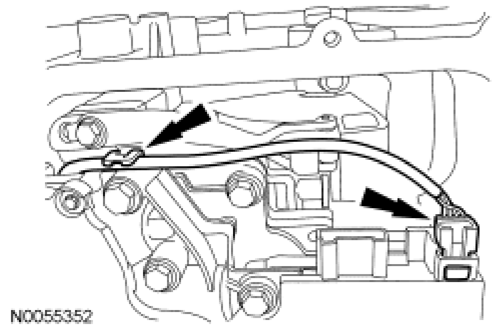


Fig. 533: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

62. Remove the 10 bolts and the lower intake manifold.
    - Discard the gaskets.

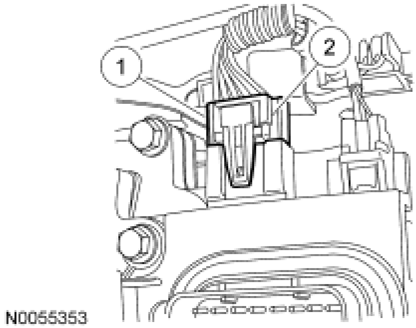


Fig. 534: Locating Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

63. Disconnect and remove the CHT sensor jumper harness.

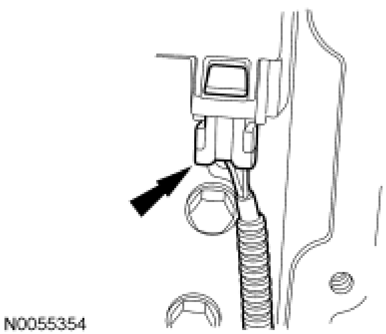


Fig. 535: Identifying CHT Sensor Jumper Harness
Courtesy of FORD MOTOR CO.

64. Remove the bolt and the LH CMP sensor.

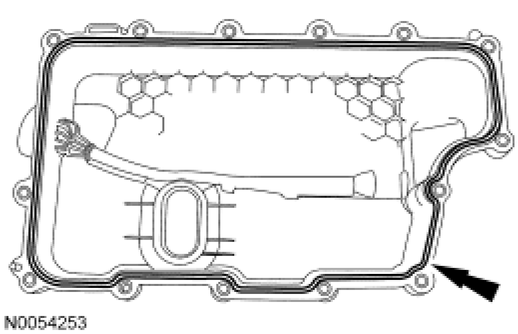


Fig. 536: Locating LH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

65. Remove the bolt and the CKP sensor.

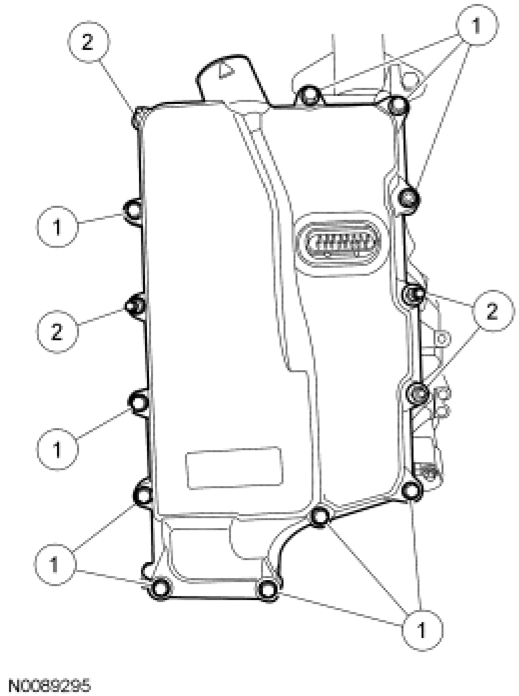


Fig. 537: Identifying CKP Sensor & Bolt
Courtesy of FORD MOTOR CO.

66. Remove the EOP switch.

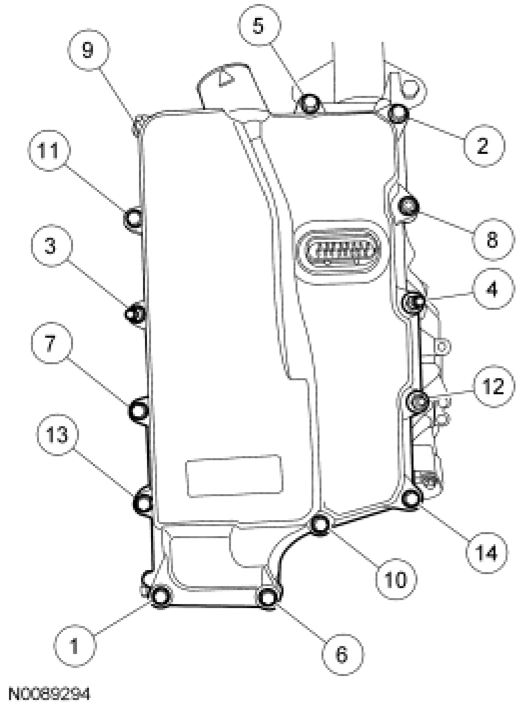


Fig. 538: Identifying EOP Switch

Courtesy of FORD MOTOR CO.

CAUTION: A new oil cooler must be installed or severe damage to the engine can occur.

67. If equipped, remove the 6 bolts and the oil cooler.
    - Discard the oil cooler and the gaskets.

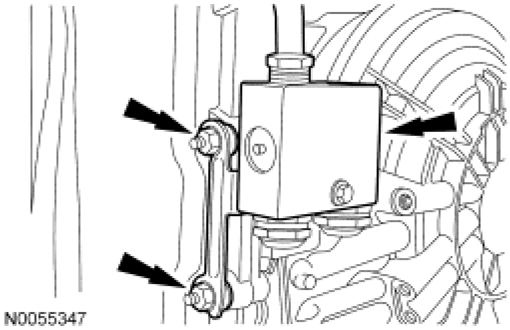


Fig. 539: Identifying Oil Cooler, Gaskets & Bolts
Courtesy of FORD MOTOR CO.

NOTE: Engine without oil cooler shown, engine with oil cooler similar.

68. Remove the 2 bolts and the oil filter adapter.
    - Discard the gasket and O-ring seal (on banjo bolt).

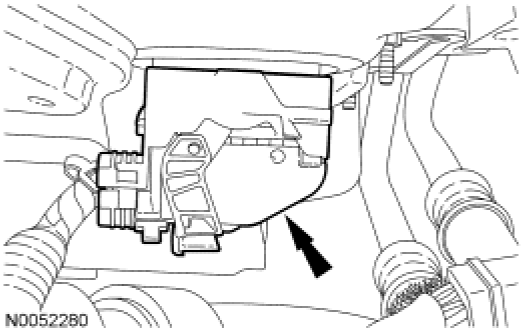


Fig. 540: Locating Oil Filter Adapter & Bolts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

69. Remove the 6 bolts and the 6 coil-on-plugs.

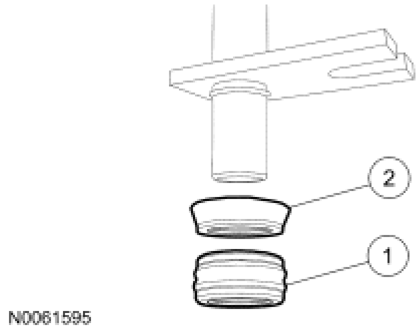


Fig. 541: Locating Coil-On-Plugs & Bolts
Courtesy of FORD MOTOR CO.

70. Remove the 11 stud bolts and the LH valve cover.
    - Discard the gasket.

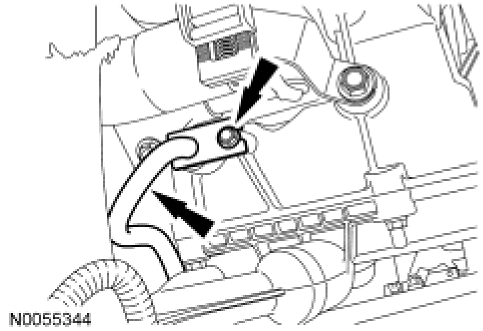


Fig. 542: Locating LH Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

71. Remove the bolt, the 10 stud bolts and the RH valve cover.
    - Discard the gasket.

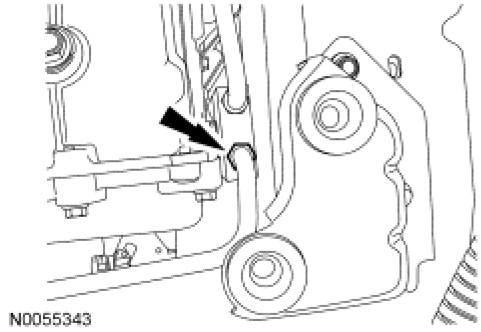


Fig. 543: Locating RH Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

NOTE: VCT solenoid seal removal shown, spark plug tube seal similar.

72. Inspect the VCT solenoid seals and the spark plug tube seals. Remove any damaged seals.
    - Using the special tools, remove the seal(s).

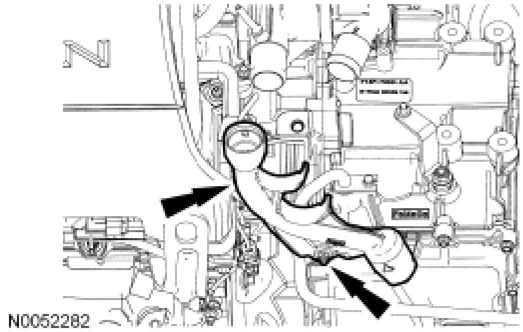


Fig. 544: Removing Seals Using Special Tools (205-153) & (303-1247/1)
Courtesy of FORD MOTOR CO.

73. Remove the crankshaft bolt and washer.
    - Discard the bolt.

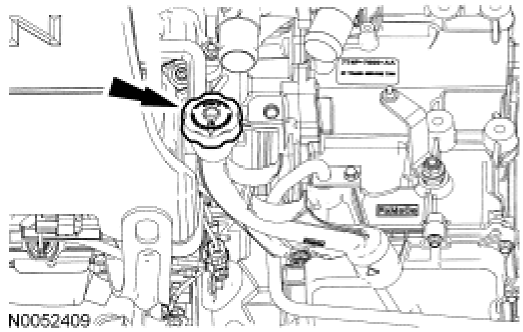


Fig. 545: Removing Crankshaft Bolt & Washer Using Special Tool (303-D055)
Courtesy of FORD MOTOR CO.

74. Using the special tool, remove the crankshaft pulley.

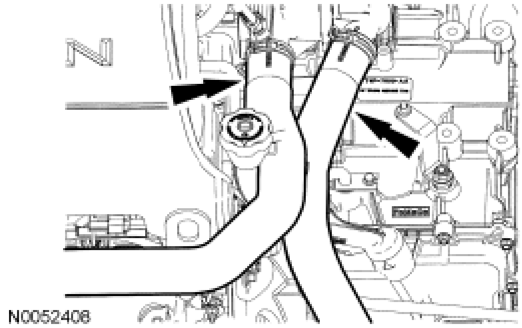


Fig. 546: Identifying Special Tools (303-D121) And Crankshaft Pulley
Courtesy of FORD MOTOR CO.

75. Using the special tool, remove and discard the crankshaft front seal.

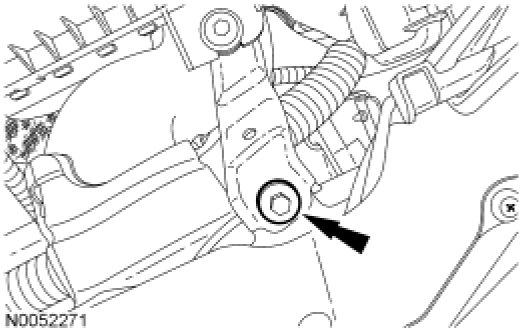


Fig. 547: Removing Crankshaft Front Seal Using Special Tool (303-409)
Courtesy of FORD MOTOR CO.

76. Remove the 2 bolts and the engine mount bracket.

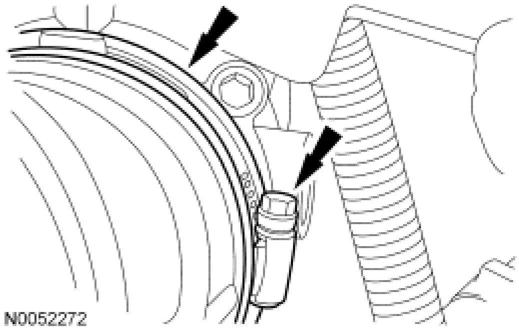


Fig. 548: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

77. Remove the 2 engine mount studs.

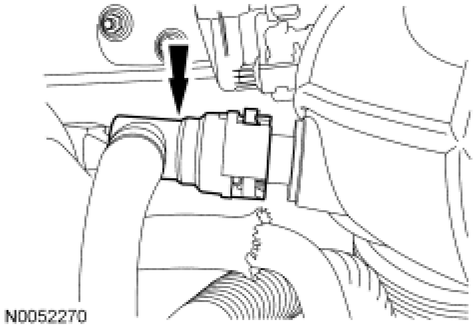


Fig. 549: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

78. Remove the 3 bolts and the engine mount bracket.

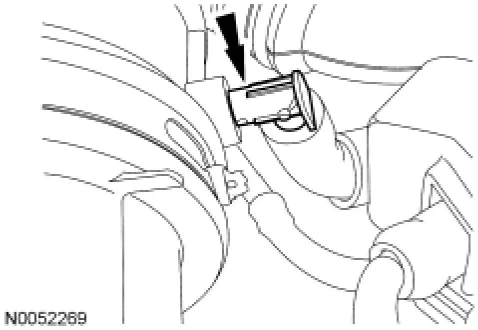


Fig. 550: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

79. Remove the 22 engine front cover bolts.

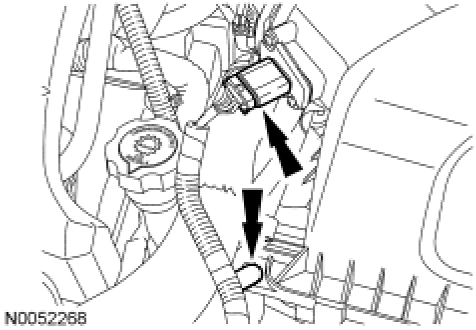


Fig. 551: Identifying Engine Front Cover Bolts
Courtesy of FORD MOTOR CO.

80. Install 6 of the engine front cover bolts (finger tight) into the 6 threaded holes in the engine front cover.
    - Tighten the bolts one turn at a time in a criss-cross pattern until the engine front cover-to-cylinder block seal is released.
        - Remove the engine front cover.

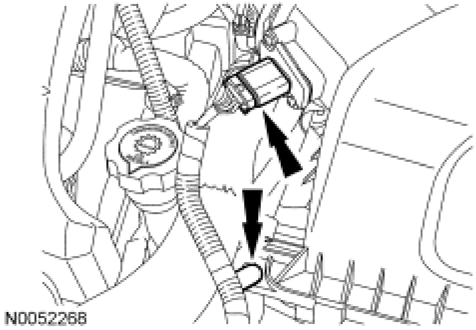


Fig. 552: Identifying Engine Front Cover Bolts
Courtesy of FORD MOTOR CO.

81. Rotate the crankshaft clockwise and align the timing marks on the VCT assemblies as shown.

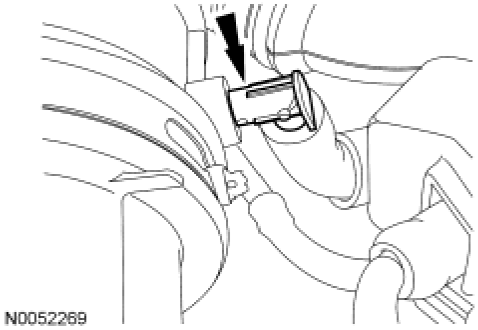


Fig. 553: Aligning Timing Marks On Variable Camshaft Timing (VCT) Assemblies
Courtesy of FORD MOTOR CO.

NOTE:	**The special tool will hold the camshafts in the top dead center (TDC) position.**

82. Install the special tool onto the flats of the LH camshafts.

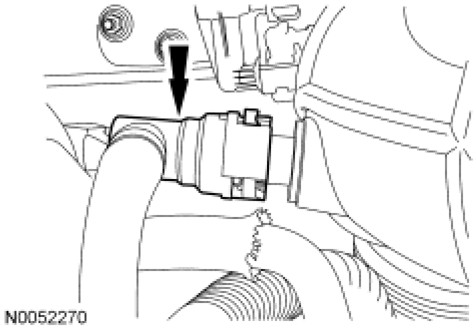


Fig. 554: Installing Special Tool (303-1248) Onto Flats Of LH Camshafts
Courtesy of FORD MOTOR CO.

NOTE:	**The special tool will hold the camshafts in the TDC position.**

83. Install the special tool onto the flats of the RH camshafts.

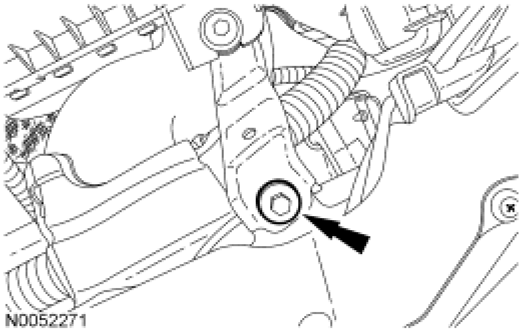


Fig. 555: Installing Special Tool (303-1248) Onto Flats Of RH Camshafts
Courtesy of FORD MOTOR CO.

84. Remove the 3 bolts and the RH VCT housing.

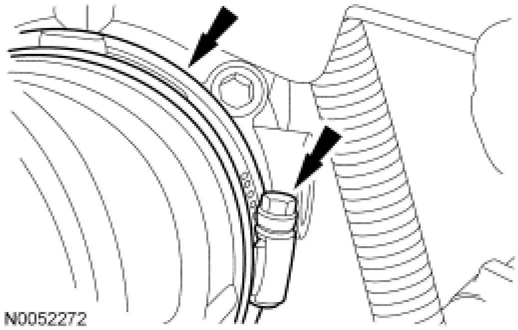


Fig. 556: Locating RH VCT Housing
Courtesy of FORD MOTOR CO.

85. Remove the 3 bolts and the LH VCT housing.

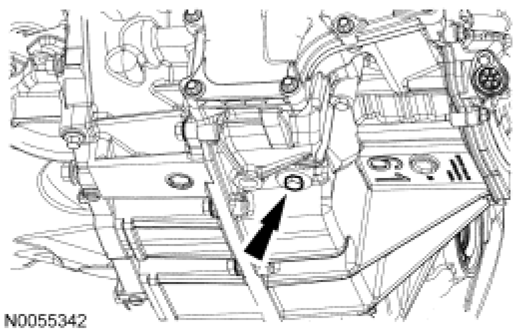


Fig. 557: Locating LH VCT Housing
Courtesy of FORD MOTOR CO.

86. Remove and discard the VCT housing seals.

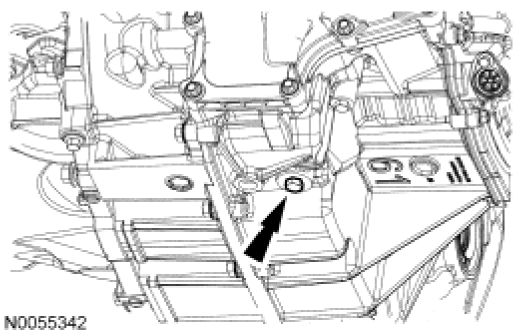


Fig. 558: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

87. Remove the 2 bolts and the primary timing chain tensioner.

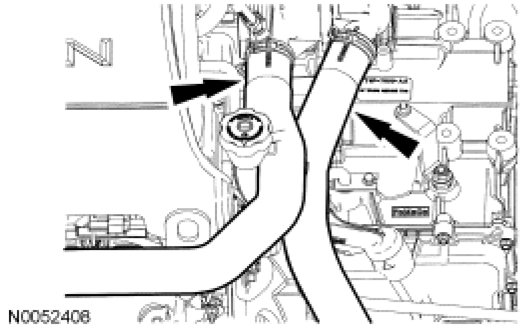


Fig. 559: Locating Primary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

88. Remove the primary timing chain tensioner arm.

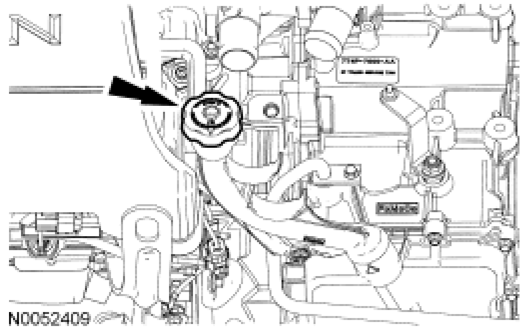


Fig. 560: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

89. Remove the 2 bolts and the lower LH primary timing chain guide.

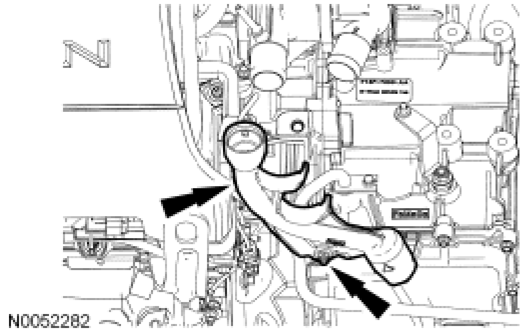


Fig. 561: Locating Lower LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

90. Remove the primary timing chain.

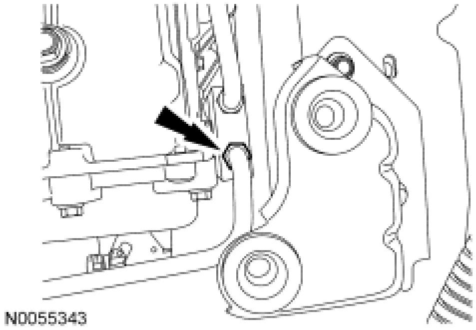


Fig. 562: Locating Primary Timing Chain
Courtesy of FORD MOTOR CO.

91. Remove the crankshaft timing chain sprocket.

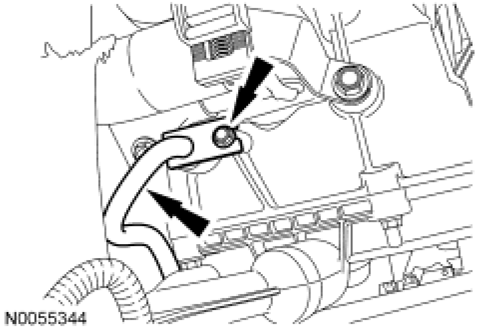


Fig. 563: Locating Crankshaft Timing Chain Sprocket
Courtesy of FORD MOTOR CO.

92. Remove the 2 bolts and the upper LH primary timing chain guide.

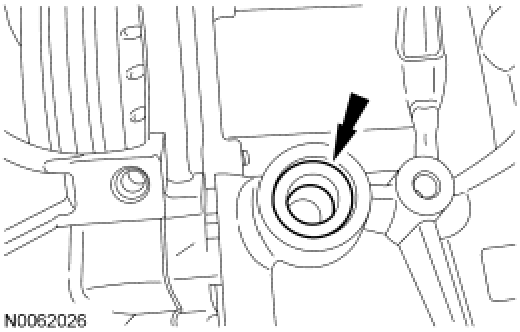


Fig. 564: Locating Upper LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

93. Compress the LH secondary timing chain tensioner and install a suitable lockpin to retain the tensioner in the collapsed position.

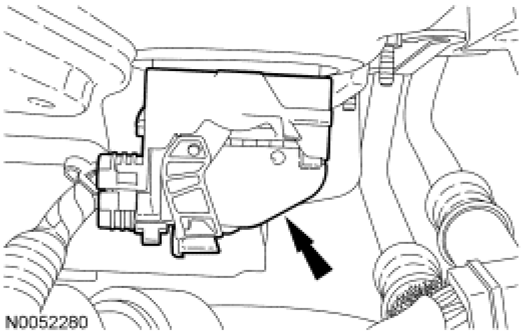


Fig. 565: Compressing LH Secondary Timing Chain Tensioner & Installing Suitable Lock Pin To Retain Tensioner In Collapsed Position
Courtesy of FORD MOTOR CO.

NOTE: **The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.**

94. Remove and discard the LH VCT assembly bolt and the LH exhaust camshaft sprocket bolt.
    - Remove the LH VCT assembly, secondary timing chain and the LH exhaust camshaft sprocket as an assembly.

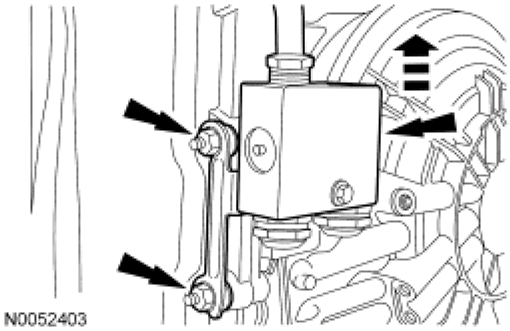


Fig. 566: Locating LH VCT Assembly Bolt & LH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

NOTE: **When the special tool is removed, valve spring pressure will rotate the LH camshafts approximately 3 degrees to a neutral position.**

95. Remove the special tool from the LH camshafts.

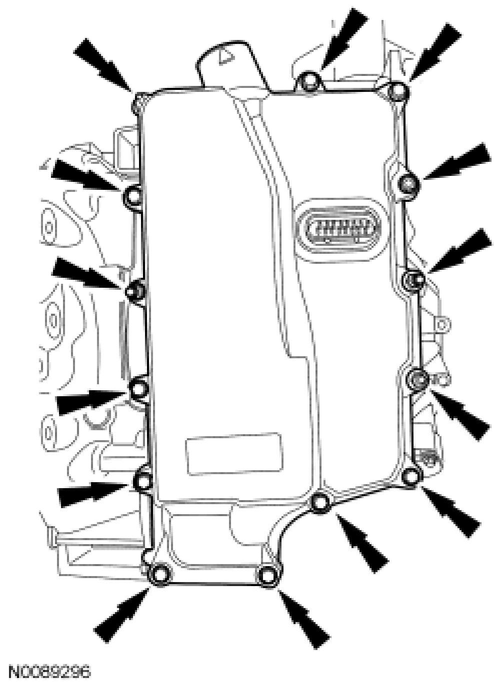


Fig. 567: Removing Special Tool (303-1248) From LH Camshafts
Courtesy of FORD MOTOR CO.

CAUTION: The camshafts must remain in the neutral position during removal or engine damage may occur.

96. Verify the LH camshafts are in the neutral position.

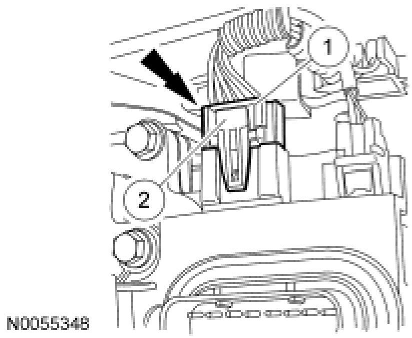
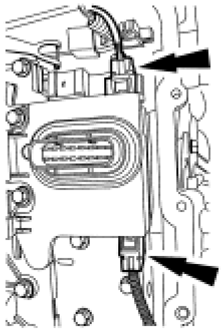


Fig. 568: Verifying LH Camshafts Are In Neutral Position
Courtesy of FORD MOTOR CO.

97. Remove the 2 bolts and the LH secondary timing chain tensioner.

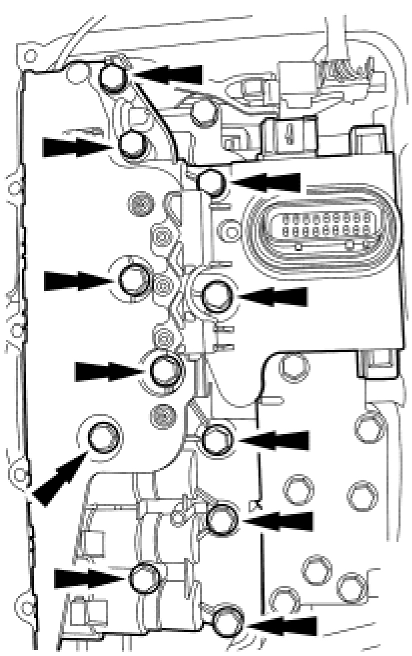


N0055349

Fig. 569: Locating LH Secondary Timing Chain Tensioner & Bolt
Courtesy of FORD MOTOR CO.

CAUTION: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions. If not reassembled in their original position, severe engine damage may occur.

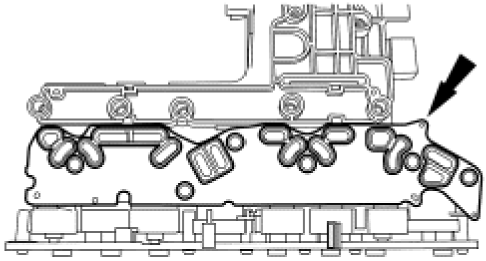
98. Remove the bolts and the LH camshaft bearing caps.
    - Remove the LH camshafts.



N0055350

Fig. 570: Identifying LH Camshafts Bolts
Courtesy of FORD MOTOR CO.

99. Compress the RH secondary timing chain tensioner and install a suitable lockpin to retain the tensioner in the collapsed position.

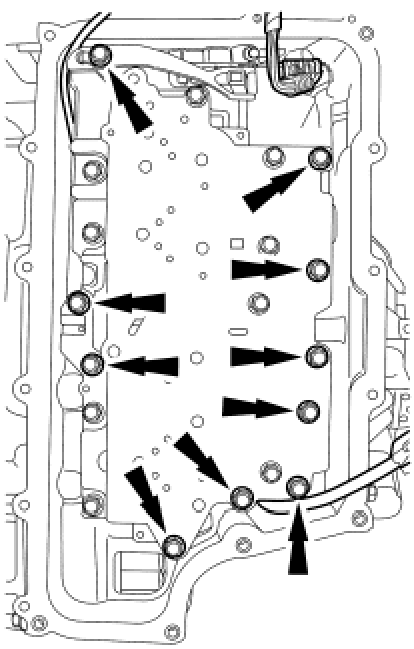


N0055016

Fig. 571: Compressing RH Secondary Timing Chain Tensioner & Installing Suitable Lock Pin To Retain Tensioner In Collapsed Position
Courtesy of FORD MOTOR CO.

NOTE: The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.

100. Remove and discard the RH VCT assembly bolt and the RH exhaust camshaft sprocket bolt.
    - Remove the RH VCT assembly, secondary timing chain and the RH exhaust camshaft sprocket as an assembly.



N0057465

Fig. 572: Locating RH VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

101. Remove the special tool from the RH camshafts.

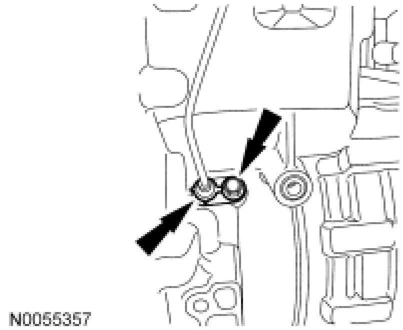


Fig. 573: Removing Special Tool (303-1248) From RH Camshafts
Courtesy of FORD MOTOR CO.

CAUTION: The camshafts must remain in the neutral position during removal or engine damage may occur.

102. Rotate the RH camshafts counterclockwise to the neutral position.

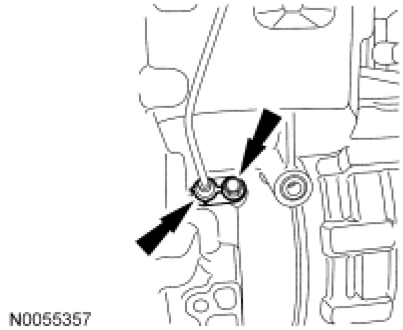


Fig. 574: Rotating RH Camshafts Counterclockwise To Neutral Position
Courtesy of FORD MOTOR CO.

103. Remove the 2 bolts and the RH secondary timing chain tensioner.

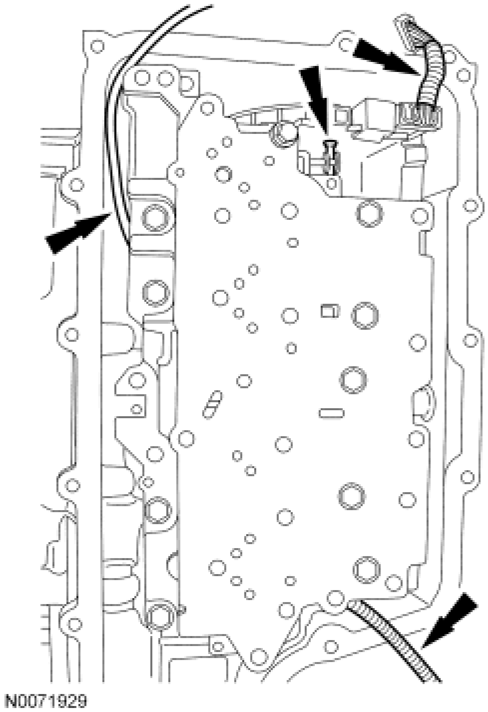


Fig. 575: Locating RH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

104. Remove the 2 bolts and the RH primary timing chain guide.

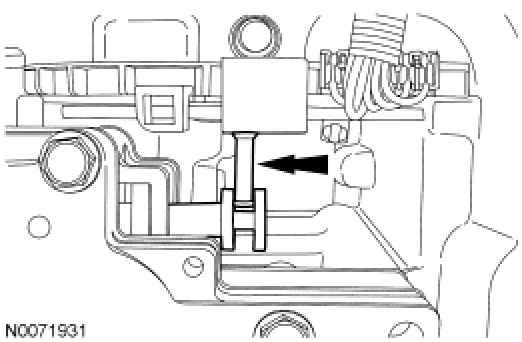


Fig. 576: Locating RH Primary Timing Chain Guide Lower Bolt
Courtesy of FORD MOTOR CO.

CAUTION: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions. If not reassembled in their original position, severe engine damage may occur.

105. Remove the bolts and the RH camshaft bearing caps.
    - Remove the RH camshafts.

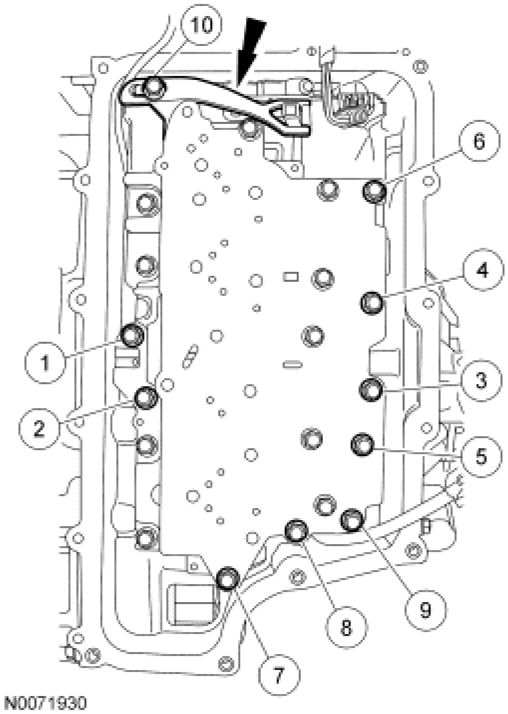


Fig. 577: Identifying RH Camshafts Bolts
Courtesy of FORD MOTOR CO.

NOTE: **If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.**

NOTE: **LH shown, RH similar.**

106. Remove the valve tappets from the cylinder heads.

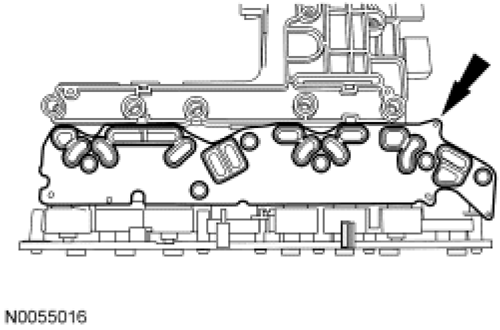


Fig. 578: Identifying Valve Tappets From Cylinder Head
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

107. Remove and discard the M6 bolt from each cylinder head.

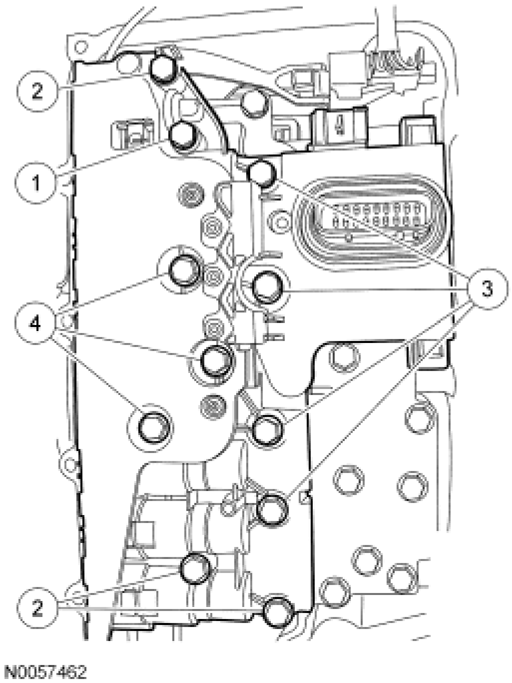


Fig. 579: Identifying M6 Bolt
Courtesy of FORD MOTOR CO.

CAUTION: Place clean, lint-free shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.

CAUTION: Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface.

NOTE: The cylinder head bolts must be discarded and new bolts must be installed. They are tighten-to-yield designed and cannot be reused.

NOTE: LH shown, RH similar.

108. Remove and discard the 8 bolts from each cylinder head.
- Remove the cylinder heads.
- Discard the cylinder head gaskets.

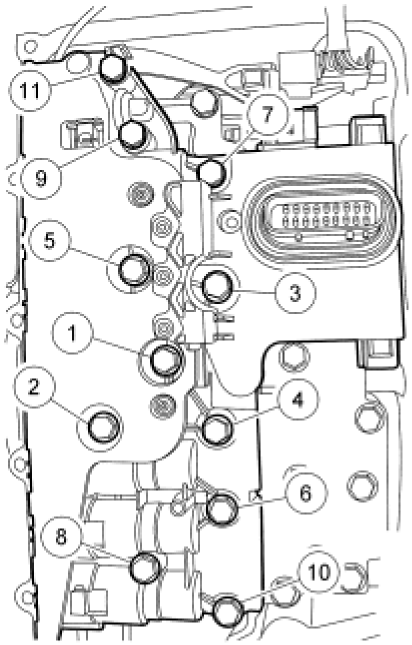


Fig. 580: Identifying Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.

NOTE: Observe all warnings or cautions and follow all application directions contained on the packaging of the silicone gasket remover and the metal surface prep.

NOTE: If there is no residual gasket material present, metal surface prep can be used to clean and prepare the surfaces.

109. Clean the cylinder head-to-cylinder block mating surfaces of both the cylinder heads and the cylinder block in the following sequence.
    1. Remove any large deposits of silicone or gasket material with a plastic scraper.
    2. Apply silicone gasket remover, following package directions, and allow to set for several minutes.
    3. Remove the silicone gasket remover with a plastic scraper. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep, following package directions, to remove any remaining traces of oil or coolant and to prepare the surfaces to bond with the new gasket. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.

5. Make sure the 2 locating dowel pins are seated correctly in the cylinder block.

110. Support the cylinder heads on a bench with the head gasket side up.

NOTE: The straightedge used must be flat within 0.0051 mm (0.0002 in) per foot of tool length.

111. Inspect all areas of the deck face with a straightedge and feeler gauge. The cylinder heads must not have depressions deeper than 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area, or scratches more than 0.0254 mm (0.001 in).
112. Remove the coolant tube.
    - Remove and discard the O-ring seals.

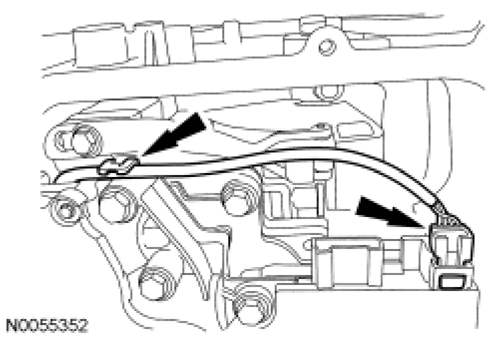


Fig. 581: Identifying Coolant Tube
Courtesy of FORD MOTOR CO.

113. Remove the 2 bolts and the KS.

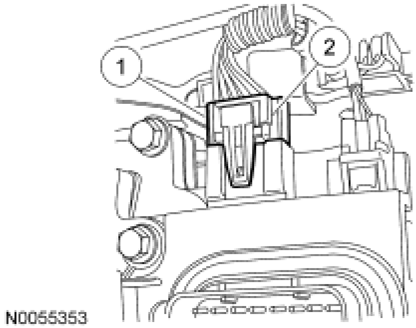


Fig. 582: Locating Knock Sensor (KS) Bolts
Courtesy of FORD MOTOR CO.

114. Remove the 8 bolts and the coolant pump.

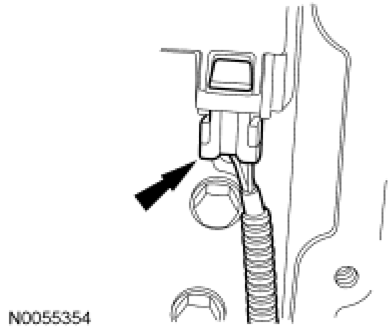


Fig. 583: Locating Coolant Pump Bolts
Courtesy of FORD MOTOR CO.

115. Remove the 16 oil pan bolts.

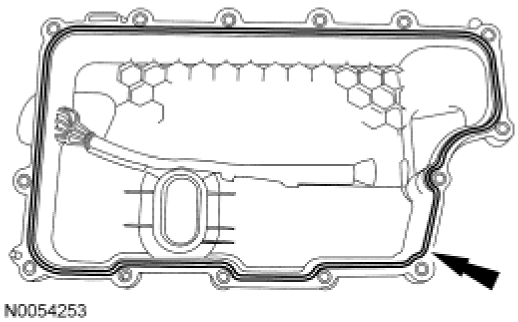


Fig. 584: Identifying Oil Pan Bolts
Courtesy of FORD MOTOR CO.

116. Install 2 of the oil pan bolts (finger tight) into the 2 threaded holes in the oil pan.
    - Alternately tighten the 2 bolts one turn at a time until the oil pan-to-cylinder block seal is released.
        - Remove the oil pan.

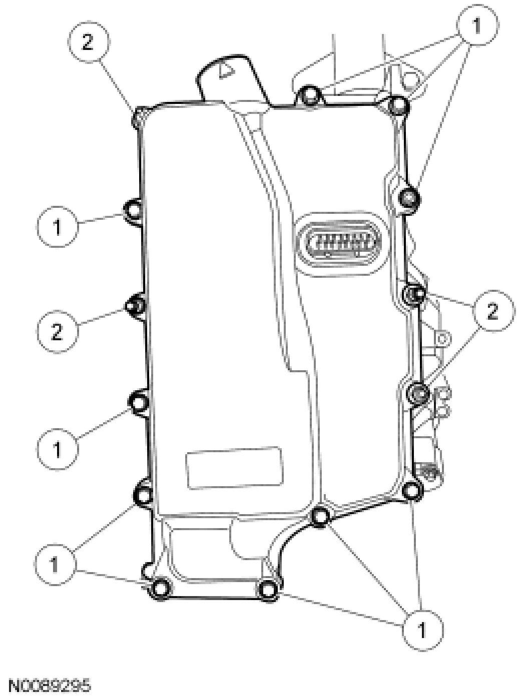


Fig. 585: Installing 2 Of Oil Pan Bolts (Finger Tight) Into 2 Threaded Holes In Oil Pan
Courtesy of FORD MOTOR CO.

117. Remove the 3 bolts and the oil pump screen and pickup tube.
    - Discard the O-ring seal.

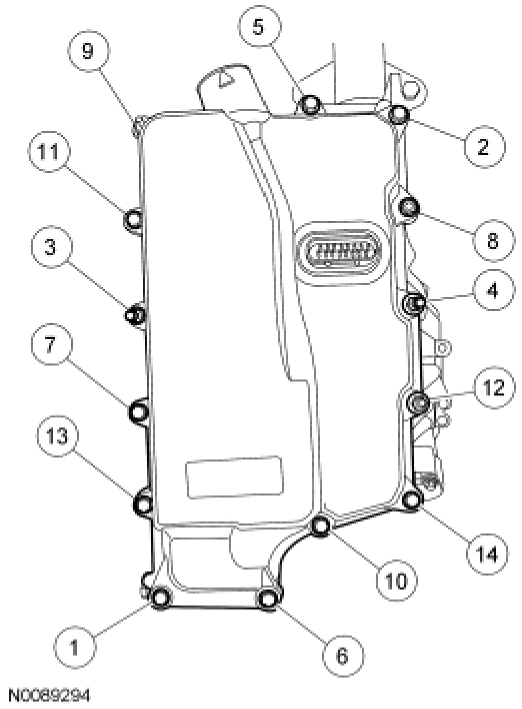


Fig. 586: Identifying Oil Pump Screen, Pickup Tube & Bolts
Courtesy of FORD MOTOR CO.

118. Remove the 3 bolts and the oil pump.

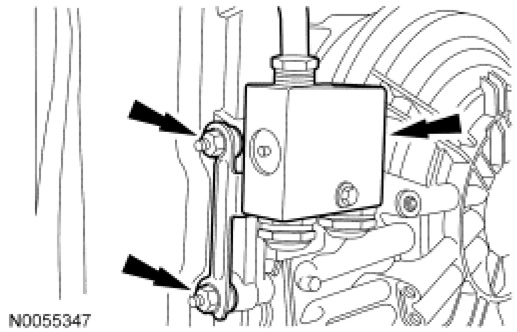


Fig. 587: Identifying Oil Pump & Bolts
Courtesy of FORD MOTOR CO.

119. Remove the 8 crankshaft rear seal retainer bolts.

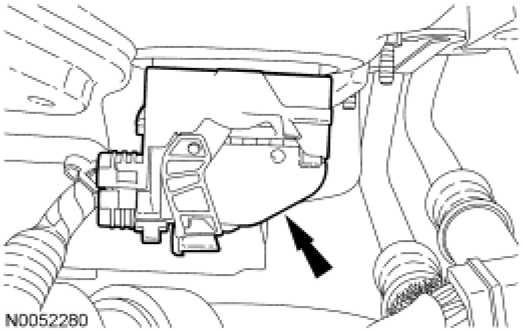


Fig. 588: Locating Crankshaft Rear Seal Retainer Bolts
Courtesy of FORD MOTOR CO.

120. Install the 2 M6 oil pan bolts (finger tight) into the 2 threaded holes in the crankshaft rear seal retainer.
    - Alternately tighten the 2 bolts one turn at a time until the crankshaft rear seal retainer-to-cylinder block seal is released.
        - Remove the crankshaft rear seal retainer.

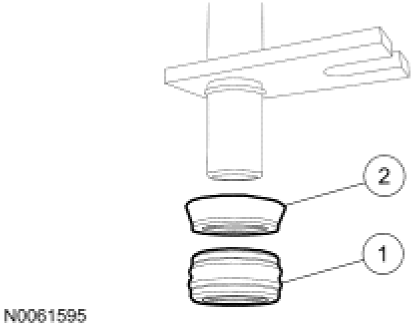


Fig. 589: Identifying M6 Oil Pan Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Only use a 3M Roloc® Bristle Disk, (2-in white, part number 07528) to clean the engine front cover, oil pan and crankshaft rear seal retainer plate. Do not use metal scrapers, wire brushes or any other power abrasive disk to clean the engine front cover, oil pan and crankshaft rear seal retainer plate. These tools cause scratches and gouges that make leak paths.

121. Clean the engine front cover, oil pan and crankshaft rear seal retainer plate using a 3M Roloc® Bristle Disk, (2 inch, white, part number 07528) in a suitable tool turning at the recommended speed of 15,000 rpm.
    - Thoroughly wash the engine front cover, oil pan and crankshaft rear seal retainer plate to remove any foreign material, including any abrasive particles created during the cleaning process.

CAUTION: Place clean, lint-free shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into

the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.

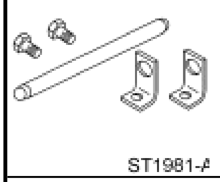
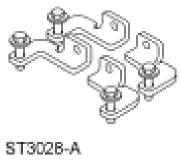
CAUTION: Do not use wire brushes, power abrasive discs or 3M Roloc® Bristle Disk (2-in white part number 07528) to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. They also cause contamination that will cause premature engine failure. Remove all traces of the gasket.

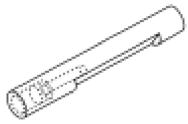
122. Clean the sealing surfaces of the cylinder block in the following sequence.
    1. Remove any large deposits of silicone or gasket material.
    2. Apply silicone gasket remover and allow to set for several minutes.
    3. Remove the silicone gasket remover. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep to remove any remaining traces of oil or coolant and to prepare the surfaces to bond. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.
    5. Make sure the 2 locating dowel pins are seated correctly in the cylinder block.

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

CYLINDER HEAD

Special Tools

Illustration	Tool Name	Tool Number
	Compressor, Valve Spring	303-300 (T87C-6565-A)
	Compressor, Valve Spring	303-350 (T89P-6565-A)
	Compressor, Valve Spring	303-1249

 ST1906-A	Installer, Valve Stem Oil Seal	303-470 (T94P-6510-CH)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

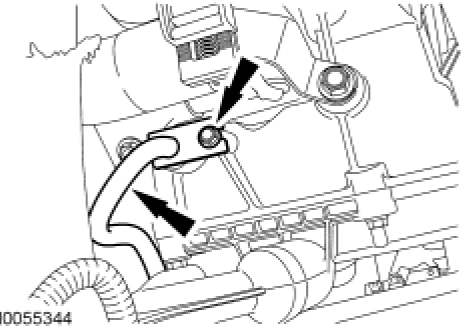

N0055344

Fig. 590: Cylinder Head
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6518	Intake valve spring retainer key (12 required)
2	6514	Intake valve spring retainer (6 required)
3	6513	Intake valve spring (6 required)
4	6A517	Intake valve stem seal (6 required)
5	6505	Intake valve (6 required)
6	6507	Exhaust valve (6 required)
7	6A517	Exhaust valve stem seal (6 required)
8	6513	Exhaust valve spring (6 required)
9	6514	Exhaust valve spring retainer (6 required)
10	6518	Exhaust valve spring retainer key (12 required)
11	6G004	Cylinder Head Temperature (CHT) sensor

DISASSEMBLY

All cylinder heads

NOTE:	If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

1. Using the Valve Spring Compressors, remove the keys, retainer and spring.

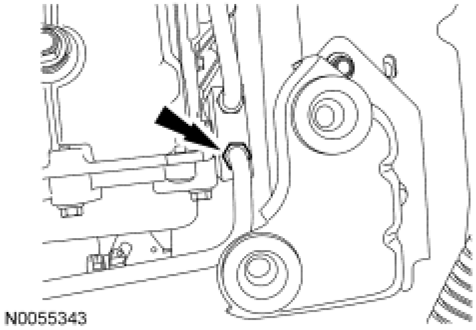


Fig. 591: Removing Keys, Retainer & Spring Using Special Tools (303-1249, 303-350, 303-300)
Courtesy of FORD MOTOR CO.

2. Remove the valve from the cylinder head.
3. Remove and discard the valve stem seal.
4. Repeat the above steps for each valve.

RH cylinder head

5. Remove and discard the Cylinder Head Temperature (CHT) sensor.

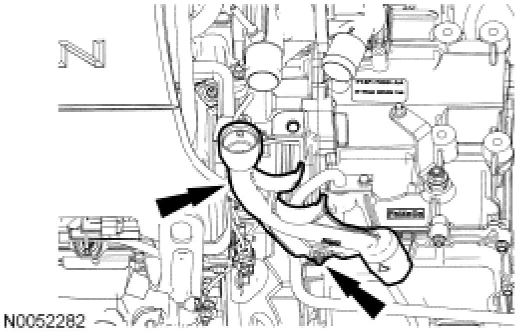


Fig. 592: Identifying Cylinder Head Temperature (CHT) Sensor
Courtesy of FORD MOTOR CO.

ASSEMBLY

All cylinder heads

NOTE:	Lubricate the valve stem seal with clean engine oil prior to installation.

1. Using the Valve Stem Oil Seal Installer, install a new valve stem seal.

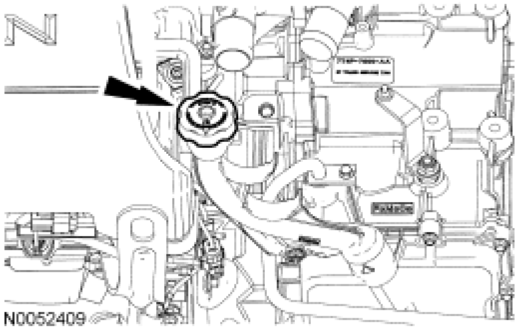


Fig. 593: Installing New Valve Stem Seal Using Special Tool (303-470)
Courtesy of FORD MOTOR CO.

2. Install the valve.
3. Using the Valve Spring Compressors, install the valve spring, retainer and key.

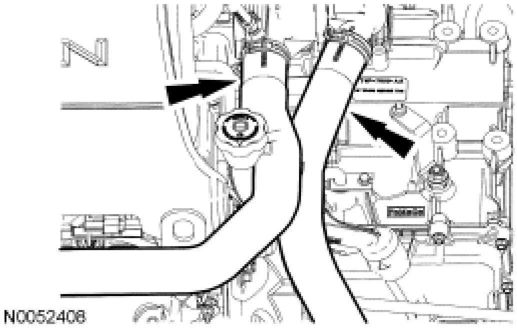


Fig. 594: Removing Keys, Retainer & Spring Using Special Tools (303-1249, 303-350, 303-300)
Courtesy of FORD MOTOR CO.

4. Repeat the above steps for each valve.

   RH cylinder head

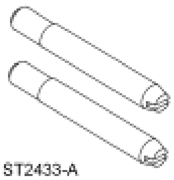
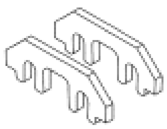
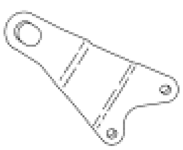
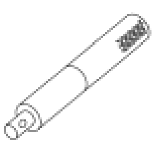
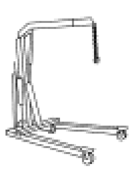
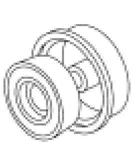
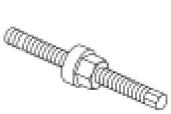
5. Install a new CHT sensor.
   - Tighten to 10 Nm (89 lb-in).

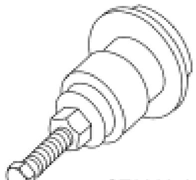
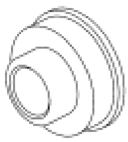
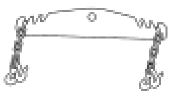
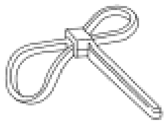
ASSEMBLY

ENGINE

Special Tools

Illustration	Tool Name	Tool Number

 ST2433-A	Alignment Pins	307-399
 ST2979-A	Camshaft Alignment Tool	303-1248
 ST2976A	Engine Lifting Bracket	303-1245
 ST1326-A	Handle	205-153 (T80T-4000-W)
 ST1341-A	Heavy Duty Floor Crane	014-00071 or equivalent
 ST2981-A	Installer, Crankshaft Front Seal	303-1251
 ST2980-A	Installer, Crankshaft Rear Seal	303-1250
 ST1287-A	Installer, Crankshaft Vibration Damper	303-102 (T74P-6316-B)

 ST2296-A	Installer, Front Cover Oil Seal	303-335
 ST2983-A	Installer, Seal	303-1247/2
 ST1602-A	Spreader Bar	303-D089 (D93P-6001-A3) or equivalent
 ST1438-A	Strap Wrench	303-D055 (D85L-6000-A)

Material

Item	Specification
Motorcraft High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft Metal Surface Prep ZC-31-A	-
Motorcraft Premium Gold Engine Coolant with Bittering Agent (bittered in US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket Remover ZC-30	-
Thread Sealant with PTFE TA-24	WSK-M2G350-A2

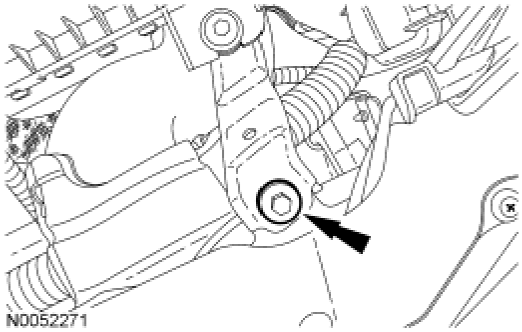


Fig. 595: Identifying Engine Upper Components
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	12C508	Engine control harness
2	9S455	Upper intake manifold
3	9F797	Fuel rail
4	9J444	Upper intake manifold bracket
5	9K461	Lower intake manifold
6	8A856	Thermostat housing
7	9N271	Coolant tube
8	9N271	Knock sensor (KS)
9	6010	Cylinder block

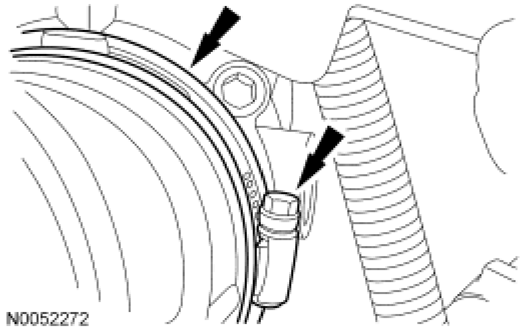


Fig. 596: Identifying Engine Front Components
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6A0003	Engine mount bracket
2	W701512	Crankshaft pulley bolt
3	N806165	Crankshaft pulley washer
4	6316	Crankshaft pulley
5	6700	Crankshaft front seal
6	6C086	Engine front cover

7	6268	Timing chain
8	6306	Crankshaft timing sprocket
9	6K254	Primary timing chain tensioner
10	6K255	Primary timing chain tensioner arm
11	6B274	LH lower primary timing chain guide
12	6M256	RH primary timing chain guide
13	6K297	LH upper primary timing chain guide
14	8501	Coolant pump
15	6010	Cylinder block

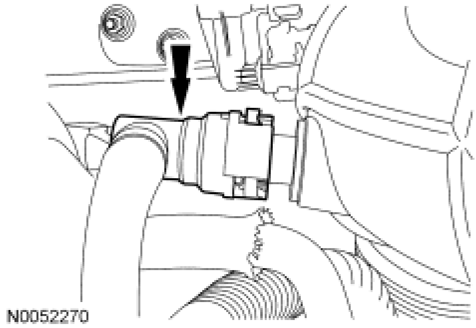


Fig. 597: Identifying Engine Lower Components
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6675	Oil pan
2	6622	Oil pump screen and pickup tube
3	6621	Oil pump
4	6010	Cylinder block
5	6D327	Crankshaft rear seal retainer
6	12A227	Crankshaft sensor ring
7	6375	Flexplate
8	6881	Oil filter adapter (without oil cooler)
9	6881	Oil filter adapter (with oil cooler)
10	9278	Engine oil pressure (EOP) switch

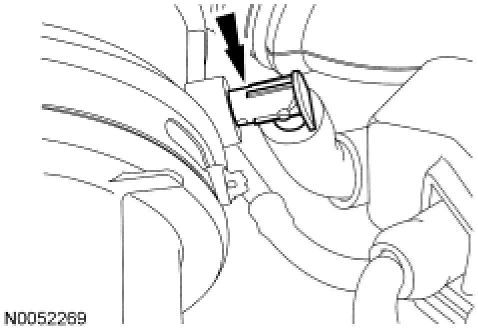


Fig. 598: Exploded View Of LH Cylinder Head
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6083	LH cylinder head gasket
2	6C261	LH variable camshaft timing (VCT) housing
3	W12244	LH exhaust manifold stud (6 required)
4	6500	Valve tappet (32 required)
5	6050	LH cylinder head
6	6279	LH camshaft bolt (2 required)
7	W710738	LH exhaust camshaft sprocket washer
8	6C524	LH VCT assembly
9	6256	LH exhaust camshaft sprocket
10	6C256	LH secondary timing chain
11	6A258	LH camshaft cap (8 required)
12	6A505	LH valve cover
13	6A267	LH intake camshaft
14	6A269	LH exhaust camshaft
15	6C271	LH secondary timing chain tensioner

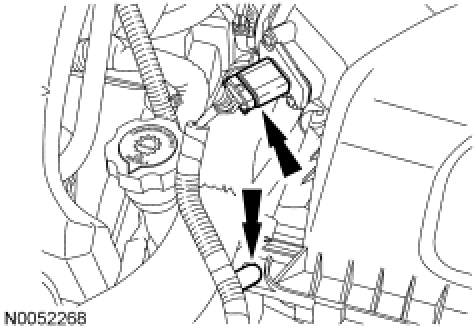


Fig. 599: Exploded View Of RH Cylinder Head
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W712244	RH exhaust manifold stud (6 required)
2	6051	RH cylinder head gasket
3	6G004	Cylinder head temperature (CHT) sensor
4	14B485	CHT sensor jumper harness
5	6B288	Camshaft position (CMP) sensor (2 required)
6	6049	RH cylinder head
7	17A084	Engine lift eye
8	6C260	RH variable camshaft timing (VCT) housing
9	6279	RH camshaft bolt (2 required)
10	W710738	RH exhaust camshaft sprocket washer
11	6256	RH exhaust camshaft sprocket
12	6C524	RH VCT assembly
13	6C256	RH secondary timing chain
14	6A266	RH intake camshaft
15	6A268	RH exhaust camshaft
16	12405	Spark plug (6 required)
17	6A258	RH camshaft cap (8 required)
18	6582	RH valve cover
19	12A375	Coil-on-plug (6 required)
20	6C270	RH secondary timing chain tensioner

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

All vehicles

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The crankshaft rear seal retainer must be installed and the bolts tightened within 4 minutes of sealant application.

1. Apply a 3 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the sealing surface of the crankshaft rear seal retainer.

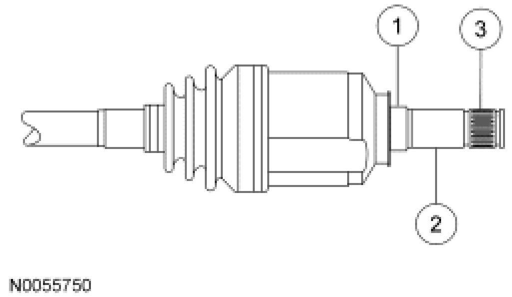


Fig. 600: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Sealing Surface Of Crankshaft Rear Seal Retainer
Courtesy of FORD MOTOR CO.

2. Install the crankshaft rear seal retainer and the 8 bolts.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).

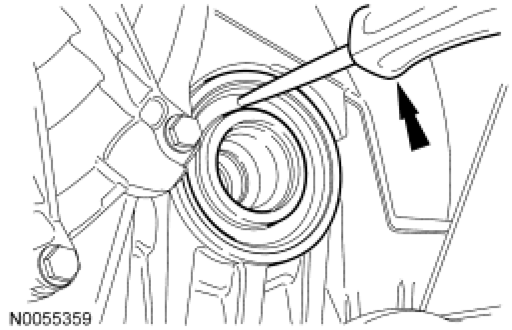


Fig. 601: Installing Crankshaft Rear Seal Retainer Bolts In Sequence
Courtesy of FORD MOTOR CO.

3. Install the oil pump and the 3 bolts.
   - Tighten to 10 Nm (89 lb-in).

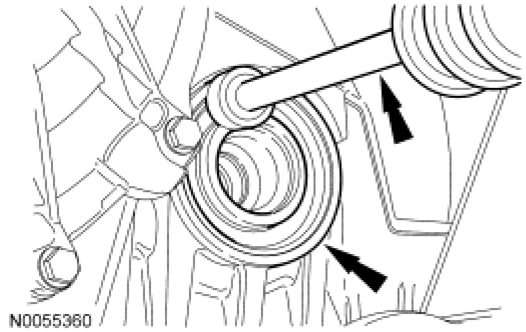


Fig. 602: Identifying Oil Pump & Bolts
Courtesy of FORD MOTOR CO.

4. Using a new O-ring seal, install the oil pump screen and pickup tube and the 3 bolts.

- Tighten to 10 Nm (89 lb-in).

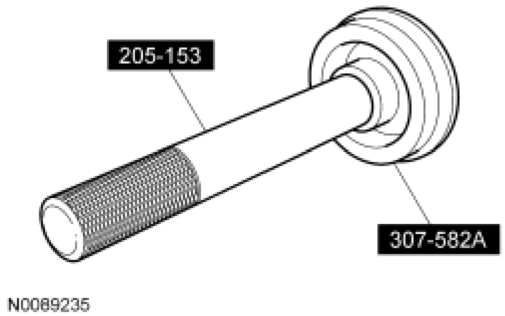


Fig. 603: Identifying Oil Pump Screen, Pickup Tube & Bolts
Courtesy of FORD MOTOR CO.

NOTE: The A/C compressor must be installed on the cylinder block and the 2 bolts tightened prior to installing the oil pan.

5. Install the A/C compressor and the 2 bolts.
   - Tighten to 25 Nm (18 lb-ft).

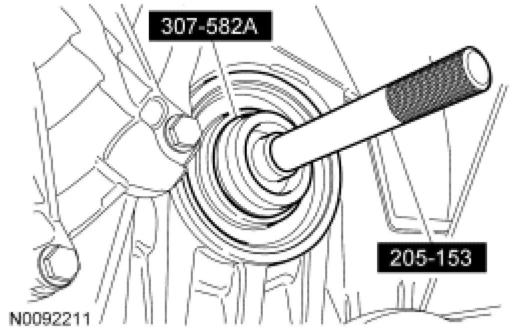


Fig. 604: Identifying A/C Compressor Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The oil pan and the 4 specified bolts must be installed and the oil pan aligned to the cylinder block and A/C compressor within 4 minutes of sealant application. Final tightening of the oil pan bolts must be carried out within 60 minutes of sealant application.

6. Apply a 3 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the sealing surface of the oil pan.

- Apply a 5.5 mm (0.21 in) bead of Motorcraft High Performance Engine RTV Silicone to the 2 crankshaft seal retainer plate-to-cylinder block joint areas on the sealing surface of the oil pan.

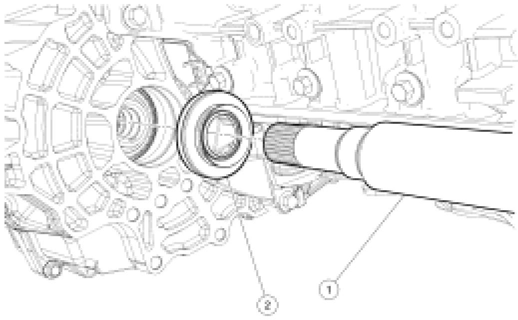


Fig. 605: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Crankshaft Seal Retainer Plate-To-Cylinder Block
Courtesy of FORD MOTOR CO.

NOTE: The oil pan and the 4 specified bolts must be installed within 4 minutes of the start of sealant application.

7. Install the oil pan and bolts 10, 11, 13 and 14.
    - Tighten the bolts in the sequence shown to 3 Nm (27 lb-in).
    - Loosen the bolts 180 degrees.

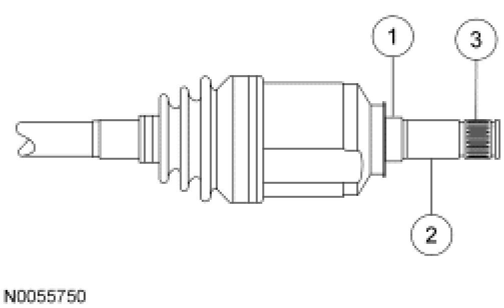


Fig. 606: Installing Oil Pan Bolts 10, 11, 13 & 14 In Sequence
Courtesy of FORD MOTOR CO.

8. Align the oil pan to the cylinder block and the A/C compressor.
    - Position the oil pan so the mounting boss is against the A/C compressor and using a straightedge, align the oil pan flush with the rear of the cylinder block at the 2 areas shown.

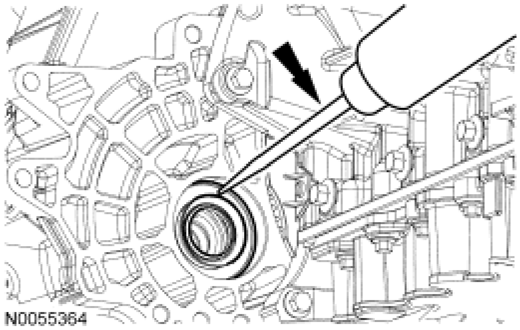


Fig. 607: Aligning Oil Pan Flush With Rear Of Cylinder Block
Courtesy of FORD MOTOR CO.

9. Tighten bolts 10, 11, 13 and 14 in the sequence shown, to 3 Nm (27 lb-in).

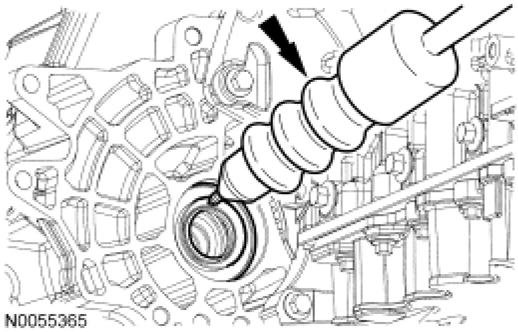


Fig. 608: Installing Oil Pan Bolts 10, 11, 13 & 14 In Sequence
Courtesy of FORD MOTOR CO.

10. Install the remaining oil pan bolts. Tighten all the oil pan bolts in the sequence shown.
    - Tighten the large bolts (1-14) to 24 Nm (18 lb-ft).
    - Tighten the small bolts (15 and 16) to 10 Nm (89 lb-in).

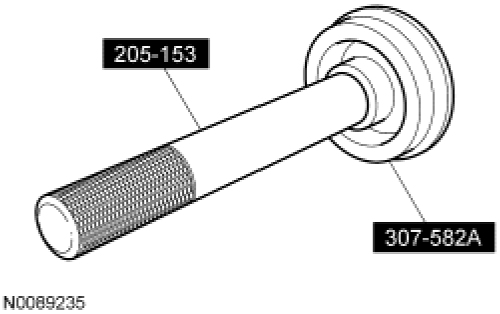


Fig. 609: Installing Remaining Oil Pan Bolts In Sequence
Courtesy of FORD MOTOR CO.

11. Install the A/C compressor mounting stud and nut.

- Tighten the stud to 9 Nm (80 lb-in) and the nut to 25 Nm (18 lb-ft).

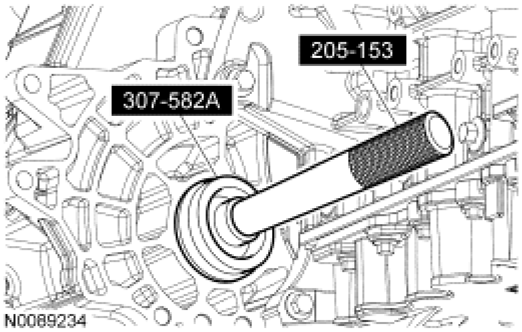


Fig. 610: Locating A/C Compressor Nut & Stud
Courtesy of FORD MOTOR CO.

12. Install the coolant pump and the 8 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

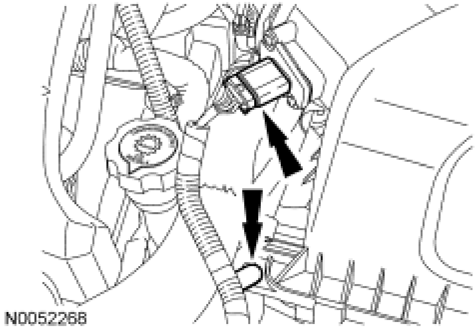


Fig. 611: Identifying Coolant Pump Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

13. Install the knock sensor (KS) and the 2 bolts.
    - Tighten to 20 Nm (15 lb-ft).

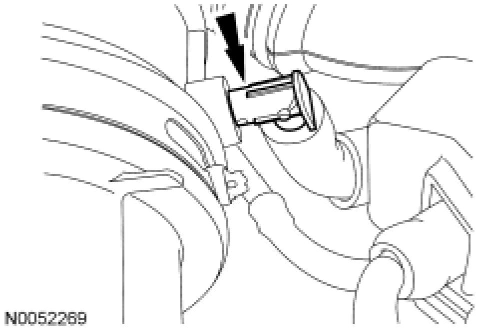


Fig. 612: Locating Knock Sensor (KS) Bolts
Courtesy of FORD MOTOR CO.

NOTE: Apply clean engine coolant to the O-ring seals prior to installation.

14. Using new O-ring seals, install the coolant tube.

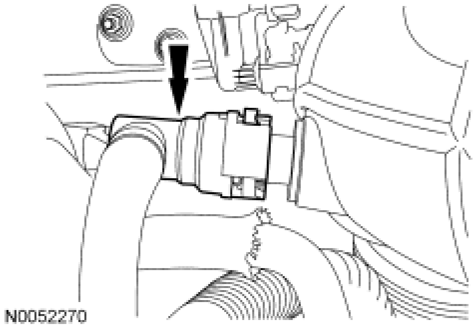


Fig. 613: Identifying Coolant Tube
Courtesy of FORD MOTOR CO.

15. Install a new gasket, the RH cylinder head and 8 new bolts. Tighten in the sequence shown in 5 stages:
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten to 35 Nm (26 lb-ft).
    - Stage 3: Tighten 90 degrees.
    - Stage 4: Tighten 90 degrees.
    - Stage 5: Tighten 90 degrees.

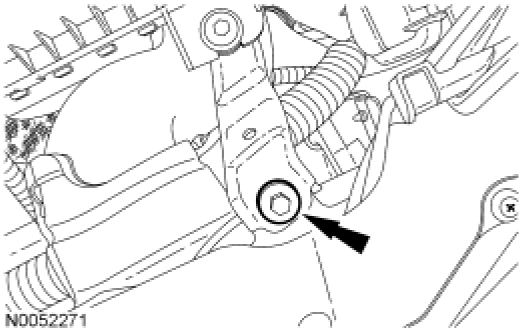


Fig. 614: Installing RH Cylinder Head Bolts In Sequence
Courtesy of FORD MOTOR CO.

16. Install the bolt.
    - Tighten to 10 Nm (89 lb-in).

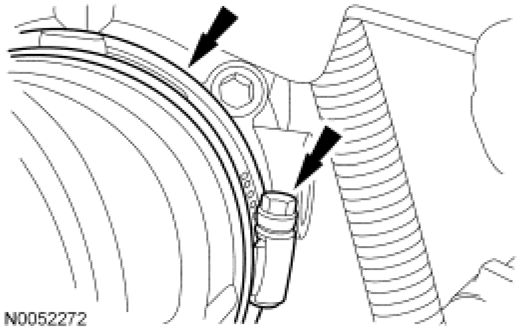


Fig. 615: Identifying M6 Bolt
Courtesy of FORD MOTOR CO.

17. Install a new gasket, the LH cylinder head and 8 new bolts. Tighten in the sequence shown in 5 stages:
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten to 35 Nm (26 lb-ft).
    - Stage 3: Tighten 90 degrees.
    - Stage 4: Tighten 90 degrees.
    - Stage 5: Tighten 90 degrees.

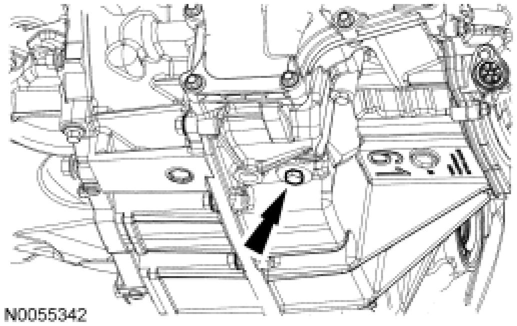


Fig. 616: Installing LH Cylinder Head Bolts In Sequence
Courtesy of FORD MOTOR CO.

18. Install the bolt.
    - Tighten to 10 Nm (89 lb-in).

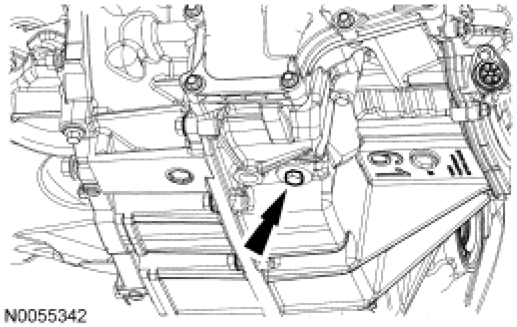


Fig. 617: Identifying M6 Bolt
Courtesy of FORD MOTOR CO.

CAUTION: The crankshaft must remain in the freewheeling position (crankshaft dowel pin at 9 o'clock) until after the camshafts are installed and the valve clearance is checked/adjusted. Do not turn the crankshaft until instructed to do so. Failure to follow this process will result in severe engine damage.

19. Position the crankshaft dowel pin in the 9 o'clock position.

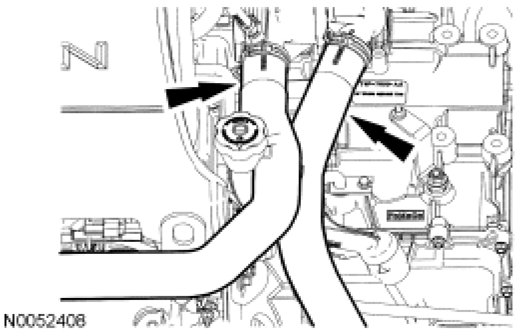


Fig. 618: Positioning Crankshaft Dowel Pin In 9 O'clock Position
Courtesy of FORD MOTOR CO.

NOTE: The valve tappets must be installed in their original positions.

NOTE: Coat the valve tappets with clean engine oil prior to installation.

NOTE: LH shown, RH similar.

20. Install the valve tappets.

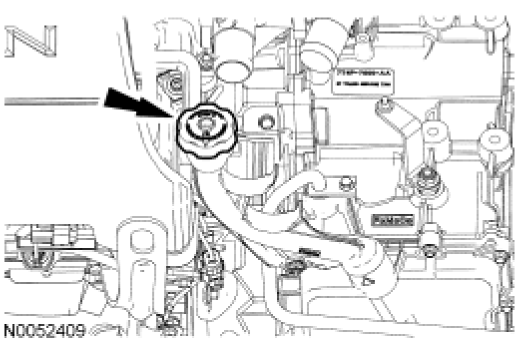


Fig. 619: Identifying Valve Tappets From Cylinder Head
Courtesy of FORD MOTOR CO.

CAUTION: The camshafts must remain in the neutral position during installation or engine damage may occur.

NOTE: Coat the camshafts with clean engine oil prior to installation.

21. Position the camshafts onto the RH cylinder head in the neutral position as shown.

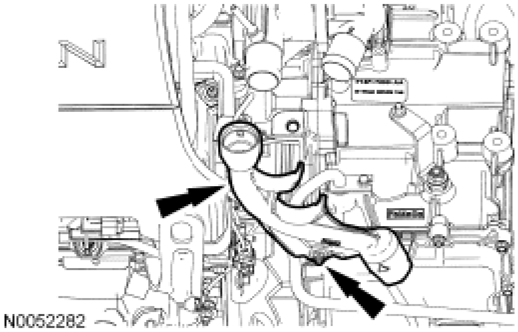


Fig. 620: Positioning Camshafts Onto RH Cylinder Head In Neutral Position
Courtesy of FORD MOTOR CO.

CAUTION: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions. If not reassembled in their original positions, severe engine damage may occur.

22. Install the 8 camshaft caps and the 16 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

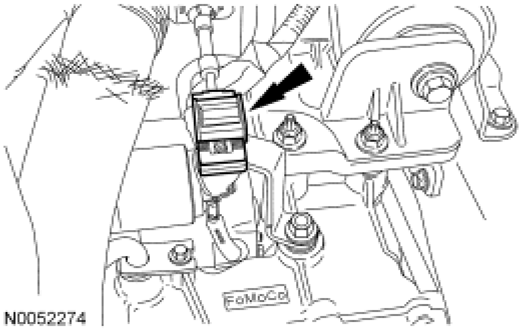


Fig. 621: Installing Camshaft Caps & Bolts In Sequence
Courtesy of FORD MOTOR CO.

CAUTION: The camshafts must remain in the neutral position during installation or engine damage may occur.

NOTE: Coat the camshafts with clean engine oil prior to installation.

23. Position the camshafts onto the LH cylinder head in the neutral position as shown.

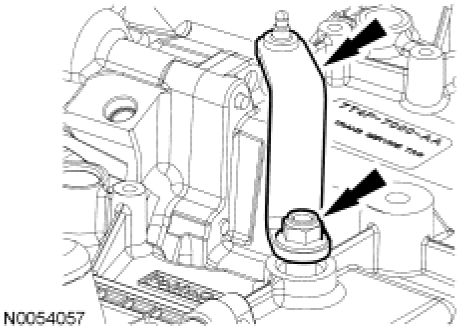


Fig. 622: Positioning Camshafts Onto LH Cylinder Head In Neutral Position
Courtesy of FORD MOTOR CO.

CAUTION: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions. If not reassembled in their original positions, severe engine damage may occur.

24. Install the 8 camshaft caps and the 16 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

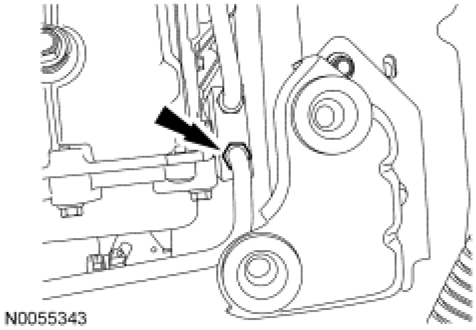


Fig. 623: Installing Camshaft Caps & Bolts In Sequence
Courtesy of FORD MOTOR CO.

CAUTION: If any components are installed new, the engine valve clearance must be checked/adjusted or engine damage may occur.

NOTE: Use a camshaft sprocket bolt to turn the camshafts.

25. Using a feeler gauge, confirm that the valve tappet clearances are within specification. For additional information, refer to **Valve Clearance Check**.

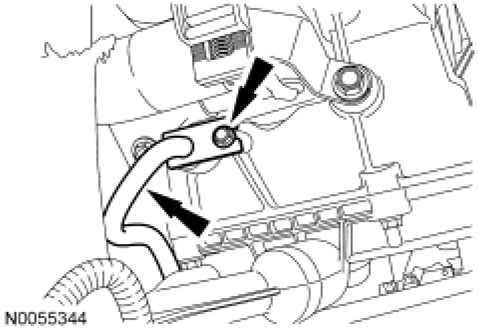


Fig. 624: Measuring Valve Clearance
Courtesy of FORD MOTOR CO.

26. Install the RH primary timing chain guide and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

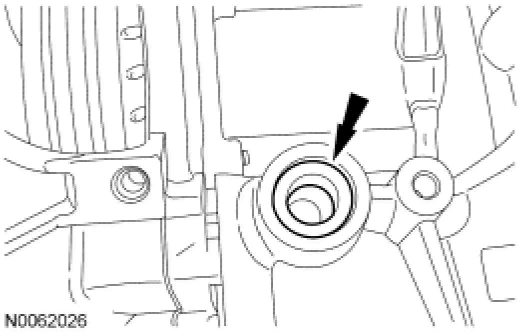


Fig. 625: Locating RH Primary Timing Chain Guide Lower Bolt
Courtesy of FORD MOTOR CO.

27. Install the RH secondary timing chain tensioner and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

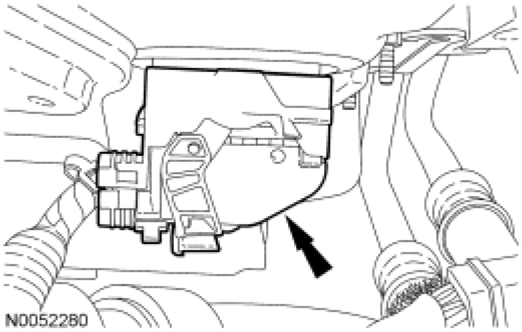


Fig. 626: Locating RH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

NOTE: Use a camshaft sprocket bolt to turn the camshafts.

28. Rotate the RH camshafts to the top dead center position and install the special tool on the flats of the camshafts.

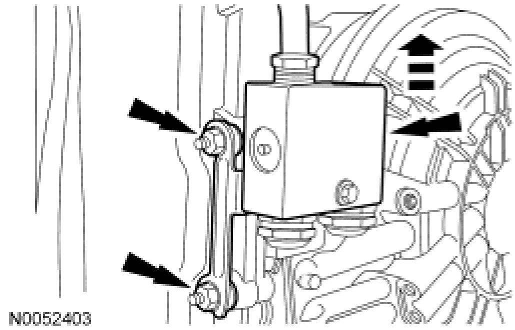


Fig. 627: Installing Special Tool (303-1248) On Flats Of Camshafts
Courtesy of FORD MOTOR CO.

29. Assemble the RH variable camshaft timing (VCT) assembly, the RH exhaust camshaft sprocket and the RH secondary timing chain.
    - Align the colored links with the timing marks.

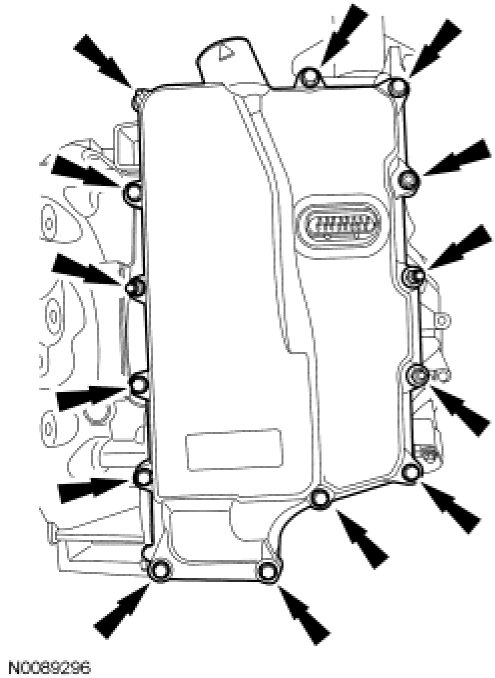


Fig. 628: Aligning RH Exhaust Camshaft Sprocket & RH Secondary Timing Chain Colored Links With Timing Marks
Courtesy of FORD MOTOR CO.

30. Position the RH secondary timing assembly onto the camshafts.

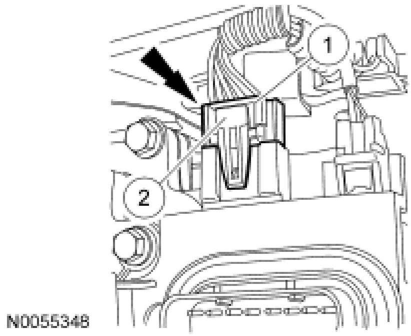


Fig. 629: Positioning RH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

31. Install 2 new bolts and the original washer. Tighten in 4 stages.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 10 Nm (89 lb-in).
    - Stage 4: Tighten 90 degrees.

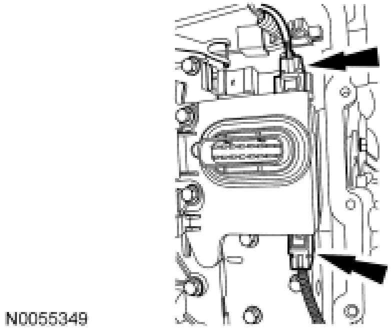
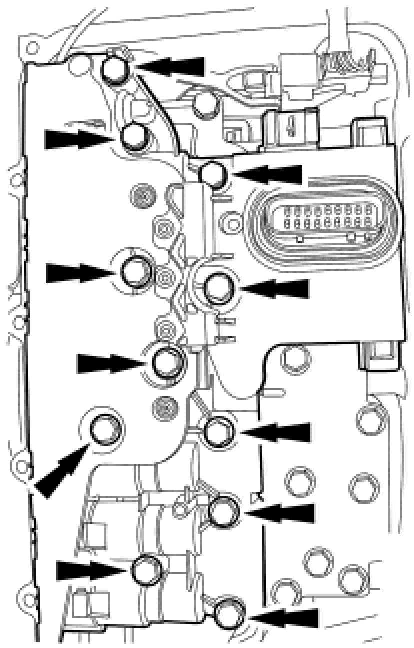


Fig. 630: Locating RH VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

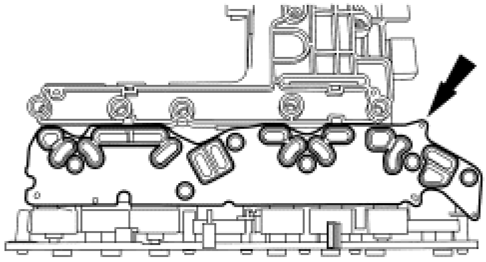
32. Remove the lockpin from the RH secondary timing chain tensioner.



N0055350

Fig. 631: Identifying Lock Pin On RH Secondary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

33. Install the LH secondary timing chain tensioner and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).



N0055016

Fig. 632: Locating LH Secondary Timing Chain Tensioner & Bolt
Courtesy of FORD MOTOR CO.

NOTE: Use a camshaft sprocket bolt to turn the camshafts.

34. Rotate the LH camshafts to the top dead center position and install the special tool on the flats of the camshafts.

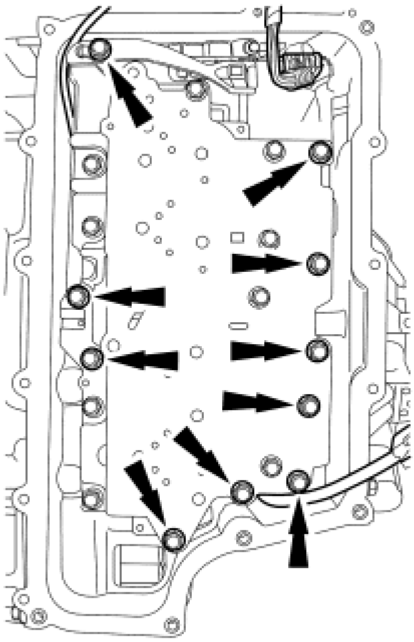

N0057465

Fig. 633: Installing Special Tool (303-1248) On Flats Of Camshafts
Courtesy of FORD MOTOR CO.

35. Assemble the LH VCT assembly, the LH exhaust camshaft sprocket and the LH secondary timing chain.
    - Align the colored links with the timing marks.

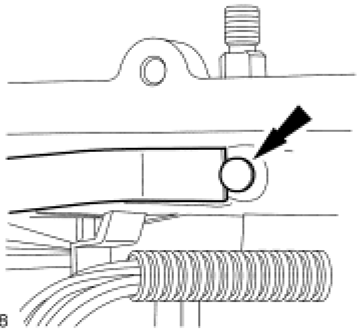

N0057728

Fig. 634: Aligning LH Exhaust Camshaft Sprocket & LH Secondary Timing Chain Colored Links With Timing Marks
Courtesy of FORD MOTOR CO.

36. Position the LH secondary timing assembly onto the camshafts.

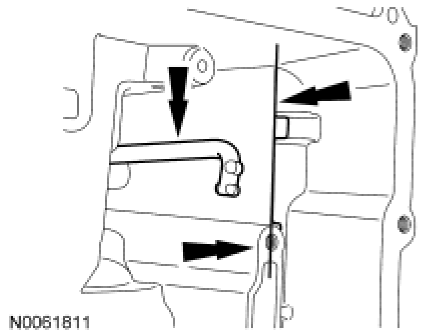


Fig. 635: Positioning LH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

37. Install 2 new bolts and the original washer. Tighten in 4 stages.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 10 Nm (89 lb-in).
    - Stage 4: Tighten 90 degrees.

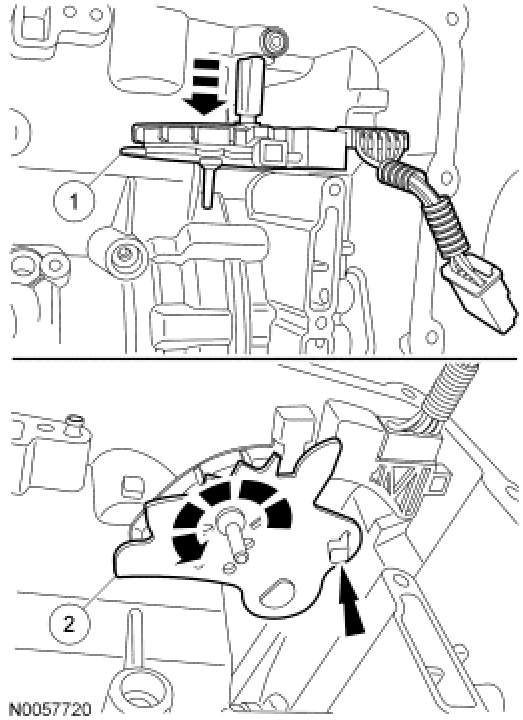


Fig. 636: Locating LH VCT Assembly Bolt & LH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

38. Remove the lockpin from the LH secondary timing chain tensioner.

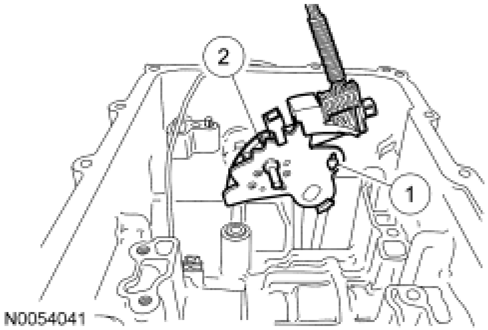


Fig. 637: Locating Lock Pin On LH Secondary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

39. Rotate the crankshaft clockwise 60 degrees to the top dead center position (crankshaft dowel pin at 11 o'clock).

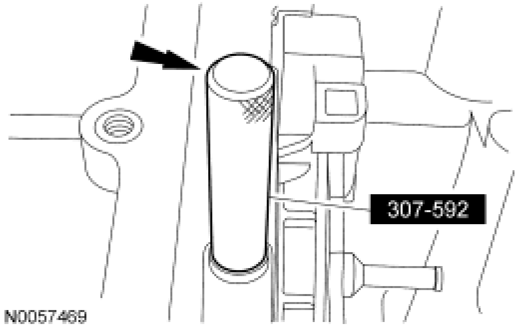


Fig. 638: Identifying Crankshaft Dowel Pin
Courtesy of FORD MOTOR CO.

40. Install the crankshaft timing chain sprocket.

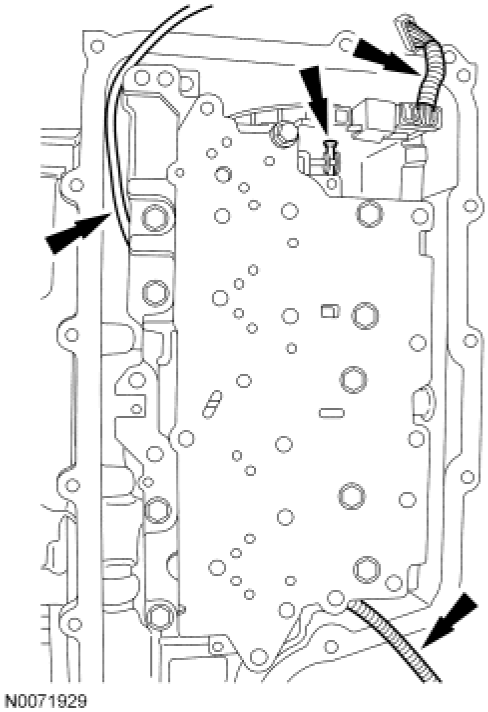


Fig. 639: Locating Crankshaft Timing Chain Sprocket
Courtesy of FORD MOTOR CO.

41. Install the primary timing chain with the colored links aligned with the timing marks on the VCT assemblies and the crankshaft sprocket.

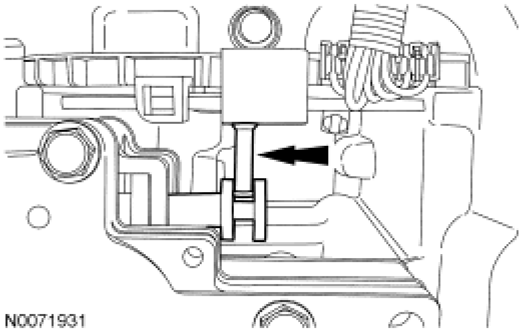


Fig. 640: Aligning Timing Marks On VCT Assemblies & Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

42. Install the upper LH primary timing chain guide and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

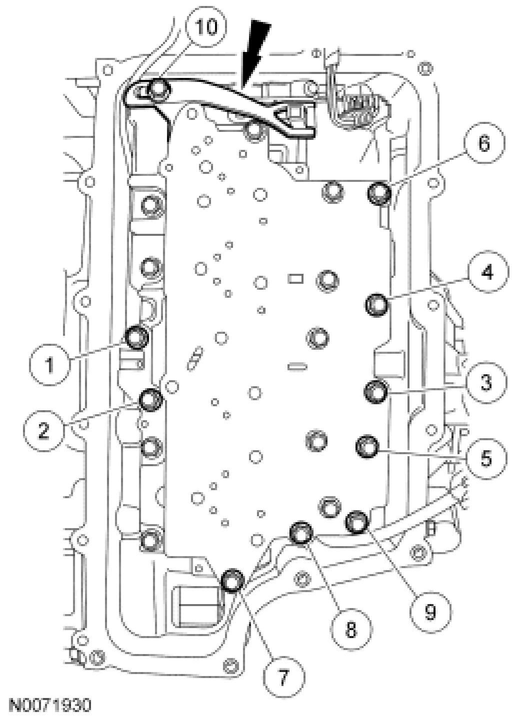


Fig. 641: Locating Upper LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

43. Install the lower LH primary timing chain guide and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

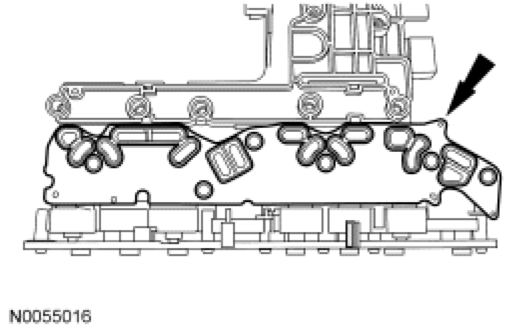


Fig. 642: Locating Lower LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

44. Install the primary timing chain tensioner arm.

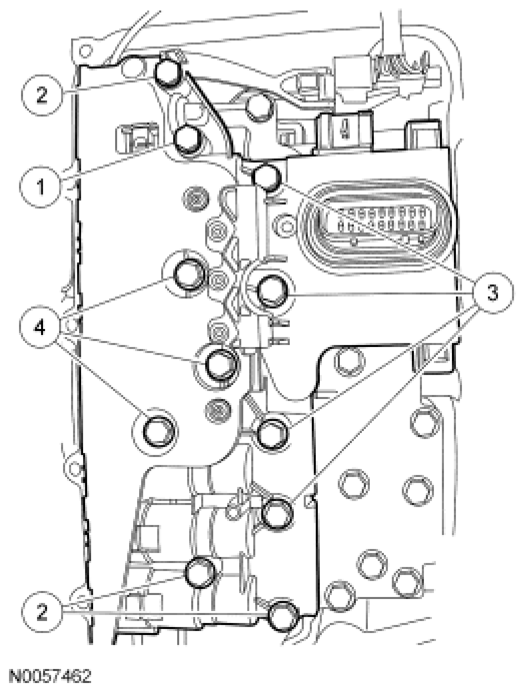


Fig. 643: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

45. Reset the primary timing chain tensioner.
    - Rotate the lever counterclockwise.
    - Using a soft-jawed vise, compress the plunger.
    - Align the hole in the lever with the hole in the tensioner housing.
    - Install a suitable lockpin.

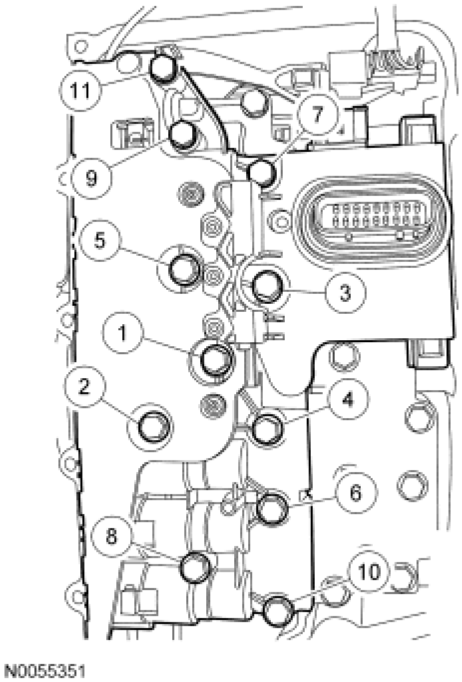


Fig. 644: Compressing Plunger Using A Soft-Jawed Vise
Courtesy of FORD MOTOR CO.

NOTE: It may be necessary to rotate the crankshaft slightly to remove slack from the timing chain and install the tensioner.

46. Install the primary tensioner and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).
    - Remove the lockpin.

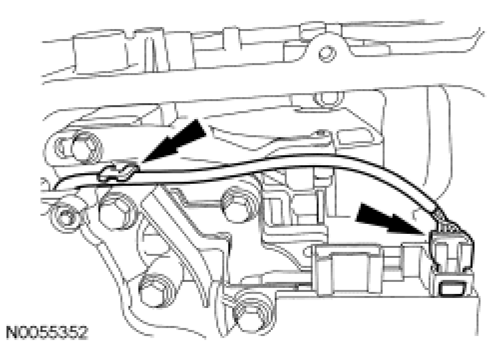


Fig. 645: Locating Primary Tensioner Bolts
Courtesy of FORD MOTOR CO.

47. As a post-check, verify correct alignment of all timing marks.

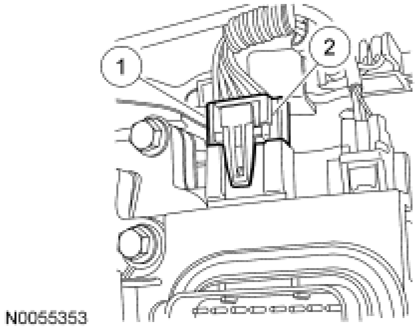


Fig. 646: Verifying Correct Alignment Of All Timing Marks
Courtesy of FORD MOTOR CO.

48. Install new VCT housing seals.

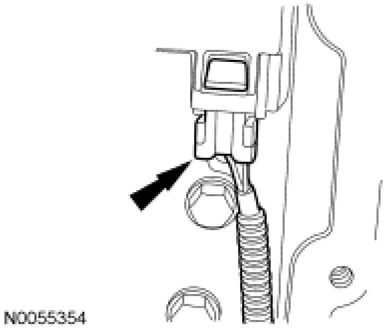


Fig. 647: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

CAUTION: Make sure the dowels on the variable camshaft timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

49. Install the LH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

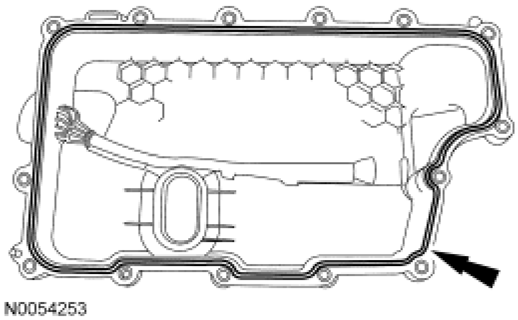


Fig. 648: Identifying LH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

CAUTION: Make sure the dowels on the variable camshaft timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

50. Install the RH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

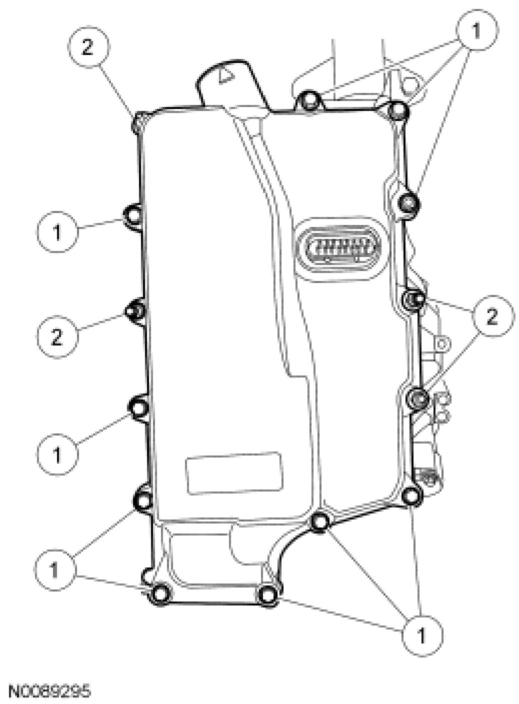


Fig. 649: Identifying RH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

51. Install the special tools.

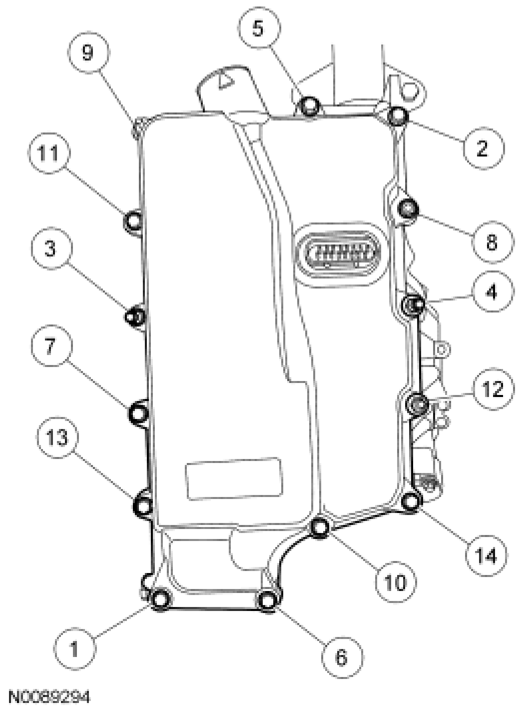


Fig. 650: Identifying Special Tool (307-399)
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The engine front cover and bolts 17, 18, 19 and 20 must be installed within 4 minutes of the initial sealant application. The remainder of the engine front cover bolts and the engine mount bracket bolts must be installed and tightened within 35 minutes of the initial sealant application. If the time limits are exceeded, the sealant must be removed, the sealing area cleaned and sealant reapplied. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

52. Apply a 3.0 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover sealing surfaces including the 3 engine mount bracket bosses.
    - Apply a 5.5 mm (0.21 in) bead of Motorcraft High Performance Engine RTV Silicone to the oil pan-to-cylinder block joint and the cylinder head-to-cylinder block joint areas of the engine front cover in 5 places as indicated.

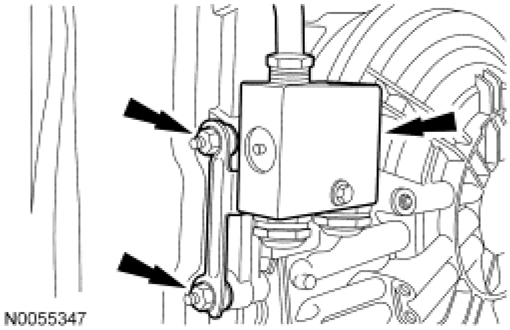


Fig. 651: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover Sealing Surfaces
Courtesy of FORD MOTOR CO.

NOTE: **Make sure the 2 locating dowel pins are seated correctly in the cylinder block.**

53. Install the engine front cover and bolts 17, 18, 19 and 20.
    - Tighten in sequence to 3 Nm (27 lb-in).

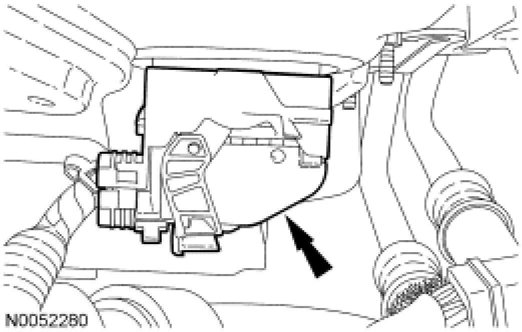


Fig. 652: Installing Engine Front Cover & Bolts In Sequence
Courtesy of FORD MOTOR CO.

54. Remove the special tools (alignment pins).

NOTE: **Do not tighten the bolts at this time.**

55. Install the engine mount bracket and the 3 bolts.

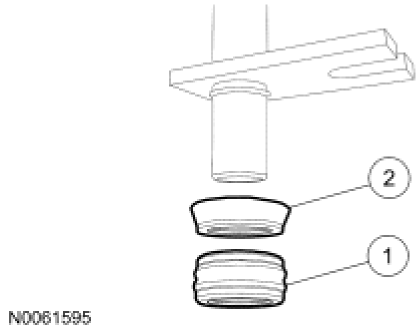


Fig. 653: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Do not expose the Motorcraft High Performance Engine RTV Silicone to engine oil for at least 90 minutes after installing the engine front cover. Failure to follow this instruction may cause oil leakage.

56. Install the remaining engine front cover bolts. Tighten all of the engine front cover bolts and engine mount bracket bolts in the sequence shown in 2 stages:
    - Stage 1: Tighten bolts 1 thru 22 to 10 Nm (89 lb-in) and bolts 23, 24 and 25 to 15 Nm (11 lb-ft).
    - Stage 2: Tighten bolts 1 thru 22 to 24 Nm (18 lb-ft) and bolts 23, 24 and 25 to 75 Nm (55 lb-ft).

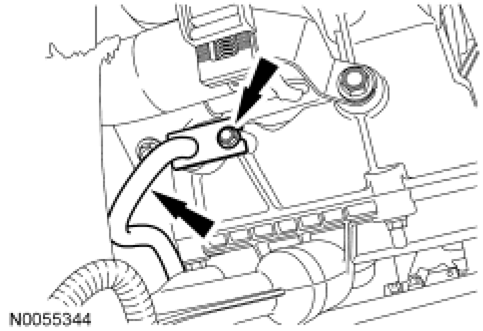


Fig. 654: Identifying Tightening Of Engine Front Cover Bolts & Engine Mount Bracket Bolts In Sequence
Courtesy of FORD MOTOR CO.

57. Install the 2 engine mount studs.
    - Tighten to 18 Nm (13 lb-ft).

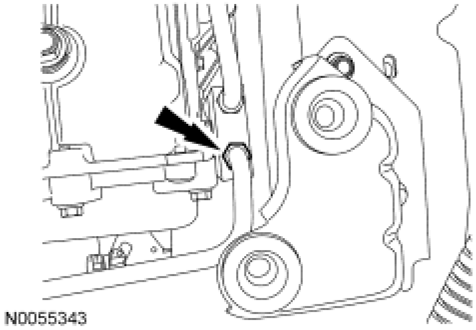


Fig. 655: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

58. Install the engine mount bracket and the 2 bolts.
    - Tighten to 24 Nm (18 lb-ft).

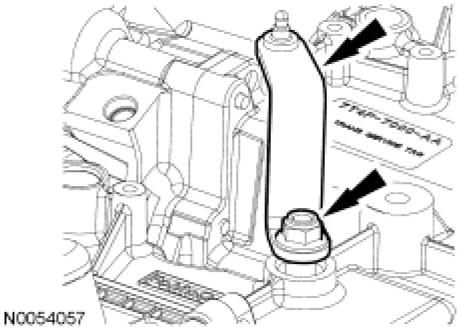


Fig. 656: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

NOTE:	**Apply clean engine oil to the crankshaft front seal bore in the engine front cover.**

59. Using the special tools, install a new crankshaft front seal.

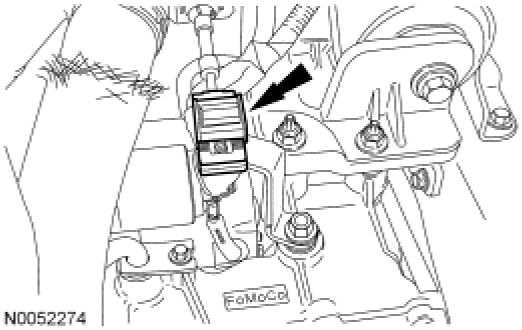


Fig. 657: Installing Crankshaft Front Seal Using Special Tools (303-102) & (303-1251)
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the outside diameter sealing surfaces with clean engine oil.

60. Using the special tools, install the crankshaft pulley.

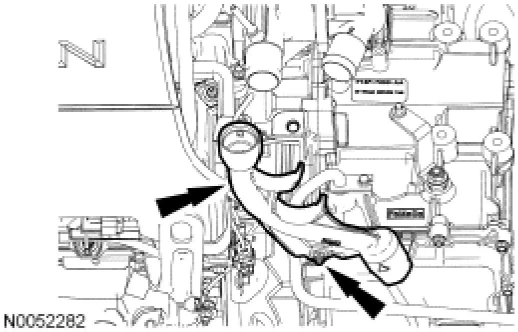


Fig. 658: Installing Crankshaft Pulley
Courtesy of FORD MOTOR CO.

61. Using the special tool, install the crankshaft pulley washer and new bolt and tighten in 4 stages.
    - Stage 1: Tighten to 120 Nm (89 (lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten an additional 90 degrees.

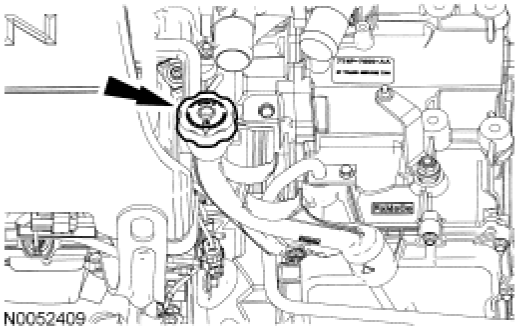


Fig. 659: Installing Crankshaft Pulley Washer & Bolt Using Special Tools (303-D055)
Courtesy of FORD MOTOR CO.

NOTE: Installation of new seals is only required if damaged seals were removed during disassembly of the engine.

NOTE: Spark plug tube seal installation shown, VCT seal installation similar.

62. Using the special tools, install new VCT solenoid and/or spark plug tube seals.

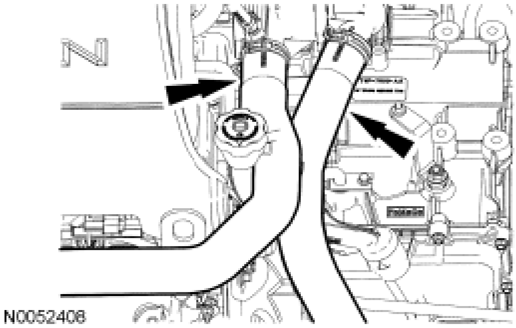


Fig. 660: Installing VCT Solenoid And/Or Spark Plug Tube Seals Using Special Tools (205-153) & (303-1247/2)
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

63. Apply a 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-RH cylinder head joints.

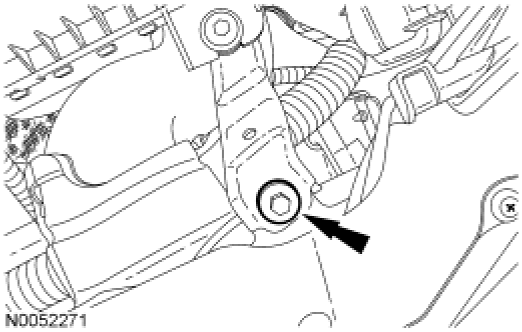


Fig. 661: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover-To-RH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

64. Using a new gasket, install the RH valve cover, bolt and the 10 stud bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

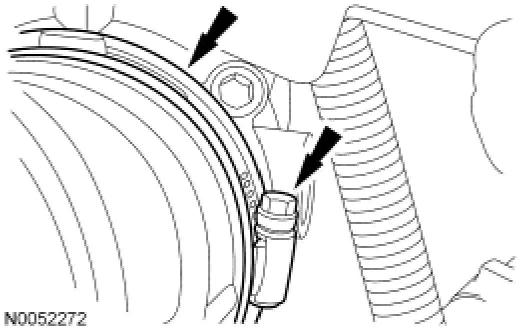


Fig. 662: Installing RH Valve Cover Stud Bolts In Sequence
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

65. Apply a 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-LH cylinder head joints.

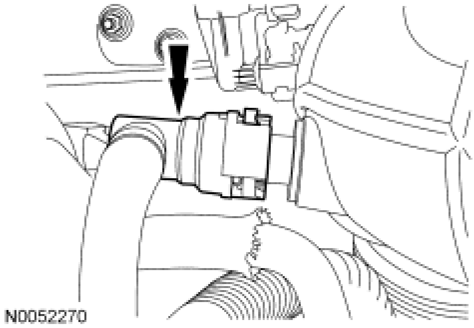


Fig. 663: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover-To-LH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

66. Using a new gasket, install the LH valve cover and 11 stud bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

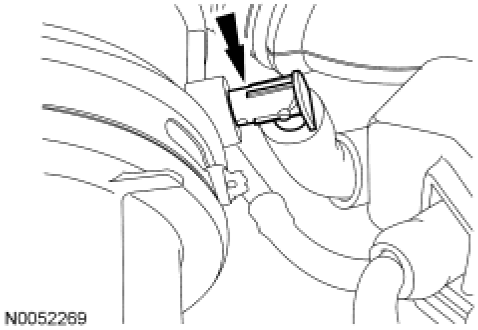


Fig. 664: Installing LH Valve Cover Stud Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

67. Install the 6 coil-on-plug assemblies and the 6 bolts.
    - Tighten to 7 Nm (62 lb-in).

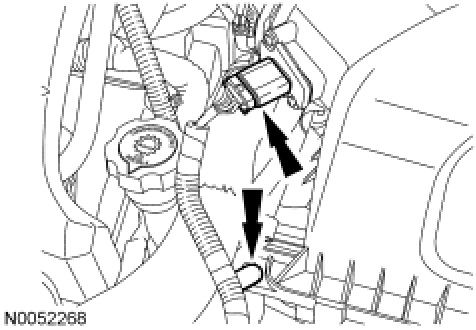


Fig. 665: Locating Coil-On-Plugs & Bolts
Courtesy of FORD MOTOR CO.

NOTE: Engine without oil cooler shown, engine with oil cooler similar.

68. Using a new gasket and O-ring seal, install the oil filter adapter and the 2 bolts.
    - Tighten the large bolt to 57 Nm (42 lb-ft).
    - Tighten the small bolt to 10 Nm (89 lb-in).

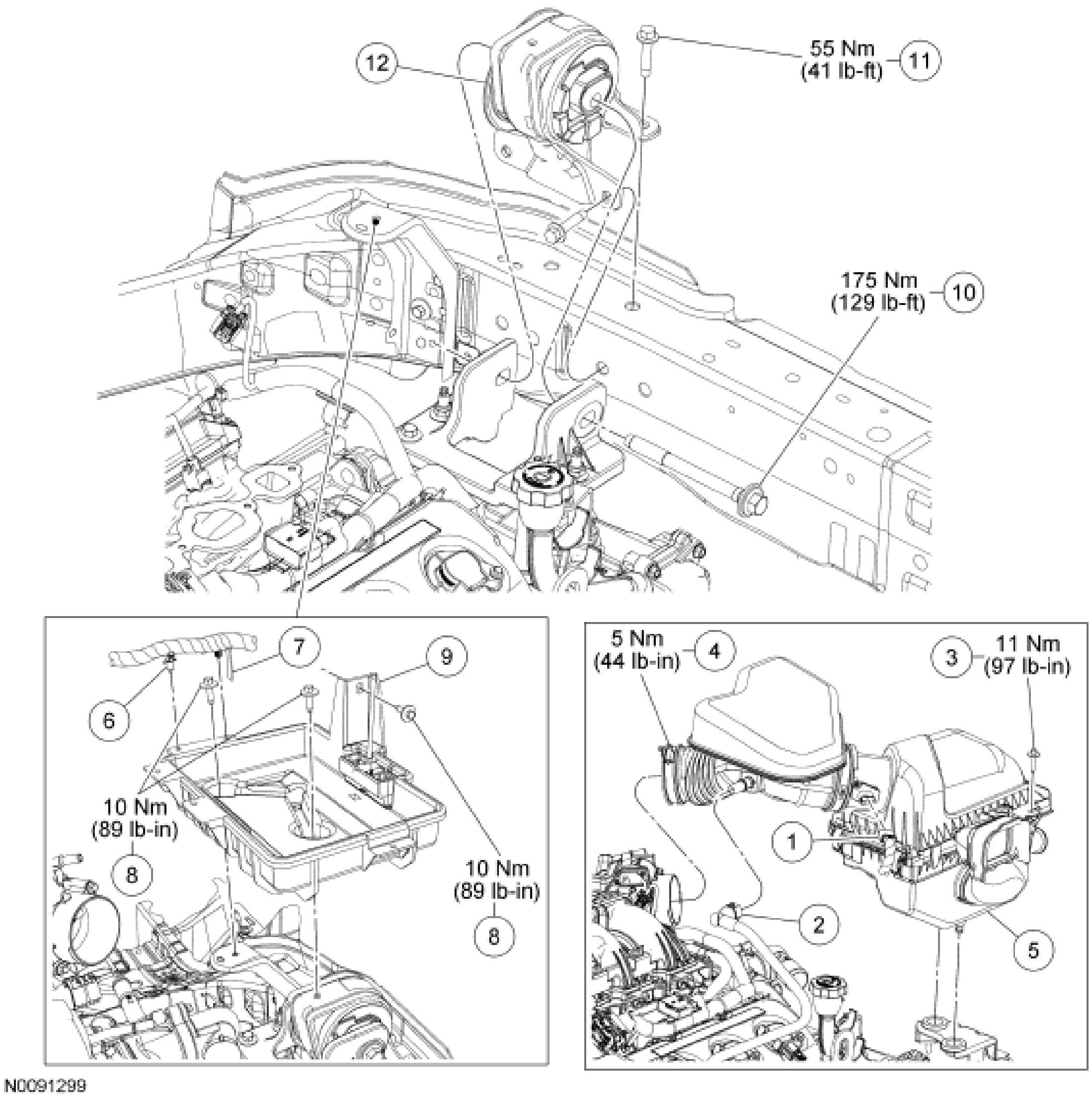


Fig. 666: Locating Oil Filter Adapter & Bolts
Courtesy of FORD MOTOR CO.

CAUTION: A new oil cooler must be installed or severe damage to the engine may occur.

69. If equipped, install a new oil cooler, new gaskets and the 6 bolts.
    - Tighten to 10 Nm (89 lb-in).

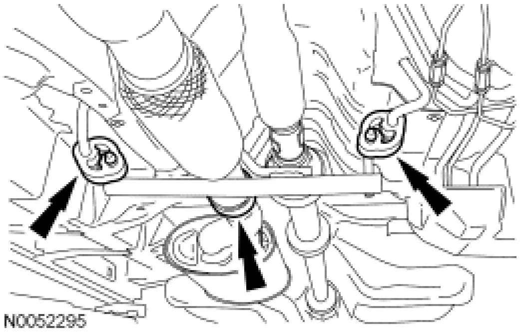


Fig. 667: Identifying Oil Cooler, Gaskets & Bolts
Courtesy of FORD MOTOR CO.

NOTE: **Apply thread sealant with PTFE to the engine oil pressure (EOP) switch threads.**

70. Install the EOP switch.
    - Tighten to 18 Nm (13 lb-ft).

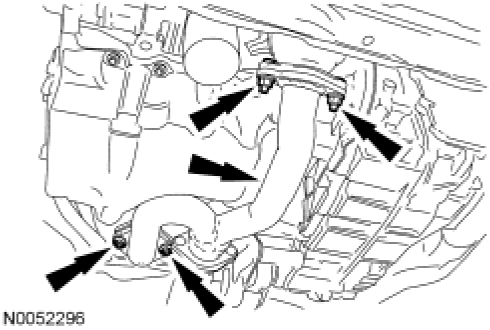


Fig. 668: Identifying EOP Switch
Courtesy of FORD MOTOR CO.

71. Install the crankshaft position (CKP) sensor and install the bolt.
    - Tighten to 10 Nm (89 lb-in).

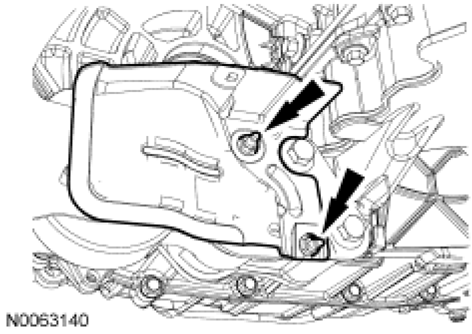


Fig. 669: Identifying CKP Sensor & Bolt

Courtesy of FORD MOTOR CO.

72. Install LH camshaft position (CMP) sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).

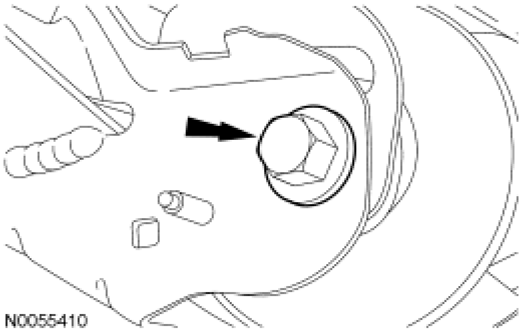


Fig. 670: Locating LH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

73. Install and connect the cylinder head temperature (CHT) sensor jumper harness.

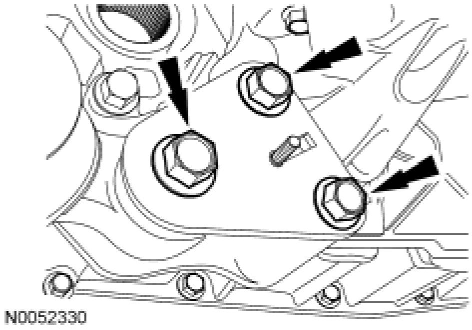


Fig. 671: Identifying CHT Sensor Jumper Harness
Courtesy of FORD MOTOR CO.

74. Using new gaskets, install the lower intake manifold and the 10 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

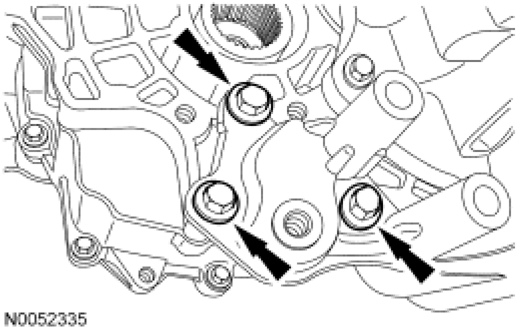


Fig. 672: Installing Lower Intake Manifold Bolts In Sequence

Courtesy of FORD MOTOR CO.

75. Using a new gasket, install the thermostat housing and the 3 bolts.
    - Tighten to 10 Nm (89 lb-in).

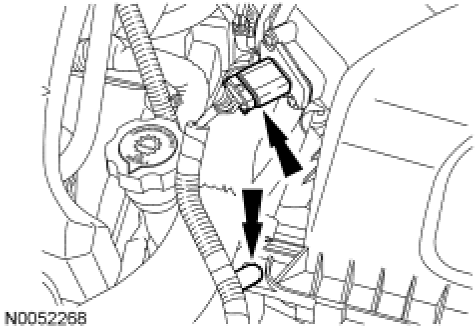


Fig. 673: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Use O-ring seals that are made of special fuel-resistant material. The use of ordinary O-rings can cause the fuel system to leak. Do not reuse the O-ring seals.

NOTE: The upper and lower O-ring seals are not interchangeable.

76. Install new fuel injector O-ring seals.
    - Remove the retaining clips and separate the fuel injectors from the fuel rail.
    - Remove and discard the O-ring seals.
    - Install new O-ring seals and lubricate with clean engine oil.
    - Install the fuel injectors and the retaining clips onto the fuel rail.

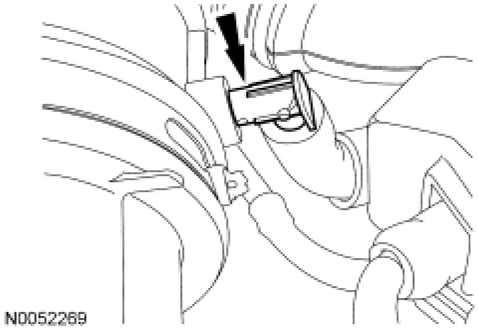


Fig. 674: Identifying Fuel Injector O-Ring Seals
Courtesy of FORD MOTOR CO.

77. Install the fuel rail and injectors as an assembly and install the 4 bolts.
    - Tighten to 10 Nm (89 lb-in).

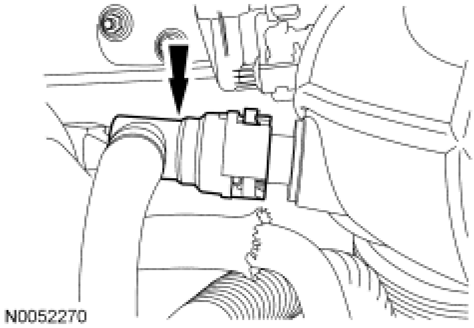


Fig. 675: Identifying Fuel Rail And Injectors
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

78. Install the catalytic converter bracket and the 2 bolts.
    - Tighten to 48 Nm (35 lb-ft).

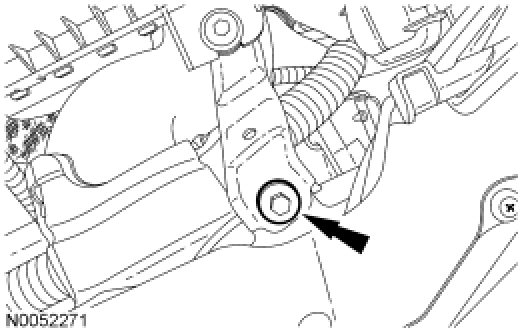


Fig. 676: Locating Catalytic Converter Bracket & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

79. Install the RH CMP sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).

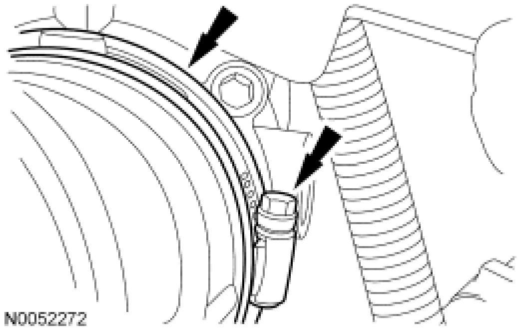


Fig. 677: Locating RH CMP Sensor & Bolt

Courtesy of FORD MOTOR CO.

80. Install the engine lifting eye and the 2 bolts.
    - Tighten to 24 Nm (18 lb-ft).

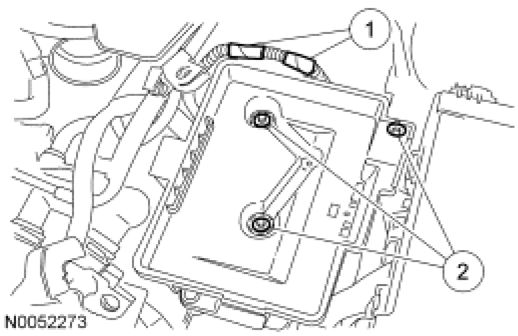


Fig. 678: Locating Engine Lifting Eye & Bolts
Courtesy of FORD MOTOR CO.

81. Install the cover and the pin-type retainer.

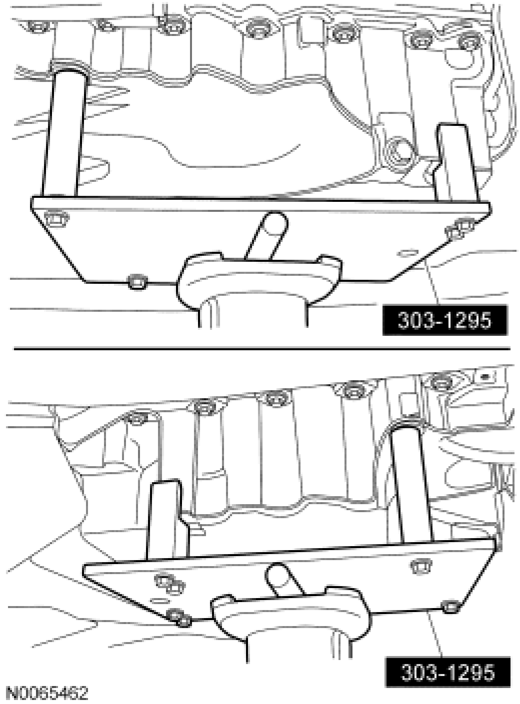


Fig. 679: Locating Pin-Type Retainer & Cover
Courtesy of FORD MOTOR CO.

82. Install the LH cylinder block drain plug.
    - Tighten to 20 Nm (15 lb-ft) plus an additional 180 degrees.

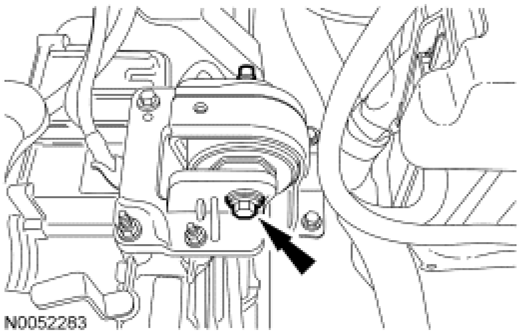


Fig. 680: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

83. Install the RH cylinder block drain plug or, if equipped, the block heater.
    - Tighten to 40 Nm (30 lb-ft).

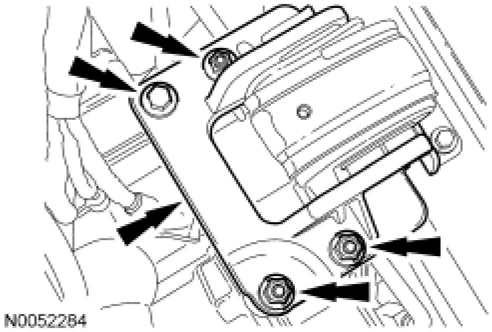


Fig. 681: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

84. Install 6 new RH exhaust manifold studs.
    - Tighten to 12 Nm (9 lb-ft).

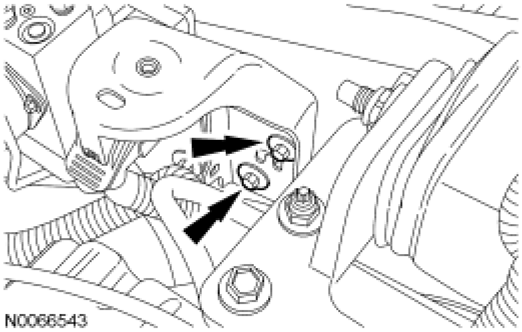


Fig. 682: Locating RH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

CAUTION: Failure to tighten the exhaust manifold nuts to specification a second

time will cause the exhaust manifold to develop an exhaust leak.

85. Using a new gasket, install the RH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown:
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten to 20 Nm (15 lb-ft).

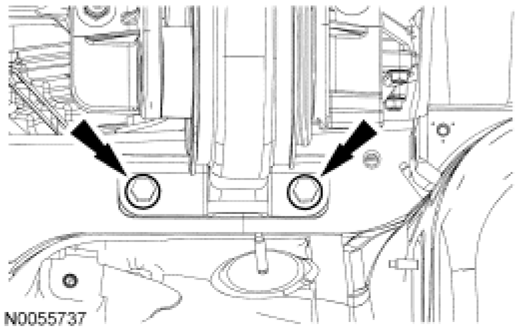


Fig. 683: Installing RH Exhaust Manifold Nuts In Sequence
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

86. Install the RH exhaust manifold heat shield and the 3 bolts.
    - Tighten to 14 Nm (10 lb-ft).

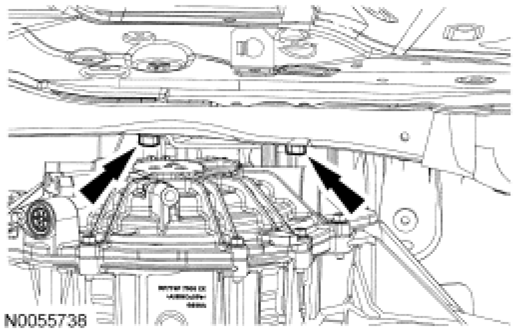


Fig. 684: Locating RH Exhaust Manifold Heat Shield & Nuts
Courtesy of FORD MOTOR CO.

87. Using a new gasket, install the RH catalytic converter and the 4 new nuts.
    - Tighten to 40 Nm (30 lb-ft).

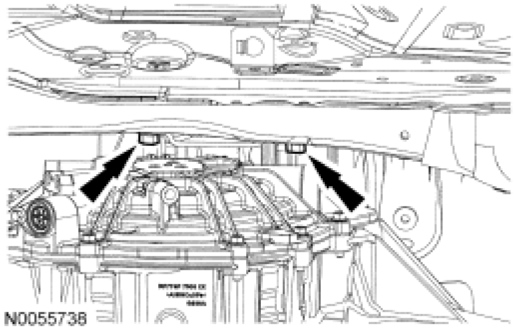


Fig. 685: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

All vehicles

88. Install 6 new LH exhaust manifold studs.
    - Tighten to 12 Nm (9 lb-ft).

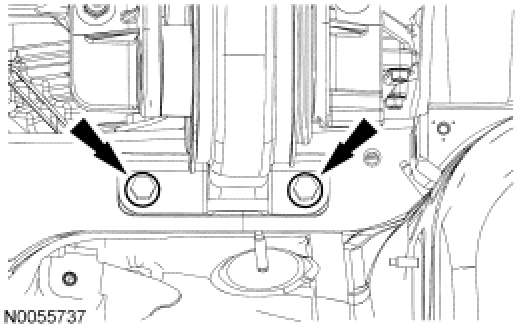


Fig. 686: Locating LH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

CAUTION: Failure to tighten the exhaust manifold nuts to specification a second time will cause the exhaust manifold to develop an exhaust leak.

89. Using a new gasket, install the LH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown:
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten to 20 Nm (15 lb-ft).

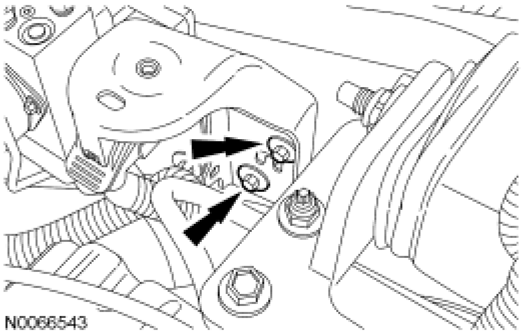


Fig. 687: Installing LH Exhaust Manifold Nuts In Sequence
Courtesy of FORD MOTOR CO.

90. Install the LH exhaust manifold heat shield and the 3 bolts.
    - Tighten to 14 Nm (10 lb-ft).

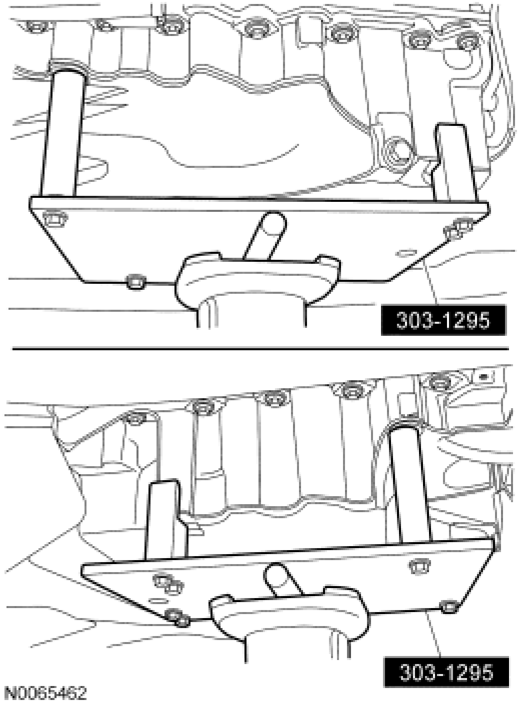


Fig. 688: Locating LH Exhaust Manifold Heat Shield & Nuts
Courtesy of FORD MOTOR CO.

91. Using a new gasket, install the LH catalytic converter and 4 new nuts (3 shown).
    - Tighten to 40 Nm (30 lb-ft).

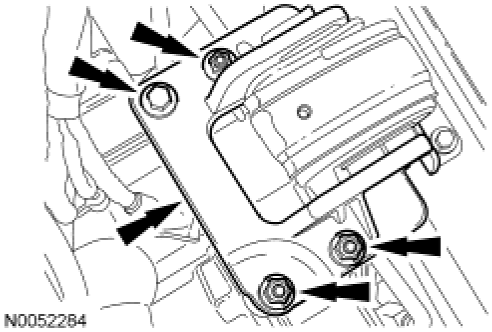


Fig. 689: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

92. Install the accessory drive belt tensioner and the 3 bolts.
    - Tighten to 11 Nm (8 lb-ft).

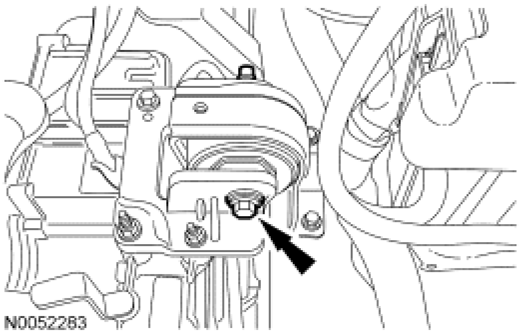


Fig. 690: Locating Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

93. Install the power steering pump and the 3 bolts.
    - Tighten to 24 Nm (18 lb-ft).

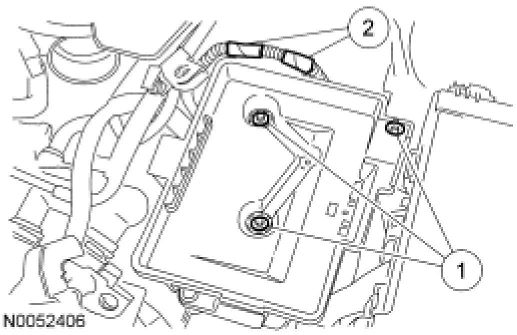


Fig. 691: Locating Power Steering Pump Bolts
Courtesy of FORD MOTOR CO.

94. Install the generator, the bolt and the nut.

- Tighten to 47 Nm (35 lb-ft).

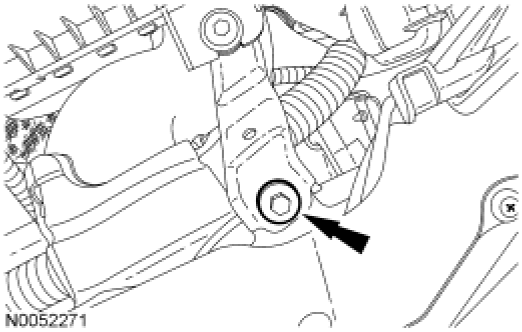


Fig. 692: Locating Generator, Bolts & Nuts
Courtesy of FORD MOTOR CO.

95. Position the wiring harness onto the engine.
96. Connect the EOP switch electrical connector and the wiring harness pin-type retainer.

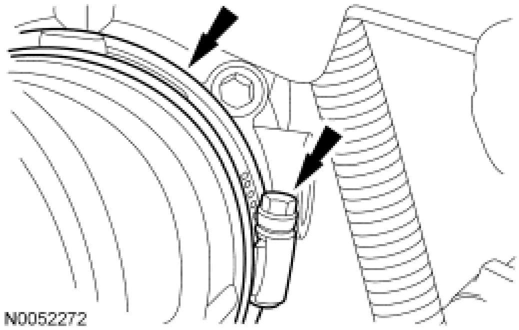


Fig. 693: Locating Engine Oil Pressure (EOP) Switch Electrical Connector & Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

97. Attach the wiring harness retainer to the generator.

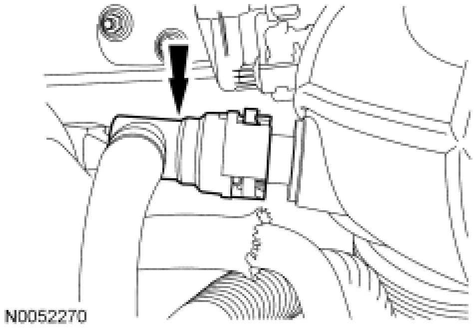
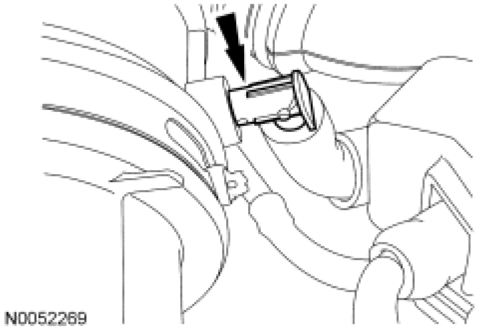


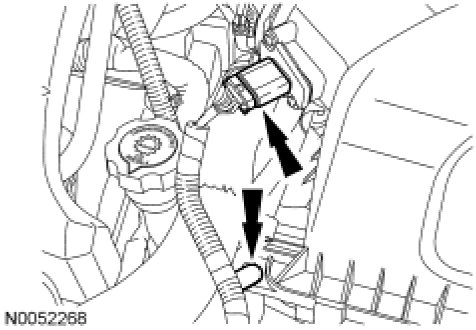
Fig. 694: Identifying Wiring Harness Retainer From Generator
Courtesy of FORD MOTOR CO.

98. Connect the generator electrical connector.



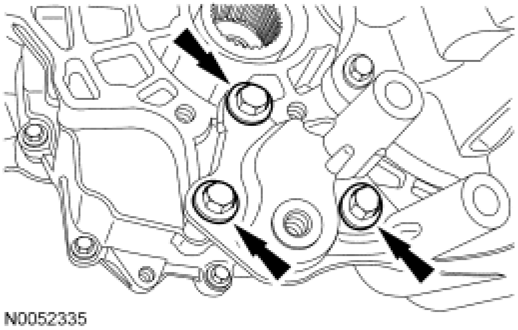
<u>Fig. 695: Identifying Generator Electrical Connector</u>
Courtesy of FORD MOTOR CO.

99. Connect the generator B+ cable and install the nut.
    - Tighten to 6 Nm (53 lb-in).



<u>Fig. 696: Identifying Generator B+ Cable & Nut</u>
Courtesy of FORD MOTOR CO.

100. Connect the A/C compressor electrical connector.



<u>Fig. 697: Identifying A/C Compressor Electrical Connector</u>
Courtesy of FORD MOTOR CO.

101. Connect the CKP sensor electrical connector.

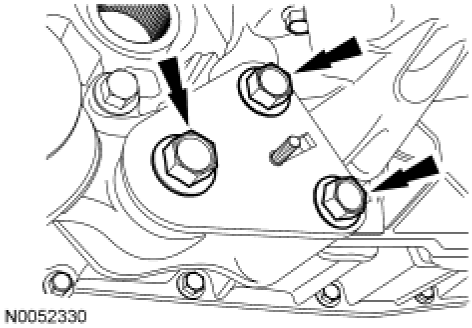


Fig. 698: Identifying Crankshaft Position (CKP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

102. Install the wiring harness grommet.

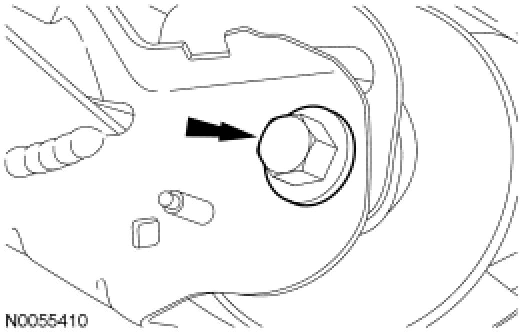


Fig. 699: Identifying Wiring Harness Grommet
Courtesy of FORD MOTOR CO.

103. Install the wiring harness retainer stud bolt.
   - Tighten to 10 Nm (89 lb-in).

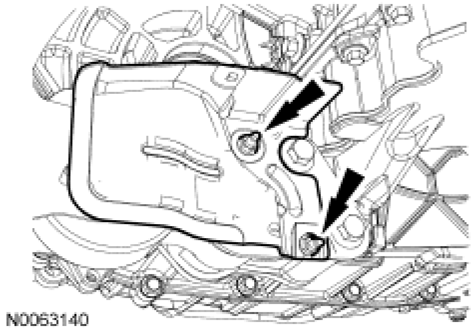


Fig. 700: Identifying Wiring Harness Retainer Stud Bolt
Courtesy of FORD MOTOR CO.

104. Install the heat shield, the nut and the bolt.
   - Tighten to 10 Nm (89 lb-in).

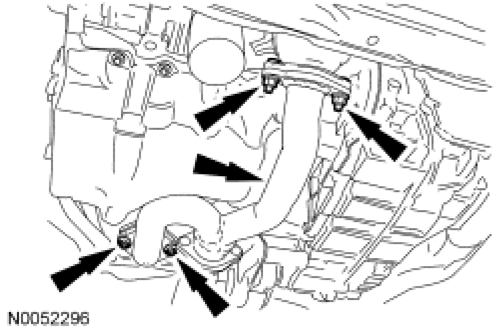


Fig. 701: Identifying Heat Shield, Nut & Bolt
Courtesy of FORD MOTOR CO.

105. Install the wiring harness retainer bolt on the rear of the LH cylinder head.
    - Tighten to 10 Nm (89 lb-in).

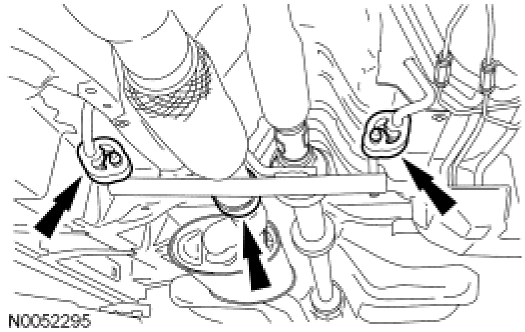


Fig. 702: Identifying Wiring Harness Retainer Bolt From Rear Of LH Cylinder Head
Courtesy of FORD MOTOR CO.

106. Attach all of the wiring harness retainers to the LH valve cover and stud bolts.
107. Connect the LH camshaft VCT solenoid electrical connector.

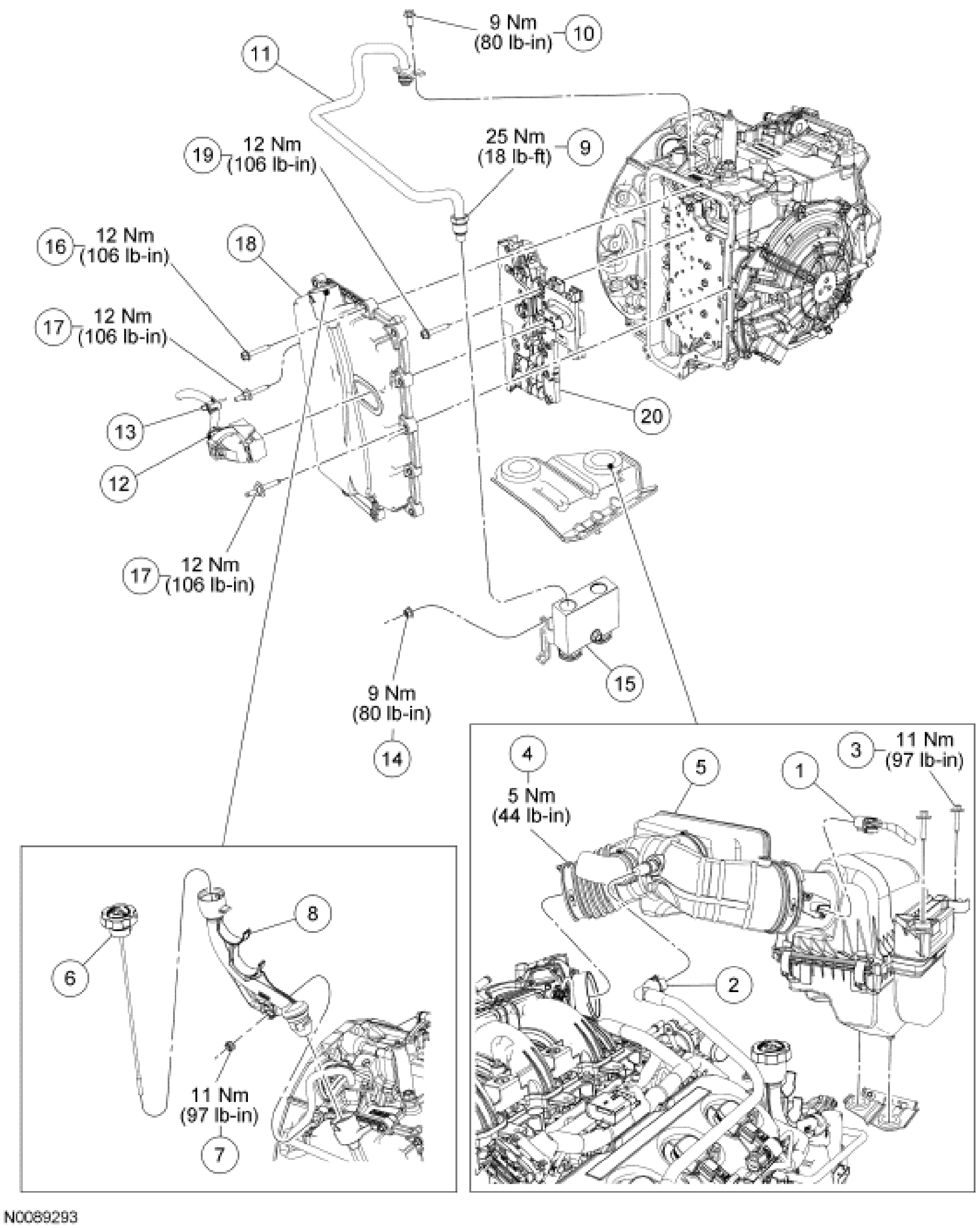


Fig. 703: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

108. Connect the 3 LH coil-on-plug electrical connectors.

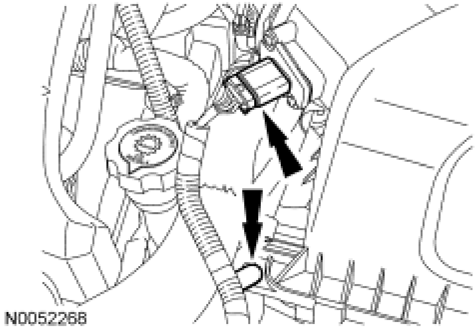


Fig. 704: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

109. Connect the LH heated oxygen sensor (HO2S) electrical connector.

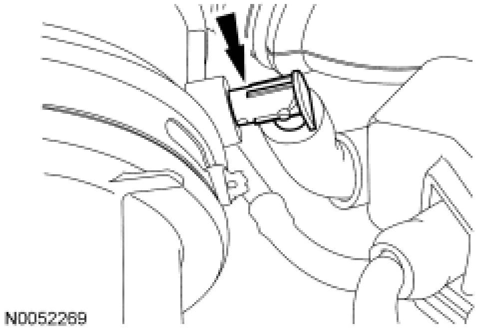


Fig. 705: Locating LH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

110. Connect the LH catalyst monitor sensor electrical connector.

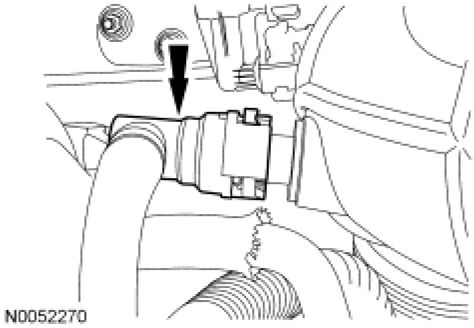


Fig. 706: Identifying LH Catalyst Monitor Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

111. Connect the LH CMP sensor electrical connector.

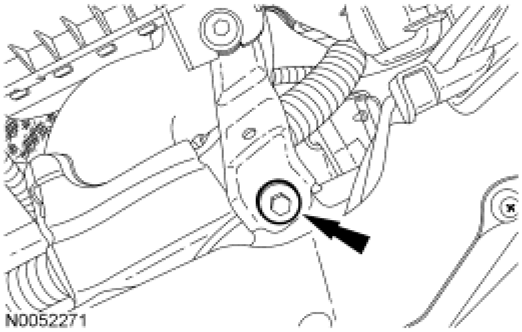


Fig. 707: Locating LH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

112. Connect the CHT sensor electrical connector.

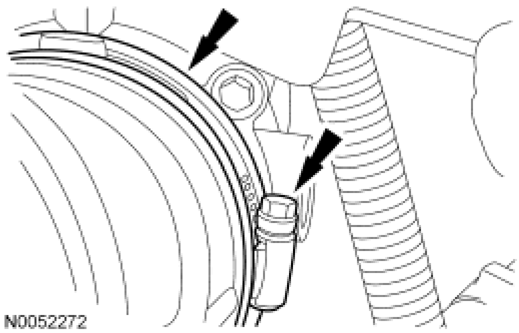


Fig. 708: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

113. Connect the 6 fuel injector electrical connectors (3 shown).

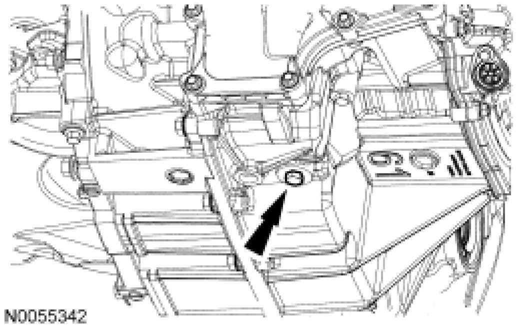


Fig. 709: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

114. Install the ground cable and the bolt.
    - Tighten to 10 Nm (89 lb-in).

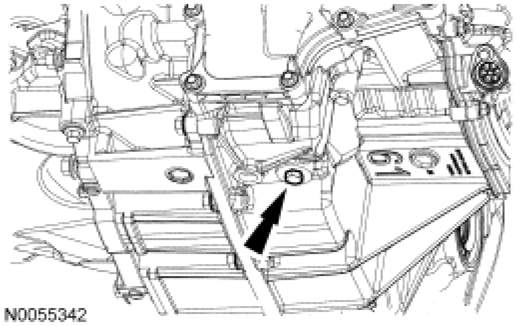


Fig. 710: Locating Ground Cable From RH Cylinder
Courtesy of FORD MOTOR CO.

115. Connect the KS electrical connector.

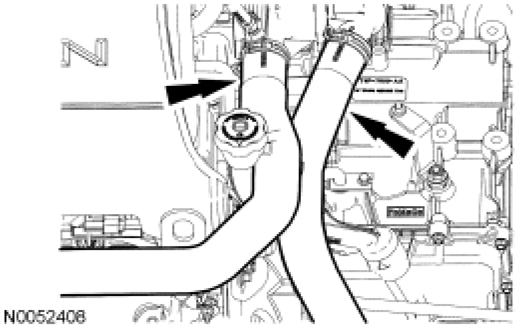


Fig. 711: Locating Knock Sensor (KS) Electrical Connector
Courtesy of FORD MOTOR CO.

116. Connect the RH CMP sensor electrical connector.

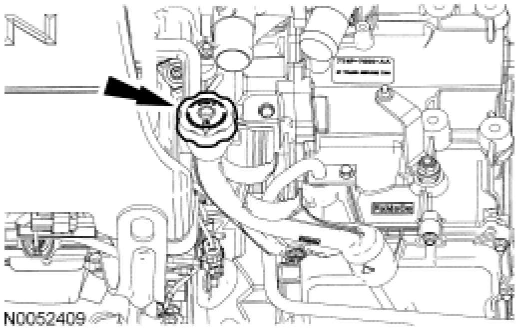


Fig. 712: Locating RH Camshaft Position (CMP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

117. Attach all of the wiring harness retainers to the RH valve cover and stud bolts.
118. Connect the 3 RH coil-on-plug electrical connectors.

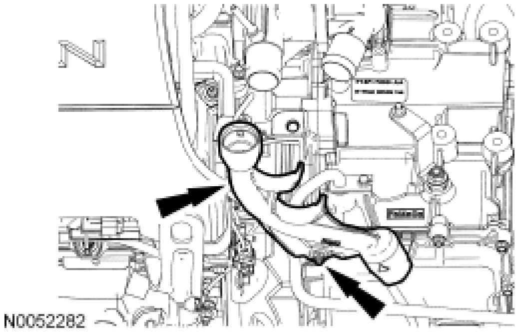


Fig. 713: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

119. Connect the RH VCT solenoid electrical connector.

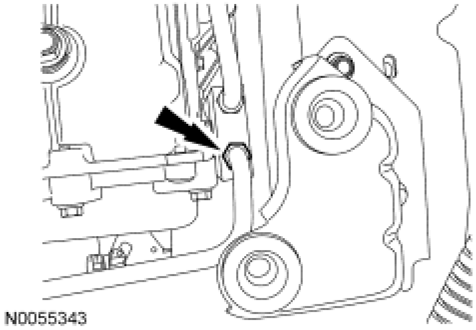


Fig. 714: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

FWD vehicles

120. Connect the RH catalyst monitor sensor electrical connector.

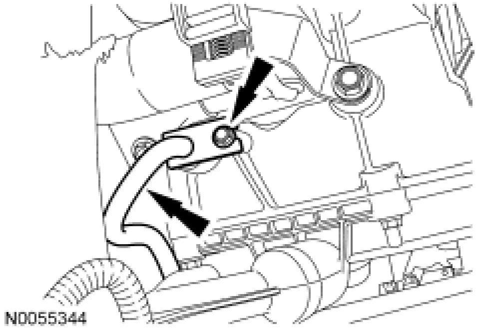


Fig. 715: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

121. Connect the power steering pressure (PSP) switch electrical connector.

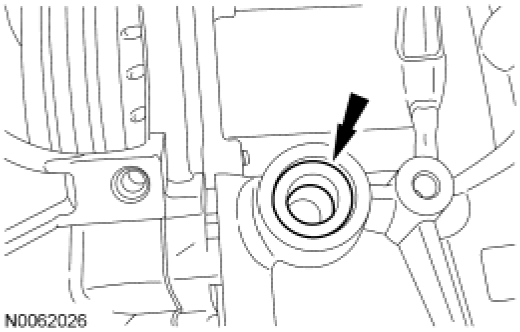


Fig. 716: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

122. Using a new gasket, install the upper intake manifold and the 6 bolts.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).

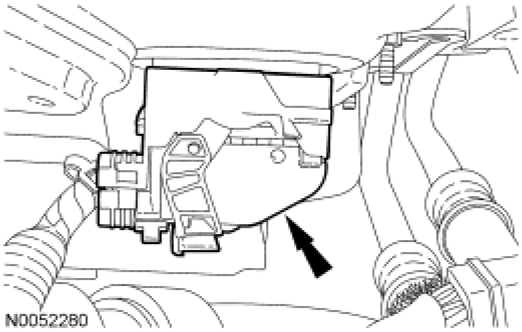


Fig. 717: Identifying Bolt Sequence
Courtesy of FORD MOTOR CO.

123. Install the upper intake manifold support bracket and the 2 bolts (1 shown).
   - Tighten to 10 Nm (89 lb-in).

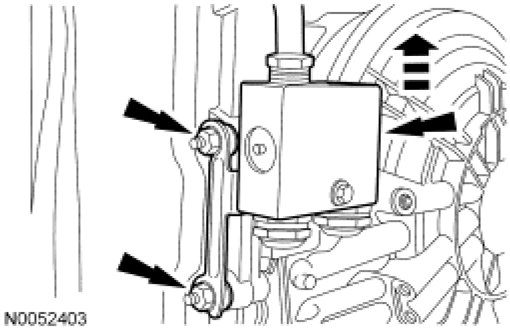


Fig. 718: Identifying Upper Intake Manifold Support Bracket & Bolt
Courtesy of FORD MOTOR CO.

124. Connect the RH HO2S electrical connector.

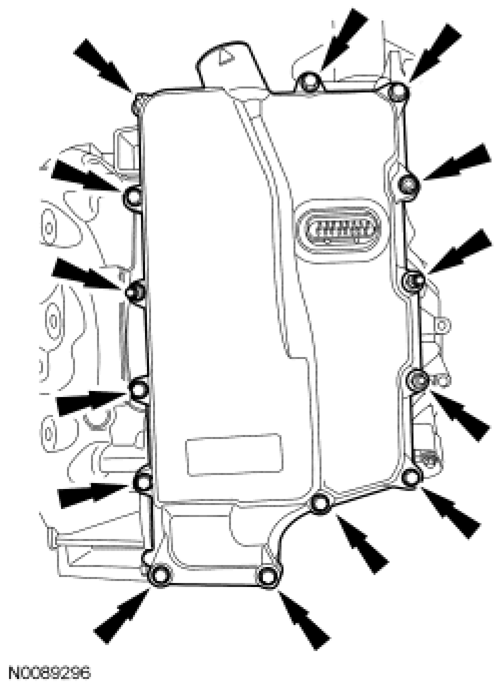


Fig. 719: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

125. Attach the wiring harness retainers to the upper intake manifold.

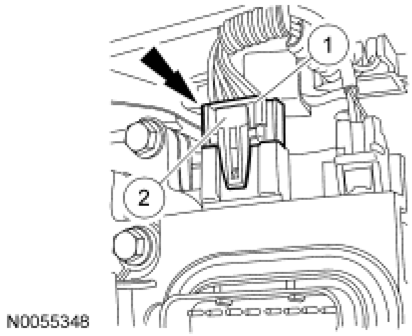


Fig. 720: Locating Wiring Harness Retainers From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

126. Connect the throttle body (TB) electrical connector.

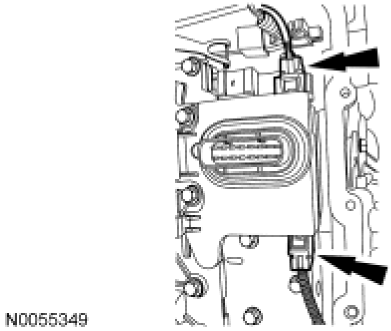


Fig. 721: Locating Throttle Body Electrical Connector
Courtesy of FORD MOTOR CO.

127. Connect the PCV hose to the PCV valve.

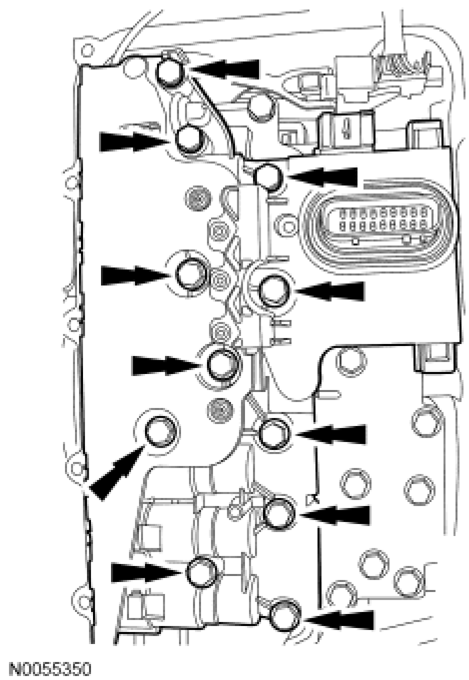
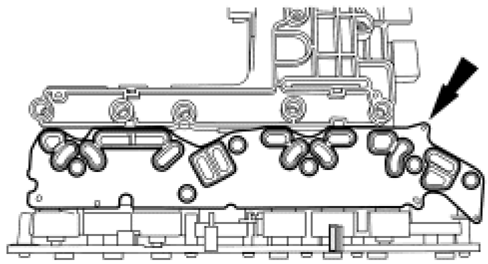


Fig. 722: Identifying PCV Hose
Courtesy of FORD MOTOR CO.

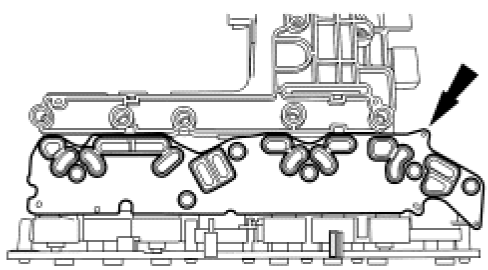
128. If equipped, position the block heater wiring harness onto the engine and attach all of the harness retainers.
129. If equipped, connect the block heater electrical connector and install the heat shield.



N0055016

Fig. 723: Identifying Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

130. Install the special tool on the LH cylinder head.



N0055016

Fig. 724: Installing Special Tool (303-1245) On LH Cylinder Head
Courtesy of FORD MOTOR CO.

131. Using the special tools, remove the engine from the stand.

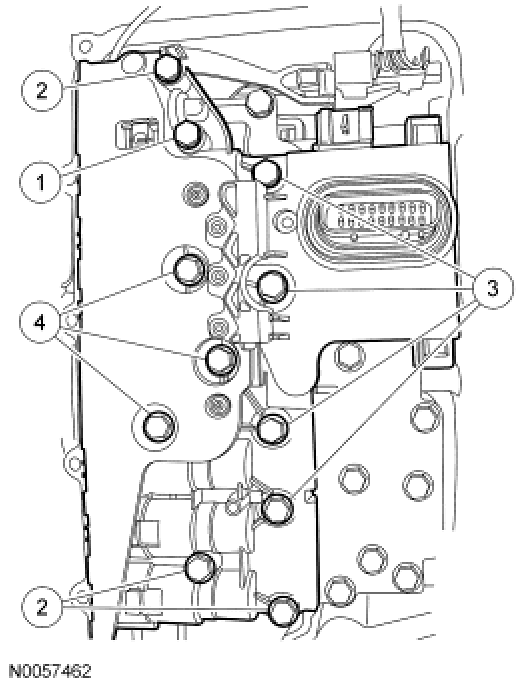


Fig. 725: Removing Engine & Transaxle From Lift Table Using Special Tools (303-D089, 014-00071) & Suitable Engine Crane
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the seal lips and bore with clean engine oil prior to installation.

132. Position the special tool onto the end of the crankshaft and slide a new crankshaft rear seal onto the tool.

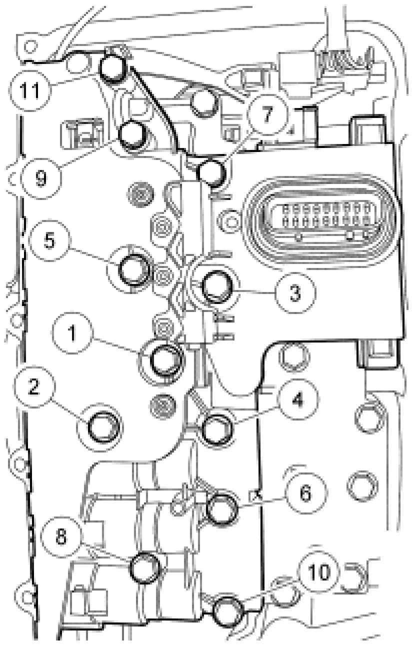


Fig. 726: Positioning Special Tool (303-1250) Onto End Of Crankshaft
Courtesy of FORD MOTOR CO.

133. Using the special tools, install the new crankshaft rear seal.

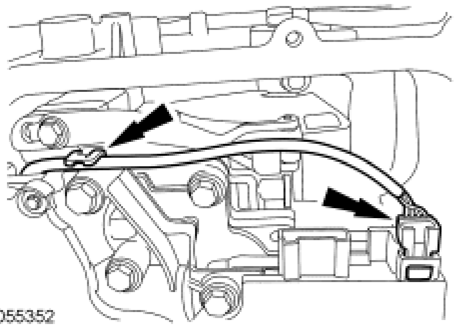


Fig. 727: Installing New Crankshaft Rear Seal Using Special Tools (303-1250) & (205-153)
Courtesy of FORD MOTOR CO.

134. Install the crankshaft sensor ring.

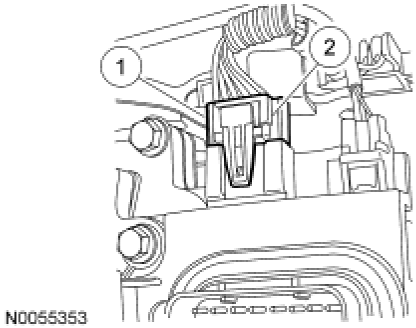


Fig. 728: Identifying Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

135. Install the flexplate and the 8 bolts.
    - Tighten to 80 Nm (59 lb-ft).

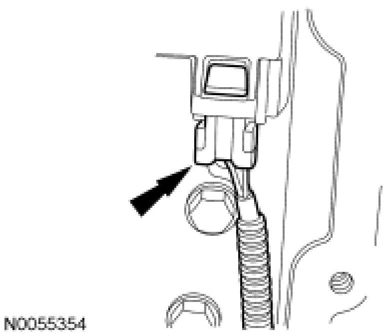
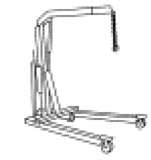


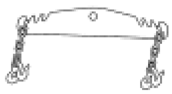
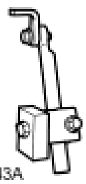
Fig. 729: Identifying Flexplate & Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

ENGINE

Special Tools

Illustration	Tool Name	Tool Number
	Heavy Duty Floor Crane	014-00071 or equivalent
	Powertrain Lift	014-00765

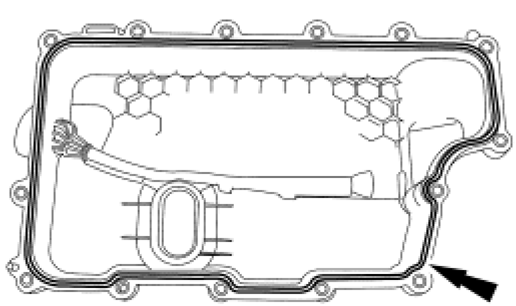
 ST1602-A	Spreader Bar	303-D089 (D93P-6001-A3) or equivalent
 ST2743A	Universal Adapter Brackets	014-0001

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

All vehicles

1. Align the transaxle to the engine.
2. Install the 5 transaxle-to-engine bolts.
    - Tighten to 48 Nm (35 lb-ft).



N0054253

Fig. 730: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

3. Install the 2 engine-to-transaxle bolts.
    - Tighten to 48 Nm (35 lb-ft).

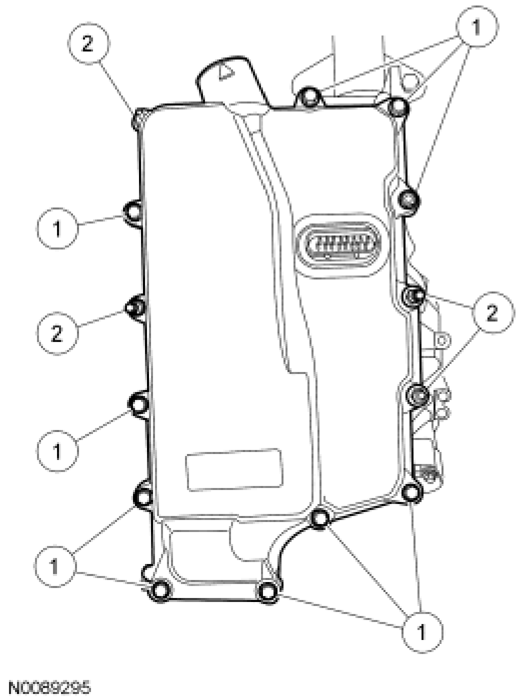


Fig. 731: Locating Engine-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

4. Using the special tools, position the engine and transaxle onto the lift table.

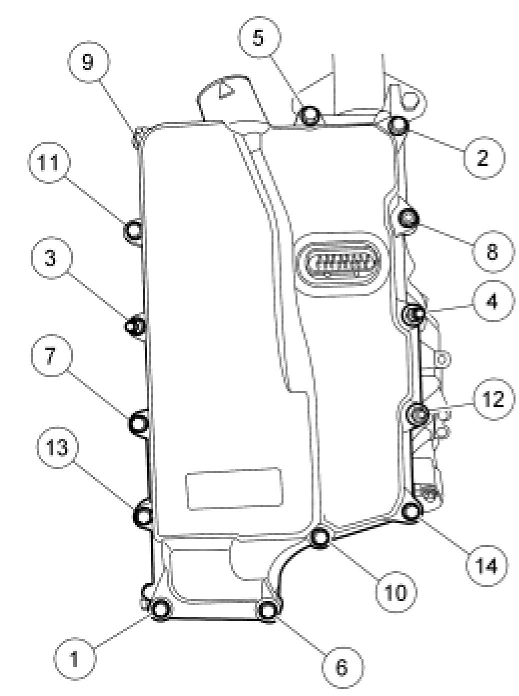


Fig. 732: Removing Engine & Transaxle From Lift Table Using Special Tools (303-D089, 014-

00071) & Suitable Engine Crane
Courtesy of FORD MOTOR CO.

NOTE: Position a block of wood under the transaxle.

5. Install the special tools.

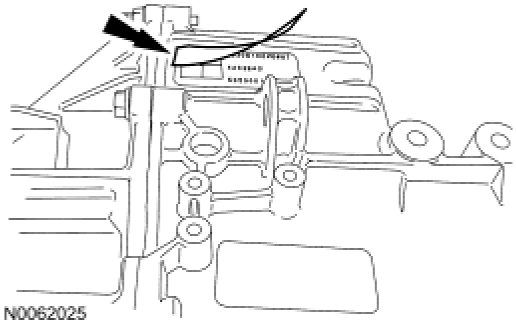


Fig. 733: Positioning A Block Of Wood Under Transaxle Using Special Tools (014-0001) & (014-00765)
Courtesy of FORD MOTOR CO.

6. Install the starter, the bolt and the stud bolt.
   - Tighten to 27 Nm (20 lb-ft).

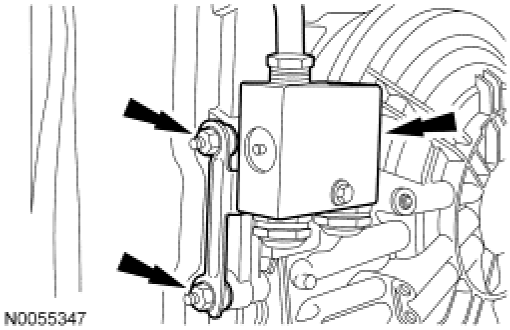


Fig. 734: Identifying Bolt, Stud Bolt & Starter
Courtesy of FORD MOTOR CO.

7. Connect the wiring harness retainer to the starter stud bolt.

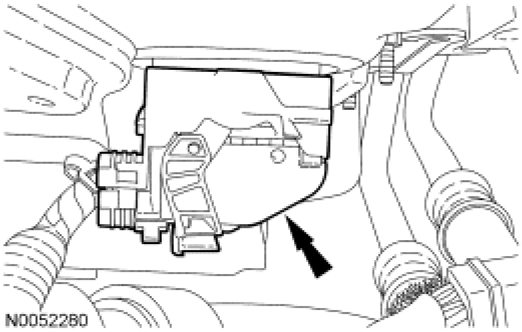


Fig. 735: Identifying Wiring Harness Retainer From Starter Motor Stud Bolt
Courtesy of FORD MOTOR CO.

8. Attach the starter motor wire terminals and install the 2 nuts.
   1. Tighten to 12 Nm (9 lb-ft).
   2. Tighten to 5 Nm (44 lb-in).
      - Position the starter terminal boot over the starter terminal.

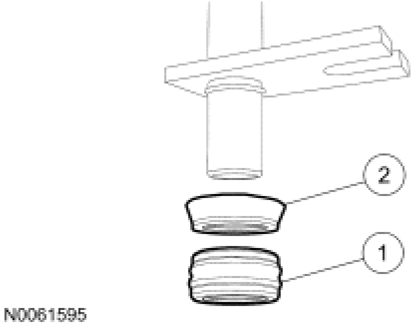


Fig. 736: Identifying Starter Motor Wire Terminals & Nuts
Courtesy of FORD MOTOR CO.

9. Raise the engine and transaxle assembly into the vehicle.
10. Install the engine mount and the 3 bolts.
    - Tighten to 90 Nm (66 lb-ft).

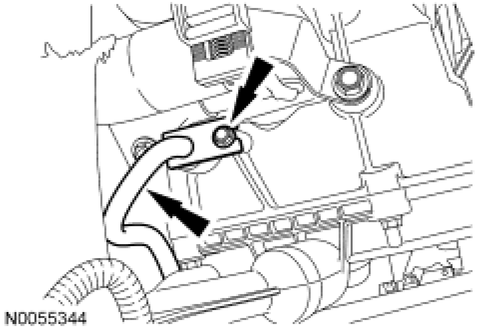


Fig. 737: Locating Engine Mount Bolts

Courtesy of FORD MOTOR CO.

11. Install the 4 engine mount nuts.
    - Tighten to 63 Nm (46 lb-ft).

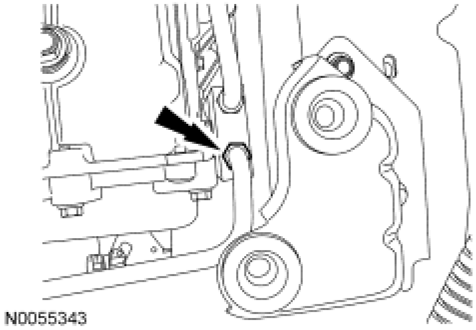


Fig. 738: Locating Engine Mount Nuts
Courtesy of FORD MOTOR CO.

12. Install the engine mount brace, the nut and the bolt.
    - Tighten to 20 Nm (15 lb-ft).

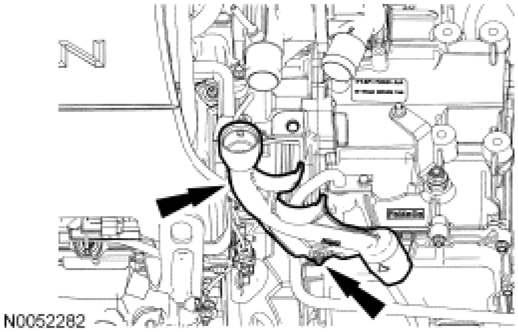


Fig. 739: Locating Nut, Bolt & Engine Mount Brace
Courtesy of FORD MOTOR CO.

13. Install the transaxle support insulator bracket, the 3 nuts and the bolt.
    - Tighten to 63 Nm (46 lb-ft).

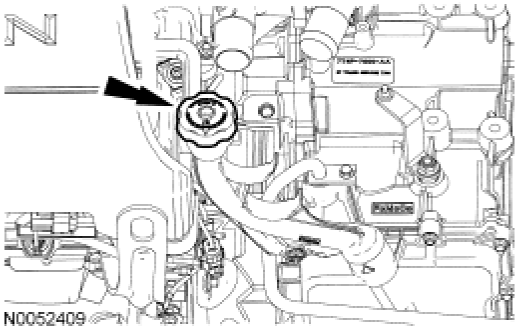


Fig. 740: Identifying Transaxle Support Insulator Bracket, Nuts & Bolts
Courtesy of FORD MOTOR CO.

14. Install the transaxle support insulator through bolt and nut.
    - Tighten to 175 Nm (129 lb-ft).

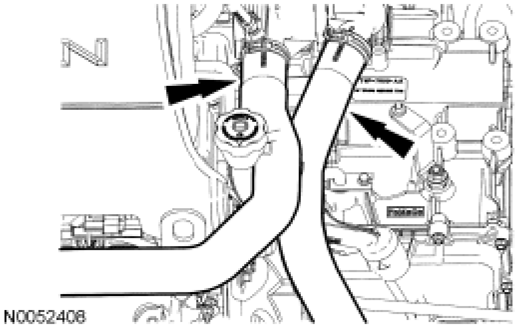


Fig. 741: Identifying Transaxle Support Insulator Bolt
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

15. Position the power transfer unit (PTU) in place and install the 5 bolts.
    - Tighten to 90 Nm (66 lb-ft).

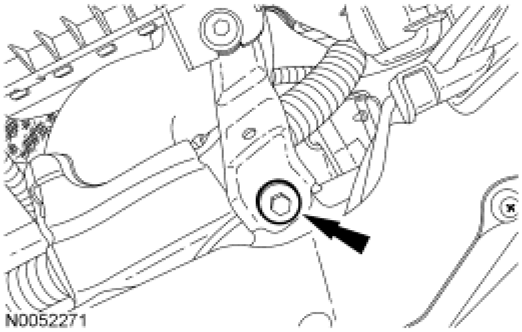


Fig. 742: Identifying PTU & Bolts
Courtesy of FORD MOTOR CO.

16. Position the PTU support bracket in place and install the 5 bolts.
    - Tighten to 70 Nm (52 lb-ft).

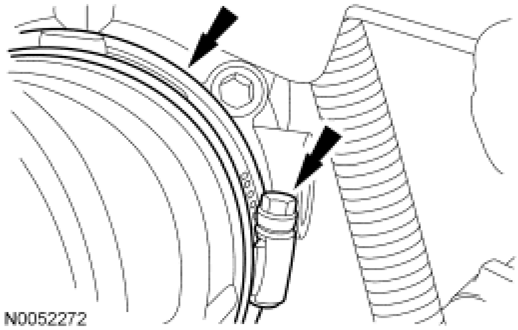


Fig. 743: Locating Power Transfer Unit (PTU) Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

NOTE: Do not tighten the 4 catalytic converter nuts at this time.

17. Using a new gasket, install the RH catalytic converter and 4 new nuts.

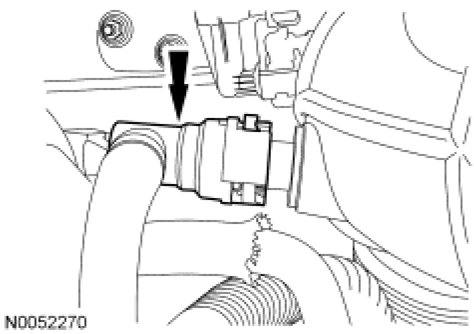


Fig. 744: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

18. Install the 2 catalytic converter-to-bracket bolts.
    - Tighten the 4 catalytic converter nuts to 40 Nm (30 lb-ft).
    - Tighten the 2 catalytic converter-to-bracket bolts to 20 Nm (15 lb-ft).

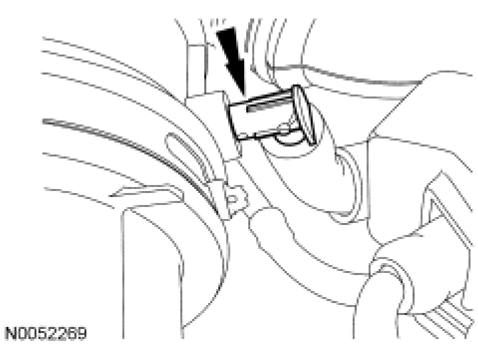


Fig. 745: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

19. Connect the RH catalyst monitor electrical connector.

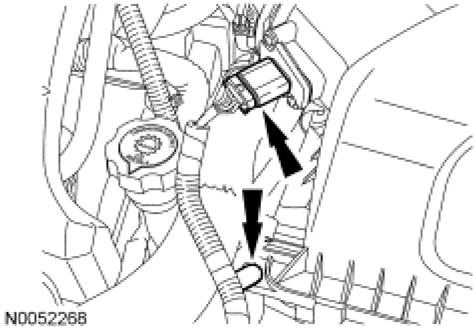


Fig. 746: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: A new PTU seal must be installed whenever the intermediate shaft is removed.

20. Install a new PTU seal. For additional information, refer to **TRANSFER CASE - POWER TRANSFER UNIT (PTU)** article.

NOTE: Prior to installation of the halfshaft, inspect the halfshaft sealing surface for wear or damage and install new, if necessary.

21. Position the RH halfshaft/intermediate shaft assembly in the PTU and in the steering knuckle and install the 2 bolts.
    - Tighten to 40 Nm (30 lb-ft).

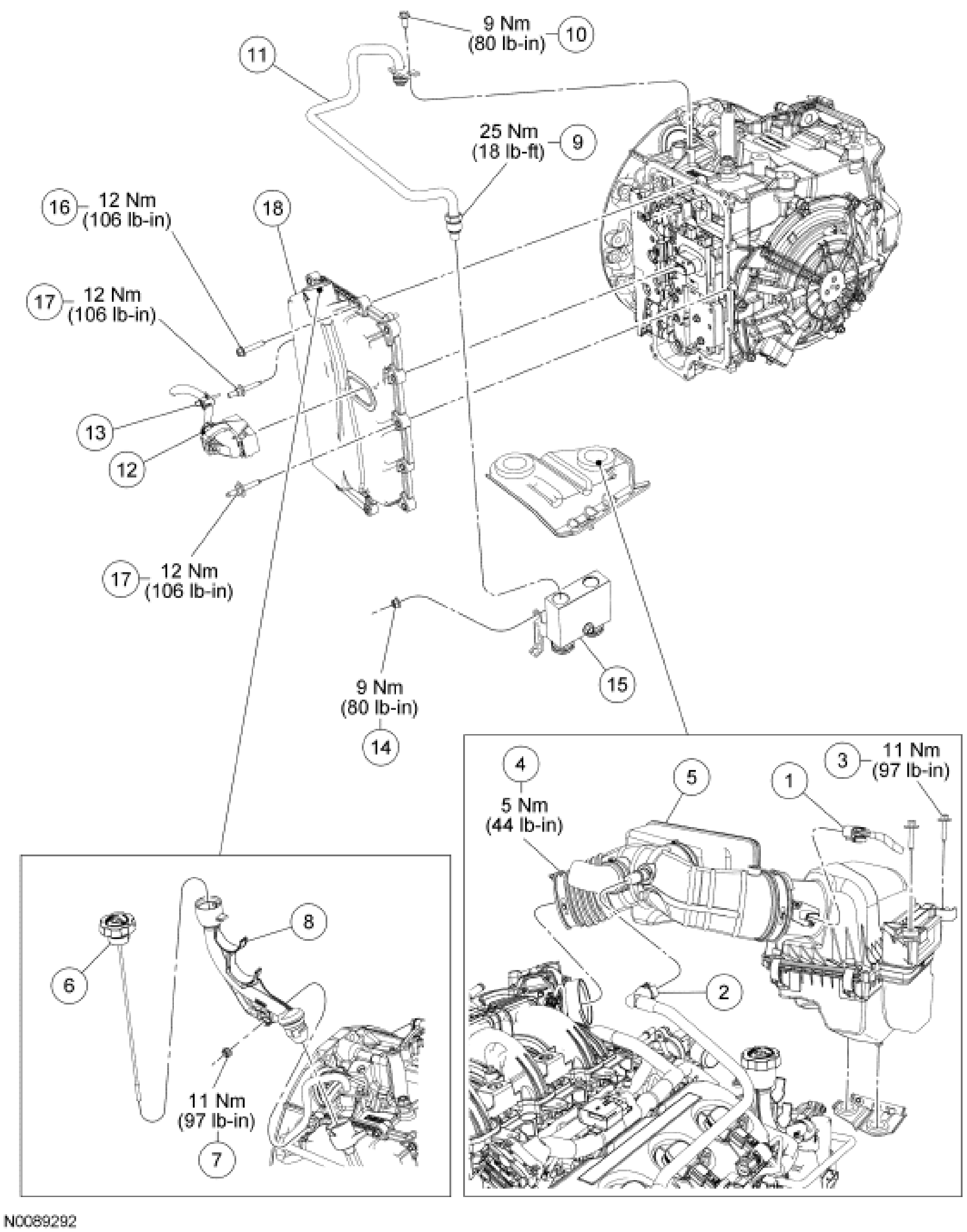


Fig. 747: Locating RH Halfshaft Bearing Support Bracket Bolts
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

NOTE: **Prior to installation of the halfshaft, inspect the halfshaft sealing surface for wear or damage and install new if necessary.**

22. Position the RH halfshaft/intermediate shaft assembly in the transaxle and in the steering knuckle and install the 2 stud bolts.
    - Tighten to 55 Nm (41 lb-ft).

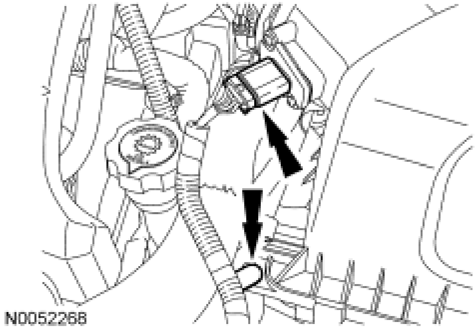


Fig. 748: Locating Stud Bolts & RH Halfshaft/Intermediate Shaft Assembly
Courtesy of FORD MOTOR CO.

NOTE: Do not tighten the 2 catalytic converter support bracket bolts at this time.

23. Install the converter support bracket and the 2 bolts.

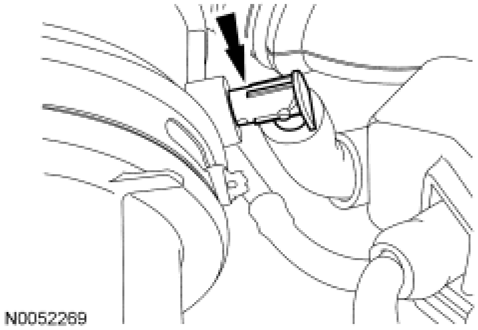


Fig. 749: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

24. Install the catalytic converter bracket bolt and the nut.
    1. Tighten the nut to 40 Nm (30 lb-ft).
    2. Tighten the bolt to 55 Nm (41 lb-ft).

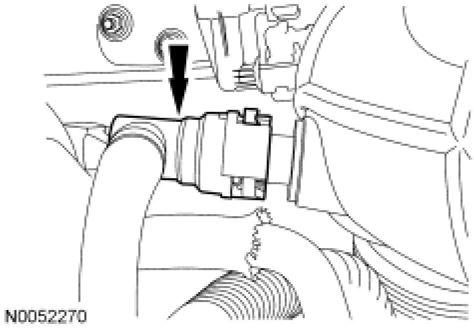


Fig. 750: Locating Catalytic Converter Bracket Bolt & Nut
Courtesy of FORD MOTOR CO.

25. Tighten the 2 RH catalytic converter support bracket bolts to 20 Nm (15 lb-ft).

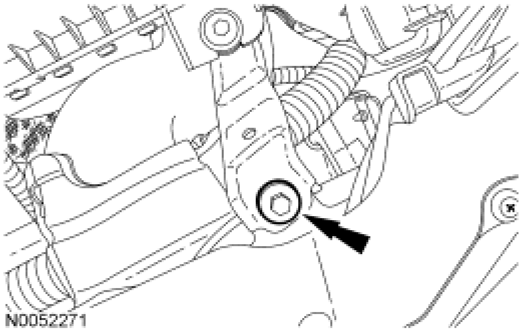


Fig. 751: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

All vehicles

NOTE:	**Prior to installation of the halfshaft, inspect the halfshaft sealing surface for wear or damage and install new, if necessary.**

26. Install the LH halfshaft into the transaxle.

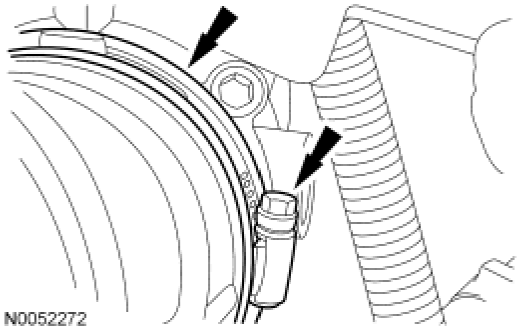


Fig. 752: Identifying LH Halfshaft
Courtesy of FORD MOTOR CO.

27. If equipped, connect the oil cooler coolant hoses.

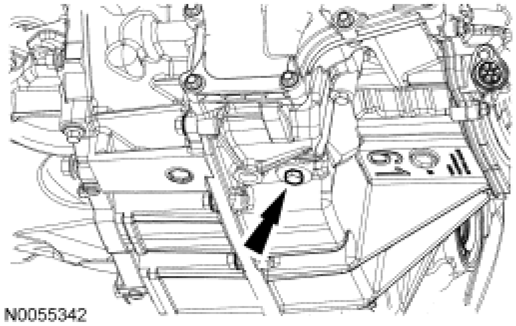


Fig. 753: Locating Oil Cooler Coolant Hoses
Courtesy of FORD MOTOR CO.

28. Using the special tool, raise the subframe into the installed position.

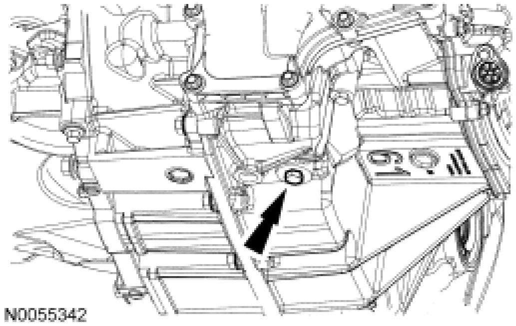


Fig. 754: Positioning Special Tool (014-00765) Under Subframe Assembly
Courtesy of FORD MOTOR CO.

29. Install the 2 middle subframe nuts.
    - Tighten to 133 Nm (98 lb-ft).

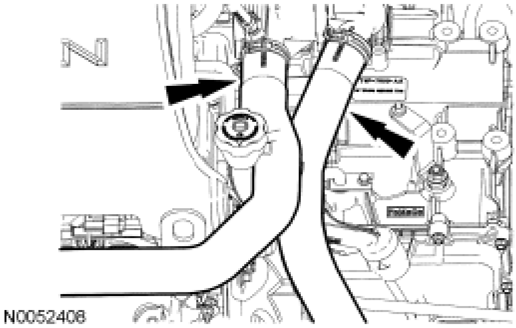


Fig. 755: Locating Middle Subframe Nuts
Courtesy of FORD MOTOR CO.

30. Install the 2 front subframe nuts.

- Tighten to 133 Nm (98 lb-ft).

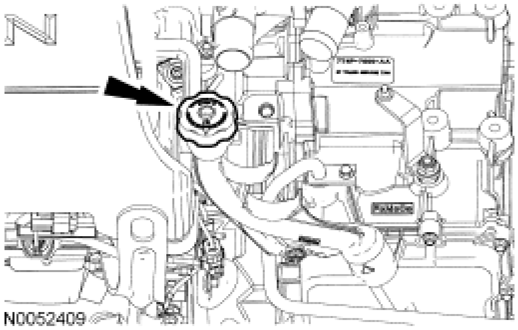


Fig. 756: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

31. Position the subframe support brackets in place and loosely install the 4 bolts.

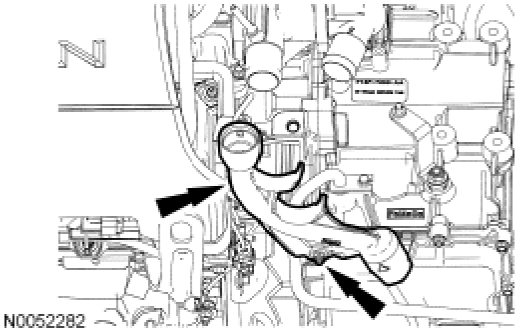


Fig. 757: Locating Subframe Support Brackets And Bolts
Courtesy of FORD MOTOR CO.

32. Install the 2 rear subframe bracket nuts.
    - Tighten to 133 Nm (98 lb-ft).

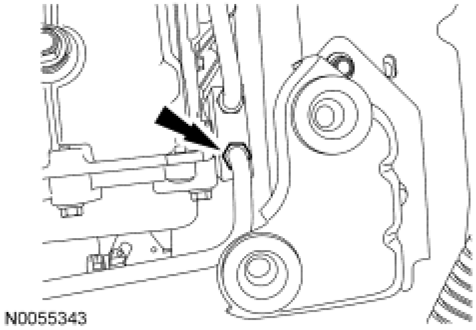


Fig. 758: Locating Rear Subframe Nuts
Courtesy of FORD MOTOR CO.

33. Tighten the 4 subframe support bracket bolts.

- Tighten to 90 Nm (66 lb-ft).

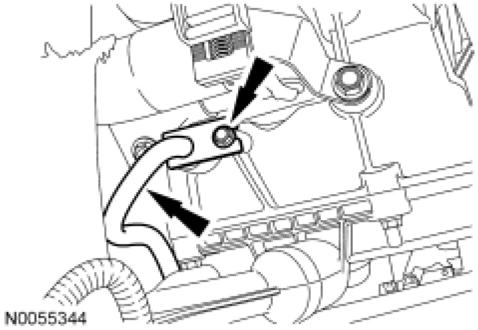


Fig. 759: Locating Subframe Support Brackets And Bolts
Courtesy of FORD MOTOR CO.

34. Position the lower bumper on the subframe and install the 3 LH nuts.
    - Tighten to 9 Nm (80 lb-in).

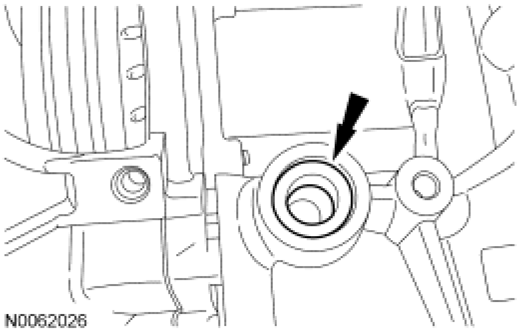


Fig. 760: Locating LH Subframe-To-Lower Bumper Nuts
Courtesy of FORD MOTOR CO.

35. Install the 3 RH lower bumper-to-subframe nuts.
    - Tighten to 9 Nm (80 lb-in).

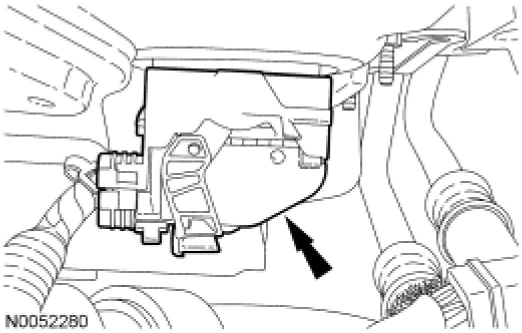


Fig. 761: Locating RH Subframe-To-Lower Bumper Nuts
Courtesy of FORD MOTOR CO.

NOTE: **RH side shown, LH side similar.**

36. Install the ball joints in the steering knuckles and install the pinch bolts.
    - Tighten to 55 Nm (41 lb-ft).

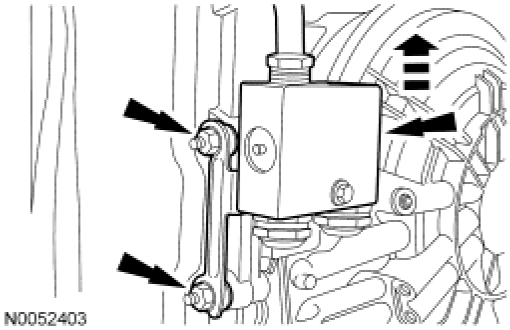


Fig. 762: Locating Ball Joint Pinch Bolt
Courtesy of FORD MOTOR CO.

NOTE: **RH side shown, LH side similar.**

37. Position the stabilizer bar links in the lower control arms and install the nuts.
    - Tighten to 90 Nm (66 lb-ft).

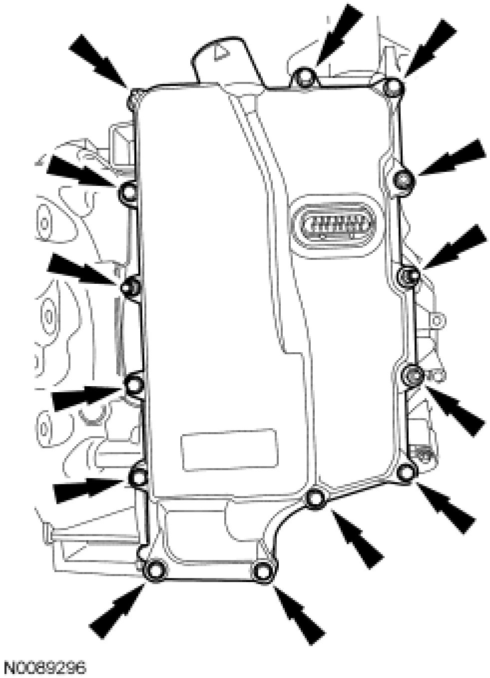


Fig. 763: Locating Stabilizer Bar Link Nut
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

38. Install the tie-rod ends and nuts.
    - Tighten to 48 Nm (35 lb-ft).
    - Install new cotter pins.

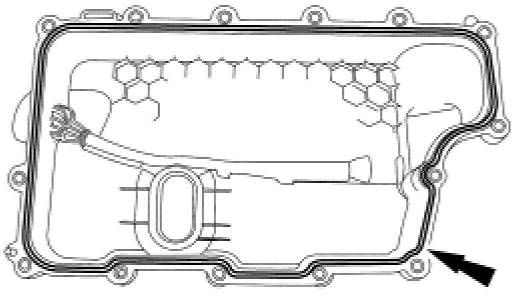


Fig. 764: Locating Tie-Rod Ends Nuts And Cotter Pin
Courtesy of FORD MOTOR CO.

CAUTION: Do not allow the intermediate shaft to rotate while it is disconnected from the gear or damage to the clockspring can occur. If there is evidence that the intermediate shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to SUPPLEMENTAL RESTRAINT SYSTEM article.

39. Install the intermediate shaft onto the steering gear and install a new bolt.
    - Tighten to 23 Nm (17 lb-ft).

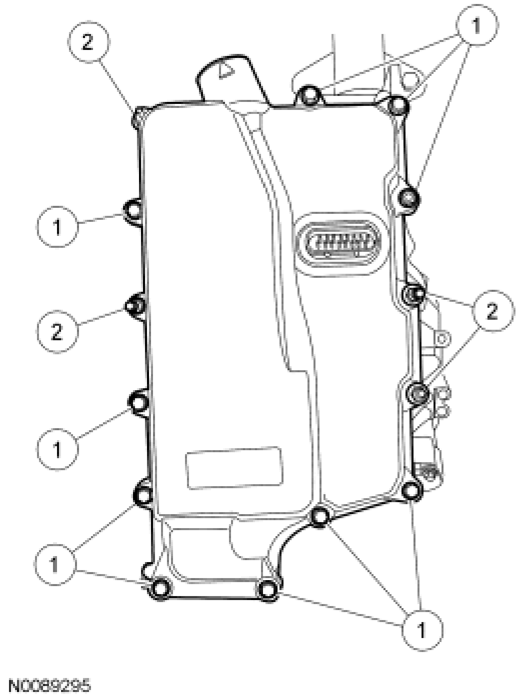


Fig. 765: Identifying Steering Intermediate Shaft Bolt
Courtesy of FORD MOTOR CO.

40. Using a new banjo bolt and 2 new seals, install the power steering pressure (PSP) tube.
    - Tighten to 48 Nm (35 lb-ft).

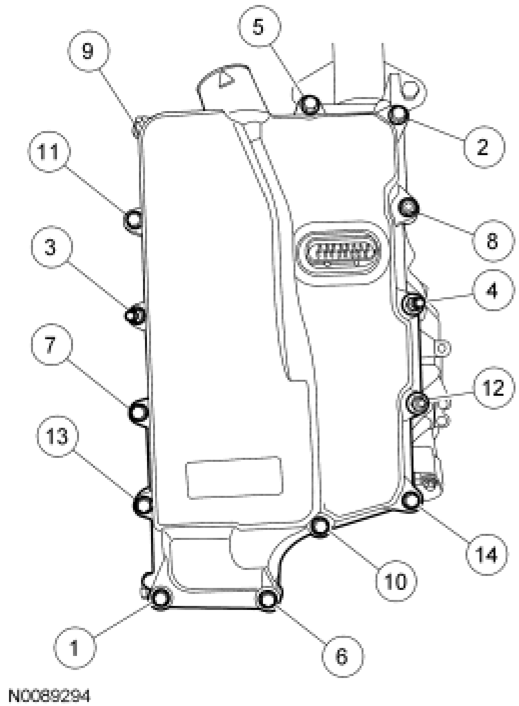


Fig. 766: Locating Power Steering Pressure (PSP) Tube-To-Pump Banjo Bolt & Seals
Courtesy of FORD MOTOR CO.

41. Install the engine roll restrictor-to-subframe through bolt.
    - Tighten to 103 Nm (76 lb-ft).

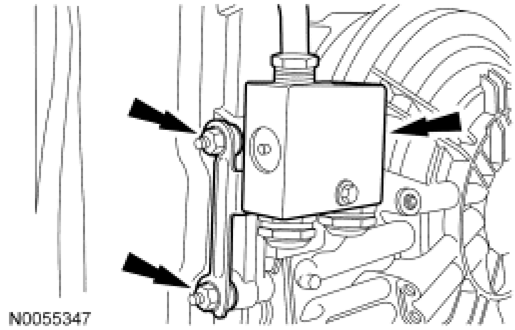


Fig. 767: Locating Roll Restrictor-To-Subframe Bolt
Courtesy of FORD MOTOR CO.

42. Install the roll restrictor heat shield and the 2 nuts.
    - Tighten to 11 Nm (8 lb-ft).

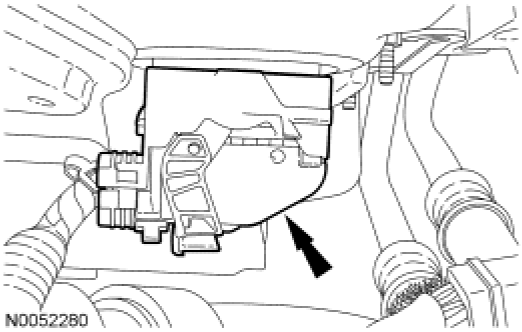


Fig. 768: Locating Roll Restrictor Heat Shield Nuts
Courtesy of FORD MOTOR CO.

NOTE: Apply the brake to keep the halfshaft from rotating.

43. Install a new RH front halfshaft nut.
    - Tighten to 350 Nm (258 lb-ft).

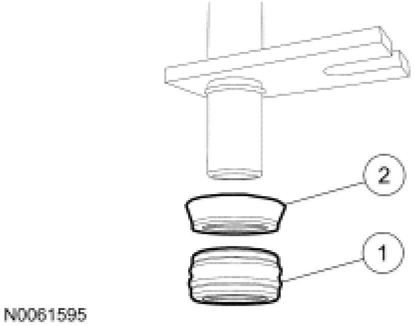


Fig. 769: Locating RH Front Halfshaft Nut
Courtesy of FORD MOTOR CO.

AWD vehicles

44. Line up the index marks on the rear driveshaft to the index marks on the PTU flange made during removal and install the 4 bolts.
    - Tighten to 70 Nm (52 lb-ft).

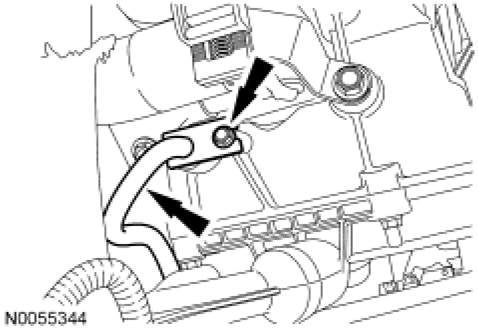


Fig. 770: Locating Driveshaft Aside Bolts
Courtesy of FORD MOTOR CO.

All vehicles

45. Install the power steering cooler bracket bolt to the RH side of the subframe.
    - Tighten to 9 Nm (80 lb-in).

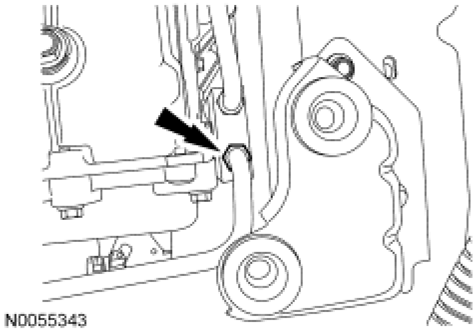


Fig. 771: Identifying Power Steering Cooler Bracket Bolt
Courtesy of FORD MOTOR CO.

46. Connect the power steering cooler hose.

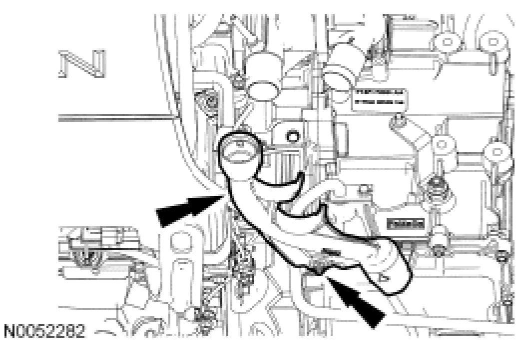


Fig. 772: Identifying Power Steering Cooler Hose
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the engine oil filter gasket with clean engine oil prior to installing the oil filter.

47. Install a new engine oil filter.
    - Tighten to 5 Nm (44 lb-in) and then rotate an additional 180 degrees.

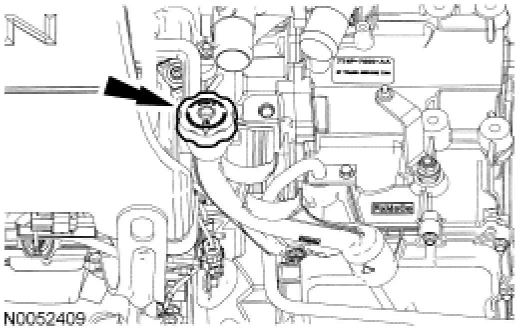


Fig. 773: Identifying Engine Oil Filter
Courtesy of FORD MOTOR CO.

48. Install the 3 new torque converter bolts.
    - Tighten to 55 Nm (41 lb-ft).

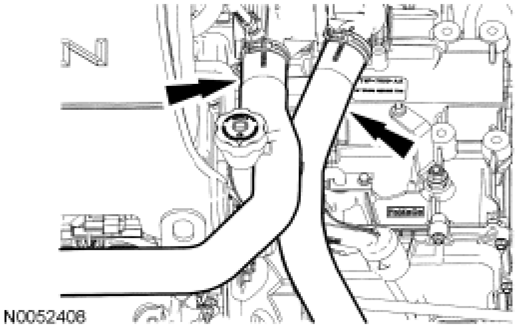


Fig. 774: Locating Torque Converter Bolts
Courtesy of FORD MOTOR CO.

49. Install the inspection cover and the 2 fasteners.

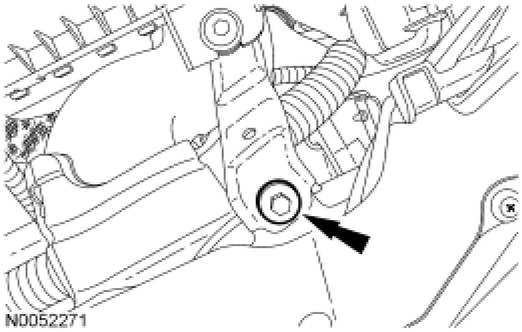


Fig. 775: Locating Oil Fasteners On Inspection Cover
Courtesy of FORD MOTOR CO.

50. Install the 4 oil pan-to-transaxle bolts.
    - Tighten to 48 Nm (35 lb-ft).

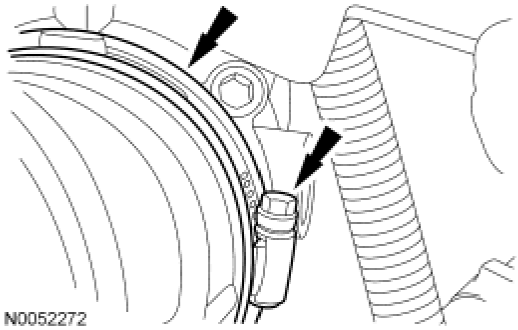


Fig. 776: Locating Oil Pan-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

51. Connect the 2 transmission fluid cooler tubes.

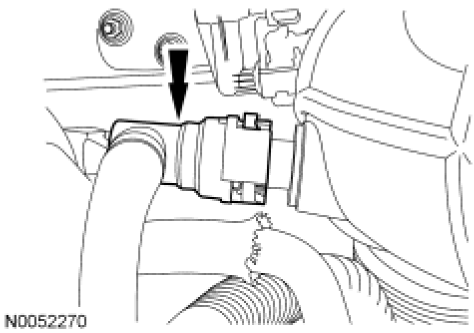


Fig. 777: Locating Transmission Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

52. Install the 2 secondary latches onto the transmission fluid cooler tubes.

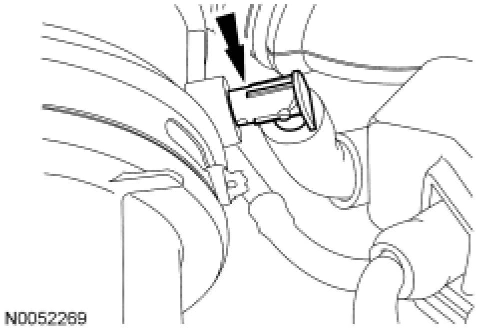


Fig. 778: Locating Secondary Latches On Transmission Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

53. Install the LH inner splash shield. For additional information, refer to **FRONT END BODY PANELS** article.
54. Install the radiator splash shield, the 3 pin-type retainers and the 7 screws.

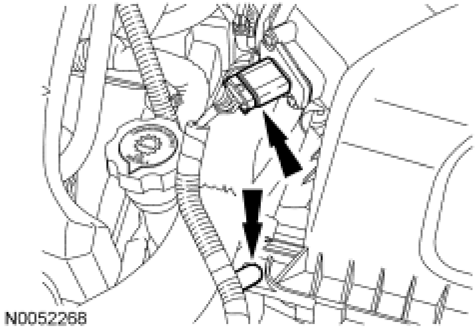


Fig. 779: Locating Push Pin Fasteners & Front Splash Shield Screws
Courtesy of FORD MOTOR CO.

55. Using a new gasket, install the Y-pipe and exhaust flexible pipe assembly and 4 new nuts.
    - Tighten to 40 Nm (30 lb-ft).

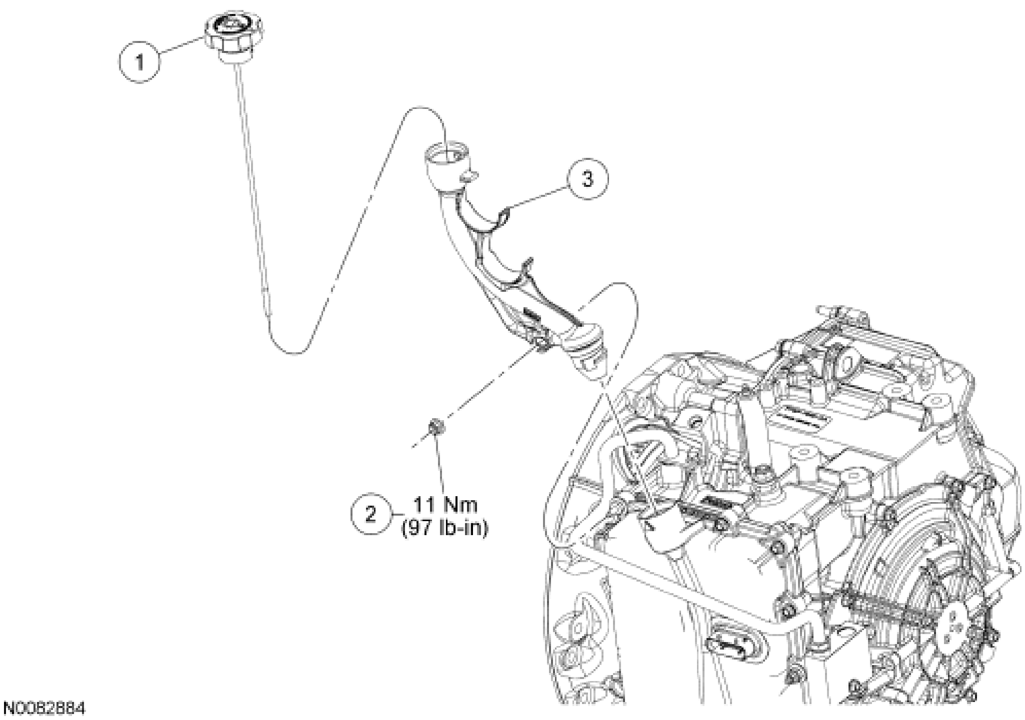


Fig. 780: Locating Exhaust Flexible Pipe, Y-Pipe & Nuts
Courtesy of FORD MOTOR CO.

56. Install the 2 exhaust hangers and tighten the exhaust clamp.
    - Tighten to 40 Nm (30 lb-ft).

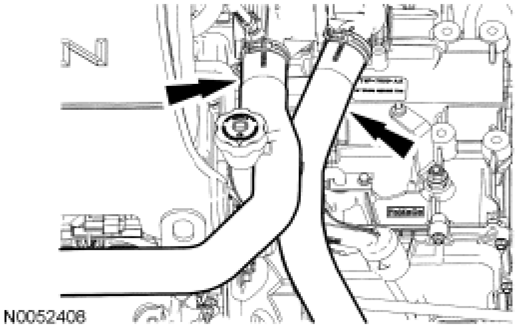


Fig. 781: Locating Exhaust Flexible Pipe Clamp & Exhaust Hangers
Courtesy of FORD MOTOR CO.

57. Install the ground wire, the radio interference capacitor wire and the nut to the engine front cover stud.
    - Tighten to 10 Nm (89 lb-in).

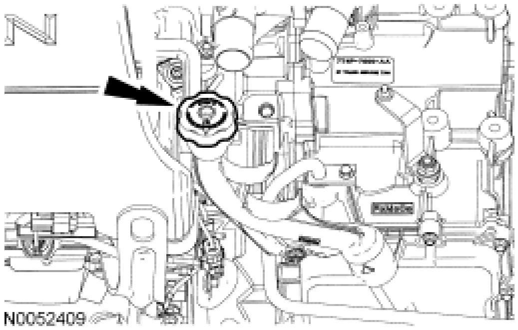


Fig. 782: Removing/installing Nut, Ground Wire & Radio Interference Capacitor Wire From Engine Front Cover Stud
Courtesy of FORD MOTOR CO.

58. Install the ground wire and bolt to the engine front cover.
    - Tighten to 10 Nm (89 lb-in).

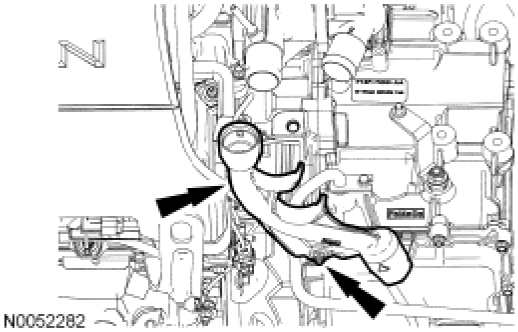


Fig. 783: Removing/Installing Bolt & Ground Wire From Engine Front Cover
Courtesy of FORD MOTOR CO.

59. Attach the wiring harness retainer to the RH valve cover stud bolt.

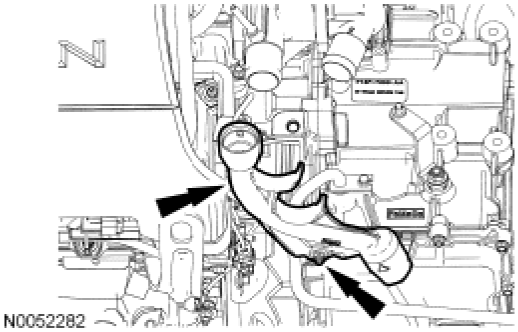


Fig. 784: Identifying Wiring Harness Retainer From RH Valve Cover Stud Bolt
Courtesy of FORD MOTOR CO.

60. Install the oil level indicator.

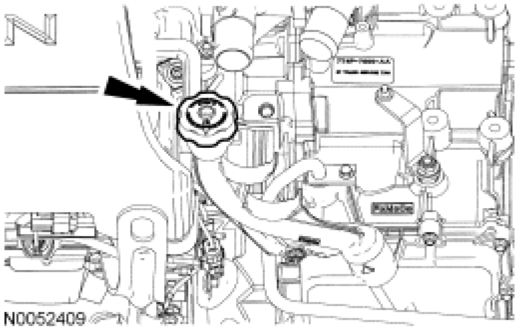


Fig. 785: Identifying Oil Level Indicator
Courtesy of FORD MOTOR CO.

61. Connect the 2 engine wiring harness electrical connectors.
    - Attach the electrical connector to the LH valve cover.

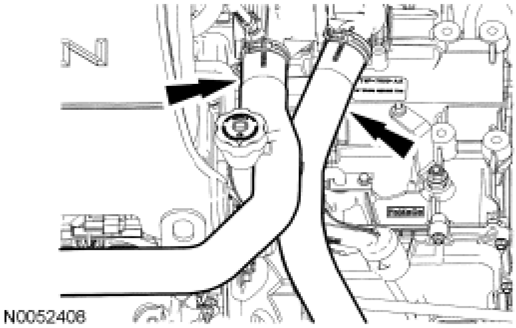


Fig. 786: Identifying Engine Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

62. Connect the fuel hose routing clip to the transaxle stud.

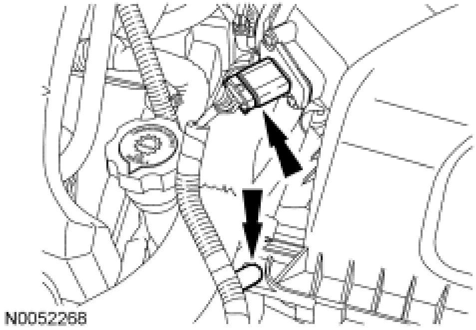


Fig. 787: Identifying Fuel Hose Routing Clip From Transaxle Stud
Courtesy of FORD MOTOR CO.

63. Connect the fuel supply tube. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

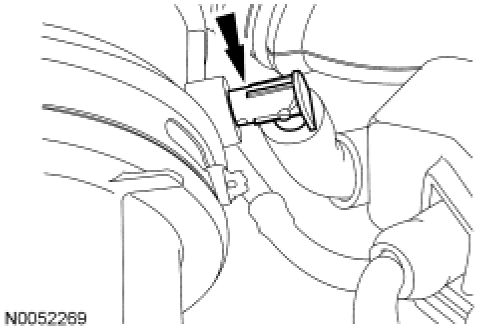


Fig. 788: Identifying Fuel Supply Tube
Courtesy of FORD MOTOR CO.

64. Connect the hose to the power steering reservoir.

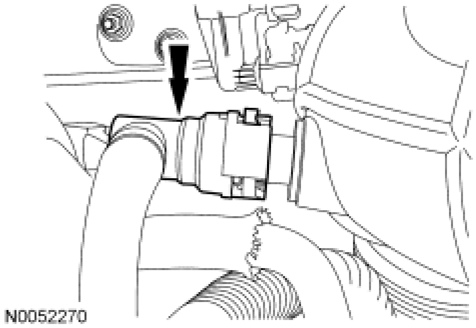


Fig. 789: Disconnecting Hose From Power Steering Reservoir
Courtesy of FORD MOTOR CO.

65. Connect the A/C suction tube fitting.
    - Install the safety clip onto the A/C fitting.

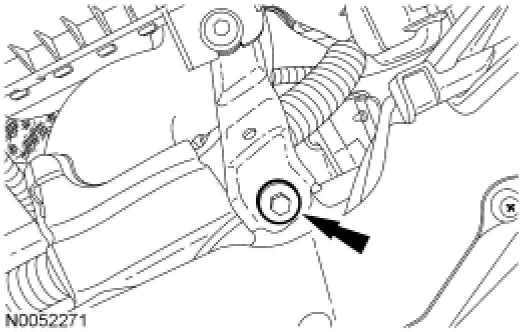


Fig. 790: Identifying Safety Clip On A/C Suction Tube Fitting
Courtesy of FORD MOTOR CO.

66. Using a new O-ring seal, connect the A/C tube fitting and install the nut.
    - Tighten to 8 Nm (71 lb-in).

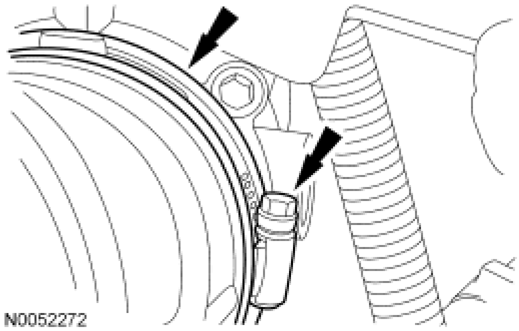


Fig. 791: Identifying A/C Pressure Tube Fitting Nut
Courtesy of FORD MOTOR CO.

67. If equipped, attach the engine block heater harness retainers to the radiator support and the A/C suction tube.

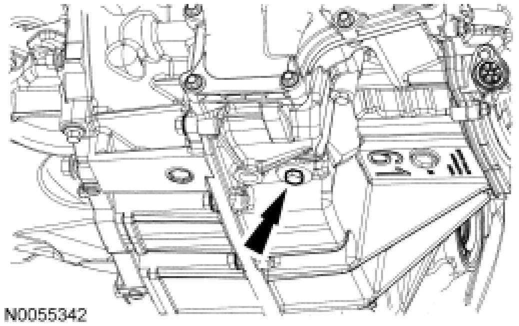


Fig. 792: Identifying Engine Block Heater Harness, Radiator Support, A/C Suction Tube & Engine Wiring Harness
Courtesy of FORD MOTOR CO.

68. Connect the transaxle control electrical connector.

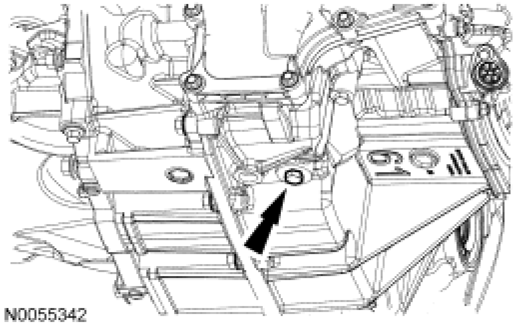


Fig. 793: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

69. Attach the control cable to the bracket.
    - Connect the transaxle control cable to the control lever.

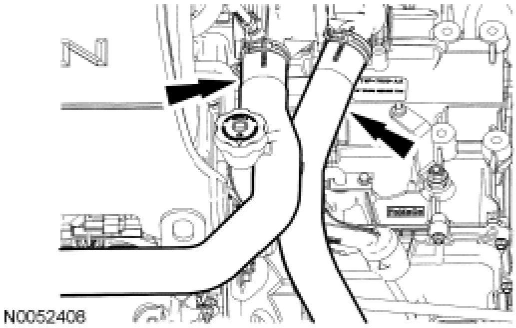


Fig. 794: Locating Transaxle Control Cable From Control Lever
Courtesy of FORD MOTOR CO.

70. Attach the wiring harness retainer to the transaxle control cable bracket.

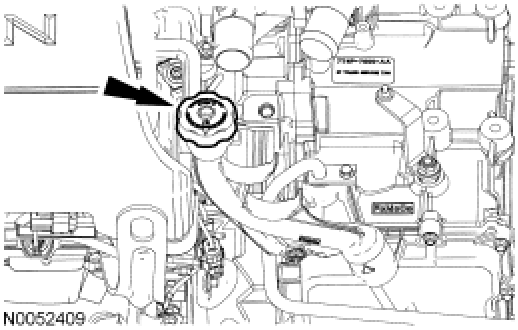


Fig. 795: Locating Wiring Harness Retainer From Transaxle Control Cable Bracket
Courtesy of FORD MOTOR CO.

71. Connect the upper radiator hose, lower radiator hose and 2 heater hoses to the thermostat housing.

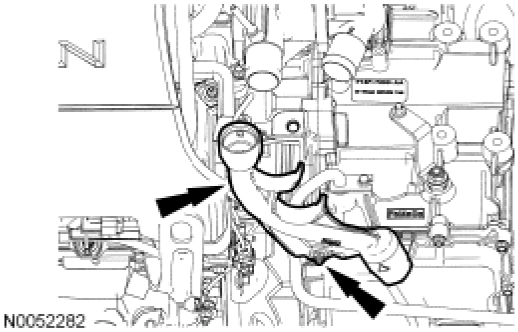


Fig. 796: Locating Upper Radiator Hose, Lower Radiator Hose & Heater Hoses
Courtesy of FORD MOTOR CO.

72. Connect the upper evaporative emissions (EVAP) tube quick connect coupling to the purge valve. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

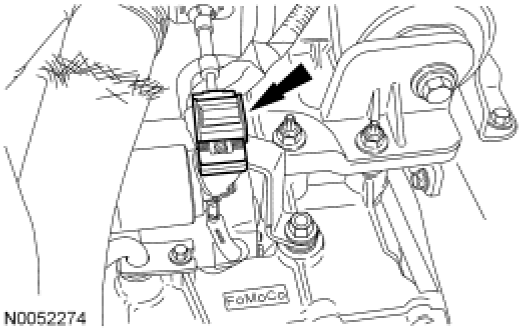


Fig. 797: Locating Upper Evaporative Emissions (EVAP) Tube Quick Connect Coupling
Courtesy of FORD MOTOR CO.

73. Connect the vacuum hose to the upper intake manifold.

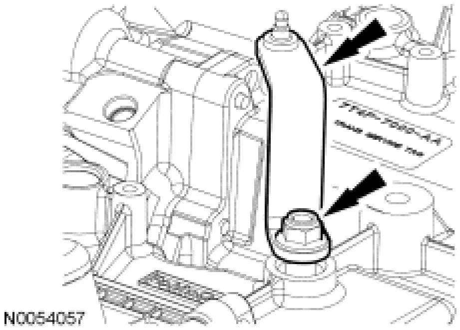


Fig. 798: Identifying Vacuum Hose From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

74. Install the ground wire and the bolt.
    - Tighten to 10 Nm (89 lb-in).
    - Attach the 2 wiring harness retainers to the cowl.

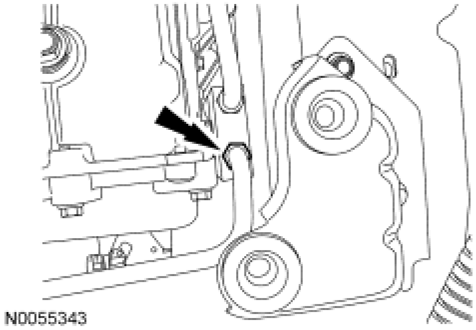


Fig. 799: Identifying Wiring Harness Retainers From Cowl
Courtesy of FORD MOTOR CO.

75. Connect the power feed to the battery terminal and install the nut.
    - Tighten to 8 Nm (71 lb-in).

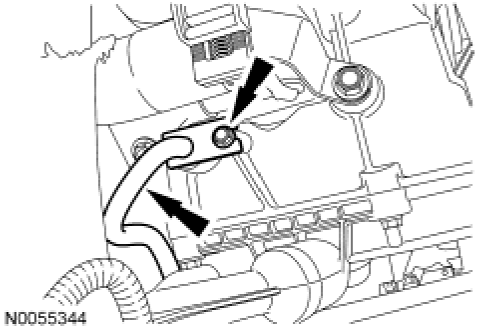


Fig. 800: Locating Power Feed To Battery Terminal And Nut
Courtesy of FORD MOTOR CO.

76. Connect the battery harness electrical connector.

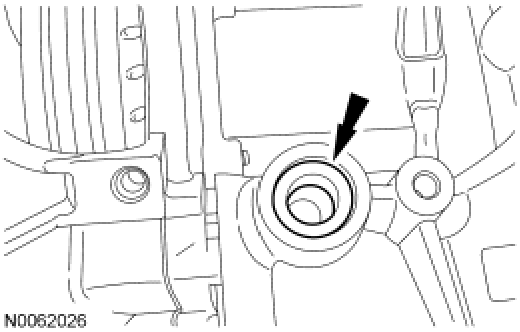


Fig. 801: Identifying Battery Harness Electrical Connector
Courtesy of FORD MOTOR CO.

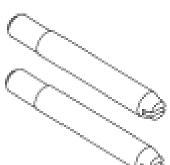
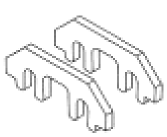
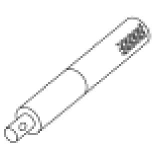
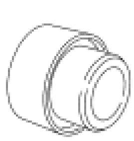
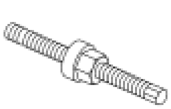
77. Install the battery tray. For additional information, refer to **BATTERY, MOUNTING & CABLES** article.
78. Install the engine air cleaner and the air cleaner outlet pipe. For additional information, refer to **INTAKE**

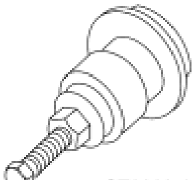
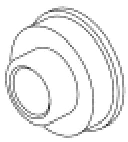
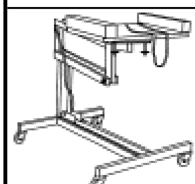
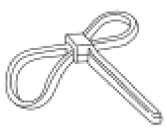
AIR DISTRIBUTION & FILTERING article.

79. Install the degas bottle. For additional information, refer to **ENGINE COOLING** article.
80. Install the accessory drive belt and the power steering belt. For additional information, refer to **ACCESSORY DRIVE** article.
81. Fill the engine with clean engine oil.
82. Fill and bleed the cooling system. For additional information, refer to **ENGINE COOLING** article.
83. Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** article.
84. Recharge the air conditioning system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION & DIAGNOSTICS** article.

CAMSHAFT

Special Tools

Illustration	Tool Name	Tool Number
 ST2433-A	Alignment Pins	307-399
 ST2979-A	Camshaft Alignment Tool	303-1248
 ST1326-A	Handle	205-153 (T80T-4000-W)
 ST2981-A	Installer, Crankshaft Front Seal	303-1251
 ST1287-A	Installer, Crankshaft Vibration Damper	303-102 (T74P-6316-B)

 ST2296-A	Installer, Front Cover Oil Seal	303-335
 ST2983-A	Installer, Seal	303-1247/2
 ST1293-A	Powertrain Lift	014-00765
 ST1436-A	Strap Wrench	303-D055 (D85L-6000-A)

Material

Item	Specification
Motorcraft High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft Metal Surface Prep ZC-31-A	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket Remover ZC-30	-

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

CAUTION: **During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can**

cause engine failure.

All camshafts

CAUTION: The crankshaft must remain in the freewheeling position (crankshaft dowel pin at 9 o'clock) until after the camshafts are installed and the valve clearance is checked/adjusted. Do not turn the crankshaft until instructed to do so. Failure to follow this process will result in severe engine damage.

1. Rotate the crankshaft counterclockwise until the crankshaft dowel pin is in the 9 o'clock position.

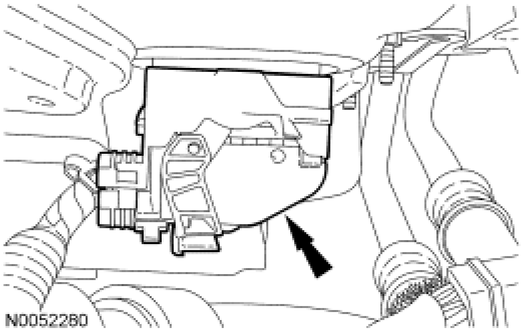


Fig. 802: Rotating Crankshaft Counterclockwise Until Crankshaft Dowel Pin Is In 9 O'clock Position
Courtesy of FORD MOTOR CO.

LH camshafts

CAUTION: The camshafts must remain in the neutral position during installation or engine damage may occur.

NOTE: Coat the camshafts with clean engine oil prior to installation.

2. Position the camshafts onto the LH cylinder head in the neutral position as shown.

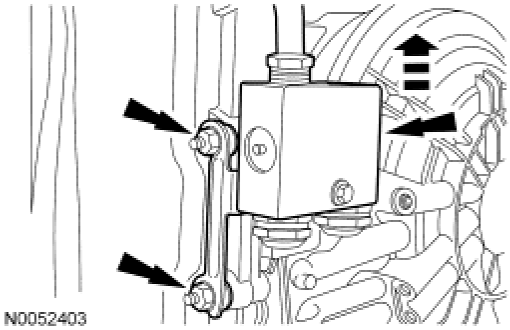


Fig. 803: Verifying LH Camshafts Are In Neutral Position
Courtesy of FORD MOTOR CO.

CAUTION: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions. If not reassembled in their original positions, severe engine damage may occur.

3. Install the 8 camshaft caps and the 16 bolts.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).

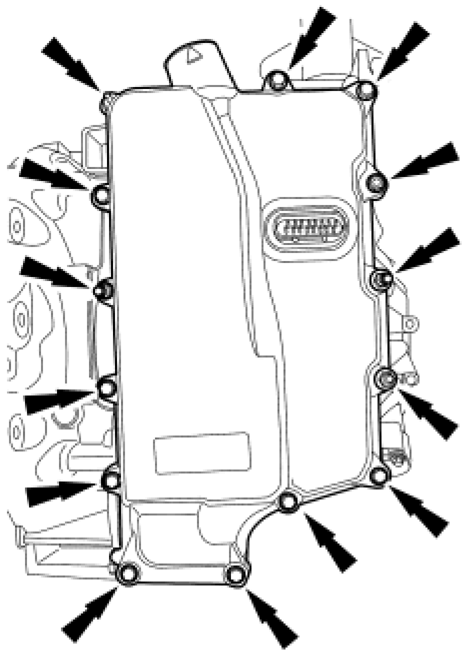


Fig. 804: Installing Camshaft Caps & Bolts In Sequence
Courtesy of FORD MOTOR CO.

RH camshafts

CAUTION: The camshafts must remain in the neutral position during installation or engine damage may occur.

NOTE: Coat the camshafts with clean engine oil prior to installation.

4. Position the camshafts onto the RH cylinder head in the neutral position as shown.

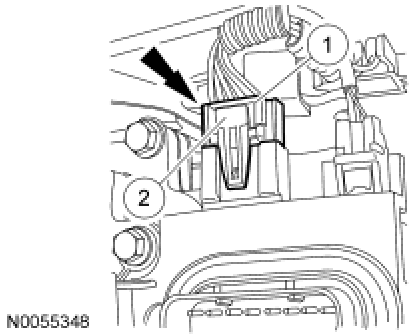


Fig. 805: Positioning Camshafts Onto RH Cylinder Head In Neutral Position
Courtesy of FORD MOTOR CO.

CAUTION: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions. If not reassembled in their original positions, severe engine damage may occur.

5. Install the 8 camshaft caps and the 16 bolts.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).

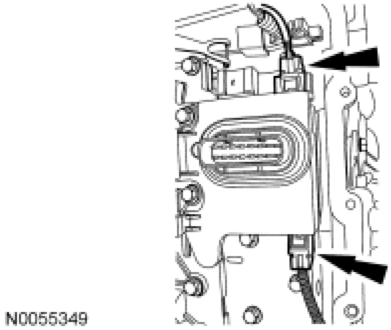


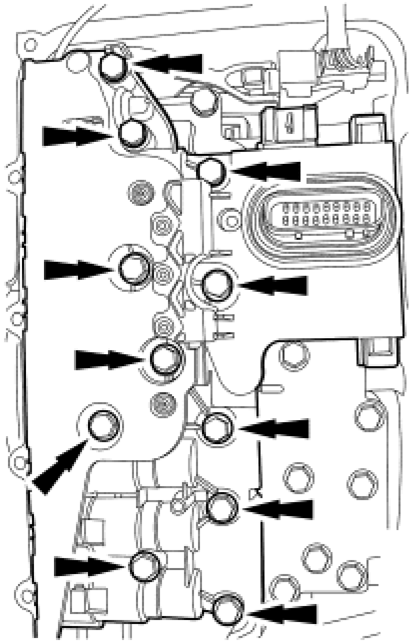
Fig. 806: Installing Camshaft Caps & Bolts In Sequence
Courtesy of FORD MOTOR CO.

All camshafts

CAUTION: If any components are installed new, the engine valve clearance must be checked/adjusted or engine damage may occur.

NOTE: Use a camshaft sprocket bolt to turn the camshafts.

6. Using a feeler gauge, confirm that the valve tappet clearances are within specification. If valve tappet clearances are not within specification, the clearance must be adjusted by installing new valve tappet(s) of the correct size. For additional information, refer to **Valve Clearance Check**.



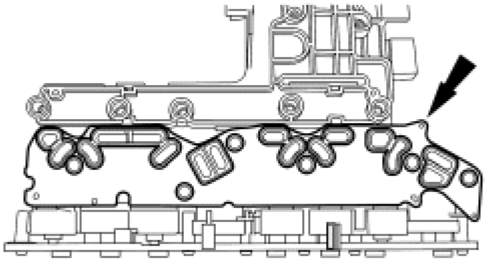
N0055350

Fig. 807: Measuring Valve Clearance
Courtesy of FORD MOTOR CO.

LH camshafts

NOTE: Use a camshaft sprocket bolt to turn the camshafts.

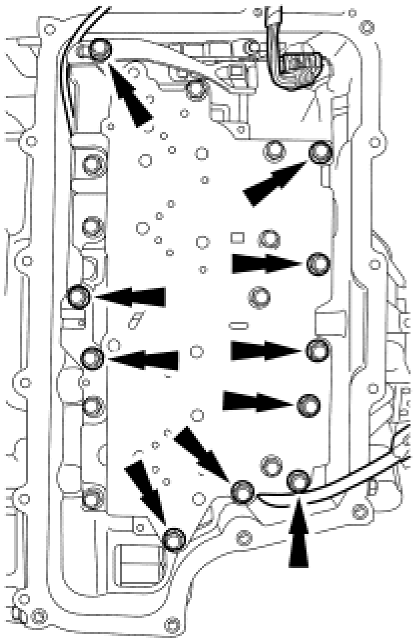
7. Rotate the LH camshafts to the top dead center position and install the special tool on the flats of the camshafts.



N0055016

Fig. 808: Installing Special Tool (303-1248) On Flats Of Camshafts
Courtesy of FORD MOTOR CO.

8. Assemble the LH variable camshaft timing (VCT) assembly, the LH exhaust camshaft sprocket and the LH secondary timing chain.
   - Align the colored links with the timing marks.



N0057465

Fig. 809: Aligning LH Exhaust Camshaft Sprocket & LH Secondary Timing Chain Colored Links With Timing Marks
Courtesy of FORD MOTOR CO.

9. Position the LH secondary timing assembly onto the camshafts.

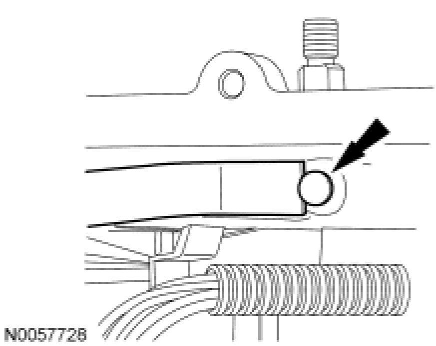


Fig. 810: Positioning LH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

10. Install 2 new bolts and the original washer. Tighten in 4 stages.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 10 Nm (89 lb-in).
    - Stage 4: Tighten 90 degrees.

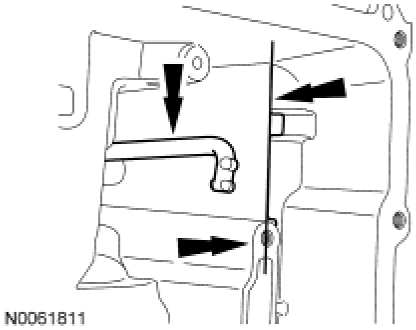


Fig. 811: Locating LH VCT Assembly Bolt & LH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

11. Remove the lockpin from the LH secondary timing chain tensioner.

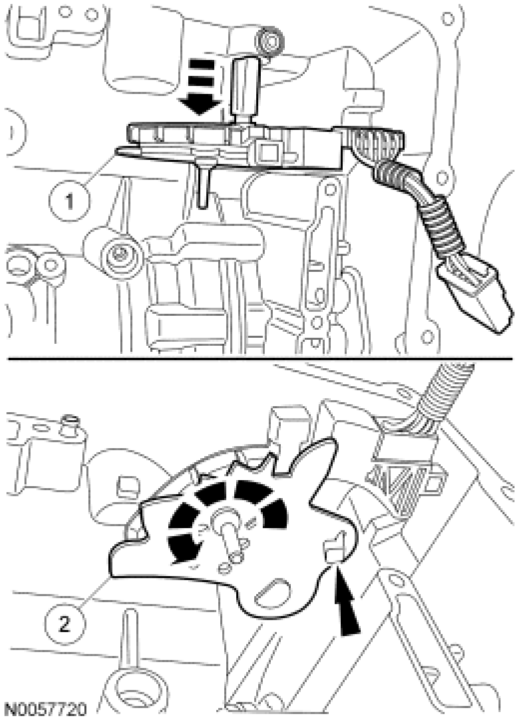


Fig. 812: Locating Lock Pin On LH Secondary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

RH camshafts

NOTE: Use a camshaft sprocket bolt to turn the camshafts.

12. Rotate the RH camshafts to the top dead center position and install the special tool on the flats of the camshafts.

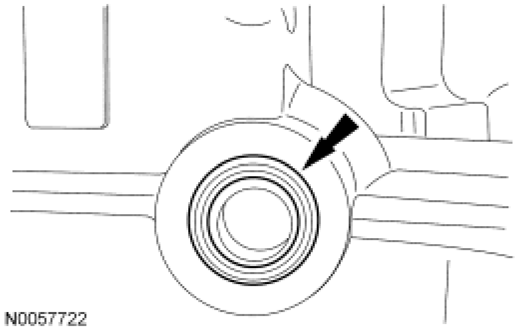


Fig. 813: Installing Special Tool (303-1248) On Flats Of Camshafts
Courtesy of FORD MOTOR CO.

13. Assemble the RH VCT assembly, the RH exhaust camshaft sprocket and the RH secondary timing chain.
    - Align the colored links with the timing marks.

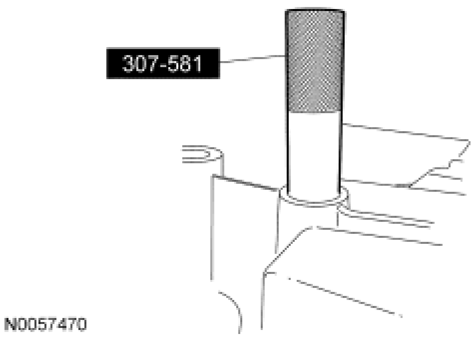


Fig. 814: Aligning RH Exhaust Camshaft Sprocket & RH Secondary Timing Chain Colored Links With Timing Marks
Courtesy of FORD MOTOR CO.

14. Position the RH secondary timing assembly onto the camshafts.

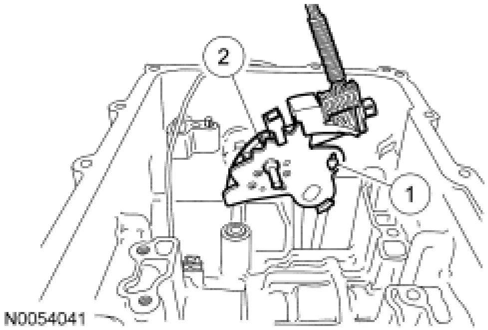


Fig. 815: Positioning RH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

15. Install 2 new bolts and the original washer. Tighten in 4 stages.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).

- Stage 2: Loosen one full turn.
- Stage 3: Tighten to 10 Nm (89 lb-in).
- Stage 4: Tighten 90 degrees.

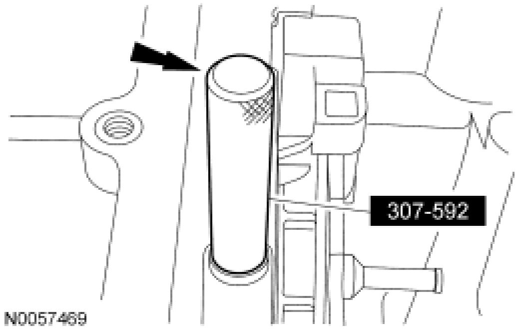


Fig. 816: Locating RH VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

16. Remove the lockpin from the RH secondary timing chain tensioner.

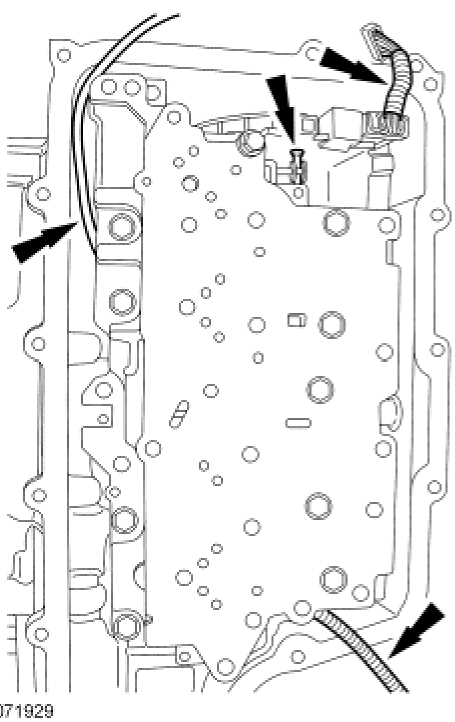


Fig. 817: Identifying Lock Pin On RH Secondary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

All camshafts

17. Rotate the crankshaft clockwise 60 degrees to the top dead center position (crankshaft dowel pin at 11 o'clock).

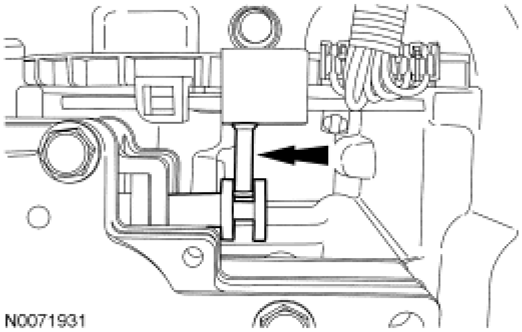


Fig. 818: Identifying Crankshaft Dowel Pin At 11 O'clock
Courtesy of FORD MOTOR CO.

18. Install the primary timing chain with the colored links aligned with the timing marks on the VCT assemblies and the crankshaft sprocket.

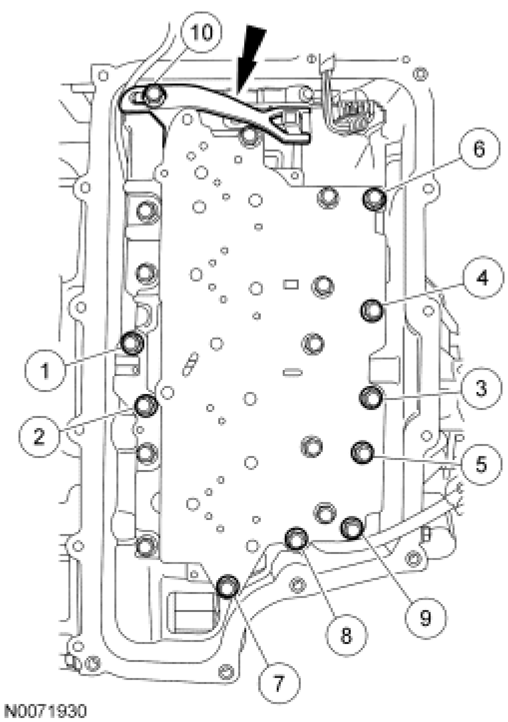


Fig. 819: Aligning Timing Marks On VCT Assemblies & Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

19. Install the lower LH primary timing chain guide and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

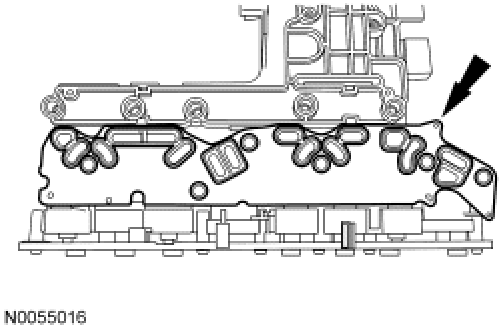


Fig. 820: Locating Lower LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

20. Install the primary timing chain tensioner arm.

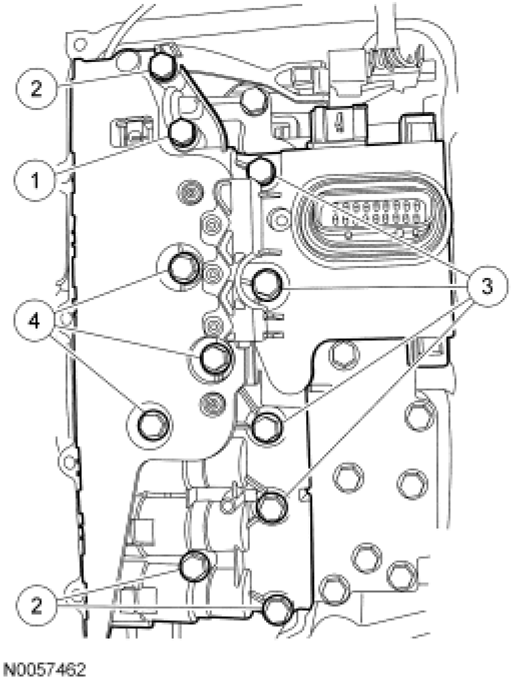


Fig. 821: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

21. Reset the primary timing chain tensioner.
    - Rotate the lever counterclockwise.
    - Using a soft-jawed vise, compress the plunger.
    - Align the hole in the lever with the hole in the tensioner housing.
    - Install a suitable lockpin.

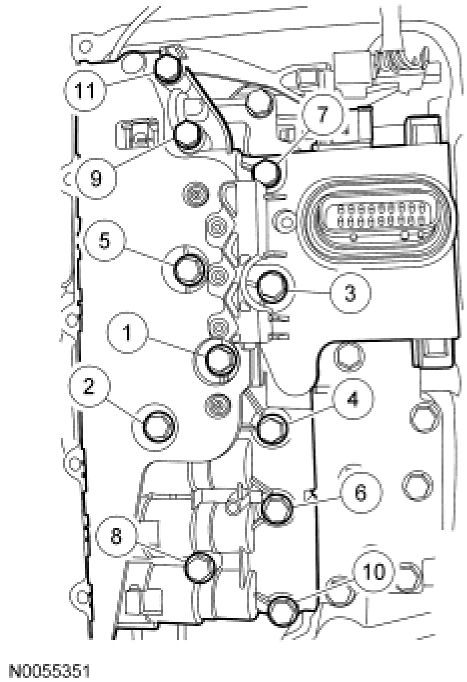


Fig. 822: Compressing Plunger Using A Soft-Jawed Vise
Courtesy of FORD MOTOR CO.

NOTE: **It may be necessary to rotate the crankshaft slightly to remove slack from the timing chain and install the tensioner.**

22. Install the primary tensioner and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).
    - Remove the lockpin.

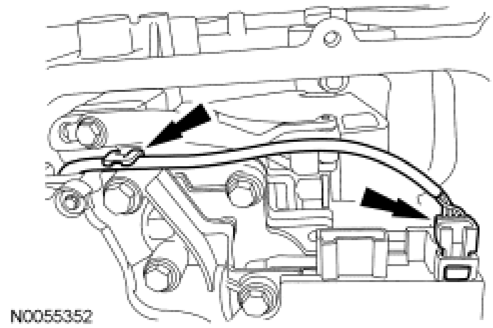


Fig. 823: Locating Primary Tensioner Bolts
Courtesy of FORD MOTOR CO.

23. As a post-check, verify correct alignment of all timing marks.

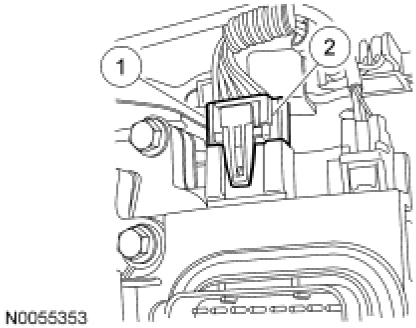


Fig. 824: Verifying Correct Alignment Of All Timing Marks
Courtesy of FORD MOTOR CO.

24. Install new VCT housing seals.

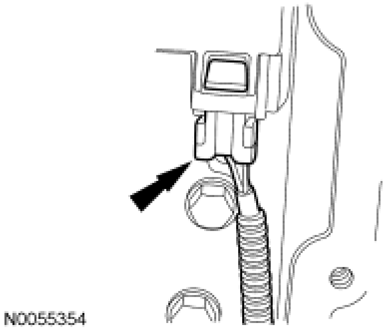


Fig. 825: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

CAUTION: Make sure the dowels on the variable camshaft timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

25. Install the LH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

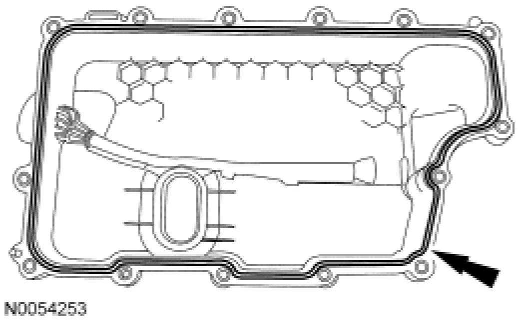


Fig. 826: Identifying LH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

CAUTION: Make sure the dowels on the variable camshaft timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

26. Install the RH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

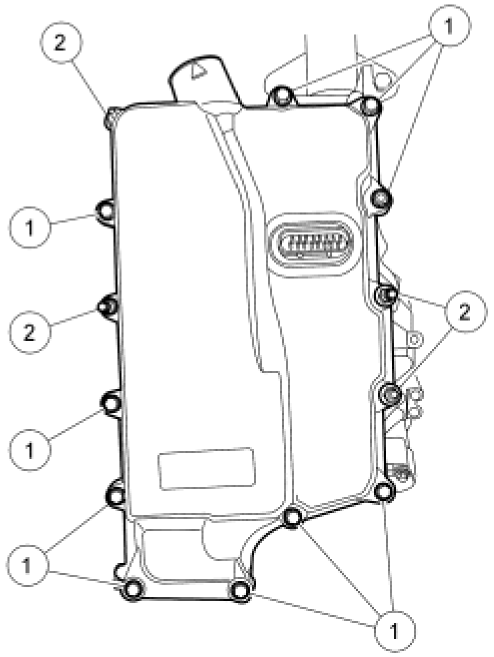


Fig. 827: Identifying RH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

27. Install the special tools.

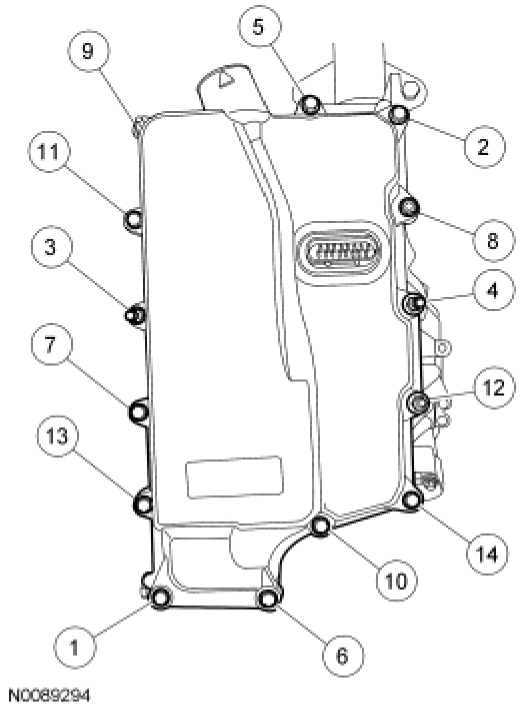


Fig. 828: Identifying Special Tool (307-399)
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The engine front cover and bolts 17, 18, 19 and 20 must be installed within 4 minutes of the initial sealant application. The remainder of the engine front cover bolts and the engine mount bracket bolts must be installed and tightened within 35 minutes of the initial sealant application. If the time limits are exceeded, the sealant must be removed, the sealing area cleaned and sealant reapplied. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

28. Apply a 3.0 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover sealing surfaces including the 3 engine mount bracket bosses.
    - Apply a 5.5 mm (0.21 in) bead of Motorcraft High Performance Engine RTV Silicone to the oil pan-to-cylinder block joint and the cylinder head-to-cylinder block joint areas of the engine front cover in 5 places as indicated.

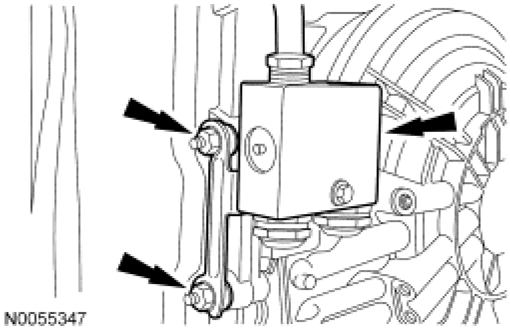


Fig. 829: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover Sealing Surfaces
Courtesy of FORD MOTOR CO.

NOTE: **Make sure the 2 locating dowel pins are seated correctly in the cylinder block.**

29. Install the engine front cover and bolts 17, 18, 19 and 20.
    - Tighten in sequence to 3 Nm (27 lb-in).

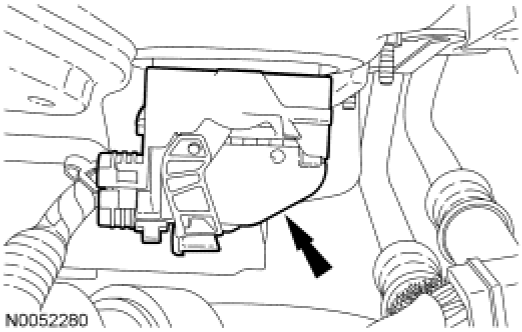


Fig. 830: Installing Engine Front Cover & Bolts In Sequence
Courtesy of FORD MOTOR CO.

30. Remove the special tools (alignment pins).

NOTE: **Do not tighten the bolts at this time.**

31. Install the engine mount bracket and the 3 bolts.

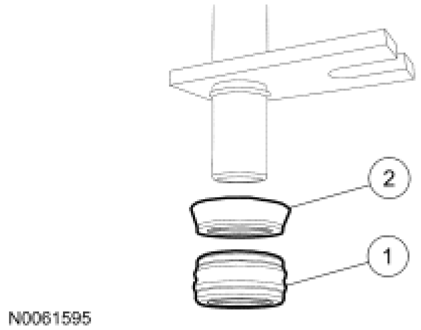


Fig. 831: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Do not expose the Motorcraft High Performance Engine RTV Silicone to engine oil for at least 90 minutes after installing the engine front cover. Failure to follow this instruction may cause oil leakage.

32. Install the remaining engine front cover bolts. Tighten all of the engine front cover bolts and engine mount bracket bolts in the sequence shown in 2 stages:
    - Stage 1: Tighten bolts 1 thru 22 to 10 Nm (89 lb-in) and bolts 23, 24 and 25 to 15 Nm (11 lb-ft).
    - Stage 2: Tighten bolts 1 thru 22 to 24 Nm (18 lb-ft) and bolts 23, 24 and 25 to 75 Nm (55 lb-ft).

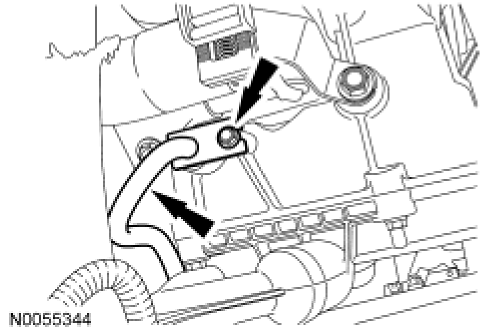


Fig. 832: Identifying Tightening Of Engine Front Cover Bolts & Engine Mount Bracket Bolts In Sequence
Courtesy of FORD MOTOR CO.

33. Install the 2 engine mount studs.
    - Tighten to 18 Nm (13 lb-ft).

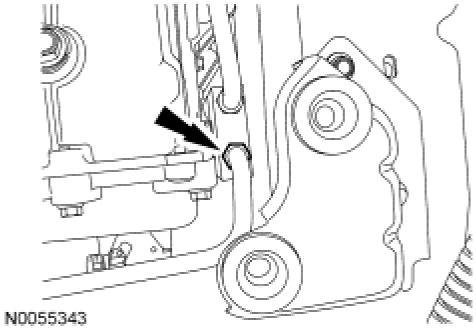


Fig. 833: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

34. Install the engine mount bracket and the 2 bolts.
    - Tighten to 24 Nm (18 lb-ft).

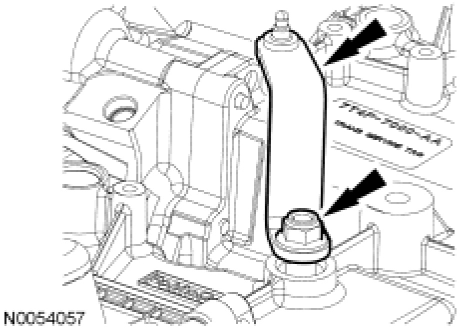


Fig. 834: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

NOTE: Apply clean engine oil to the crankshaft front seal bore in the engine front cover.

35. Using the special tools, install a new crankshaft front seal.

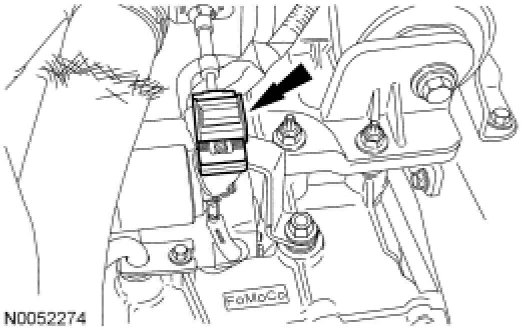


Fig. 835: Installing Crankshaft Front Seal Using Special Tools (303-102) & (303-1251)
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the outside diameter sealing surfaces with clean engine oil.

36. Using the special tools, install the crankshaft pulley.

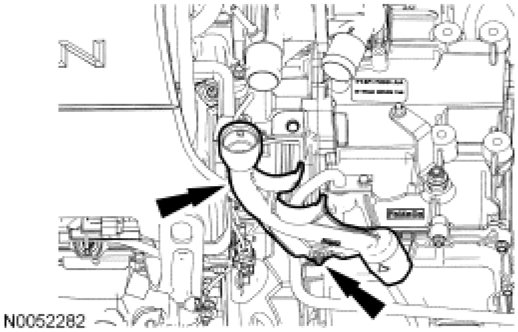


Fig. 836: Installing Crankshaft Pulley
Courtesy of FORD MOTOR CO.

37. Using the special tool, install the crankshaft pulley washer and new bolt and tighten in 4 stages.
    - Stage 1: Tighten to 120 Nm (89 lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten an additional 90 degrees.

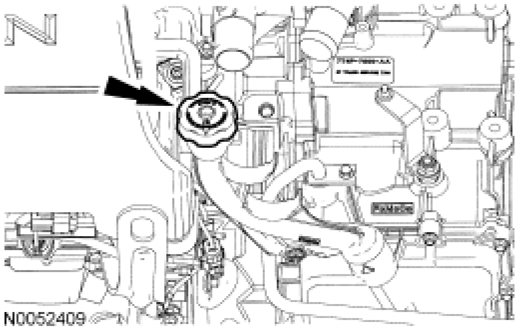


Fig. 837: Installing Crankshaft Pulley Washer & Bolt Using Special Tools (303-D055)
Courtesy of FORD MOTOR CO.

38. Install the accessory drive belt tensioner and the 3 bolts.
    - Tighten to 11 Nm (8 lb-ft).

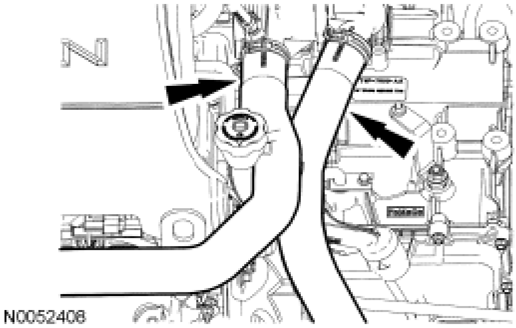


Fig. 838: Locating Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

39. Install the power steering pump and the 3 bolts.
    - Tighten to 24 Nm (18 lb-ft).

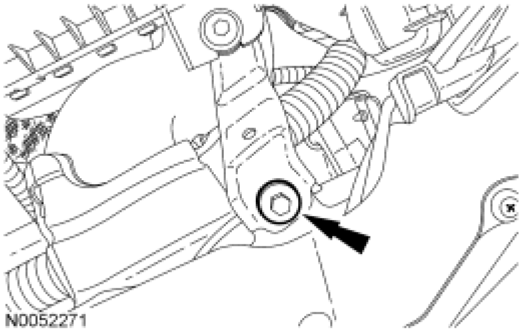


Fig. 839: Locating Power Steering Pump Bolts
Courtesy of FORD MOTOR CO.

NOTE: **Installation of new seals is only required if damaged seals were removed during disassembly of the engine.**

NOTE: **Spark plug tube seal installation shown, VCT seal installation similar.**

40. Using the special tools, install new VCT solenoid and/or spark plug tube seals.

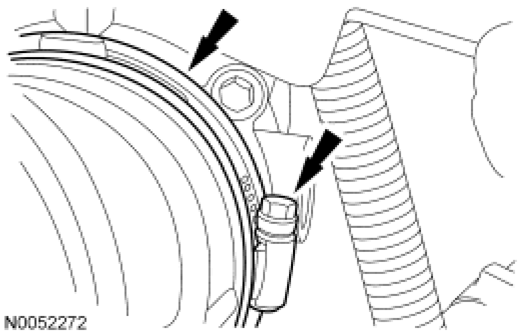


Fig. 840: Installing VCT Solenoid And/Or Spark Plug Tube Seals Using Special Tools (205-153) & (303-1247/2)
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

41. Apply a 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-RH cylinder head joints.

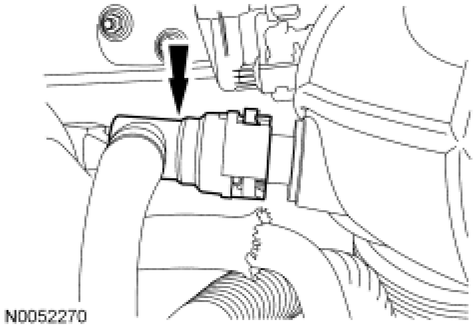


Fig. 841: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover-To-RH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

42. Using a new gasket, install the RH valve cover, bolt and the 10 stud bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

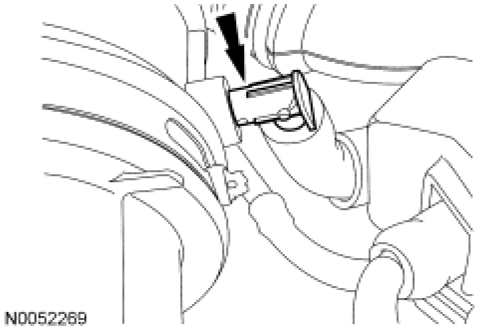


Fig. 842: Installing RH Valve Cover Stud Bolts In Sequence
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

43. Apply a 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-LH cylinder head joints.

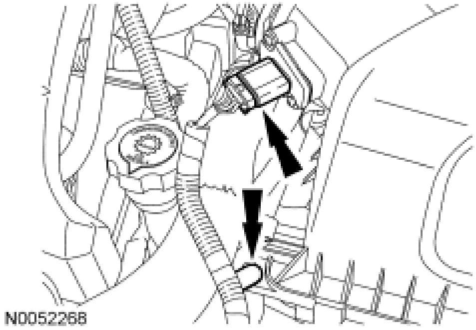


Fig. 843: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover-To-LH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

44. Using a new gasket, install the LH valve cover and 11 stud bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

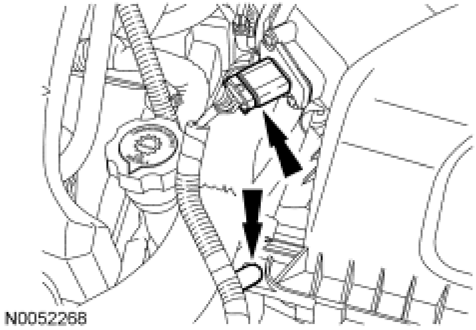


Fig. 844: Installing LH Valve Cover Stud Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

45. Install the 6 coil-on-plug assemblies and the 6 bolts.

- Tighten to 7 Nm (62 lb-in).

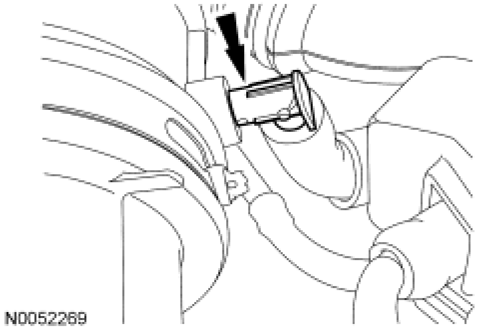


Fig. 845: Locating Coil-On-Plugs & Bolts
Courtesy of FORD MOTOR CO.

46. Attach all of the wiring harness retainers to the LH valve cover and stud bolts.
47. Connect the 3 LH coil-on-plug electrical connectors.

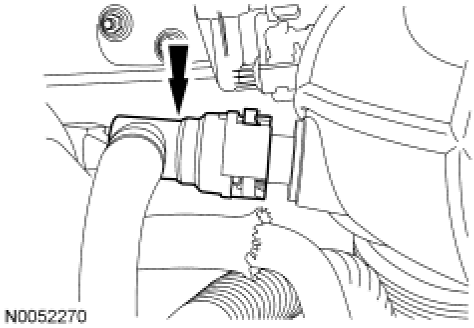


Fig. 846: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

48. Connect the LH camshaft VCT solenoid electrical connector.

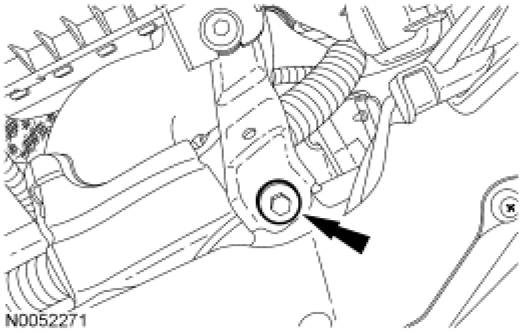


Fig. 847: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

49. Attach all of the wiring harness retainers to the RH valve cover and stud bolts.

50. Connect the 3 RH coil-on-plug electrical connectors.

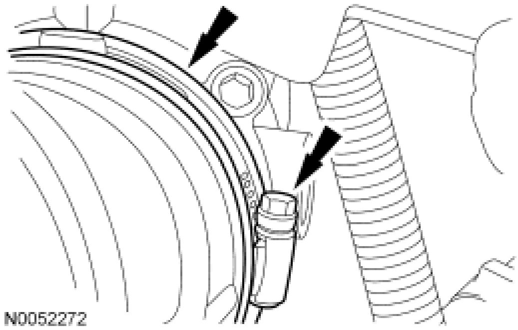


Fig. 848: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

51. Connect the RH VCT solenoid electrical connector.

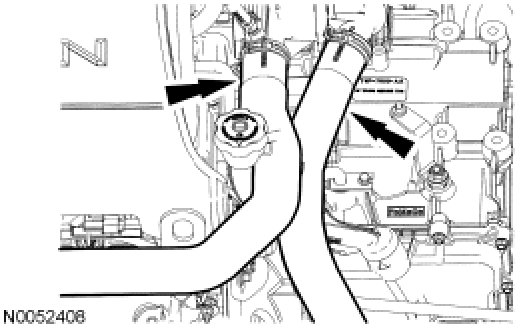


Fig. 849: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

52. Connect the power steering pressure (PSP) switch electrical connector.

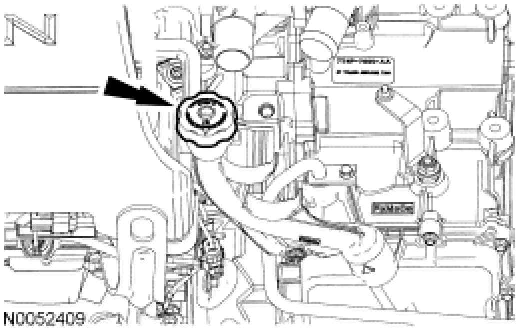


Fig. 850: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

53. Connect the RH catalyst monitor sensor electrical connector.

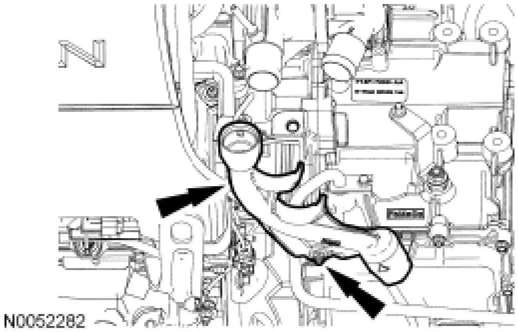


Fig. 851: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

54. Using new gaskets, install the upper intake manifold and the 6 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

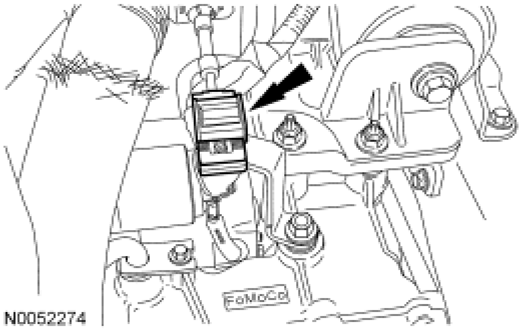


Fig. 852: Identifying Bolt Sequence
Courtesy of FORD MOTOR CO.

55. Install the upper intake manifold support bracket bolt.
    - Tighten to 10 Nm (89 lb-in).

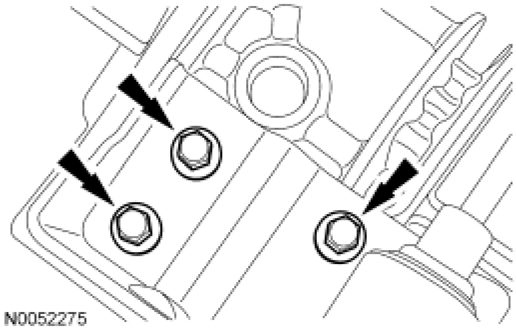


Fig. 853: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

56. Attach the wiring harness retainers to the upper intake manifold.

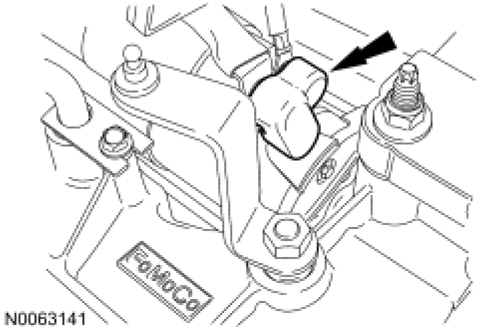


Fig. 854: Locating Wiring Harness Retainers From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

57. Connect the throttle body (TB) electrical connector.

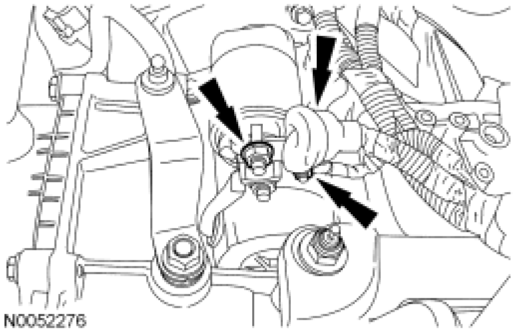


Fig. 855: Locating Throttle Body Electrical Connector
Courtesy of FORD MOTOR CO.

58. Connect the PCV hose to the PCV valve.

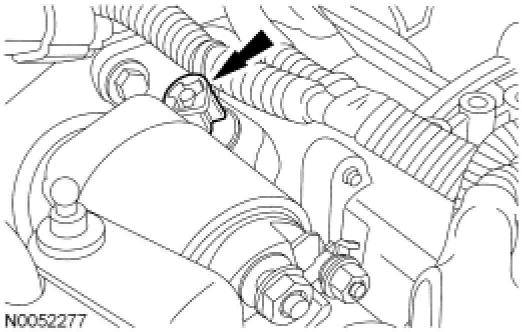


Fig. 856: Identifying PCV Hose
Courtesy of FORD MOTOR CO.

59. If equipped, attach the engine block heater wiring harness retainers.
60. Raise the engine and transaxle assembly into the vehicle.
61. Install the engine mount and the 3 bolts.

- Tighten to 90 Nm (66 lb-ft).

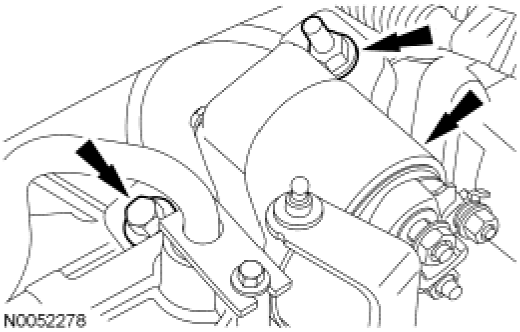


Fig. 857: Locating Engine Mount Bolts
Courtesy of FORD MOTOR CO.

62. Install the 4 engine mount nuts.
    - Tighten to 63 Nm (46 lb-ft).

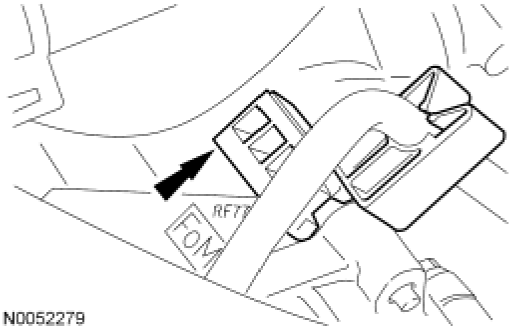


Fig. 858: Locating Engine Mount Nuts
Courtesy of FORD MOTOR CO.

63. Install the engine mount brace, the nut and the bolt.
    - Tighten to 20 Nm (15 lb-ft).

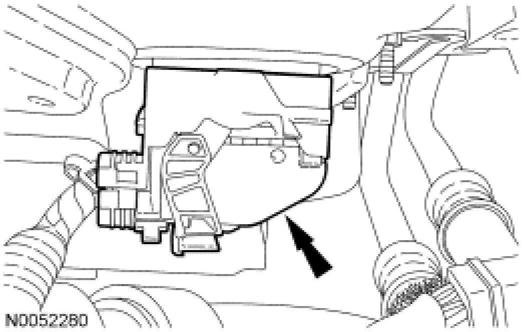


Fig. 859: Locating Nut, Bolt & Engine Mount Brace
Courtesy of FORD MOTOR CO.

64. Install the transaxle support insulator bracket, the 3 nuts and the bolt.
    - Tighten to 63 Nm (46 lb-ft).

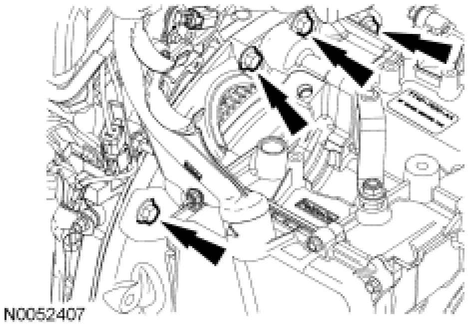


Fig. 860: Identifying Transaxle Support Insulator Bracket, Nuts & Bolts
Courtesy of FORD MOTOR CO.

65. Install the transaxle support insulator through bolt and nut.
    - Tighten to 175 Nm (129 lb-ft).

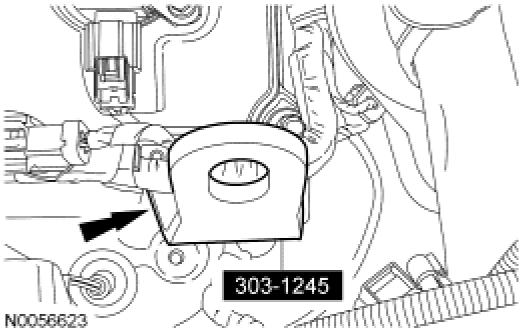


Fig. 861: Identifying Transaxle Support Insulator Bolt
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

NOTE: A new powertrain transfer unit (PTU) seal must be installed whenever the intermediate shaft is removed.

66. Install a new PTU seal. For additional information, refer to **TRANSFER CASE - POWER TRANSFER UNIT (PTU)** article.

NOTE: Prior to installation of the halfshaft, inspect the halfshaft sealing surface for wear or damage and install new, if necessary.

67. Position the RH halfshaft/intermediate shaft assembly in the PTU and in the steering knuckle and install the 2 bolts.

- Tighten to 40 Nm (30 lb-ft).

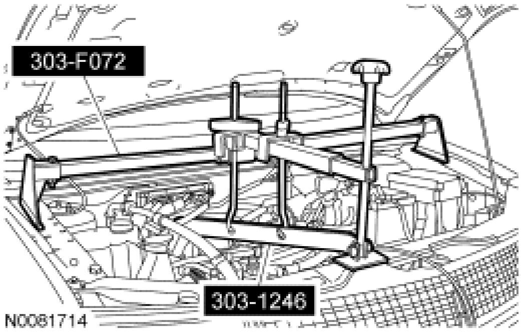


Fig. 862: Locating RH Halfshaft Bearing Support Bracket Bolts
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

NOTE:	**Prior to installation of the halfshaft, inspect the halfshaft sealing surface for wear or damage and install new if necessary.**

68. Position the RH halfshaft/intermediate shaft assembly in the transaxle and in the steering knuckle and install the 2 stud bolts.
    - Tighten to 55 Nm (41 lb-ft).

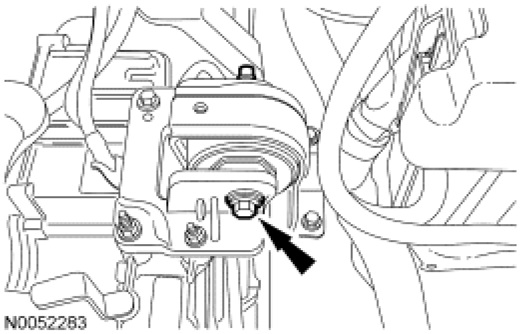


Fig. 863: Locating Stud Bolts & RH Halfshaft/Intermediate Shaft Assembly
Courtesy of FORD MOTOR CO.

NOTE:	**Do not tighten the 2 catalytic converter support bracket bolts at this time.**

69. Install the converter support bracket and the 2 bolts.

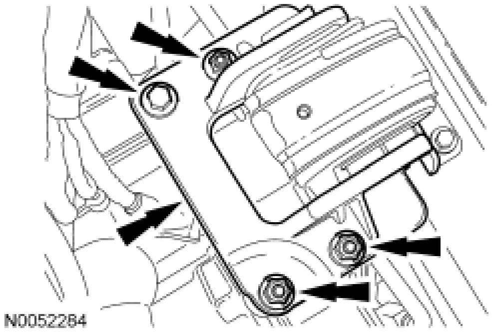


Fig. 864: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

70. Install the catalytic converter bracket bolt and the nut.
    1. Tighten the nut to 40 Nm (30 lb-ft).
    2. Tighten the bolt to 55 Nm (41 lb-ft).

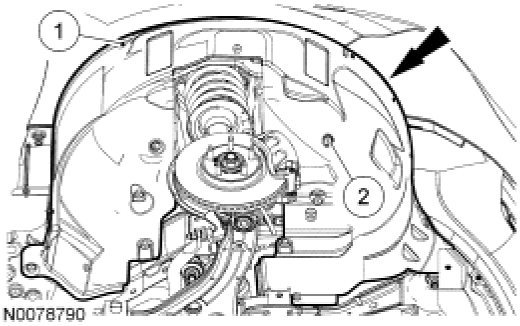


Fig. 865: Locating Catalytic Converter Bracket Bolt & Nut
Courtesy of FORD MOTOR CO.

71. Tighten the 2 RH catalytic converter support bracket bolts to 20 Nm (15 lb-ft).

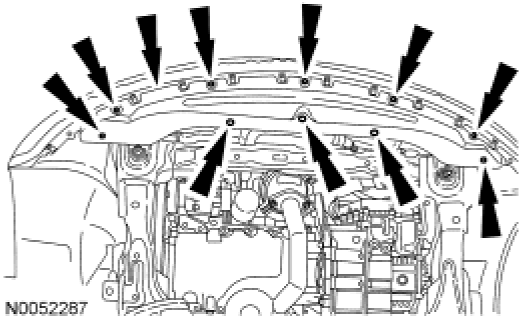


Fig. 866: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: **Prior to installation of the halfshaft, inspect the halfshaft sealing surface for wear or damage and install new, if necessary.**

72. Install the LH halfshaft into the transaxle.

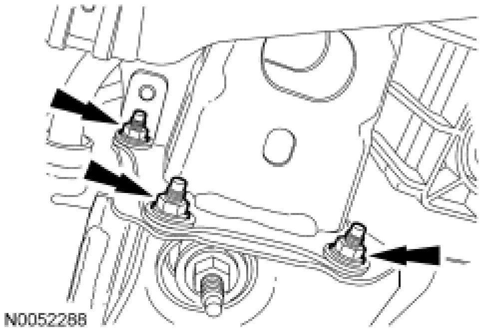


Fig. 867: Identifying LH Halfshaft
Courtesy of FORD MOTOR CO.

73. If equipped, connect the oil cooler coolant hoses.

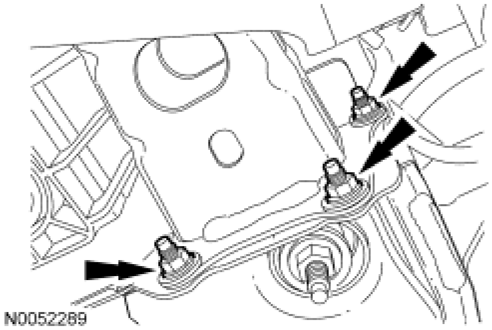


Fig. 868: Locating Oil Cooler Coolant Hoses
Courtesy of FORD MOTOR CO.

74. Using the special tool, raise the subframe into the installed position.

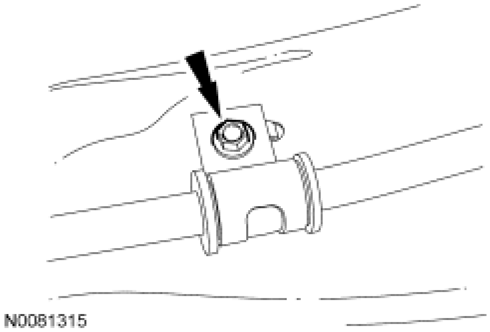


Fig. 869: Positioning Special Tool (014-00765) Under Subframe Assembly
Courtesy of FORD MOTOR CO.

75. Install the 2 middle subframe nuts.
    - Tighten to 133 Nm (98 lb-ft).

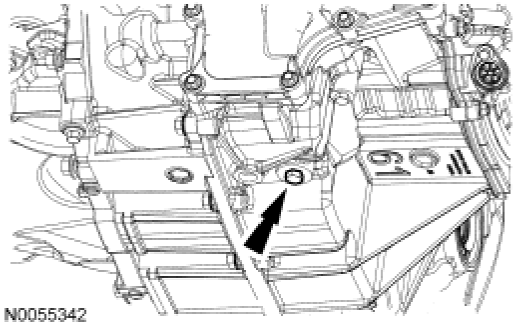


Fig. 870: Locating Middle Subframe Nuts
Courtesy of FORD MOTOR CO.

76. Install the 2 front subframe nuts.
    - Tighten to 133 Nm (98 lb-ft).

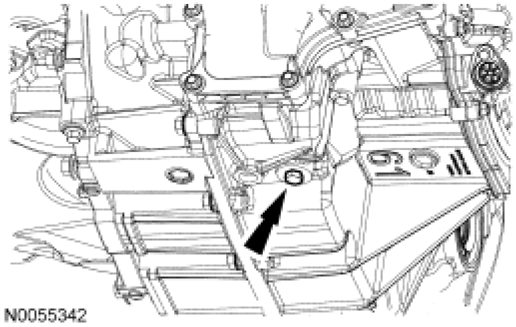


Fig. 871: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

77. Position the subframe support brackets in place and loosely install the 4 bolts.

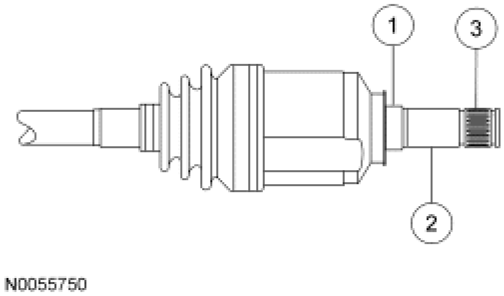


Fig. 872: Locating Subframe Support Brackets And Bolts
Courtesy of FORD MOTOR CO.

78. Install the 2 rear subframe bracket nuts.
    - Tighten to 133 Nm (98 lb-ft).

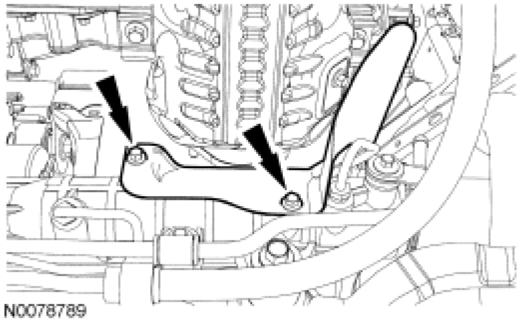


Fig. 873: Locating Rear Subframe Nuts
Courtesy of FORD MOTOR CO.

79. Tighten the 4 subframe support bracket bolts.
    - Tighten to 90 Nm (66 lb-ft).

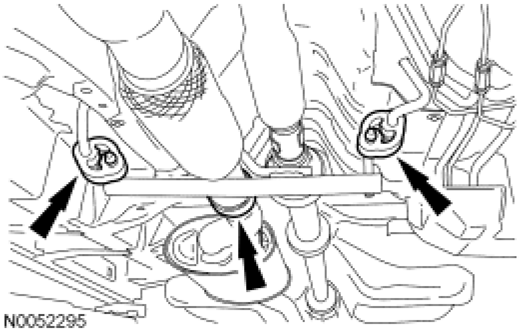


Fig. 874: Locating Subframe Support Brackets And Bolts
Courtesy of FORD MOTOR CO.

80. Position the lower bumper on the subframe and install the 3 LH nuts.
    - Tighten to 9 Nm (80 lb-in).

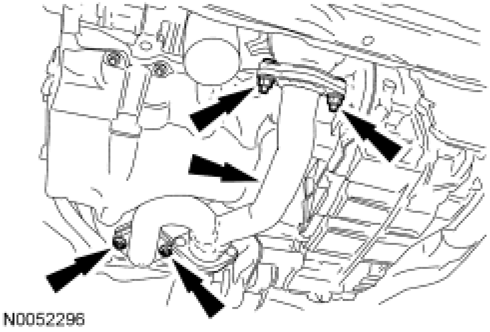


Fig. 875: Locating LH Subframe-To-Lower Bumper Nuts

Courtesy of FORD MOTOR CO.

81. Install the 3 RH lower bumper-to-subframe nuts.
    - Tighten to 9 Nm (80 lb-in).

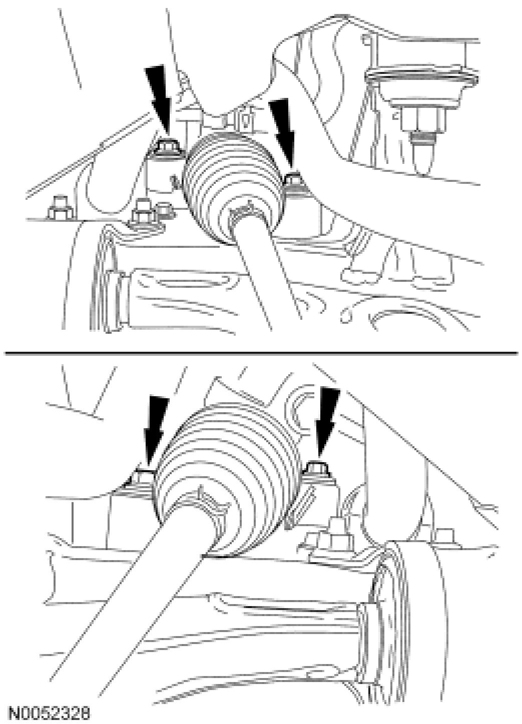


Fig. 876: Locating RH Subframe-To-Lower Bumper Nuts
Courtesy of FORD MOTOR CO.

NOTE: RH side shown, LH side similar.

82. Install the ball joints in the steering knuckles and install the pinch bolts.
    - Tighten to 55 Nm (41 lb-ft).

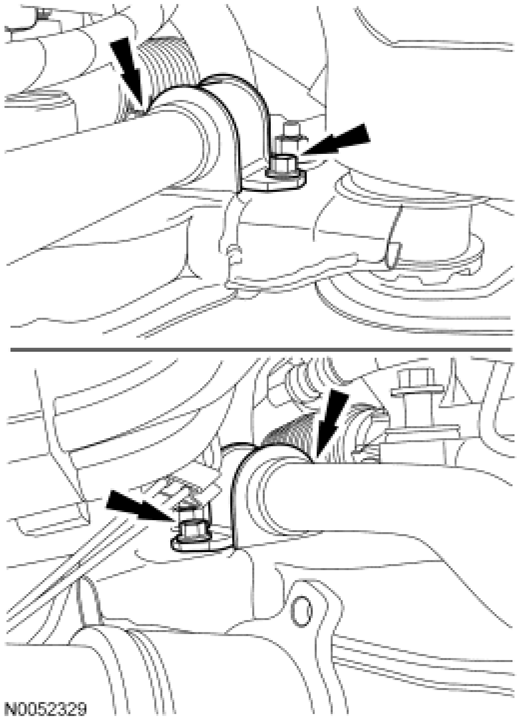


Fig. 877: Locating Ball Joint Pinch Bolt
Courtesy of FORD MOTOR CO.

NOTE: RH side shown, LH side similar.

83. Position the stabilizer bar links in the lower control arms and install the nuts.
    - Tighten to 90 Nm (66 lb-ft).

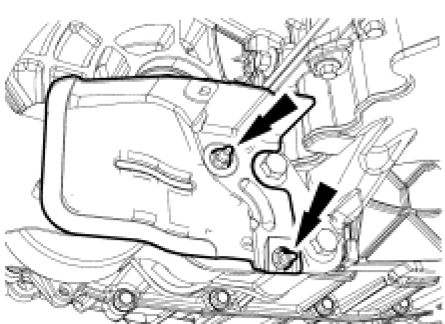


Fig. 878: Locating Stabilizer Bar Link Nut
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

84. Install the tie-rod ends and nuts.
    - Tighten to 48 Nm (35 lb-ft).

- Install new cotter pins.

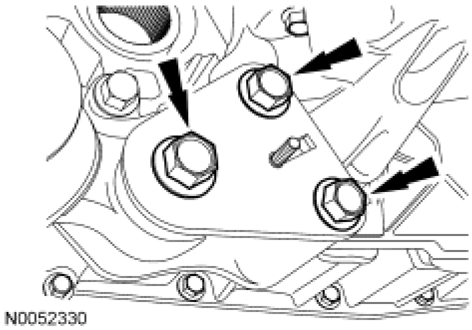


Fig. 879: Locating Tie-Rod Ends Nuts And Cotter Pin
Courtesy of FORD MOTOR CO.

CAUTION: Do not allow the intermediate shaft to rotate while it is disconnected from the gear or damage to the clockspring can occur. If there is evidence that the intermediate shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to SUPPLEMENTAL RESTRAINT SYSTEM article.

85. Install the intermediate shaft onto the steering gear and install a new bolt.
    - Tighten to 23 Nm (17 lb-ft).

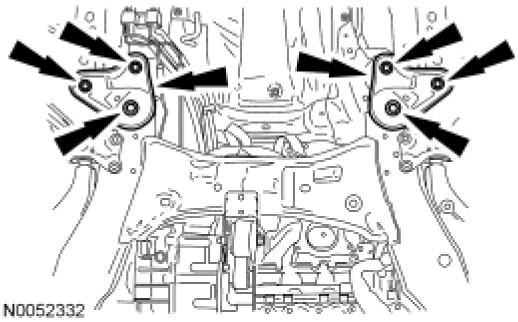


Fig. 880: Identifying Steering Intermediate Shaft Bolt
Courtesy of FORD MOTOR CO.

86. Using a new banjo bolt and 2 new seals, install the PSP tube.
    - Tighten to 48 Nm (35 lb-ft).

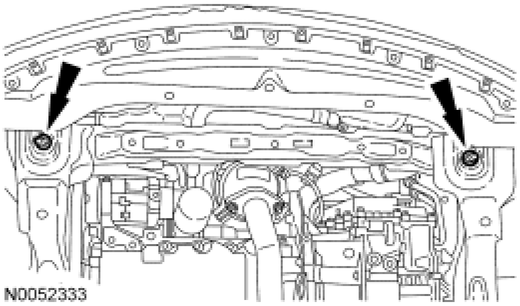


Fig. 881: Locating Power Steering Pressure (PSP) Tube-To-Pump Banjo Bolt & Seals
Courtesy of FORD MOTOR CO.

87. Install the engine roll restrictor-to-subframe through bolt.
    - Tighten to 103 Nm (76 lb-ft).

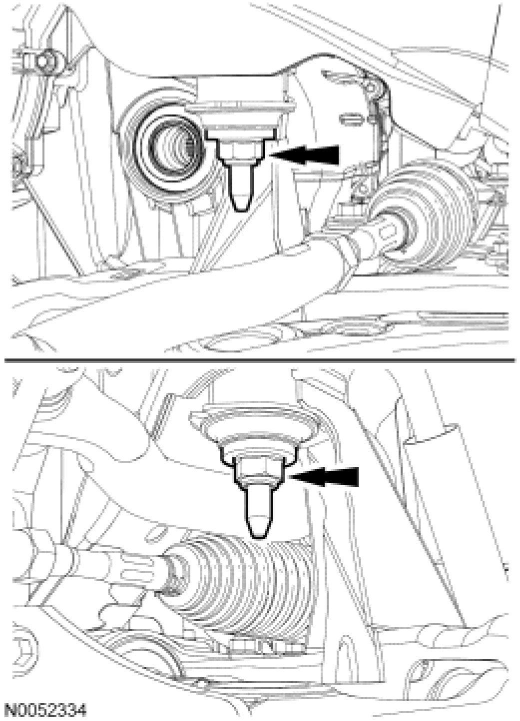
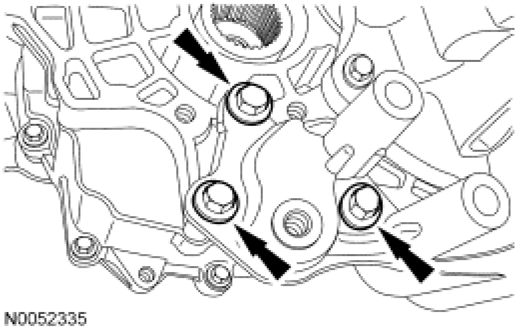


Fig. 882: Locating Roll Restrictor-To-Subframe Bolt
Courtesy of FORD MOTOR CO.

88. Install the roll restrictor heat shield and the 2 nuts.
    - Tighten to 11 Nm (8 lb-ft).

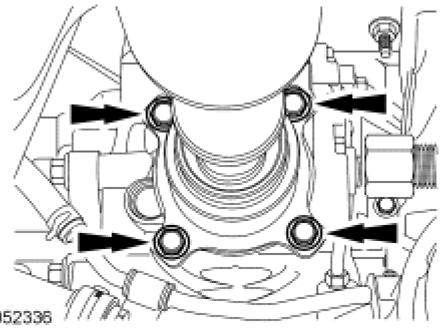


N0052335

Fig. 883: Locating Roll Restrictor Heat Shield Nuts
Courtesy of FORD MOTOR CO.

NOTE: Apply the brake to keep the halfshaft from rotating.

89. Install a new RH front halfshaft nut.
    - Tighten to 350 Nm (258 lb-ft).

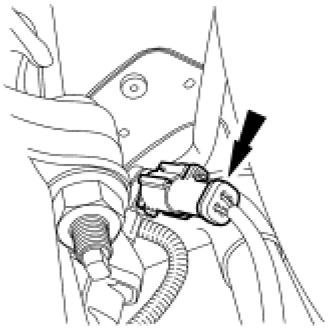


N0052336

Fig. 884: Locating RH Front Halfshaft Nut
Courtesy of FORD MOTOR CO.

AWD vehicles

90. Line up the index marks on the rear driveshaft to the index marks on the PTU flange made during removal and install the 4 bolts.
    - Tighten to 70 Nm (52 lb-ft).



N0052337

Fig. 885: Locating Driveshaft Aside Bolts
Courtesy of FORD MOTOR CO.

All vehicles

91. Install the power steering cooler bracket bolt to the RH side of the subframe.
    - Tighten to 9 Nm (80 lb-in).

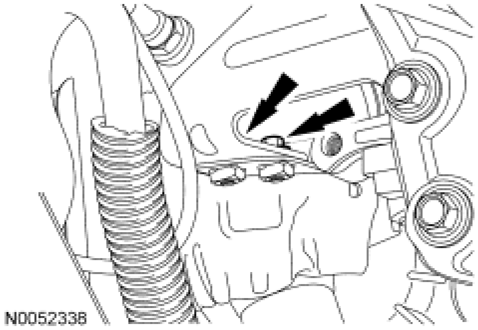


Fig. 886: Identifying Power Steering Cooler Bracket Bolt
Courtesy of FORD MOTOR CO.

92. Connect the power steering cooler hose.

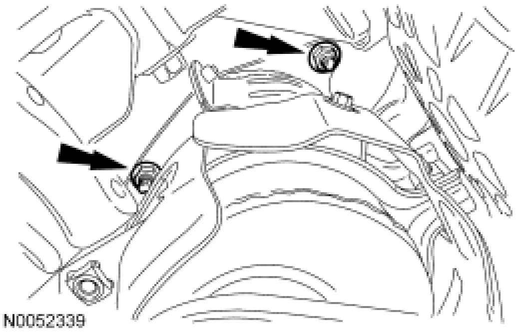


Fig. 887: Identifying Power Steering Cooler Hose
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the engine oil filter gasket with clean engine oil prior to installing the oil filter.

93. Install a new engine oil filter.
    - Tighten to 5 Nm (44 lb-in) and then rotate an additional 180 degrees.

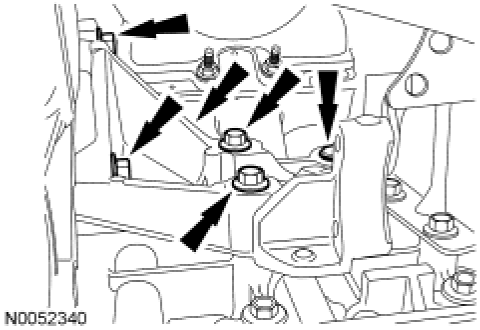


Fig. 888: Identifying Engine Oil Filter
Courtesy of FORD MOTOR CO.

94. Connect the 2 transmission fluid cooler tubes.

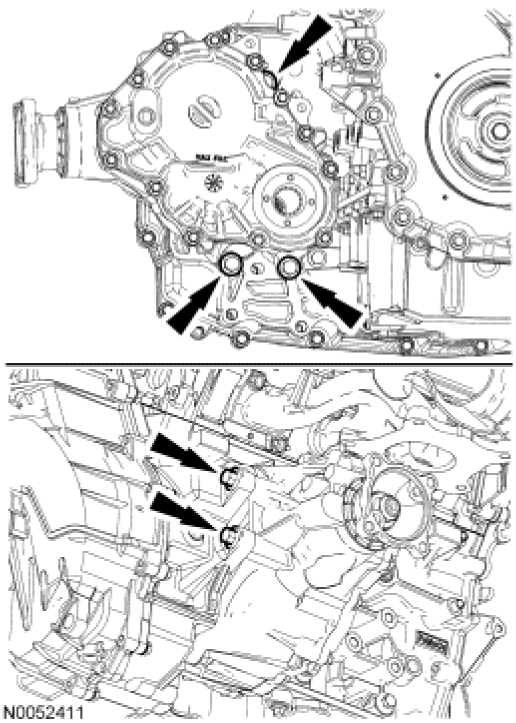


Fig. 889: Locating Transmission Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

95. Install the 2 secondary latches onto the transmission fluid cooler tubes.

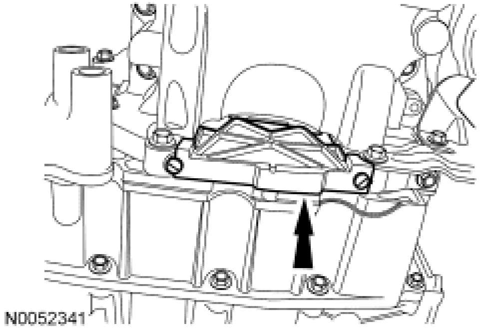


Fig. 890: Locating Secondary Latches On Transmission Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

96. Install the LH inner splash shield. For additional information, refer to **FRONT END BODY PANELS** article.
97. Install the radiator splash shield, the 3 pin-type retainers and the 7 screws.

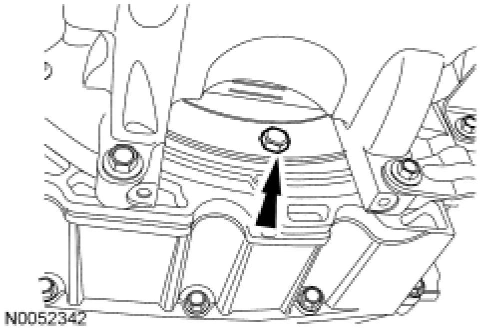


Fig. 891: Locating Push Pin Fasteners & Front Splash Shield Screws
Courtesy of FORD MOTOR CO.

98. Using a new gasket, install the Y-pipe and exhaust flexible pipe assembly and 4 new nuts.
    - Tighten to 40 Nm (30 lb-ft).

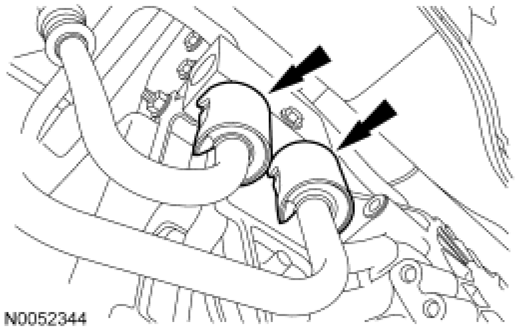


Fig. 892: Locating Exhaust Flexible Pipe, Y-Pipe & Nuts
Courtesy of FORD MOTOR CO.

99. Install the 2 exhaust hangers and tighten the exhaust clamp.

- Tighten to 40 Nm (30 lb-ft).

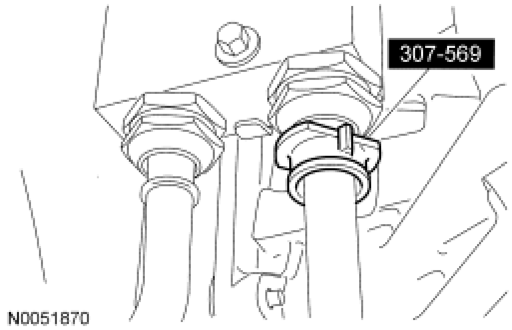


Fig. 893: Locating Exhaust Flexible Pipe Clamp & Exhaust Hangers
Courtesy of FORD MOTOR CO.

100. Install the ground wire, the radio interference capacitor wire and the nut to the engine front cover stud.
    - Tighten to 10 Nm (89 lb-in).

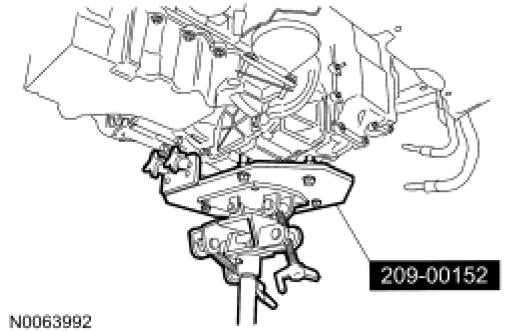


Fig. 894: Removing/installing Nut, Ground Wire & Radio Interference Capacitor Wire From Engine Front Cover Stud
Courtesy of FORD MOTOR CO.

101. Install the ground wire and bolt to the engine front cover.
    - Tighten to 10 Nm (89 lb-in).

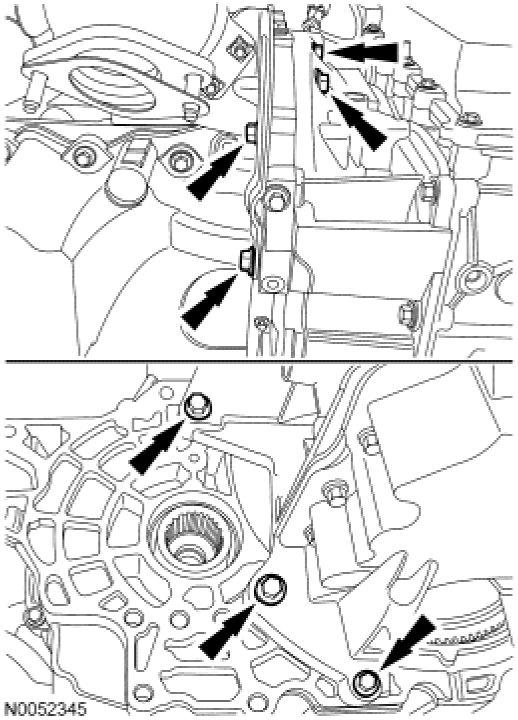


Fig. 895: Removing/Installing Bolt & Ground Wire From Engine Front Cover
Courtesy of FORD MOTOR CO.

102. Attach the wiring harness retainer to the RH valve cover stud bolt.

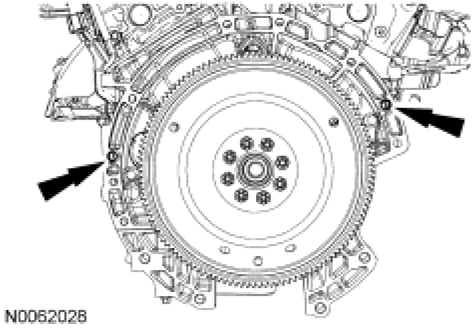


Fig. 896: Identifying Wiring Harness Retainer From RH Valve Cover Stud Bolt
Courtesy of FORD MOTOR CO.

103. Install the oil level indicator.

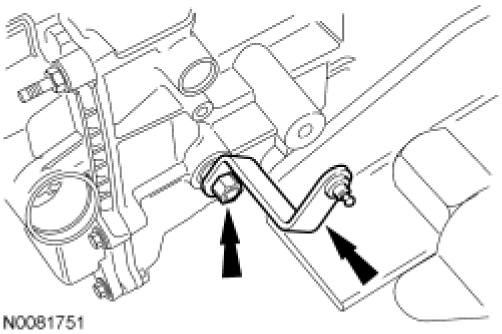


Fig. 897: Identifying Oil Level Indicator
Courtesy of FORD MOTOR CO.

104. Connect the 2 engine wiring harness electrical connectors.
    - Attach the electrical connector to the LH valve cover.

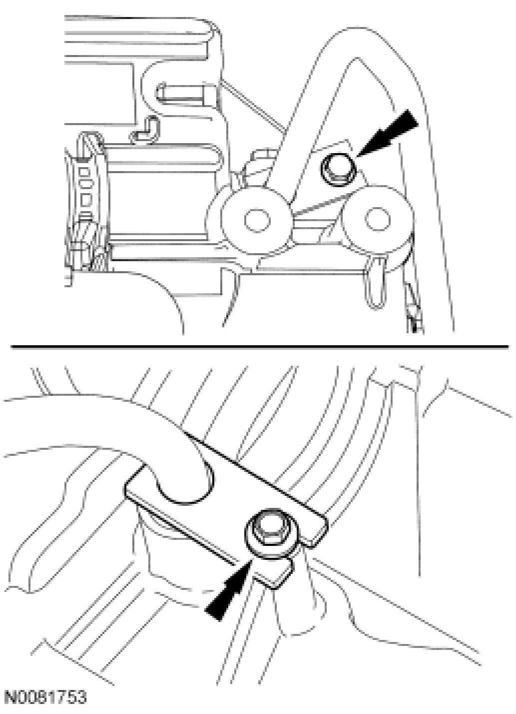


Fig. 898: Identifying Engine Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

105. Connect the fuel hose routing clip to the transaxle stud.

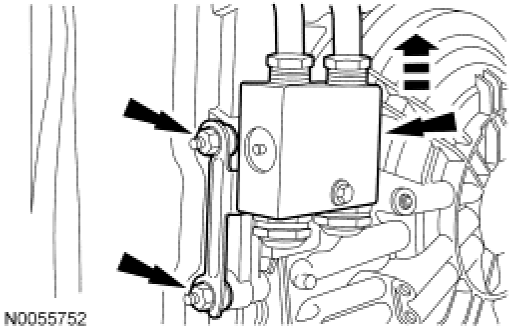


Fig. 899: Identifying Fuel Hose Routing Clip From Transaxle Stud
Courtesy of FORD MOTOR CO.

106. Connect the fuel supply tube. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

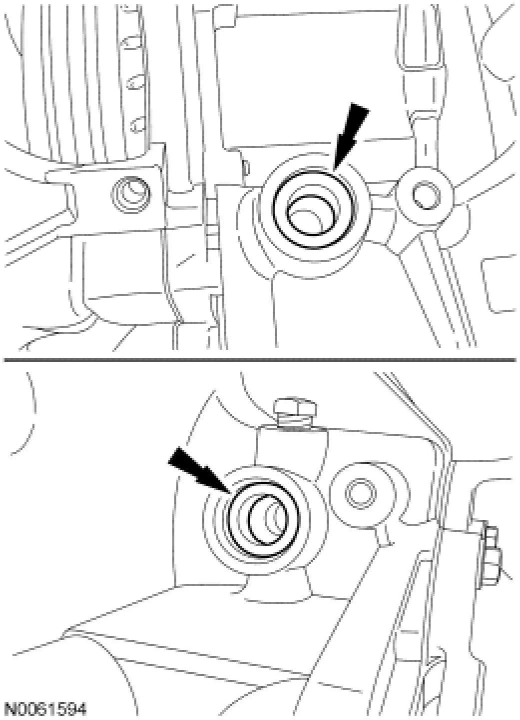


Fig. 900: Identifying Fuel Supply Tube
Courtesy of FORD MOTOR CO.

107. Connect the hose to the power steering reservoir.

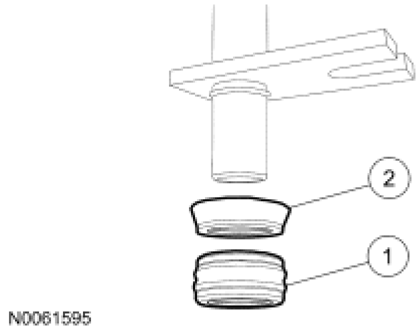


Fig. 901: Disconnecting Hose From Power Steering Reservoir
Courtesy of FORD MOTOR CO.

108. Connect the A/C suction tube fitting.
    - Install the safety clip onto the A/C fitting.

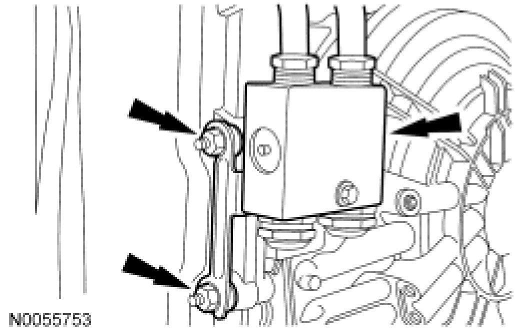


Fig. 902: Identifying Safety Clip On A/C Suction Tube Fitting
Courtesy of FORD MOTOR CO.

109. Using a new O-ring seal, connect the A/C pressure tube fitting and install the nut.
    - Tighten to 8 Nm (71 lb-in).

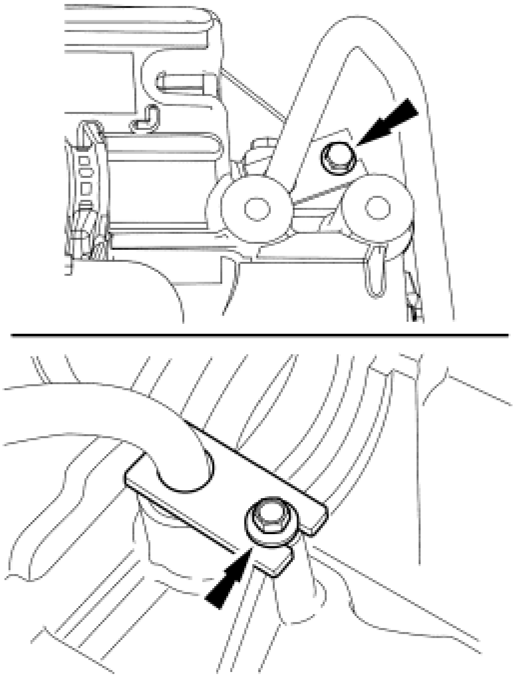


Fig. 903: Identifying A/C Pressure Tube Fitting Nut
Courtesy of FORD MOTOR CO.

110. If equipped, attach the engine block heater harness retainers from to the radiator support and the A/C suction tube.

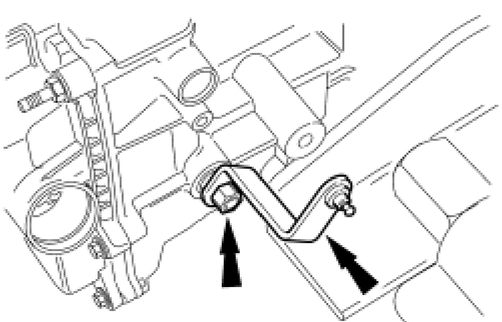


Fig. 904: Identifying Engine Block Heater Harness, Radiator Support, A/C Suction Tube & Engine Wiring Harness
Courtesy of FORD MOTOR CO.

111. Connect the transaxle control electrical connector.

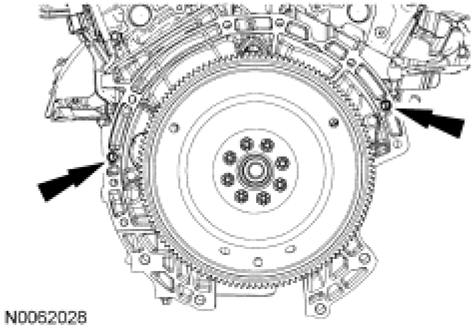


Fig. 905: Identifying Transaxle Control Electrical Connector
Courtesy of FORD MOTOR CO.

112. Attach the control cable to the bracket.
    - Connect the transaxle control cable to the control lever.

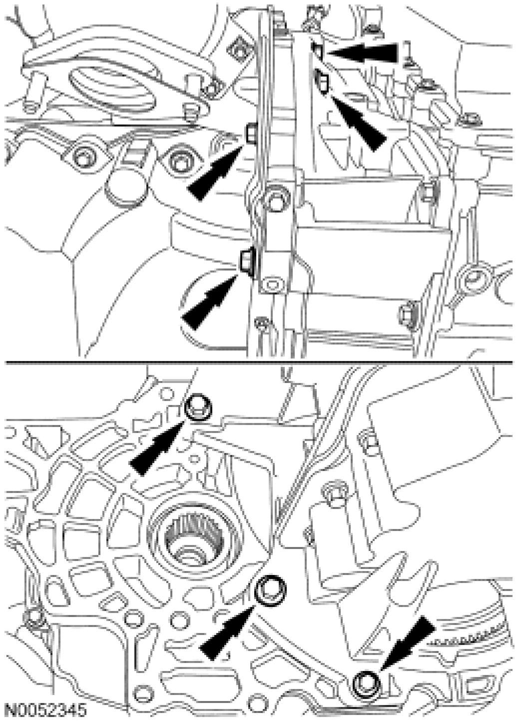


Fig. 906: Locating Transaxle Control Cable From Control Lever
Courtesy of FORD MOTOR CO.

113. Attach the wiring harness retainer to the transaxle control cable bracket.

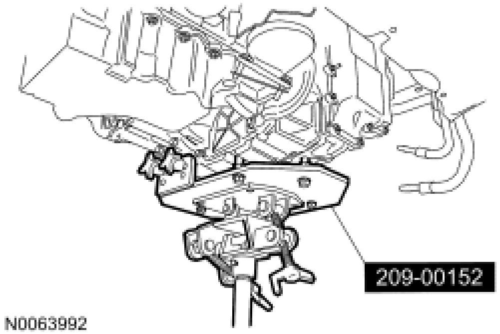


Fig. 907: Locating Wiring Harness Retainer From Transaxle Control Cable Bracket
Courtesy of FORD MOTOR CO.

114. Connect the upper radiator hose, lower radiator hose and 2 heater hoses to the thermostat housing.

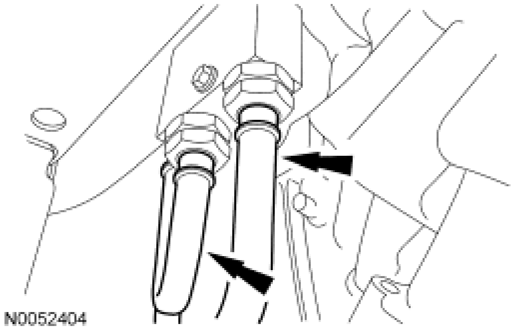


Fig. 908: Locating Upper Radiator Hose, Lower Radiator Hose & Heater Hoses
Courtesy of FORD MOTOR CO.

115. Connect the upper evaporative emissions (EVAP) tube quick connect coupling. to the purge valve. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

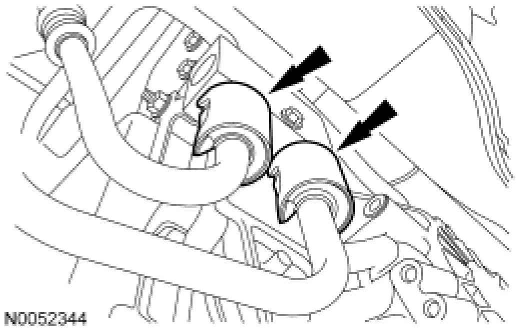


Fig. 909: Locating Upper Evaporative Emissions (EVAP) Tube Quick Connect Coupling
Courtesy of FORD MOTOR CO.

116. Connect the vacuum hose to the upper intake manifold.

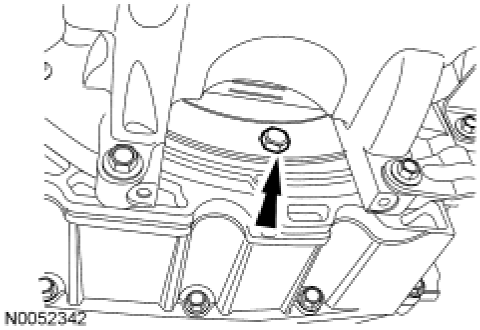


Fig. 910: Identifying Vacuum Hose From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

117. Install the ground wire and the bolt.
    - Tighten to 10 Nm (89 lb-in).
    - Attach the 2 wiring harness retainers to the cowl.

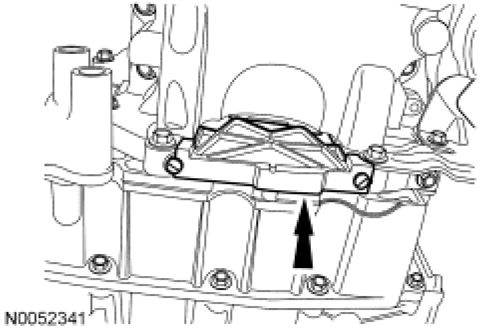


Fig. 911: Identifying Wiring Harness Retainers From Cowl
Courtesy of FORD MOTOR CO.

118. Connect the power feed to the battery terminal and install the nut.
    - Tighten to 8 Nm (71 lb-in).

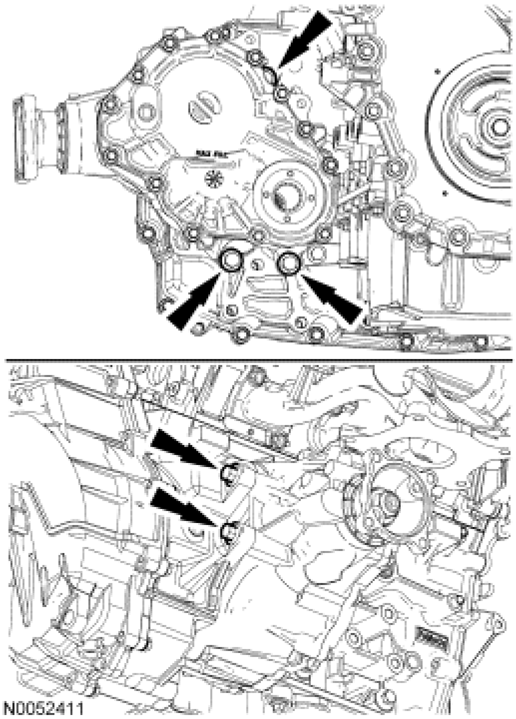


Fig. 912: Locating Power Feed To Battery Terminal And Nut
Courtesy of FORD MOTOR CO.

119. Connect the battery harness electrical connector.

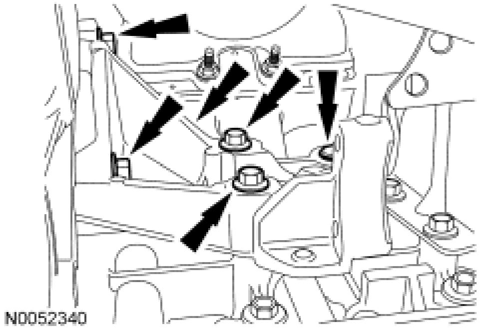


Fig. 913: Identifying Battery Harness Electrical Connector
Courtesy of FORD MOTOR CO.

120. Install the battery tray. For additional information, refer to **BATTERY, MOUNTING & CABLES** article.
121. Install the engine air cleaner and the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION & FILTERING** article.
122. Install the degas bottle. For additional information, refer to **ENGINE COOLING** article.
123. Install the accessory drive belt and the power steering belt. For additional information, refer to **ACCESSORY DRIVE** article.

CAUTION: Do not expose the Motorcraft High Performance Engine RTV Silicone to engine oil for at least 90 minutes after installing the engine front cover. Failure to follow this instruction may cause oil leakage.

124. Fill the engine with clean engine oil.
125. Fill and bleed the cooling system. For additional information, refer to **ENGINE COOLING** article.
126. Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** article.
127. Recharge the A/C system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION & DIAGNOSTICS** article.

VALVE TAPPETS

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.

NOTE: The valve tappets must be installed in their original positions.

NOTE: Coat the valve tappets with clean engine oil prior to installation.

1. Install the valve tappets.

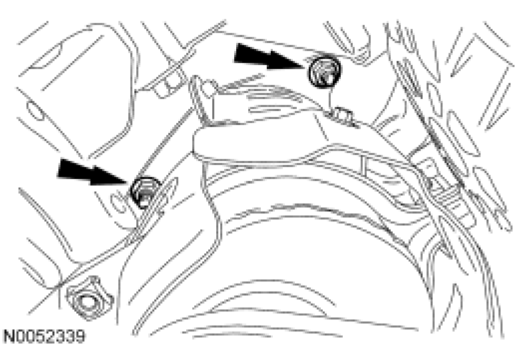
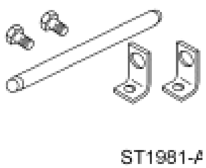
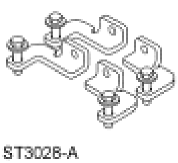
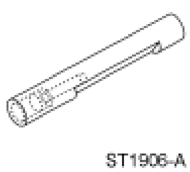


Fig. 914: Identifying Valve Tappets From Cylinder Head
Courtesy of FORD MOTOR CO.

2. Depending on the valve tappets being serviced, install the LH and/or the RH camshafts. For additional information, refer to **Camshaft**.

VALVE SPRING, RETAINER AND SEAL

Special Tools

Illustration	Tool Name	Tool Number
	Compressor, Valve Spring	303-300 (T87C-6565-A)
	Compressor, Valve Spring	303-350 (T89P-6565-A)
	Compressor, Valve Spring	303-1249
	Installer, Valve Stem Oil Seal	303-470 (T94P-6510-CH)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

NOTE: Lubricate the valve stem seal with clean engine oil prior to installation.

1. Using the Valve Stem Oil Seal Installer, install a new valve stem seal.

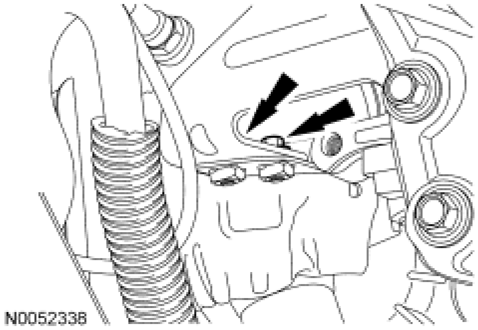


Fig. 915: Installing New Valve Stem Seal Using Special Tool (303-470)
Courtesy of FORD MOTOR CO.

2. Using the Valve Spring Compressors, install the valve spring, retainer and key.

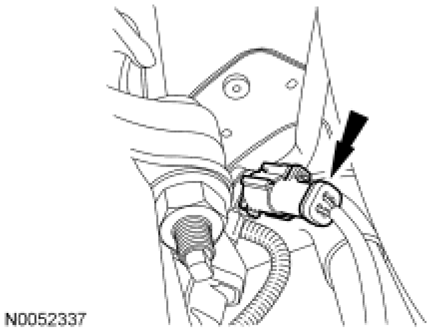


Fig. 916: Removing Keys, Retainer & Spring Using Special Tools (303-1249, 303-350, 303-300)
Courtesy of FORD MOTOR CO.

3. Install the valve tappets. For additional information, refer to **Valve Tappets**.

CYLINDER HEAD - RH

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

All vehicles

1. Install a new gasket, the RH cylinder head and 8 new bolts. Tighten in the sequence shown in 5 stages:
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten to 35 Nm (26 lb-ft).
    - Stage 3: Tighten 90 degrees.
    - Stage 4: Tighten 90 degrees.
    - Stage 5: Tighten 90 degrees.

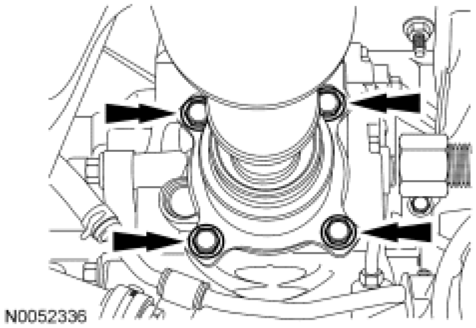


Fig. 917: Installing RH Cylinder Head Bolts In Sequence
Courtesy of FORD MOTOR CO.

2. Install the bolt.
    - Tighten to 10 Nm (89 lb-in).

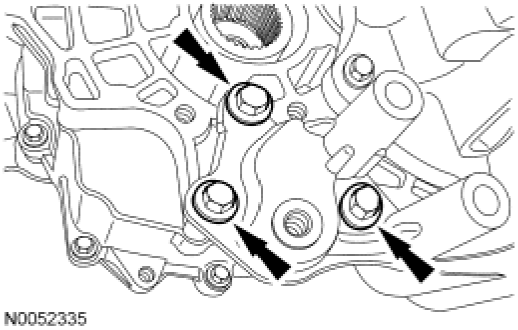


Fig. 918: Identifying M6 Bolt
Courtesy of FORD MOTOR CO.

NOTE: The valve tappets must be installed in their original positions.

NOTE: Coat the valve tappets with clean engine oil prior to installation.

3. Install the valve tappets.

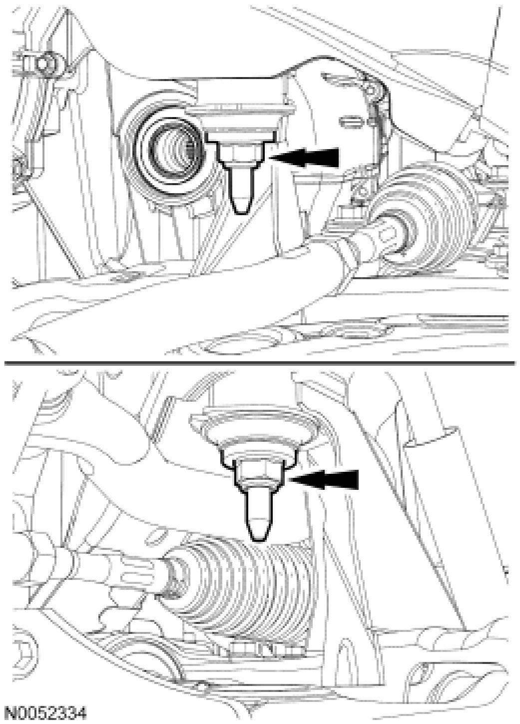


Fig. 919: Identifying Valve Tappets From Cylinder Head
Courtesy of FORD MOTOR CO.

4. Install and connect the cylinder head temperature (CHT) sensor jumper harness.

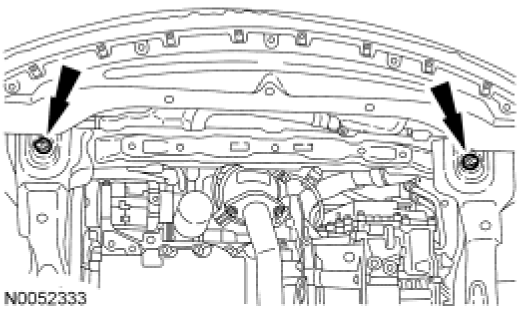


Fig. 920: Identifying CHT Sensor Jumper Harness
Courtesy of FORD MOTOR CO.

5. Using new gaskets, install the lower intake manifold and the 10 bolts.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).

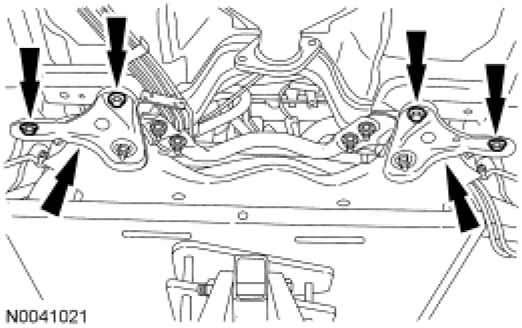


Fig. 921: Installing Lower Intake Manifold Bolts In Sequence
Courtesy of FORD MOTOR CO.

6. Using a new gasket and O-ring seal, install the thermostat housing and the 3 bolts.
   - Tighten to 10 Nm (89 lb-in).

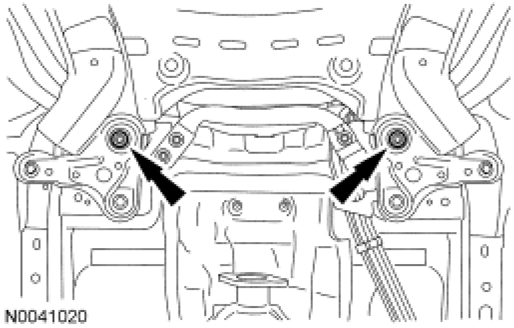


Fig. 922: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Use O-ring seals that are made of special fuel-resistant material. The use of ordinary O-rings can cause the fuel system to leak. Do not reuse the O-ring seals.

NOTE: The upper and lower O-ring seals are not interchangeable.

7. Install new fuel injector O-ring seals.
   - Remove the retaining clips and separate the fuel injectors from the fuel rail.
   - Remove and discard the O-ring seals.
   - Install new O-ring seals and lubricate with clean engine oil.
   - Install the fuel injectors and the retaining clips onto the fuel rail.

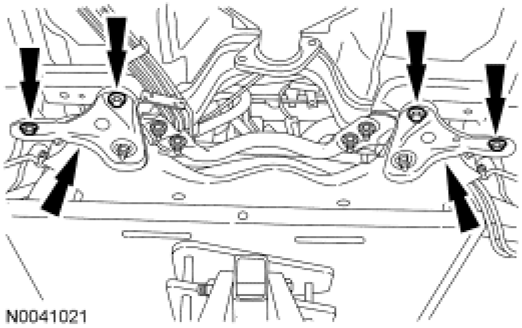


Fig. 923: Identifying Fuel Injector O-Ring Seals
Courtesy of FORD MOTOR CO.

8. Install the fuel rail and injectors as an assembly and install the 4 bolts.
    - Tighten to 10 Nm (89 lb-in).

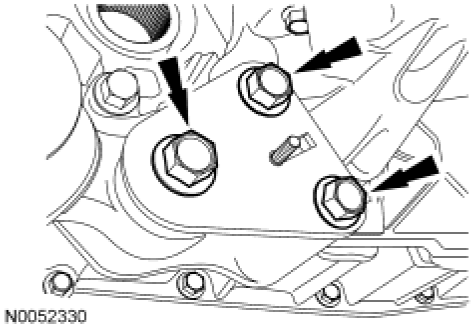


Fig. 924: Identifying Fuel Rail And Injectors
Courtesy of FORD MOTOR CO.

9. Install the RH camshaft position (CMP) sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).

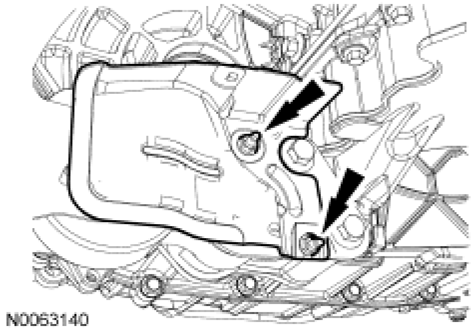


Fig. 925: Locating RH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

NOTE: **Align the bracket with the index mark made during removal.**

10. Install the upper intake manifold bracket and the bolt.
    - Tighten to 10 Nm (89 lb-in).

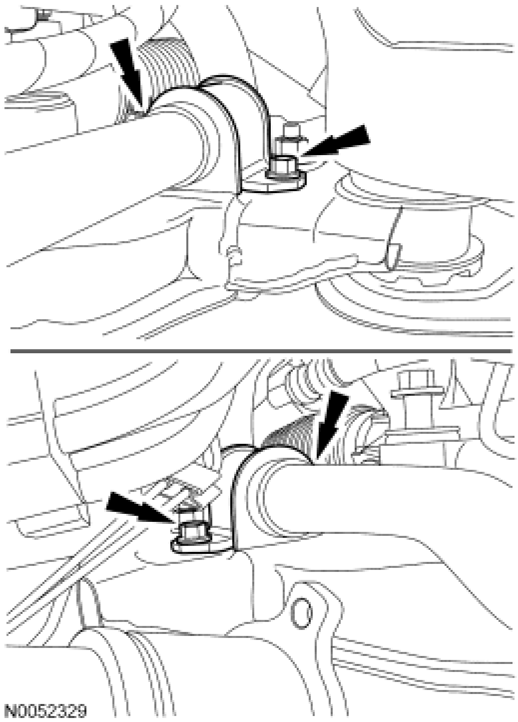


Fig. 926: Locating Upper Intake Manifold Bracket & Bolt
Courtesy of FORD MOTOR CO.

11. Install the engine lifting eye and the 2 bolts.
    - Tighten to 24 Nm (18 lb-ft).

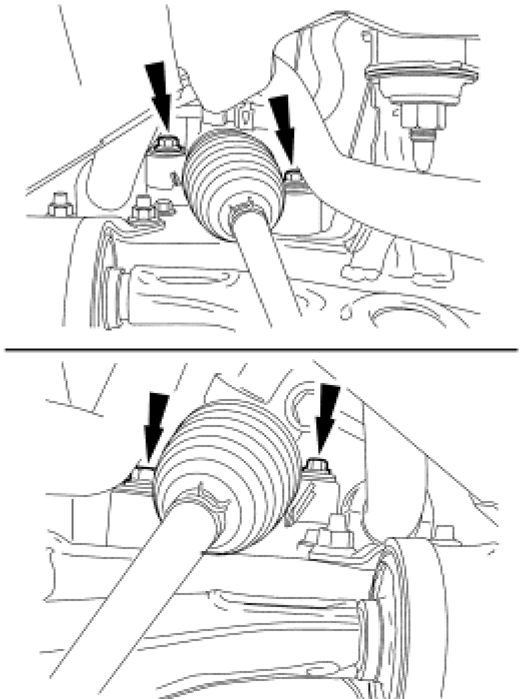


Fig. 927: Locating Engine Lifting Eye & Bolts
Courtesy of FORD MOTOR CO.

12. Install the RH secondary timing chain tensioner and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

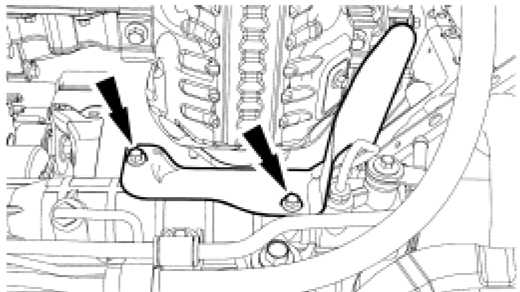


Fig. 928: Locating RH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

13. Install the RH primary timing chain guide and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

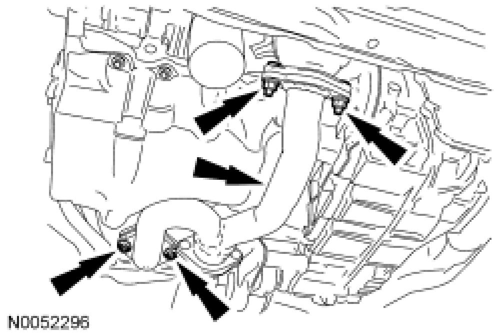


Fig. 929: Locating RH Primary Timing Chain Guide Lower Bolt
Courtesy of FORD MOTOR CO.

14. Install 6 new RH exhaust manifold studs.
    - Tighten to 12 Nm (9 lb-ft).

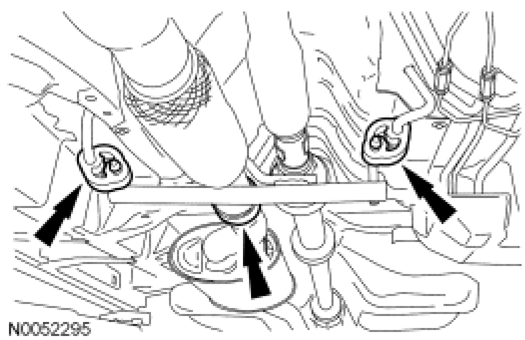


Fig. 930: Locating RH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

CAUTION: Failure to tighten the exhaust manifold nuts to specification a second time will cause the exhaust manifold to develop an exhaust leak.

15. Using a new gasket, install the RH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown:
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten to 20 Nm (15 lb-ft).

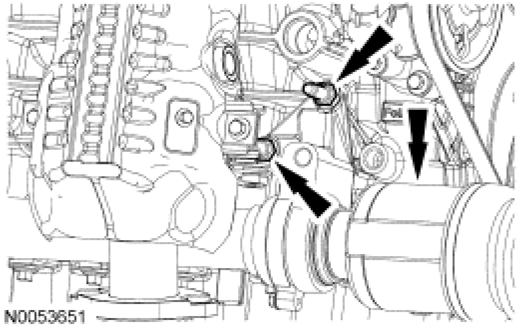


Fig. 931: Installing RH Exhaust Manifold Nuts In Sequence
Courtesy of FORD MOTOR CO.

16. Install the RH exhaust manifold heat shield and the 3 bolts.
    - Tighten to 14 Nm (10 lb-ft).

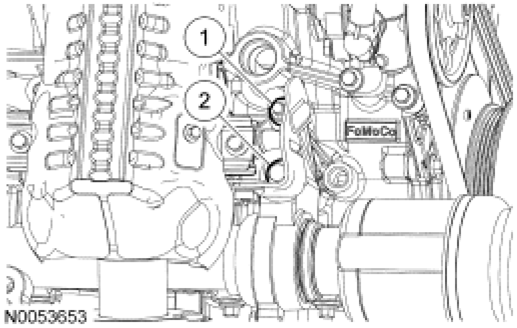


Fig. 932: Locating RH Exhaust Manifold Heat Shield & Nuts
Courtesy of FORD MOTOR CO.

17. Install the RH cylinder block drain plug or, if equipped, the block heater.
    - Tighten to 40 Nm (30 lb-ft).

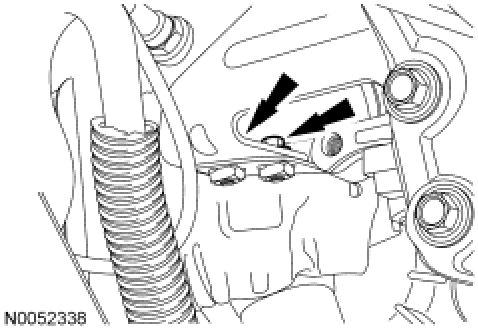


Fig. 933: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

NOTE:	**Do not tighten the 4 catalytic converter nuts at this time.**

18. Using a new gasket, install the RH catalytic converter and 4 new nuts.

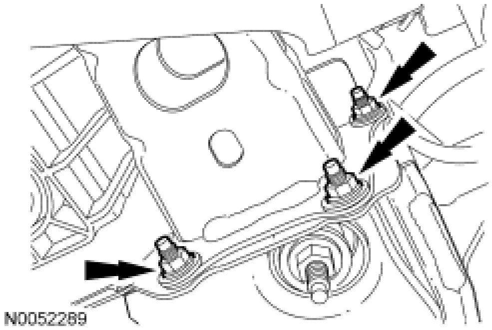


Fig. 934: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

19. Install the 2 RH catalytic converter bracket bolts.
    - Tighten the 4 catalytic converter nuts to 40 Nm (30 lb-ft).
    - Tighten the 2 catalytic converter bracket bolts to 20 Nm (15 lb-ft).

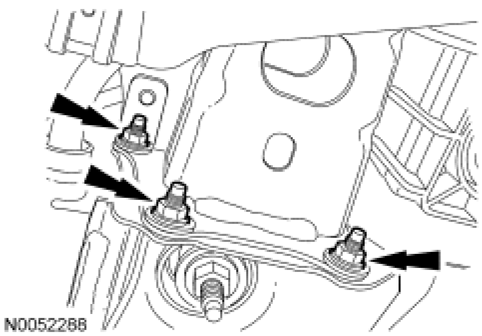


Fig. 935: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

All vehicles

20. Install the LH cylinder block drain plug.
    - Tighten to 20 Nm (15 lb-ft) plus an additional 180 degrees.

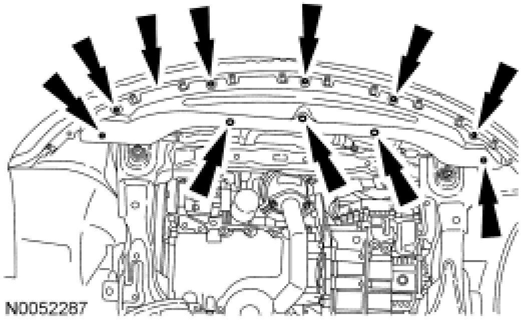


Fig. 936: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

21. Using a new gasket, install the LH catalytic converter and 4 new nuts (3 shown).
    - Tighten to 40 Nm (30 lb-ft).

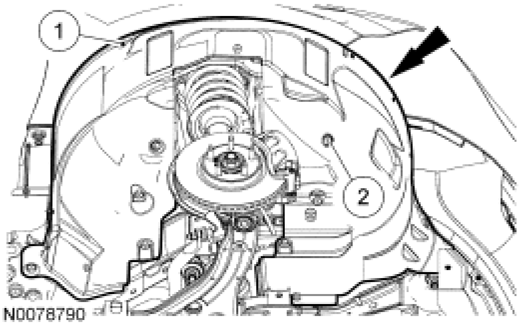


Fig. 937: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

22. Install the 2 LH catalytic converter bracket bolts.
    - Tighten to 20 Nm (15 lb-ft).

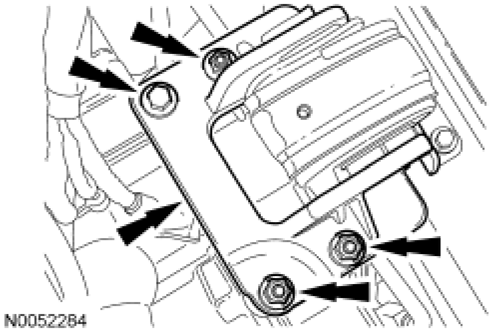


Fig. 938: Locating LH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

23. Connect the LH catalyst monitor sensor electrical connector.

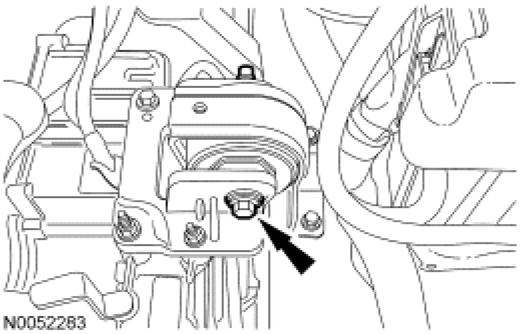


Fig. 939: Identifying LH Catalyst Monitor Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

24. Connect the CHT sensor electrical connector.

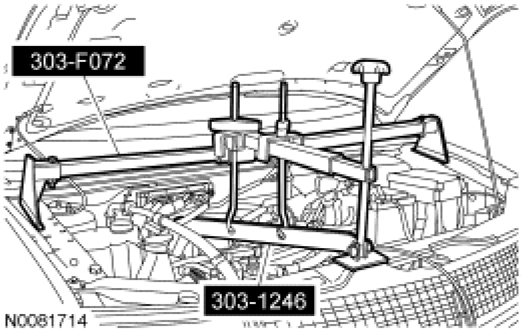


Fig. 940: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

25. Connect the 6 fuel injector electrical connectors (3 shown).

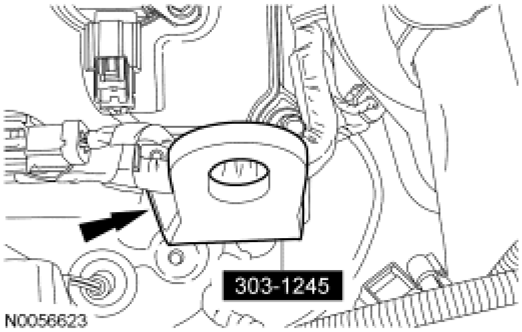


Fig. 941: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

26. Install the ground cable and the bolt.
    - Tighten to 10 Nm (89 lb-in).

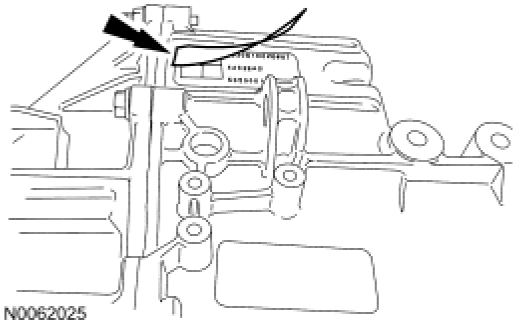


Fig. 942: Locating Ground Cable From RH Cylinder
Courtesy of FORD MOTOR CO.

27. Connect the RH CMP sensor electrical connector.

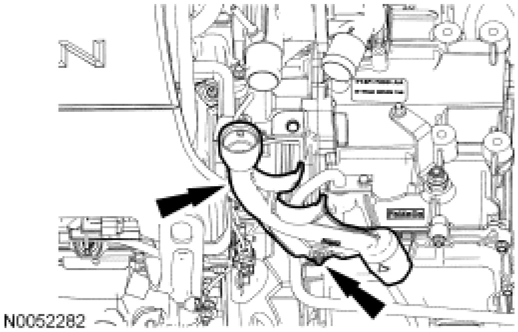


Fig. 943: Locating RH Camshaft Position (CMP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

28. Connect the RH heated oxygen sensor (HO2S) electrical connector.

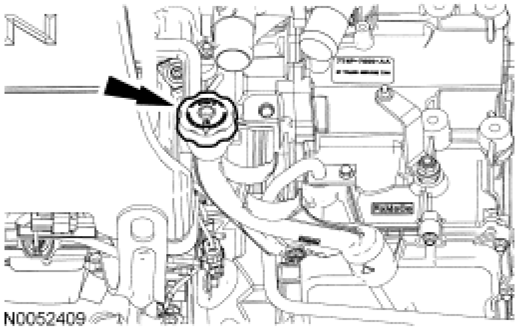


Fig. 944: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

29. If equipped, install the block heater wiring harness onto the engine.
    - Connect the block heater electrical connector and install the heat shield.

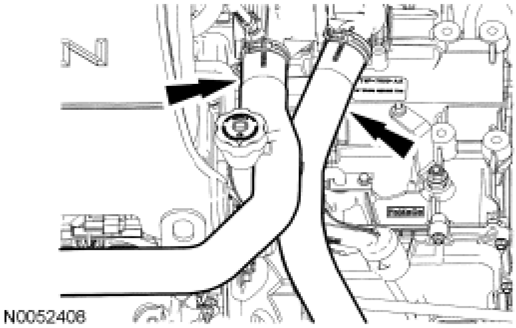


Fig. 945: Identifying Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

30. Install the RH camshafts. For additional information, refer to **Camshaft**.

CYLINDER HEAD - LH

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

All vehicles

1. Install a new gasket, the LH cylinder head and 8 new bolts. Tighten in the sequence shown in 5 stages:
   - Stage 1: Tighten to 20 Nm (15 lb-ft).
   - Stage 2: Tighten to 35 Nm (26 lb-ft).
   - Stage 3: Tighten 90 degrees.
   - Stage 4: Tighten 90 degrees.
   - Stage 5: Tighten 90 degrees.

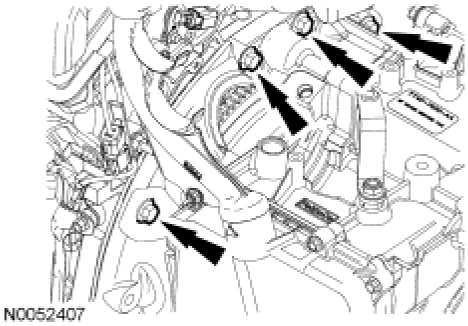


Fig. 946: Installing LH Cylinder Head Bolts In Sequence
Courtesy of FORD MOTOR CO.

2. Install the bolt.
   - Tighten to 10 Nm (89 lb-in).

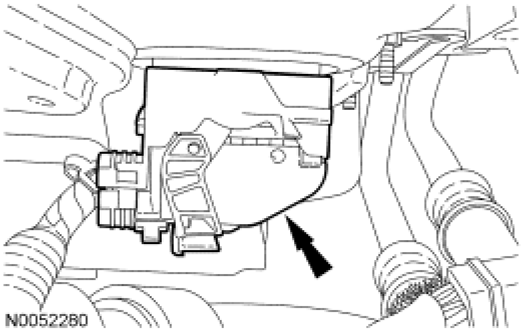


Fig. 947: Identifying M6 Bolt
Courtesy of FORD MOTOR CO.

NOTE:	**The valve tappets must be installed in their original positions.**

NOTE:	**Coat the valve tappets with clean engine oil prior to installation.**

3. Install the valve tappets.

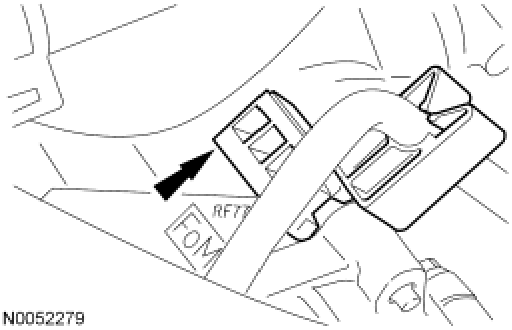


Fig. 948: Identifying Valve Tappets From Cylinder Head

Courtesy of FORD MOTOR CO.

4. Install the LH secondary timing chain tensioner and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

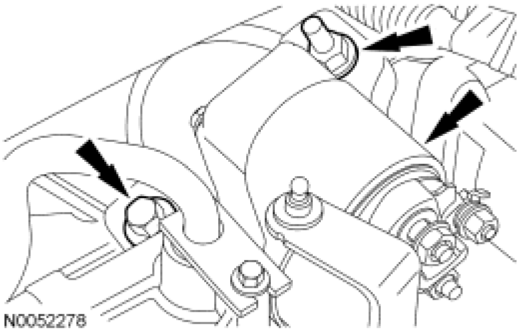


Fig. 949: Locating LH Secondary Timing Chain Tensioner & Bolt
Courtesy of FORD MOTOR CO.

5. Install the upper LH primary timing chain guide and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

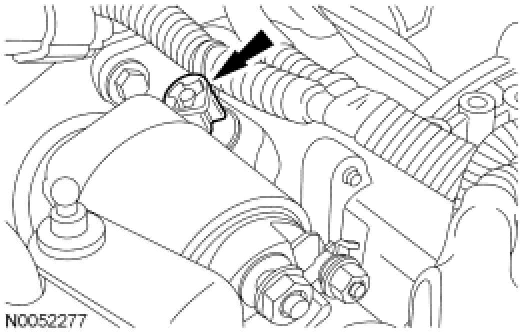


Fig. 950: Locating Upper LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

6. Install LH camshaft position (CMP) sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).

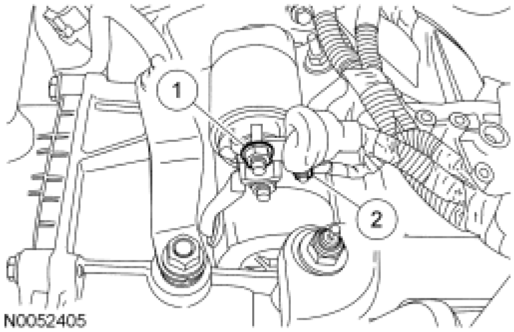


Fig. 951: Locating LH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

7. Using new gaskets, install the lower intake manifold and the 10 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

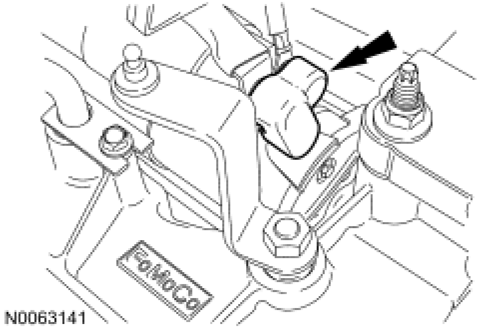


Fig. 952: Installing Lower Intake Manifold Bolts In Sequence
Courtesy of FORD MOTOR CO.

8. Using a new gasket and O-ring seal, install the thermostat housing and the 3 bolts.
    - Tighten to 10 Nm (89 lb-in).

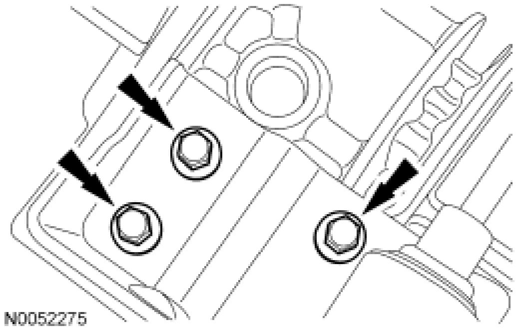


Fig. 953: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Use O-ring seals that are made of special fuel-resistant material. The use of ordinary O-rings can cause the fuel system to leak. Do not reuse the O-ring seals.

NOTE: The upper and lower O-ring seals are not interchangeable.

9. Install new fuel injector O-ring seals.
    - Remove the retaining clips and separate the fuel injectors from the fuel rail.
    - Remove and discard the O-ring seals.
    - Install new O-ring seals and lubricate with clean engine oil.

- Install the fuel injectors and the retaining clips onto the fuel rail.

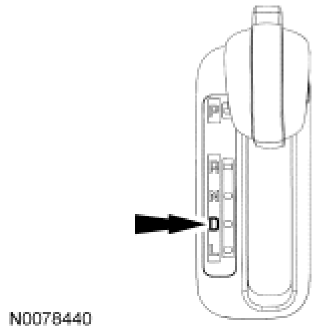


Fig. 954: Identifying Fuel Injector O-Ring Seals
Courtesy of FORD MOTOR CO.

10. Install the fuel rail and injectors as an assembly and install the 4 bolts.
    - Tighten to 10 Nm (89 lb-in).

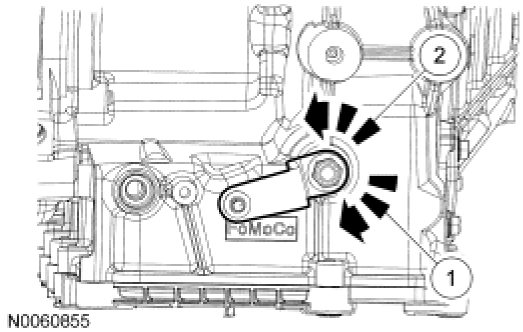


Fig. 955: Identifying Fuel Rail And Injectors
Courtesy of FORD MOTOR CO.

11. Install the RH cylinder block drain plug or, if equipped, the block heater.
    - Tighten to 40 Nm (30 lb-ft).

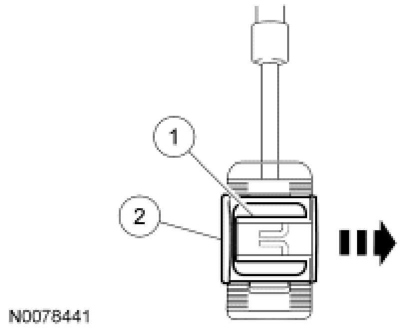


Fig. 956: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

12. Using a new gasket, install the RH catalytic converter and 4 new nuts.
    - Tighten to 40 Nm (30 lb-ft).

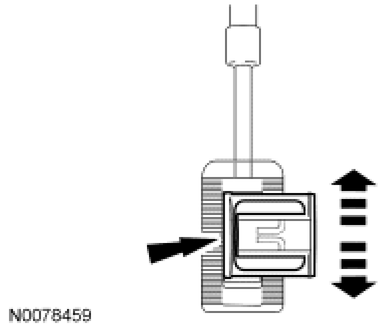


Fig. 957: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

13. Install the 2 RH catalytic converter bracket bolts.
    - Tighten the 4 catalytic converter nuts to 40 Nm (30 lb-ft).
    - Tighten the 2 catalytic converter brackets to 20 Nm (15 lb-ft).

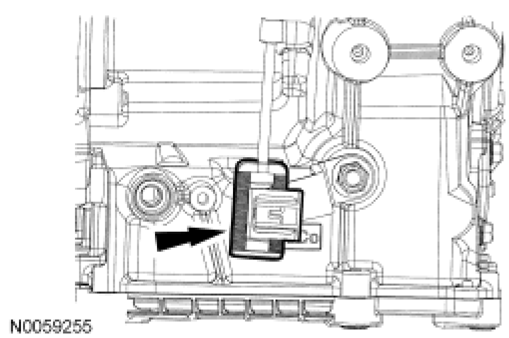


Fig. 958: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

All vehicles

14. Install the LH cylinder block drain plug.
    - Tighten to 20 Nm (15 lb-ft) plus an additional 180 degrees.

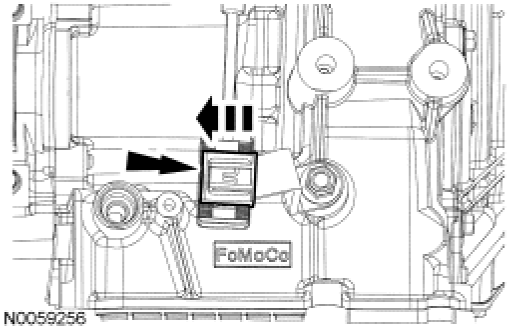


Fig. 959: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

15. Install 6 new LH exhaust manifold studs.
    - Tighten to 12 Nm (9 lb-ft).

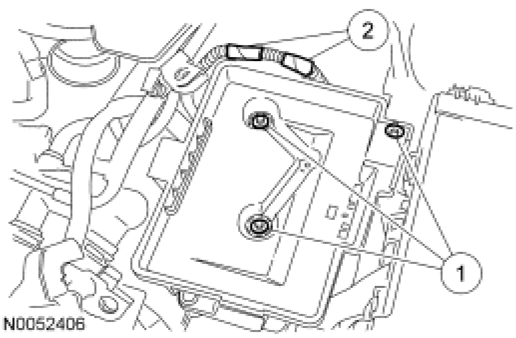


Fig. 960: Locating LH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

CAUTION: Failure to tighten the exhaust manifold nuts to specification a second time will cause the exhaust manifold to develop an exhaust leak.

16. Using a new gasket, install the LH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown:
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten to 20 Nm (15 lb-ft).

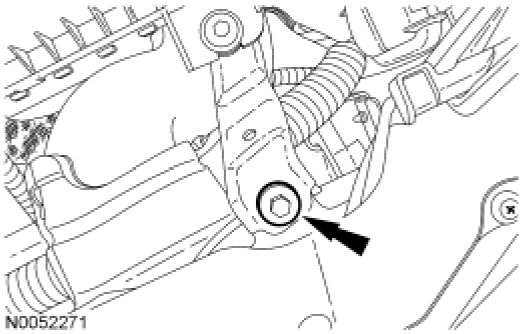


Fig. 961: Installing LH Exhaust Manifold Nuts In Sequence
Courtesy of FORD MOTOR CO.

17. Install the LH exhaust manifold heat shield and the 3 bolts.
    - Tighten to 14 Nm (10 lb-ft).

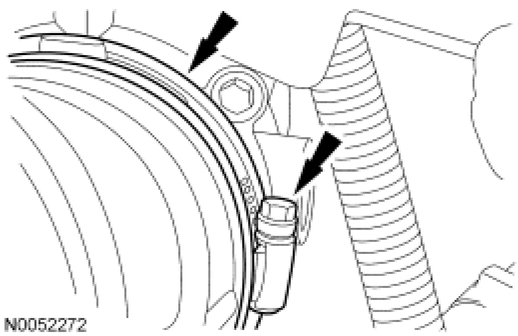


Fig. 962: Locating LH Exhaust Manifold Heat Shield & Nuts
Courtesy of FORD MOTOR CO.

18. Using a new gasket, install the LH catalytic converter and 4 new nuts (3 shown).
    - Tighten to 40 Nm (30 lb-ft).

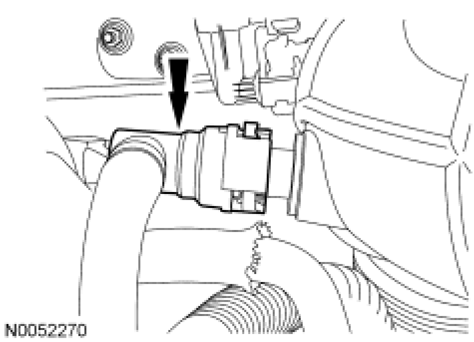


Fig. 963: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

19. Install the 2 LH catalytic converter bracket bolts.

- Tighten to 20 Nm (15 lb-ft).

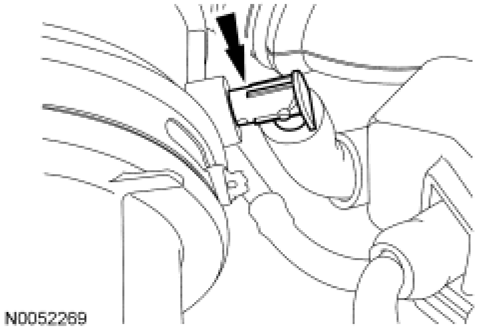


Fig. 964: Locating LH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

20. Install the generator, the bolt and the nut.
    - Tighten to 47 Nm (35 lb-ft).

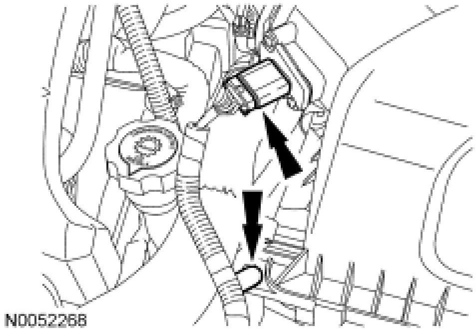


Fig. 965: Locating Generator, Bolts & Nuts
Courtesy of FORD MOTOR CO.

21. Install the A/C compressor, the nut and the 2 bolts.
    - Tighten to 25 Nm (18 lb-ft).

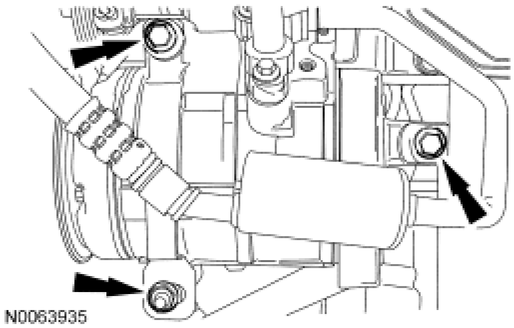


Fig. 966: Locating A/C Compressor, Bolts & Nuts
Courtesy of FORD MOTOR CO.

22. Connect the engine oil pressure (EOP) switch electrical connector and the wiring harness pin-type retainer.

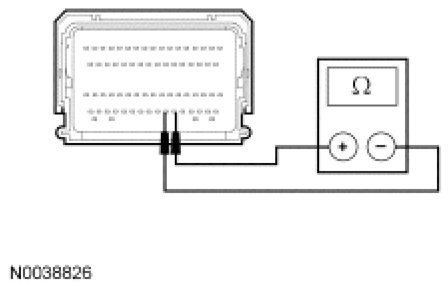


Fig. 967: Locating Engine Oil Pressure (EOP) Switch Electrical Connector & Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

23. Attach the wiring harness retainer to the generator.

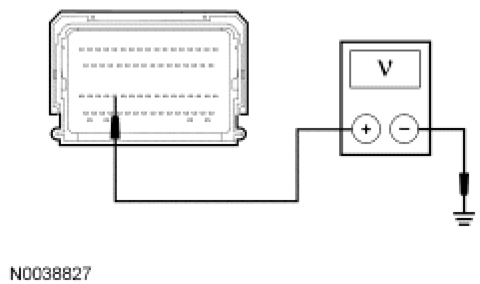


Fig. 968: Identifying Wiring Harness Retainer From Generator
Courtesy of FORD MOTOR CO.

24. Connect the generator electrical connector.

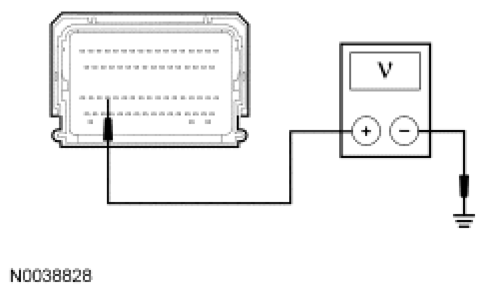


Fig. 969: Identifying Generator Electrical Connector
Courtesy of FORD MOTOR CO.

25. Connect the generator B+ cable and install the nut.
    - Tighten to 6 Nm (53 lb-in).

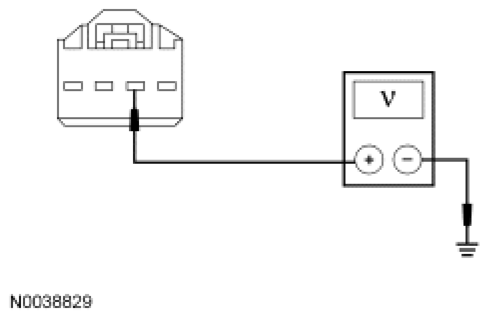


Fig. 970: Identifying Generator B+ Cable & Nut
Courtesy of FORD MOTOR CO.

26. Connect the A/C compressor electrical connector.

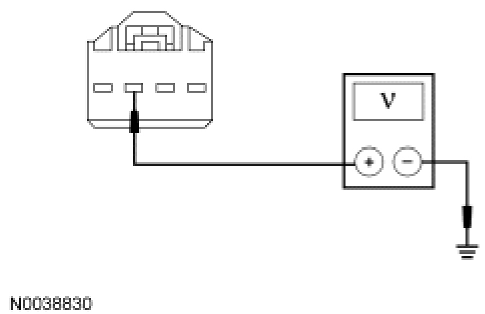


Fig. 971: Identifying A/C Compressor Electrical Connector
Courtesy of FORD MOTOR CO.

27. Install the wiring harness retainer bolt on the rear of the LH cylinder head.
    - Tighten to 10 Nm (89 lb-in).

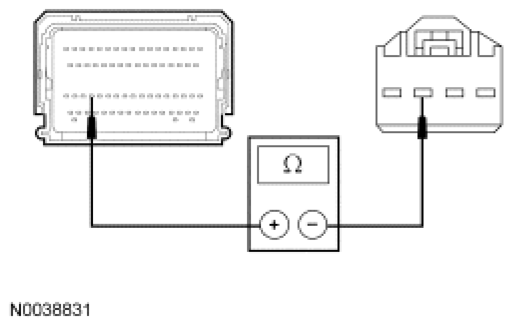


Fig. 972: Identifying Wiring Harness Retainer Bolt From Rear Of LH Cylinder Head
Courtesy of FORD MOTOR CO.

28. Connect the LH catalyst monitor sensor electrical connector.

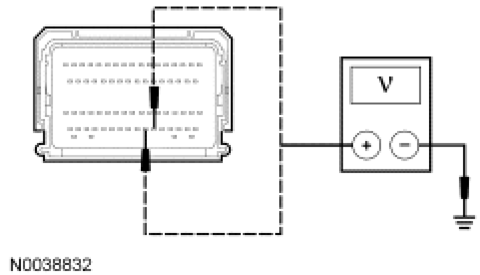


Fig. 973: Identifying LH Catalyst Monitor Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

29. Connect the LH HO2S electrical connector.

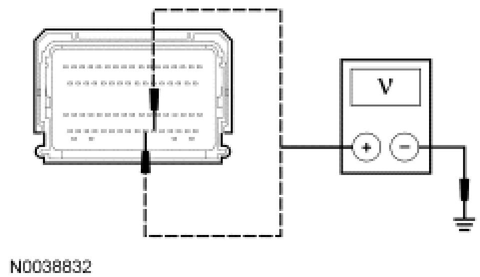


Fig. 974: Locating LH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

30. Connect the LH CMP sensor electrical connector.

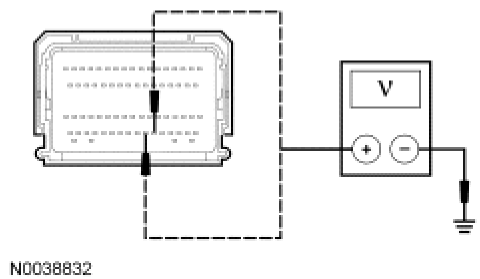


Fig. 975: Locating LH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

31. Connect the CHT sensor electrical connector.

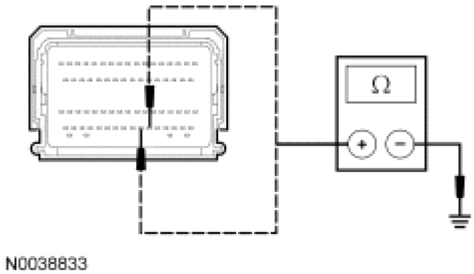


Fig. 976: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

32. Connect the 6 fuel injector electrical connectors (3 shown).

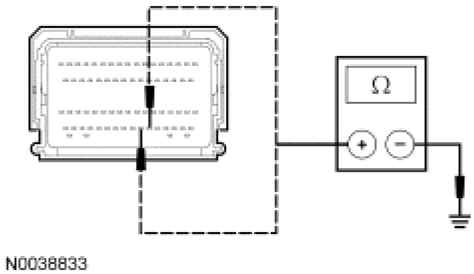


Fig. 977: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

33. If equipped, install the block heater wiring harness onto the engine.
    - Connect the block heater electrical connector and install the heat shield.

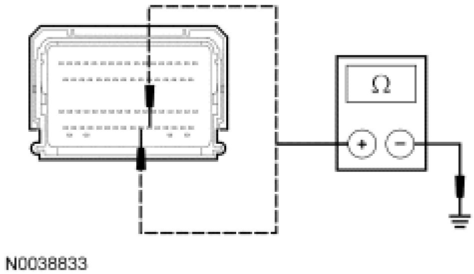
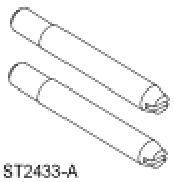
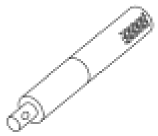
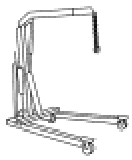
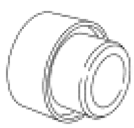
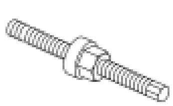
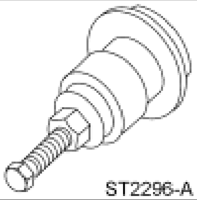
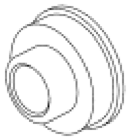


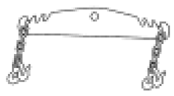
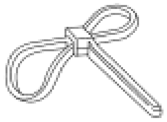
Fig. 978: Identifying Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

34. Install the LH camshafts. For additional information, refer to **Camshaft**.

OIL PAN

Special Tools

Illustration	Tool Name	Tool Number
 ST2433-A	Alignment Pins	307-399
 ST1326-A	Handle	205-153 (T80T-4000-W)
 ST1341-A	Heavy Duty Floor Crane	014-00071 or equivalent
 ST2981-A	Installer, Crankshaft Front Seal	303-1251
 ST1287-A	Installer, Crankshaft Vibration Damper	303-102 (T74P-6316-B)
 ST2296-A	Installer, Front Cover Oil Seal	303-335
 ST2983-A	Installer, Seal	303-1247/2
	Spreader Bar	303-D089 (D93P-6001-A3) or equivalent

 ST1602-A		
 ST1436-A	Strap Wrench	303-D055 (D85L-6000-A)

Material

Item	Specification
Motorcraft High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft Metal Surface Prep ZC-31-A	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket Remover ZC-30	-

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

All vehicles

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The oil pan and the 4 specified bolts must be installed and the oil pan aligned to the cylinder block and A/C compressor within 4 minutes of sealant application. Final tightening of the oil pan bolts must be carried out within 60 minutes of sealant application.

1. Apply a 3 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the sealing surface of the oil pan.

- Apply a 5.5 mm (0.21 in) bead of Motorcraft High Performance Engine RTV Silicone to the 2 crankshaft seal retainer plate-to-cylinder block joint areas on the sealing surface of the oil pan.

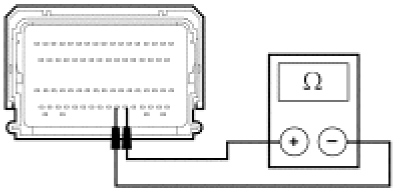


Fig. 979: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Crankshaft Seal Retainer Plate-To-Cylinder Block
Courtesy of FORD MOTOR CO.

NOTE: The oil pan and the 4 specified bolts must be installed within 4 minutes of the start of sealant application.

2. Install the oil pan and bolts 10, 11, 13 and 14.
   - Tighten the bolts in the sequence shown to 3 Nm (27 lb-in).
   - Loosen the bolts 180 degrees.

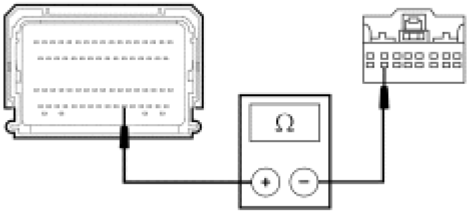
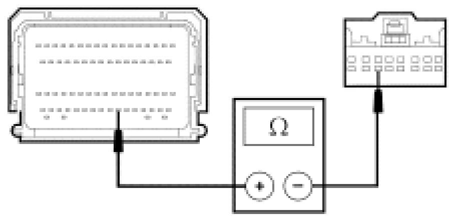


Fig. 980: Installing Oil Pan Bolts 10, 11, 13 & 14 In Sequence
Courtesy of FORD MOTOR CO.

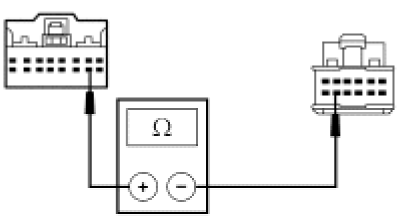
3. Align the oil pan to the cylinder block and the A/C compressor.
   - Position the oil pan so the mounting boss is against the A/C compressor and using a straightedge, align the oil pan flush with the rear of the cylinder block at the 2 areas shown.



N0075560

Fig. 981: Aligning Oil Pan Flush With Rear Of Cylinder Block
Courtesy of FORD MOTOR CO.

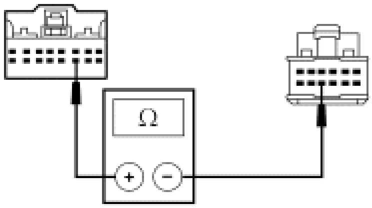
4. Tighten bolts 10, 11, 13 and 14 in the sequence shown, to 3 Nm (27 lb-in).



N0075562

Fig. 982: Installing Oil Pan Bolts 10, 11, 13 & 14 In Sequence
Courtesy of FORD MOTOR CO.

5. Install the remaining oil pan bolts. Tighten all the oil pan bolts in the sequence shown.
   - Tighten the large bolts (1-14) to 20 Nm (15 lb-ft).
   - Tighten the small bolts (15 and 16) to 10 Nm (89 lb-in).



N0075563

Fig. 983: Installing Remaining Oil Pan Bolts In Sequence
Courtesy of FORD MOTOR CO.

6. Install the A/C compressor mounting stud and nut.

- Tighten the stud to 9 Nm (80 lb-in) and the nut to 25 Nm (18 lb-ft).

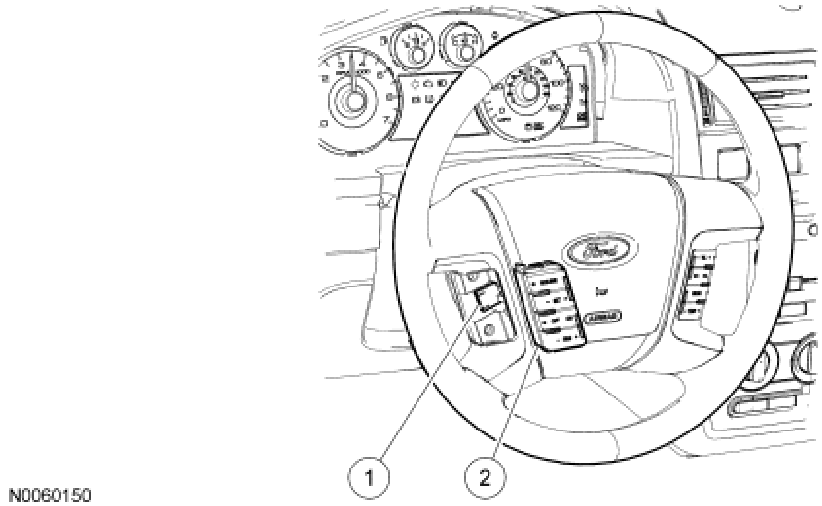


Fig. 984: Locating A/C Compressor Nut & Stud
Courtesy of FORD MOTOR CO.

7. Install the special tools.

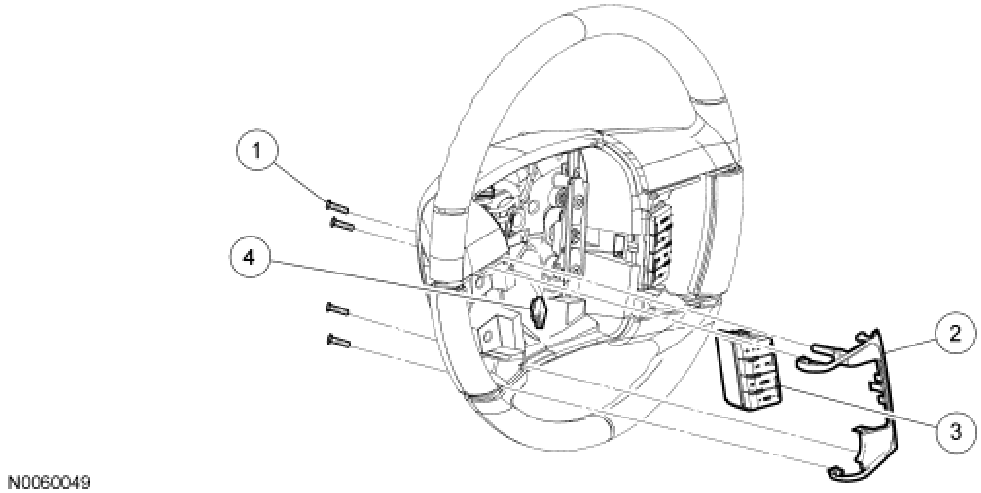


Fig. 985: Identifying Special Tool (307-399)
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The engine front cover and bolts 17, 18, 19 and 20 must be installed within 4 minutes of the initial sealant application. The remainder of the engine front cover bolts and the engine mount bracket bolts must be installed and

tightened within 35 minutes of the initial sealant application. If the time limits are exceeded, the sealant must be removed, the sealing area cleaned and sealant reapplied. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

8. Apply a 3.0 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover sealing surfaces including the 3 engine mount bracket bosses.
   - Apply a 5.5 mm (0.21 in) bead of Motorcraft High Performance Engine RTV Silicone to the oil pan-to-cylinder block joint and the cylinder head-to-cylinder block joint areas of the engine front cover in 5 places as indicated.

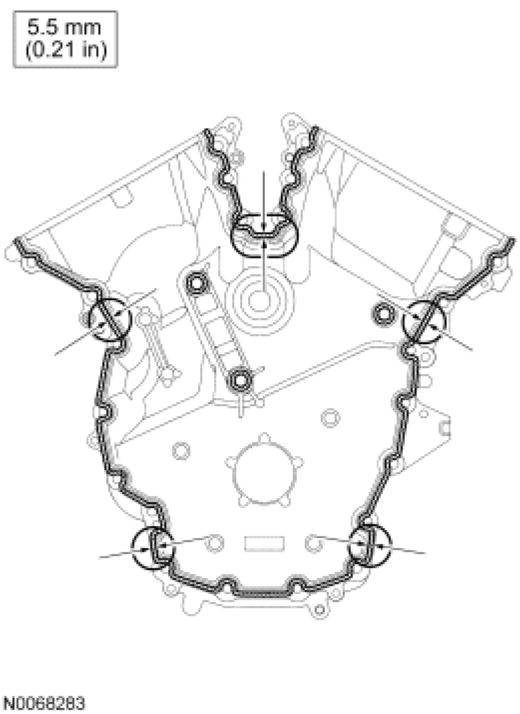
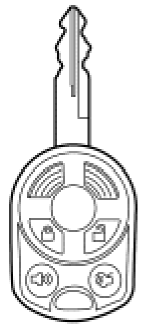


Fig. 986: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover Sealing Surfaces
Courtesy of FORD MOTOR CO.

NOTE: **Make sure the 2 locating dowel pins are seated correctly in the cylinder block.**

9. Install the engine front cover and bolts 17, 18, 19 and 20.
   - Tighten in sequence to 3 Nm (27 lb-in).



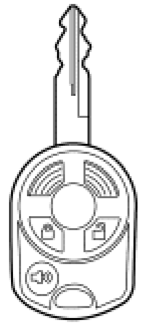
N0060211

Fig. 987: Installing Engine Front Cover & Bolts In Sequence
Courtesy of FORD MOTOR CO.

10. Remove the special tools (alignment pins).

NOTE: Do not tighten the bolt at this time.

11. Install the engine mount bracket and the 3 bolts.



N0061198

Fig. 988: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Do not expose the Motorcraft High Performance Engine RTV Silicone to engine oil for at least 90 minutes after installing the engine front cover. Failure to follow this instruction may cause oil leakage.

12. Install the remaining engine front cover bolts. Tighten all of the engine front cover bolts and engine mount bracket bolts in the sequence shown in 2 stages:
    - Stage 1: Tighten bolts 1 thru 22 to 10 Nm (89 lb-in) and bolts 23, 24 and 25 to 15 Nm (11 lb-ft).
    - Stage 2: Tighten bolts 1 thru 22 to 24 Nm (18 lb-ft) and bolts 23, 24 and 25 to 75 Nm (55 lb-ft).

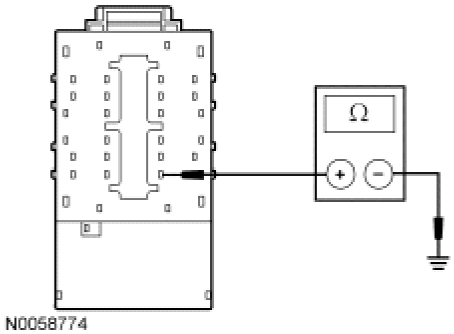


Fig. 989: Identifying Tightening Of Engine Front Cover Bolts & Engine Mount Bracket Bolts In Sequence
Courtesy of FORD MOTOR CO.

13. Install the 2 engine mount studs.
    - Tighten to 18 Nm (13 lb-ft).

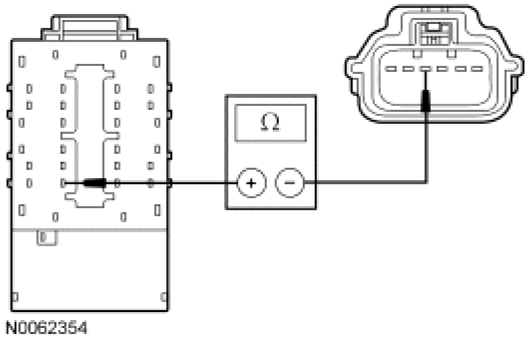


Fig. 990: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

14. Install the engine mount bracket and the 2 bolts.
    - Tighten to 24 Nm (18 lb-ft).

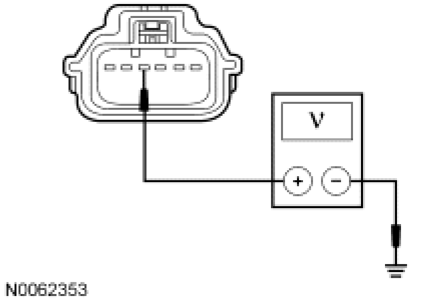


Fig. 991: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

NOTE: Apply clean engine oil to the crankshaft front seal bore in the engine front cover.

15. Using the special tools, install a new crankshaft front seal.

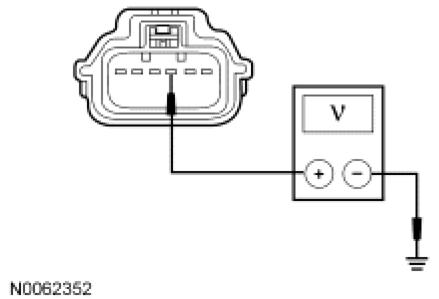


Fig. 992: Installing Crankshaft Front Seal Using Special Tools (303-102) & (303-1251)
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the outside diameter sealing surfaces with clean engine oil.

16. Using the special tools, install the crankshaft pulley.

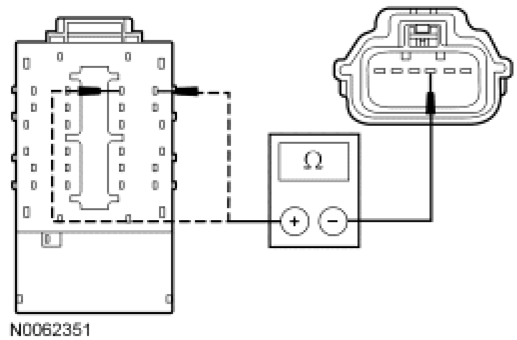
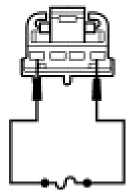


Fig. 993: Installing Crankshaft Pulley
Courtesy of FORD MOTOR CO.

17. Using the special tool, install the crankshaft pulley washer and new bolt and tighten in 4 stages.
    - Stage 1: Tighten to 120 Nm (89 (lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten an additional 90 degrees.



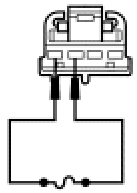
N0062349

Fig. 994: Installing Crankshaft Pulley Washer & Bolt Using Special Tools (303-D055)
Courtesy of FORD MOTOR CO.

NOTE: **Installation of new seals is only required if damaged seals were removed during disassembly of the engine.**

NOTE: **Spark plug tube seal installation shown, variable camshaft timing (VCT) seal installation similar.**

18. Using the special tools, install new VCT solenoid and/or spark plug tube seals.



N0072908

Fig. 995: Installing VCT Solenoid And/Or Spark Plug Tube Seals Using Special Tools (205-153) & (303-1247/2)
Courtesy of FORD MOTOR CO.

CAUTION: **Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.**

NOTE: **If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.**

19. Apply a 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-RH cylinder head joints.

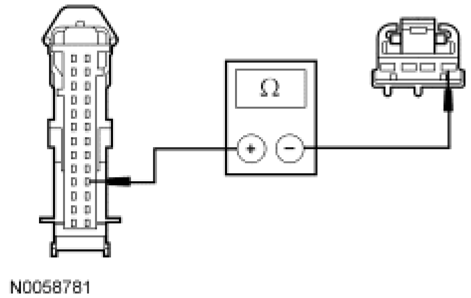


Fig. 996: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover-To-RH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

20. Using a new gasket, install the RH valve cover, bolt and the 10 stud bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

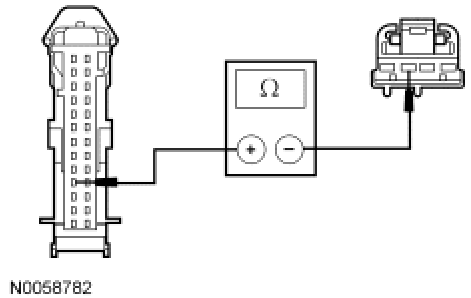


Fig. 997: Installing RH Valve Cover Stud Bolts In Sequence
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

21. Apply a 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-LH cylinder head joints.

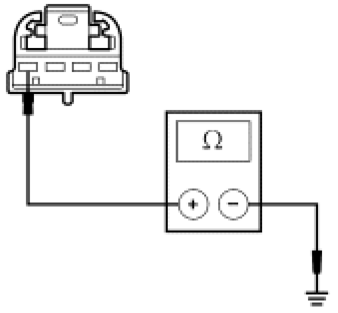


Fig. 998: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover-To-LH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

22. Using a new gasket, install the LH valve cover and 11 stud bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

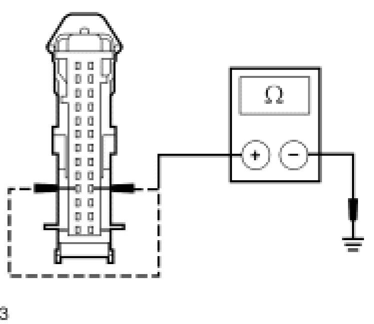


Fig. 999: Installing LH Valve Cover Stud Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

23. Install the 6 coil-on-plug assemblies and the 6 bolts.
    - Tighten to 7 Nm (62 lb-in).

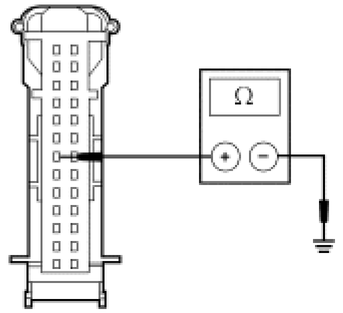


Fig. 1000: Locating Coil-On-Plugs & Bolts
Courtesy of FORD MOTOR CO.

24. Install the LH cylinder block drain plug.
    - Tighten to 20 Nm (15 lb-ft) plus an additional 180 degrees.

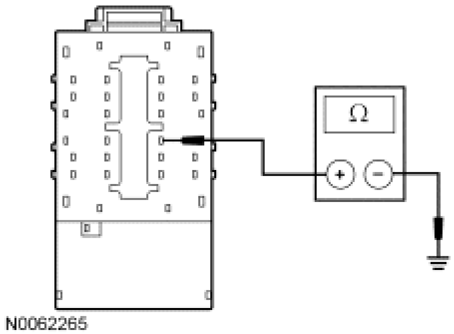


Fig. 1001: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

25. Install the RH cylinder block drain plug or, if equipped, the block heater.
    - Tighten to 40 Nm (30 lb-ft).

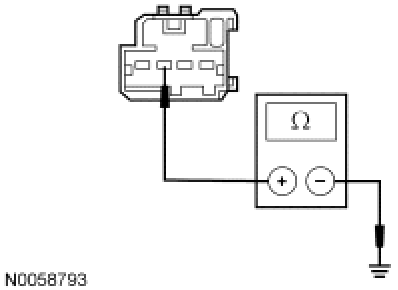


Fig. 1002: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

26. Using a new gasket, install the RH catalytic converter and 4 new nuts.
    - Tighten to 40 Nm (30 lb-ft).

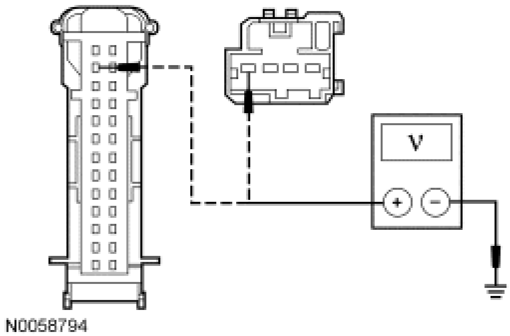


Fig. 1003: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

All vehicles

27. Using a new gasket, install the LH catalytic converter and 4 new nuts (3 shown).
    - Tighten to 40 Nm (30 lb-ft).

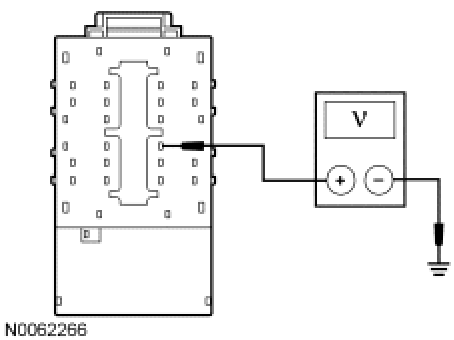


Fig. 1004: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

28. Install the accessory drive belt tensioner and the 3 bolts.
    - Tighten to 11 Nm (8 lb-ft).

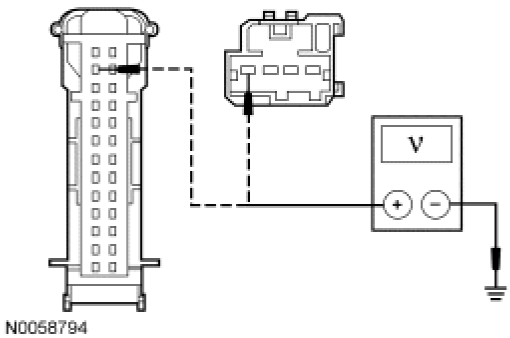


Fig. 1005: Locating Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

29. Install the power steering pump and the 3 bolts.
    - Tighten to 24 Nm (18 lb-ft).

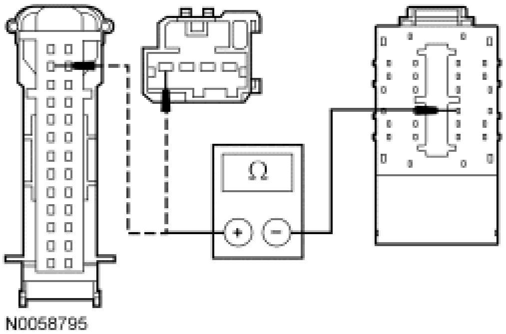


Fig. 1006: Locating Power Steering Pump Bolts
Courtesy of FORD MOTOR CO.

30. Attach all of the wiring harness retainers to the LH valve cover and stud bolts.
31. Connect the 3 LH coil-on-plug electrical connectors.

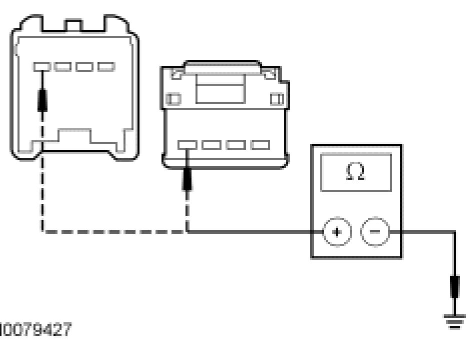


Fig. 1007: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

32. Connect the LH camshaft VCT solenoid electrical connector.

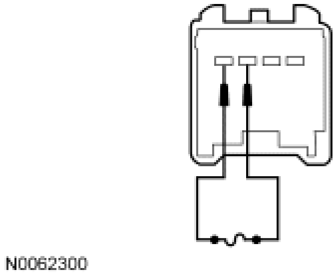


Fig. 1008: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

33. Connect the LH catalyst monitor sensor electrical connector.

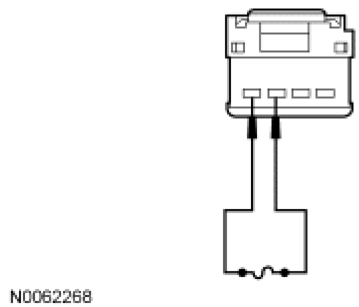


Fig. 1009: Identifying LH Catalyst Monitor Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

34. Attach all of the wiring harness retainers to the RH valve cover and stud bolts.
35. Connect the 3 RH coil-on-plug electrical connectors.

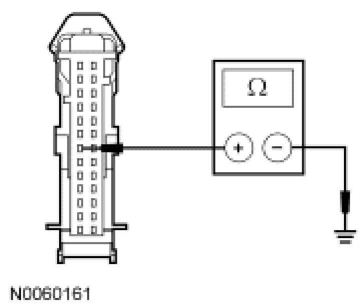


Fig. 1010: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

36. Connect the RH VCT solenoid electrical connector.

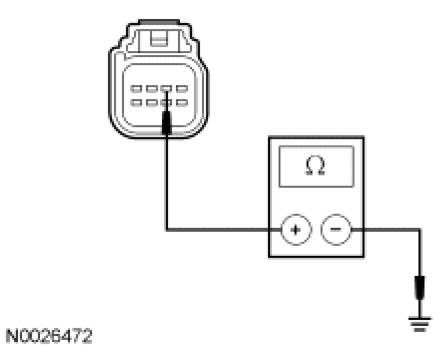


Fig. 1011: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

FWD vehicles

37. Connect the RH catalyst monitor sensor electrical connector.

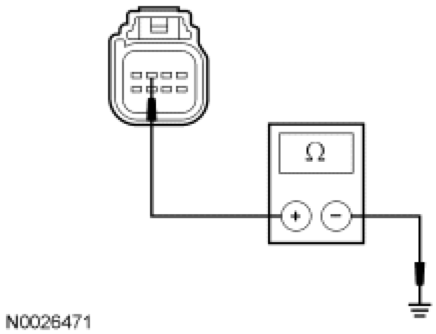


Fig. 1012: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

38. Connect the power steering pressure (PSP) switch electrical connector.

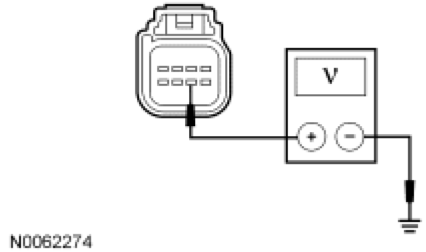


Fig. 1013: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

39. Using new gaskets, install the upper intake manifold and the 6 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

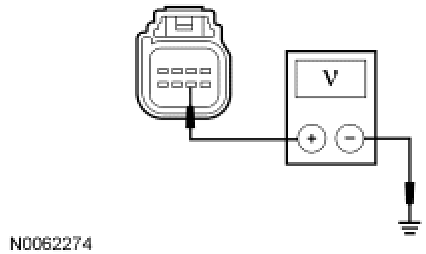


Fig. 1014: Identifying Bolt Sequence
Courtesy of FORD MOTOR CO.

40. Install the upper intake manifold support bracket bolt.
    - Tighten to 10 Nm (89 lb-in).

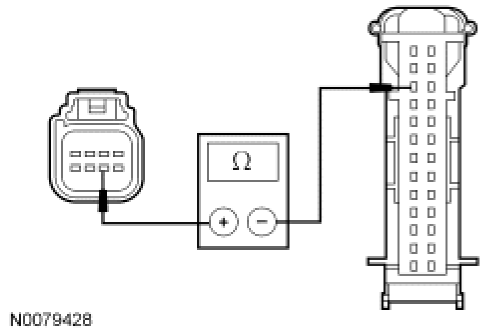


Fig. 1015: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

41. Attach the wiring harness retainers to the upper intake manifold.

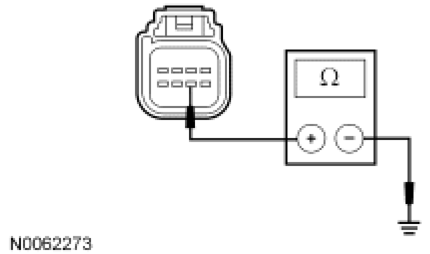


Fig. 1016: Locating Wiring Harness Retainers From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

42. Connect the throttle body (TB) electrical connector.

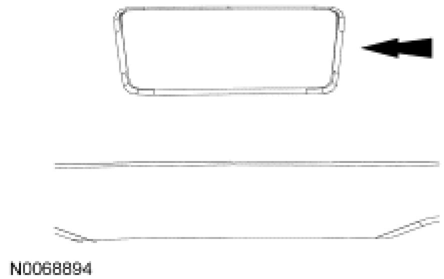


Fig. 1017: Locating Throttle Body Electrical Connector
Courtesy of FORD MOTOR CO.

43. Connect the PCV hose to the PCV valve.

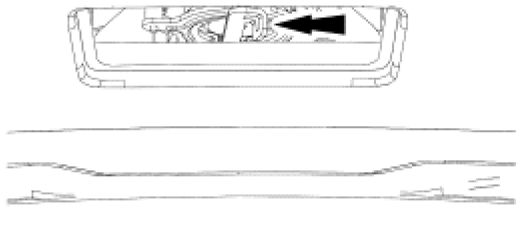


Fig. 1018: Identifying PCV Hose
Courtesy of FORD MOTOR CO.

44. If equipped, position the engine block heater harness on the engine and attach all of the harness retainers.
    - Connect the engine block heater electrical connector and install the heat shield.

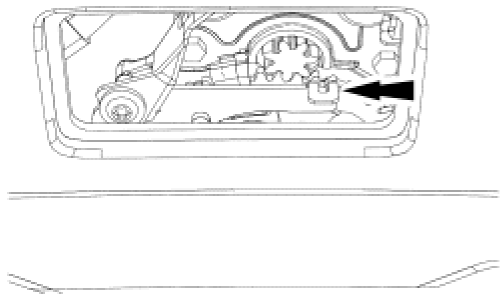


Fig. 1019: Identifying Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

45. Using the special tools, remove the engine from the stand.

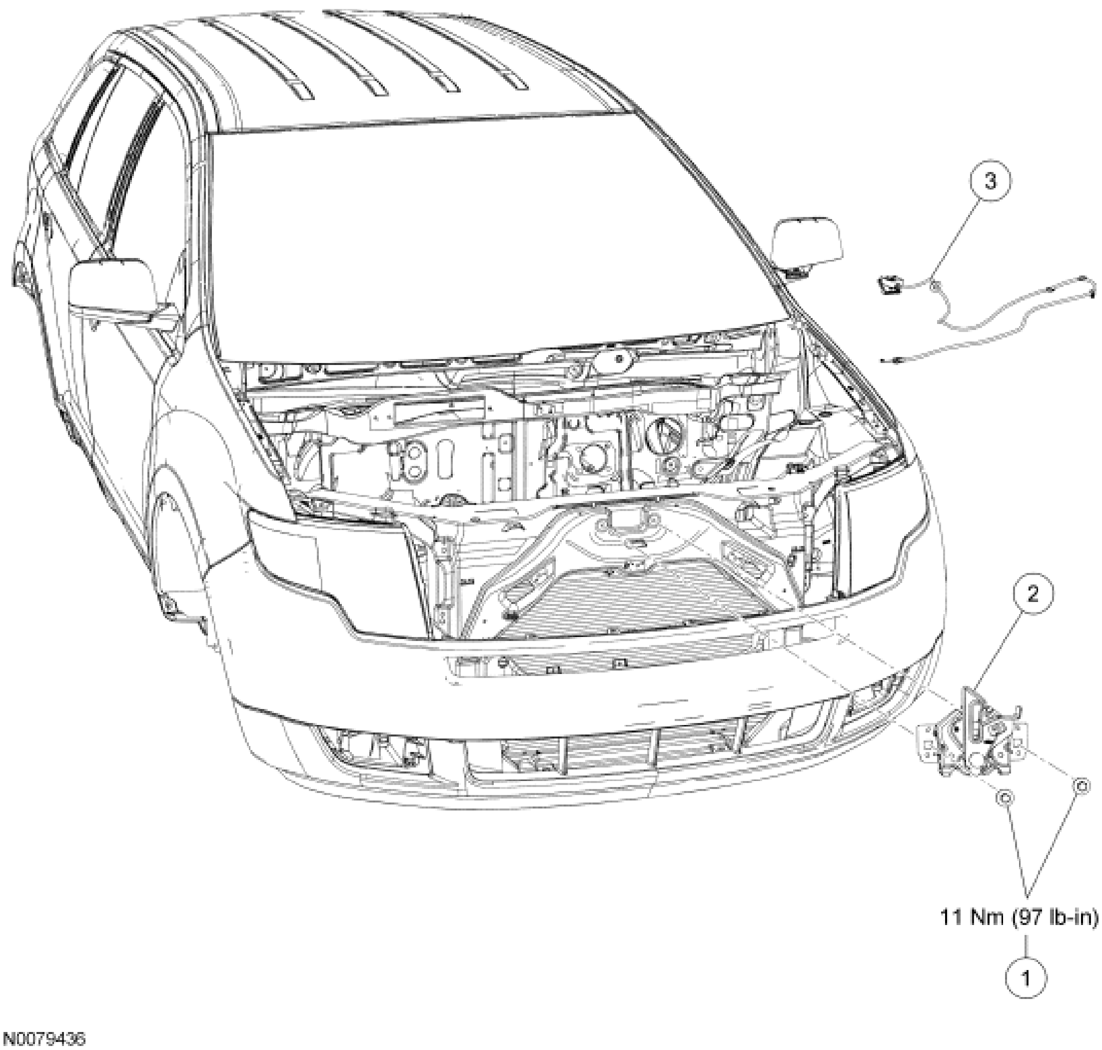


Fig. 1020: Removing Engine & Transaxle From Lift Table Using Special Tools (303-D089, 014-00071) & Suitable Engine Crane
Courtesy of FORD MOTOR CO.

46. Install the crankshaft sensor ring.

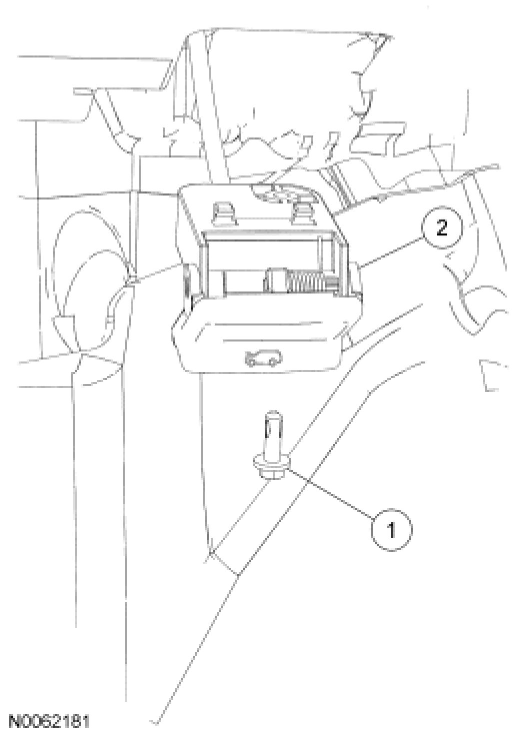


Fig. 1021: Identifying Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

47. Install the flexplate and the 8 bolts.
    - Tighten to 80 Nm (59 lb-ft).

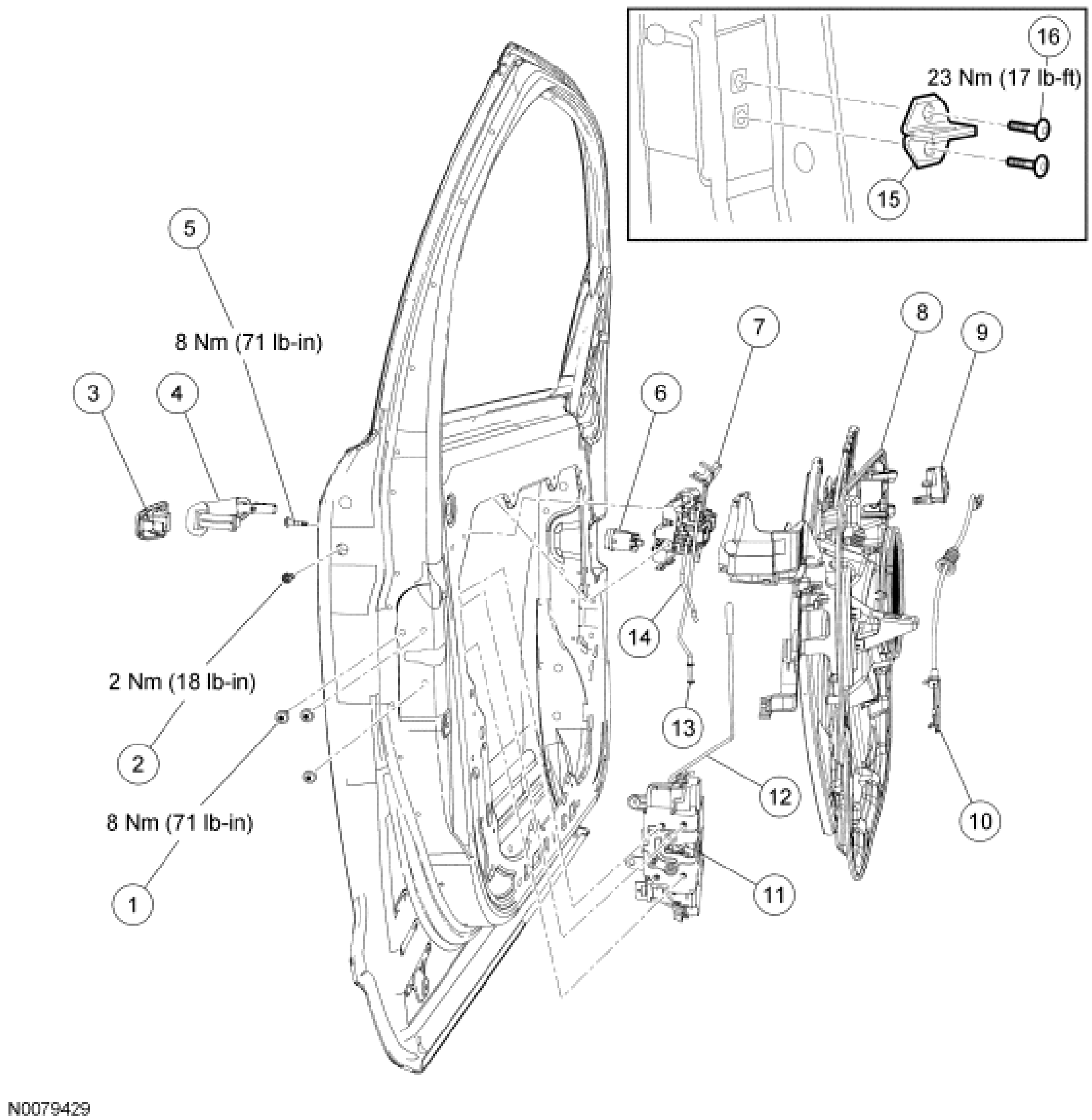


Fig. 1022: Identifying Flexplate & Bolts
Courtesy of FORD MOTOR CO.

48. Install the engine in the vehicle. For additional information, refer to **Engine**.

OIL PUMP SCREEN AND PICKUP TUBE

NOTE:	**During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.**

1. Using a new O-ring seal, install the oil pump screen and pickup tube and the 3 bolts.
   - Tighten to 10 Nm (89 lb-in).

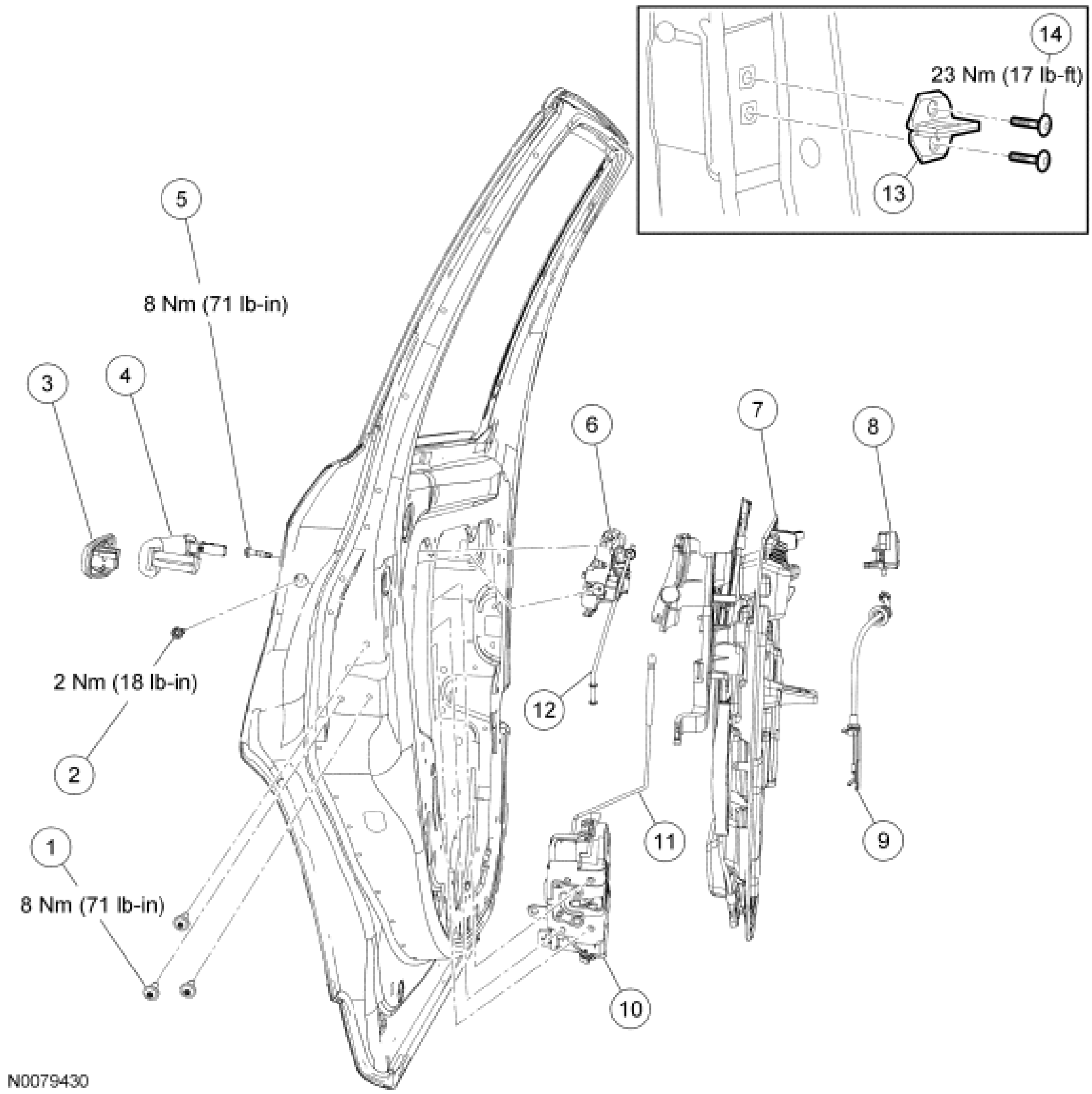
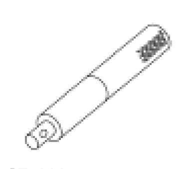


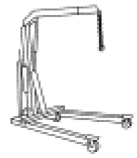
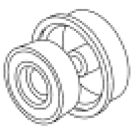
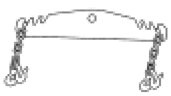
Fig. 1023: Identifying Oil Pump Screen, Pickup Tube & Bolts
Courtesy of FORD MOTOR CO.

2. Install the oil pan. For additional information, refer to **Oil Pan**.

CRANKSHAFT REAR SEAL WITH RETAINER PLATE

Special Tools

Illustration	Tool Name	Tool Number
	Handle	205-153 (T80T-4000-W)

 ST1341-A	Heavy Duty Floor Crane	014-00071 or equivalent
 ST2980-A	Installer, Rear Main Seal	303-1250
 ST1602-A	Spreader Bar	303-D089 (D93P-6001-A3) or equivalent

Material

Item	Specification
Motorcraft High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

NOTE: **During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.**

NOTE: **Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.**

NOTE: **The crankshaft rear seal retainer must be installed and the bolts tightened within 4 minutes of sealant application.**

1. Apply a 3 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the sealing surface of the crankshaft rear seal retainer.

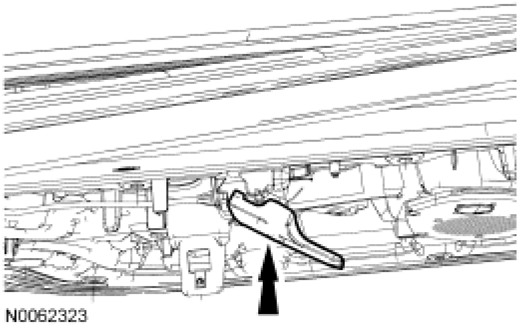


Fig. 1024: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Sealing Surface Of Crankshaft Rear Seal Retainer
Courtesy of FORD MOTOR CO.

2. Install the rear seal retainer and the 8 bolts in the sequence shown.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).

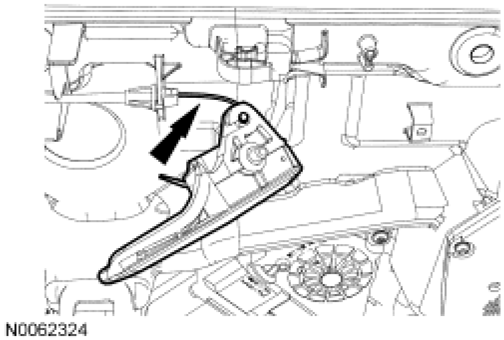


Fig. 1025: Installing Crankshaft Rear Seal Retainer Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the seal lips and bore with clean engine oil prior to installation.

3. Position the Rear Main Seal Installer onto the end of the crankshaft and slide a new crankshaft rear seal onto the tool.

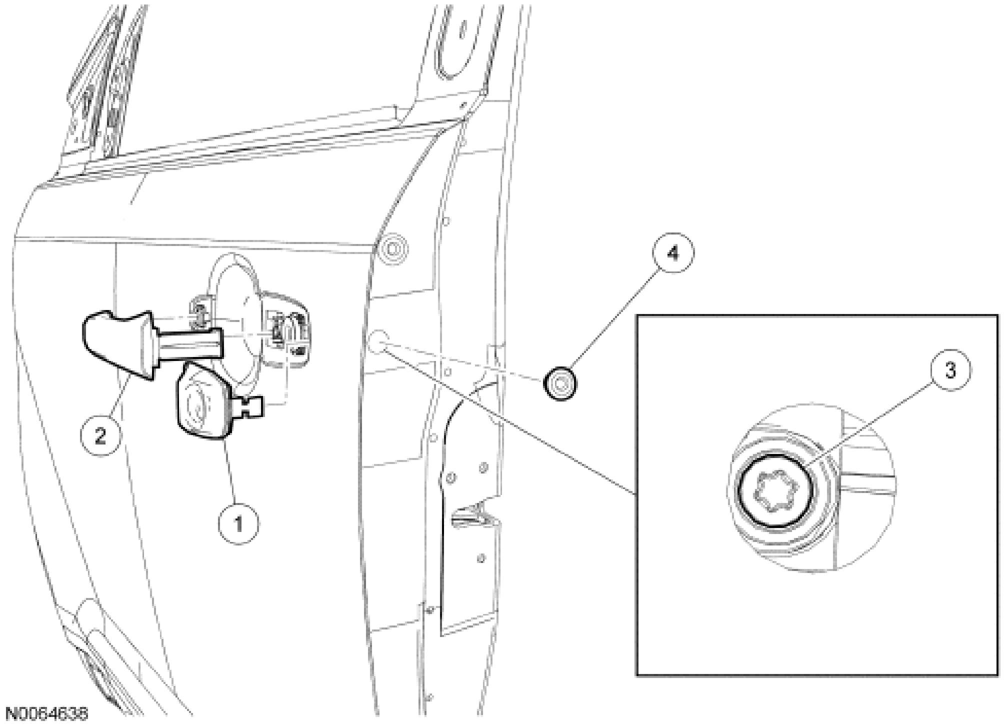


Fig. 1026: Positioning Special Tool (303-1250) Onto End Of Crankshaft
Courtesy of FORD MOTOR CO.

4. Using the Rear Main Seal Installer and Handle, install the new crankshaft rear seal.

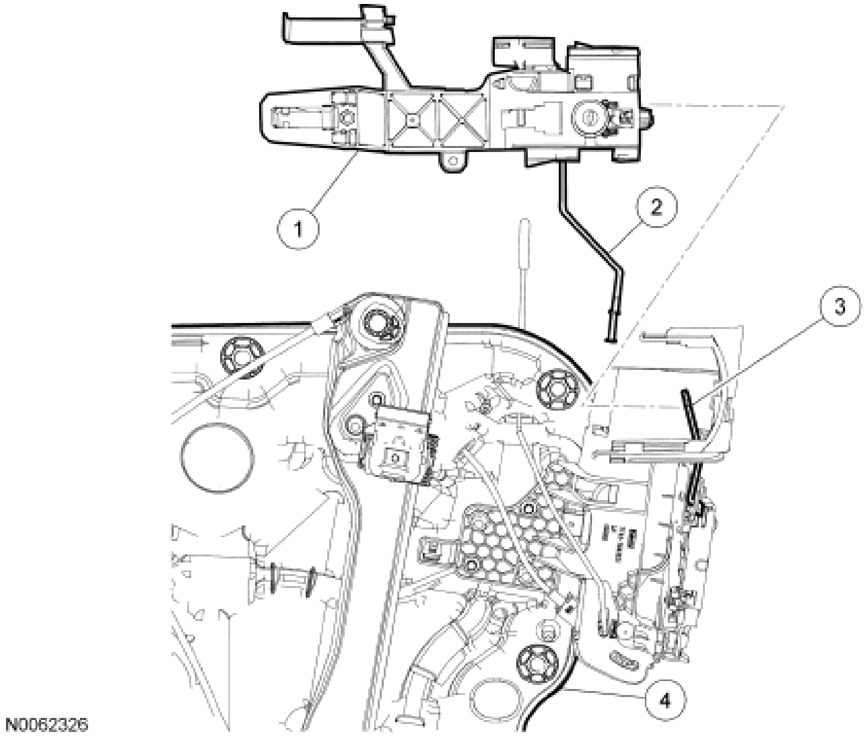


Fig. 1027: Installing New Crankshaft Rear Seal Using Special Tools (303-1250) & (205-153)
Courtesy of FORD MOTOR CO.

5. Install the Crankshaft Position (CKP) sensor and install the bolt.
   - Tighten to 10 Nm (89 lb-in).

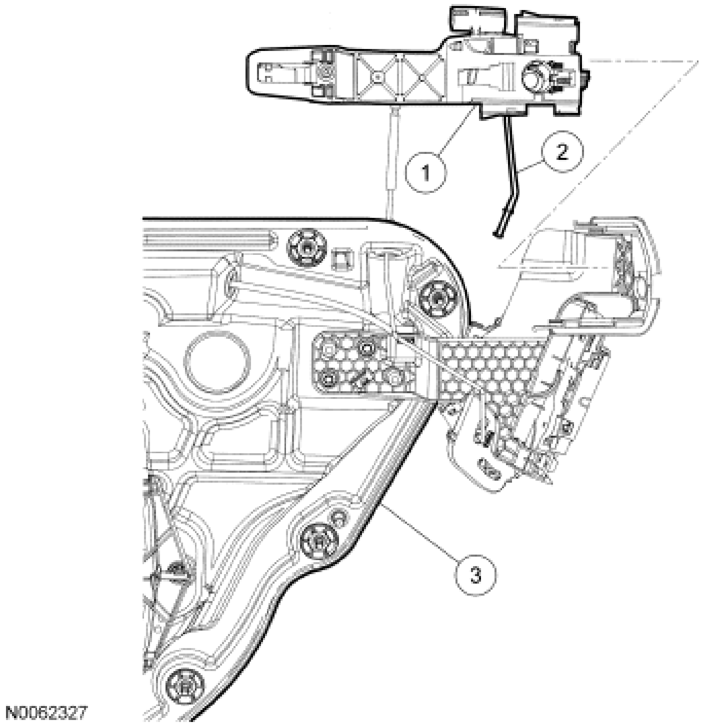


Fig. 1028: Identifying CKP Sensor & Bolt
Courtesy of FORD MOTOR CO.

6. Connect the CKP sensor electrical connector.

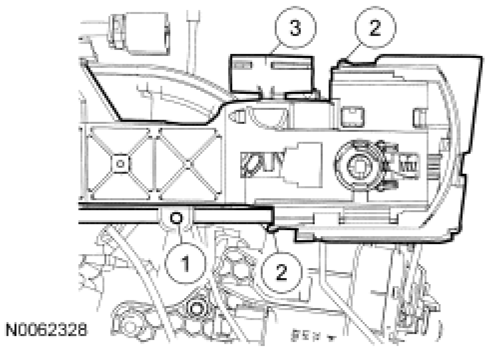


Fig. 1029: Identifying Crankshaft Position (CKP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

7. Using the Heavy Duty Floor Crane and Spreader Bar, install the engine onto the stand.

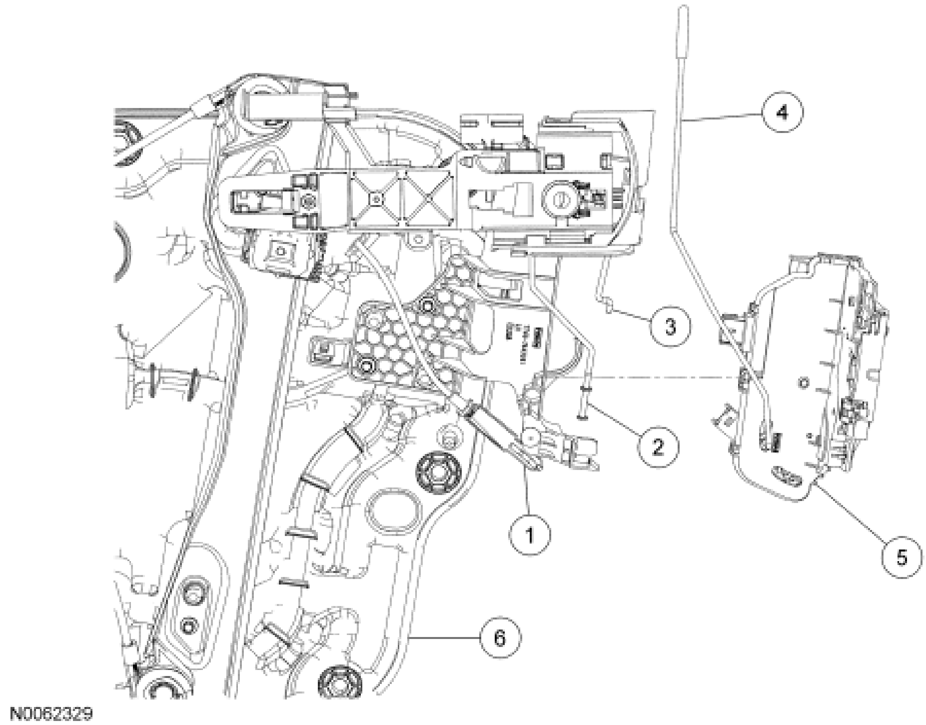


Fig. 1030: Identifying Heavy Duty Floor Crane and Spreader Bar
Courtesy of FORD MOTOR CO.

8. Install the oil pan. For additional information, refer to **Oil Pan**.

2008 ACCESSORIES & BODY, CAB

Information and Entertainment Systems - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
AM/FM antenna base bolt	7	62
AM/FM antenna cable bolt	12	106
Satellite radio antenna bolt	7	62
Satellite digital audio receiver system (SDARS) module nuts	7	62
Subwoofer amplifier screws	5	44
Subwoofer speaker bolts	7	62

DESCRIPTION AND OPERATION

INFORMATION AND ENTERTAINMENT SYSTEM

Audio Line-Up

The following audio systems are available:

- Base
  - AM/FM single CD with MP3
  - 4 speakers
- Premium - Edge
  - AM/FM 6-CD changer with MP3
  - 4 speakers
- Audiophile
  - AM/FM 6-CD changer with MP3
  - Four 2-way speakers and a subwoofer (9 speakers total)
- Premium - MKX
  - AM/FM 6-CD changer with MP3
  - 6 speakers in 6 locations (includes separate tweeter speakers)
- THX® sound
  - AM/FM 6-CD changer with MP3
  - 12 speakers in 10 locations
  - Audio digital signal processing (DSP) module (located behind the subwoofer)
  - Also available with navigation audio system
- Navigation

    - Navigation audio control module (ACM)
    - Voice-activation (includes microphone in the inside rear view mirror)
    - Available with Premium (MKX), Audiophile (Edge), or THX® sound system (MKX)

All audio systems include the following features:

- Speed sensitive volume
- Accessory delay
- MP3 capability
- Audio input jack

The following options are also available:

- Satellite audio system
    - Available with all audio systems
- DVD entertainment system
    - Available with all audio systems
    - Not available on vehicles with panoramic roof
- SYNC
    - Optional on Edge, standard on MKX
- Steering wheel controls
    - Standard on all audio systems except base
    - Unique steering wheel controls for vehicles with the SYNC system

Antenna

The antenna system consists of the antenna and the antenna cable. The antenna cable connects the ACM to the antenna, located on the front of the roof.

Audio Input Jack - Vehicles Without The SYNC System

The audio input jack is used to connect a portable MP3 device to the vehicle. When connected, the audio files from the MP3 player can be broadcast through the vehicle speakers.

Satellite Audio System

The satellite audio system provides satellite-broadcast audio. The satellite antenna is mounted on the rear spoiler. The satellite audio system consists of the following components:

- Satellite digital audio receiver system (SDARS) module (located behind the liftgate scuff plate trim panel)
- Satellite radio antenna
- Satellite radio antenna cable

DVD Entertainment System

The DVD entertainment system is available on all vehicles except the base Edge and vehicles equipped with a panoramic roof. The DVD entertainment system includes the following:

- Rear entertainment module (RETM)
- A/V ports for connecting a gaming system
- 2 wireless headphones
- A remote control

THX® Audio System

The THX® audio system provides theatre quality sound inside the vehicle. The THX® audio system is only available for the MKX, and includes the following components:

- DSP module
- Front center imaging speaker (also referred to as the instrument panel speaker)
- 2 mid-woofers in the front doors
- 2 tweeter speakers in the front doors
- 2 co-axial speakers in the rear doors
- 2 rear mid-tweeters in the D-pillars
- A subwoofer

Navigation System

The navigation system audibly and visually guides the user to a selected destination. The system uses a global positioning system (GPS) antenna, a vehicle speed input, and other sensor information to accurately establish the vehicle position. The ACM provides the visual and audible instructions of the maneuvers required to arrive at the pre-entered destination.

The only external component of the navigation system is the GPS antenna, located in the instrument panel.

SYNC System

The SYNC system is comprised of the following:

- Accessory protocol interface module (APIM), located underneath the floor console
- SYNC-specific steering wheel controls
- Microphone located in the rear view mirror
- Universal serial bus (USB) port, located in the center console
- Audio input jack, located in the center console

The SYNC system is a hands-free communications and entertainment system that allows the following interactions:

- Send and receive phone calls via a Bluetooth®-enabled phone
- Send and receive text messages via a Bluetooth®-enabled phone
- Connect media devices (such as an iPod® or USB device) in order to play audio files
- Play media files via a Bluetooth®-enabled audio device

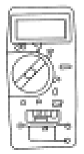
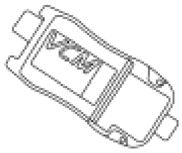
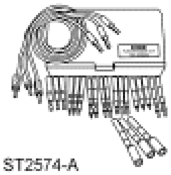
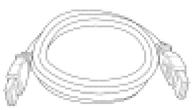
Not all features will be available with every phone.

For additional information on audio system operation, including the SYNC system, refer to the Owner's Literature.

DIAGNOSTIC TESTS

INFORMATION AND ENTERTAINMENT SYSTEM

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent
 ST3051-A	Universal Serial Bus (USB) Male-A To Male-A Cable	CCMUSB2-AM-AM-10

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

Audio Control Module (ACM)

The audio system can be operated while the key is in RUN or ACC. The accessory delay feature allows the audio system to be operated for a preset period of time after the key is turned to OFF and a front door has not been opened. The audio control module (ACM) sends AC voltage audio signals to the speakers or to the amplifier, depending on vehicle configuration. The ACM can produce its own DTCs, which can be communicated to the scan tool through the medium speed controller area network (MS-CAN), or can be retrieved through the ACM self-test by simultaneously pressing presets 3 and 6. The ACM communicates via the MS-CAN.

THX® Audio System

The THX® audio system provides theatre quality sound in the vehicle. Audio signals are sent to the audio digital signal processing (DSP) module, which processes the audio signals and sends them to the 13 speakers: 4 door speakers, 2 tweeter speakers, 3 front/center speakers, 2 rear/center speakers, and 2 subwoofer speakers. The DSP module communicates via the MS-CAN.

Navigation

The navigation module is integrated in the ACM and controls the operation and the interface between the user, the vehicle subsystems, and the external components. The navigation ACM communicates via the MS-CAN and can be diagnosed with a scan tool.

The vehicle navigation system guides the user to a pre-entered destination. A map DVD stored in the navigation ACM is used for calculating the vehicle course. The ACM display audibly and visually instructs the user of the maneuvers required to arrive at the destination entered.

A voice recognition system allows the user to interface with the system without using the touch screen. A microphone located in the interior rear view mirror provides a direct input to the navigation ACM.

In order to calculate initial vehicle position, the global positioning system (GPS) antenna is used to track several available satellites simultaneously.

The wheel pulse signal and transmission gear selected signal are received by the navigation ACM through the MS-CAN. These signals are used to increase the accuracy of the displayed course.

Satellite Audio

The satellite audio system consists of a satellite digital audio receiver system (SDARS) module, a satellite radio antenna, and an antenna cable. The satellite radio antenna receives digital audio signals and sends them to the SDARS module, where the signals are converted to analog and sent to the ACM, the rear entertainment module (RETM) (if equipped with a DVD entertainment system), or the accessory protocol interface module (APIM) (if equipped with the SYNC system). The SDARS module communicates via the MS-CAN.

SYNC System

The SYNC system allows interaction with several types of customer devices, including mobile phones and media devices. The system is comprised of the APIM, a microphone (located in the interior rear view mirror), the universal serial bus (USB) cable and port, and the audio input jack. The APIM contains an on-board Bluetooth® chipset, which enables certain wireless devices to interact with the system.

The APIM consists of 2 internal modules: the consumer interface processor (CIP) and the vehicle interface processor (VIP). The modules are not replaceable individually, but can be flashed independently, if required.

The CIP interfaces with all of the inputs to the APIM. The CIP contains an analog-to-digital- to-analog converter, as well as the Bluetooth® chipset. Any consumer-available application upgrades that are available are loaded directly to the CIP through the USB port.

The VIP provides an interface between the CIP and the vehicle. The main functions of the VIP are controlling the APIM power management and translating both inbound and outbound signals over the controller area network (CAN).

The APIM can receive inputs from the following audio sources:

- USB port
- Audio input jack
- SDARS module
- Bluetooth®

The USB port can be used for connecting a media device (such as an iPod®) with the device's available cable, or for directly plugging in a portable mass storage device (such as a "thumb drive"). When playing media files stored on a mass storage device, the SYNC system will only play files that do not have digital rights management (DRM) protection. The USB port can also be used for uploading vehicle application upgrades.

The USB port is powered by the APIM, so no external power source is needed to power a device plugged into the USB port.

The audio input jack can be used for connecting a media device (such as an iPod®) utilizing a 1/8-inch audio jack. When a device is connected through the audio input jack, only the speaker volume can be controlled by the ACM. All other functions (such as seek, fast forward, pause, etc.) must be carried out on the device itself.

If the vehicle is equipped with satellite audio, the audio signals from the SDARS module are sent to the APIM, rather than directly to the ACM. The APIM then relays the satellite audio signals to the ACM, or to the RETM if the vehicle is equipped with a DVD entertainment system. The RETM then relays the signals to the ACM.

The Bluetooth® interface can accommodate both Bluetooth®-enabled mobile phones and Bluetooth®-enabled media devices. Any Bluetooth® device used with the SYNC system must first be paired with the system before it is operational.

Bluetooth® is a secure, short-range radio frequency that allows devices to communicate wirelessly through radio waves. The operating range of a Bluetooth® signal is a maximum of 32 feet.

Only one Bluetooth® phone and one Bluetooth® device can be connected to the system at any one time. If an additional device of either type is paired with the system and made active, the APIM will disconnect any active connection and establish a connection with the new device.

It is important to understand that not all mobile phones will have the same level of features when interacting with the SYNC system. For a list of compatible phones, .

In addition to audio information, metadata may also be sent to the APIM from a device plugged into the USB port. Metadata consists of such information as artist, album title, song title, and genre. The metadata is used by the APIM to create indexes that can be used to sort for particular music, based on customer preference. Not all USB devices will send metadata to the APIM; also, no metadata is transferred when a device is connected through the audio input jack. When a new media device is connected to the SYNC system, the APIM will automatically index the information. This may take up to several minutes (depending on the amount of data on the device), and is considered normal operation. When a device that was previously connected to the SYNC system is reconnected, the APIM will update the index (rather than creating a new one), which reduces the amount of time needed to create the index.

The APIM receives both stereo and mono sound inputs, and can also transmit both stereo and mono sound. The mono function is used to receive the microphone input, and to send sound to the ACM for voice prompts, the text-to-speech (TTS) feature, ring tones, and any audio received through a connected mobile phone. The TTS feature speaks information so that it does not have to be read from the display.

The APIM communicates via the MS-CAN.

Voice Recognition For Vehicles With Navigation And The SYNC System

When a vehicle is equipped with both the navigation system and the SYNC system, the interaction between the audio system components is unique for voice recognition.

Both the navigation ACM and the APIM utilize voice-recognition, but in order for the modules to determine which one should be acknowledging the voice command, the voice command set is different. This allows the modules to identify the intended source when the VOICE button is pressed. The VOICE (an icon of someone speaking), MEDIA, and PHONE (an icon of a phone and an up-and-down arrow) buttons are wired to the navigation ACM, rather than to the APIM (as they are in non-navigation audio systems).

When the audio system enters voice recognition mode, the ACM sends a CAN message to the APIM to enter voice recognition mode. The microphone is wired directly to the APIM, which relays the microphone input to the ACM through dedicated wiring. Control of the voice functions is given to whichever module is indicated by the first voice command.

Steering Wheel Controls

The steering wheel controls consist of a series of resistors. Each steering wheel control switch function corresponds with a specific resistance value within the switch. When a switch is pressed, the ACM (or the APIM) monitors the change in reference voltage to determine the requested function.

Audio Input Jack - Vehicles Without The SYNC System

The audio input jack allows for a portable MP3 player to be connected to the vehicle audio system. When a portable MP3 player is connected, audio from the MP3 player can be played through the vehicle speakers.

Antenna - AM/FM

The roof-mounted antenna receives both AM and FM radio waves. The audio signals are then sent to the ACM through the antenna cable. An antenna module is integral to the roof-mounted antenna base.

Subwoofer

The Audiophile subwoofer is powered by its own amplifier. The subwoofer in the THX® system is powered by the THX® amplifier. The enable/clip detection circuit carries out 2 functions: to turn the amplifier on, and to indicate to the ACM when the subwoofer output distortion signal reaches a damaging level. The ACM then clips the audio output signal to prevent damage to the subwoofer.

DVD Entertainment System

When a video disc is inserted into the RETM and the PLAY button is pressed, an image is displayed on the screen and a stereo signal is transmitted to the ACM. The DVD entertainment system allows for single/dual-play mode. The RETM communicates via the MS-CAN.

Single-Play Mode

In single-play mode, any audio input routed through the RETM is broadcast through all of the vehicle speakers. These audio inputs include the RETM, satellite audio, SYNC audio, and peripheral gaming devices plugged into the RETM.

Dual-Play Mode (All Audio Systems Except THX®)

In dual-play mode, the ACM continues to control the output to the front speakers, while the RETM mutes the audio to the rear speakers. The RETM continues to broadcast the rear audio source to the headphones. When the headphones are set to channel A, all audio sources can be accessed. When the headphones are set to channel B, only the DVD audio and auxiliary audio sources (such as a gaming system) can be sent to the headphones.

Dual-Play Mode (THX®)

In dual-play mode, the DSP module continues to play the front audio source over the front speakers while muting the rear speakers. The RETM continues to broadcast the rear audio source to the headphones. When the headphones are set to channel A, all audio sources can be accessed. When the headphones are set to channel B, only the DVD audio and auxiliary audio sources (such as a gaming system) can be sent to the headphones.

Noise Suppression Equipment

The radio frequency suppression equipment reduces interference transmitted through the speakers by the engine ignition and electrical systems. When installing any new radio suppression equipment components, make sure that a good contact is made at all connections.

Audio Signals

Audio signal flow varies greatly depending on vehicle content.

Stereo signals contain left and right channel information, and are used for most audio signals.

A mono signal is used for the microphone input to the APIM. The mono signal is also used for the voice prompts, the TTS feature, ring tones, and any audio received through a connected mobile phone. These audio signals are output from the APIM to the ACM. The mono and stereo outputs from the APIM utilize separate circuits.

A digital signal is used to transmit data from a media device connected through the USB port to the APIM. The APIM then converts the signal to analog and relays the signal to the ACM.

A wireless signal is used to broadcast audio signals from a Bluetooth® device to the APIM. As with a digital signal sent through the USB port, the APIM converts the wireless audio signal to analog and relays it to the ACM.

Network Communication

The following audio system components communicate via the medium speed controller area network (MS-CAN):

- Audio control module (ACM)
- Navigation ACM
- Satellite digital audio receiver system (SDARS) module
- Rear entertainment module (RETM)
- Audio digital signal processing (DSP) module
- Accessory protocol interface module (APIM)

The following messages are utilized by the audio system:

Message	Transmitting Module	Receiving Module (s)	Audio System Function
Ignition Switch Position	Smart junction box (SJB)	ACM RETM DSP module APIM	Indicates ignition switch position for power-up/shut-down.
Illumination Dimmer Level	SJB	ACM RETM	Controls the backlight intensity, based on the position of the dimmer switch.
Transmission Selector (PRNDL) Range	Instrument cluster (IC)	ACM	For the navigation system, this signal is used for more accurate navigation

			tracking.
Accessory Delay Status	SJB	ACM RETM APIM	When active, this signal allows the audio component to be operated after the vehicle is shut off and a door has not been opened.
Volume Cutback	Parking aid module (PAM)	ACM	When active, this signal causes the ACM to reduce the audio output when the parking aid tone is active.
Vehicle Speed	IC	ACM DSP module	Used by the ACM (or DSP module) for the speed-compensated volume function.
Navigation Radio Rolling Wheel Count	IC	ACM	For the navigation system, this signal is used for more accurate navigation tracking.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Audio control module (ACM) • Antenna • Rear entertainment module (RETM) • Steering wheel controls • Audio input jack • Universal serial bus (USB) port • Speaker(s) • Noise suppression equipment	• Smart junction box (SJB) fuse(s): ○ 3 (15A) (RETM, accessory protocol interface module [APIM]) ○ 18 (20A) (audio digital signal processing [DSP] module) ○ 28 (5A) (ACM hot in START) ○ 38 (20A) (subwoofer or DSP module) ○ 39 (20A) (ACM) ○ 41 (15A) (delayed

	accessory)

3. If the fault is visually evident, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.

NOTE: Do not press any buttons on the ACM while the ACM is carrying out the self-test.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.
8. Carry out the self-test diagnostics for the ACM.
9. If the DTCs retrieved are related to the concern, go to DTC Charts.
10. If no DTCs related to the concern are retrieved, go to the Speaker Walk-Around Test, the Audio Control Module (ACM) Self-Diagnostic Mode, or the Satellite Audio Bezel Diagnostic Test.

Speaker Walk-Around Test

NOTE: To enter the speaker walk-around test or ACM self-diagnostic mode, the ACM must be on and in radio tuner (AM/FM) mode.

1. To enter the speaker walk-around test, simultaneously press the ACM preset buttons 3 and 6.
2. The speaker walk-around test stops at each speaker and applies sound to each speaker for about 1 to 2 seconds. Each speaker is tested and displayed on the ACM in the following sequence:

- Except THX®: RF, LF, LR, RR, SUBWOOFER.
- THX®: CSA FRONT, TWEETER LF, TWEETER RF, CENTER REAR, SPEAKER LF, SPEAKER RF, SPEAKER LR, SUBWOOFER, SPEAKER RR.

3. To exit the speaker walk-around test, turn the key to OFF, turn the ACM off, press preset button 1 for diagnostics (ACMs without navigation), or press "End Test" (navigation ACM).

Audio Control Module (ACM) Self-Diagnostic Mode - All ACMs Without Navigation

NOTE: To enter the ACM self-diagnostic mode, the ACM must be turned on and in radio tuner (AM/FM) mode.

1. To enter the following tests, press the desired preset button while in the speaker walk-around test or while in the ACM self-diagnostic mode.
2. The self-diagnostic mode has the following functions available:
    - Preset button 1 = On-Demand Self-Test. This button runs the on-demand self-test.
        - Pressing the MENU DOWN button allows scrolling of any DTCs found during the test while in this menu.
    - Preset button 2 = Display Continuous DTCs. This button enables viewing of any continuous DTCs that have been logged.
        - Pressing the MENU UP button allows scrolling of any DTCs while in this menu.
        - While continuous DTCs are being displayed, pressing the EJECT button will clear all present DTCs.
    - Preset button 3 = Signal Strength Test. This button displays the signal strength.
    - Preset button 4 = Software Version Display. This button displays the ACM software version.
        - Pressing the MENU UP button allows scrolling of all audio subsystem software versions while in this menu.
    - Preset button 5 = Display Test. This test illuminates all the display segments for 5 seconds, then turns all segments off.
    - Preset button 6 = Configuration Status. This button enables ACM configuration status.
        - Pressing the MENU button displays the ACM part number while in this menu.
3. To exit the self-diagnostic mode, turn the ACM off or turn the key OFF.
4. If the concern remains and the fault is not detected, go to **Symptom Chart - Audio System** to continue diagnostics.

Audio Control Module (ACM) Self-Diagnostic Mode - Navigation ACM

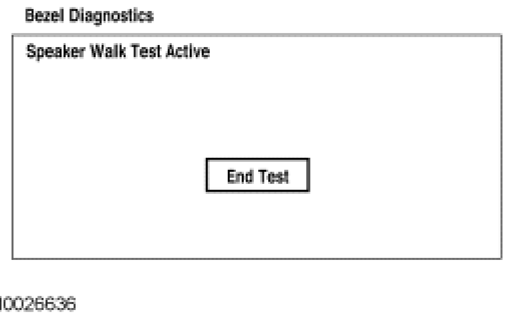


Fig. 1: Bezel Diagnostics Screen Display - Speaker Walk Test Active
Courtesy of FORD MOTOR CO.

1. To enter the self-diagnostic mode, press "End Test" during the speaker walk-around test.

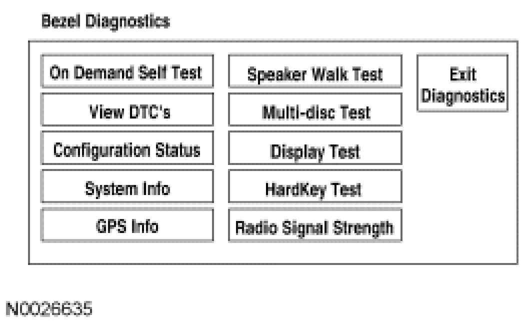


Fig. 2: Bezel Diagnostics Screen Display - On-Screen Buttons
Courtesy of FORD MOTOR CO.

2. The following diagnostic modes are available using the on-screen buttons:
   - On Demand Self Test - provides internal self-test diagnostics and displays all the DTCs resulting from the self-test.
   - View DTC's - provides a list of all the DTCs currently stored in memory.
   - Configuration Status" - displays the current unit configuration.
   - System Info - provides the navigation module part number and software information.
   - GPS Info - provides satellite information and vehicle current information.
   - Speaker Walk Test - carries out a speaker walk-around test.
   - Multi-disc Test - carries out a test of the CD player mechanism.
   - Display Test - allows the screen colors to be checked, and allows individual touch sectors of the display screen to be tested.
   - Hardkey Test - checks the operation of any ACM button.
   - Radio Signal Strength - carries out a test of the AM/FM antenna signal.
   - Exit Diagnostics - exists bezel diagnostics and returns to the previous function.
3. To exit the self-diagnostic mode, turn the ACM off, turn the key to OFF, or press "Exit Diagnostics".
4. If the concern remains and the fault is not detected, go to **Symptom Chart - Navigation System**.

Satellite Audio Bezel Diagnostic Test

NOTE: To enter the satellite audio bezel diagnostic test, the ACM must be on and in SAT mode.

1. To enter the satellite audio bezel diagnostic test, simultaneously press and hold the AUX button and preset button 2 (except navigation), or the SOUND button and preset button 1 (navigation).
2. Upon entering the self-test, the ACM produces 2 continuously alternating tones of different pitch, one for the right channel, then one for the left.
3. The test continues by displaying any DTCs currently present. If no DTCs are present, NO DTCS will be displayed. If there are DTCs present, the ACM will auto-scroll through the list of active DTCs.
4. Historical DTCs can be viewed by pressing the AUX button and preset button 2 (except navigation), or the SOUND button and preset button 1 (navigation) simultaneously while in the active DTC mode.
   - If any DTCs are present, pressing the AUX button and preset button 2 (except navigation), or the SOUND button and preset button 1 (navigation) will prompt CLEAR DTCS? on the ACM.
   - To clear historical DTCs, press preset buttons 1, 2, and 3 consecutively within 4 seconds.
   - To exit historical DTCs (with or without clearing DTCs), press the AUX button and preset button 2 (except navigation), or the SOUND button and preset button 1 (navigation) simultaneously.
5. If no historical DTCs are present, pressing the AUX button and preset button 2 (except navigation), or the SOUND button and preset button 1 (navigation) simultaneously while in active DTC mode will display the DLP software version.
6. To exit the satellite audio bezel diagnostic test, press the AUX button and preset button 2 (except navigation), or the SOUND button and preset button 1 (navigation) simultaneously while the DLP software version is displayed, or turn the ACM off.
7. If the concern remains and the fault is not detected, go to **Symptom Chart - Audio System**.

DTC Charts

NOTE: For all U-codes listed in this chart, if no related symptoms are observed, disregard the DTC.

NOTE: For all U-codes listed in this chart, if DTC B1318 is present, diagnose it before diagnosing the U-code DTC.

AUDIO CONTROL MODULE (ACM) DTC CHART

DTC	Description	Action
B1117	Audio Steering Wheel Button Stuck	VERIFY that no steering wheel control buttons are stuck and that no steering wheel control button is pressed during the self-test. If no concern is found, go to **Pinpoint Test F** .
		NOTE: **This DTC applies to the navigation DVD mechanism, not the DVD entertainment system.**

B1119 (Navigation only)	Audio Disc DVD Player Thermal Shutdown	The audio control module (ACM) was over temperature. Navigation operation will resume after the ACM cools. This is normal operation. CLEAR the DTCs.
B1136 (Navigation only)	Audio Steering Wheel Switch #2 Circuit Failure	Go to **Pinpoint Test F** .
B1140 (Navigation only)	Map Disk Invalid	REMOVE the map DVD and CLEAN it. INSPECT for scratches, fingerprints, or damage, and REPAIR as necessary. VERIFY a valid map DVD is being used. If no concern is found, INSERT a known good map DVD. REPEAT the self-test. • If the system operates correctly, the concern was caused by a damaged or invalid map DVD. • If DTC B1140 is retrieved again, INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.
B1154	Subwoofer #1 Short to Ground	Go to **Pinpoint Test E** .
B1155	Subwoofer #1 Short to Battery	Go to **Pinpoint Test E** .
B1158	Subwoofer #2 Not Connected	Go to **Pinpoint Test E** .
B1318	Battery Voltage Low	CLEAR the DTCs. TEST the charging system. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article. • If the charging system is OK, the DTC was set by a previous low voltage condition. No concern is found at this time. • If the charging system is not OK, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnose the low battery voltage condition.
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.
B2103	Antenna Not Connected	Go to **Pinpoint Test A** .
B2204 (Navigation only)	GPS Antenna Connection Open or Short	Go to **Pinpoint Test M** .
B2274	Phone Transceiver Active Circuit Failure	DISREGARD the DTC. CLEAR the DTCs.
	Audio Reverse Aid Mute	

B2384	Input Ckt. Failure	DISREGARD the DTC. CLEAR the DTCs.
B2404	Audio Steering Wheel Switch Circuit Failure	Go to **Pinpoint Test F** .
B2405	Audio Disc CD Player Thermal Shutdown Fault	The ACM was over temperature. Audio operation will resume after the ACM cools. This is normal operation. CLEAR the DTCs.
B2406	Audio Disc CD Player Internal Fault	**NOTE:** **DTC B1342 will also be set.** CLEAR the DTCs. REPEAT the self-test. If DTC B2406 is retrieved again, INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.
B2477	Module Configuration Failure	REFER to **MODULE CONFIGURATION** article.
B2633 (Navigation only)	Driver-Front Microphone Circuit Failure	Go to **Pinpoint Test R** .
B2656	DVD (Digital Versatile Disk) Error	**NOTE:** **DTC B1342 will also be set.** **NOTE:** **This DTC refers to the navigation DVD mechanism, not the DVD entertainment system.** CLEAR the DTCs. REPEAT the self-test. If DTC B2656 is retrieved again, INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.
B2913 (Audiophile only)	Audio Subwoofer Not Connected	Go to **Pinpoint Test E** .
B2924	Audio Button Stuck	**NOTE:** **For the navigation ACM, the hardkey test can be used to isolate a stuck button.** VERIFY no ACM buttons are stuck and that no ACM button is pressed during the self-test. CLEAR the DTCs. REPEAT the self-test. If DTC B2924 is retrieved again, INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.
B2965	Audio System Speaker Circuit Fault	Go to **Pinpoint Test B** .
C1992	Vehicle Speed Circuit Failure	DISREGARD the DTC. CLEAR the DTCs.

P0182	Reverse Input Circuit	DISREGARD the DTC. CLEAR the DTCs.
U0140	Lost Communication With Body Control Module (GEM)	If a backlighting concern is present, REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** article. If the accessory delay does not function correctly, REFER to **WIPERS AND WASHERS** article.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	If the speed sensitive volume does not operate correctly, go to **Pinpoint Test Y** . If the navigation is inaccurate, go to **Pinpoint Test P** .
U0159	Lost Communication With Parking Assist Control Module (PAM)	Go to **Pinpoint Test Q** .
U0193	Lost Communication With Digital Audio Control Module (SDARS)	For vehicles without a DVD entertainment system, go to **Pinpoint Test H** . For vehicles with a DVD entertainment system, go to **Pinpoint Test I** .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	CARRY OUT the network test using the scan tool. • If the scan tool communicates with the rear entertainment module (RETM), go to **Symptom Chart - Audio System** to diagnose the observed symptom. • If the scan tool does not communicate with the RETM, REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0197	Lost Communication With Telephone Control Module	Go to **Pinpoint Test S** .
U0238	Lost Communication With Digital Audio Control module "D" (DSP)	CARRY OUT the network test using the scan tool. • If the scan tool communicates with the audio digital signal processing (DSP) module, go to **Symptom Chart - Audio System** to diagnose the observed symptom. • If the scan tool does not communicate with the DSP module, REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	DISREGARD the DTC. CLEAR the DTCs.
U2050	No Application Present	REFER to **MODULE CONFIGURATION** article.
U2051	One or More Calibration Files Missing/Corrupt	REFER to **MODULE CONFIGURATION** article.
U2473	Unexpected Vehicle Speed (VSS)	Go to **Pinpoint Test P** .

NOTE: **For all U-codes listed in this chart, if no related symptoms are observed, disregard the DTC.**

NOTE: **For all U-codes listed in this chart, if DTC B1318 is present, diagnose it before diagnosing the U-code DTC.**

AUDIO DIGITAL SIGNAL PROCESSING (DSP) MODULE DTC CHART

DTC	Description	Action
B1158	Subwoofer #2 Not Connected	Go to **Pinpoint Test C** .
B1317	Battery Voltage High	CLEAR the DTCs. TEST the charging system. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article. • If the charging system is OK, the DTC was set by a previous over-charge condition. No concern is found at this time. • If the charging system is not OK, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnose the over-charging condition.
B1318	Battery Voltage Low	CLEAR the DTCs. TEST the charging system. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article. • If the charging system is OK, the DTC was set by a previous low voltage condition. No concern is found at this time. • If the charging system is not OK, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnose the low battery voltage condition.
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new audio digital signal processing (DSP) module. REFER to **Audio Digital Signal Processing (DSP) Module**. TEST the system for normal operation.
B2477	Module Configuration Failure	REFER to **MODULE CONFIGURATION** article.
B2913	Audio Subwoofer Not Connected	Go to **Pinpoint Test C** .
B2925	Subwoofer Speaker Short Circuit	If the symptom is no audio from all speakers, go to **Pinpoint Test D** . If the symptom is no audio from the subwoofer, go to **Pinpoint Test C** .
		NOTE:

B292A	Subwoofer #2 Speaker Short Circuit	**Despite the DTC description, this DTC applies to the THX® amplifier clip/enable circuit, not the subwoofer.** Go to **Pinpoint Test D** .
B2965	Audio System Speaker Circuit Fault	If the symptom is no audio from all speakers, go to **Pinpoint Test D** . If the symptom is no audio from one or more (but not all) speakers, go to **Pinpoint Test C** .
C1992	Vehicle Speed Circuit Failure	DISREGARD the DTC. CLEAR the DTCs.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	CARRY OUT the network test using the scan tool. • If the scan tool communicates with the IC, go to **Symptom Chart - Audio System** to diagnose the observed symptom. • If the scan tool does not communicate with the IC, REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0184	Lost Communication With Radio (ACM)	CARRY OUT the network test using the scan tool. • If the scan tool communicates with the ACM, go to **Symptom Chart - Audio System** to diagnose the observed symptom. • If the scan tool does not communicate with the ACM, REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	CARRY OUT the network test using the scan tool. • If the scan tool communicates with the rear entertainment module (RETM), go to **Symptom Chart - Audio System** to diagnose the observed symptom. • If the scan tool does not communicate with the RETM, REFER to **MODULE COMMUNICATIONS NETWORK** article.
U2050	No Application Present	REFER to **MODULE CONFIGURATION** article.
U2051	One or More Calibration Files Missing/Corrupt	REFER to **MODULE CONFIGURATION** article.

NOTE: **For all U-codes listed in this chart, if no related symptoms are observed, disregard the DTC.**

NOTE: **For all U-codes listed in this chart, if DTC B1318 is present, diagnose it before diagnosing the U-code DTC.**

SATELLITE DIGITAL AUDIO RECEIVER SYSTEM (SDARS) MODULE DTC CHART

DTC	Description	Action
B1031	SDARS Satellite Antenna Open	Go to **Pinpoint Test J** .
B1032	SDARS Satellite Antenna Short	Go to **Pinpoint Test J** .
B1318	Battery Voltage Low	CLEAR the DTCs. TEST the charging system. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article. • If the charging system is OK, the DTC was set by a previous low voltage condition. No concern is found at this time. • If the charging system is not OK, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnosis the low battery voltage condition.
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new satellite digital audio receiver system (SDARS) module. REFER to **Satellite Digital Audio Receiver System (SDARS) Module**. TEST the system for normal operation.
B2477	Module Configuration Failure	REFER to **MODULE CONFIGURATION** article.
U0184	Lost Communication With Radio (ACM)	For vehicles without a DVD entertainment system, go to **Pinpoint Test H** . For vehicles with a DVD entertainment system, go to **Pinpoint Test I** .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	Go to **Pinpoint Test I** .
U0197	Lost Communication With Telephone Control Module	For vehicles without a DVD entertainment system, go to **Pinpoint Test H** . For vehicles with a DVD entertainment system, go to **Pinpoint Test I** .
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	DISREGARD the DTC. CLEAR the DTCs.
U0255	Lost Communication With Front Controls Interface Module	DISREGARD the DTC. CLEAR the DTCs.
U0256	Lost Communication With Front Display Interface Module	DISREGARD the DTC. CLEAR the DTCs.
U2050	No Application Present	REFER to **MODULE CONFIGURATION** article.

NOTE: **For all U-codes listed in this chart, if no related symptoms are observed, disregard the DTC.**

NOTE: **For all U-codes listed in this chart, if DTC B1318 is present, diagnose it before diagnosing the U-code DTC.**

REAR ENTERTAINMENT MODULE (RETM) DTC CHART

DTC	Description	Action
B1119	Audio Disc DVD Player Thermal Shutdown	The rear entertainment module (RETM) was over-temperature. Operation will resume once the RETM has cooled. This is normal operation. CLEAR the DTCs.
B111F	LCD Thermal Shutdown	The LCD screen was over-temperature. Operation will resume after the LCD screen cools. This is normal operation. CLEAR the DTCs.
B1317	Battery Voltage High	CLEAR the DTCs. TEST the charging system. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article. • If the charging system is OK, the DTC was set by a previous over-charge condition. No concern is found at this time. • If the charging system is not OK, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnosis the overcharging condition.
B1318	Battery Voltage Low	CLEAR the DTCs. TEST the charging system. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article. • If the charging system is OK, the DTC was set by a previous low voltage condition. No concern is found at this time. • If the charging system is not OK, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnosis the low battery voltage condition.
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new RETM. REFER to **Rear Entertainment Module (RETM)**. TEST the system for normal operation.
B2477	Module Configuration Failure	REFER to **MODULE CONFIGURATION** article.
B2656	DVD (Digital Versatile Disk) Error	CLEAR the DTCs. REPEAT the self-test. If DTC B2656 is retrieved again, INSTALL a new RETM. REFER to **Rear Entertainment Module (RETM)**. TEST the system for normal operation.
B2924	Audio Button Stuck	VERIFY no RETM buttons are stuck and that no RETM button is pressed during the self-test. CLEAR the DTCs. REPEAT the self-test. If DTC B2924 is retrieved again,

		INSTALL a new RETM. REFER to Rear Entertainment Module (RETM). TEST the system for normal operation.
U0140	Lost Communication With Body Control Module (GEM)	If a backlighting concern is present, REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** article. If the accessory delay does not function correctly, REFER to **WIPERS AND WASHERS** article.
U0184	Lost Communication With Radio (ACM)	CARRY OUT the network test using the scan tool. • If the scan tool communicates with the ACM, go to **Symptom Chart - Audio System** to diagnose the observed symptom. • If the scan tool does not communicate with the ACM, REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0193	Lost Communication With Digital Audio Control Module (SDARS)	Go to **Pinpoint Test I** .
U2050	No Application Present	REFER to **MODULE CONFIGURATION** article.

NOTE: For all U-codes listed in this chart, if no related symptoms are observed, disregard the DTC.

NOTE: For all U-codes listed in this chart, if DTC B1318 is present, diagnose it before diagnosing the U-code DTC.

ACCESSORY PROTOCOL INTERFACE MODULE (APIM) DTC CHART

DTC	Description	Action
B1038	Microphone Input Circuit Failure	Go to **Pinpoint Test W** .
B1117	Audio Steering Wheel Button Stuck	Go to **Pinpoint Test F** .
B1136	Audio Steering Wheel Switch #2 Circuit Failure	Go to **Pinpoint Test F** .
B1317	Battery Voltage High	CLEAR the DTCs. TEST the charging system. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article. • If the charging system is OK, the DTC was set by a previous high voltage condition. No concern is found at this time. • If the charging system is not OK, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnosis the over-charging condition.

B1318	Battery Voltage Low	CLEAR the DTCs. TEST the charging system. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article. • If the charging system is OK, the DTC was set by a previous low voltage condition. No concern is found at this time. • If the charging system is not OK, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnosis the low battery voltage condition.
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new accessory protocol interface module (APIM). REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation.
B2477	Module Configuration Failure	REFER to **MODULE CONFIGURATION** article.
U0184	Lost Communication With Radio (ACM)	Go to **Pinpoint Test S** .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	Go to **Pinpoint Test S** .
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	DISREGARD the DTC. CLEAR the DTCs.
U0255	Lost Communication With Front Controls Interface Module	DISREGARD the DTC. CLEAR the DTCs.
U0256	Lost Communication With Front Display Interface Module	DISREGARD the DTC. CLEAR the DTCs.
U2050	No Application Present	REFER to **MODULE CONFIGURATION** article.
U261C	USB #1 Device Error	Go to **Pinpoint Test U** .

Symptom Chart

Symptom Chart - Audio System

Condition	Possible Sources	Action
• No communication with the audio control module (ACM)	• Fuse • Wiring, terminals or connectors • ACM	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• No communication with the audio digital signal processing (DSP) module	• Fuse • Wiring, terminals or connectors	• REFER to **MODULE COMMUNICATIONS NETWORK** article.

	• DSP module	
• No communication with the satellite digital audio receiver system (SDARS) module	• Fuse • Wiring, terminals or connectors • SDARS module	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• No communication with the rear entertainment module (RETM)	• Fuse • Wiring, terminals or connectors • RETM	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• No communication with the accessory protocol interface module (APIM)	• Fuse • Wiring, terminals or connectors • APIM	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The satellite audio is inoperative/does not operate correctly - vehicles without DVD entertainment	• Wiring, terminals or connectors • APIM (if equipped) • SDARS module • ACM	• Go to **Pinpoint Test H** .
• The satellite audio is inoperative/does not operate correctly - vehicles with DVD entertainment	• Wiring, terminals or connectors • RETM • APIM (if equipped) • SDARS module • ACM	• Go to **Pinpoint Test I** .
• The ACM display is blank, but the ACM operates	• ACM	• INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.
• The ACM backlighting does not operate correctly	• Backlighting system concern • Wiring, terminals or connectors • ACM	• REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** article.
• The RETM backlighting does not operate correctly	• Backlighting system concern • Wiring, terminals or connectors • RETM	• REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** article.

• The CD player is inoperative/does not operate correctly	• CD
	• ACM
		• INSPECT the CD for scratches, fingerprints, a loose paper label, incorrect format, or damage. INSERT a known good CD and TEST the system.
		  ◦ If the system operates correctly, the concern was caused by a damaged CD.
		  ◦ If the system does not operate correctly, INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

• Poor reception - AM/FM	• Wiring, terminals or connectors • Antenna • Antenna cable • Charging system • Ignition system • Noise suppression equipment • ACM	• Go to **Pinpoint Test A** .
• Continuous seek/scan in AM/FM	• RDS/PTY function setting • Antenna • Antenna cable • Noise suppression equipment • Antenna module • ACM	• Go to **Pinpoint Test A** .
• Poor reception - satellite audio	• Obstructions to the line of sight • Satellite radio antenna • Satellite radio antenna cable • SDARS module	• Go to **Pinpoint Test J** .
• No sound while in satellite	• Satellite radio antenna • Satellite radio	• Go to **Pinpoint Test J** .

radio mode	antenna cable • SDARS module	
• Poor quality/distorted/no sound from one or more speakers (not all speakers) - all audio systems except THX®	• Wiring, terminals or connectors • Speaker • RETM (if equipped) • ACM	• Go to **Pinpoint Test B** .
• Poor quality/distorted/no sound from one or more speakers (not all speakers) - THX® audio system	• Fuse • Wiring, terminals or connectors • Speaker • Subwoofer • DSP module • ACM	• Go to **Pinpoint Test C** .

• Poor quality/distorted/no sound from all speakers - all audio systems except THX®	• Wiring, terminals or connectors
	• ACM
		NOTE:
		If DTC B2965 is set in the ACM, the cause of the concern is a short to ground or short to voltage in the circuitry to an individual speaker. Go to Pinpoint Test B .
		• With the key in any position except START, MEASURE the voltage between the ACM C290a-15, circuit CBP13 (GY/BN), harness side and ground.
		  ◦ If any voltage is present, REPAIR the circuit. TEST the system for normal operation.
		  ◦ If no voltage is present, INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

• Poor quality/distorted/no sound while in SYNC mode	• Wiring, terminals or connectors • APIM • ACM	• Go to **Pinpoint Test X** .
	• Fuse	

• Poor quality/distorted/no sound from all speakers - THX® audio system	• Wiring, terminals or connectors • DSP module • ACM	• Go to **Pinpoint Test D** .
• The subwoofer is inoperative/does not operate correctly - Audiophile	• Fuse • Wiring, terminals or connectors • Subwoofer • ACM	• Go to **Pinpoint Test E** .
• The subwoofer is inoperative/does not operate correctly - THX® audio system	• Fuse • Wiring, terminals or connectors • Speaker • DSP module • ACM	• Go to **Pinpoint Test C** .
• The video system is inoperative/does not operate correctly	• Damaged DVD • RETM setting • RETM	• Go to **Pinpoint Test K** .
• The video system is inoperative/does not operate correctly - no audio	• Wiring, terminals or connectors • RETM • ACM	• Go to **Pinpoint Test K** .
• No auxiliary headphone audio - all audio systems except THX®	• Headphones • RETM	• INSTALL a set of known good headphones and OPERATE the audio system in radio tuner (AM/FM) dual-play mode. ◦ If the system operates correctly, the concern was caused by inoperative headphones. ◦ If the system does not operate correctly, INSTALL a new RETM. REFER to **Rear Entertainment Module (RETM)**. TEST the system for normal operation.
• No auxiliary headphone audio - THX®	• Wiring, terminals or connectors • Headphones • RETM	• Go to **Pinpoint Test L** .

• The video system remote control does not function correctly	• Remote control batteries • Video system concern	• INSTALL new batteries in the remote control. TEST the system for normal operation. If the concern is still present, CONTACT an authorized audio repair facility for further diagnostic test procedures.
• The steering wheel controls are inoperative/do not operate correctly	• Wiring, terminals or connectors • Clockspring • Steering wheel controls • ACM • APIM (if equipped)	• Go to **Pinpoint Test F** .
• The speed sensitive volume does not operate correctly	• Instrument cluster (IC) • ACM	• Go to **Pinpoint Test Y**
• The audio input jack is inoperative/does not operate correctly	• Wiring, terminals or connectors • Audio input jack • ACM • APIM (if equipped)	• Go to **Pinpoint Test J** .
• The audio does not reduce when the parking aid tone sounds	• Parking aid system concern • ACM	• Go to **Pinpoint Test Q** .
• Voice recognition is inoperative/does not operate correctly - vehicles without the SYNC system	• Fuse • Wiring, terminals or connectors • Microphone (part of interior rear view mirror) • Steering wheel controls • ACM	• Go to **Pinpoint Test R** .
• Voice recognition is inoperative/does not operate correctly - vehicles with the SYNC system	• Fuse • Wiring, terminals or connectors • Microphone (part of interior rear view mirror) • Steering wheel	• Go to **Pinpoint Test W** .

	controls • ACM (if equipped with navigation) • APIM	

Symptom Chart - Navigation

Condition	Possible Sources	Action
• No global positioning system (GPS) antenna signal	• GPS antenna • ACM	• Go to **Pinpoint Test M** .
• Navigation screen only displays Dearborn, Michigan	• GPS antenna	• Go to **Pinpoint Test M** .
• The position cursor is inaccurate	• GPS antenna • Vehicle speed sensor (VSS) signal concern • ACM	• Go to **Pinpoint Test P** .
• The audible switch feedback is inoperative	• Audible switch feedback setting • ACM	• Go to **Pinpoint Test N** .

• Unable to read map disc	• Map DVD
	• ACM
		• REMOVE the map DVD and CLEAN it. INSPECT for scratches, fingerprints, or damage, and REPAIR as necessary. VERIFY a valid map DVD is being used. If no concern is found, INSERT a known good map DVD. TEST the system.
		  ◦ If the system operates correctly, the concern was caused by a damaged or inoperable map DVD.
		  ◦ If the system does not operate correctly, INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.
		• INSPECT the instrument panel center trim panel for

• The screen does not open/close	• Trim panel interference • ACM	interference with the navigation screen, and REPAIR as necessary. If no interference is found, INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.
• The voice guidance is inoperative/does not operate correctly	• Incorrect system setting • Wiring, terminals or connectors (THX® only) • DSP module (THX® only) • ACM	• Go to **Pinpoint Test O** .

• The display screen is inoperative	• Wiring, terminals or connectors
	• ACM
		• VERIFY the operation of the AM/FM audio.
		  ◦ If the AM/FM audio system does not operate correctly, go to **Symptom Chart - Audio System**.
		  ◦ If the AM/FM audio system operates correctly, INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

• Voice recognition is inoperative/does not operate correctly - vehicles without the SYNC system	• Fuse • Wiring, terminals or connectors • Microphone (part of interior rear view mirror) • Steering wheel controls • ACM	• Go to **Pinpoint Test R** .
• Voice recognition is	• Fuse • Wiring, terminals or connectors • Microphone (part of interior rear view	

inoperative/does not operate correctly - vehicles with the SYNC system	mirror) • Steering wheel controls • ACM (if equipped with navigation) • APIM	• Go to **Pinpoint Test W** .

Symptom Chart - SYNC System

Condition	Possible Sources	Action
• The SYNC system is completely inoperative	• Audio system concern • Communication network concern • Customer error • Customer device • APIM	• Go to **Pinpoint Test S** .
• Unable to pair Bluetooth® device	• Incompatible Bluetooth® device • Customer error • Customer Bluetooth® device • APIM	• Go to **Pinpoint Test T** .
• An individual Bluetooth® device feature is inoperative	• Customer device compatibility	**NOTE:** **If a Bluetooth® device is able to pair with the SYNC system, there are no concerns with the APIM.** • INSTRUCT the customer to review the interoperability list on the . Not all phone features are available through SYNC. This is normal operation.
• The universal serial bus (USB) port is inoperative/does not operate correctly	• Customer USB device • USB cable and port • APIM	• Go to **Pinpoint Test U** .
• The steering wheel controls are inoperative/do not operate correctly	• Wiring, terminals or connectors • Steering wheel controls • ACM	• Go to **Pinpoint Test F** .

	• APIM	
• The audio input jack is inoperative/does not operate correctly	• Wiring, terminals or connectors • Audio input jack • Audio control module (ACM) • APIM	• Go to **Pinpoint Test G** .
• The SYNC system audible prompts are inoperative/do not operate correctly	• Wiring, terminals or connectors • Customer setting • ACM • APIM	**NOTE:** **The audible prompts include the text-to-speech (TTS) feature, voice prompts, and ring tones.** • Go to **Pinpoint Test V** .
• During a phone call, no incoming audio is heard in the vehicle	• Wiring, terminals or connectors • Customer setting • ACM • APIM	• Go to **Pinpoint Test V** .
• Voice recognition is inoperative/does not operate correctly	• Fuse • Wiring, terminals or connectors • Microphone (part of interior rear view mirror) • Steering wheel controls • ACM (if equipped with navigation) • APIM	• Go to **Pinpoint Test W** .
• During a phone call, no outgoing audio is heard on the outside device	• Fuse • Wiring, terminals or connectors • Microphone (part of interior rear view mirror) • APIM	• Go to **Pinpoint Test W** .

Pinpoint Tests

Pinpoint Test A: Poor Reception - AM/FM

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Audio System/Navigation for schematic and

connector information.

Normal Operation

The antenna receives AM and FM radio waves. The antenna module is integral with the roof-mounted antenna and receives voltage from the audio control module (ACM) through circuit CME44 (YE/GN).

The noise suppression equipment reduces engine ignition and electrical systems interference transmitted through the speakers.

- DTC B2103 (Antenna Not Connected) - sets during the on-demand self-test when the signal strength is less than the configured minimum value. The ACM must be tuned to AM during the self-test for this DTC to set. Also, the DTC will not set when the ACM self-diagnostic mode is run.

This pinpoint test is intended to diagnose the following:

- RDS/PTY function setting
- Wiring, terminals or connectors
- Antenna
- Antenna cable
- Charging system
- Ignition system
- Noise suppression equipment
- ACM

PINPOINT TEST A: POOR RECEPTION - AM/FM

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

A1 VERIFY THE RDS/PTY SETTING

- Verify the RDS/PTY function is set to ALL.
  - For non-navigation audio systems, press MENU repeatedly until RBDS (ON/OFF) appears on the display, then press the TUNE UP or TUNE DOWN button until ALL is displayed.
  - For navigation audio system, while in FM mode, press SHOW OPTIONS, make sure RDS is active, then press SET PTY and select ALL.
- Press the SEEK DOWN or SEEK UP button to scan for a good channel.
- **Is a good channel found?**

  YES : The system is operating correctly at this time. The cause of the concern was that no channel in the selected category was found.

  NO : Go to A2.

A2 CHECK THE AUDIO SYSTEM RECEPTION

- Check the ACM reception with the engine running, and with the engine off.
- **Does the poor reception only occur with the engine running?**

  YES : Go to A3.

  NO : Go to A6.

A3 CHECK THE NOISE SUPPRESSION EQUIPMENT

- Check all required noise suppression equipment and the radio frequency interference suppression bond for security, cleanliness, and metal-to-metal contact.
- **Are the connections clean, secure, and in metal-to-metal contact?**

  YES : Go to A4.

  NO : CLEAN and SECURE the antenna connections, or INSTALL new noise suppression equipment as needed. TEST the system for normal operation.

A4 CHECK THE GENERATOR

- Key in OFF position.
- Check the generator by disconnecting the wiring harness from the voltage regulator.
- Start the engine.
- Operate the audio system in radio tuner (AM/FM) mode.
- **Is the reception OK?**

  YES : INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. TEST the system for normal operation.

  NO : Go to A5.

A5 CHECK THE IGNITION CIRCUITS

- Key in OFF position.
- Connect the wiring harness to the voltage regulator.
- Check the ignition circuits for correct routing, grounding, and integrity of the connections.
- **Are the ignition components OK?**

  YES : USE a jumper cable to ground various parts of the vehicle to the frame (for example: engine, fenders, quarter panels, stone deflectors, air cleaner, body sheet metal). When the noise is eliminated, PROVIDE a permanent ground where necessary. TEST the system for normal operation.

  NO : REPAIR the ignition system as necessary. TEST the system for normal operation.

A6 CHECK CIRCUIT CME44 (YE/GN) FOR VOLTAGE

- Key in OFF position.
- Disconnect: Antenna C2086
- Operate the audio system in radio tuner (AM/FM) mode.

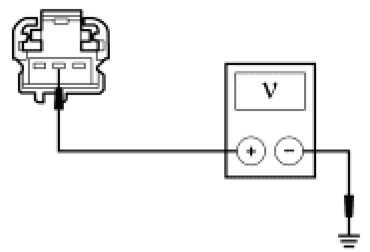


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Fig. 3: Measuring Voltage Between Antenna C2086-2, Circuit CME44 (YE/GN), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the antenna C2086-2, circuit CME44 (YE/GN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to A8.

  NO : Go to A7.

A7 CHECK CIRCUIT CME44 (YE/GN) FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Disconnect: ACM C240a

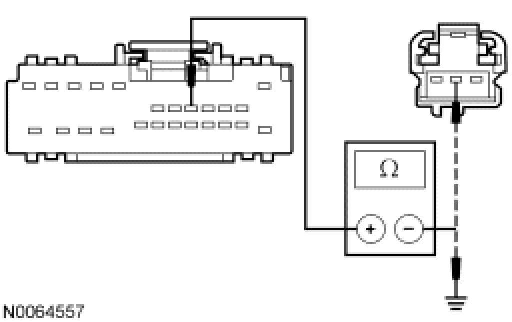

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Fig. 4: Measuring Resistance Between Audio Unit C240A-5, Circuit CME44 (YE/GN) & Antenna C2086-2
Courtesy of FORD MOTOR CO.

- Measure the resistance between the ACM C240a-5, circuit CME44 (YE/GN), harness side and the antenna C2086-2, circuit CME44 (YE/GN), harness side; and between the ACM C240a-5, circuit CME44 (YE/GN), harness side and ground.
- **Is the resistance less than 5 ohms between the ACM and the antenna, and greater than 10,000 ohms between the ACM and ground?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

A8 CHECK THE ANTENNA COAXIAL CABLE

- Key in OFF position.
- Disconnect: Antenna Coaxial Cable (At ACM)
- Measure the resistance of the antenna coaxial cable between the antenna and the ACM.
- **Is the resistance less than 2 ohms?**

  YES : Go to A9.

  NO : INSTALL a new antenna cable. REFER to **Antenna Cable - AM/FM**. CLEAR the DTCs. REPEAT the self-test.

A9 ISOLATE THE ANTENNA

- Connect: Antenna Coaxial Cable (At ACM)
- Substitute the antenna for a known good antenna.
- Operate the audio system in radio tuner (AM/FM) mode.
- **Is the reception OK?**

  YES : INSTALL a new antenna. REFER to **Antenna - AM/FM**. CLEAR the DTCs. REPEAT the self-test.

  NO : INSTALL the original antenna. Go to A10.

A10 SUBSTITUTE THE ANTENNA CABLE

- Key in OFF position.
- Substitute a known good AM/FM antenna cable.
- Operate the audio system in radio tuner (AM/FM) mode.
- **Is the reception OK?**

  YES : INSTALL a new antenna cable. REFER to **Antenna Cable - AM/FM**. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to A11.

A11 CHECK THE ACM FOR CORRECT OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the ACM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: Poor Quality/Distorted/No Sound From One Or More Speakers (Not All Speakers) -

Except THX® Audio System

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Audio System/Navigation for schematic and connector information.

Normal Operation

The audio control module (ACM) directs audio signals to the front door speakers and to the rear entertainment module (RETM) (if equipped) in the form of a fluctuating AC voltage. The tweeter speakers (if equipped) are wired in series with the front door speakers. The rear door speakers receive audio signals through the RETM (if equipped) or directly from the ACM.

If the vehicle is equipped with the DVD entertainment system, the RETM mutes the speaker output to the rear speakers when the audio system is in dual-play mode. Make sure the audio system is in single-play mode before diagnosing a symptom of no sound to the rear speakers.

For the navigation system, if the voice guidance setting is set to zero rather than to off, it may appear that the front speakers intermittently produce no sound. Make sure the voice guidance setting is not set to zero before addressing a concern with the front speakers.

- DTC B2965 (Audio System Speaker Circuit Fault) - sets when an open, a short to ground, or a short to voltage is detected on the front or rear door speaker circuits. The ACM checks for faults once every 500ms during normal operation, or for any duration during the ACM self-test. The following should also be noted:
    - The Audiophile ACM does not check for opens in the front door speakers.
    - The navigation ACM does not check for opens.

For some ACMs, a short to ground or short to voltage in the circuitry to one of the speakers will cause all speakers to lose sound due to the built-in overload protection feature of the ACM. In this case, DTC B2965 will set in the ACM, and this pinpoint test should be followed to isolate the damaged circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Speaker
- RETM (if equipped)
- ACM

PINPOINT TEST B: POOR QUALITY/DISTORTED/NO SOUND FROM ONE OR MORE SPEAKERS (NOT ALL SPEAKERS) - EXCEPT THX® AUDIO SYSTEM

NOTE:	**Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

B1 ISOLATE THE SUSPECT SPEAKER

NOTE: Make sure the audio system is in single-play mode before beginning this pinpoint test, or the results will not be accurate.

- Key in ON position.
- Carry out the speaker walk-around test.
- **Is the concern with a high-mounted tweeter speaker only?**

  YES : Go to B13.

  NO : Go to B2.

B2 CHECK THE SPEAKER CIRCUITS FOR VOLTAGE

- Key in OFF position.
- Disconnect: Suspect Speaker
- Operate the audio system in radio tuner (AM/FM) mode.
- Measure the AC voltage between the suspect speaker pin 1 and pin 2, harness side as follows:

Suspect Speaker	Connector-Pin/Circuit	Connector-Pin/Circuit
LH front	C536-1 or C570a-1 VME07 (WH)	C536-2 or C570a-2 RME07 (WH/BN)
RH front	C628-1 or C612a-1 VME10 (WH/VT)	C628-2 or C612a-2 RME10 (WH/OG)
LH rear	C702-1 VME09 (WH/GN)	C702-2 RME09 (BN/YE)
RH rear	C802-1 VME12 (BN/WH)	C802-2 RME12 (BN/BU)

- **Is a fluctuating AC voltage present?**

  YES : INSTALL a new speaker for the suspect speaker. REFER to **Door Speaker**. CLEAR any DTCs present. TEST the system for normal operation.

  NO : For a front speaker concern, go to B11.

  For a rear speaker concern, go to B3.

B3 VERIFY THE PRESENCE OF A DVD ENTERTAINMENT SYSTEM

- Key in OFF position.
- Check for the presence of a DVD entertainment system.
- **Is the vehicle equipped with a DVD entertainment system?**

YES : Go to B6.

NO : Go to B4.

B4 CHECK THE REAR SPEAKER CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect: ACM C240a
- Key in ON position.
- Measure the voltage between the suspect speaker pins, harness side and ground as follows:

Suspect Speaker	Connector-Pin	Circuit
LH rear	C702-1	VME09 (WH/GN)
	C702-2	RME09 (BN/YE)
RH rear	C802-1	VME12 (BN/WH)
	C802-2	RME12 (BN/BU)

- **Is any voltage present?**

YES : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

NO : Go to B5.

B5 CHECK THE REAR SPEAKER CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the suspect speaker, harness side and the ACM, harness side; and between the suspect speaker, harness side and ground as follows:

Suspect Speaker	Speaker Connector-Pin	ACM Connector-Pin	Circuit
LH rear	C702-1	C240a-9	VME09 (WH/GN)
	C702-2	C240a-22	RME09 (BN/YE)
RH rear	C802-1	C240a-10	VME12 (BN/WH)
	C802-2	C240a-23	RME12 (BN/BU)

- **Is the resistance less than 5 ohms between the suspect speaker and the ACM, and greater than 10,000 ohms between the suspect speaker and ground?**

YES : Go to B17.

NO : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

B6 CHECK THE ACM OUTPUT SIGNALS

- Disconnect: RETM C949
- Operate the audio system in radio tuner (AM/FM) mode.
- Measure the AC voltage between the RETM pins, harness side as follows:

Suspect Speaker	Connector-Pin/Circuit	Connector-Pin/Circuit
LH rear	C949-27 VME09 (WH/GN)	C949-28 RME09 (BN/YE)
RH rear	C949-11 VME12 (BN/WH)	C949-12 RME12 (BN/BU)

- **Is a fluctuating AC voltage present?**

  YES : Go to B9.

  NO : Go to B7.

B7 CHECK THE ACM OUTPUT CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C240a
- Key in ON position.
- Measure the voltage between the RETM, harness side and ground as follows:

Suspect Speaker	Connector-Pin	Circuit
LH rear	C949-27	VME09 (WH/GN)
	C949-28	RME09 (BN/YE)
RH rear	C949-11	VME12 (BN/WH)
	C949-12	RME12 (BN/BU)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

  NO : Go to B8.

B8 CHECK THE ACM OUTPUT CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the ACM and the RETM, harness side; and between the ACM, harness side and ground as follows:

Suspect Speaker	ACM Connector-Pin	RETM Connector-Pin	Circuit
LH rear	C240a-9	C949-27	VME09 (WH/GN)
	C240a-22	C949-28	RME09 (BN/YE)
RH rear	C240a-10	C949-11	VME12 (BN/WH)
	C240a-23	C949-12	RME12 (BN/BU)

- **Is the resistance less than 5 ohms between the ACM and the RETM, and greater than 10,000 ohms between the ACM and ground?**

  YES : Go to B17.

  NO : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

B9 CHECK THE RETM OUTPUT CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Suspect Speaker
- Key in ON position.
- Measure the voltage between the suspect speaker, harness side and ground as follows:

Suspect Speaker	Connector-Pin	Circuit
LH rear	C702-1	VME09 (WH/GN)
	C702-2	RME09 (BN/YE)
RH rear	C802-1	VME12 (BN/WH)
	C802-2	RME12 (BN/BU)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

  NO : Go to B10.

B10 CHECK THE RETM OUTPUT CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the suspect speaker, harness side and the RETM, harness side; and between the suspect speaker, harness side and ground as follows:

Suspect Speaker	Speaker Connector-Pin	RETM Connector-Pin	Circuit
LH rear	C949-30	C702-1	VME09 (WH/GN)
	C949-29	C702-2	RME09 (BN/YE)
RH rear	C949-14	C802-1	VME12 (BN/WH)
	C949-13	C802-2	RME12 (BN/BU)

- **Is the resistance less than 5 ohms between the suspect speaker and the RETM, and greater than 10,000 ohms between the suspect speaker and ground?**

  YES : Go to B18.

  NO : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

B11 CHECK THE FRONT SPEAKER CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C240a
- Key in ON position.
- Measure the voltage between the suspect speaker, harness side and ground as follows:

Suspect Speaker	Connector-Pin/Circuit	Connector-Pin/Circuit
LH front	C536-1 or C570a-1	VME07 (WH)
	C536-2 or C570a-2	RME07 (WH/BN)
RH front	C628-1 or C612a-1	VME10 (WH/VT)
	C628-2 or C612a-2	RME10 (WH/OG)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

NO : Go to B12.

B12 CHECK THE FRONT SPEAKER CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the ACM, harness side and the suspect speaker, harness side; and between the ACM, harness side and ground as follows:

Suspect Speaker	ACM Connector-Pin	Speaker Connector-Pin	Circuit
LH front	C240a-8	C536-1 or C570a-1	VME07 (WH)
	C240a-21	C536-2 or C570a-2	RME07 (WH/BN)
RH front	C240a-11	C628-1 or C612a-1	VME10 (WH/VT)
	C240a-12	C628-2 or C612a-2	RME10 (WH/OG)

- **Is the resistance less than 5 ohms between the ACM and the suspect speaker, and greater than 10,000 ohms between the ACM and ground?**

  YES : Go to B17.

  NO : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

B13 CHECK FOR VOLTAGE TO THE SUSPECT TWEETER SPEAKER

- Key in OFF position.
- Disconnect: Suspect Tweeter Speaker
- Operate the audio system in radio tuner (AM/FM) mode.
- Measure the AC voltage between the suspect tweeter speaker pin 1 and pin 2, harness side as follows:

Suspect Speaker	Connector-Pin/Circuit	Connector-Pin/Circuit
LH tweeter	C569-1 VME08 (GN/OG)	C569-2 RME08 (GY/OG)
RH tweeter	C613-1 VME11 (VT/OG)	C613-2 RME11 (YE/OG)

- **Is a fluctuating AC voltage present?**

  YES : INSTALL a new speaker for the suspect tweeter speaker. REFER to **Door Speaker**. TEST the system for normal operation.

NO : Go to B14.

B14 CHECK THE TWEETER SPEAKER CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: LF Speaker C570b or RF Speaker C612b
- Key in ON position.
- Measure the voltage between the suspect tweeter speaker, harness side and ground as follows:

Suspect Tweeter Speaker	Tweeter Speaker Connector-Pin	Circuit
LH tweeter	C569-1	VME08 (GN/OG)
	C569-2	RME08 (GY/OG)
RH tweeter	C613-1	VME11 (VT/OG)
	C613-2	RME11 (YE/OG)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

  NO : Go to B15.

B15 CHECK THE TWEETER SPEAKER CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the suspect tweeter speaker, harness side and the respective door speaker, harness side; and between the suspect tweeter speaker, harness side and ground as follows:

Suspect Tweeter Speaker	Tweeter Speaker Connector-Pin	Door Speaker Connector-Pin	Circuit
LH tweeter	C569-1	C570b-1	VME08 (GN/OG)
	C569-2	C570b-2	RME08 (GY/OG)
RH tweeter	C613-1	C612b-1	VME11 (VT/OG)
	C613-2	C612b-2	RME11 (YE/OG)

- **Is the resistance less than 5 ohms between the suspect tweeter speaker and the door speaker,**

and greater than 10,000 ohms between the suspect tweeter speaker and ground?

YES : Go to B16.

NO : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

B16 ISOLATE THE DOOR SPEAKER

- Connect: Suspect Tweeter Speaker
- Install a known good door speaker for the door with the suspect tweeter speaker.
- Operate the audio system in radio tuner (AM/FM) mode.
- **Does the tweeter speaker operate correctly?**

YES : INSTALL a new door speaker. REFER to **Door Speaker**. TEST the system for normal operation.

NO : INSTALL a new tweeter speaker. REFER to **Door Speaker**. TEST the system for normal operation.

B17 CHECK FOR CORRECT ACM OPERATION

- Key in OFF position.
- Connect: All Disconnected Connectors
- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the ACM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

B18 CHECK FOR CORRECT RETM OPERATION

- Key in OFF position.
- Connect: All Disconnected Connectors
- Disconnect the RETM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the RETM connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.

- **Is the concern still present?**

  YES : INSTALL a new RETM. REFER to **Rear Entertainment Module (RETM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: Poor Quality/Distorted/No Sound From One Or More Speakers (Not All Speakers) - THX® Audio System

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Audio System/Navigation for schematic and connector information.

Normal Operation

The audio control module (ACM) directs the audio signals to the audio digital signal processing (DSP) module, which processes the audio signals and sends them to the speakers. Each speaker has a signal and return circuit.

DTC Description	Fault Set Conditions
B1158 - Subwoofer #2 Not Connected	May set when an open is detected in the subwoofer circuit.
B2913 - Audio Subwoofer Not Connected	May set when an open is detected in the subwoofer circuit.
B2925 - Subwoofer Speaker Short Circuit	Sets when a short to ground is detected in the subwoofer circuit.
B2965 - Audio System Speaker Circuit Fault	May set when an open or a short to ground is detected in the front door or rear door speaker circuits, or in the subwoofer.

The following should also be noted:

- The ACM does not set DTC B2965 when the vehicle is equipped with the THX® audio system. Only the DSP module can set this DTC.
- This DTC may not set due to a fault in the circuitry to the rear tweeters.
- An open or short to ground in the rear tweeter circuitry may cause both rear tweeters to lose sound.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Speaker
- Subwoofer
- DSP module
- ACM

PINPOINT TEST C: POOR QUALITY/DISTORTED/NO SOUND FROM ONE OR MORE SPEAKERS (NOT ALL SPEAKERS) - THX® AUDIO SYSTEM

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

C1 CHECK THE AUDIO SIGNALS TO THE SUSPECT SPEAKER

- Key in OFF position.
- Disconnect: Suspect Speaker
- Operate the audio system in radio tuner (AM/FM) mode.
- Measure the AC voltage between the suspect speaker pins, harness side as follows:

Suspect Speaker	Speaker Connector-Pin/Circuit	Speaker Connector-Pin/Circuit
LR door	C702-1 VME09 (WH/GN)	C702-2 RME09 (BN/YE)
LF door	C536-1 VME28 (BN/VT)	C536-2 RME28 (BN/GN)
LH tweeter	C569-1 VME07 (WH)	C569-2 RME07 (WH/BN)
LH front imaging	C2359-1 VME07 (WH)	C2359-4 RME07 (WH/BN)
Center front imaging	C2359-2 VME06 (GN)	C2359-5 RME06 (GY/YE)
RH front imaging	C2359-3 VME10 (WH/VT)	C2359-6 RME10 (WH/OG)
RH tweeter	C613-1 VME11 (VT/OG)	C613-2 RME11 (WH/OG)
RF door	C628-1 VME29 (GN/WH)	C628-2 RME29 (BU/WH)
RR door	C802-1 VME12 (BN/WH)	C802-2 RME12 (BN/BU)
Subwoofer 1	C4212-1 VME01	C4212-2 RME01

	(GN/VT)	(GY)
Subwoofer 2	C4212-3 VME02 (VT)	C4212-4 RME02 (YE)
LH rear center imaging	C4337-1 VME30 (GN/BN)	C4337-2 RME30 (VT/BN)
RH rear center imaging	C4438-1 VME30 (GN/BN)	C4438-2 RME30 (VT/BN)

- **Is a fluctuating AC voltage present?**

  YES : INSTALL a new speaker for the suspect speaker. REFER to **Door Speaker**, **Instrument Panel Speaker**, or **Subwoofer Speaker** . CLEAR any DTCs present. TEST the system for normal operation.

  NO : Go to C2.

C2 CHECK THE CIRCUITS TO THE SUSPECT SPEAKER FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DSP Module C4348b or C4348c
- Key in ON position.
- Measure the voltage between the suspect speaker, harness side and ground as follows:

Suspect Speaker	Speaker Connector-Pin	Circuit
LR door	C702-1	VME09 (WH/GN)
	C702-2	RME09 (BN/YE)
LF door	C536-1	VME28 (BN/VT)
	C536-2	RME28 (BN/GN)
LH tweeter	C569-1	VME07 (WH)
	C569-2	RME07 (WH/BN)
LH front imaging	C2359-1	VME07 (WH)
	C2359-4	RME07 (WH/BN)
Center front	C2359-2	VME06 (GN)

imaging		
	C2359-5	RME06 (GY/YE)
RH front imaging	C2359-3	VME10 (WH/VT)
	C2359-6	RME10 (WH/OG)
RH tweeter	C613-1	VME11 (VT/OG)
	C613-2	RME11 (WH/OG)
RF door	C628-1	VME29 (GN/WH)
	C628-2	RME29 (BU/WH)
RR door	C802-1	VME12 (BN/WH)
	C802-2	RME12 (BN/BU)
Subwoofer 1	C4212-1	VME01 (GN/VT)
	C4212-2	RME01 (GY)
Subwoofer 2	C4212-3	VME02 (VT)
	C4212-4	RME02 (YE)
LH rear center imaging	C4337-1	VME30 (GN/BN)
	C4337-2	RME30 (VT/BN)
RH rear center imaging	C4338-1	VME30 (GN/BN)
	C4338-2	RME30 (VT/BN)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

  NO : Go to C3.

C3 CHECK THE CIRCUITS TO THE SUSPECT SPEAKER FOR AN OPEN OR SHORT TO GROUND

- Measure the resistance between the suspect speaker, harness side and the DSP module, harness side; and between the suspect speaker, harness side and ground as follows:

Suspect Speaker	Speaker Connector- Pin	DSP Module Connector-Pin	Circuit
LR door	C702-1 C702-2	C4348c-7 C4348c-6	VME09 (WH/GN) RME09 (BN/YE)
LF door	C536-1 C536-2	C4348c-3 C4348c-2	VME28 (BN/VT) RME28 (BN/GN)
LH tweeter	C569-1 C569-2	C4348b-9 C4348b-10	VME08 (GN/OG) RME08 (GY/OG)
LH front imaging	C2359-1 C2359-4	C4348b-2 C4348b-1	VME07 (WH) RME07 (WH/BN)
Center front imaging	C2359-2 C2359-5	C4348b-4 C4348b-3	VME06 (GN) RME06 (GY/YE)
RH front imaging	C2359-3 C2359-6	C4348b-6 C4348b-5	VME10 (WH/VT) RME10 (WH/OG)
RH tweeter	C613-1 C613-2	C4348b-11 C4348b-12	VME11 (VT/OG) RME11 (YE/OG)
RF door	C628-1 C628-2	C4348c-5 C4348c-4	VME29 (GN/WH) RME29 (BU/WH)
RR door	C802-1 C802-2	C4348c-18 C4348c-19	VME12 (BN/WH) RME12 (BN/BU)
Subwoofer 1	C4212-1 C4212-2	C4348c-14 C4348c-15	VME01 (GN/VT) RME01 (GY)
Subwoofer 2	C4212-3 C4212-4	C4348c-16 C4348c-17	VME02 (VT) RME02 (YE)
LH rear center imaging	C4337-1 C4337-2	C4348b-13 C4348b-14	VME30 (GN/BN) RME30 (VT/BN)
RH rear center imaging	C4338-1 C4338-2	C4348b-13 C4348b-14	VME30 (GN/BN) RME30 (VT/BN)

- **Is the resistance less than 5 ohms between the suspect speaker and the DSP module, and greater than 10,000 ohms between the suspect speaker and ground?**

  YES : Go to C4.

  NO : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

C4 ISOLATE THE SUSPECT SPEAKER

- Key in OFF position.
- Connect: DSP Module C4348b and C4348c

- Substitute a known good speaker for the suspect speaker.
- Operate the audio system in radio tuner (AM/FM) mode.
- **Is the concern still present?**

  YES : Go to C5.

  NO : INSTALL a new speaker for the suspect speaker. REFER to **Door Speaker**, **Instrument Panel Speaker**, or **Subwoofer Speaker** . CLEAR any DTCs present. TEST the system for normal operation.

C5 CHECK FOR CORRECT DSP MODULE OPERATION

- Key in OFF position.
- Connect: All Disconnected Connectors
- Disconnect all the DSP module connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the DSP module connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DSP module. REFER to **Audio Digital Signal Processing (DSP) Module**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test D: Poor Quality/Distorted/No Sound From All Speakers - THX® Audio System

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Audio System/Navigation for schematic and connector information.

Normal Operation

The THX® amplifier receives voltage through circuits SBP38 (BN/RD) and SBP18 (YE/RD), and ground through circuit GD148 (BK/YE).

Left and right channel audio signals are sent from the audio control module (ACM) to the audio digital signal processing (DSP) module through circuits VME07 (WH), RME07 (WH/BN), VME10 (WH/VT), and RME10 (WH/OG). If there is a fault on one of these circuits, the audio quality will be reduced by approximately 25% for all speakers.

To enable the DSP module, the ACM sends voltage through the enable/clip circuit SME23 (VT/RD). The circuit acts as both an output (to enable the amplifier) and an input (to detect an amplifier overload condition). A variable resistor in the DSP module modifies the voltage signal from the ACM. In the event of an overload, the ACM clips the audio output signal to the amplifier (heard as distortion), in order to prevent damage to the amplifier and speakers.

The clip/enable status is based on the following voltages, as detected by the ACM:

- Less than 0.4 volts: amplifier disabled
- Between 3.8 and 6.7 volts: amplifier enabled
- Greater than 8.5 volts: amplifier clipped

NOTE: Despite their names, DTCs B2925 and B292A apply to the DSP module clip/enable circuit, not to the subwoofer.

- DTC B2925 (Subwoofer Speaker Short Circuit) - sets with DTCs B2965 and B292A when a short to ground is detected in circuit SME23 (VT/RD).
- DTC B292A (Subwoofer #2 Speaker Short Circuit) - sets when an open or short to ground is detected in circuit SME23 (VT/RD). If an open is detected, DTC B2965 will also be set. If a short to ground is detected, DTCs B2965 and B2925 will also be set.
- DTC B2965 (Audio System Speaker Circuit Fault) - sets when an open or short to ground is detected in circuit SME23 (VT/RD).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- DSP module
- ACM

PINPOINT TEST D: POOR QUALITY/DISTORTED/NO SOUND FROM ALL SPEAKERS - THX® AUDIO SYSTEM

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

D1 CHECK THE DSP MODULE DTCs

- Carry out the DSP module continuous and on-demand self-tests.
- **Is DTC B292A present?**

  YES : Go to D5.

  NO : Go to D2.

D2 CHECK CIRCUITS SBP18 (YE/RD) AND SBP38 (BN/RD) FOR VOLTAGE

- Key in OFF position.
- Disconnect: DSP Module C4348c
- Measure the voltage between the DSP module, harness side and ground as follows:

Connector-Pin	Circuit
C4348c-9	SBP38 (BN/RD)
C4348c-10	SBP38 (BN/RD)
C4348c-11	SBP18 (YE/RD)
C4348c-12	SBP18 (YE/RD)

- **Are the voltages greater than 10 volts?**

  YES : Go to D3.

  NO : VERIFY the smart junction box (SJB) fuse 38 (20A) or fuse 18 (20A) is OK. If OK, REPAIR the circuit in question. TEST the system for normal operation. If not OK, REFER to appropriate SYSTEM WIRING DIAGRAMS article to identify the possible sources of the circuit short.

D3 CHECK CIRCUIT GD148 (BK/YE) FOR AN OPEN

- Measure the resistance between the DSP module, harness side and ground as follows:

Connector-Pin	Circuit
C4348c-22	GD148 (BK/YE)
C4348c-23	GD148 (BK/YE)
C4348c-24	GD148 (BK/YE)

- **Are the resistances less than 5 ohms?**

  YES : Go to D4.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

D4 CHECK CIRCUIT SME23 (VT/RD) FOR VOLTAGE

- Connect: DSP Module C4348c
- Disconnect: DSP Module C4348a
- Operate the audio system in radio tuner (AM/FM) mode.

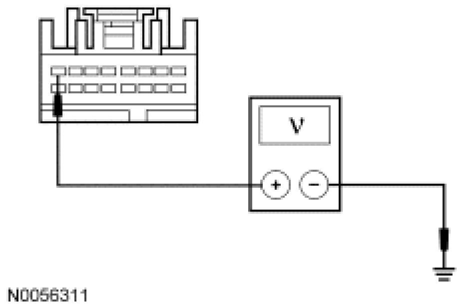

Fig. 5: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the DSP moduleC4348a-8, circuit SME23 (VT/RD), harness side and ground.
- **Is the voltage between 3.8 and 6.7 volts?**

  YES : Go to D6.

  NO : Go to D5.

D5 CHECK CIRCUIT SME23 (VT/RD) FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Disconnect: ACM C240c

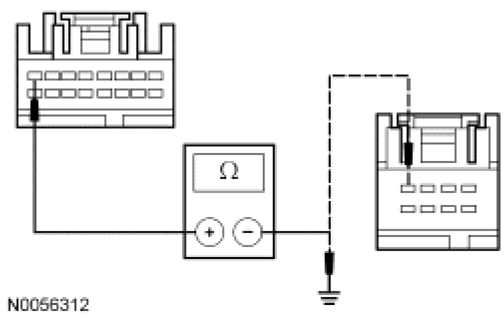

Fig. 6: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DSP module C4384a-8, circuit SME23 (VT/RD), harness side and the ACM C240c-4, circuit SME23 (VT/RD), harness side; and between the DSP module C4384a-8, circuit SME23 (VT/RD), harness side and ground.
- **Is the resistance less than 5 ohms between the DSP module and the ACM, and greater than 10,000 ohms between the DSP module and ground?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : REPAIR the circuit. CLEAR and DTCs present. TEST the system for normal operation.

D6 CHECK THE AUDIO SIGNALS TO THE DSP MODULE

- Operate the audio system in radio tuner (AM/FM) mode.
- Measure the AC voltage between the audio circuits at the DSP module as follows:

Connector-Pin	Circuit
C4348a-1 C4348a-2	VME07 (WH) RME07 (WH/BN)
C4348a-3 C4348a-4	VME10 (WH/VT) RME10 (WH/OG)

- **Is a fluctuating AC voltage present?**

  YES : Go to D10.

  NO : Go to D7.

D7 CHECK THE AUDIO CIRCUITS TO THE DSP MODULE FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C240a
- Key in ON position.
- Measure the voltage between the DSP module, harness side and ground as follows:

Connector-Pin	Circuit
C4348a-1	VME07 (WH)
C4348a-2	RME07 (WH/BN)
C4348a-3	VME10 (WH/VT)
C4348a-4	RME10 (WH/OG)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

  NO : Go to D8.

D8 CHECK THE AUDIO CIRCUITS TO THE DSP MODULE FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the DSP module, harness side and the ACM, harness side; and

between the DSP module, harness side and ground as follows:

DSP Module Connector-Pin	ACM Connector-Pin	Circuit
C4348a-1	C240a-8	VME07 (WH)
C4348a-2	C240a-21	RME07 (WH/BN)
C4348a-3	C240a-11	VME10 (WH/VT)
C4348a-4	C240a-12	RME10 (WH/OG)

- **Is the resistance less than 5 ohms between the DSP module and the ACM, and greater than 10,000 ohms between the DSP module and ground?**

  YES : Go to D9.

  NO : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

D9 CHECK FOR CORRECT ACM OPERATION

- Key in OFF position.
- Connect: All Disconnected Connectors
- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the ACM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. CLEAR any DSP module DTCs present. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DSP module DTCs present.

D10 CHECK FOR CORRECT DSP MODULE OPERATION

- Key in OFF position.
- Connect: All Disconnected Connectors
- Disconnect all the DSP module connectors.
- Check for:
  - corrosion

    - damaged pins
    - pushed-out pins
- Connect the DSP module connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DSP module. REFER to **Audio Digital Signal Processing (DSP) Module**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test E: The Subwoofer Is Inoperative/Does Not Operate Correctly - Audiophile

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Audio System/Navigation for schematic and connector information.

Normal Operation

The subwoofer amplifier receives voltage through circuit SBP38 (BN/RD) and ground through circuit GD148 (BK/YE). The subwoofer speakers and subwoofer amplifier are integral to the enclosure and cannot be repaired individually.

To enable the subwoofer amplifier, the audio control module (ACM) sends voltage through the enable/clip circuit SME23 (VT/RD). The circuit acts as both an output (to enable the amplifier) and an input (to detect an amplifier overload condition). A variable resistor in the subwoofer amplifier modifies the voltage signal from the ACM. In the event of an overload, the ACM clips the audio output signal to the amplifier (heard as distortion), in order to prevent damage to the amplifier and speakers.

The clip/enable status is based on the following voltages, as detected by the ACM:

- Less than 0.4 volts: amplifier disabled
- Between 3.8 and 6.7 volts: amplifier enabled
- Greater than 8.5 volts: amplifier clipped

An open in circuit SME23 (VT/RD) will cause the subwoofer to produce no sound, because the enable signal will not reach the subwoofer amplifier. A short to ground or short to voltage can cause severe distortion to be heard in the subwoofer.

- DTC B1154 (Subwoofer #1 Short to Ground) - sets when a short to ground is detected on circuit RME22 (GN/WH) or circuit VME22 (VT/GN). This DTC only sets during the on-demand self-test.
- DTC B1155 (Subwoofer #1 Short to Battery) - sets when a short to voltage is detected on circuit RME22 (GN/WH) or circuit VME22 (VT/GN). This DTC only sets during the on-demand self-test.
- DTC B2913 (Audio Subwoofer Not Connected) - sets when the ACM does not detect the subwoofer through circuit SME23 (VT/RD) during the subwoofer connection test (part of the ACM self-test).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Subwoofer
- ACM

PINPOINT TEST E: THE SUBWOOFER IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - AUDIOPHILE

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

E1 CHECK CIRCUIT SBP38 (BN/RD) FOR VOLTAGE

- Key in OFF position.
- Disconnect: Subwoofer C4208

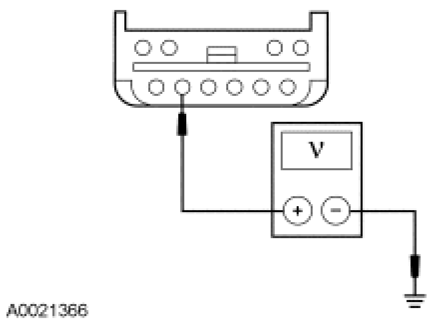

Fig. 7: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the subwoofer C4208-5, circuit SBP38 (BN/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to E2.

  NO : VERIFY the smart junction box (SJB) fuse 38 (20A) is OK. If OK, REPAIR the circuit. CLEAR any DTCs present. TEST the system for normal operation. If not OK, REFER to appropriate SYSTEM WIRING DIAGRAMS article to identify the possible sources of the circuit short.

E2 CHECK CIRCUIT GD148 (BK/YE) FOR AN OPEN

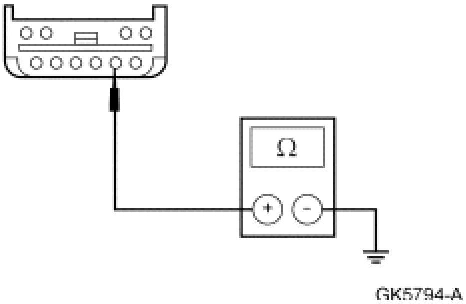

Fig. 8: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the subwoofer C4208-2, circuit GD148 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : Go to E3.

NO : REPAIR the circuit. CLEAR any DTCs present. TEST the system for normal operation.

E3 CHECK CIRCUIT SME23 (VT/RD) FOR VOLTAGE

- Operate the audio system in radio tuner (AM/FM) mode.

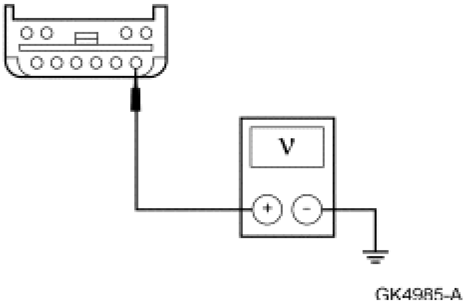

Fig. 9: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the subwoofer C4208-1, circuit SME23 (VT/RD), harness side and ground.
- **Is the voltage between 3.8 and 6.7 volts?**

YES : Go to E6.

NO : Go to E4.

E4 CHECK CIRCUIT SME23 (VT/RD) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C240c
- Key in ON position.

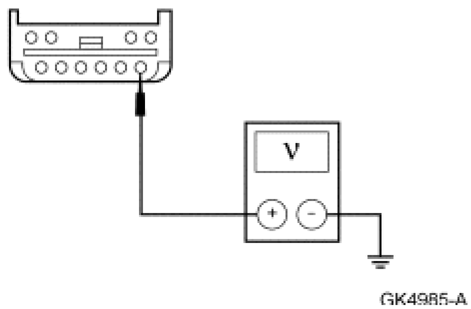

Fig. 10: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the subwoofer C4208-1, circuit SME23 (VT/RD), harness side and ground.
- **Is any voltage present?**

YES : Go to E5.

NO : REPAIR the circuit. CLEAR any DTCs present. TEST the system for normal operation.

E5 CHECK CIRCUIT SME23 (VT/RD) FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.

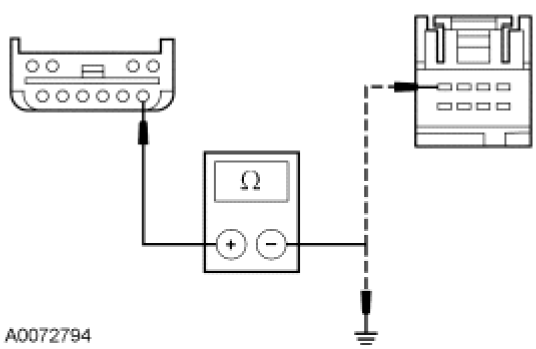

Fig. 11: Checking Circuit For Open Or Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the subwoofer C4208-1, circuit SME23 (VT/RD), harness side and the ACM C240c-4, circuit SME23 (VT/RD), harness side; and between the subwoofer C4208-1, circuit SME23 (VT/RD), harness side and ground.
- **Is the resistance less than 5 ohms between the subwoofer and the ACM, and greater than 10,000 ohms between the subwoofer and ground?**

YES : Go to E9.

NO : REPAIR the circuit. CLEAR any DTCs present. TEST the system for normal operation.

E6 CHECK THE AUDIO SIGNAL TO THE SUBWOOFER

- Key in OFF position.
- Disconnect: Subwoofer C4208
- Operate the audio system in radio tuner (AM/FM) mode.

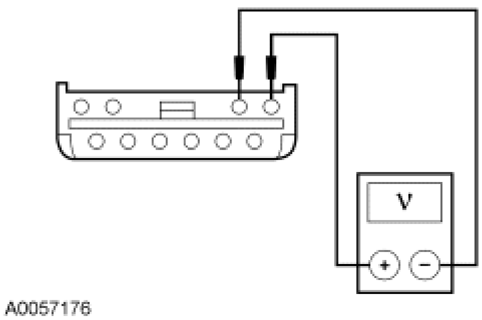

Fig. 12: Checking Audio Signal
Courtesy of FORD MOTOR CO.

- Measure the AC voltage between the subwoofer C4208-7, circuit VME22 (VT/GN), harness side and the subwoofer C4208-8, circuit RME22 (GN/WH), harness side.
- **Is a fluctuating AC voltage present?**

  YES : INSTALL a new subwoofer. REFER to **Subwoofer Speaker**. CLEAR any DTCs present. TEST the system for normal operation.

  NO : Go to E7.

E7 CHECK THE AUDIO CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C240c
- Key in ON position.

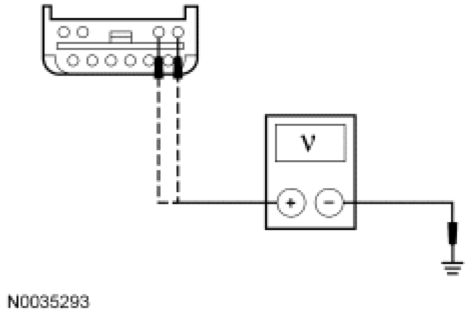

Fig. 13: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the subwoofer C4208-7, circuit VME22 (VT/GN), harness side and ground; and between the subwoofer C4208-8, circuit RME22 (GN/WH), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

  NO : Go to E8.

E8 CHECK THE AUDIO CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the subwoofer, harness side and the ACM, harness side; and between the subwoofer, harness side and ground as follows:

Subwoofer Connector-Pin	ACM Connector-Pin	Circuit
C4208-7	C240c-1	VME22 (VT/GN)
C4208-8	C240c-2	RME22 (GN/WH)

- **Is the resistance less than 5 ohms between the subwoofer and the ACM, and greater than 10,000 ohms between the subwoofer and ground?**

  YES : Go to E9.

  NO : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

E9 CHECK FOR CORRECT ACM OPERATION

- Key in OFF position.
- Connect: All Disconnected Connectors
- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the ACM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test F: The Steering Wheel Controls Are Inoperative/Do Not Operate Correctly

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Audio System/Navigation for schematic and connector information.

Normal Operation

There are 4 different steering wheel controls configurations:

- Non-navigation, without the SYNC system
  - VOL-, VOL+, SEEK-, SEEK+, MEDIA
- Non-navigation, with the SYNC system
  - VOL-, VOL+, SEEK-, SEEK+, VOICE, MEDIA, PHONE, OK
- Navigation, without the SYNC system
  - VOL-, VOL+, SEEK-, SEEK+, VOICE, MEDIA
- Navigation, with the SYNC system
  - VOL-, VOL+, SEEK-, SEEK+, VOICE, MEDIA, PHONE

The VOL-, VOL+, SEEK+, SEEK-, and MEDIA buttons are always wired to the audio control module (ACM). Voltage is sent from the ACM to the steering wheel controls through circuit VME14 (GY/YE), and the ACM grounds the reference voltage through circuit RME24 (BU/WH).

For vehicles equipped with navigation, but not the SYNC system, the VOICE button is wired to the ACM.

For vehicles equipped with the SYNC system, the VOICE (an icon of someone speaking), PHONE (an icon of a phone with an up and down arrow), and OK buttons are wired directly to the accessory protocol interface module (APIM) unless the vehicle is equipped with navigation, in which case there is no OK button, and the VOICE and PHONE buttons are wired to the ACM. Voltage is sent from the APIM (or ACM if equipped with navigation) to the steering wheel controls through circuit VME54 (BU/OG), and the APIM (or ACM if equipped with navigation) grounds the reference voltage through circuit RME54 (WH/VT).

When a switch is pressed, the voltage is routed through a specific resistor value for each function. The ACM (or APIM) then uses this reference voltage to determine which control input function has been selected.

- DTC B1117 (Audio Steering Wheel Button Stuck) - set by the ACM or the APIM (depending on vehicle configuration) when a steering wheel control button is detected as active for greater than 120 seconds during normal operation, or for any duration during the self-test.
- DTC B1136 (Audio Steering Wheel Switch #2 Circuit Failure) - set by the ACM or the APIM (depending on vehicle configuration) when the reference voltage to the steering wheel controls is out-of-range. This can be caused by a number of different failures on the steering wheel controls circuit, except for a short to ground in circuit RME54 (WH/VT). This DTC only applies to the VOICE, PHONE, and OK buttons.
- DTC B2404 (Audio Steering Wheel Switch Circuit Fault) - set by the ACM when the reference voltage to the steering wheel controls is out-of-range. This can be caused by a number of different failures on the steering wheel controls circuit, except for a short to ground in circuit RME24 (BU/WH). This DTC only applies to the VOL-, VOL+, SEEK+, SEEK-, and MEDIA buttons.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Clockspring
- Steering wheel controls
- ACM

- APIM (if equipped)

PINPOINT TEST F: THE STEERING WHEEL CONTROLS ARE INOPERATIVE/DO NOT OPERATE CORRECTLY

F1 DETERMINE THE INOPERATIVE STEERING WHEEL CONTROLS

- Determine which steering wheel controls are inoperative by pressing each steering wheel control button individually while operating the audio system in various modes (AM/FM, SYNC, etc.).
- **Is the concern with the VOL-, VOL+, SEEK-, SEEK+, or MEDIA button?**

  YES : Go to F2.

  NO : Go to F3.

F2 MONITOR THE STEERING WHEEL CONTROL PIDs (EXCEPT NAVIGATION/SYNC SWITCHES)

- Enter the following diagnostic mode on the diagnostic tool: ACM DataLogger
- Monitor the steering wheel controls PIDs while pressing each steering wheel controls button as follows:

Steering Wheel Control Button	PID
VOL-	VOL_DN
VOL+	VOL_UP
SEEK-	SEEK_DN
SEEK+	SEEK_UP
MEDIA	MODE_SW

- **Do the PID values agree with the switch positions?**

  YES : Go to F8.

  NO : If only one PID value is incorrect or the PID value always reads one particular switch position, INSTALL new steering wheel controls. REFER to **Steering Wheel Controls**. CLEAR any DTCs present. TEST the system for normal operation.

  Otherwise, go to F3.

F3 MONITOR THE STEERING WHEEL CONTROL PIDs (NAVIGATION/SYNC SWITCHES)

- Enter the following diagnostic mode on the diagnostic tool: ACM DataLogger (With Navigation) or APIM DataLogger (Without Navigation)
- Monitor the steering wheel controls PIDs while pressing each steering wheel controls button as follows:

Steering	

Wheel Controls Button	PID
VOICE	VOICE_SW
PHONE	PHONE_SW
OK (without navigation only)	OK_SW

- **Do the PID values agree with the switch positions?**

  YES : For vehicles with navigation, go to F8.

  For vehicles without navigation, go to F9.

  NO : If only one PID value is incorrect or the PID value always reads one particular switch position, INSTALL new steering wheel controls. REFER to **Steering Wheel Controls**. CLEAR any DTCs present. TEST the system for normal operation.

  Otherwise, go to F4.

F4 CHECK THE REFERENCE VOLTAGE CIRCUIT TO THE CLOCKSPRING FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Clockspring C218a
- Disconnect: ACM C240a or APIM C3342
- Key in ON position.

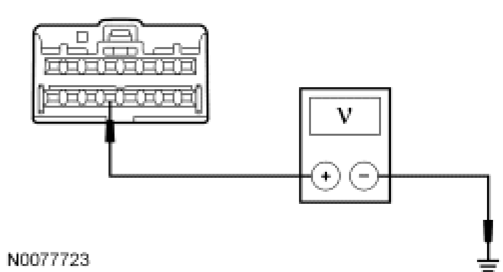

Fig. 14: Measuring Voltage Between Clockspring C218A-13, Circuit VME14 (GY/YE)
Courtesy of FORD MOTOR CO.

- For a concern with the VOL-, VOL+, SEEK-, SEEK+, or MEDIA buttons, measure the voltage between the clockspring C218a-13, circuit VME14 (GY/YE), harness side and ground.

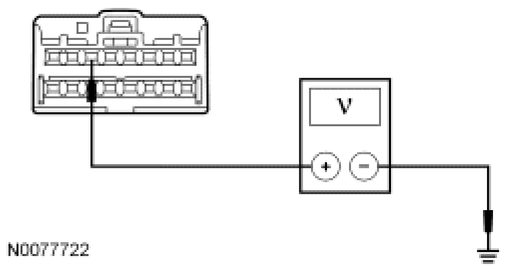

Fig. 15: Measuring Voltage Between Clockspring C218A-6, Circuit VME54 (BU/OG)
Courtesy of FORD MOTOR CO.

- For a concern with the VOICE, PHONE (or SEND), or OK (or END) buttons, measure the voltage between the clockspring C218a-6, circuit VME54 (BU/OG), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. CLEAR any DTCs present. TEST the system for normal operation.

  NO : Go to F5.

F5 CHECK THE CIRCUITS TO THE CLOCKSPRING FOR AN OPEN OR SHORT TO GROUND

NOTE: Circuits RME14 (BU/WH) and RME54 (WH/VT) do not need to be checked for a short to ground.

- Key in OFF position.
- For a concern with the VOL-, VOL+, SEEK-, SEEK+, or MEDIA buttons, measure the resistance between the ACM, harness side and the clockspring, harness side; and between the ACM, harness side and ground as follows:

ACM Connector-Pin	Clockspring Connector-Pin	Circuit
C240a-18	C218a-13	VME14 (GY/YE)
C240a-19	C218a-12	RME24 (BU/WH)

- For a concern with the VOICE, PHONE, or OK buttons, measure the resistance between the ACM (with navigation) or APIM (with the SYNC system, without navigation), harness side and the clockspring, harness side; and between the ACM (with navigation) or APIM (with the SYNC system, without navigation), harness side and ground as follows:

ACM or APIM Connector-	Clockspring Connector-	Circuit

Pin	Pin	
C240a-17 or C3342-14	C218a-6	VME54 (BU/OG)
C240a-16 or C3342-15	C218a-4	RME54 (WH/VT)

- **Is the resistance less than 5 ohms between the ACM (or APIM) and the clockspring, and greater than 10,000 ohms between the ACM (or APIM) and ground?**

  YES : Go to F6.

  NO : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

F6 CHECK THE REFERENCE VOLTAGE CIRCUIT TO THE STEERING WHEEL CONTROLS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Clockspring C218b
- Disconnect: Steering Wheel Controls C2999
- Key in ON position.
- For a concern with the VOL-, VOL+, SEEK-, SEEK+, or MEDIA buttons, measure the voltage between the clockspring C218b-10, circuit VME14 (GY/YE), harness side and ground.
- For a concern with the VOICE, PHONE, or OK buttons, measure the voltage between the clockspring C218b-3, circuit VME54 (BU/OG), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. CLEAR any DTCs present. TEST the system for normal operation.

  NO : Go to F7.

F7 CHECK THE CIRCUITS TO THE STEERING WHEEL CONTROLS FOR AN OPEN OR SHORT TO GROUND

NOTE: Circuits RME14 (BU/WH) and RME54 (WH/VT) do not need to be checked for a short to ground.

- Key in OFF position.
- For a concern with the VOL-, VOL+, SEEK-, SEEK+, or MEDIA buttons, measure the resistance between the clockspring, harness side and the steering wheel controls, harness side; and between the clockspring, harness side and ground as follows:

Clockspring Connector-Pin	Steering Wheel Controls Connector-Pin	Circuit

C218b-10	C2999-2	VME14 (GY/YE)
C218b-11	C2999-4	RME24 (BU/WH)

- For a concern with the VOICE, PHONE, or OK buttons, measure the resistance between the clockspring, harness side and the steering wheel controls, harness side; and between the clockspring, harness side and ground as follows:

Clockspring Connector-Pin	Steering Wheel Controls Connector-Pin	Circuit
C218b-3	C2999-6	VME54 (BU/OG)
C218b-5	C2999-7	RME54 (WH/VT)

- **Is the resistance less than 5 ohms between the clockspring and the steering wheel controls, and greater than 10,000 ohms between the clockspring and ground?**

  YES : INSTALL a new clockspring. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

F8 CHECK FOR CORRECT ACM OPERATION

- Key in OFF position.
- Connect: All Disconnected Connectors
- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

F9 CHECK FOR CORRECT APIM OPERATION

- Key in OFF position.

- Disconnect the APIM connector.
- Check for:
    - corrosion
    - damaged pins
    - pushed-out pints
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initialize.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test G: The Audio Input Jack Is Inoperative/Does Not Operate Correctly

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Audio System/Navigation for schematic and connector information.

Normal Operation - Vehicles Without the SYNC System

Audio signals are sent from the audio input jack to the audio control module (ACM). There are no external power or ground circuits to the audio input jack.

Vehicles With The SYNC System

Audio signals are sent from the audio input jack to the accessory protocol interface module (APIM). The signals are then sent to the ACM. There are no external power or ground circuits to the audio input jack.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Audio input jack
- ACM
- APIM (if equipped)

PINPOINT TEST G: THE AUDIO INPUT JACK IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTE:	**Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Before carrying out this pinpoint test, make sure the MP3 device is operating correctly.

G1 CHECK THE AUDIO INPUT JACK AUDIO

- Connect: Known Good MP3 Device (to Audio Input Jack)
- Using the known good MP3 device, attempt to play a file using the audio input jack.
- **Does the file play correctly?**

  YES : The system is operating correctly at this time. The concern may be with the customer device.

  NO : Go to G2.

G2 DETERMINE THE VEHICLE CONTENT

- Determine if the vehicle is equipped with the SYNC system.
- **Is the vehicle equipped with the SYNC system?**

  YES : Go to G3.

  NO : Go to G4.

G3 CHECK THE APIM AUDIO OUTPUT

- Attempt to play an audio file using either the universal serial bus (USB) port or a Bluetooth® device.
- **Is the audio output OK for devices connected through the USB port or Bluetooth®?**

  YES : Go to G4.

  NO : Go to **Pinpoint Test S** .

G4 CHECK THE AUDIO INPUT JACK CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Audio Input Jack C3312
- Disconnect: ACM C240b or APIM C3342 (if equipped)
- Key in ON position.
- Measure the voltage between the audio input jack, harness side and ground as follows:

Connector-Pin	Circuit
C3312-1	VME46 (BU/GN)
C3312-2	RME46 (WH/GN)
C3312-3	RME45 (YE/GN)
C3312-4	VME45 (BU)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

NO : Go to G5.

G5 CHECK THE AUDIO INPUT JACK CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the audio input jack, harness side and the ACM (or APIM, if equipped), harness side; and between the audio input jack, harness side and ground as follows:

Audio Input Jack Connector-Pin	ACM or APIM Connector-Pin	Circuit
C3312-1	C240b-6 or C3342-47	VME46 (BU/GN)
C3312-2	C240b-14 or C3342-48	RME46 (WH/GN)
C3312-3	C240b-8 or C3342-46	RME45 (YE/GN)
C3312-4	C240b-7 or C3342-45	VME45 (BU)

- **Is the resistance less than 5 ohms between the audio input jack and the ACM (or APIM), and greater than 10,000 ohms between the audio input jack and ground?**

  YES : Go to G6.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

G6 SUBSTITUTE THE AUDIO INPUT JACK

- Install a known good audio input jack.
- Operate the audio system using a device plugged into the audio input jack.
- **Does the system operate correctly?**

  YES : INSTALL a new audio input jack. REFER to **Audio Input Jack**. TEST the system for normal operation.

  NO : INSTALL the original audio input jack. For vehicles without the SYNC system, go to G7.

  For vehicles with the SYNC system, go to G8.

G7 CHECK FOR CORRECT ACM OPERATION

- Key in OFF position.
- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins

- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

G8 CHECK FOR CORRECT APIM OPERATION

- Key in OFF position.
- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pints
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initialize.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test H: The Satellite Audio Is Inoperative/Does Not Operate Correctly - Vehicles Without DVD Entertainment

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Audio System/Navigation for schematic and connector information.

Normal Operation

The satellite digital audio receiver system (SDARS) module receives voltage through circuit CBP13 (GY/BN) and ground through circuit GD148 (BK/YE). Digital signals are received by the satellite radio antenna and sent to the SDARS module, which converts the signals to analog and send them to either the audio control module (ACM) or the accessory protocol interface module (APIM) (if equipped).

If there is an open in the satellite antenna circuit, there will be no satellite audio. The ACM display will indicate a satellite antenna concern (the method varies according to the type of ACM) when the audio system is operated in satellite radio mode. To diagnose an open in the satellite antenna circuit, go to **Pinpoint Test J** .

The SDARS module transmits left and right channel audio signals. When there is a fault on any of these circuits, the audio quality is reduced. If the circuits for a specific channel are shorted together, loss of audio on that entire channel will occur. This can be detected by using the SDARS module tones test.

- DTC U0184 (Lost Communication With Radio [ACM]) - set by the SDARS module when certain medium speed controller area network (MS-CAN) messages are missing from the ACM.
- DTC U0193 (Lost Communication With Digital Audio Control Module [SDARS]) - set by the ACM when certain MS-CAN messages are missing from the SDARS module.
- DTC U0197 (Lost Communication With Telephone Control Module) - set by the SDARS module when certain MS-CAN messages are missing from the APIM.

This pinpoint test is intended to diagnose the following:

- Subscription status
- Wiring, terminals or connectors
- SDARS module
- APIM (if equipped)
- ACM

PINPOINT TEST H: THE SATELLITE AUDIO IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - VEHICLES WITHOUT DVD ENTERTAINMENT

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

H1 VERIFY AN ACTIVE SUBSCRIPTION

- Operate the audio system in satellite radio mode and observe the display.
- **Does the display read CALL SIRIUS?**

  YES : The subscription has expired. INFORM the customer to contact Sirius to re-activate the subscription.

  NO : If the display indicates a satellite antenna fault, go to **Pinpoint Test J** .

  Otherwise, go to H2.

H2 CHECK FOR NON-NETWORK DTCs

- Carry out the SDARS module self-test using the scan tool.
- **Are any non-network DTCs present?**

  YES : For DTC B1031 or DTC B1032, go to **Pinpoint Test J** .

  For all other DTCs, REFER to DTC Charts in this service information.

  NO : Go to H3.

H3 CHECK FOR COMMUNICATION WITH THE ACM AND APIM

- Carry out the network test using the scan tool.

- **Does the scan tool communicate with the ACM and the APIM (if equipped)?**

  YES : Go to H4.

  NO : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose no communication with the ACM or APIM.

H4 CHECK FOR LOST COMMUNICATION DTCs

- Key in ON position.
- Using the scan tool, clear any ACM and SDARS module continuous DTCs.
- Key in OFF position.
- Key in ON position.
- Wait at least 10 seconds.
- Retrieve the ACM and SDARS module continuous DTCs.
- **Is DTC U0184 (SDARS module), U0193 (ACM), or U0197 (SDARS module, if equipped with the SYNC system) present?**

  YES : For DTC U0184, go to H13.

  For DTC U0193, go to H11.

  For DTC U0197, go to H12.

  NO : Go to H5.

H5 CHECK THE SATELLITE AUDIO OUTPUT

- Enter the following diagnostic mode on the diagnostic tool: SDARS Module Tones Test
- Carry out the SDARS module tones test.
- **Are alternating LH/RH tones audible?**

  YES : Go to H11.

  NO : If the vehicle is equipped with the SYNC system, go to H6.

  Otherwise, go to H9.

H6 CHECK THE OPERATION OF THE SYNC SYSTEM AUDIO

- Operate the audio system in radio tuner (AM/FM) mode.
- Connect: Known Good MP3 Device (To Audio Input Jack)
- Using the ACM buttons, press AUX until "SYNC LINE IN" appears on the display (except navigation), or press MEDIA, select "USER DEVICE", and press "SOURCE" repeatedly until "LINE IN" appears (navigation).
- Using the known good device, attempt to play a file through the audio input jack.
- **Does the SYNC system audio operate correctly?**

  YES : Go to H7.

  NO : Go to **Pinpoint Test S** .

H7 CHECK THE AUDIO CIRCUITS TO THE APIM FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: APIM C3342
- Disconnect: SDARS Module C4344
- Key in ON position.
- Measure the voltage between the SDARS module, harness side and ground as follows:

Connector-Pin	Circuit
C4344-5	VME41 (GN/OG)
C4344-6	VME42 (VT/BN)
C4344-11	RME41 (BU/BN)
C4344-12	RME42 (YE/BU)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to H8.

H8 CHECK THE AUDIO CIRCUITS TO THE APIM FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the APIM, harness side and the SDARS module, harness side; and between the APIM, harness side and ground as follows:

APIM Connector-Pin	SDARS Module Connector-Pin	Circuit
C3342-10	C4344-5	VME41 (GN/OG)
C3342-7	C4344-6	VME42 (VT/BN)
C3342-11	C4344-11	RME41 (BU/BN)
C3342-8	C4344-12	RME42 (YE/BU)

- **Is the resistance less than 5 ohms between the APIM and the SDARS module, and greater than 10,000 ohms between the APIM and ground?**

  YES : Go to H11.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

H9 CHECK THE AUDIO CIRCUITS TO THE ACM FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C240b
- Disconnect: SDARS Module C4344
- Key in ON position.
- Measure the voltage between the ACM, harness side and ground as follows:

Connector-Pin	Circuit
C240b-1	VME52 (BU)
C240b-2	RME52 (GY/OG)
C240b-9	VME53 (VT/GN)
C240b-10	RME53 (BN/WH)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to H10.

H10 CHECK THE AUDIO CIRCUITS FROM THE SDARS MODULE FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the SDARS module, harness side and the ACM, harness side; and between the SDARS module, harness side and ground as follows:

SDARS Module Connector-Pin/Circuit	ACM Connector-Pin/Circuit
C4344-5 VME41 (GN/OG)	C240b-1 VME52 (BU)
C4344-6 VME42 (VT/BN)	C240b-9 RME52 (GY/OG)
C4344-11 RME41 (BU/BN)	C240b-2 VME53 (VT/GN)
C4344-12 RME42	C240b-10 RME53

(YE/BU)	(BN/WH)

- **Is the resistance less than 5 ohms between the SDARS module and the ACM, and greater than 10,000 ohms between the SDARS module and ground?**

  YES : Go to H11.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

H11 ISOLATE THE SDARS MODULE

- Key in OFF position.
- Connect: ACM C240b
- Connect: APIM C3342 (If Equipped)
- Install a new SDARS module. Refer to **Satellite Digital Audio Receiver System (SDARS) Module**.
- Operate the audio system in satellite radio mode.
- **Does the system operate correctly?**

  YES : The concern was caused by an inoperative SDARS module. The system is operating correctly at this time.

  NO : If equipped with the SYNC system, go to H12.

  Otherwise, go to H13.

H12 CHECK FOR CORRECT APIM OPERATION

- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation. If the concern is still present, go to H13.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

H13 CHECK FOR CORRECT ACM OPERATION

- Key in OFF position.
- Disconnect all the ACM connectors.
- Check for:
  - corrosion

    - damaged pins
    - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test I: The Satellite Audio Is Inoperative/Does Not Operate Correctly - Vehicles With DVD Entertainment

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Audio System/Navigation for schematic and connector information.

Normal Operation

The satellite digital audio receiver system (SDARS) module receives voltage through circuit CBP13 (GY/BN) and ground through circuit GD148 (BK/YE). Digital signals are received by the satellite radio antenna and sent to the SDARS module, which converts the signals to analog and sends them to either the rear entertainment module (RETM), or the accessory protocol interface module (APIM) (if equipped).

The satellite audio signals utilize separate circuitry from the remaining audio signals. This allows the audio control module (ACM) to distinguish between satellite audio and SYNC or DVD audio, in order to provide for more dual-play options.

If there is an open in the satellite antenna circuit, there will be no satellite audio. The ACM display will indicate a satellite antenna concern (the method varies according to the type of ACM) when the audio system is operated in satellite radio mode. To diagnose an open in the satellite antenna circuit, go to **Pinpoint Test J** .

Circuits VME41 (GN/OG), RME41 (BU/BN), VME42 (VT/BN), and RME42 (YE/BU) transmit left and right channel audio signals. When there is a fault on any of these circuits, the audio quality is reduced. If the circuits for a specific channel are shorted together, loss of audio on that entire channel will occur. This can be detected by using the SDARS module tones test.

DTC Description	Fault Set Conditions
U0184 - Lost Communication With Radio (ACM)	Set by the SDARS module when certain medium speed controller area network (MS-CAN) messages are missing from the ACM.
U0193 - Lost Communication With Digital Audio Control Module (SDARS)	Set by the ACM or the RETM when certain MS-CAN messages are missing from the SDARS module.
U0196 - Lost Communication With Entertainment Control	Set by the SDARS module when certain

Module - Rear (AUX)	MS-CAN messages are missing from the RETM.
U0197 - Lost Communication With Telephone Control Module	Set by the SDARS module when certain MS-CAN messages are missing from the APIM.

This pinpoint test is intended to diagnose the following:

- Subscription status
- Wiring, terminals or connectors
- SDARS module
- RETM
- APIM (if equipped)
- ACM

PINPOINT TEST I: THE SATELLITE AUDIO IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - VEHICLES WITH DVD ENTERTAINMENT

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

I1 VERIFY AN ACTIVE SUBSCRIPTION

- Operate the audio system in satellite radio mode and observe the display.
- **Does the display read CALL SIRIUS?**

  YES : The subscription has expired. INFORM the customer to contact Sirius to re-activate the subscription.

  NO : If the display indicates a satellite antenna fault, go to **Pinpoint Test J** .

  Otherwise, go to I2.

I2 CHECK FOR NON-NETWORK DTCs

- Carry out the SDARS module self-test using the scan tool.
- **Are any non-network DTCs present?**

  YES : For DTC B1031 or DTC B1032, go to **Pinpoint Test J** .

  For all other DTCs, REFER to DTC Charts in this service information.

  NO : Go to I3.

I3 CHECK FOR COMMUNICATION WITH THE ACM AND APIM

- Carry out the network test using the scan tool.
- **Does the scan tool communicate with the ACM, the RETM, and the APIM (if equipped)?**

  YES : Go to I4.

NO : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose no communication with the ACM or APIM.

I4 CHECK FOR LOST COMMUNICATION DTCs

- Key in ON position.
- Using the scan tool, clear any ACM and SDARS module continuous DTCs.
- Key in OFF position.
- Key in ON position.
- Wait at least 10 seconds.
- Retrieve the ACM and SDARS module continuous DTCs.
- **Is DTC U0184 (SDARS module), U0193 (ACM), U0196 (SDARS module), or U0197 (SDARS module, if equipped with the SYNC system) present?**

  YES : For DTC U0184, go to I16.

  For DTC U0193, go to I13.

  For DTC U0197, go to I14.

  For DTC U0196, go to I15.

  NO : Go to I5.

I5 CHECK THE SATELLITE AUDIO OUTPUT

- Enter the following diagnostic mode on the diagnostic tool: SDARS Module Tones Test
- Carry out the SDARS module tones test.
- **Are alternating LH/RH tones audible?**

  YES : Go to I13.

  NO : Go to I6.

I6 CHECK THE OPERATION OF THE DVD AUDIO

- Insert a known good DVD, and operate the audio system in DVD mode.
- Observe the audio output from the DVD.
- **Does the DVD audio operate correctly?**

  YES : If the vehicle is equipped with the SYNC system, go to I7.

  Otherwise, go to I11.

  NO : Go to **Symptom Chart - Audio System** to diagnose the observed symptom.

I7 CHECK THE AUDIO CIRCUITS TO THE APIM FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SDARS Module C4344
- Disconnect: APIM C3342
- Key in ON position.

- Measure the voltage between the SDARS module, harness side and ground as follows:

Connector-Pin	Circuit
C4344-5	VME41 (GN/OG)
C4344-6	VME42 (VT/BN)
C4344-11	RME41 (BU/BN)
C4344-12	RME42 (YE/BU)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to I8.

I8 CHECK THE AUDIO CIRCUITS TO THE APIM FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the SDARS module, harness side and the APIM, harness side; and between the SDARS module, harness side and ground as follows:

SDARS Module Connector-Pin	APIM Connector-Pin	Circuit
C4344-5	C3342-10	VME41 (GN/OG)
C4344-6	C3342-7	VME42 (VT/BN)
C4344-11	C3342-11	RME41 (BU/BN)
C4344-12	C3342-8	RME42 (YE/BU)

- **Is the resistance less than 5 ohms between the SDARS module and the APIM, and greater than 10,000 ohms between the SDARS module and ground?**

  YES : Go to I9.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

I9 CHECK THE AUDIO CIRCUITS FROM THE APIM TO THE RETM FOR A SHORT TO VOLTAGE

- Disconnect: RETM C949
- Key in ON position.

- Measure the voltage between the RETM, harness side and ground as follows:

Connector-Pin	Circuit
C949-5	VME41 (GN/OG)
C949-6	RME41 (BU/BN)
C949-21	VME42 (VT/BN)
C949-22	RME42 (YE/BU)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to I10.

I10 CHECK THE AUDIO CIRCUITS FROM THE APIM TO THE RETM FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the APIM, harness side and the RETM, harness side; and between the APIM, harness side and ground as follows:

APIM Connector-Pin	RETM Connector-Pin	Circuit
C3342-40	C949-5	VME41 (GN/OG)
C3342-41	C949-6	RME41 (BU/BN)
C3342-42	C949-21	VME42 (VT/BN)
C3342-43	C949-22	RME42 (YE/BU)

- **Is the resistance less than 5 ohms between the APIM and the RETM, and greater than 10,000 ohms between the APIM and ground?**

  YES : Go to I13.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

I11 CHECK THE AUDIO CIRCUITS FROM THE SDARS MODULE FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SDARS Module C4344

- Disconnect: RETM C949
- Key in ON position.
- Measure the voltage between the SDARS module, harness side and ground as follows:

Connector-Pin	Circuit
C4344-5	VME41 (GN/OG)
C4344-6	VME42 (VT/BN)
C4344-11	RME41 (BU/BN)
C4344-12	RME42 (YE/BU)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to I12.

I12 CHECK THE AUDIO CIRCUITS FROM THE SDARS MODULE FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the SDARS module, harness side and the RETM, harness side; and between the SDARS module, harness side and ground as follows:

SDARS Module Connector-Pin	RETM Connector-Pin	Circuit
C4344-5	C949-5	VME41 (GN/OG)
C4344-6	C949-21	VME42 (VT/BN)
C4344-11	C949-6	RME41 (BU/BN)
C4344-12	C949-22	RME42 (YE/BU)

- **Is the resistance less than 5 ohms between the SDARS module and the RETM, and greater than 10,000 ohms between the SDARS module and ground?**

  YES : Go to I13.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

I13 ISOLATE THE SDARS MODULE

- Key in OFF position.
- Connect: RETM C949
- Connect: APIM C3342 (If Equipped)
- Install a new SDARS module. Refer to **Satellite Digital Audio Receiver System (SDARS) Module**.
- Operate the audio system in satellite radio mode.
- **Does the system operate correctly?**

  YES : The concern was caused by an inoperative SDARS module. The system is operating correctly at this time.

  NO : If equipped with the SYNC system, go to I14.

  Otherwise, go to I15.

I14 CHECK FOR CORRECT APIM OPERATION

- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation. If the concern is still present, go to I15.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

I15 CHECK FOR CORRECT RETM OPERATION

- Disconnect the RETM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the RETM connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new RETM. REFER to **Rear Entertainment Module (RETM)**. TEST the system for normal operation. If the concern is still present, go to I16.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose

or corroded connector.

I16 CHECK FOR CORRECT ACM OPERATION

- Key in OFF position.
- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test J: Poor Reception/No Sound - Satellite Audio

Normal Operation

Digital signals are received by the satellite radio antenna and sent to the satellite digital audio receiver system (SDARS) module, which then converts the signals and provides analog audio signals to the audio control module (ACM), the accessory protocol interface module (APIM), or to the rear entertainment module (RETM), depending on vehicle configuration.

A short to ground typically has no effect on the antenna signal. However, an open in the antenna circuit will result in no sound from the satellite radio system. A short to voltage in the antenna circuit can have varying effects on the system.

- DTC B1031 (SDARS Satellite Antenna Open) - sets when an open or high resistance is detected in the satellite antenna circuit. This DTC can be either continuous or on-demand.
- DTC B1032 (SDARS Satellite Antenna Short) - sets when a short to ground or short to voltage is detected in the satellite antenna circuit. This DTC can be either continuous or on-demand.

This pinpoint test is intended to diagnose the following:

- Obstructions to the line of sight
- Satellite radio antenna cable
- Satellite radio antenna
- SDARS module

PINPOINT TEST J: POOR RECEPTION/NO SOUND - SATELLITE AUDIO

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

J1 CHECK THE OPERATION OF THE SATELLITE AUDIO SYSTEM

- Drive the vehicle to an open location, free of obstacles.
- Operate the audio system in satellite audio mode.
- **Is the reception OK?**

  YES : The system is OK at this time. ADVISE the customer that the satellite signal can be affected by obstructions to the satellite radio antenna line of sight.

  NO : Go to J2.

J2 CHECK FOR A SATELLITE ANTENNA FAULT MESSAGE

- Operate the audio system in satellite audio mode and observe the ACM display.
- **Does the ACM display indicate a satellite radio antenna fault?**

  YES : Go to J3.

  NO : For vehicles without a DVD entertainment system, go to **Pinpoint Test H** .

  For vehicles with a DVD entertainment system, go to **Pinpoint Test I** .

J3 CHECK THE SATELLITE RADIO ANTENNA CABLE

- Key in OFF position.
- Disconnect: Satellite Radio Antenna Connection (At SDARS Module)
- Disconnect: Satellite Radio Antenna Connection (At Satellite Radio Antenna)
- Measure the resistance of the satellite radio antenna cable between the SDARS module and the satellite radio antenna connection.
- **Is the resistance less than 1 ohm?**

  YES : Go to J4.

  NO : INSTALL a new satellite radio antenna cable. REFER to **Antenna Cable - Satellite Radio**. CLEAR any DTCs present. TEST the system for normal operation.

J4 SUBSTITUTE THE SATELLITE RADIO ANTENNA

- Install a known good satellite radio antenna.
- Operate the audio system in satellite audio mode.
- **Is the reception OK?**

  YES : INSTALL a new satellite radio antenna. REFER to **Antenna - Satellite Radio**. CLEAR any DTCs present. TEST the system for normal operation.

  NO : Go to J5.

J5 CHECK FOR CORRECT SDARS MODULE OPERATION

- Key in OFF position.
- Disconnect the SDARS module connector.
- Check for:
  - corrosion
  - damaged pins

    - pushed-out pins
  - Connect the SDARS module connector and make sure it seats correctly.
  - Operate the system and determine if the concern is still present.
  - **Is the concern still present?**

    YES : INSTALL a new SDARS module. REFER to **Satellite Digital Audio Receiver System (SDARS) Module**. TEST the system for normal operation.

    NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test K: The Video System Is Inoperative/Does Not Operate Correctly

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Audio System/Navigation for schematic and connector information.

Normal Operation

The rear entertainment module (RETM) routes audio signals to the audio control module (ACM). In single-play mode, the ACM plays the DVD audio on all speakers. In dual-play mode, the audio to the rear speakers is muted and the RETM continues to control the rear audio source to the headphones.

If the vehicle is equipped with satellite audio and/or the SYNC system, the audio signals from these sources are routed through the RETM to the ACM. This allows for single-play and dual-play to include these audio sources.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- RETM
- ACM

PINPOINT TEST K: THE VIDEO SYSTEM IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Before diagnosing the RETM, make sure a known good DVD is installed.

K1 IDENTIFY THE SYMPTOM

  - Operate the audio system in DVD single-play mode and observe the DVD audio.
  - **Does the DVD audio operate correctly?**

    YES : Go to K2.

    NO : If the vehicle is equipped with satellite audio or the SYNC system, go to K3.

    Otherwise, go to K4.

K2 CHECK THE OPERATION OF THE DVD VIDEO

- Operate the audio system in DVD single-play mode.
- **Does the DVD video operate correctly?**

  YES : The system is operating correctly at this time. The concern was caused by an incorrect system setting. INFORM the customer that pressing the power button or the VIDEO button while a DVD is playing can cause the display to go blank.

  NO : Go to K6.

K3 CHECK THE RETM AUDIO PASS-THROUGH

- Operate the audio system in satellite audio or SYNC mode.
- **Does the satellite audio (or SYNC) audio operate correctly?**

  YES : Go to K6.

  NO : Go to K4.

K4 CHECK THE AUDIO CIRCUITS TO THE ACM FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C240b
- Disconnect: RETM C949
- Key in ON position.
- Measure the voltage between the ACM, harness side and ground as follows:

Connector-Pin	Circuit
C240b-1	VME17 (GN)
C240b-2	RME17 (GY)
C240b-9	VME18 (VT)
C240b-10	RME18 (YE)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to K5.

K5 CHECK THE AUDIO CIRCUITS TO THE ACM FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the ACM, harness side and the RETM, harness side; and between the ACM, harness side and ground as follows:

ACM Connector-	RETM Connector-	Circuit

Pin	Pin	
C240b-1	C949-10	VME17 (GN)
C240b-2	C949-9	RME17 (GY)
C240b-9	C949-26	VME18 (VT)
C240b-10	C949-25	RME18 (YE)

- **Is the resistance less than 5 ohms between the ACM and the RETM, and greater than 10,000 ohms between the ACM and ground?**

  YES : Go to K6.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

K6 CHECK FOR CORRECT RETM OPERATION

- Disconnect all the RETM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the RETM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new RETM. REFER to **Rear Entertainment Module (RETM)**. TEST the system for normal operation. If the concern is still present, Go to K7

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

K7 CHECK FOR CORRECT ACM OPERATION

- Key in OFF position.
- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose

or corroded connector.

Pinpoint Test L: No Auxiliary Headphone Audio - THX®

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Audio System/Navigation for schematic and connector information.

Normal Operation

The audio control module (ACM) receives audio input from the rear entertainment module (RETM). The audio signals are then routed to the audio digital signal processing (DSP) module. In dual-play mode, the rear speaker audio is muted and the RETM controls the rear audio source to the headphones.

It is important to note that if the vehicle is equipped with the SYNC system, the headphones must be set to channel A in order to listen to SYNC media. Channel B only allows audio from the RETM, which can be either DVD audio or audio from a peripheral device plugged into the RETM.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Headphones
- RETM

PINPOINT TEST L: NO AUXILIARY HEADPHONE AUDIO - THX®

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Before diagnosing this condition, make sure the headphone batteries are OK.

L1 CHECK THE OPERATION OF THE BASE AUDIO SYSTEM

- Operate the audio system in radio tuner (AM/FM) mode.
- **Does the audio system operate correctly?**

  YES : Go to L2.

  NO : Go to **Symptom Chart - Audio System**.

L2 CHECK THE ACM OUTPUT TO THE RETM

- Key in OFF position.
- Disconnect: RETM C949

NOTE: Make sure the headphones are set to "Radio" as their audio source.

- Operate the audio system in radio tuner (AM/FM) dual-play mode.
- Measure the AC voltage between the RETM pins, harness side as follows:

Connector-Pin/Circuit	Connector-Pin/Circuit
C949-11 VME12 (BN/WH)	C949-12 RME12 (BN/BU)
C949-27 VME09 (WH/GN)	C949-28 RME09 (BN/YE)

- **Is a fluctuating AC voltage present?**

  YES : Go to L5.

  NO : Go to L3.

L3 CHECK THE AUDIO CIRCUITS FROM THE ACM FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C240a
- Key in ON position.
- Measure the voltage between the ACM, harness side and ground as follows:

Connector-Pin	Circuit
C240a-9	VME09 (WH/GN)
C240a-10	VME12 (BN/WH)
C240a-22	RME09 (BN/YE)
C240a-23	RME12 (BN/BU)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to L4.

L4 CHECK THE AUDIO CIRCUITS FROM THE ACM FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the ACM, harness side and the RETM, harness side; and between the ACM, harness side and ground as follows:

ACM Connector-Pin	RETM Connector-Pin	Circuit
		VME09

C240a-9	C949-27	(WH/GN)
C240a-10	C949-11	VME12 (BN/WH)
C240a-22	C949-28	RME09 (BN/YE)
C240a-23	C949-12	RME12 (BN/BU)

- **Is the resistance less than 5 ohms between the ACM and the RETM, and greater than 10,000 ohms between the ACM and ground?**

  YES : Go to L5.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

L5 ISOLATE THE HEADPHONES

- Connect: ACM C240a
- Connect: RETM C949
- Install a set of known good headphones.

NOTE: Make sure the headphones are set to "Radio" as their audio source.

- Operate the audio system in radio tuner (AM/FM) dual-play mode and listen through the headphones.
- **Do the headphones operate correctly?**

  YES : The concern was caused by inoperative headphones. The system is OK at this time.

  NO : Go to L6.

L6 CHECK FOR CORRECT RETM OPERATION

- Key in OFF position.
- Disconnect the RETM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the RETM connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new RETM. REFER to **Rear Entertainment Module (RETM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test M: No Global Positioning System (GPS) Antenna Signal

Normal Operation

The global positioning system (GPS) antenna provides information from the GPS satellite system to the GPS receiver in the navigation module (part of the navigation audio control module [ACM]). This information is used to calculate vehicle position and direction of travel.

- DTC B2204 (GPS Antenna Connection Open or Short) - sets when an open or short to ground is detected in the GPS antenna circuit.

This pinpoint test is intended to diagnose the following:

- GPS antenna
- ACM

PINPOINT TEST M: NO GLOBAL POSITIONING SYSTEM (GPS) ANTENNA SIGNAL

M1 CHECK THE OPERATION OF THE NAVIGATION SYSTEM

- Move the vehicle outside of any enclosed structure to an area that is unobstructed by trees, tall buildings, and bridges.

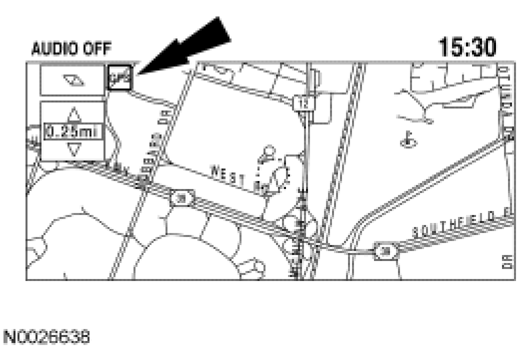

Fig. 16: Checking Operation Of Navigation System
Courtesy of FORD MOTOR CO.

- Operate the audio system in navigation mode.
- **Does the GPS icon appear, then disappear?**

  YES : The system is operating correctly at this time. NOTIFY the customer that obstructions to the line of sight may affect the GPS antenna.

  NO : Go to M2.

M2 CHECK THE ACM DTCs

- Retrieve the ACM continuous and on-demand DTCs.
- **Is DTC B2204 recorded?**

  YES : Go to M4.

  NO : Go to M3.

M3 CHECK THE GPS ANTENNA MOUNTING

- Verify the GPS antenna is installed correctly and no aftermarket equipment is obstructing the antenna.
- **Is the GPS antenna mounted correctly?**

  YES : Go to M4.

  NO : Correctly INSTALL the GPS antenna. REFER to **Global Positioning System (GPS) Antenna**. TEST the system for normal operation.

M4 SUBSTITUTE THE GPS ANTENNA

- Install a known good GPS antenna.
- Move the vehicle outside of any enclosed structure to an area that is unobstructed by trees, tall buildings, and bridges.

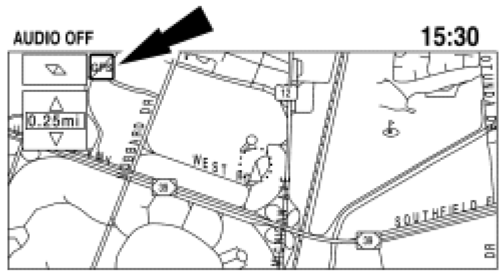

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Fig. 17: Checking Operation Of Navigation System
Courtesy of FORD MOTOR CO.

- Operate the audio system in navigation mode.
- **Does the GPS icon appear, then disappear?**

  YES : INSTALL a new GPS antenna. REFER to **Global Positioning System (GPS) Antenna**. CLEAR any DTCs present. TEST the system for normal operation.

  NO : INSTALL the original GPS antenna. Go to M5.

M5 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test N: The Audible Switch Feedback Is Inoperative

Normal Operation

The audible switch feedback settings are controlled by the audio control module (ACM). The audible switch feedback can be set to ALL, TOUCH SCREEN, or NONE, depending on user preference.

This pinpoint test is intended to diagnose the following:

- Audible switch feedback setting
- ACM

PINPOINT TEST N: THE AUDIBLE SWITCH FEEDBACK IS INOPERATIVE

N1 CHECK THE SWITCH DISPLAY

- Turn the ACM on.
- Press the MENU button.

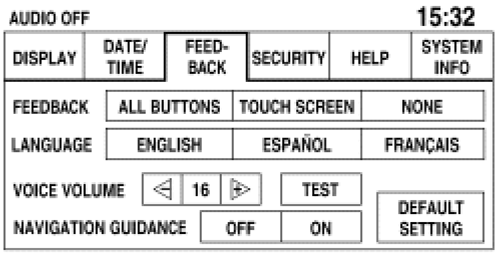

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Fig. 18: Checking Switch Display
Courtesy of FORD MOTOR CO.

- Select the FEEDBACK tab.
- **Is NONE highlighted on the audible feedback settings?**

  YES : SELECT "ALL BUTTONS". TEST the system for normal operation.

  NO : Go to N2.

N2 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.

- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test O: The Voice Guidance Is Inoperative/Does Not Operate Correctly

Normal Operation

The voice guidance settings are controlled by the audio control module (ACM). The voice guidance volume can be adjusted or turned off depending on user preference.

For the THX® audio system, the ACM sends the voice guidance signal to the audio digital signal processing (DSP) module through circuits VME22 (VT/GN) and RME22 (GN/WH).

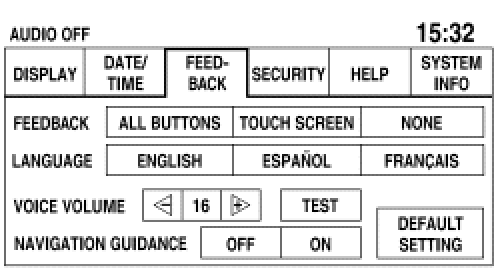
This pinpoint test is intended to diagnose the following:

- Incorrect system setting
- Wiring, terminals or connectors (THX® only)
- DSP module (if equipped)
- ACM

PINPOINT TEST O: THE VOICE GUIDANCE IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

O1 CHECK THE VOICE GUIDANCE SETTINGS

- Operate the audio system in navigation mode.
- Press the MENU button.



N0026637

Fig. 19: Checking Switch Display
Courtesy of FORD MOTOR CO.

- Select the FEEDBACK tab.
- Select DEFAULT SETTING.

- Verify the operation of the voice guidance.
- **Does the voice guidance operate correctly?**

  YES : The system is operating correctly at this time. The concern was caused by a customer-selected setting.

  NO : If the vehicle is equipped with THX® audio, go to O2.

  Otherwise, go to O4.

O2 CHECK THE VOICE SIGNAL CIRCUITS TO THE DSP MODULE FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C240c
- Disconnect: DSP Module C4348a
- Key in ON position.

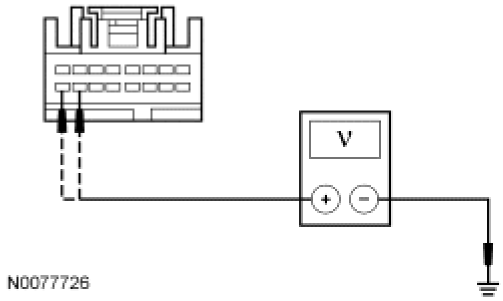


Fig. 20: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the DSP module C4348a-15, circuit VME22 (VT/GN), harness side and ground; and between the DSP module C4348a-16, circuit RME22 (GN/WH), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to O3.

O3 CHECK THE VOICE SIGNAL CIRCUITS TO THE DSP MODULE FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the DSP module and the ACM, harness side; and between the DSP module, harness side and ground as follows:

DSP Module Connector-	ACM Connector-Pin	Circuit

Pin		
C4348a-15	C240c-1	VME22 (VT/GN)
C4348a-16	C240c-2	RME22 (GN/WH)

- **Is the resistance less than 5 ohms between the DSP module and the ACM, and greater than 10,000 ohms between the DSP module and ground?**

  YES : Go to O5.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

O4 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

O5 CHECK FOR CORRECT DSP MODULE OPERATION

- Key in OFF position.
- Disconnect all the DSP module connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the DSP module connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DSP module. REFER to **Audio Digital Signal Processing (DSP) Module**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test P: The Position Cursor Is Inaccurate

Normal Operation

The primary source of vehicle location for the navigation system is the audio control module (ACM) receiving the position signal through the global positioning system (GPS) antenna.

In addition, the ACM receives the wheel pulse signal from the instrument cluster (IC), which gateways the signal from the ABS module. This secondary signal is used to calculate vehicle position when the GPS signal is lost. It also supports the adaptive learning function of the ACM, whereby the ACM can compensate for long-term differences between the GPS signal location, and the actual distance traveled by the vehicle.

- DTC B2204 (GPS Antenna Connection Open or Short) - sets when an open, short to ground, or short to voltage is detected in the GPS antenna circuit. If DTC B2204 is present, go to **Pinpoint Test M** .
- DTC U0155 (Lost Communication With Instrument Panel Cluster [IC] Control Module) - sets when the ACM is missing messages from the IC for greater than 5 seconds. For this symptom, the message in question is the wheel pulse data message.
- DTC U2473 (Unexpected Vehicle Speed [VSS]) - sets when the calculated vehicle distance traveled based on the wheel pulse signal does not agree with the GPS antenna location. To do this, the ACM compares the wheel pulse signal during a 4-second range and compares it with the change in GPS antenna location. If the ACM finds that the variation is greater than 0.5% after carrying out this check 4 times, it sets DTC U2473. When DTC U2473 is set, the adaptive learn function is disabled. This DTC is also set when the navigation rolling wheel count signal is missing for greater than 2 seconds with the key in RUN.

This pinpoint test is intended to diagnose the following:

- VSS signal concern
- ACM

PINPOINT TEST P: THE POSITION CURSOR IS INACCURATE

P1 CHECK THE OPERATION OF THE NAVIGATION SYSTEM

- Move the vehicle outside of any enclosed structure to an area that is unobstructed by trees, tall buildings, and bridges.

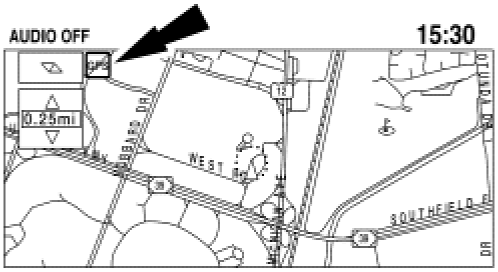


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Fig. 21: Checking Operation Of Navigation System
Courtesy of FORD MOTOR CO.

- Operate the audio system in navigation mode.
- **Does the GPS icon appear, then disappear?**

  YES : Go to P2.

  NO : Go to **Pinpoint Test M** .

P2 CHECK THE ACM DTCs

- Retrieve the continuous DTCs from the ACM self-test.
- **Is DTC U2473 or U0155 present?**

  YES : Go to P3.

  NO : Go to **Pinpoint Test M** .

P3 CHECK FOR COMMUNICATION WITH THE IC

- Carry out the network test using the scan tool.
- **Does the scan tool communicate with the IC?**

  YES : Go to P4.

  NO : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose no communication with the IC.

P4 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test Q: The Audio Does Not Reduce When The Parking Aid Tone Sounds

Normal Operation

The parking aid module (PAM) sends the volume cutback message to the audio control module (ACM) via the medium speed controller area network (MS-CAN). When the ACM receives this message, it reduces the speaker output so that the parking aid tone can be heard more clearly.

- DTC U0159 (Lost Communication With Parking Assist Control Module [PAM]) - sets when the volume cutback message is missing for greater than 5 seconds. When the message is missing, the ACM defaults to no volume cutback when the parking aid tone is sounding.

This pinpoint test is intended to diagnose the following:

- Parking aid system concern
- ACM

PINPOINT TEST Q: THE AUDIO DOES NOT REDUCE WHEN THE PARKING AID TONE SOUNDS

Q1 CHECK THE ACM CONFIGURATION

- Apply the parking brake.
- Place an object behind the vehicle within the range of the parking aid sensors. Refer to **PARKING AID** article.
- Key in ON position.
- Place the transmission in REVERSE (R).
- Enter the following diagnostic mode on the diagnostic tool: ACM DataLogger
- Monitor the RPA_STAT (Parking Aid Input Status) PID while the parking aid tone is sounding.
- **Does the RPA_STAT PID read "Enabled" while the parking aid tone is sounding?**

  YES : Go to Q2.

  NO : REFER to **PARKING AID** article to continue diagnosis of the parking aid system.

Q2 CHECK FOR COMMUNICATION WITH THE PAM

- Carry out the network test using the scan tool.
- **Does the scan tool communicate with the PAM?**

  YES : Go to Q3.

  NO : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose no communication with the PAM.

Q3 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test R: Voice Recognition Is Inoperative/Does Not Operate Correctly - Vehicles Without The

SYNC System

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Audio System/Navigation for schematic and connector information.

Normal Operation

When the VOICE switch is pressed, it changes the reference voltage from the audio control module (ACM) on circuit VMN54 (BU/OG), and the ACM enters voice recognition mode. A microphone located in the interior rear view mirror receives the voice command and sends a signal to the ACM through circuits VMM13 (YE/GN) and RMM13 (BU). Power to the interior rear view mirror is provided through circuit CBP41 (BU). Ground is provided through circuit GD133 (BK).

The microphone test is available through the integrated diagnostic system (IDS). Running this test causes the ACM to produce a test tone. If the system is operating correctly, the microphone detects the tone and produces a signal to the ACM indicating the tone was heard.

- DTC B2633 (Driver-Front Microphone Circuit Failure) - set by the ACM during the microphone test when the ACM does not receive an adequate signal from the microphone when the test tone is sounded.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Steering wheel controls
- Microphone (part of the interior rear view mirror)
- ACM

PINPOINT TEST R: VOICE RECOGNITION IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - VEHICLES WITHOUT THE SYNC SYSTEM

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

R1 CHECK THE OPERATION OF THE STEERING WHEEL CONTROLS

- Operate the audio system in radio tuner (AM/FM) mode.
- Press the VOICE button on the steering wheel controls.
- **Does the audio system enter voice recognition mode?**

  YES : Go to R2.

  NO : Go to **Pinpoint Test F** \ to diagnose the steering wheel controls system.

R2 CHECK CIRCUIT CBP41 (BU) FOR VOLTAGE

- Key in OFF position.
- Disconnect: Interior Rear View Mirror C911

- Key in ON position.

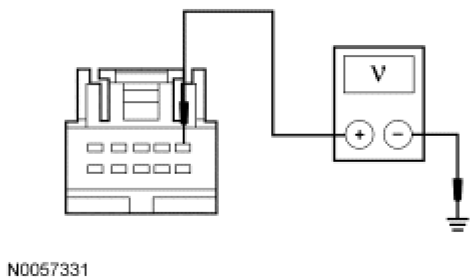


Fig. 22: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the interior rear view mirror C911-1, circuit CBP41 (BU), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to R3.

  NO : VERIFY the smart junction box (SJB) fuse 41 (15A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. If not OK, REFER to appropriate SYSTEM WIRING DIAGRAMS article to identify the possible sources of the circuit short.

R3 CHECK CIRCUIT GD133 (BK) FOR AN OPEN

- Key in OFF position.

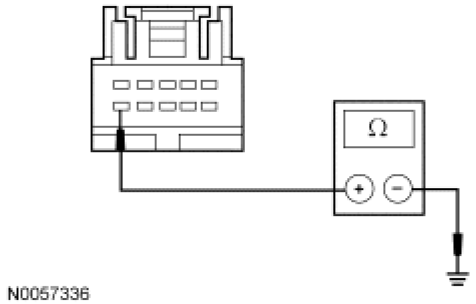


Fig. 23: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the interior rear view mirror C911-10, circuit GD133 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to R4.

  NO : REPAIR the circuit. TEST the system for normal operation.

R4 CHECK THE MICROPHONE CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect: ACM C240b
- Key in ON position.

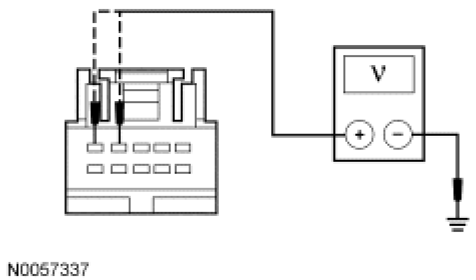


Fig. 24: Checking Circuits For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the interior rear view mirror C911-4, circuit VMM13 (YE/GN), harness side and ground; and between the interior rear view mirror C911-5, circuit RMM13 (BU), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to R5.

R5 CHECK THE MICROPHONE CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the inside rear view mirror, harness side and the ACM, harness side; and between the interior rear view mirror, harness side and ground as follows:

Interior Rear View Mirror Connector-Pin/Circuit	ACM Connector-Pin/Circuit
C911-4 VMM13 (YE/GN)	C240b-11 VMN01 (BU/BN)
C911-5 RMM13 (BU)	C240b-12 RMN01 (GN)

- **Is the resistance less than 5 ohms between the interior rear view mirror and the ACM, and greater than 10,000 ohms between the interior rear view mirror and ground?**

  YES : Go to R6.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

R6 ISOLATE THE INTERIOR REAR VIEW MIRROR

- Connect: ACM C240b
- Install a new interior rear view mirror. Refer to **REAR VIEW MIRRORS** article.
- Operate the audio system in radio tuner (AM/FM) mode.
- Press the VOICE button on the steering wheel controls, and attempt several voice commands.
- **Does the voice recognition operate correctly?**

  YES : The fault was caused by an inoperative inside rear view mirror. The system is now operating correctly.

  NO : Go to R7.

R7 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test S: The SYNC System Is Completely Inoperative

Normal Operation

The accessory protocol interface module (APIM) receives voltage at all times from circuit SBP03 (BU/RD), and ground through circuit GD148 (BK/YE). The wake-up signal is sent to the APIM by the audio control module (ACM) via the medium speed controller area network (MS-CAN).

- DTC U0184 (Lost Communication With Radio [ACM]) - set by the APIM when it is missing messages from the ACM over the MS-CAN for greater than 5 seconds.
- DTC U0196 (Lost Communication With Entertainment Control Module - Rear [AUX]) - set by the APIM when it is missing messages from the rear entertainment module (RETM) over the MS-CAN for greater than 5 seconds.
- DTC U0197 (Lost Communication With Telephone Control Module) - set by the ACM when it is missing messages from the APIM over the MS-CAN for greater than 5 seconds.

This pinpoint test is intended to diagnose the following:

- Audio system concern

- Communication network concern
- Customer error
- Customer device
- APIM
- ACM

PINPOINT TEST S: THE SYNC SYSTEM IS COMPLETELY INOPERATIVE

NOTE:	**Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

S1 CHECK THE AUDIO SYSTEM OPERATION

- Press the AUX button repeatedly until "SYNC LINE IN" appears on the display (except navigation), or look for the presence of the "USER DEVICE" tab (navigation).
- **Is "SYNC LINE IN" available when pressing the AUX button (except navigation), or is the "USER DEVICE" tab present (navigation)?**

  YES : Go to S2.

  NO : Go to S3.

S2 CHECK THE SYNC SYSTEM OPERATION

- Connect: Known Good MP3 Device (To Audio Input Jack)

NOTE:	**Make sure no universal serial bus (USB) device is plugged-in, and no Bluetooth® device is active for this step.**

- Using the ACM buttons, press AUX until "SYNC LINE IN" appears on the display (except navigation), or press MEDIA, select "USER DEVICE", and press "SOURCE" repeatedly until "LINE IN" appears (navigation).
- Using the known good MP3 device, attempt to play a file using the audio input jack.
- Disconnect: Known Good MP3 Device (From Audio Input Jack)
- Connect: Known Good USB Device (To USB Port)
- Using the ACM buttons, press AUX until "SYNC USB" appears on the display (except navigation), or press MEDIA, select "USER DEVICE", and press "SOURCE" repeatedly until "USB" appears (navigation).

NOTE:	**If a USB mass storage device is used to play the audio files, the SYNC system will only play audio files that do not have digital rights management (DRM) protection.**

- Using a known good MP3 device or a mass storage device, attempt to play a file using the USB port.
- Disconnect: Known Good USB Device (From USB Port)

- Using a known good Bluetooth® device capable of streaming audio, attempt to pair to the APIM using Bluetooth®, and attempt to play an audio file using Bluetooth® connection. Refer to the Owner's Literature.
- **Do all of the SYNC inputs function correctly?**

  YES : The SYNC system is operating correctly. REVIEW the system operation with the customer. If the customer device still does not operate correctly, the fault is with the customer device.

  NO : If only some of the inputs are inoperative, go to **Symptom Chart - SYNC System** to diagnose the observed symptom.

  If all inputs have poor quality/distorted sound, go to **Pinpoint Test U** .

S3 CHECK FOR SCAN TOOL COMMUNICATION

- Carry out the network test using the scan tool.
- **Does the APIM pass the network test?**

  YES : Go to S4.

  NO : REFER to **MODULE COMMUNICATIONS NETWORK** article.

S4 CHECK FOR CORRECT APIM OPERATION

- Key in OFF position.
- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pints
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initialize.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test T: Unable To Pair Bluetooth® Device

Normal Operation

When a new Bluetooth® device is added, the accessory protocol interface module (APIM) and the Bluetooth® device must be paired together. Most Bluetooth® devices will pair with the SYNC system, although functionality will vary. To determine if a Bluetooth® device is supported, retrieve the consumer interface processor (CIP) software level using the **Accessory Protocol Interface Module (APIM) Software Level Check** , and verify the customer device is on the compatibility list for the current CIP software level.

Pairing a Bluetooth® device is accomplished through the "Add Device" selection of the phone menu. When pairing a device, the SYNC system generates a unique personal identification number (PIN) that must be entered on the Bluetooth® device in order for the pairing process to be successful. There are also some device-specific actions that must take place. For additional information on the pairing process, refer to the Owner's Literature.

This pinpoint test is intended to diagnose the following:

- Incompatible Bluetooth® device
- Customer error
- Customer Bluetooth® device
- APIM

PINPOINT TEST T: UNABLE TO PAIR BLUETOOTH® DEVICE

T1 CHECK THE BLUETOOTH® CONNECTION

NOTE: Carrying out a Master Reset will return all preference settings to the factory defaults, erase all the phone book and call histories and delete any devices paired with the SYNC system.

NOTE: Refer to www.syncmyride.com for a list of compatible devices.

- Using a known good Bluetooth® device, attempt to pair to the SYNC system using Bluetooth®. Refer to the Owner's Literature.
- Enter the following diagnostic mode on the diagnostic tool: APIM DataLogger
- Monitor the BT_PAIR (Bluetooth® device paired) and BT_CONN (Bluetooth® device connected) PIDs.
- **Do the BT_PAIR and BT_CONN PIDs both read "Yes"?**

  YES : The SYNC system is operating correctly at this time. CARRY OUT a SYNC system Master Reset.

  For vehicles without navigation, PRESS the "PHONE" button on the steering wheel controls, SCROLL until "SYSTEM SETTINGS" displays on the screen, PRESS "OK", SCROLL until "ADVANCED" displays on the screen, PRESS "OK", SCROLL until "MASTER RESET" displays on the screen, and PRESS "OK" twice.

  For vehicles with navigation, PRESS "PHONE" on the ACM display, SELECT the "SETTINGS" tab, PRESS "ADVANCED", SELECT "Master Reset", and PRESS "YES".

  REVIEW the pairing process with the customer. If the customer device still does not pair, the fault is with the customer device.

  NO : Go to T2.

T2 CHECK FOR CORRECT APIM OPERATION

- Key in OFF position.
- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pints
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initialize.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test U: The Universal Serial Bus (USB) Port Is Inoperative/Does Not Operate Correctly

Normal Operation

The universal serial bus (USB) port is connected to the accessory protocol interface module (APIM) through the USB cable. The USB port can be used for mass storage devices, or for connecting a media device.

If supported by the user device, the USB can provide charging. Because of this feature, when a USB device is plugged into the USB port, the SYNC system does not automatically switch to the device.

The USB cable and port are not serviceable separately.

- DTC U261C (USB #1 Device Error) - sets when the APIM detects an over-current or over-temperature condition in the USB circuit. This can be caused by a fault in the USB cable or port, or by the customer USB device.

This pinpoint test is intended to diagnose the following:

- Customer USB device
- USB cable and port
- APIM

PINPOINT TEST U: THE UNIVERSAL SERIAL BUS (USB) PORT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

U1 CHECK THE USB CONNECTION

- Connect: Known Good USB Device (To USB Port)

- Using the ACM buttons, press AUX until "SYNC USB" appears on the display (except navigation), or press AUX until "SYNC USB" appears on the display (except navigation), or press MEDIA, select "USER DEVICE", and press "SOURCE" repeatedly until "USB" appears (navigation)

NOTE: **If a USB mass storage device is used to play the audio files, SYNC will only play audio files that do not have digital rights management (DRM) protection.**

- Using a known good MP3 device or a mass storage device, attempt to play a file using the USB port.
- **Does the known good device successfully play an audio file using the USB connection?**

  YES : The SYNC system is operating correctly. REVIEW the operation of the USB port with the customer. If the customer device still does not operate correctly, the fault is with the customer device.

  NO : Go to U2.

U2 INSPECT THE USB CABLE

- Key in OFF position.
- Disconnect: USB Cable (At APIM)
- Inspect the USB cable for damage.
- Connect: USB Cable (At APIM)
- Key in ON position.
- Using the ACM buttons, press AUX until "SYNC USB" appears on the display (except navigation), or press AUX until "SYNC USB" appears on the display (except navigation), or press MEDIA, select "USER DEVICE", and press "SOURCE" repeatedly until "USB" appears (navigation).
- Using a known good MP3 device or a mass storage device, attempt to play a file using the USB port.
- **Does the known good device successfully play an audio file using the USB connection?**

  YES : The concern was caused by the USB connection not being seated correctly. The system is now operating correctly.

  NO : Go to U3.

U3 ISOLATE THE USB CABLE AND PORT

- Disconnect: Known Good USB Device (From USB Port)
- Install a new USB cable and port. Refer to **Universal Serial Bus (USB) Cable and Port**.
- Connect: Known Good USB Device (To USB Port)
- Using the ACM buttons, press AUX until "SYNC USB" appears on the display (except navigation), or press AUX until "SYNC USB" appears on the display (except navigation), or press MEDIA, select "USER DEVICE", and press "SOURCE" repeatedly until "USB" appears (navigation).
- Using a known good MP3 device or a mass storage device, attempt to play a file using the USB port.
- **Does the known good device successfully play an audio file using the USB connection?**

  YES : The concern was caused by an inoperative USB cable. The system is now operating correctly.

NO : Go to U4.

U4 CHECK FOR CORRECT APIM OPERATION

- Key in OFF position.
- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pints
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initialize.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test V: The SYNC System Audible Prompts Are Inoperative/Do Not Operate Correctly

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Audio System/Navigation for schematic and connector information.

Normal Operation

The text-to-speech (TTS) and voice prompt features speak certain text information and interaction requests in order to minimize driver distraction by having to look at the audio control module (ACM) while driving. The ring tone alerts the driver to an incoming call.

Audible prompts can range from a simple tone to more elaborate spoken text, based on the customer setting. When interaction mode is set to standard, detailed guidance is provided. When interaction mode is set to advanced, most prompts are tones only and minimal audible guidance is provided. Refer to the Owner's Literature for further information on voice interaction.

The audio signals for the TTS and voice prompt features, the ring tones, and audio from the outside device during a phone call, are sent from a accessory protocol interface module (APIM) to the ACM through circuits VMN14 (WH/VT) and RMN14 (GY/BN).

This pinpoint test is intended to diagnose the following:

- Customer setting
- Wiring, terminals or connectors
- ACM

- APIM

PINPOINT TEST V: THE SYNC SYSTEM AUDIBLE PROMPTS ARE INOPERATIVE/DO NOT OPERATE CORRECTLY

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

V1 CHECK THE AUDIBLE PROMPT SETTING

- Operate the audio system in SYNC mode.
- Verify the audible prompts are enabled. Refer to "SYNC Voice Recognition Feature" in the Owner's Literature.
- Press the VOICE button on the steering wheel controls and observe the SYNC voice prompt.
- **Does the SYNC system produce a voice prompt correctly?**

  YES : The concern was caused by a customer setting. ADVISE the customer on the operation of the TTS feature.

  NO : Go to V2.

V2 CHECK THE AUDIBLE PROMPT CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C240b
- Disconnect: APIM C3342
- Key in ON position.

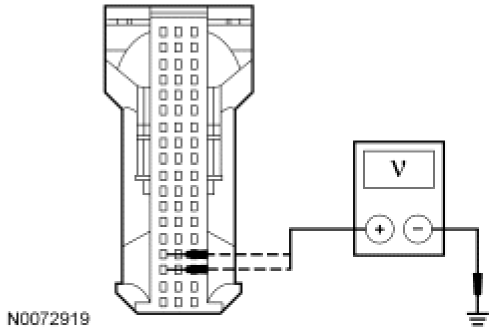


Fig. 25: Checking Audible Prompt Circuits For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the APIM C3342-3, circuit VMN14 (WH/VT), harness side and ground; and between the APIM C3342-4, circuit RMN14 (GY/BN), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to V3.

V3 CHECK THE AUDIBLE PROMPT CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the APIM, harness side and the ACM, harness side; and between the APIM, harness side and ground as follows:

APIM Connector-Pin	ACM Connector-Pin	Circuit
C3342-3	C240b-4	VMN14 (WH/VT)
C3342-4	C240b-5	RMN14 (GY/BN)

- **Is the resistance less than 5 ohms between the APIM and the ACM, and greater than 10,000 ohms between the APIM and ground?**

  YES : Go to V4.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

V4 CHECK FOR A VOLTAGE SIGNAL FROM THE APIM

- Connect: ACM C240b
- Connect: APIM C3342
- Operate the audio system in SYNC mode, and verify the audible prompts are enabled. Refer to "Voice Prompts" in the Owner's Literature.
- While pressing the VOICE button repeatedly, measure the AC voltage by backprobing between the ACM C240b-4, circuit VMN14 (WH/VT), harness side and the ACM C240b-5, circuit RMN14 (GY/BN), harness side.
- **Is an AC voltage produced each time the VOICE button is pressed?**

  YES : Go to V5.

  NO : Go to V6.

V5 CHECK FOR CORRECT ACM OPERATION

- Key in OFF position.
- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose

or corroded connector.

V6 CHECK FOR CORRECT APIM OPERATION

- Key in OFF position.
- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initialize.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test W: Voice Recognition Is Inoperative/Does Not Operate Correctly - Vehicles With The SYNC System

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Audio System/Navigation for schematic and connector information.

Normal Operation

When the VOICE button (represented by an icon of someone speaking) is pressed, it changes the reference voltage on circuit VMN54 (BU/OG), and the audio system enters voice recognition mode. If the vehicle is equipped with navigation, the VOICE switch is wired to the audio control module (ACM). If the vehicle is not equipped with navigation, the VOICE switch is wired to the accessory protocol interface module (APIM). A microphone located in the interior rear view mirror receives the voice command and sends a signal to the APIM through circuits VMM13 (YE/GN) and RMM13 (BU). Power to the interior rear view mirror is provided through circuit CBP41 (BU). Ground is provided through circuit GD133 (BK). The microphone is also used to detect outgoing audio during a phone call.

The microphone test (with navigation only) is available through the scan tool. Running this test causes the ACM to produce a test tone. If the system is operating correctly, the microphone detects the tone and produces a signal to the ACM indicating the tone was heard.

If the vehicle is equipped with navigation, the APIM receives the microphone input, and also broadcasts it to the ACM through circuits VMN01 (BU/BN) and RMN01 (GN). This allows voice commands specific to the navigation system to be handled directly by the ACM. The first voice commands spoken determine which system handles the voice commands.

- DTC B1038 (Microphone Input Circuit Failure) - set by the APIM during the on-demand self-test if the

APIM does not detect the microphone.

- DTC B2633 (Driver-Front Microphone Circuit Failure) - set by the ACM during the microphone test when the ACM does not receive an adequate signal from the microphone when the test tone is sounded.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Steering wheel controls
- Microphone (part of the interior rear view mirror)
- ACM (if equipped with navigation)
- APIM

PINPOINT TEST W: VOICE RECOGNITION IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - VEHICLES WITH THE SYNC SYSTEM

NOTE:	**Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

W1 VERIFY THE OPERATION OF THE STEERING WHEEL CONTROLS

- Operate the audio system in radio tuner (AM/FM) mode.
- Press the VOICE button on the steering wheel controls.
- **Does the audio system enter voice recognition mode?**

  YES : Go to W2.

  NO : Go to **Pinpoint Test F** to diagnose the steering wheel controls system.

W2 CHECK THE OPERATION OF THE VOICE RECOGNITION

- Press the VOICE button on the steering wheel controls.
- Wait for the SYNC system to acknowledge the VOICE button being pressed.
- While still in voice recognition mode, speak the command "PHONE", and observe the audio system.
- **Does the SYNC system acknowledge the command "PHONE"?**

  YES : If the vehicle is equipped with navigation, go to W3.

  Otherwise, the system is operating correctly at this time. ADVISE the customer on the correct operation of the voice recognition system.

  NO : Go to W6.

W3 CHECK THE MICROPHONE SIGNAL TO THE ACM

- Key in OFF position.
- Disconnect: ACM C240b

NOTE: ACM C240a must remain connected for this step to produce accurate results.

- Operate the audio system in radio tuner (AM/FM) mode.
- Press the VOICE button on the steering wheel controls.

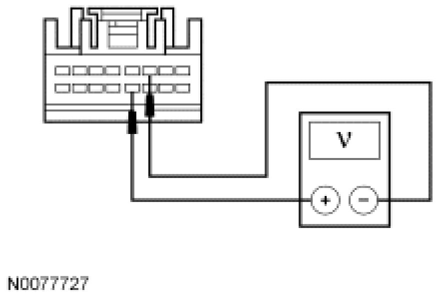


Fig. 26: Checking Microphone Signal To ACM
Courtesy of FORD MOTOR CO.

- While speaking a command, measure the AC voltage between the ACM C240b-11, circuit VMN01 (BU/BN), harness side and the ACM C240b-12, circuit RMN01 (GN), harness side.
- **Is a fluctuating AC voltage present?**

  YES : Go to W12.

  NO : Go to W4.

W4 CHECK THE MICROPHONE CIRCUITS TO THE ACM FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: APIM C3342
- Key in ON position.

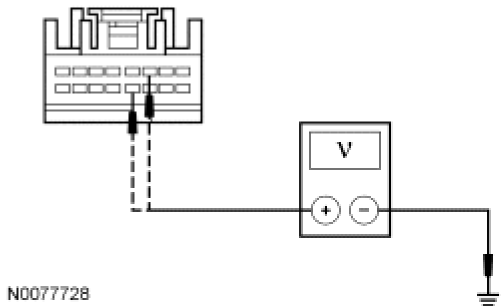


Fig. 27: Checking Microphone Circuits To ACM For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the ACM C240b-11, circuit VMN01 (BU/BN), harness side and ground; and between the ACM C240b-12, circuit RMN01 (GN), harness side and ground.

- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to W5.

W5 CHECK THE MICROPHONE CIRCUITS TO THE ACM FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the ACM, harness side and the APIM, harness side; and between the ACM, harness side and ground as follows:

ACM Connector-Pin	APIM Connector-Pin	Circuit
C240b-11	C3342-12	VMN01 (BU/BN)
C240b-12	C3342-13	RMN01 (BU)

- **Is the resistance less than 5 ohms between the ACM and the APIM, and greater than 10,000 ohms between the ACM and ground?**

  YES : Go to W11.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

W6 CHECK CIRCUIT CBP41 (BU) FOR VOLTAGE

- Key in OFF position.
- Disconnect: Interior Rear View Mirror C9012
- Key in ON position.

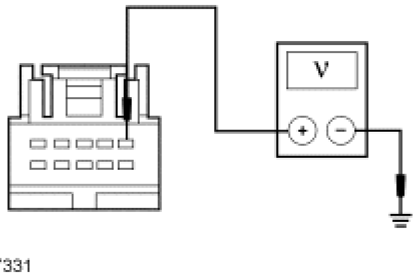


Fig. 28: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the interior rear view mirror C9012-1, circuit CBP41 (BU), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to W7.

NO : VERIFY the smart junction box (SJB) fuse 41 (15A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. If not OK, REFER to appropriate SYSTEM WIRING DIAGRAMS article to identify the possible sources of the circuit short.

W7 CHECK CIRCUIT GD133 (BK) FOR AN OPEN

- Key in OFF position.

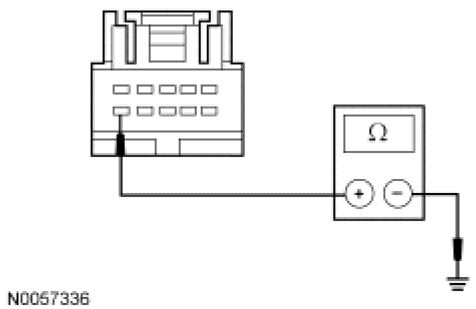


Fig. 29: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the interior rear view mirror C9012-10, circuit GD133 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to W8.

  NO : REPAIR the circuit. TEST the system for normal operation.

W8 CHECK THE MICROPHONE CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect: APIM C3342
- Key in ON position.

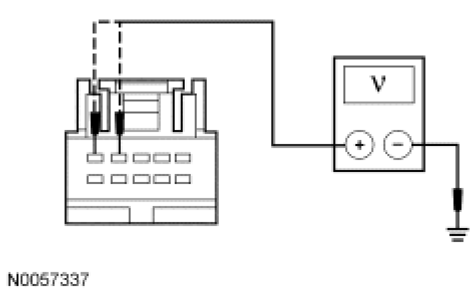


Fig. 30: Checking Circuits For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the interior rear view mirror C9012-4, circuit VMM13 (YE/GN), harness side and ground; and between the interior rear view mirror C9012-5, circuit RMM13 (BU), harness side and ground.
- **Is any voltage present?**

YES : REPAIR the circuit in question. TEST the system for normal operation.

NO : Go to W9.

W9 CHECK THE MICROPHONE CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the inside rear view mirror, harness side and the APIM, harness side; and between the interior rear view mirror, harness side and ground as follows:

Interior Rear View Mirror Connector-Pin	APIM Connector-Pin	Circuit
C9012-4	C3342-5	VMM13 (YE/GN)
C9012-5	C3342-6	RMM13 (BU)

- **Is the resistance less than 5 ohms between the interior rear view mirror and the APIM, and greater than 10,000 ohms between the interior rear view mirror and ground?**

YES : Go to W10.

NO : REPAIR the circuit in question. TEST the system for normal operation.

W10 ISOLATE THE INTERIOR REAR VIEW MIRROR

- Connect: APIM C3342
- Install a new interior rear view mirror. Refer to **REAR VIEW MIRRORS** article.
- Operate the audio system in SYNC mode.
- Press the VOICE button on the steering wheel controls, and attempt several voice commands.
- **Does the voice recognition operate correctly?**

YES : The fault was caused by an inoperative inside rear view mirror. The system is now operating correctly.

NO : Go to W11.

W11 CHECK FOR CORRECT APIM OPERATION

- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initialize.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

W12 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test X: Poor Quality/Distorted/No Sound While In SYNC Mode

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Audio System/Navigation for schematic and connector information.

Normal Operation

The accessory protocol interface module (APIM) sends left and right channel analog audio signals through circuits VME52 (BU), RME52 (GY/OG), VME53 (VT/GN), and RME53 (BN/WH). If the vehicle is equipped with a DVD entertainment system, these audio signals are sent to the rear entertainment module (RETM), then to the audio control module (ACM). In vehicles without a DVD entertainment system, the audio signals are sent directly to the ACM.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- RETM (if equipped)
- ACM
- APIM

PINPOINT TEST X: POOR QUALITY/DISTORTED/NO SOUND WHILE IN SYNC MODE

NOTE:	**Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

X1 VERIFY THE OPERATION OF THE SYNC AUDIO SOURCES

- Connect: Known Good MP3 Device (To Audio Input Jack)

NOTE: Make sure no universal serial bus (USB) device is plugged-in, and no Bluetooth® device is active for this step.

- Using the ACM buttons, press AUX until "SYNC LINE IN" appears on the display (except navigation), or press MEDIA, select "USER DEVICE", and press "SOURCE" repeatedly until "LINE IN" appears (navigation).
- Using a known good MP3 device, attempt to play a file using the audio input jack, and listen to the audio output.
- Disconnect: Known Good MP3 Device (From Audio Input Jack)
- Connect: Known Good USB Device (To USB Port)
- Using the ACM buttons, press AUX until "SYNC USB" appears on the display (except navigation), or press MEDIA, select "USER DEVICE", and press "SOURCE" repeatedly until "USB" appears (navigation).

NOTE: If a USB mass storage device is used to play the audio files, SYNC will only play audio files that do not have digital rights management (DRM) protection.

- Using a known good MP3 device or a mass storage device, attempt to play a file using the USB port.
- Disconnect: Known Good USB Device (From USB Port)
- Using a known good Bluetooth® device capable of streaming audio, attempt to pair to the APIM using Bluetooth®, and attempt to play an audio file using the Bluetooth® connection. Refer to the Owner's Literature.
- **Is there poor quality/distorted/no sound from each SYNC audio source?**

  YES : If the vehicle is equipped with a DVD entertainment system, go to X2.

  Otherwise, go to X3.

  NO : If the concern is only with some of the audio sources, go to **Symptom Chart - SYNC System** to diagnose the observed symptom.

  If all audio sources operate correctly, the concern is with the customer device.

X2 CHECK THE OPERATION OF THE DVD AUDIO

NOTE: Make sure a known good DVD is inserted in the RETM before carrying out this step.

- Operate the audio system in DVD mode.

- Observe the audio output.
- **Is there poor quality/distorted sound while in DVD mode?**

  YES : Go to **Pinpoint Test K** .

  NO : Go to X3.

X3 CHECK THE CIRCUITS FROM THE APIM FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C240b (Without DVD Entertainment)
- Disconnect: RETM C949 (With DVD Entertainment)
- Disconnect: APIM C3342
- Measure the voltage between the APIM pins, harness side as follows:

Connector-Pin	Circuit
C3342-23	VME53 (VT/GN)
C3342-24	RME53 (BN/WH)
C3342-25	VME52 (BU)
C3342-26	RME52 (GY/OG)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to X4.

X4 CHECK THE CIRCUITS FROM THE APIM FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the APIM, harness side, and the ACM or RETM (if equipped with DVD entertainment), harness side; and between the APIM, harness side and ground as follows:

APIM Connector-Pin/Circuit	ACM or RETM Connector-Pin/Circuit	Circuit
C3342-23 VME53 (VT/GN)	C240b-9 or C949-20	VME53 (VT/GN)
C3342-23 RME53 (BN/WH)	C240b-10 or C949-19	RME53 (BN/WH)
C3342-23	C240b-1 or	VME52

VME52 (BU)	C949-4	(BU)
C3342-23 RME52 (GN/OG)	C240b-2 or C949-3	RME52 (GN/OG)

- **Is the resistance less than 5 ohms between the APIM and the ACM (or RETM), and greater than 10,000 ohms between the APIM and ground?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to X5.

X5 CHECK FOR CORRECT APIM OPERATION

- Connect: All Disconnected Connectors
- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initialize.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation. If the concern is still present and the vehicle is equipped with a DVD entertainment system, go to X6. If the concern is still present and the vehicle is not equipped with a DVD entertainment system, go to X7.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

X6 CHECK FOR CORRECT RETM OPERATION

- Disconnect the RETM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the RETM connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new RETM. REFER to **Rear Entertainment Module (RETM)**. TEST the system for normal operation. If the concern is still present, go to X7.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

X7 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test Y: The Speed Sensitive Volume Does Not Operate Correctly

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Audio System/Navigation for schematic and connector information.

Normal Operation

The speed sensitive volume function adjusts the volume based on the vehicle speed sensor (VSS) signal from the instrument cluster (IC). The IC does not generate the VSS signal; it gateways the signal from the PCM.

For vehicles without THX® sound, the audio control module (ACM) receives the VSS signal from the IC. For vehicles with THX® sound, the audio digital signal processing (DSP) module receives the VSS signal from the IC and controls the speed sensitive volume based on the ACM setting.

- DTC U0155 (Lost Communication With Instrument Panel Cluster Control [IC] Module) - sets when the VSS signal is lost for greater than 5 seconds. When the signal is lost, the ACM turns the speed sensitive volume feature off. The smart junction box (SJB) and HVAC module also receive this signal, and should demonstrate symptoms if the VSS signal is lost. If no symptoms are present, this DTC can be ignored, as it may have been set by a low battery voltage condition.
- DTC U0184 (Lost Communication With Radio [ACM]) - set by the DSP module when expected medium speed controller area network (MS-CAN) messages are missing from the ACM lost for greater than 5 seconds. This includes the speed sensitive volume setting. If the speed sensitive volume setting message is missing, the DSP module turns the speed sensitive volume feature off.

This pinpoint test is intended to diagnose the following:

- Speed sensitive volume setting
- VSS signal concern
- ACM

PINPOINT TEST Y: THE SPEED SENSITIVE VOLUME DOES NOT OPERATE CORRECTLY

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Y1 CHECK THE SPEEDOMETER OPERATION

- Drive the vehicle and observe the speedometer.
- **Does the speedometer operate correctly?**

  YES : Go to Y2.

  NO : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article to diagnose the inoperative speedometer.

Y2 CHECK THE SPEED SENSITIVE VOLUME SETTING

- Turn the speed sensitive volume off.
  - For vehicles without navigation, press MENU until the speed sensitive volume prompt is reached, then press TUNE DOWN until the feature is turned off.
  - For vehicles with navigation, press SOUND, select the SCV tab, and turn the feature off.
- Operate the audio system in radio tuner (AM/FM) mode.
- Drive the vehicle at various speeds and observe the speaker volume.
- Set the speed sensitive volume to maximum compensation.
  - For vehicles without navigation, press MENU until the speed sensitive volume prompt is reached, then press TUNE UP until the feature is set to setting "7".
  - For vehicles with navigation, press SOUND, select the SCV tab, then press "7".
- Operate the audio system in radio tuner (AM/FM) mode.
- Drive the vehicle at various speeds and observe the speaker volume.
- **Does the volume remain constant with the speed sensitive volume turned off, and increase and decrease with vehicle speed with the speed sensitive volume set to maximum?**

  YES : The system is operating correctly at this time. ADVISE the customer on the correct operation of the speed sensitive volume feature.

  NO : Go to Y3.

Y3 CHECK FOR DTC U0155 (ACM) OR U0184 (DSP)

- Key in ON position.
- Using the scan tool, clear any ACM and DSP module continuous DTCs.
- Key in OFF position.
- Key in ON position.
- Wait at least 10 seconds.
- Retrieve the ACM and DSP module continuous DTCs.
- **Is DTC U0155 (ACM) or U0184 (DSP) present?**

  YES : Go to Y4.

  NO : If the vehicle is equipped with THX® sound, go to Y5.

Otherwise, go to Y6.

Y4 CHECK FOR COMMUNICATION WITH THE ACM AND INSTRUMENT CLUSTER (IC)

- Carry out the network test using the scan tool.
- **Does the scan tool communicate with the ACM and the IC?**

  YES : If the vehicle is equipped with THX® sound, go to Y5.

  Otherwise, go to Y6.

  NO : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose no communication with the ACM or IC.

Y5 CHECK FOR CORRECT DSP MODULE OPERATION

- Disconnect all the DSP module connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the DSP module connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Y6 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

GENERAL PROCEDURES

AUDIO UNIT PART NUMBER RETRIEVAL

Audio Systems Without Navigation

NOTE: The terms "Audio Control Module (ACM)" and "audio unit" refer to the same component.

1. Turn the ACM on.
2. Press and hold preset buttons 3 and 6 for 3 seconds. The speaker walk-around test will begin.
3. Before the speaker walk-around test is complete, press preset button 6.

   NOTE: This step will cause the ACM to auto-scroll through configuration 1, configuration 2, EEPROM number, and ACM part number.

4. Press the TUNE UP button.

   NOTE: Step 4 may need to be repeated until the ACM part number can be recorded.

5. Record the ACM part number.
6. Turn the ACM off.

Navigation Audio System

1. Turn the ACM on.
2. Press and hold preset buttons 3 and 6 for 3 seconds. The speaker walk-around test will begin.
3. Before the speaker walk-around test is complete, press END TEST on the display screen.
4. Select SYSTEM INFO from the menu.
5. Record the ACM part number.
6. Turn the ACM off.

SATELLITE RADIO RECEIVER ELECTRONIC SERIAL NUMBER (ESN) RETRIEVAL

Audio Systems Without Navigation

1. Operate the audio system in satellite radio mode.
2. Press and hold the AUX button and preset button 1, simultaneously.
   - The satellite radio receiver Electronic Serial Number (ESN) will be displayed on the screen.
3. Record the satellite radio receiver ESN.
4. Turn the audio system off.

Audio Systems With Navigation

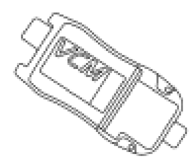
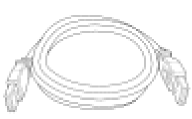
1. Turn the audio system on.
2. Press the MENU button.
3. Select the SYSTEM INFO tab.

NOTE: The satellite radio receiver ESN is shown on the lower left corner of the screen with the text "SR ESN:".

4. Record the satellite radio receiver ESN.
5. Turn the audio system off.

ACCESSORY PROTOCOL INTERFACE MODULE (APIM) SOFTWARE LEVEL CHECK

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST3051-A	Universal Serial Bus (USB) Male-A to Male-A Cable	CCMUSB2-AM-AM-10 or equivalent

1. Turn the Audio Control Module (ACM) on.
2. Connect the scan tool to the Data Link Connector (DLC).
3. Connect one end of the Universal Serial Bus (USB) male-A to male-A cable to the scan tool.
4. Connect the other end of the USB male-A to male-A cable to the vehicle USB port.
5. From the technician service publication website, run On-Line Automotive Service Information System (OASIS) using Quick Start or by manually entering the Vehicle Identification Number (VIN).
6. From the OASIS tab, select the "Sync/APIM" bullet.
7. Select the "Read APIM" button to verify the current Accessory Protocol Interface Module (APIM) software level.
    - The display shows both the Vehicle Interface Processor (VIP) and Consumer Interface Processor (CIP) software levels.
8. The scan tool displays the following information:
    - Last Recorded State - Hardware
        - VIN: vehicle identification number associated with the current APIM
        - Installed date: date the APIM was installed

- Radio: currently identified ACM in the vehicle
- HW Part No.: APIM hardware part number
- Un-installed date: date (if any) the APIM was uninstalled
- S/N: APIM serial number

- Last Recorded State - Software
    - Date/Time: date and time of last recorded software installation
    - VIP: VIP software that was installed at that time
    - CIP: CIP software that was installed at that time
    - Description: a description of the content of the software revision
- History - Software
    - Date/Time: date and time of any recorded software installation
    - VIP: VIP software that was installed at that time
    - CIP: CIP software that was installed at that time
    - Description: a description of the content of the software revision
- Available Software for Programming
    - Select: allows the software package to be selected
    - Lineage: the original software release, if the software available is a revision
    - VIP: VIP software level that is available with the selection
    - CIP: CIP software level that is available with the selection
    - Description: a description of the content of the software revision

9. Click a CIP software level to view the device compatibility list associated with the CIP software level, if desired.
10. To exit the APIM software level check, disconnect the scan tool from the DLC and the USB port, or exit the OASIS screen.

REMOVAL AND INSTALLATION

AUDIO DIGITAL SIGNAL PROCESSING (DSP) MODULE

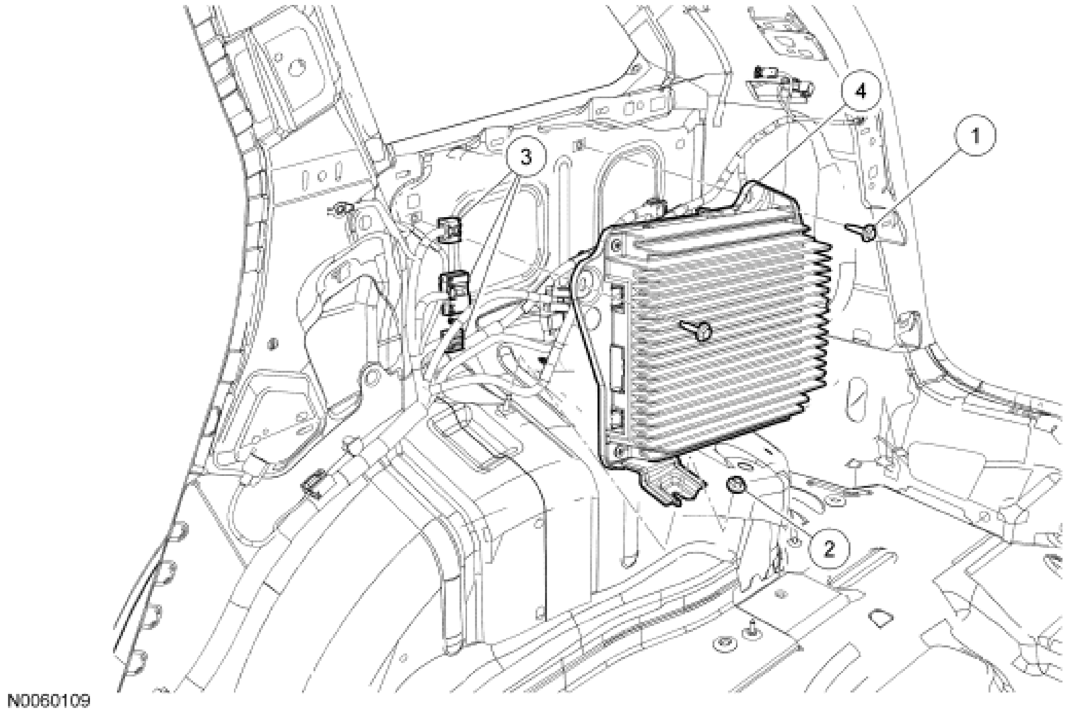


Fig. 31: Exploded View Of Audio Amplifier - THX(R)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W505425-S	Audio digital signal processing (DSP) module screws (2 required)
2	N811309-S	Audio DSP module nut
3	-	Audio DSP module electrical connectors (part of 14A005)
4	18A849	Audio DSP module

REMOVAL AND INSTALLATION

NOTE: Module configuration is only required if a new audio digital signal processing (DSP) module is being installed.

1. Upload the audio DSP module configuration information to the scan tool. For additional information, refer to Programmable Module Installation (PMI) in **MODULE CONFIGURATION** article.
2. Remove the subwoofer speaker. For additional information, refer to **Subwoofer Speaker**.
3. Disconnect the audio DSP module electrical connectors.
4. Remove the 2 screws, the nut, and the audio DSP module.
5. To install, reverse the removal procedure.
   - Download the configuration information to the audio DSP module. For additional information, refer to PMI in **MODULE CONFIGURATION** article.

AUDIO INPUT JACK

NOTE: **Vehicle equipped with SYNC shown, others similar.**

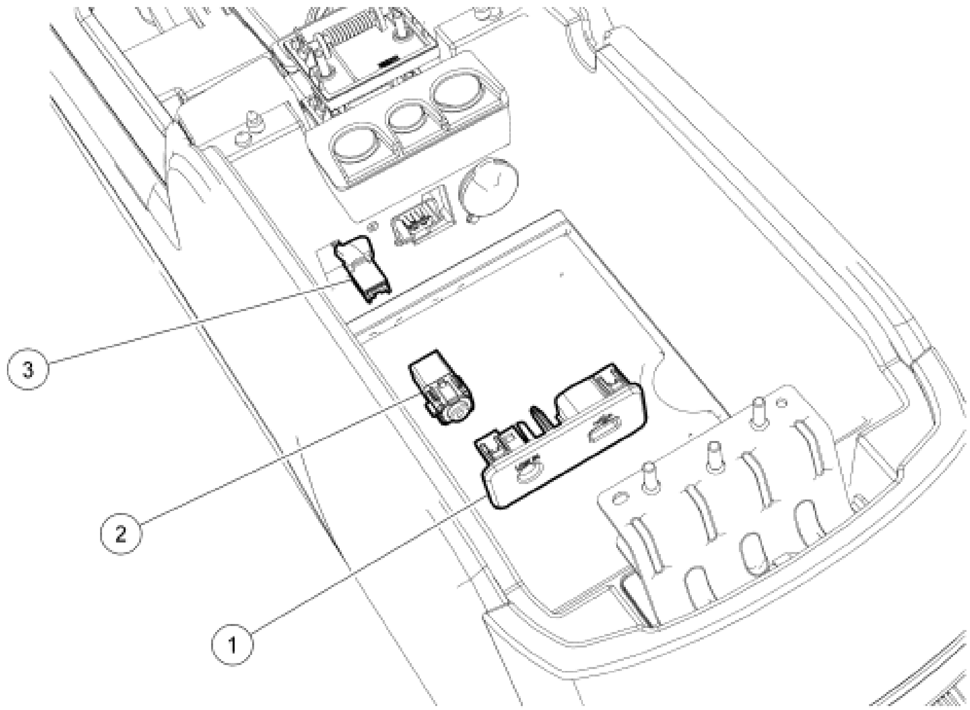


Fig. 32: Identifying Audio Input Jack Connectors
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Audio input jack bezel (part of 78045A06)
2	19A164	Audio input jack
3	-	Audio input jack electrical connector (part of 14B079)

REMOVAL AND INSTALLATION

1. Using a suitable tool, pry the audio input jack bezel out from the floor console storage bin.
   - Disconnect the universal serial bus (USB) connector, if equipped.
2. Disconnect the audio input jack electrical connector.
3. Release the tabs and remove the audio input jack.

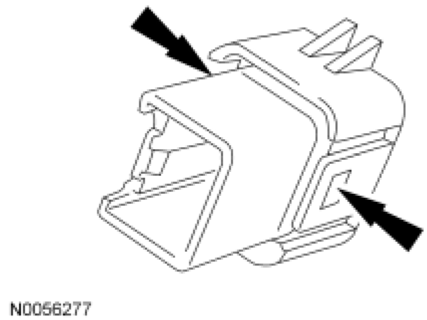


Fig. 33: Identifying Tabs On Audio Input Jack
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.

AUDIO CONTROL MODULE (ACM)

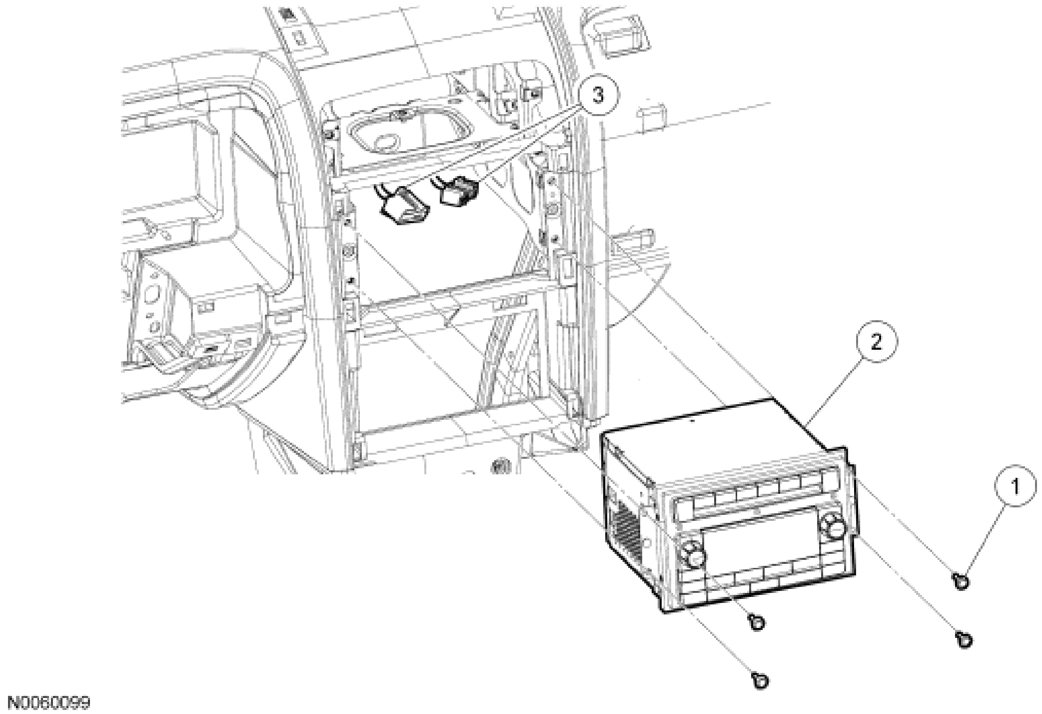


Fig. 34: Exploded View Of Audio Unit
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W707628	Audio control module (ACM) screws (4 required)
2	18C815	ACM
3	-	ACM electrical connectors (part of 14401 or 18812)

REMOVAL AND INSTALLATION

NOTE: **It is not necessary to remove the audio control module (ACM) to retrieve the part number. For additional information, refer to Audio Unit Part Number Retrieval.**

NOTE: **Module configuration is only required if a new ACM is being installed.**

1. Upload the ACM configuration information to the scan tool. For additional information, refer to **MODULE CONFIGURATION** article.
2. Remove the instrument panel center finish panel. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
3. Remove the 4 screws and the ACM.
   - Disconnect the electrical connectors and the antenna cable.
4. To install, reverse the removal procedure.
   - Download the configuration information to the ACM. For additional information, refer to **MODULE CONFIGURATION** article.

SATELLITE DIGITAL AUDIO RECEIVER SYSTEM (SDARS) MODULE

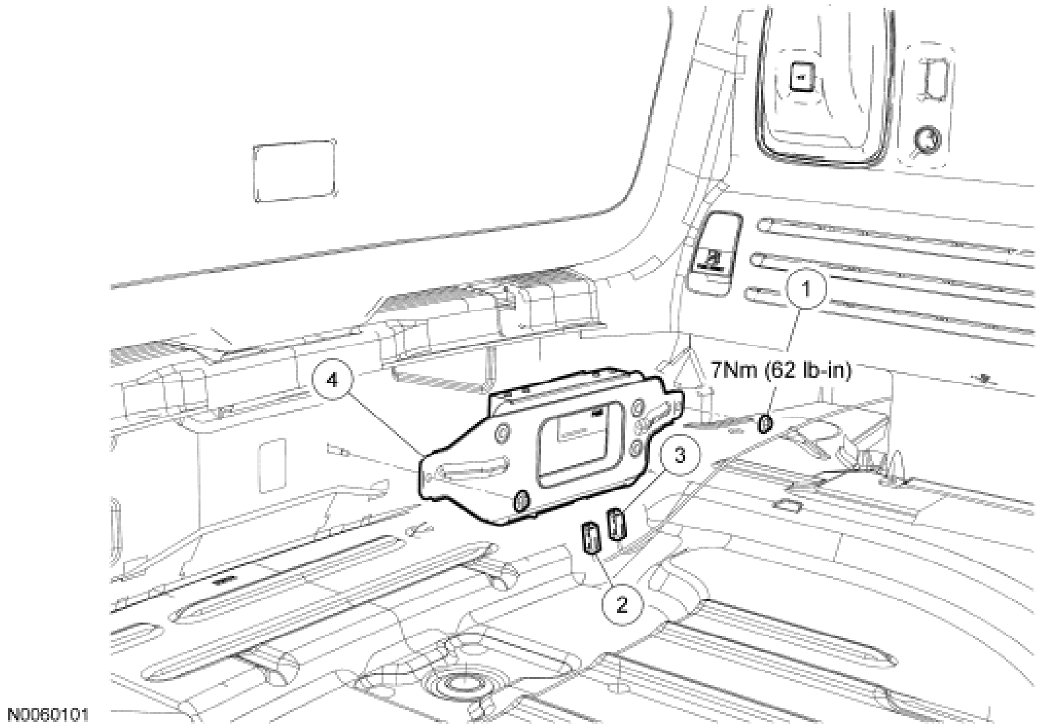


Fig. 35: Exploded View Of Satellite Radio Receiver With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description

1	W707293-S	Satellite digital audio receiver system (SDARS) module nuts (2 required)
2	19A397	Satellite radio antenna connector
3	-	SDARS module electrical connector (part of 14A005)
4	18C960	SDARS module

REMOVAL AND INSTALLATION

NOTE: Module configuration is only required if a new satellite digital audio receiver (SDARS) module is being installed.

1. Upload the SDARS module configuration information to the scan tool. For additional information, refer to Programmable Module Installation (PMI) in **MODULE CONFIGURATION** article.
2. Remove the liftgate scuff plate. For additional information, refer to Interior Trim - Exploded View in **INTERIOR TRIM AND ORNAMENTATION** article.
3. Remove the 2 nuts and the SDARS module.
   - Disconnect the satellite radio antenna connector and the electrical connector.
   - To install, tighten the nuts to 7 Nm (62 lb-in).
4. To install, reverse the removal procedure.
   - Download the configuration information to the SDARS module. For additional information, refer to PMI in **MODULE CONFIGURATION** article.

STEERING WHEEL CONTROLS

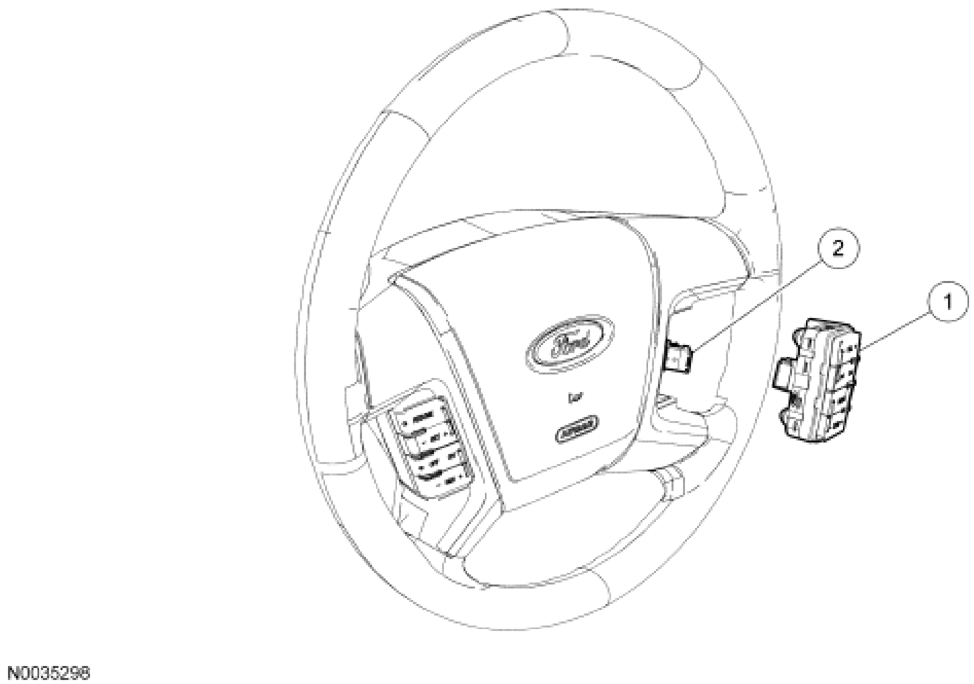


Fig. 36: Exploded View Of Steering Wheel Controls - Edge
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	9C888	Steering wheel controls
2	-	Steering wheel controls electrical connector (part of 14A411)

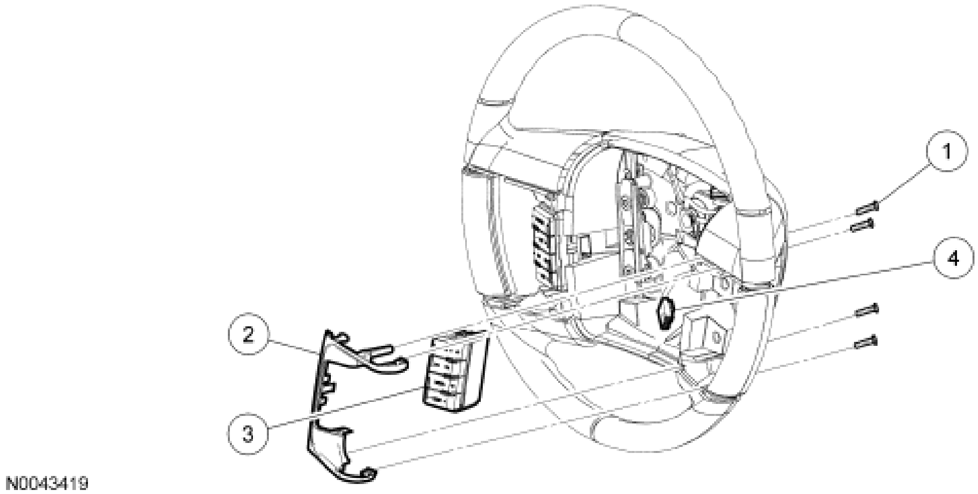


Fig. 37: Exploded View Of Steering Wheel Controls - MKX
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Steering wheel controls bezel screws (4 required)
2	-	Steering wheel controls bezel
3	9C888	Steering wheel controls
4	-	Steering wheel controls electrical connector (part of 14A411)

REMOVAL AND INSTALLATION

MKX

1. Remove the driver air bag module. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
2. Remove the 4 screws and the steering wheel controls bezel.

   All vehicles

3. Remove the steering wheel controls by pulling the switch toward the rear of the vehicle.
   - Disconnect the electrical connector.
4. To install, reverse the removal procedure.

ANTENNA - AM/FM

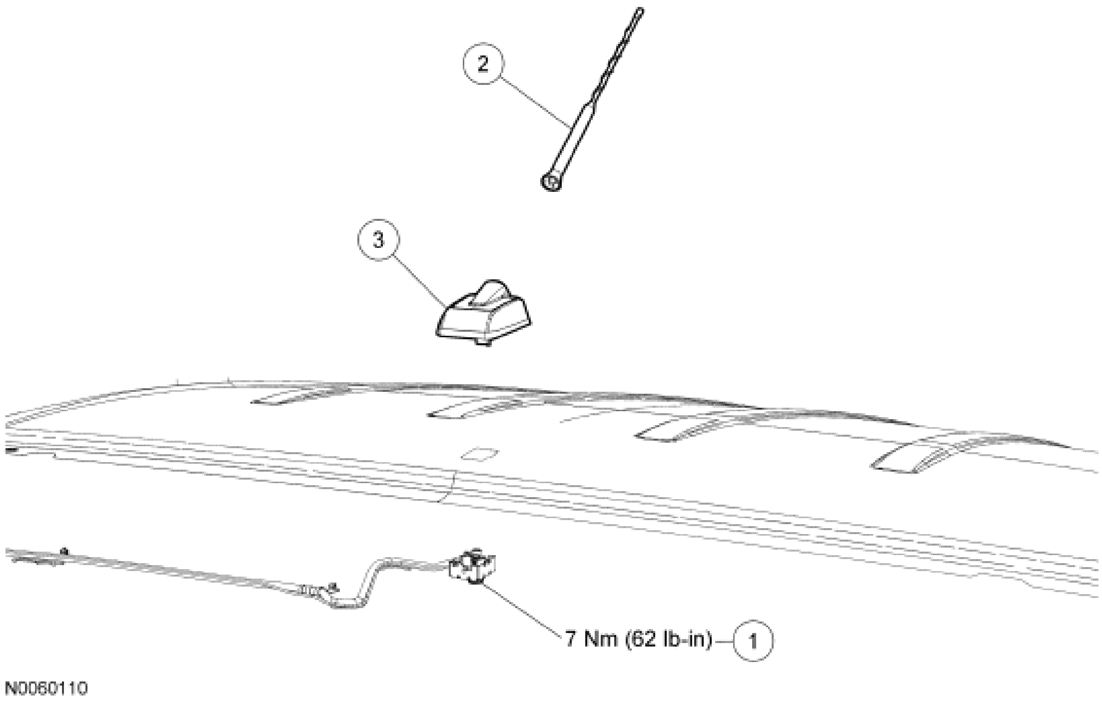


Fig. 38: Exploded View Of AM/FM Antenna With Torque Specifications

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	AM/FM antenna base bolt (part of 18812)
2	18813	AM/FM antenna mast
3	18936	AM/FM antenna

REMOVAL AND INSTALLATION

1. Remove the AM/FM antenna mast, if desired.
2. Remove the dome lamp. For additional information, refer to **INTERIOR LIGHTING** article.
3. Loosen the AM/FM antenna base bolt.
   - To install, tighten to 7 Nm (62 lb-in).
4. Remove the AM/FM antenna.
5. To install, reverse the removal procedure.

ANTENNA - SATELLITE RADIO

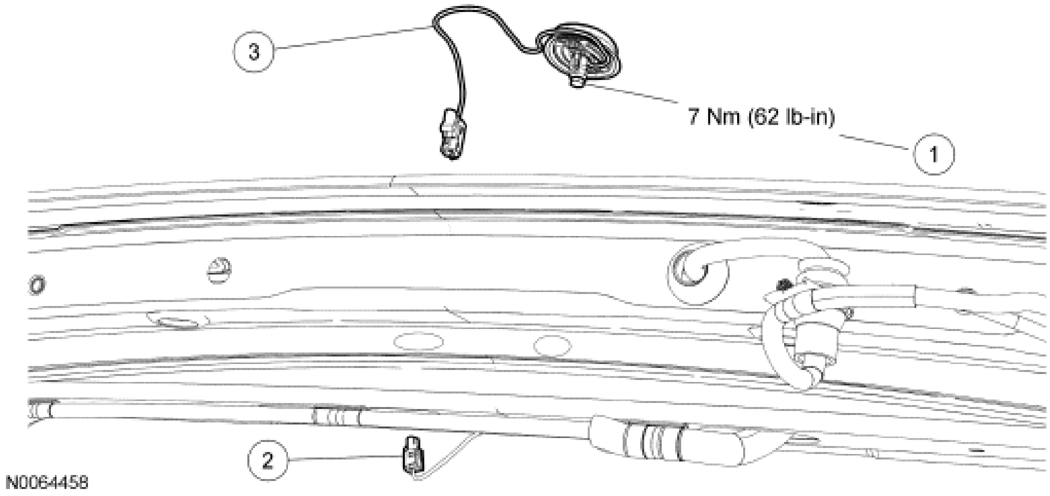


Fig. 39: Exploded View Of Satellite Radio Antenna With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Satellite radio antenna cable bolt (part of 18812)
2	-	Satellite radio antenna cable electrical connector (part of 19A397)
3	10E893	Satellite radio antenna

REMOVAL AND INSTALLATION

1. Remove the spoiler. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
   - Disconnect the satellite radio antenna electrical connector.
2. Loosen the satellite radio antenna cable bolt.
   - To install, tighten to 7 Nm (62 lb-in).
3. Remove the satellite radio antenna.
4. To install, reverse the removal procedure.

ANTENNA CABLE - AM/FM

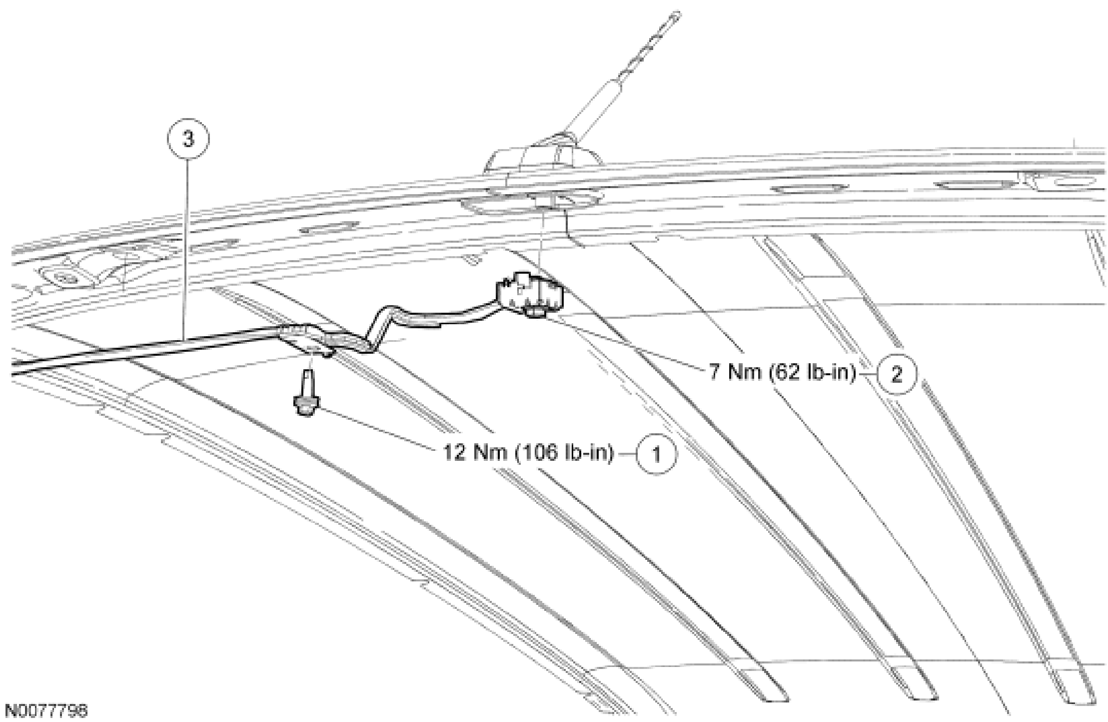


Fig. 40: Antenna Cable-to-Antenna With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	AM/FM antenna cable bolt
2	-	AM/FM antenna base bolt (part of 18812)
3	18812	Upper AM/FM antenna cable

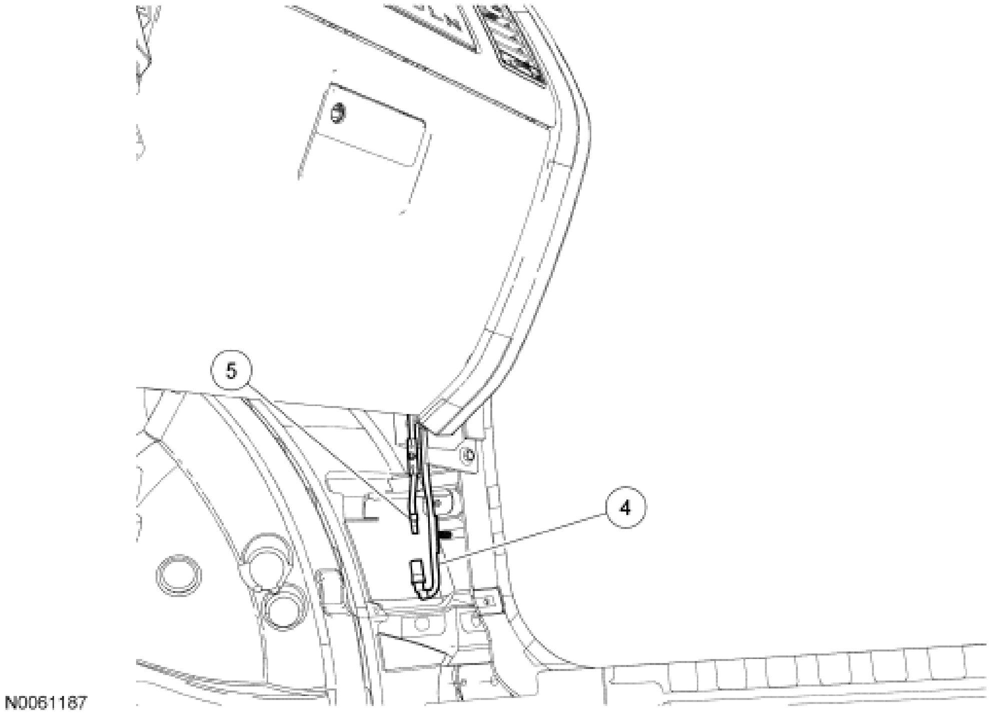


Fig. 41: Upper Antenna Cable-to-Lower Antenna Cable
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
4	18812	Upper AM/FM antenna cable
5	18812	Lower AM/FM antenna cable

REMOVAL AND INSTALLATION

Lower antenna cable

1. Remove the audio control module (ACM). For additional information, refer to **Audio Control Module (ACM)**.

   Upper antenna cable

2. Remove the RH A-pillar trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
3. Remove the interior dome lamp. For additional information, refer to **INTERIOR LIGHTING** article.
4. Loosen the AM/FM antenna base bolt and disconnect the antenna cable from the antenna.
   - To install, tighten to 7 Nm (62 lb-in).
5. Remove the RH sun visor. For additional information, refer to Headliner in **INTERIOR TRIM AND ORNAMENTATION** article.

NOTE: Lower the headliner, as necessary.

6. Remove the AM/FM antenna cable bolt and the antenna cable.
   - To install, tighten the bolt to 12 Nm (106 lb-in).

Both antenna cables

7. Remove the RH front door scuff plate. For additional information, refer to Interior Trim - Exploded View in **INTERIOR TRIM AND ORNAMENTATION** article.
8. Disconnect the upper antenna cable from the lower antenna cable.
9. Release the pin-type retainers and remove the antenna cable.
10. To install, reverse the removal procedure.

ANTENNA CABLE - SATELLITE RADIO

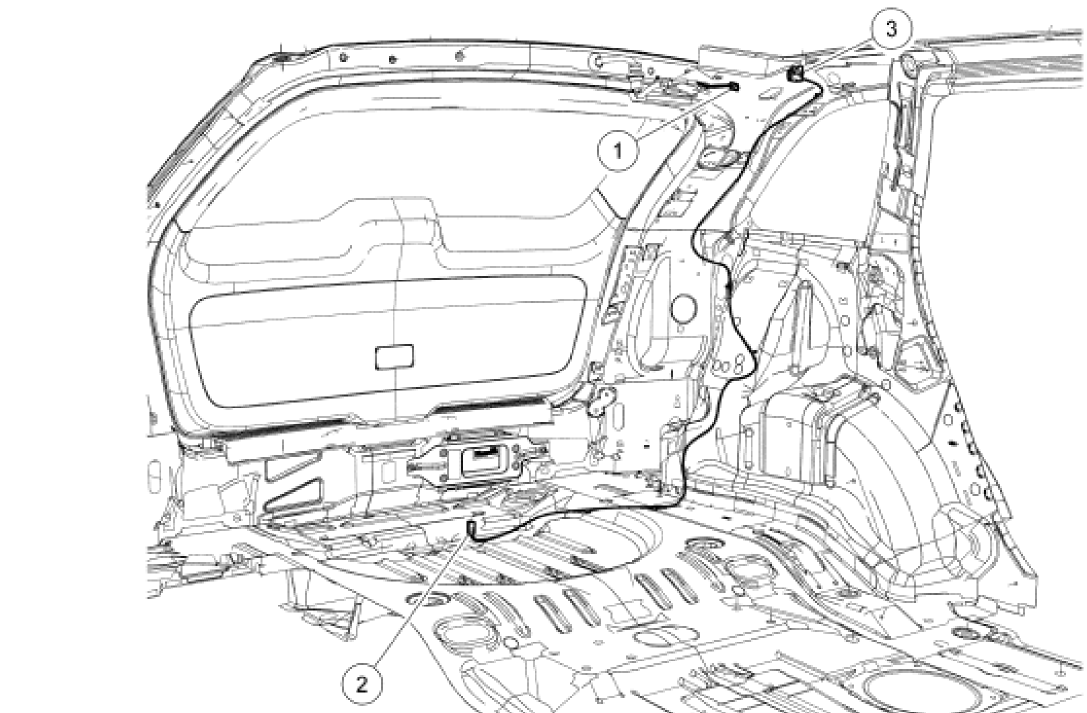


Fig. 42: Exploded View Of Satellite Radio Antenna Cable
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Satellite radio antenna cable-to-satellite radio antenna electrical connector (part of 19A397)
2	-	Satellite radio antenna cable-to-satellite digital audio receiver system (SDARS)

		module electrical connector (part of 19A397)
3	19A397	Satellite radio antenna cable

REMOVAL AND INSTALLATION

1. Remove the LH quarter trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the D-pillar trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
3. Remove the liftgate scuff plate. For additional information, refer to Interior Trim - Exploded View in **INTERIOR TRIM AND ORNAMENTATION** article.
4. Disconnect the satellite radio antenna cable from the satellite digital audio receiver system (SDARS) module.
5. Disconnect the satellite radio antenna cable from the satellite radio antenna, and remove the cable.
6. To install, reverse the removal procedure.

DOOR SPEAKER

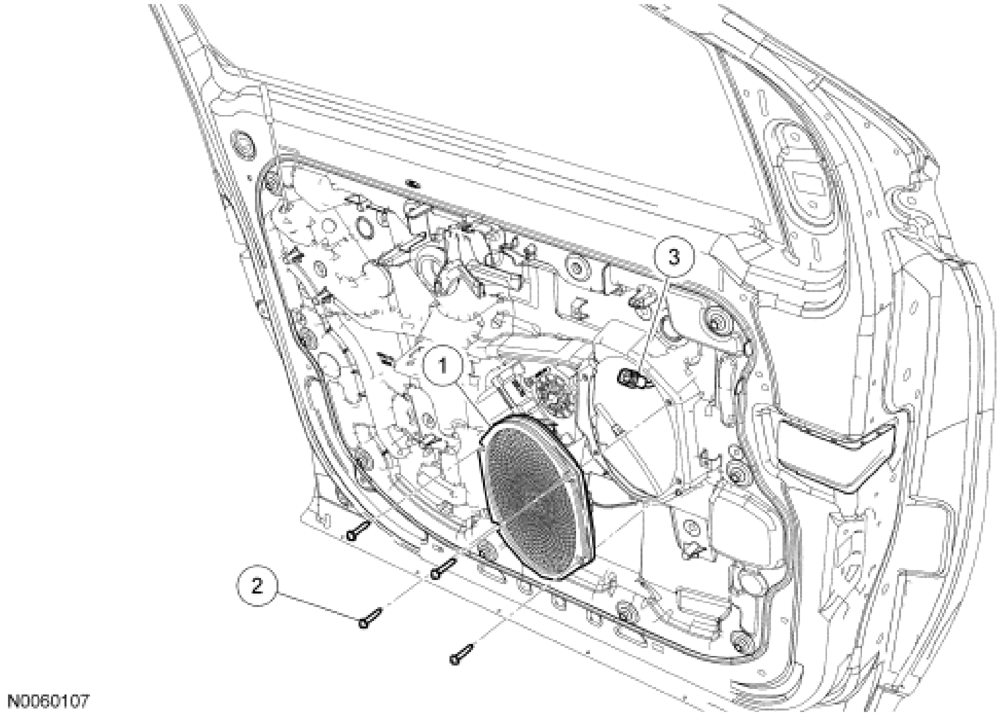


Fig. 43: Front or Rear Door
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	18808	Door speaker

2	973791	Door speaker screws (4 required)
3	-	Door speaker electrical connector(s) (part of door harness)

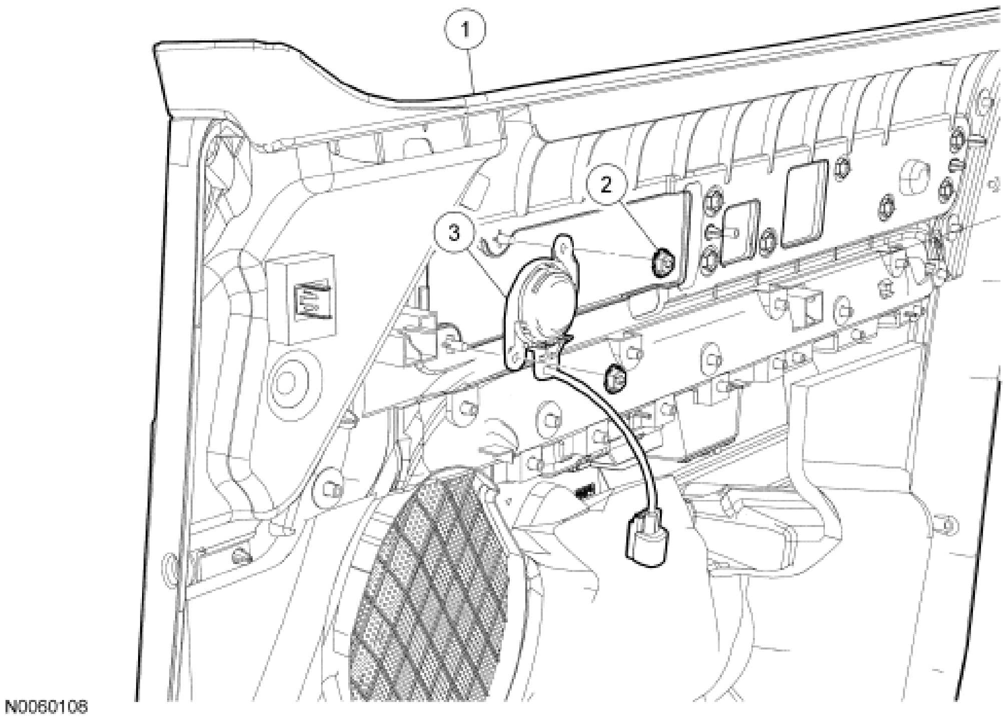


Fig. 44: Front Door Tweeter
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Door trim panel
2	W706675-S	Front door tweeter speaker nuts (2 required)
3	19B170	Front door tweeter speaker

REMOVAL AND INSTALLATION

All speakers

1. Remove the door trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

   Front door tweeter speaker

2. Remove the 2 screws and the front door tweeter speaker from the door trim panel.

   Front or rear door speaker

3. Remove the 4 screws and the door speaker.
   - Disconnect the electrical connector(s).

   All speakers

4. To install, reverse the removal procedure.

INSTRUMENT PANEL SPEAKER

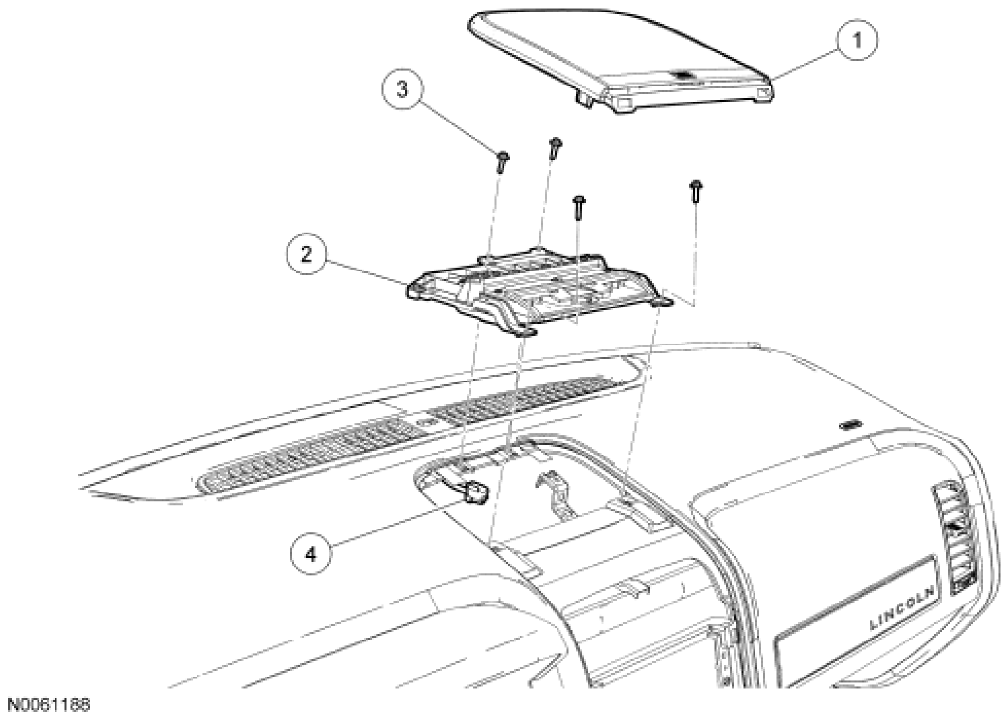


Fig. 45: Exploded View Of Instrument Panel Speaker
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	78044A92	Instrument panel speaker cover
2	18808	Instrument panel speaker
3	-	Instrument panel speaker electrical connector (part of 14401)
4	W707628-S	Instrument panel speaker screws (4 required)

REMOVAL AND INSTALLATION

1. Remove the center instrument panel finish panel. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
2. Remove the instrument panel speaker cover.

3. Remove the 4 screws and the instrument panel speaker.
   - Disconnect the electrical connector.
4. To install, reverse the removal procedure.

SUBWOOFER SPEAKER

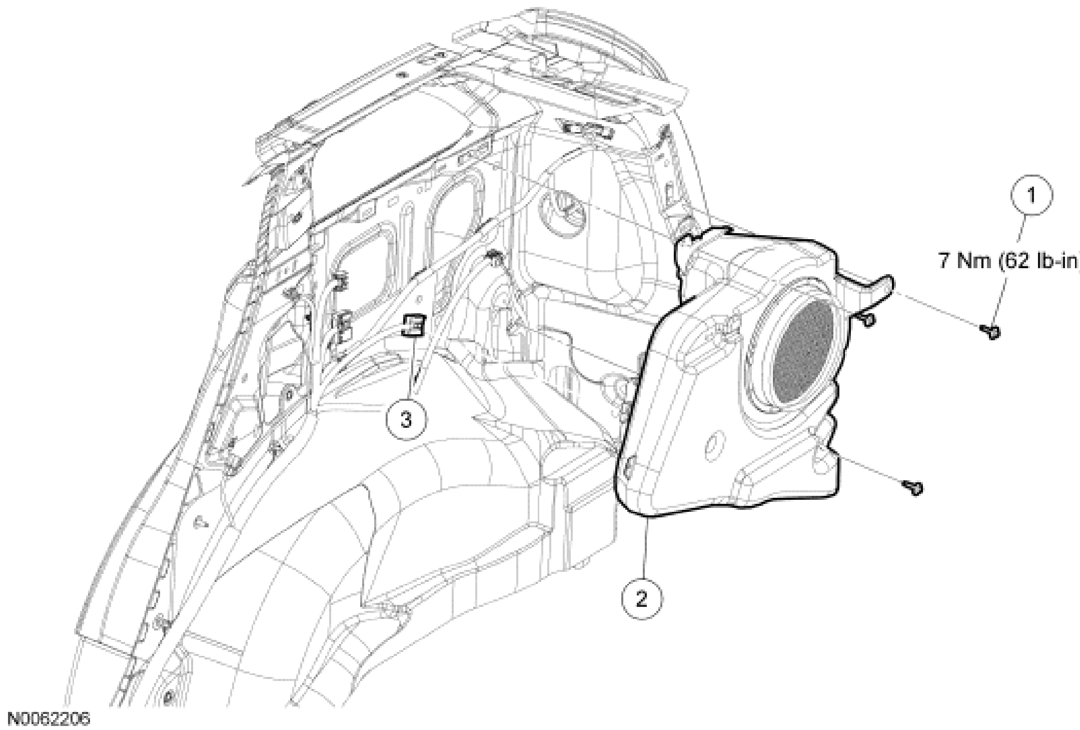


Fig. 46: Exploded View Of Subwoofer Speaker With Torque Specification - Edge
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W505425-S	Subwoofer speaker bolts (3 required)
2	18C804	Subwoofer speaker
3	-	Subwoofer speaker electrical connector (part of 14A005)

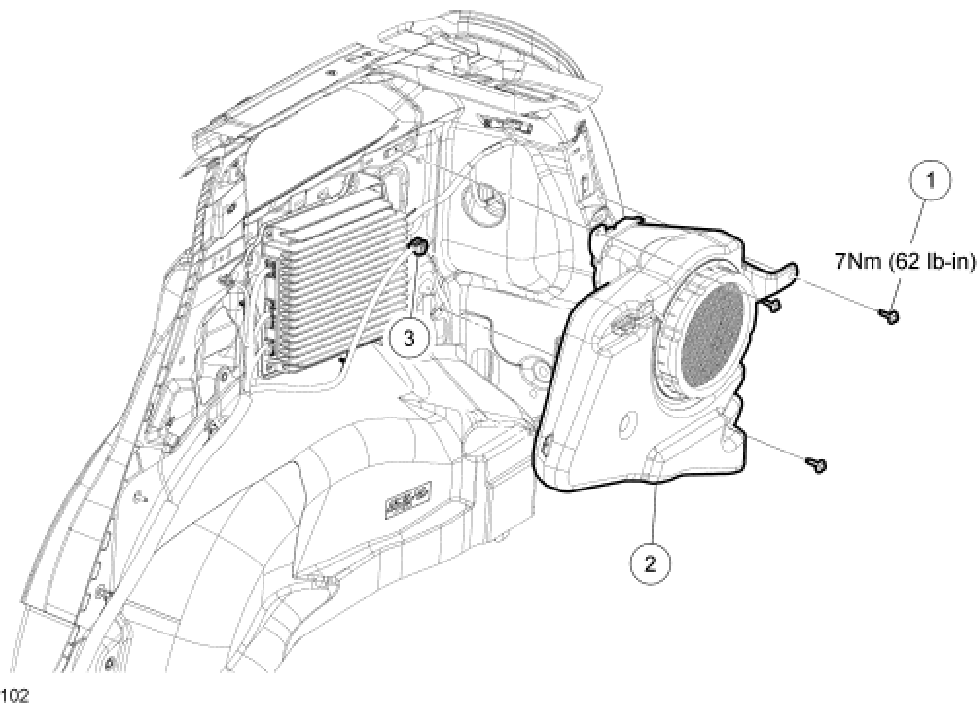


Fig. 47: Exploded View Of Subwoofer Speaker With Torque Specification - MKX
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W505425-S	Subwoofer speaker bolts (3 required)
2	18808	Subwoofer speaker
3	-	Subwoofer speaker electrical connector (part of 14A005)

REMOVAL AND INSTALLATION

1. Remove the quarter panel trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the 3 bolts and the subwoofer speaker.
   - Disconnect the electrical connector.
   - To install, tighten the bolts to 7 Nm (62 lb-in).
3. To install, reverse the removal procedure.

REAR ENTERTAINMENT MODULE (RETM)

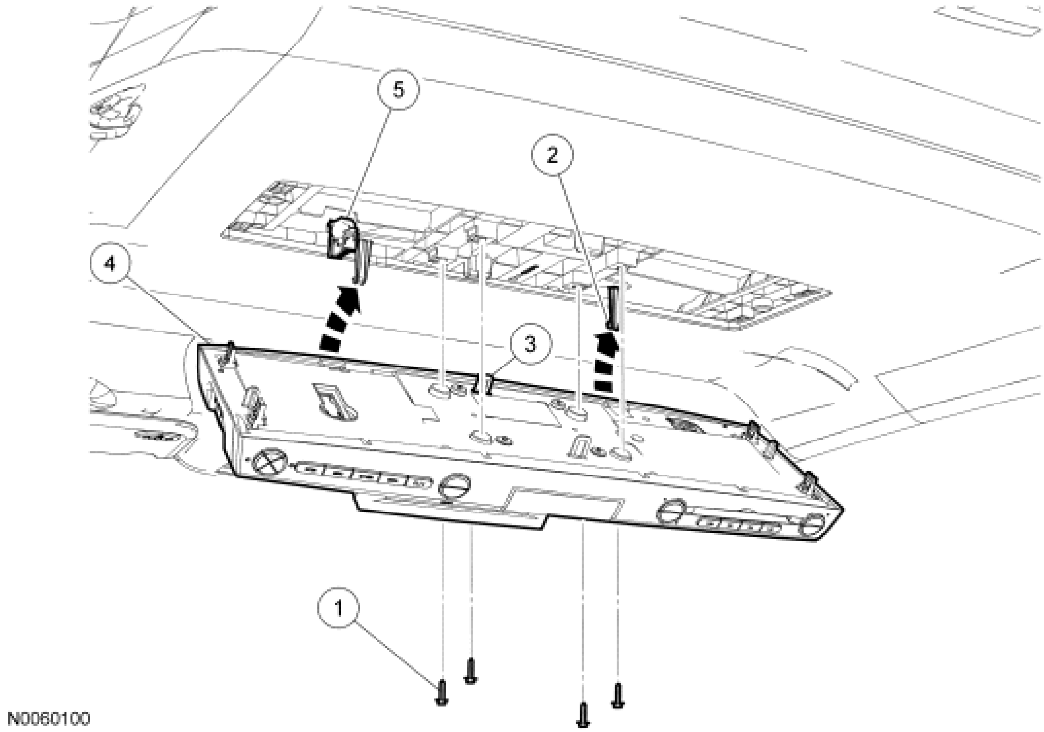


Fig. 48: Exploded View Of Digital Versatile Disc (DVD) Player
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W704875-S	Rear entertainment module (RETM) screws (4 required)
2	-	J-hook (part of 10E957)
3	-	U-hook (part of 10E947)
4	10E947	RETM
5	-	RETM electrical connector (part of 15A657)

REMOVAL

NOTE: Programmable module installation (PMI) only needs to be carried out if the rear entertainment module (RETM) is being replaced.

1. Upload the RETM configuration to the scan tool. For additional information, refer to **MODULE CONFIGURATION** article.

NOTE: Open the display to access the screws.

2. Remove the 4 screws.
3. Remove the RETM.

- Pull down on the sides of the RETM to disengage the clips from the bracket.
- Using a suitable tool, push the rear most U-hook forward and release the U-hooks.
- Hang the RETM on the J-hooks and disconnect the electrical connector.
- Remove the RETM from the J-hooks.

INSTALLATION

1. Hang the RETM on the J-hooks.
2. Connect the electrical connector.
3. Remove the RETM from the J-hooks.

NOTE: Tilt the RETM, as necessary, to align it correctly.

4. Align the left side guide pin with the left side locating hole.
5. Lift up the right side of the RETM and engage the U-hooks.
6. Install the 4 screws.
7. Push on the left and right sides of the RETM to engage the clips.
8. Download the RETM configuration from the scan tool. For additional information, refer to **MODULE CONFIGURATION** article.

GLOBAL POSITIONING SYSTEM (GPS) ANTENNA

NOTE: The view is shown from the back side of the instrument panel; however, the instrument panel does not have to be removed to carry out this procedure.

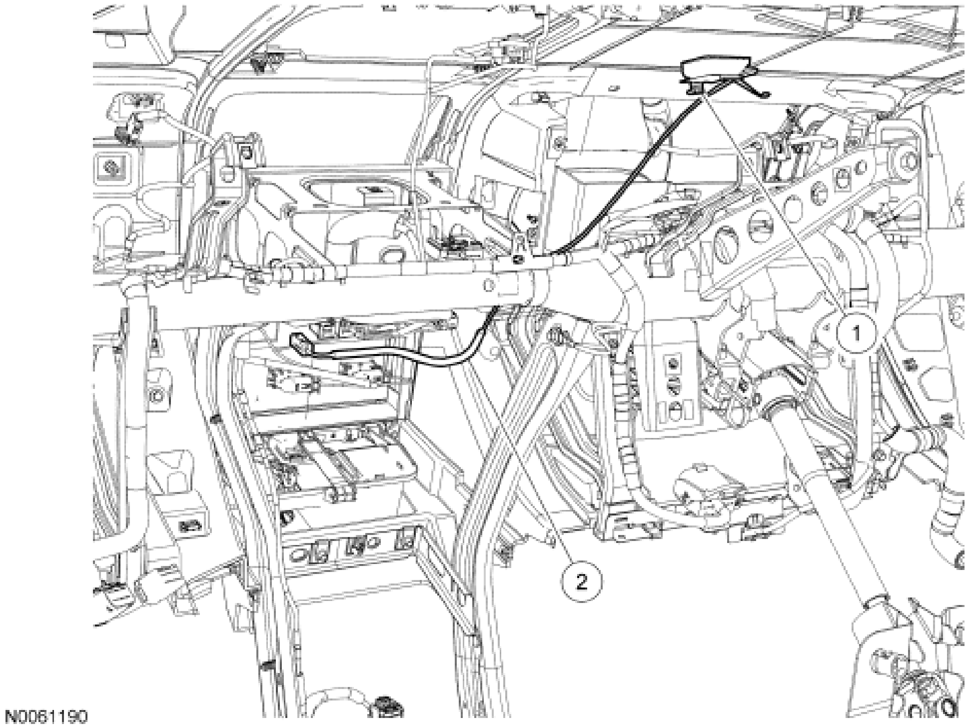


Fig. 49: Exploded View Of Global Positioning System (GPS) Antenna
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Global positioning system (GPS) antenna clip (part of 10E893)
2	10E893	GPS antenna

REMOVAL AND INSTALLATION

MKX

1. Remove the instrument cluster (IC). For additional information, refer to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

   All vehicles

2. Remove the audio control module (ACM). For additional information, refer to **Audio Control Module (ACM)**.

   NOTE: **For vehicles without THX® audio, the vehicle will have an upper storage bin, rather than an instrument panel speaker.**

3. Remove the instrument panel speaker. For additional information, refer to **Instrument Panel Speaker**.
4. Release the clip and remove the global positioning system (GPS) antenna.

5. To install, reverse the removal procedure.

ACCESSORY PROTOCOL INTERFACE MODULE (APIM)

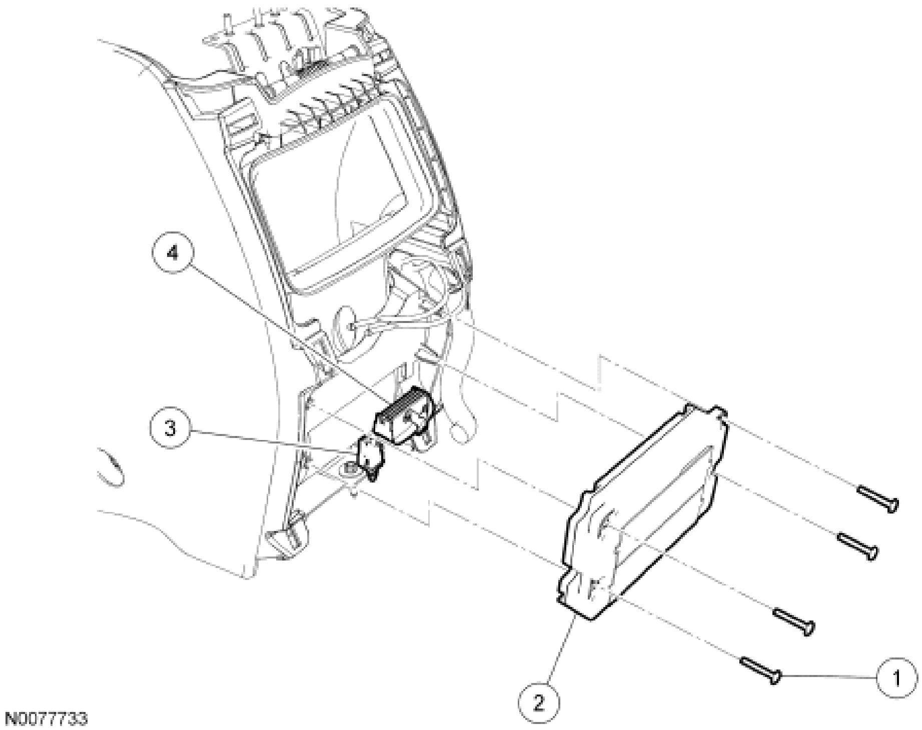


Fig. 50: Identifying Accessory Protocol Interface Module (APIM)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Accessory protocol interface module (APIM) screws (4 required) (part of 78045A06)
2	14D212	APIM
3	14D202	Universal serial bus (USB) cable
4	-	APIM electrical connector (part of 14B079)

REMOVAL AND INSTALLATION

NOTE: Accessory protocol interface module (APIM) reprogramming is only necessary if a new module is being installed.

1. Verify the current APIM software and hardware level. For additional information, refer to Accessory Protocol Interface Module (APIM) Reprogramming in **MODULE CONFIGURATION** article.
2. Remove the floor console rear trim panel by pulling straight back to disengage the clips.

3. Disconnect the universal serial bus (USB) cable and the electrical connector.
4. Remove the 4 screws and the APIM.
5. To install, reverse the removal procedure.
    - Reprogram the APIM. For additional information, refer to **MODULE CONFIGURATION** article.

UNIVERSAL SERIAL BUS (USB) CABLE AND PORT

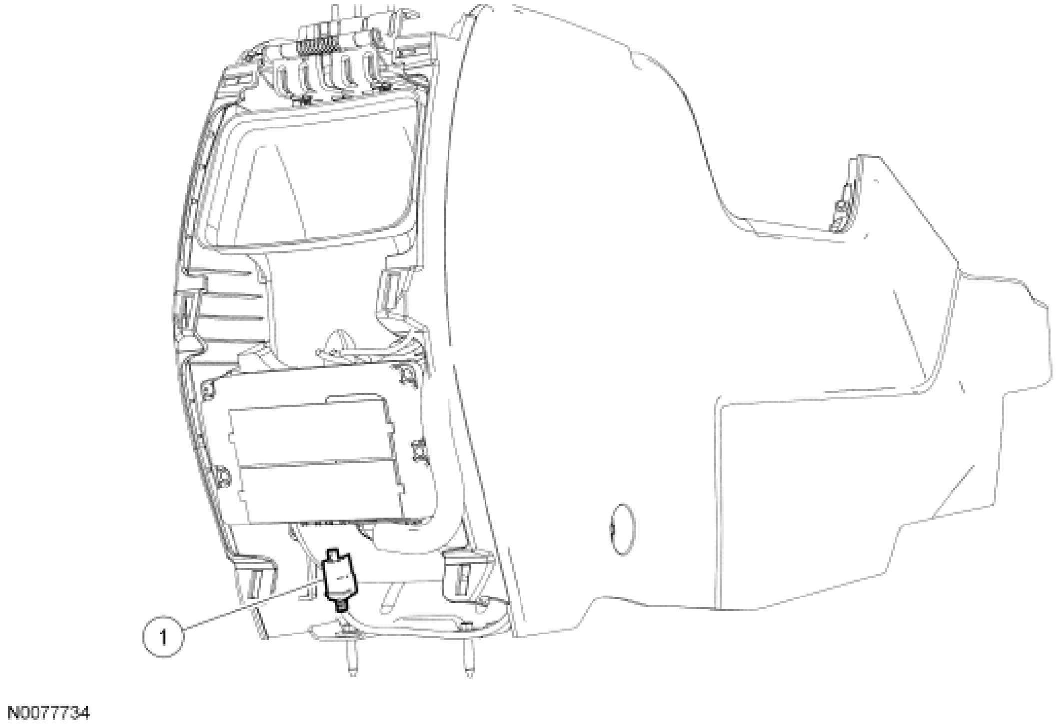


Fig. 51: Universal Serial Bus (USB) Cable-To-Accessory Protocol Interface Module (APIM)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Universal Serial Bus (USB) cable-to-Accessory Protocol Interface Module (APIM) connector (part of 14D202)

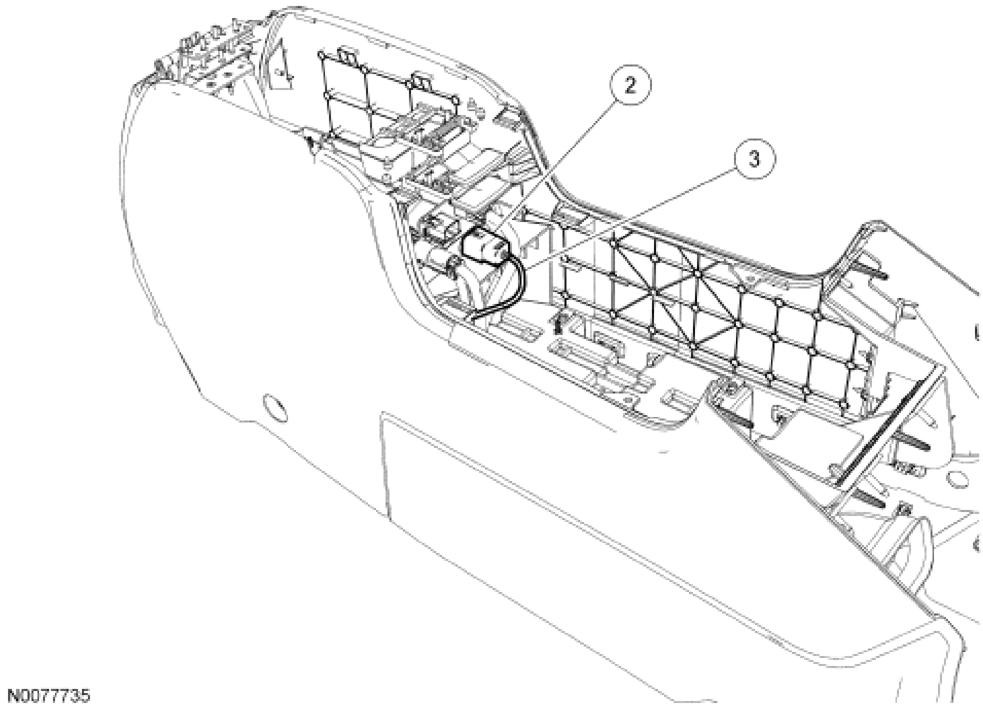


Fig. 52: Universal Serial Bus (USB)-To-Accessory Protocol Interface Module (APIM)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
2	-	USB cable-to-bezel connector
3	14D202	USB cable and port

REMOVAL AND INSTALLATION

1. Remove the floor console. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
2. Remove the floor console rear trim panel by pulling straight rearward to disengage the clips.
3. Disconnect the Universal Serial Bus (USB) cable-to-Accessory Protocol Interface Module (APIM) connector.
4. Disconnect the USB cable-to-bezel connector.
   - Disengage the push-pin near the connection.
5. Disconnect the USB cable-to-bezel connector.
6. Remove the 3 screws holding the front of the RH panel to the floor console.

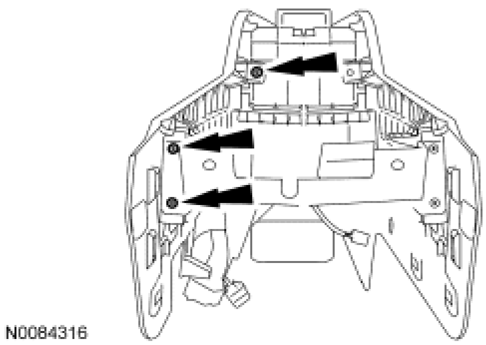


Fig. 53: Identifying Screws
Courtesy of FORD MOTOR CO.

7. Remove the 2 screws and the APIM and bracket as an assembly.
   - Disconnect the electrical connector.

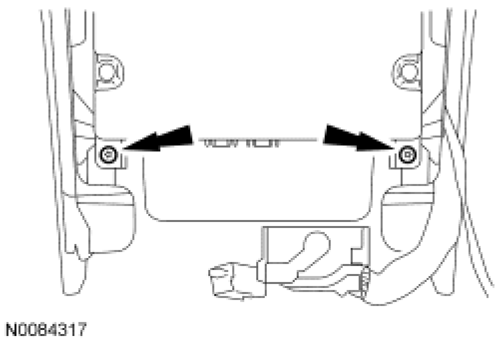


Fig. 54: Identifying Screws
Courtesy of FORD MOTOR CO.

8. Remove the screw holding the upper rear of the RH panel to the floor console.

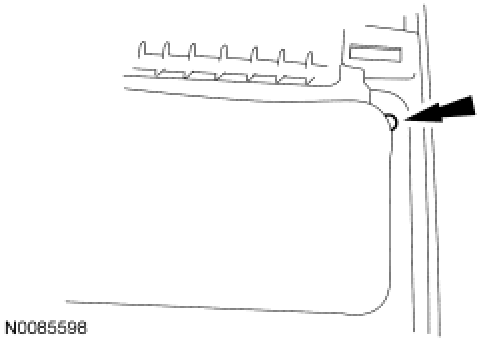


Fig. 55: Identifying Screws
Courtesy of FORD MOTOR CO.

9. Remove the screw holding the lower rear of the RH panel to the floor console.

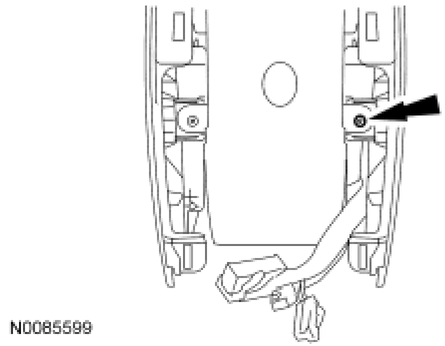


Fig. 56: Identifying Screws
Courtesy of FORD MOTOR CO.

10. Remove the RH panel from the floor console by sliding it upward to disengage the clips.
11. Disengage the push-pins and remove the USB cable and port.

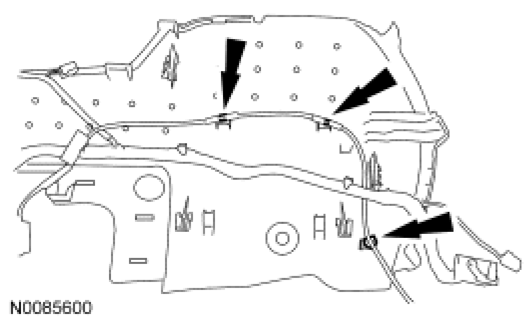


Fig. 57: Identifying push-pins
Courtesy of FORD MOTOR CO.

12. To install, reverse the removal procedure.

2008 ENGINE PERFORMANCE

Evaporative Emissions - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Evaporative emission (EVAP) canister bolts	9	-	80
EVAP shield bolts	9	-	80
Fuel tank bolts	25	18	-
Fuel tank bracket bolts	25	18	-

DESCRIPTION AND OPERATION

EVAPORATIVE EMISSIONS

NOTE: The vehicle emission vacuum routing diagrams are contained in the Description and Operation subsection of the Engine Emissions Control part. Refer to ENGINE EMISSION CONTROL article.

The evaporative emission (EVAP) system consists of the:

- EVAP canister purge valve.
- EVAP canister.
- EVAP canister vent solenoid (includes the dust separator).
- fuel vapor tube assembly (includes the fuel tank pressure [FTP] sensor).
- fuel tank filler cap.

The EVAP system:

- prevents hydrocarbon emissions from reaching the atmosphere.
- stores fuel vapors in the EVAP canisters, that are generated during vehicle operation or hot soak, until they can be consumed by the engine during normal engine operation.
- routes the stored fuel vapors to the engine during engine operation.
- is controlled by the PCM which, using various sensor inputs, calculates the desired amount of purge flow. The PCM regulates the purge flow, induced by the application of intake manifold vacuum, by varying the duty cycle applied to the vapor tube.

The fuel vapors are routed:

- from the fuel tank through the vapor vent valve (internal to the tank).
- to the EVAP canisters through a vapor tube.

- from the EVAP canister to the engine when the EVAP canister purge valve is opened by the PCM.

The FTP sensor (part of fuel vapor tube assembly):

- monitors the pressure levels in the fuel tank.
- communicates the pressure reading to the PCM during the OBD II leak test.

The fuel vapor tube assembly:

- is located midway under the vehicle along the LH frame rail.
- is used to route the flow of fuel vapors entering the EVAP system.

The EVAP canister:

- is located on the underside of the vehicle directly below the driver seat.
- contains activated carbon.
- stores fuel vapors.

The fuel tank filler cap:

- is sealed against the fuel tank filler pipe and does not relieve system pressure.

The EVAP canister vent solenoid:

- is normally open.
- seals the EVAP system for the inspection and maintenance (I/M 240) test and OBD II leak and pressure tests.
- is mounted to the EVAP canister bracket.

The EVAP canister purge valve:

- is normally closed.
- regulates the purging of the EVAP canister.
- is controlled by the PCM.
- is repaired as a separate item.
- is mounted to the cowl on a bracket.

The EVAP dust separator:

- is attached to the EVAP canister vent solenoid mounted on the EVAP canister bracket.
- prevents suspended dust and dirt particles from entering the EVAP system.
- is repaired as an assembly with the EVAP canister vent solenoid.

The EVAP system monitor:

- is a self-test strategy within the PCM which tests the integrity of the EVAP system.
- monitors the EVAP system for leaks.
- monitors electronic EVAP components for irrationally high or low voltages.
- monitors for correct EVAP system operation.
- uses negative and positive leak test methods to test and activate the EVAP system.

The engine ON EVAP leak-check monitor:

- is executed by the individual components of the enhanced EVAP system. Intake manifold vacuum is utilized to reach a target vacuum on the EVAP system. The FTP sensor is used by the engine ON EVAP leak-check monitor to determine if the target vacuum necessary to carry out the leak-check on the EVAP system has been reached. Once target vacuum on the EVAP system is achieved, the change in EVAP system vacuum over a calibrated period of time determines if a leak exists.

The Engine Off Natural Vacuum (EONV) EVAP leak-check monitor is executed:

- once the engine ON EVAP leak-check monitor is completed and the key is turned OFF. The EONV EVAP leak-check monitor determines if a leak is present when the naturally occurring change in the fuel tank pressure or vacuum does not exceed a calibrated limit during a calibrated amount of time. A separate, low-power consuming microprocessor in the PCM manages the EONV leak-check. The engine OFF EVAP leak-check monitor is executed by the individual components of the enhanced EVAP system.

DIAGNOSTIC TESTS

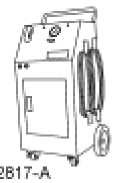
EVAPORATIVE EMISSIONS

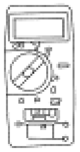
Refer to the **Introduction - Gasoline Engines** article.

GENERAL PROCEDURES

EVAPORATIVE EMISSION SYSTEM LEAK TEST

Special Tools

Illustration	Tool Name	Tool Number
 ST2617-A	VACUTEC Smoke Machine Fuel Evaporative Emission System Tester	218-0002 or equivalent
	Vehicle Communication Module (VCM) and Integrated Diagnostic	software with appropriate

 ST1137-A	System (IDS)	hardware, or equivalent scan tool

Phase 1 - Leak Verification

1. Run the EVAP Test with the scan tool.

NOTE: Some small leaks may not be detected using the EVAP Test. If the system has passed the test but a leak is still suspected, then proceed to Phase 2.

2. If the Evaporative Emission (EVAP) system failed the EVAP Test, then proceed to Phase 2.

Phase 2 - System Leak Check

1. Disconnect the upper vapor tube-to-EVAP canister purge valve quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
2. Connect the VACUTEC Smoke Machine Fuel Evaporative Emission System Tester to the upper EVAP canister purge valve fitting. For additional information, refer to the manufacturer's instructions.

NOTE: The battery ground cable was previously disconnected in the vapor tube quick connect coupling procedure.

3. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

NOTE: In the scan tool, the EVAP canister purge valve is referred to as the EVAP vapor management valve.

4. Open the EVAP canister purge valve with the scan tool.
5. Close the canister vent solenoid with the scan tool.
6. Carefully turn the fuel tank filler cap counterclockwise until the thread disengages and position aside.

NOTE: If smoke does not exit the fuel tank filler pipe neck area after the system is pressurized, open the canister vent solenoid with the scan tool to allow the air to purge. Once smoke is seen at the canister vent solenoid, close the canister vent solenoid with the scan tool.

7. Introduce smoke from the VACUTEC Smoke Machine Fuel Evaporative Emission System Tester into the EVAP system and verify that smoke is exiting the fuel tank filler pipe neck area. For additional information, refer to the manufacturer's instructions.
8. Install the fuel tank filler cap once smoke is observed exiting the fuel tank filler pipe neck area.

9. Continue to enter smoke into the system for 60 seconds to obtain pressure.
10. Press and release the remote start button in intervals of 15 seconds ON and 15 seconds OFF while checking for exiting smoke.
11. Use the halogen light provided with the VACUTEC Smoke Machine Fuel Evaporative Emission System Tester to follow the EVAP system path and look for smoke exiting at the source of the leak(s).
12. Repair any leaks as necessary.
13. Repeat the leak test until the system passes.

REMOVAL AND INSTALLATION

EVAPORATIVE EMISSION CANISTER PURGE VALVE

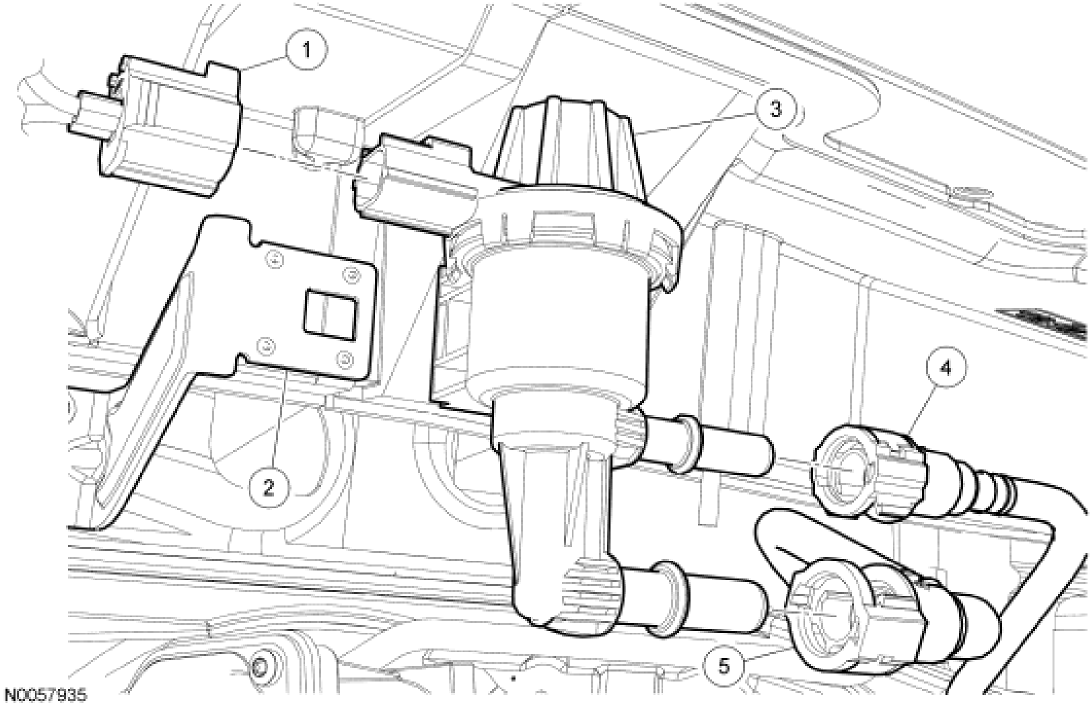


Fig. 1: Exploded View Of Evaporative Emission Canister Purge Valve
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Evaporative emission (EVAP) canister purge valve electrical connector
2	9F931	EVAP canister purge valve bracket
3	9G641	EVAP canister purge valve
4	-	EVAP canister purge valve vapor tube quick connect coupling (part of 9G271)
5	-	EVAP canister purge valve vapor tube quick connect coupling (part of 9D661)

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

1. Disconnect the evaporative emission (EVAP) canister purge valve electrical connector.
2. Disconnect the 2 EVAP canister purge valve vapor tube quick connect couplings. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
3. Depress the tab and remove the EVAP canister purge valve from the bracket.

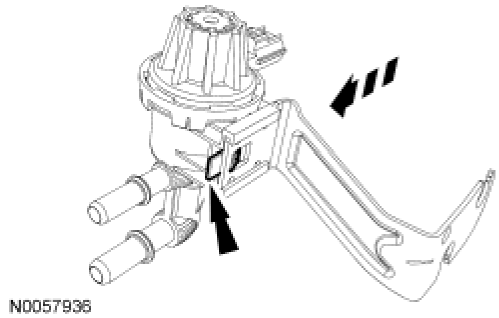


Fig. 2: Depressing Tab & Removing EVAP Canister Purge Valve From Bracket
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.
   - Carry out the Evaporative Emission System Leak Test. For additional information, refer to **Evaporative Emission System Leak Test**.

EVAPORATIVE EMISSION CANISTER

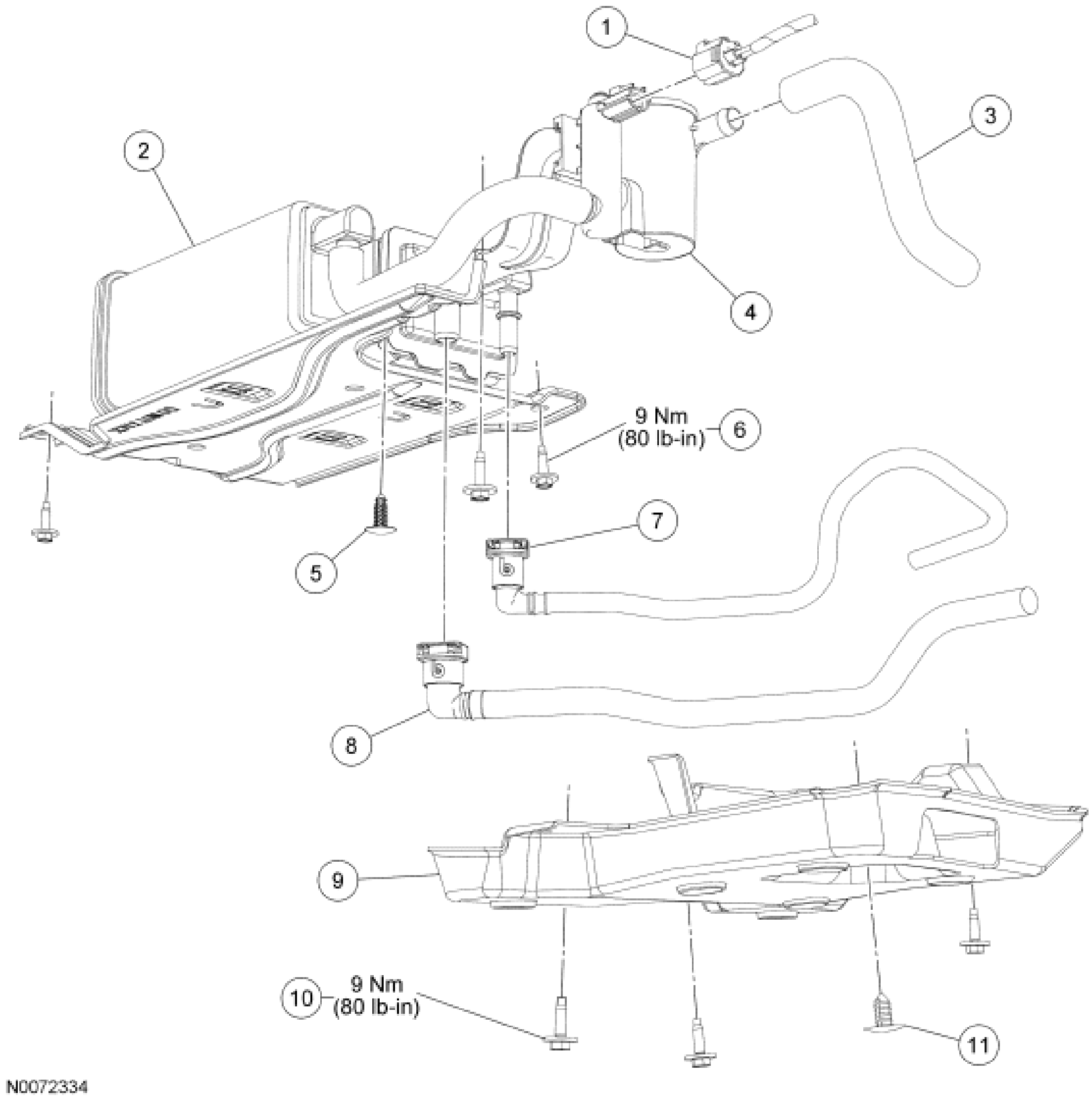


Fig. 3: Exploded View Of Evaporative Emission Canister With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Evaporative emission (EVAP) canister vent solenoid electrical connector
2	9E857	EVAP canister
3	-	Fuel vapor tube (part of 9E857)
4	9G676	EVAP canister vent solenoid/dust separator
5	W705681	EVAP canister pin-type retainer
6	W710330	EVAP canister bolt (3 required)
7	-	Fuel vapor tube-to-EVAP canister quick connect coupling (part of 9S284)
8	-	Fuel vapor tube assembly-to-EVAP canister quick connect coupling

		(part of 9S284)
9	9H296	EVAP shield
10	W710330	EVAP shield bolt (3 required)
11	W705681	EVAP shield pin-type retainer

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

NOTE: Correct placement of the hoist arm to the frame lifting point is essential for the removal and installation of the evaporative emission (EVAP) canister.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Remove the 3 bolts, pin-type retainer and the EVAP shield.
   - To install, tighten to 9 Nm (80 lb-in).
4. Disconnect the EVAP canister vent solenoid electrical connector.
5. Disconnect the fuel vapor tube-to-EVAP canister quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
6. Disconnect the fuel vapor tube assembly-to-EVAP canister quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
7. Disconnect the fuel vapor tube to the dust separator.
8. Remove the 3 EVAP canister bolts.
   - To install, tighten to 9 Nm (80 lb-in).
9. Release the pin-type retainer and remove the EVAP canister.

NOTE: When installing the EVAP canister, insert the alignment tab into the body first, then install the pin-type retainer and 3 bolts.

10. To install, reverse the removal procedure.
    - Carry out the Evaporative Emission System Leak Test. For additional information, refer to

Evaporative Emission System Leak Test.

EVAPORATIVE EMISSION CANISTER VENT SOLENOID

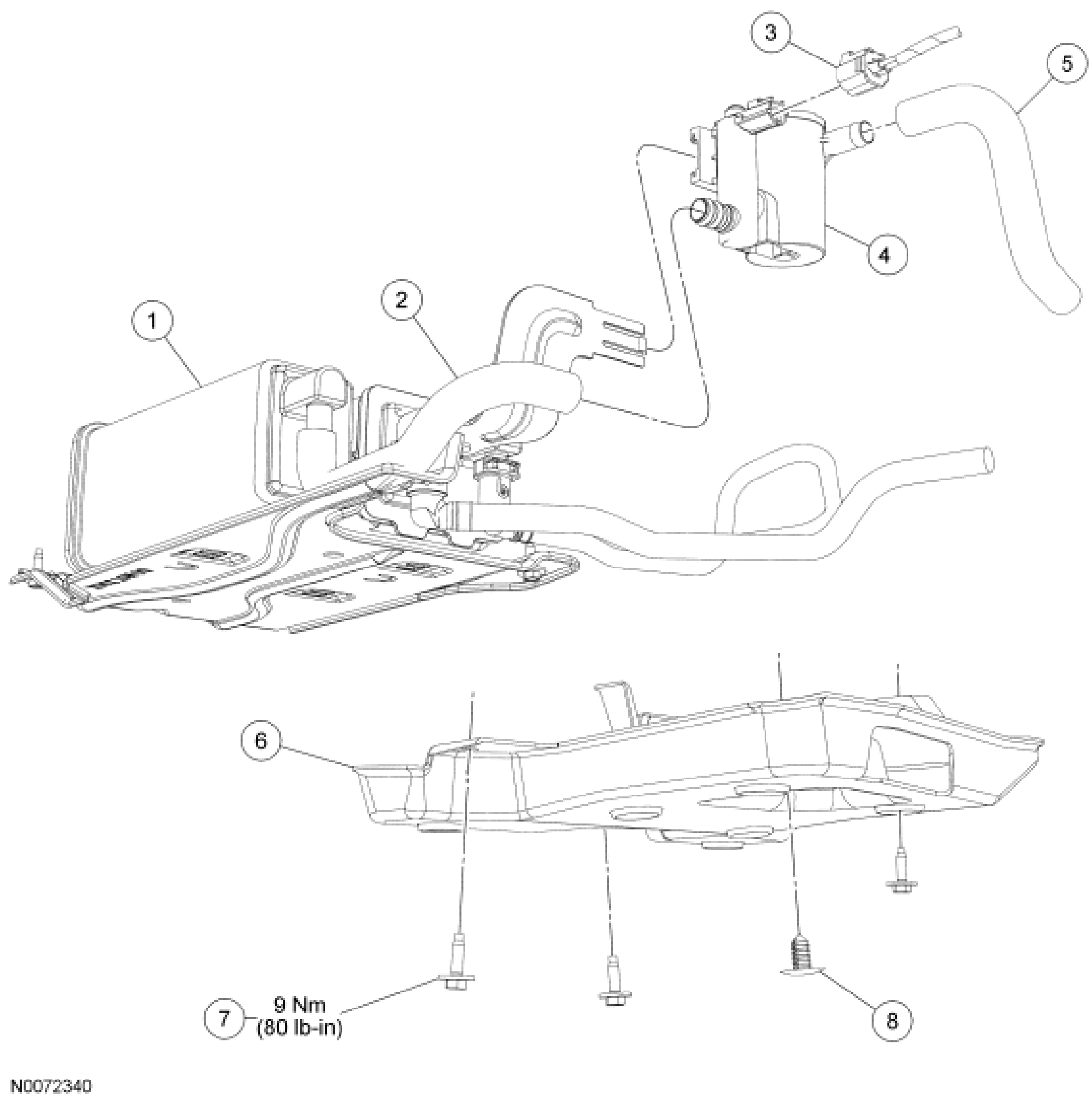


Fig. 4: Exploded View Of Evaporative Emission Canister Vent Solenoid With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	9E857	Evaporative emission (EVAP) canister
2	-	Fuel vapor tube (part of 9E857)
3	14A464	EVAP canister vent solenoid electrical connector
4	9G676	EVAP canister vent solenoid/dust separator

5	-	Fuel vapor tube (part of 9E857)
6	9H296	EVAP shield
7	W710330	EVAP shield bolt (3 required)
8	W705681	EVAP shield pin-type retainer

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

NOTE: The evaporative emission (EVAP) canister vent solenoid and the dust separator are serviced as an assembly.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Remove the 3 bolts, pin-type retainer and the EVAP shield.
   - To install, tighten to 9 Nm (80 lb-in).
4. Disconnect the EVAP canister vent solenoid electrical connector.
5. Disconnect the 2 fuel vapor tubes from the EVAP canister vent solenoid/dust separator.
6. Depress the tab and remove the EVAP canister vent solenoid/dust separator from the EVAP canister bracket.
7. To install, reverse the removal procedure.
   - Carry out the Evaporative Emission System Leak Test. For additional information, refer to **Evaporative Emission System Leak Test**.

FUEL VAPOR TUBE ASSEMBLY

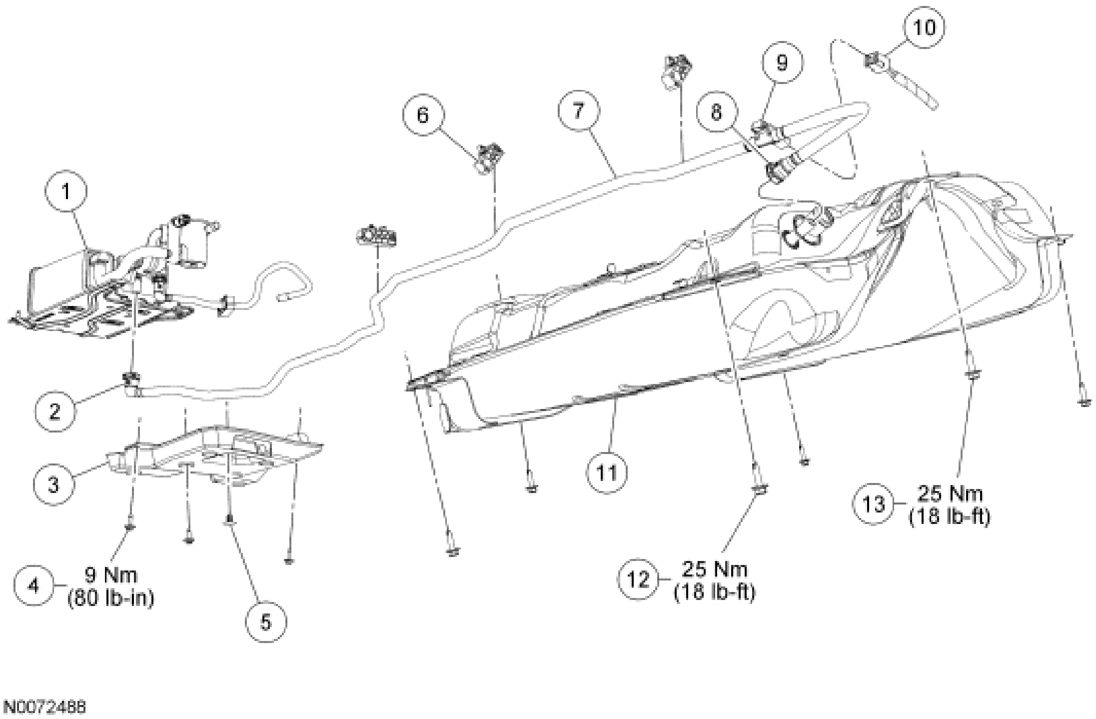


Fig. 5: Exploded View Of Fuel Vapor Tube Assembly With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	9E857	Evaporative emission (EVAP) canister
2	-	Fuel vapor tube assembly-to-EVAP canister quick connect coupling (part of 9S284)
3	9H296	EVAP shield
4	W710330	EVAP shield bolt (3 required)
5	W705681	EVAP shield pin-type retainer
6	9F931	Fuel tube bundle retainer clip (4 required)
7	9S284	Fuel vapor tube assembly
8	-	Fuel vapor tube assembly-to-fuel tank quick connect coupling (part of 9S284)
9	-	Fuel tank pressure (FTP) sensor (part of 9S284)
10	14A464	FTP sensor electrical connector
11	9K007	Fuel tank
12	W712826	Fuel tank bolt (4 required)
13	W712826	Fuel tank bracket bolt (2 required)

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable**

mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the fuel tank pressure (FTP) sensor electrical connector.
3. Remove the 3 bolts, pin-type retainer and the evaporative emission (EVAP) shield.
   - To install, tighten to 9 Nm (80 lb-in).
4. Disconnect the fuel vapor tube assembly-to-EVAP canister quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
5. Disconnect the fuel vapor tube assembly-to-fuel tank quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
6. Position a suitable lifting device under the fuel tank.
7. Remove the 2 fuel tank bracket bolts and the 4 fuel tank bolts and partially lower the fuel tank.
   - To install, tighten to 25 Nm (18 lb-ft).
8. Release the 4 fuel tube bundle retainer clips and remove the fuel vapor tube assembly.
9. To install, reverse the removal procedure.
   - Carry out the Evaporative Emission System Leak Test. For additional information, refer to **Evaporative Emission System Leak Test**.

2008 ENGINE

Exhaust System - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft
Bracket-to-catalytic converter bolts	20	15
Catalytic converter support bracket-to-engine block bolts	40	30
Catalytic converter support bracket-to-engine block nut	40	30
Catalytic converter support bracket-to-transmission bolts	48	35
Catalytic converter-to-exhaust manifold nuts	40	30
Catalytic converter-to-exhaust manifold studs	25	18
Exhaust flexible pipe-to-exhaust Y-pipe nuts	40	30
Exhaust Y-pipe-to-catalytic converter nuts	40	30
Power steering rack shield bolts	15	11
Roll restrictor bolt	90	66
Roll restrictor shield nuts	11	8
Torca® clamp	47	35
Universal joint (U-joint) flange bolts	70	52

DESCRIPTION AND OPERATION

EXHAUST SYSTEM

The exhaust system consists of:

- an exhaust flexible pipe.
- two muffler assemblies.
- one resonator assembly.
- muffler brackets with isolators bolted to the body.
- an exhaust Y-pipe.
- a catalyst monitor sensor mounted to each catalytic converter.
- a LH and RH catalytic converter.

The exhaust system provides an exit for exhaust gases and reduces engine noise by passing exhaust gases through the catalytic converters, a muffler assembly and resonator. Rubber exhaust hanger isolators attach the exhaust system to the mounting hooks.

Catalytic Converter

The catalytic converter plays a major role in the emission control system. The catalytic converter operates as a gas reactor. Its catalytic function is to speed the heat-producing chemical reaction of components in the exhaust gases in order to reduce air pollutants.

The catalyst material inside the catalytic converter consists of a ceramic substrate.

Precautions

CAUTION: Do not use leaded fuel in a vehicle equipped with a catalytic converter. In a vehicle that is continually misfueled, the lead in the fuel will be deposited in the catalytic converter and completely blanket the catalyst. Lead reacts with platinum to "poison" the catalyst. Continuous use of leaded fuel can destroy the catalyst and render the catalytic converter useless.

CAUTION: The addition of lead to the catalytic converter can also solidify the catalyst, causing excessive back pressure in the exhaust system and possibly causing engine damage.

CAUTION: Extremely high temperatures of 1,100°C (2,012°F) or above due to misfiring or an over-rich fuel/air mixture will cause the ceramic substrate to sinter or burn, destroying the catalytic converter. Do not continue to operate the vehicle if the engine is misfiring, there is a power loss, or other unusual operating conditions, such as engine overheating and backfiring.

The catalytic converter is designed to provide a long life. No maintenance is necessary for the catalytic converter.

Sound Insulators and Shields

Sound insulators and shields, attached to the underbody, protect the vehicle from exhaust system heat and should be inspected at regular intervals to make sure they are not dented or out of position. If a sound insulator and shield is damaged or shows evidence of deterioration, it should be replaced. The sound insulators and shields for the muffler, muffler pipe, resonator and catalytic converter pipe are installed separately.

DIAGNOSTIC TESTS

EXHAUST SYSTEM

Special Tools

Illustration	Tool Name	Tool Number
 ST2311-A	Electronic Vibration Analyzer or equivalent	100-F027 (014-00344)

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the components of the exhaust system and related controls that may affect exhaust gas quality or loss of power.
3. Visually inspect for obvious signs of mechanical damage. Refer to the following chart.

VISUAL INSPECTION CHART

Mechanical
• Exhaust pipe pinched or crushed • Damaged muffler • Broken or damaged exhaust hanger brackets • Damaged catalytic converter • Cracked exhaust manifold • Loose or damaged heat shields

4. Verify that the exhaust system is installed correctly, with clamps correctly located and tightened to specification.
5. If the fault is not visually evident, determine the symptom. Go to **Symptom Chart - Exhaust System** or Go to **Symptom Chart - Noise, Vibration and Harshness (NVH)**.

Symptom Chart - Exhaust System

Symptom Chart - Exhaust System

Condition	Possible Sources	Action
• Vehicle has low or no power - vehicle performance complaint	• Exhaust pipe pinched or crushed • Damaged catalytic converter • Loose obstruction in exhaust	• INSPECT the exhaust components for damage. REPAIR or INSTALL new components as necessary. TEST the system for normal operation. If the concern is still present, REFER to the **Introduction - Gasoline Engines** article.
	• Restricted exhaust (possible frozen condensate in muffler)	• CHECK drain holes for debris. PARK the vehicle inside to thaw. TEST the vehicle for normal operation. If the concern is still present, REFER to the **Introduction - Gasoline Engines** article.

• Burning smell - usually occurs at idle, with possible traces of smoke	• Foreign material caught in exhaust system • Missing heat shields	• INSPECT the exhaust system for debris or missing heat shields. REPAIR or INSTALL new components as necessary. TEST the system for normal operation after the repair.
• Odor - described as a sulfur or rotten egg smell	• Catalytic converter • Excessive sulfur content in fuel	• At times, a slight sulfur smell is normal for catalytic converters. The cause is the sulfur content in the gasoline being used. ADVISE the customer no repair is required.
	• Rich fuel conditions • Misfire conditions	• REFER to the **Introduction - Gasoline Engines** article.
• Visible rust on surface of exhaust pipes	• Catalytic converter/exhaust system	• Surface rust is a characteristic of materials used on exhaust systems. Exposure to heat or road salt may result in surface rust. INSPECT for perforations. If there are no perforations, the condition is normal.

Symptom Chart - Noise, Vibration and Harshness (NVH)

NOTE: Noise, vibration and harshness (NVH) symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.

Symptom Chart - Noise, Vibration and Harshness (NVH)

Condition	Possible Sources	Action
		• INSPECT the exhaust system for loose or missing heat shields or foreign material trapped between the heat

• Rattle, squeaks or buzz type noise - from the bottom of the vehicle	• Loose or damaged heat shield	shields and the exhaust system components. If any heat shields are loose, INSTALL worm gear clamp 7L5Z-5A231-AA and tighten to 7 Nm (62 lb-in). If the heat shields are missing, INSTALL new heat shields or exhaust system components as necessary. If a rattle, noise or buzz condition persists, INSTALL a new heat shield or component as necessary. TEST the system for normal operation after the repair.
	• Loose or damaged exhaust isolators	• VERIFY that the exhaust isolators are correctly installed. INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary. TEST the system for normal operation after the repair.
	• Damaged exhaust isolator hanger bracket	• INSPECT the exhaust system components for damage or broken hangers. INSTALL new components as necessary. CHECK for loose or damaged exhaust hanger brackets or fasteners. TIGHTEN the bolts to specification or INSTALL new components as necessary. TEST the system for normal operation after the repair.
	• Loose or damaged catalytic converter or muffler	• MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler, then the catalytic converter. DETERMINE if there are loose or broken baffles in the

	• Exhaust grounded to chassis	muffler or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary. TEST the system for normal operation after the repair. • INSPECT for signs of exhaust components-to-body contact. If necessary, CARRY OUT the **Exhaust System Alignment**.
• Drone or clunk type noise - from the bottom of the vehicle	• Loose or damaged exhaust isolators • Exhaust grounded to chassis	• INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary. TEST the system for normal operation after the repair. • INSPECT for signs of exhaust components-to-body contact. If necessary, CARRY OUT the **Exhaust System Alignment**.
• Whistles, boom, hum or ticking type noise - noise tends to change as the engine warms. The noises are often accompanied by exhaust fumes	• Exhaust system leak	• INSPECT the entire exhaust system for leaks. CHECK for punctures, loose or damaged clamps/fasteners, gaskets, sensors or broken welds. EXAMINE the chassis for grayish-white or black exhaust soot, which indicates exhaust leakage at that point. To magnify a small leak, have an assistant hold a rag over the tailpipe outlet while listening for a leak. REPAIR or INSTALL new components as necessary. TEST the system for normal operation after the repair.
		• MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system.

	• Catalytic converter	Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler and the catalytic converter. DETERMINE if there are loose or broken baffles in the muffler, or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary. TEST the system for normal operation after the repair.
	• Exhaust muffler/resonator drain hole enlarged due to corrosion	• CONFIRM the drain holes are the noise source. INSTALL new components as necessary. TEST the system for normal operation after the repair.
• Hissing or rushing noise - high frequency sound. Vehicle performance is unaffected	• Exhaust system. Exhaust flow through pipes	• CHECK the exhaust system for leaks. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler and the catalytic converter. Determine if there are loose or broken baffles in the muffler, or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary. TEST the system for normal operation after the repair.
• Pinging noise - occurs when exhaust system is hot, engine turned off	• Catalytic converter/exhaust system	• Cool down pinging is a result of the exhaust system expanding and contracting during heating and cooling. This is a normal condition.
• Vibration - occurs at idle and at low speeds. Also accompanied by a clunk or buzz type noise	• Loose or damaged exhaust isolator	• INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary. TEST the system for normal operation after the repair.

	• Loose or damaged exhaust isolator hanger brackets	• INSPECT the exhaust isolator hanger brackets for wear or damage. INSTALL or REPAIR as necessary. TEST the system for normal operation after the repair.
	• Damper broken or out of position	• CHECK for the correct damper orientation . RELOCATE to the correct position and tighten the nuts to specification. INSPECT for missing or damaged damper. INSTALL new components as necessary. TEST the system for normal operation after the repair.
	• Exhaust system grounded to chassis	• CARRY OUT the **Exhaust System Alignment**.
• Engine drumming noise - normally accompanied by vibration	• Damaged or misaligned exhaust system	• INSPECT the exhaust system for loose or damaged fasteners, Torca® clamps, or isolators. CARRY OUT the **Exhaust System Alignment**.
• Sputter type noise - noise worse when cold, lessens or disappears when the vehicle is at operating temperature	• Damaged or worn exhaust system	• INSPECT the exhaust system for leaks or damage. REPAIR as necessary. TEST the system for normal operation after the repair.
• Thumping noise - from the bottom of the vehicle, worse at acceleration	• Misaligned exhaust system	• CHECK the exhaust system to chassis clearance. CHECK the exhaust system isolators for damage. REPAIR as necessary. TEST the system for normal operation after the repair.
• Engine vibration - is felt with increases and decreases in engine RPM	• Strain on exhaust system isolators	• CARRY OUT the **Exhaust System Alignment**. REPAIR as necessary. TEST the system for normal operation after the repair.
• Drumming noise - occurs inside the vehicle during idle or high idle, hot or cold.	• Exhaust system vibration excites the body resonances	• Go to **Pinpoint Test A** .

Very low-frequency drumming is very RPM dependent	inducing interior noise	

Pinpoint Test

PINPOINT TEST A: DRUMMING NOISE

A1 CHECK THE EXHAUST SYSTEM

- Key in START position.
- Increase the engine RPM until the noise is the loudest. Note the engine RPM.
- Key in OFF position.

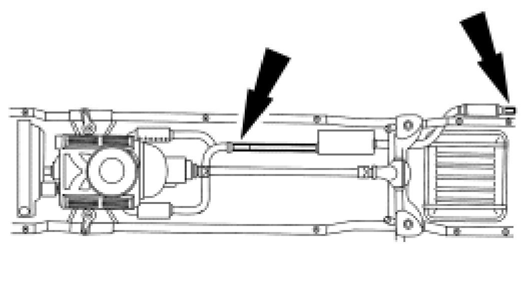


Fig. 1: Exhaust System
Courtesy of FORD MOTOR CO.

- Add approximately 9 kg (20 lb) of weight to the exhaust system. First place the weight at the tail pipe and test, then at the front pipe.
- Key in START position.
- Increase the engine RPM and listen for the drumming noise. Note the engine RPM if the noise occurs.
- Key in OFF position.
- Using a vibration analyzer (VA), determine the amount of vibration that occurs with the drumming noise.
- **Is the noise/vibration reduced or eliminated, or does the noise/vibration occur at a different RPM?**

  YES : REFER to **Exhaust System Alignment**. TEST the system for normal operation.

  NO : CONDUCT a diagnosis on other suspect systems. REFER to **NOISE, VIBRATION AND HARSHNESS** article.

GENERAL PROCEDURES

EXHAUST SYSTEM ALIGNMENT

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Loosen all fasteners joining the exhaust system components.
3. Beginning at the front of the vehicle, align the exhaust system to establish the maximum clearance. Make sure all fit pipes are pushed all the way into the preceding pipe and the notches are correctly lined up with the tabs.
4. Beginning at the front of the vehicle, tighten all fasteners and clamps to specification. For additional information, refer to **SPECIFICATIONS**.
5. Start the engine and check the exhaust system for leaks.

TORCA® CLAMP

1. Remove the nut from the Torca® clamp.
2. Grind the spot weld from the Torca® clamp and remove the clamp.
3. Clean the uneven surface area and position a Torca® clamp.

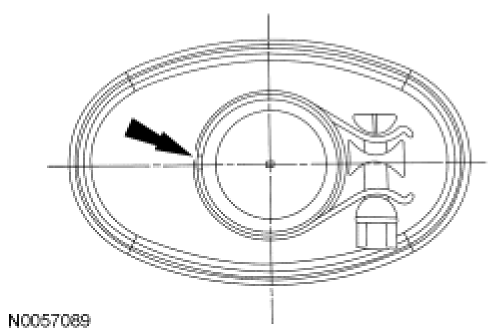


Fig. 2: Locating Uneven Surface Area
Courtesy of FORD MOTOR CO.

NOTE: Make sure the clamp position is no more than 27.5 mm (1.08 in) or less than 25.5 mm (1 in) from the inlet of the resonator pipe.

4. Make sure the back of the slot is covered by the clamp and the button is fully seated inside the notch.

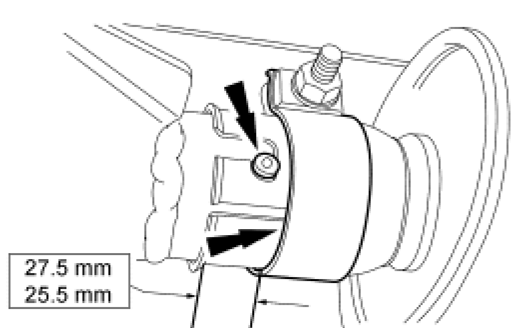


Fig. 3: Making Sure Back Of Slot Is Covered By Clamp & Button Is Fully Seated Inside Notch

With Specifications
Courtesy of FORD MOTOR CO.

NOTE: Do not tighten the clamp until the exhaust system has been aligned.

5. Tighten the Torca® clamp.
    - Tighten to 47 Nm (35 lb-ft).

REMOVAL AND INSTALLATION

EXHAUST SYSTEM - EXPLODED VIEW

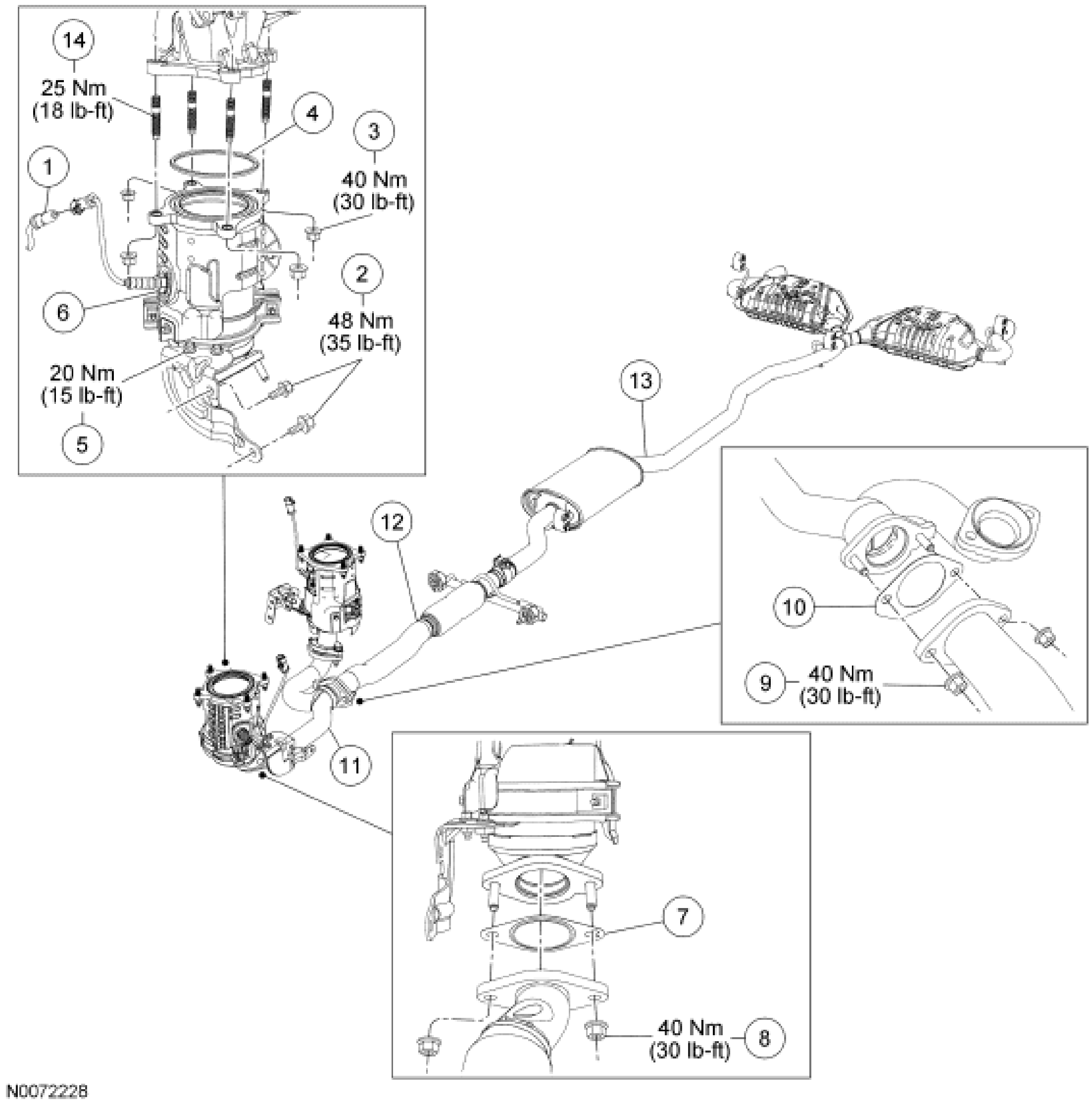


Fig. 4: Exploded View Of Exhaust System With Torque Specifications (1 Of 3)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	LH catalyst monitor sensor electrical connector
2	W710656	LH catalytic converter support bracket-to-transmission bolts (2 required)
3	W705443	LH catalytic converter-to-exhaust manifold nut (4 required)
4	5F263	Gasket
5	5G228	Bracket-to-LH catalytic converter bolt (2 required)
6	5E213	LH catalytic converter
7	9451	Gasket
8	W705443	Exhaust Y-pipe-to-LH catalytic converter nut
9	W705443	Exhaust flexible pipe-to-exhaust Y-pipe nut (2 required)
10	9451	Gasket
11	5G274	Exhaust Y-pipe
12	5G203	Exhaust flexible pipe
13	5G213	Muffler and tailpipe
14	W712458	LH catalytic converter-to-exhaust manifold stud (4 required)

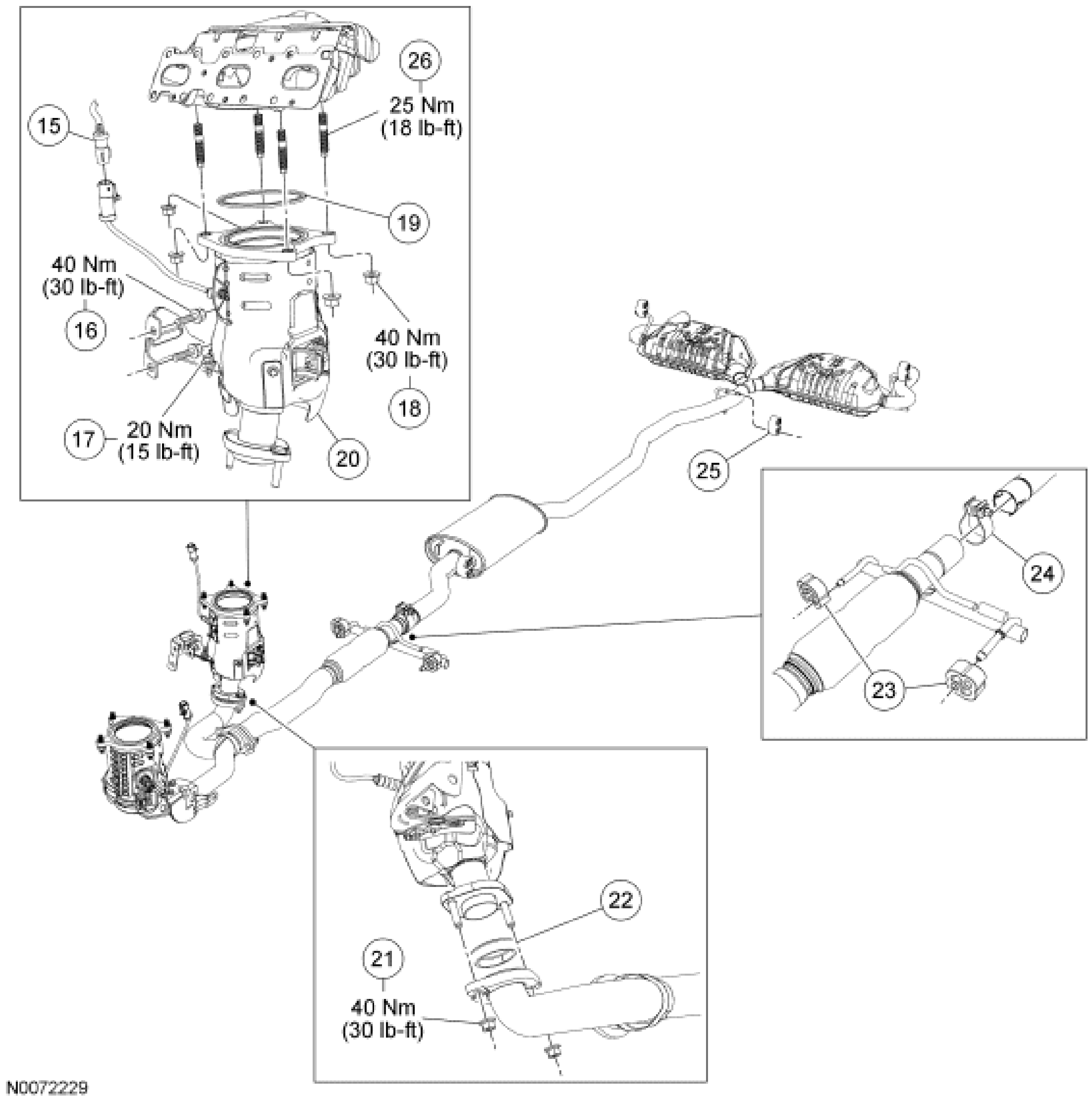


Fig. 5: Exploded View Of Exhaust System With Torque Specifications (2 Of 3)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
15	14A464	RH catalyst monitor sensor electrical connector
16	W710512/ W705443	RH catalytic converter support bracket-to-engine block bolt (2 required) (front wheel drive [FWD] nut)
17	5G228	Bracket-to-RH catalytic converter bolt (2 required)
18	W705443	RH catalytic converter-to-exhaust manifold nut (4 required)
19	5F263	Gasket

20	5E211	RH catalytic converter
21	W705443	Exhaust Y-pipe-to-RH catalytic converter nut (2 required)
22	5E241	Gasket
23	5F262	Exhaust flexible pipe isolators (2 required)
24	5221	Torca® clamp
25	5F262	Muffler and tailpipe isolator (4 required)
26	W712458	RH catalytic converter-to-exhaust manifold stud (4 required)

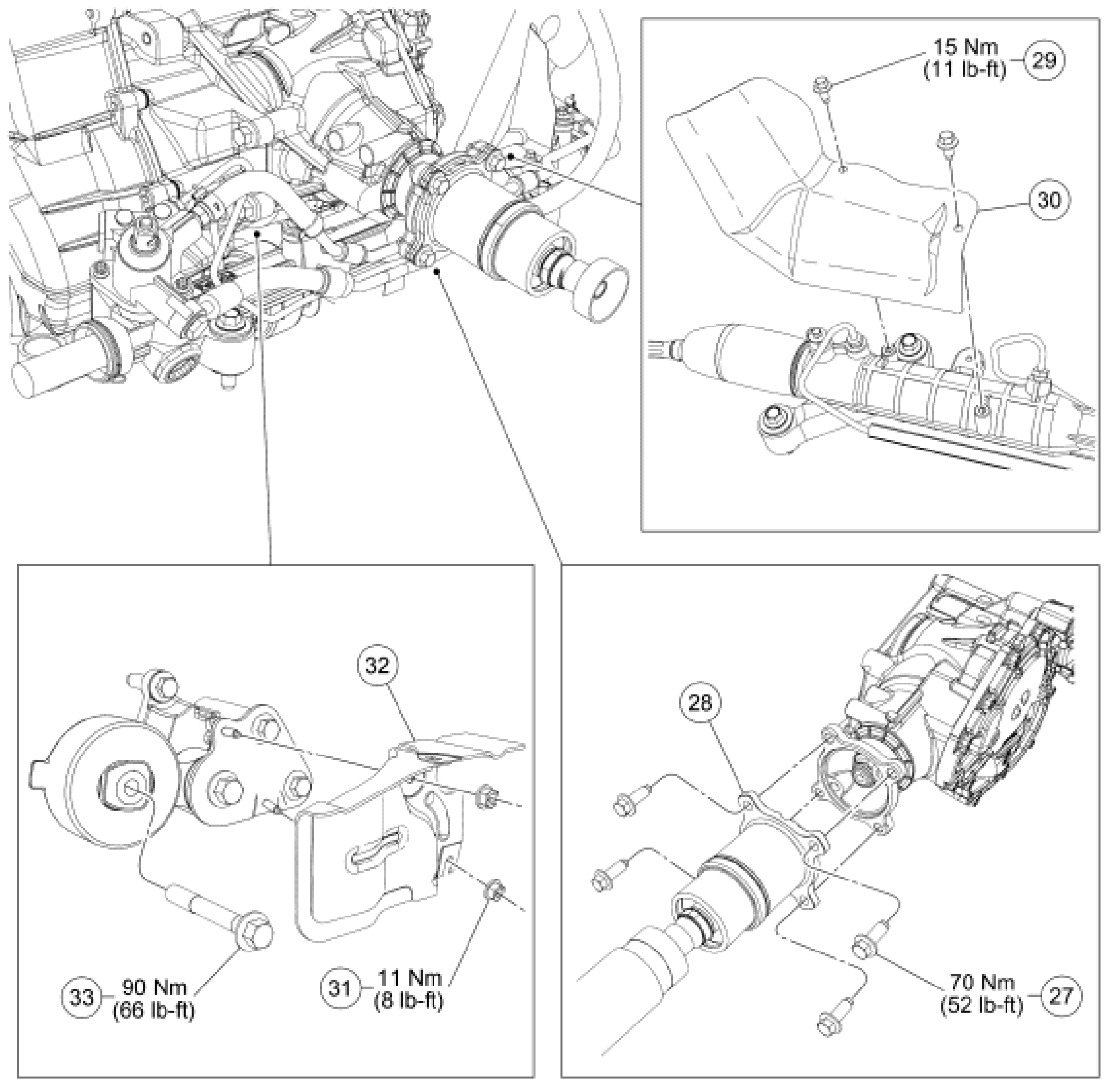


Fig. 6: Exploded View Of Exhaust System With Torque Specifications (3 Of 3)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
27	W711918	U-joint flange bolts (4 required) (all wheel drive [AWD] only)
28	4K357	Front driveshaft (AWD only)
29	W500210	Power steering rack shield bolts (2 required)
30	-	Power steering rack shield
31	W700101	Roll restrictor shield nut (2 required)
32	6C038	Roll restrictor shield
33	W706674	Roll restrictor bolt

1. For additional information, refer to the appropriate procedure.

CATALYTIC CONVERTER - LH

REMOVAL AND INSTALLATION

NOTE: Always install new fasteners and gaskets. Clean flange faces prior to new gasket installation to make sure of correct sealing.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the catalyst monitor sensor electrical connector.
3. Remove the exhaust Y-pipe. For additional information, refer to **Exhaust Y-Pipe**.
4. Remove the 2 catalytic converter support bracket-to-transmission bolts.
   - To install, tighten to 48 Nm (35 lb-ft).
5. Remove the 4 nuts and the LH catalytic converter.
   - Discard the nuts and gasket.
   - To install, tighten to 40 Nm (30 lb-ft).
6. To install, reverse the removal procedure.
   - Install a new gasket and nuts.

CATALYTIC CONVERTER - RH

All vehicles

NOTE: If necessary, the catalytic converter heat shield can be serviced separately.

NOTE: Always install new fasteners and gaskets. Clean flange faces prior to new gasket installation to make sure of correct sealing.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the catalyst monitor sensor. For additional information, refer to **ELECTRONIC ENGINE CONTROLS** article.
3. Remove the exhaust Y-pipe. For additional information, refer to **Exhaust Y-Pipe**.

All wheel drive (AWD) vehicles

NOTE: Index-mark the driveshaft for installation.

4. Remove and discard the 4 U-joint flange bolts and separate the front driveshaft and secure it with a length of mechanic's wire.
    - To install, tighten to 70 Nm (52 lb-ft).
5. Remove the intermediate shaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.
6. Remove the 2 catalytic converter support bracket-to-engine block bolts.
    - To install, tighten to 40 Nm (30 lb-ft).

All vehicles

7. Remove the 2 bolts and the power steering rack shield.
    - To install, tighten to 15 Nm (11 lb-ft).

Front wheel drive (FWD) vehicles

8. Remove the catalytic converter support bracket-to-engine block bolt and nut.
    - To install, tighten to 40 Nm (30 lb-ft).

All vehicles

9. Remove the 2 nuts and the roll restrictor shield.
    - To install, tighten to 11 Nm (8 lb-ft).
10. Remove the roll restrictor bolt and rotate the engine forward.
    - To install, tighten to 90 Nm (66 lb-ft).

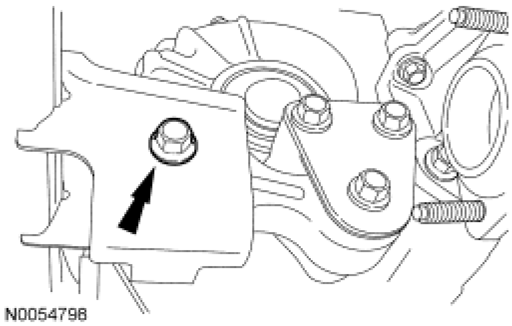


Fig. 7: Locating Roll Restrictor Bolt
Courtesy of FORD MOTOR CO.

11. Remove the 2 bracket-to-RH catalytic converter bolts.
    - To install, tighten to 20 Nm (15 lb-ft).
12. Remove the 4 nuts and the RH catalytic converter.
    - Discard the 4 RH catalytic converter nuts and gasket.
    - To install, tighten to 40 Nm (30 lb-ft).
13. To install, reverse the removal procedure.
    - Install a new gasket, nuts and studs.

EXHAUST FLEXIBLE PIPE

REMOVAL AND INSTALLATION

CAUTION: Do not excessively bend, twist or allow the exhaust to hang from the flexible pipe or damage to the exhaust system may occur.

NOTE: Always install new fasteners and gaskets. Clean flange faces prior to new gasket installation to make sure of correct sealing.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove and discard the 2 exhaust flexible pipe-to-exhaust Y-pipe nuts.
    - Discard the gasket.
    - To install, tighten to 40 Nm (30 lb-ft).
3. Remove the Torca® clamp. For additional information, refer to **Torca® Clamp**.
4. Separate the 2 exhaust flexible pipe isolators and remove the exhaust flexible pipe.
5. To install, reverse the removal procedure.
    - Install a new gasket and nuts.
6. Start the engine and check for exhaust leaks.

EXHAUST Y-PIPE

REMOVAL AND INSTALLATION

CAUTION: Do not excessively bend, twist or allow the exhaust to hang from the flexible pipe or damage to the exhaust system may occur.

NOTE: Always install new fasteners and gaskets. Clean flange faces prior to new gasket installation to make sure of correct sealing.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove and discard the 4 exhaust Y-pipe-to-LH and RH catalytic converter nuts.
   - Discard the gaskets.
   - To install, tighten to 40 Nm (30 lb-ft).
3. Remove and discard the exhaust Y-pipe-to-exhaust flexible pipe nuts and remove the exhaust Y-pipe.
   - Discard the gasket.
   - To install, tighten to 40 Nm (30 lb-ft).
4. To install, reverse the removal procedure.
   - Install new gaskets and nuts.
5. Start the engine and check for exhaust leaks.

MUFFLER AND TAILPIPE

REMOVAL AND INSTALLATION

NOTE: Do not use oil or grease-based lubricants on the isolators. They may cause deterioration of the rubber.

NOTE: Oil or grease-based lubricants on the isolators may cause the exhaust hanger isolator to separate from the exhaust hanger bracket during vehicle operation.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Support the muffler and tailpipe with a suitable jackstand.

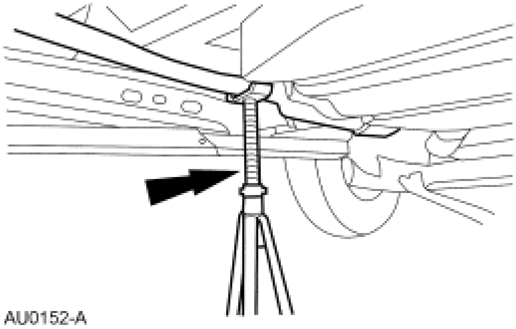


Fig. 8: Supporting Muffler & Tailpipe With A Suitable Jackstand
Courtesy of FORD MOTOR CO.

3. Remove the Torca® clamp. For additional information, refer to **Torca® Clamp**.

NOTE: Do not damage or tear the isolators during removal.

4. Using soapy water, separate the 4 muffler and tailpipe isolators from the vehicle.
5. Separate the muffler and tailpipe from the exhaust flexible pipe and remove the muffler and tailpipe.
6. To install, reverse the removal procedure.
   - Inspect and replace any isolators damaged or torn during the removal process.
7. Start the engine and check for exhaust leaks.

2008 ACCESSORIES & BODY, CAB

Exterior Lighting - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Headlamp assembly bolts	4	35
Liftgate lamp assembly nuts	6	53
Rear lamp screws	3	27

DESCRIPTION AND OPERATION

EXTERIOR LIGHTING

NOTE: **If equipped, the perimeter lighting feature can be enabled or disabled. When enabled, the exterior lamps are illuminated when the UNLOCK button is pressed on the remote keyless entry (RKE) transmitter. Refer to HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS article.**

NOTE: **The smart junction box (SJB) is also known as the generic electronic module (GEM).**

Battery Saver

NOTE: **Time-out is 1 minute if the vehicle has less than 80 km (50 miles).**

The battery saver is internal to the SJB and provides automatic shut-off of the headlamps and parking lamps after 10 minutes in order to save battery voltage. A timer is started when the ignition switch is turned to the OFF position with the headlamp switch in the HEADLAMPS ON position, or the headlamp switch is placed in the HEADLAMPS ON position with the ignition switch off. When the time-out period has elapsed, the voltage is automatically shut off to the lamps by the battery saver.

The battery saver does **not** control the parking lamps if the headlamp switch is in the PARKING LAMPS ON position.

Headlamps

The headlamp system is a quad-beam pattern system. It consists of replaceable low and high beam bulbs. The headlamp assembly has the park/turn indicator lamp integrated into the headlamp assembly. The SJB supplies voltage to the headlamps when demanded.

NOTE: **Some vehicles are equipped with the adaptive headlighting option. Refer to**

Adaptive Headlighting .

If the headlamps are on when the ignition switch is turned off, the battery saver feature turns off the headlamps after 10 minutes have elapsed.

Autolamps

The autolamp system provides light sensitive automatic on/off control of the exterior lamps. The autolamp system keeps the exterior lamps on for a pre-selected period of time after the ignition switch is turned to the OFF position (20 seconds is the factory default setting). The pre-selected time lapse is adjustable up to approximately 3 minutes.

Headlamps On With Wipers On Feature

On vehicles equipped with autolamps, there is also a feature called the headlamps on with wipers on feature. If the headlamp switch is in the AUTOLAMPS ON position and the front wipers are on for more than 10 seconds (except during a mist wipe or while the wipers are on to clear washer fluid during a wash condition), the exterior lamps are turned on. The exterior lamps are turned off when the ignition switch is changed to the OFF or ACC position, the headlamp switch is placed in the OFF position, or the front wipers are off for more than 30 seconds. The exception to this is when the exterior lights are on because of darkness determined by the light sensor.

For the headlamps on with wipers on feature, refer to **WIPERS AND WASHERS** article.

Stoplamps

The stoplamp switch is located on the brake pedal assembly. The stoplamps are supplied voltage when the brake pedal is applied.

Turn Signal/Hazard Lamps

The front turn signal lamps are located within the headlamp assemblies. The rear lamps share functionality with the stoplamps. When the multifunction switch is placed in the LH or RH TURN positions, the SJB routes voltage to the LH or RH turn signal lamps. The SJB then cycles the voltage on and off approximately 80 times per minute. If a front or rear turn bulb is inoperative, the SJB cycles the voltage on and off approximately 160 times per minute.

The hazard switch is located on the center instrument panel finish panel. When the hazard switch is pressed, the SJB supplies voltage to all the turn lamps. The SJB cycles the voltage on and off approximately 80 times per minute.

Parking Lamps

The SJB supplies voltage to the parking lamps when demanded. The parking lamp system includes the following:

- Front parking lamps

- Front side marker lamps
- Rear parking lamps
- Rear side marker lamps
- License plate lamps
- Liftgate lamp assembly (MKX only)

Fog Lamps

The fog lamp switch is integrated into the headlamp switch. When the fog lamp switch is engaged, the SJB provides ground for the fog lamp relay coil (integrated into the SJB), which then energizes and routes voltage to the fog lamps. The fog lamps can be turned on when the ignition switch is in the RUN or ACC position, the parking lamps are on, and the high beam headlamps are off.

Reversing Lamps

When the transmission is placed in REVERSE (R), the PCM provides ground for the reversing lamp relay coil. The reversing lamps receive voltage when the reversing lamp relay is energized. The reversing lamps are located within the rear lamp assemblies.

For MKX, the reversing lamps are LEDs integrated into the rear lamp assemblies.

Trailer Tow

When the vehicle's rear stop/turn or parking lamps are illuminated, voltage is also supplied to a corresponding trailer tow relay (coil side) located in the battery junction box (BJB).

Adaptive Headlighting

Vehicles equipped with adaptive front lighting have a module (located on the bottom of the LH headlamp assembly) to control the left/right aiming of the headlamp bulbs. Depending on the inputs received (steering wheel angle and vehicle speed for example), the adaptive front lighting module can change the angle at which the headlamps are aimed (left or right) to improve nighttime visibility around curves.

There are sensors and motors within each headlamp that the module uses to control the angle of the headlamp beams and are not repaired separately.

Daytime Running Lamps (DRL)

The SJB can be configured to turn the DRL on for this vehicle. Refer to **MODULE CONFIGURATION** article for additional information on this programmable parameter.

The DRL system operates the low beam headlamps at a reduced intensity.

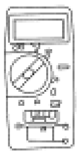
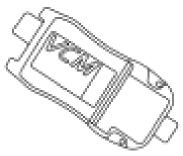
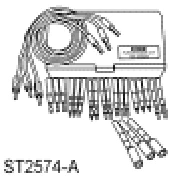
The SJB supplies pulse-width modulated (PWM) voltage to illuminate the low beam headlamps at a reduced intensity when the following conditions are met:

- The ignition switch is in the RUN position.
- The headlamps have not been turned on by the autolamp system or the headlamp switch.
- The transmission is not in PARK (P).

DIAGNOSTIC TESTS

HEADLAMPS

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

Exterior Lighting

The SJB monitors the headlamp switch position by sending voltage reference signals on multiple circuits to the headlamp switch. There is one circuit for each headlamp switch position. At any given time, one of the signal circuits is routed to ground.

If the SJB does not detect any of the inputs to the headlamp switch are active (routed to ground) for 5 seconds, the SJB turns on the exterior lights and keeps them on for 10 minutes after the ignition switch is turned off (or 10 minutes from the time the SJB does not detect any headlamp switch input if the ignition switch was already off). Additionally, if the SJB detects multiple circuits short to ground, the SJB implements a planned strategy depending on the multiple inputs received.

If either of these situations occur, the SJB should **NOT** be ruled immediately as being at fault. This is normal behavior of the SJB design as it has detected a fault with the inputs from the headlamp switch.

High Beam and Flash-to-Pass

The SJB also monitors the multifunction switch for a flash-to-pass or high beam request. There are 2 voltage reference circuits which monitor this. When the multifunction switch is in the FLASH-TO-PASS or HIGH BEAM position, the voltage signal is routed to ground.

NOTE: The flash-to-pass feature does not require any input from the headlamp switch.

When the SJB receives an input requesting the headlamps on, the SJB supplies voltage to the low beams. If the low beams are on and the SJB receives a request for high beams (or just a flash-to-pass request), the SJB energizes an internal relay which routes voltage to the headlamps.

Field-Effect Transistor (FET) Protection

The SJB utilizes a FET protective circuit strategy for many of its outputs (for example, the headlamp output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault is detected. A continuous DTC is stored at that time of the fault. The circuit then resets after a customer demand of the function (switching the component on, battery saver being energized). When an excessive circuit load occurs several times, the module shuts down the output until a repair procedure is carried out. At the same time, the continuous DTC that was stored on the first failure, does not clear by a command to clear the continuous DTCs. The module does not allow this code to be cleared or the circuit restored to normal operation until a successful on-demand self-test proves that the fault has been repaired. After the on-demand self-test has successfully completed (no on-demand DTCs present), the continuous DTC clears and the circuit function returns.

Each circuit has 3 predefined levels of short circuit tolerance established in the module based on each circuits' capability. When the first or second level is reached, the continuous DTC associated with the circuit sets along with DTC B106E. These DTCs may be cleared using the Clear DTC operation on the scan tool as long as the fault itself has been corrected. If any of the circuits are shorted past the third level, then DTCs B106F and B1342 set along with the associated continuous DTC. This DTC cannot be cleared and the module must be replaced.

The SJB FET protected output circuits for the headlamp system are for the LH low beam output and the RH low beam output circuits.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
	• Smart junction box

• Headlamp switch • Multifunction switch • Headlamp assembly	(SJB) fuse(s): ◦ 7 (10A) (LH low beam) ◦ 8 (10A) (RH low beam) ◦ 23 (15A) (high beams) • Bulb(s) • Bulb holder(s) • Wiring, terminals or connectors • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1472	Lamp Headlamp Input Circuit Short to Ground	Go to **Pinpoint Test D** .
B1510	Flash To Pass Switch Circuit Short to Ground	Go to **Pinpoint Test D** .
B1696	Autolamp On Circuit Short To Ground	Go to **Pinpoint Test D** .
B2008	Wipers On Signal Circuit Short to Ground	Go to **Pinpoint Test D** .
B2A22	Headlamp Off Circuit Open	ADDRESS any other DTCs first. Go to **Pinpoint Test D** .
B2A23	High Beam Input Circuit Short to Ground	Go to **Pinpoint Test D** .
B2A2E	Right Front Lamp Low Beam Circuit Open	If the low beam is inoperative, go to **Pinpoint Test B** . If the low beam is always on, go to **Pinpoint Test D** .
B2A2F	Right Front Lamp Low Beam Circuit Short to Ground	Go to **Pinpoint Test B** .
B2A30	Left Front Lamp Low Beam Circuit Open	If the low beam is inoperative, go to **Pinpoint Test B** . If the low beam is always on, go to **Pinpoint Test D** .
B2A31	Left Front Lamp Low Beam Circuit Short to Ground	Go to **Pinpoint Test B** .
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Fuse • Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
	NOTE:	

• Both low beams are inoperative	**Due to varying wattage ratings and resulting current draw, certain aftermarket headlamp bulbs may cause the SJB to shut down the short circuit protection, resulting in the low beams becoming inoperative.** • Incorrect bulbs	• VERIFY that the bulbs meet Ford specifications. If the bulbs do not meet Ford specifications, INSTALL the correct bulbs. RUN the on-demand self-test (required to clear certain DTCs and reset the SJB). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.

	• SJB	• CHECK for recorded SJB DTCs.
		  • If DTCs are present, REFER to DTC Charts in this service information.
		  • If no DTCs are present, INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

• Both high beams are inoperative	• Fuse • Wiring, terminals or connectors • Joint connector • Multifunction switch • SJB	• Go to **Pinpoint Test A** .
• One low beam headlamp is inoperative	• Fuse • Wiring, terminals or connectors • Joint connector • Headlamp assembly (MKX) • SJB	• Go to **Pinpoint Test B** .
• One high beam headlamp is inoperative	• Wiring, terminals or connectors • Joint connector • Headlamp assembly (MKX)	• Go to **Pinpoint Test C** .

• The headlamp(s) are on continuously	• Wiring, terminals or connectors • Joint connector • Headlamp switch • Multifunction switch • Windshield wiper motor • SJB	• Go to **Pinpoint Test D** .
• The flash-to-pass feature is inoperative	• Wiring, terminals or connectors • Multifunction switch • SJB	• Go to **Pinpoint Test E** .

Pinpoint Tests

Pinpoint Test A: Both High Beams Are Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Headlamps/Autolamps for schematic and connector information.

Normal Operation

When the headlamp switch is placed in the HEADLAMPS ON position, the smart junction box (SJB) monitors the high beam request circuit from the multifunction switch through circuit CLF17 (WH/OG). When the multifunction switch is placed in the HIGH BEAM position, the signal is routed to ground through circuit GD116 (BK/VT) (which routes through a joint connector). The SJB then energizes the high beam relay (integrated into the SJB) which supplies voltage to the headlamps through circuit CLF08 (YE/VT).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Joint connector
- Multifunction switch
- SJB

PINPOINT TEST A: BOTH HIGH BEAMS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

A1 CHECK THE HIGH BEAM INDICATOR

- Key in ON position.
- Place the headlamp switch in the HEADLAMPS ON position.
- Place the multifunction switch in the HIGH BEAM position.
- **Does the high beam indicator illuminate?**

  YES : Go to A6.

  NO : Go to A2.

A2 CHECK THE MULTIFUNCTION SWITCH

- Place the headlamp switch in the OFF position.
- Key in OFF position.
- Disconnect: Multifunction Switch C202

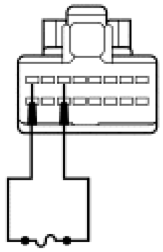


Fig. 1: Connecting Fused Jumper Wire
Courtesy of FORD MOTOR CO.

- Connect a fused (5A) jumper wire between the multifunction switch C202-6, circuit CLF17 (WH/OG), harness side and the multifunction switch C202-8, circuit GD116 (BK/VT), harness side.
- Place the headlamp switch in the HEADLAMPS ON position.
- **Do the high beams illuminate?**

  YES : REMOVE the jumper wire. INSTALL a new multifunction switch. REFER to **STEERING COLUMN SWITCHES** article. TEST the system for normal operation.

  NO : REMOVE the jumper wire. Go to A3.

A3 CHECK CIRCUIT GD116 (BK/VT) FOR CONTINUITY TO GROUND

NOTE: **The battery ground cable must be disconnected for accurate test results when checking ground circuits for continuity to ground.**

- Place the headlamp switch in the OFF position.

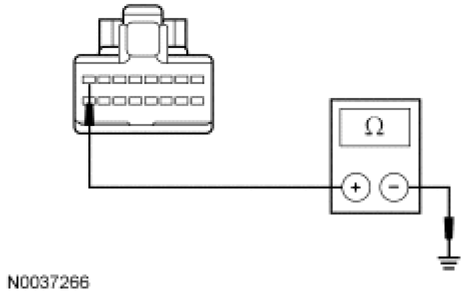


Fig. 2: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the multifunction switch C202-8, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to A5.

  NO : Go to A4.

A4 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

- Disconnect: Joint Connector 6 C2365

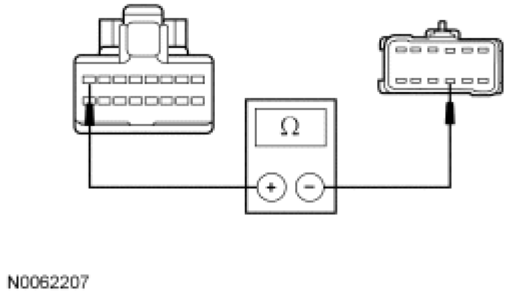


Fig. 3: Measuring Resistance Between Multifunction Switch C202-8, Circuit GD116 (BK/VT) & Joint Connector 6 C2365-D
Courtesy of FORD MOTOR CO.

- Measure the resistance between the multifunction switch C202-8, circuit GD116 (BK/VT), harness side and the joint connector 6 C2365-D, circuit GD116 (BK/VT), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new joint connector. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

A5 CHECK CIRCUIT CLF17 (WH/OG) FOR AN OPEN

- Disconnect: SJB C2280b

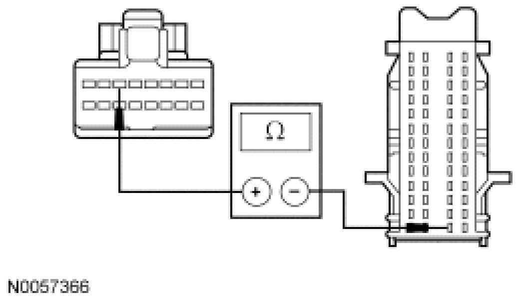


Fig. 4: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the multifunction switch C202-6, circuit CLF17 (WH/OG), harness side and the SJB C2280b-27, circuit CLF17 (WH/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A7.

  NO : REPAIR the circuit. TEST the system for normal operation.

A6 CHECK CIRCUIT CLF08 (YE/VT) FOR AN OPEN

- Disconnect: SJB C2280e

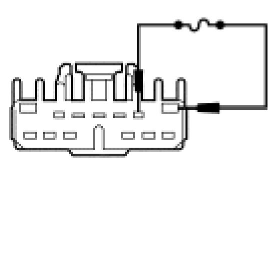


Fig. 5: Connecting Fused Jumper Wire
Courtesy of FORD MOTOR CO.

- Connect a fused (20A) jumper wire between the SJB C2280e-1, circuit CBB53 (GY/BN), harness side and the SJB C2280e-2, circuit CLF08 (YE/VT), harness side.
- Key in ON position.
- **Do the high beams illuminate?**

  YES : VERIFY the SJB fuse 23 (15A) is OK. If OK, go to A7.

  NO : REPAIR the circuit. TEST the system for normal operation.

A7 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion

- damaged pins
- pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: One Low Beam Headlamp Is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Headlamps/Autolamps for schematic and connector information.

Normal Operation

When the smart junction box (SJB) detects the headlamp switch in the HEADLAMPS ON position and the multifunction switch in the LOW BEAM position, the SJB provides voltage through circuits CLF04 (BN/BU) and CLF05 (BU/GN) to the LH and RH low beam headlamps, respectively. Ground is supplied on circuit GD123 (BK/GY) for RH headlamp. Ground for the LH headlamp is routed through a joint connector through circuit GD120 (BK/GN).

DTC Description	Fault Trigger Conditions
B2A2E - Right Front Lamp Low Beam Circuit Open	An on-demand DTC that sets when the SJB detects an open in the RH low beam output circuit.
B2A2F - Right Front Lamp Low Beam Circuit Short to Ground	A continuous and on-demand DTC that sets when the SJB detects a short to ground in the RH low beam output circuit.
B2A30 - Left Front Lamp Low Beam Circuit Open	An on-demand DTC that sets when the SJB detects an open in the LH low beam output circuit.
B2A31 - Left Front Lamp Low Beam Circuit Short to Ground	A continuous and on-demand DTC that sets when the SJB detects a short to ground in the LH low beam output circuit.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Joint connector
- Headlamp assembly (MKX)
- SJB

PINPOINT TEST B: ONE LOW BEAM HEADLAMP IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Due to varying wattage ratings and resulting current draw, certain aftermarket headlamp bulbs may cause the SJB to shut down the short circuit protection, resulting in the low beams becoming inoperative. Verify that the bulbs meet Ford specifications. If the bulbs do not meet Ford specifications, install the correct bulbs. Run the on-demand self-test (required to clear certain DTCs and reset the SJB). Correct any unresolved DTCs. Clear all DTCs. Test the system for normal operation.

NOTE: The battery ground cable must be disconnected for accurate test results when checking ground circuits for continuity to ground.

B1 USE THE RECORDED DTCs FROM THE SJB SELF-TEST

- Check the recorded results from the SJB self-test.
- **Is DTCs B2A2F or B2A31 recorded?**

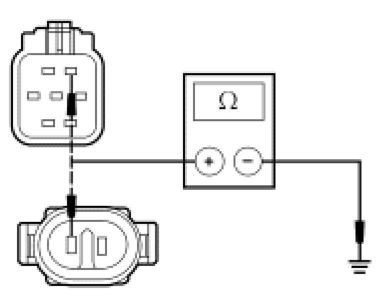
YES : For MKX, go to B7.

For Edge, go to B8.

NO : Go to B2.

B2 CHECK THE HEADLAMP GROUND CIRCUIT FOR CONTINUITY TO GROUND

- Key in OFF position.
- Disconnect: Inoperative Headlamp



N0062208

Fig. 6: Measuring Resistance Between Inoperative Headlamp, Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the inoperative headlamp, harness side and ground as follows:

Connector-	

Pin	Circuit
Edge	
LH low beam C1111-A	GD120 (BK/GN)
RH low beam C1112-A	GD123 (BK/GY)
MKX	
LH headlamp C1021a-2	GD120 (BK/GN)
RH headlamp C1041a-2	GD123 (BK/GY)

- **Is the resistance less than 5 ohms?**

  YES :

  For MKX, go to B5.

  For Edge, VERIFY the SJB fuse 7 (10A) (LH low beam) or fuse 8 (10A) (RH low beam) is OK. If OK Go to B6.

  NO : For RH headlamp, REPAIR circuit GD123 (BK/GY) for an open. CLEAR the DTCs. REPEAT the self-test.

  For LH headlamp, go to B3.

B3 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN (JOINT CONNECTOR TO GROUND)

- Disconnect: Joint Connector 7 C2200

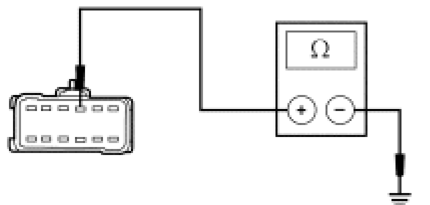


Fig. 7: Measuring Resistance Between Joint Connector 7 C2200-J, Circuit GD120 (BK/GN) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the joint connector 7 C2200-J, circuit GD120 (BK/GN), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to B4.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

B4 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN (HEADLAMP TO JOINT CONNECTOR)

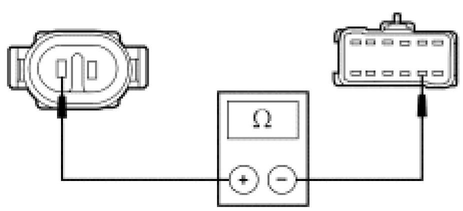


Fig. 8: Measuring Resistance Between LH Low Beam C1111-A, Circuit GD120 (BK/GN) & Joint Connector 7 C2200-E
Courtesy of FORD MOTOR CO.

- For Edge, measure the resistance between the LH low beam C1111-A, circuit GD120 (BK/GN), harness side and the joint connector 7 C2200-E, circuit GD120 (BK/GN), harness side.

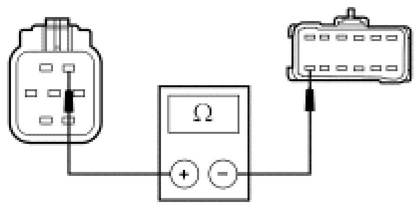


Fig. 9: Measuring Resistance Between LH Headlamp C1021A-2, Circuit GD120 (BK/GN) & Joint Connector 7 C2200-A
Courtesy of FORD MOTOR CO.

- For MKX, measure the resistance between the LH headlamp C1021a-2, circuit GD120 (BK/GN), harness side and the joint connector 7 C2200-A, circuit GD120 (BK/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new joint connector. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

B5 CHECK THE SJB HEADLAMP VOLTAGE SUPPLY CIRCUIT FOR VOLTAGE

- Place the headlamp switch in the HEADLAMPS ON position.

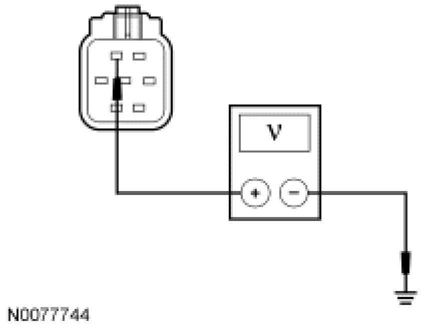


Fig. 10: Measuring Voltage Between Inoperative Headlamp, Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the inoperative headlamp, harness side and ground as follows:

Connector-Pin	Circuit
LH headlamp C1021a-1	CLF04 (BN/BU)
RH headlamp C1041a-1	CLF05 (BU/GN)

- **Is the voltage greater than 10 volts?**

  YES : REPAIR or INSTALL a new headlamp assembly. REFER to **Headlamp Assembly**. CLEAR the DTCs. REPEAT the self-test.

  NO : VERIFY the SJB fuse 7 (10A) (LH low beam) or fuse 8 (10A) (RH low beam) is OK. If OK, go to B6.

B6 CHECK THE SJB HEADLAMP VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Place the headlamp switch in the OFF position.
- Disconnect: SJB C2280e
- Measure the resistance between the inoperative headlamp, harness side and the SJB as follows:

Headlamp Connector-Pin	SJB Connector-Pin	Circuit
Edge		
LH low beam C1111-B	SJB C2280e-13	CLF04 (BN/BU)
RH low		

beam C1112-B	SJB C2280e-4	CLF05 (BU/GN)
MKX		
LH headlamp C1021a-1	SJB C2280e-13	CLF04 (BN/BU)
RH headlamp C1041a-1	SJB C2280e-4	CLF05 (BU/GN)

- **Is the resistance less than 5 ohms?**

  YES : Go to B9.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

B7 CHECK THE HEADLAMP ASSEMBLY

- Key in OFF position.
- Disconnect: Inoperative Headlamp
- Key in ON position.
- Repeat the SJB on-demand self-test.
- **Is DTC B2A2F or B2A31 retrieved again?**

  YES : Go to B8.

  NO : INSTALL a new headlamp assembly. REFER to **Headlamp Assembly**. TEST the system for normal operation.

B8 CHECK CIRCUIT CLF04 (BN/BU) (LH HEADLAMP) OR CIRCUIT CLF05 (BU/GN) (RH HEADLAMP) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280e
- Disconnect: Inoperative Headlamp

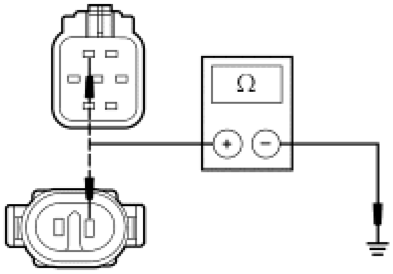


Fig. 11: Measuring Resistance Between Inoperative Headlamp, Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the inoperative headlamp, harness side and ground as follows:

Connector-Pin	Circuit
Edge	
LH low beam C1111-B	CLF04 (BN/BU)
RH low beam C1112-B	CLF05 (BU/GN)
MKX	
LH headlamp C1021a-1	CLF04 (BN/BU)
RH headlamp C1041a-1	CLF05 (BU/GN)

- **Is the resistance greater than 10,000 ohms?**

  YES : Go to B9.

  NO : REPAIR the circuit in question. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.

B9 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: One High Beam Headlamp Is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Headlamps/Autolamps for schematic and connector information.

Normal Operation

When the smart junction box (SJB) detects the headlamp switch in the HEADLAMPS ON position and the multifunction switch in the HIGH BEAM position, the SJB energizes an internal relay. When the relay is energized, the relay routes voltage through circuit CLF08 (YE/VT) to the high beams. Ground is supplied on circuit GD123 (BK/GY) for the RH headlamp. Ground for the LH headlamp is routed through a joint connector through circuit GD120 (BK/GN).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Joint connector
- Headlamp assembly (MKX)

PINPOINT TEST C: ONE HIGH BEAM HEADLAMP IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: The battery ground cable must be disconnected for accurate test results when checking ground circuits for continuity to ground.

C1 CHECK THE LOW BEAM OPERATION

- Check the operation of the low beams.
- **Do the low beams operate correctly?**

  YES : Go to C2.

  NO : Go to **Pinpoint Test B** .

C2 CHECK FOR CONTINUITY TO GROUND

- Key in OFF position.
- Disconnect: Inoperative Headlamp

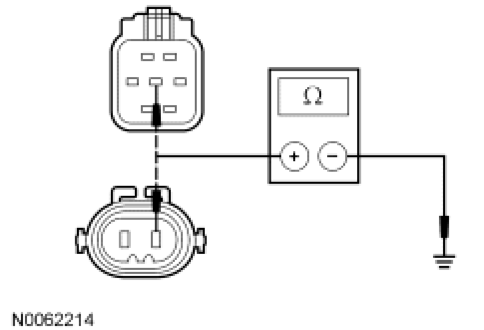


Fig. 12: Measuring Resistance Between Inoperative Lamp, Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the inoperative lamp, harness side and ground as follows:

Inoperative Lamp	Connector-Pin	Circuit
Edge		
LH high beam	C1020-A	GD120 (BK/GN)
RH high beam	C1040-A	GD123 (BK/GY)
MKX		
LH headlamp	C1021a-4	GD120 (BK/GN)
RH headlamp	C1041a-4	GD123 (BK/GY)

- **Is the resistance less than 5 ohms?**

  YES : For Edge, REPAIR circuit CLF08 (YE/VT) for an open. TEST the system for normal operation.

  For MKX, go to C4.

  NO : For the RH headlamp, REPAIR circuit GD123 (BK/GY) for an open. TEST the system for normal operation.

  For the LH headlamp, go to C3.

C3 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN (HEADLAMP TO JOINT CONNECTOR)

- Disconnect: Joint Connector 7 C2200

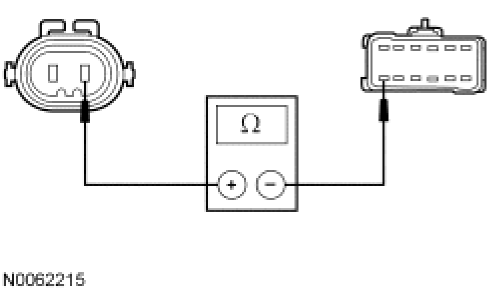
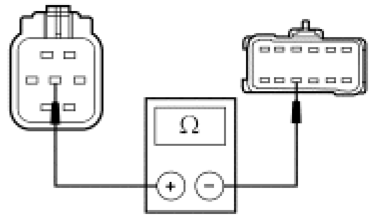


Fig. 13: Measuring Resistance Between LH High Beam C1020-A, Circuit GD120 (BK/GN) & Joint Connector 7 C2200-A
Courtesy of FORD MOTOR CO.

- For Edge, measure the resistance between the LH high beam C1020-A, circuit GD120 (BK/GN), harness side and the joint connector 7 C2200-A, circuit GD120 (BK/GN), harness side.



N0062216

Fig. 14: Measuring Resistance Between LH High headlamp C1021A-4, Circuit GD120 (BK/GN) & Joint Connector 7 C2200-C
Courtesy of FORD MOTOR CO.

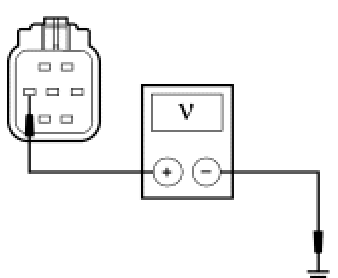
- For MKX, measure the resistance between the LH headlamp C1021a-4, circuit GD120 (BK/GN), harness side and the joint connector 7 C2200-C, circuit GD120 (BK/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new joint connector. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

C4 CHECK CIRCUIT CLF08 (YE/VT) FOR AN OPEN

- Place the headlamp switch in the HEADLAMPS ON position.
- Place the multifunction switch in the HIGH BEAM position.



N0077746

Fig. 15: Measuring Voltage Between Inoperative Lamp, Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the inoperative lamp, harness side and ground as follows:

Inoperative Lamp	Connector-Pin	Circuit
LH headlamp	C1021a-3	CLF08 (YE/VT)
RH headlamp	C1041a-3	CLF08 (YE/VT)

- **Is the voltage greater than 10 volts?**

  YES : REPAIR or INSTALL a new headlamp assembly. REFER to **Headlamp Assembly**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test D: The Headlamp(s) Are On Continuously

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Headlamps/Autolamps for schematic and connector information.

Normal Operation - Low Beams

The smart junction box (SJB) sends reference signals to the headlamp switch through circuits CLF19 (VT/GN) (AUTOLAMPS), CLF23 (WH/VT) (OFF), CLS34 (GY) (PARKING LAMPS) and CLF18 (BU/WH) (HEADLAMPS). At any given time, the headlamp switch routes one of the input circuits to ground through joint connector 6 through circuit GD116 (BK/VT).

When the SJB detects the headlamp switch in the HEADLAMPS ON position and the multifunction switch in the LOW BEAM position, the SJB provides voltage through circuits CLF04 (BN/BU) and CLF05 (BU/GN) to the LH and RH low beam headlamps, respectively.

On vehicles equipped with autolamps, the SJB also monitors input from the windshield wiper motor through circuit CRW01 (WH) for the headlamps on with wipers on feature.

High Beams

The SJB sends a reference signal to the multifunction switch through circuits CLF27 (GN/BN) and CLF17 (WH/OG). When the multifunction switch is placed in the FLASH-TO-PASS or HIGH BEAM position, the voltage signal is routed to ground. When the SJB detects a request for flash-to-pass or high beams (when the low beams are on), the SJB energizes the high beam relay (integrated into the SJB), which routes voltage through circuit CLF08 (YE/VT) to the headlamps.

DTC Description	Fault Trigger Conditions
B1472 - Lamp Headlamp Input Circuit Short to Ground	An on-demand DTC that sets when the SJB detects the headlamps on input circuit is short to ground.
B1510 - Flash To Pass Switch Circuit Short to Ground	An on-demand DTC that sets when the SJB detects the flash-to-pass request input circuit is short to ground.
B1696 - Autolamp On Circuit Short To Ground	An on-demand DTC that sets when the SJB detects the autolamps on request input circuit is short to ground.
B2008 - Wipers On Signal Circuit Short to Ground	An on-demand DTC that sets when the SJB detects the wipers on input circuit is short to ground.
B2A22 - Headlamp Off Circuit Open	An on-demand DTC that sets when the SJB detects the headlamp switch off input circuit open.

B2A23 - High Beam Input Circuit Short to Ground	An on-demand DTC that sets when the SJB detects a short to ground on the high beam request input circuit.
B2A2E - Right Front Lamp Low Beam Circuit Open	An on-demand DTC that sets when the SJB detects the RH low beam output circuit shorted to voltage.
B2A30 - Left Front Lamp Low Beam Circuit Open	An on-demand DTC that sets when the SJB detects the LH low beam output circuit shorted to voltage.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Joint connector
- Headlamp switch
- Multifunction switch
- Windshield wiper motor
- SJB

PINPOINT TEST D: THE HEADLAMP(S) ARE ON CONTINUOUSLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: The battery ground cable must be disconnected for accurate test results when checking ground circuits for continuity to ground.

D1 VERIFY THE HEADLAMP OPERATION

- Key in ON position.
- **Are the high beam headlamps illuminated?**

  YES : Go to D13.

  NO : Go to D2.

D2 CHECK THE SJB HEADLAMP SWITCH PIDs

- Enter the following diagnostic mode on the diagnostic tool: SJB Data Logger

  NOTE: Make sure the headlamp switch is lined up in the correct position when monitoring the PIDs.

- Monitor the SJB headlamp switch PIDs (HD_LMP_S2 and HEAD_L) while moving the headlamp switch through all positions. Refer to the following chart.

Headlamp Switch Position	HD_LMP_S2 Expected Value	HEAD_L Expected Value

Autolamps	AUTOLAMP	OFF
OFF	-	OFF
Parklamps	-	-
Headlamp	-	HEADLAMP

- **Do the headlamp switch positions agree with the PIDs?**

  YES : Go to D9.

  NO : Go to D3.

D3 CHECK THE HEADLAMP SWITCH

- Key in OFF position.
- Disconnect: Headlamp Switch C205
- Carry out the headlamp switch component test. Refer to appropriate COMPONENT TESTING article.
- **Is the headlamp switch OK?**

  YES : Go to D4.

  NO : INSTALL a new headlamp switch. REFER to **Headlamp Switch**. CLEAR the DTCs. REPEAT the self-test.

D4 CHECK FOR CONTINUITY TO GROUND FROM THE HEADLAMP SWITCH

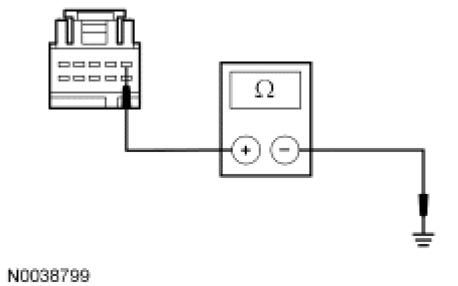


Fig. 16: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

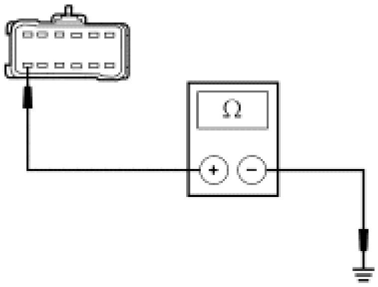
- Measure the resistance between the headlamp switch C205-1, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to D7.

  NO : Go to D5.

D5 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN (JOINT CONNECTOR TO GROUND)

- Disconnect: Joint Connector 6 C2365



N0062217

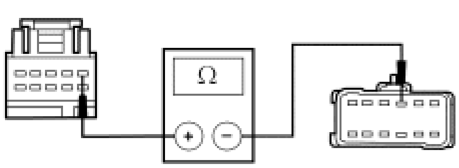
Fig. 17: Measuring Resistance Between Joint Connector 6 C2365-A, Circuit GD116 (BK/VT) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the joint connector 6 C2365-A, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to D6.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

D6 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN (HEADLAMP SWITCH TO JOINT CONNECTOR)



N0062218

Fig. 18: Measuring Resistance Between Headlamp Switch C205-1, Circuit GD116 (BK/VT) & Joint Connector 6 C2365-J
Courtesy of FORD MOTOR CO.

- Measure the resistance between the headlamp switch C205-1, circuit GD116 (BK/VT), harness side and joint connector 6 C2365-J, circuit GD116 (BK/VT), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new joint connector. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

D7 CHECK THE HEADLAMP SWITCH INPUT CIRCUITS FOR A SHORT TO GROUND

- Disconnect: SJB C2280b

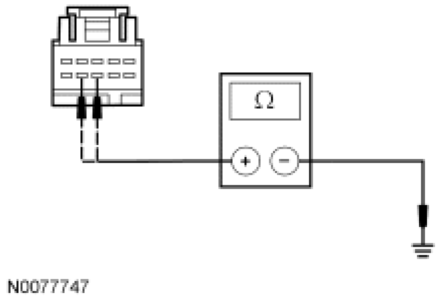


Fig. 19: Measuring Resistance Between Headlamp Switch, Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the headlamp switch, harness side and ground as follows:

Connector-Pin	Circuit
C205-9 (if equipped with autolamps)	CLF19 (VT/GN)
C205-8	CLF18 (BU/WH)

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to D8.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

D8 CHECK THE HEADLAMP SWITCH INPUT CIRCUITS FOR AN OPEN

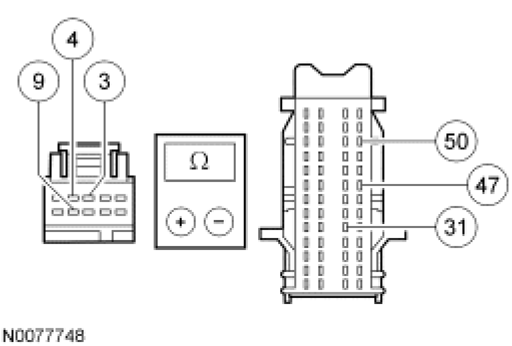


Fig. 20: Measuring Resistance Between Headlamp Switch, Harness Side & SJB
Courtesy of FORD MOTOR CO.

- Measure the resistance between the headlamp switch, harness side and the SJB, harness side as follows:

Headlamp Switch Connector-Pin	SJB Connector-Pin	Circuit
C205-9 (if equipped with autolamps)	C2280b-50	CLF19 (VT/GN)
C205-4	C2280b-47	CLF23 (WH/VT)
C205-3	C2280b-31	CLS34 (GY)

- **Are the resistances less than 5 ohms?**

  YES : Go to D16.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

D9 CHECK FOR SJB DTC B2008

- Check the recorded results from the SJB self-test.
- **Is DTC B2008 present?**

  YES : Go to D10.

  NO : Go to D12.

D10 CHECK THE WINDSHIELD WIPER MOTOR

- Key in OFF position.
- Disconnect: Windshield Wiper Motor C1552
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB Self-Test
- Repeat the SJB self-test.
- **Is DTC B2008 still present?**

  YES : Go to D11.

  NO : INSTALL a new windshield wiper motor. REFER to **WIPERS AND WASHERS** article. TEST the system for normal operation.

D11 CHECK CIRCUIT CRW01 (WH) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280f

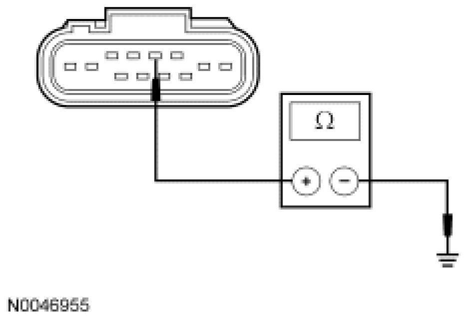


Fig. 21: Checking Circuit For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the windshield wiper motor C1552-2, circuit CRW01 (WH), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to D16.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

D12 CHECK THE SJB OUTPUT

- Disconnect: SJB C2280e
- **Does the LH or RH headlamp continue to illuminate?**

  YES : REPAIR circuit CLF04 (BN/BU) (LH headlamp) or circuit CLF05 (BU/GN) (RH headlamp) for a short to voltage as necessary. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to D16.

D13 CHECK CIRCUIT CLF08 (YE/VT) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280e
- Key in ON position.
- **Do the high beams continue to illuminate?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to D14.

D14 CHECK THE MULTIFUNCTION SWITCH

- Key in OFF position.
- Connect: SJB C2280e
- Disconnect: Multifunction Switch C202
- Key in ON position.
- **Do the high beams continue to illuminate?**

  YES : Go to D15.

  NO : INSTALL a new multifunction switch. REFER to <u>**STEERING COLUMN SWITCHES**</u> article. CLEAR the DTCs. REPEAT the self-test.

D15 CHECK CIRCUIT CLF17 (WH/OG) (HIGH BEAM) OR CIRCUIT CLF27 (GN/BN)

(FLASH-TO-PASS) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280b

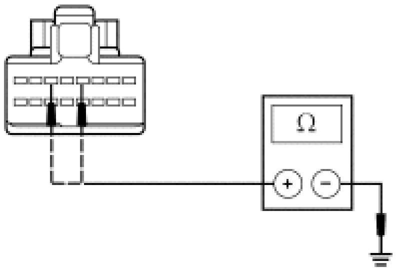


Fig. 22: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the multifunction switch C202-6, circuit CLF17 (WH/OG), harness side and ground; and between the multifunction switch C202-4, circuit CLF27 (GN/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to D16.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

D16 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: The Flash-To-Pass Feature Is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Headlamps/Autolamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a reference signal to the multifunction switch through circuit CLF27 (GN/BN). When the multifunction switch is placed in the FLASH-TO-PASS position, the voltage signal is routed to ground. When the SJB detects a request for the flash-to-pass, the SJB provides voltage to the high beam headlamps.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Multifunction switch
- SJB

PINPOINT TEST E: THE FLASH-TO-PASS FEATURE IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

E1 VERIFY THE HIGH BEAM HEADLAMP OPERATION

- Key in ON position.
- Place the headlamp switch in the HEADLAMPS ON position.
- Place the multifunction switch in the HIGH BEAM position while observing the headlamps.
- **Do the high beam headlamps illuminate?**

  YES : Go to E2.

  NO : Go to **Pinpoint Test A** .

E2 CHECK THE MULTIFUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multifunction Switch C202

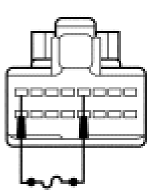


Fig. 23: Checking Multifunction Switch
Courtesy of FORD MOTOR CO.

- Connect a fused (5A) jumper wire between the multifunction switch C202-4, circuit CLF27 (GN/BN), harness side and the multifunction switch C202-8, circuit GD116 (BK/VT), harness side.
- **Do the high beams illuminate?**

YES : REMOVE the jumper wire. INSTALL a new multifunction switch. REFER to **STEERING COLUMN SWITCHES** article. TEST the system for normal operation.

NO : REMOVE the jumper wire. Go to E3.

E3 CHECK CIRCUIT CLF27 (GN/BN) FOR AN OPEN

- Disconnect: SJB C2280b

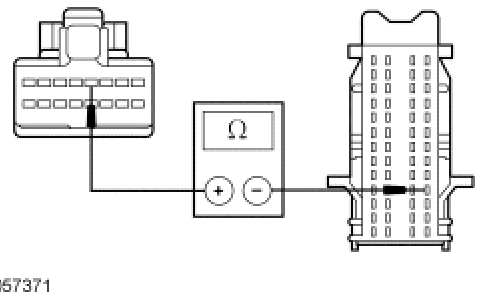


Fig. 24: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the multifunction switch C202-4, circuit CLF27 (GN/BN), harness side and the SJB C2280b-43, circuit CLF27 (GN/BN), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to E4.

NO : REPAIR the circuit. TEST the system for normal operation.

E4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

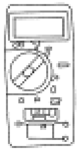
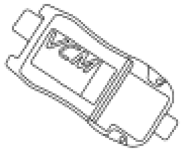
YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

AUTOLAMPS

Special Tools

Illustration	Tool Name	Tool Number

 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: For the perimeter lighting feature, refer to HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS article.

NOTE: For the headlamps on with the wipers on feature, refer to WIPERS AND WASHERS article.

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

Exterior Lighting

The SJB monitors the headlamp switch position by sending voltage reference signals on multiple circuits to the headlamp switch. There is one circuit for each headlamp switch position. At any given time, one of the signal circuits is routed to ground.

If the SJB does not detect any of the inputs to the headlamp switch are active (routed to ground) for 5 seconds, the SJB turns on the exterior lights and keeps them on for 10 minutes after the ignition switch is turned off (or 10 minutes from the time the SJB does not detect any headlamp switch input if the ignition switch was already off). Additionally, if the SJB detects multiple circuits short to ground, the SJB implements a planned strategy depending on the multiple inputs received.

If either of these situations occur, the SJB should **NOT** be ruled immediately as being at fault. This is normal behavior of the SJB design as it has detected a fault with the inputs from the headlamp switch.

Autolamps Feature

The SJB monitors the light sensor with a voltage reference signal. The light sensor input to the SJB varies with the ambient light conditions.

When the SJB receives an input from the headlamp switch indicating a request for the autolamps, the SJB monitors the light sensor for the ambient light condition. If the SJB determines the ambient light level is dark, the SJB supplies voltage to the exterior lamps.

If the ignition switch is already in the RUN position and the vehicle enters a dark/lighted area (such as when entering/exiting a non-lighted tunnel during the daytime), the transition from light to dark (or dark to light) needs to last 15 seconds before the SJB turns the exterior lamps on or off. This strategy is to prevent the exterior lamps from unnecessarily flashing on and off.

The SJB does react quicker under extreme light conditions. If the SJB has detected a very dark condition, the exterior lamps are turned on after 1.5 seconds. If the SJB has detected a very high ambient light level, the exterior lamps are turned off after 4 seconds.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Headlamp switch	• Wiring, terminals or connectors • Light sensor • Smart junction box (SJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: **Make sure the headlamp switch is in the OFF position.**

NOTE: **Make sure the multifunction switch is in the LOW BEAM position.**

NOTE: **Make sure to use the latest scan tool software release.**

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: **The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.**

5. If the scan tool does not communicate with the VCM:

- Check the VCM connection to the vehicle.
- Check the scan tool connection to the VCM.
- Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
    - Verify the ignition key is in the ON position.
    - Verify the scan tool operation with a known good vehicle.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1472	Lamp Headlamp Input Circuit Short to Ground	Go to **Pinpoint Test G** .
B1696	Autolamp On Circuit Short To Ground	Go to **Pinpoint Test G** .
B1791	Autolamp Sensor Input Circuit Open	Go to **Pinpoint Test G** .
B1793	Autolamp Sensor Input Circuit Short to Ground	Go to **Pinpoint Test G** .
B2008	Wipers On Signal Circuit Short to Ground	Go to **Pinpoint Test G** .
B2A22	Headlamp Off Circuit Open	ADDRESS any other DTCs first. Go to **Pinpoint Test G** .
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
	• Fuse	

• No communication with the smart junction box (SJB)	• Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The autolamps are inoperative	• Light sensor • SJB	• Go to **Pinpoint Test F** .
• The autolamps are on continuously	• Wiring, terminals or connectors • Joint connector • Light sensor • Headlamp switch • Windshield wiper motor • SJB	• Go to **Pinpoint Test G** .

Pinpoint Tests

Pinpoint Test F: The Autolamps Are Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Headlamps/Autolamps for schematic and connector information.

Normal Operation

When the smart junction box (SJB) detects the headlamp switch in the AUTOLAMPS ON position, the SJB monitors the light sensor input. The light sensor determines the amount of light based on the input received from the ambient lighting conditions. When the ambient light level has reached a point (determined by the internal programming of the SJB), the SJB provides voltage to the headlamps, parking and license plate lamps.

This pinpoint test is intended to diagnose the following:

- Light sensor
- SJB

PINPOINT TEST F: THE AUTOLAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

F1 CHECK THE MANUAL HEADLAMP OPERATION

- Place the headlamp switch in the HEADLAMPS ON position.
- **Do the headlamps operate correctly?**

  YES : Go to F2.

NO : REFER to **Headlamps**.

F2 CHECK FOR VOLTAGE TO THE LIGHT SENSOR

- Key in OFF position.
- Disconnect: Light Sensor C286 or C287
- Key in ON position.
- Place the headlamp switch in the AUTOLAMPS ON position.

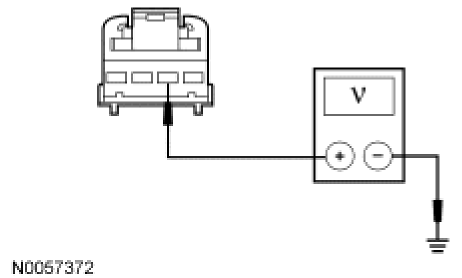


Fig. 25: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- For vehicles with EATC, measure the voltage between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.

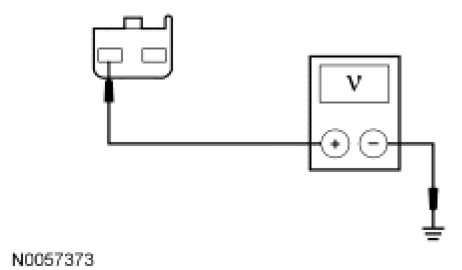


Fig. 26: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- For vehicles with manual temperature control, measure the voltage between the light sensor C287a-A, circuit VLF14 (BU/BN), harness side and ground.
- **Is the voltage approximately 5 volts?**

  YES : INSTALL a new light sensor. REFER to **Light Sensor**. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to F3.

F3 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.

- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: The Autolamps Are On Continuously

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Headlamps/Autolamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a reference voltage signal to the headlamp switch through circuit CLF19 (VT/GN) and a reference voltage signal to the light sensor through circuit VLF14 (BU/BN). Ground for the light sensor is provided by circuit GD115 (BK/GY).

When the headlamp switch is placed in the AUTOLAMPS ON position, the voltage signal is routed to ground. When the SJB detects the headlamp switch in the AUTOLAMPS ON position, the SJB monitors the light sensor input. The light sensor determines the amount of light based on the input received from the ambient lighting conditions. When the ambient light level has reached a point (determined by the internal programming of the SJB), the SJB provides voltage to the headlamps, parking and license plate lamps.

DTC Description	Fault Trigger Conditions
B1472 - Lamp Headlamp Input Circuit Short to Ground	An on-demand DTC that sets when the SJB detects the headlamps on input circuit is shorted to ground.
B1696 - Autolamp On Circuit Short To Ground	An on-demand DTC that sets when the SJB detects the autolamps on input circuit shorted to ground.
B1791 - Autolamp Sensor Input Circuit Open	An on-demand DTC that sets when the SJB detects an open on the light sensor input circuit.
B1793 - Autolamp Sensor Input Circuit Short to Ground	A continuous and on-demand DTC that sets when the SJB detects a short to ground on the light sensor input circuit.
B2008 - Wipers On Signal Circuit Short to Ground	A n on-demand DTC that sets when the SJB detects the wipers on input circuit is short to ground.
	An on-demand DTC that sets when the SJB detects

B2A22 - Headlamp Off Circuit Open	the headlamp switch off circuit open.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Joint connector
- Light sensor
- Headlamp switch
- Windshield wiper motor
- SJB

PINPOINT TEST G: THE AUTOLAMPS ARE ON CONTINUOUSLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: The battery ground cable must be disconnected for accurate test results when checking ground circuits for continuity to ground.

G1 USE THE RECORDED DTCs FROM THE SJB SELF-TEST

- Check the recorded results from the SJB self-test.
- **Was DTC B2008, B1791 or B1793 recorded?**

  YES : For DTC B2008, go to G10.

  For DTC B1791, go to G12.

  For DTC B1793, go to G16.

  NO : Go to G2.

G2 CHECK THE SJB HEADLAMP SWITCH PIDs

- Enter the following diagnostic mode on the diagnostic tool: SJB Data Logger

NOTE: Make sure the headlamp switch is lined up in the correct position when monitoring the PIDs.

- Monitor the SJB headlamp switch PIDs (HD_LMP_S2 and HEAD_L) while moving the headlamp switch through all positions. Refer to the following chart.

Headlamp Switch Position	HD_LMP_S2 Expected Value	HEAD_L Expected Value
Autolamps	AUTOLAMP	OFF

OFF	-	OFF
PARKING LAMPS	-	-
HEADLAMPS	-	HEADLAMP

- **Do the headlamp switch positions agree with the PIDs?**

  YES : Go to G9.

  NO : Go to G3.

G3 CHECK THE HEADLAMP SWITCH

- Key in OFF position.
- Disconnect: Headlamp Switch C205
- Carry out the headlamp switch component test. Refer to appropriate COMPONENT TESTING article.
- **Is the headlamp switch OK?**

  YES : Go to G4.

  NO : INSTALL a new headlamp switch. REFER to **Headlamp Switch**. CLEAR the DTCs. REPEAT the self-test.

G4 CHECK FOR CONTINUITY TO GROUND FROM THE HEADLAMP SWITCH

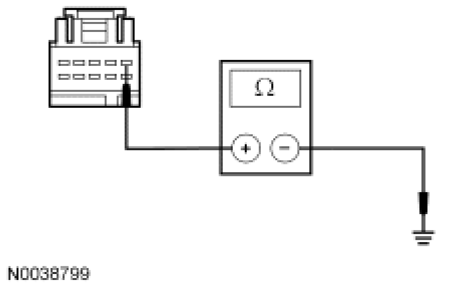


Fig. 27: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

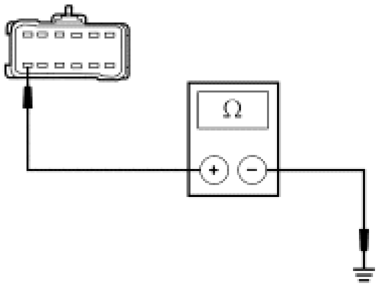
- Measure the resistance between the headlamp switch C205-1, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to G7.

  NO : Go to G5.

G5 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN (JOINT CONNECTOR TO GROUND)

- Disconnect: Joint Connector 6 C2365



N0062217

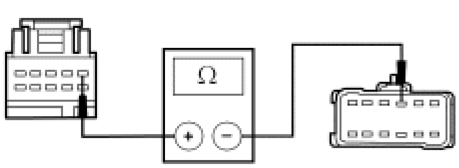
Fig. 28: Measuring Resistance Between Joint Connector 6 C2365-A, Circuit GD116 (BK/VT) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the joint connector 6 C2365-A, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to G6.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

G6 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN (HEADLAMP SWITCH TO JOINT CONNECTOR)



N0062218

Fig. 29: Measuring Resistance Between Headlamp Switch C205-1, Circuit GD116 (BK/VT) & Joint Connector 6 C2365-J
Courtesy of FORD MOTOR CO.

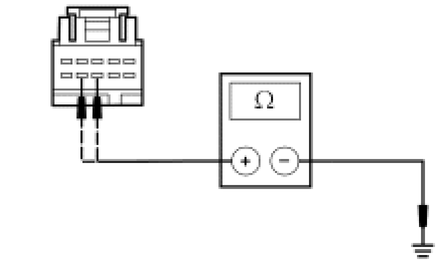
- Measure the resistance between the headlamp switch C205-1, circuit GD116 (BK/VT), harness side and joint connector 6 C2365-J, circuit GD116 (BK/VT), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new joint connector. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

G7 CHECK THE HEADLAMP SWITCH INPUT CIRCUITS FOR A SHORT TO GROUND

- Disconnect: SJB C2280b



N0077747

Fig. 30: Measuring Resistance Between Headlamp Switch, Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the headlamp switch, harness side and ground as follows:

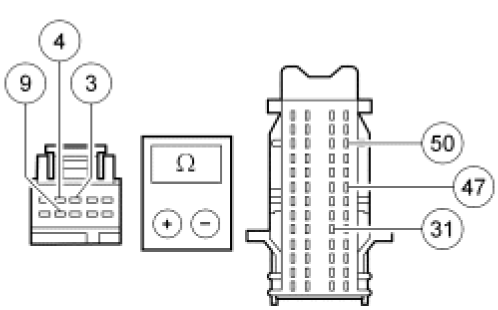
Connector-Pin	Circuit
C205-9	CLF19 (VT/GN)
C205-8	CLF18 (BU/WH)

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to G8.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

G8 CHECK THE HEADLAMP SWITCH INPUT CIRCUITS FOR AN OPEN



N0077748

Fig. 31: Measuring Resistance Between Headlamp Switch, Harness Side & SJB
Courtesy of FORD MOTOR CO.

- Measure the resistance between the headlamp switch, harness side and the SJB, harness side as follows:

Headlamp Switch	SJB Connector-	Circuit

Connector-Pin	Pin	
C205-9	C2280b-50	CLF19 (VT/GN)
C205-4	C2280b-47	CLF23 (WH/VT)
C205-3	C2280b-31	CLS34 (GY)

- **Are the resistances less than 5 ohms?**

  YES : Go to G18.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

G9 CHECK FOR VOLTAGE TO THE LIGHT SENSOR

- Key in OFF position.
- Disconnect: Light Sensor C286 or C287
- Key in ON position.
- Place the headlamp switch in the AUTOLAMPS ON position.

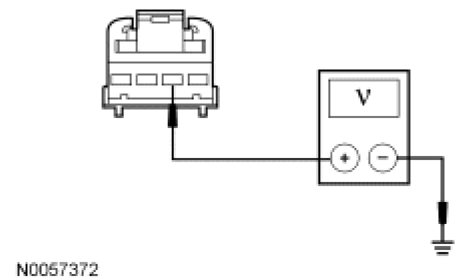


Fig. 32: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- For vehicles with EATC, measure the voltage between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.

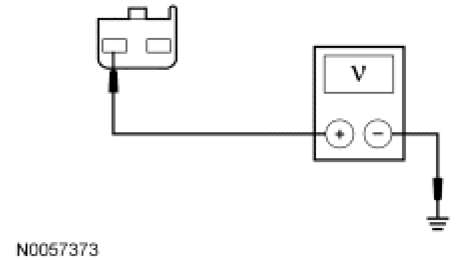


Fig. 33: Checking Circuit For Voltage

Courtesy of FORD MOTOR CO.

- For vehicles with manual temperature control, measure the voltage between the light sensor C287a-A, circuit VLF14 (BU/BN), harness side and ground.
- **Is the voltage approximately 5 volts?**

  YES : INSTALL a new light sensor. REFER to **Light Sensor**. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to G18.

G10 CHECK THE WINDSHIELD WIPER MOTOR

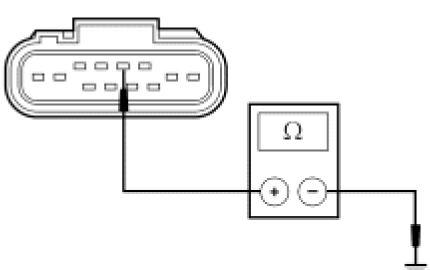
- Disconnect: Windshield Wiper Motor C1552
- Enter the following diagnostic mode on the diagnostic tool: SJB Self-Test
- Repeat the SJB self-test.
- **Is DTC B2008 still present?**

  YES : Go to G11.

  NO : INSTALL a new windshield wiper motor. REFER to **WIPERS AND WASHERS** article. TEST the system for normal operation.

G11 CHECK CIRCUIT CRW01 (WH) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280f



N0046955

Fig. 34: Checking Circuit For Short To Ground
Courtesy of FORD MOTOR CO.

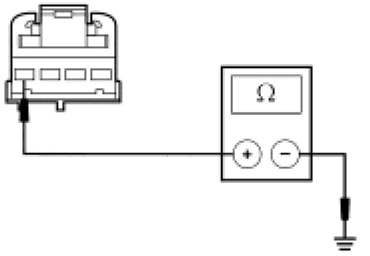
- Measure the resistance between the windshield wiper motor C1552-2, circuit CRW01 (WH), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to G18.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

G12 CHECK CIRCUIT GD115 (BK/GY) FOR AN OPEN

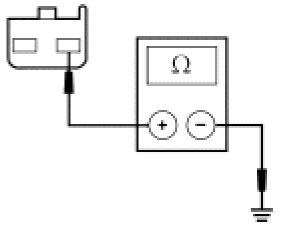
- Key in OFF position.
- Disconnect: Light Sensor C286 or C287



N0038803

Fig. 35: Measuring Resistance
Courtesy of FORD MOTOR CO.

- On vehicles with EATC, measure the resistance between the light sensor C286-4, circuit GD115 (BK/GY), harness side and ground.



N0057377

Fig. 36: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

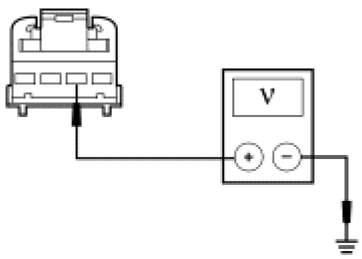
- On vehicles with manual climate control, measure the resistance between the light sensor C287-B, circuit GD115 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to G13.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

G13 CHECK CIRCUIT VLF14 (BU/BN) FOR A SHORT TO VOLTAGE

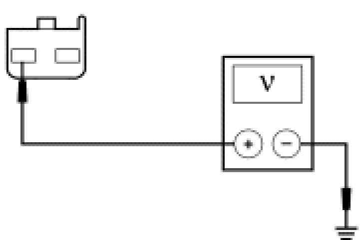
- Disconnect: SJB C2280b
- Key in ON position.



N0057372

Fig. 37: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- On vehicles with EATC, measure the voltage between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.



N0057373

Fig. 38: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- On vehicles with manual climate control, measure the voltage between the light sensor C287-A, circuit VLF14 (BU/BN), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to G14.

G14 CHECK CIRCUIT VLF14 (BU/BN) FOR AN OPEN

- Key in OFF position.

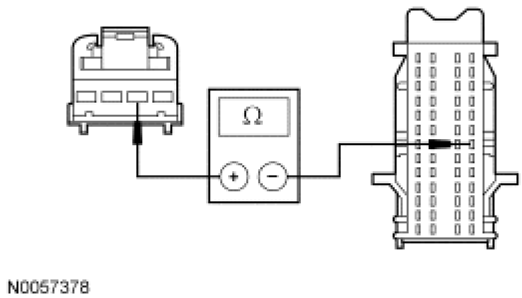


Fig. 39: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- On vehicles with EATC, measure the resistance between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and the SJB C2280b-46, circuit VLF14 (BU/BN), harness side.

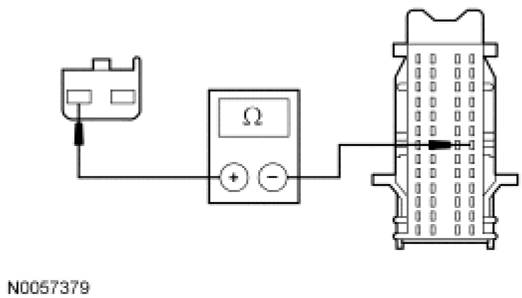


Fig. 40: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

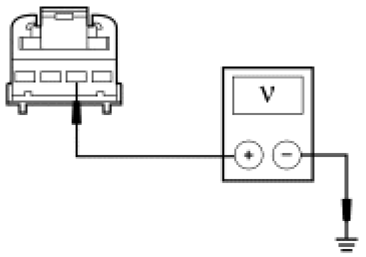
- On vehicles with manual climate control, measure the resistance between the light sensor C287-A, circuit VLF14 (BU/BN), harness side and the SJB C2280b-46, circuit VLF14 (BU/BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to G15.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

G15 CHECK FOR VOLTAGE TO THE LIGHT SENSOR (DTC B1791)

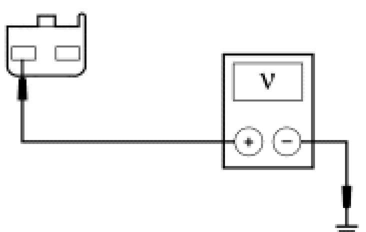
- Connect: SJB C2280b
- Key in ON position.
- Place the headlamp switch in the AUTOLAMPS ON position.



N0057372

Fig. 41: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- On vehicles with EATC, measure the voltage between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.



N0057373

Fig. 42: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

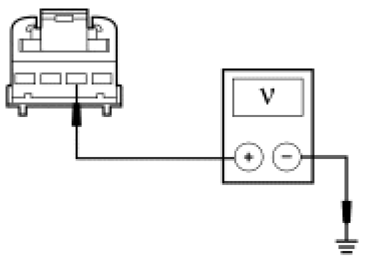
- On vehicles with manual climate control, measure the voltage between the light sensor C287-A, circuit VLF14 (BU/BN), harness side and ground.
- **Is the voltage approximately 5 volts?**

  YES : INSTALL a new light sensor. REFER to **Light Sensor**. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to G18.

G16 CHECK FOR VOLTAGE TO THE LIGHT SENSOR (DTC B1793)

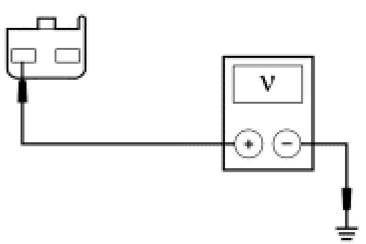
- Disconnect: Light Sensor C286 or C287
- Key in ON position.
- Place the headlamp switch in the AUTOLAMPS ON position.



N0057372

Fig. 43: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- On vehicles with EATC, measure the voltage between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.



N0057373

Fig. 44: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- On vehicles with manual temperature control, measure the voltage between the light sensor C287-A, circuit VLF14 (BU/BN), harness side and ground.
- **Is the voltage approximately 5 volts?**

  YES : INSTALL a new light sensor. REFER to **Light Sensor**. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to G17.

G17 CHECK CIRCUIT VLF14 (BU/BN) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280b

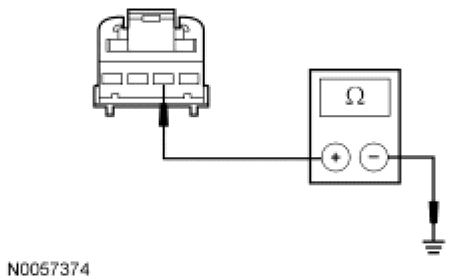


Fig. 45: Checking Circuit For Short To Ground
Courtesy of FORD MOTOR CO.

- On vehicles with EATC, measure the resistance between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.

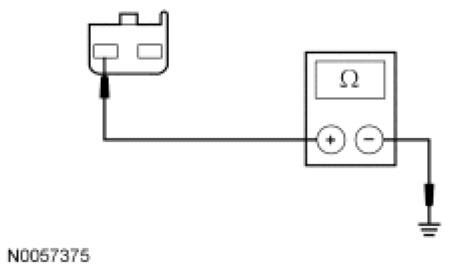


Fig. 46: Checking Circuit For Short To Ground
Courtesy of FORD MOTOR CO.

- On vehicles with manual temperature control, measure the resistance between the light sensor C287-A, circuit VLF14 (BU/BN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to G18.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

G18 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

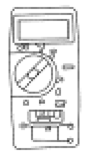
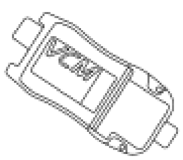
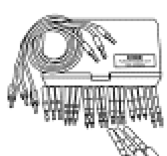
  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES**

article. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

STOPLAMPS

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The SJB monitors the input from the stoplamp switch. When the brake pedal is applied, voltage is routed to the SJB and the high mounted stoplamp. The SJB then supplies voltage to the stoplamps.

Field-Effect Transistor (FET) Protection

The SJB utilizes a FET protective circuit strategy for many of its outputs (for example, the headlamp output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault is detected. A continuous DTC is stored at that time of the fault. The circuit then resets after a customer demand of the function (switching the component on, battery saver being energized). When an excessive circuit load occurs several times, the module shuts down the output until a repair procedure is carried out. At the same time, the continuous DTC that was stored on the first failure, does not clear by a command to clear the continuous DTCs. The module does not allow this code to be cleared or the circuit restored to normal operation until a successful on-demand self-test proves that the fault has been repaired. After the on-demand self-test has successfully completed (no on-demand DTCs present), the continuous DTC clears and the circuit function returns.

Each circuit has 3 predefined levels of short circuit tolerance established in the module based on each circuits' capability. When the first or second level is reached, the continuous DTC associated with the circuit sets along with DTC B106E. These DTCs may be cleared using the Clear DTC operation on the scan tool as long as the fault itself has been corrected. If any of the circuits are shorted past the third level, then DTCs B106F and B1342 set along with the associated continuous DTC. This DTC cannot be cleared and the module must be replaced.

The SJB FET protected output circuits for the stoplamp system are for the LH rear stop/turn lamp output and the RH rear stop/turn lamp output circuits.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Stoplamp switch	• Battery junction box (BJB) fuse 71 (10A) (stoplamp switch) • Smart junction box (SJB) fuse 6 (20A) (rear stoplamps) • Bulb(s) • Bulb holder(s) • Wiring, terminals or connectors • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1485	Brake Pedal Input Short to Battery	Go to **Pinpoint Test J** .
B2044	Left Rear Stop Lamp Circuit Short to Ground	Go to **Pinpoint Test I** .
B2045	Left Rear Stop Lamp Circuit Open	If the lamp is inoperative, go to **Pinpoint Test I** . If the lamp is always on, go to **Pinpoint Test J** .
B2046	Right Rear Stop Lamp Circuit Short to Ground	Go to **Pinpoint Test I** .
B2047	Right Rear Stop Lamp Circuit Open	If the lamp is inoperative, go to **Pinpoint Test I** . If the lamp is always on, go to **Pinpoint Test J** .
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with	• Fuse	• REFER to **MODULE**

the smart junction box (SJB)	• Wiring, terminals or connectors • SJB	**COMMUNICATIONS NETWORK** article.
• All the stoplamps are inoperative	• Fuse • Wiring, terminals or connectors • Stoplamp switch	• Go to **Pinpoint Test H** .
• One or more stoplamps are inoperative	• Wiring, terminals or connectors • Bulb holder • High mounted stoplamp • SJB	• Go to **Pinpoint Test I** .
• The stoplamps are on continuously	• Wiring, terminals or connectors • Stoplamp switch • PCM • SJB	• Go to **Pinpoint Test J** .

Pinpoint Tests

Pinpoint Test H: All The Stoplamps Are Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

The stoplamp switch is supplied voltage through circuit SBB71 (WH/RD) from the battery junction box (BJB). When the brake pedal is applied, the stoplamp switch routes voltage to the smart junction box (SJB) and the high mounted stoplamp through circuit CCB08 (VT/WH).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Stoplamp switch

PINPOINT TEST H: ALL THE STOPLAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

H1 CHECK CIRCUIT SBB71 (WH/RD) FOR AN OPEN

- Key in OFF position.
- Disconnect: Stoplamp Switch C2064

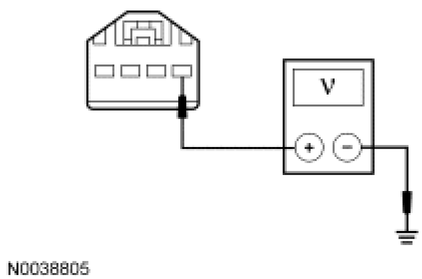


Fig. 47: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the stoplamp switch C2064-1, circuit SBB71 (WH/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to H2.

  NO : VERIFY the BJB fuse 71 (10A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

H2 CHECK THE STOPLAMP SWITCH

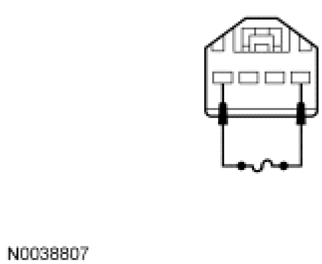


Fig. 48: Checking Stoplamp Switch
Courtesy of FORD MOTOR CO.

- Connect a fused (5A) jumper wire between the stoplamp switch C2064-1, circuit SBB71 (WH/RD), harness side and the stoplamp switch C2064-4, circuit CCB08 (VT/WH), harness side.
- **Are the stoplamps illuminated?**

  YES : INSTALL a new stoplamp switch. REFER to **Stoplamp Switch**. TEST the system for normal operation.

  NO : REPAIR circuit CCB08 (VT/WH) for an open. TEST the system for normal operation.

Pinpoint Test I: One Or More Stoplamps Are Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

When the brake pedal is applied, the stoplamp switch routes voltage to the smart junction box (SJB) and the high mounted stoplamp through circuit CCB08 (VT/WH).

When the SJB detects the brake pedal is applied, the SJB provides voltage to the LH and RH rear stoplamps through circuits CLS18 (GY/BN) and CLS19 (VT/OG), respectively.

Ground for the LH and RH rear stoplamps is provided through circuits GD149 (BK/GY) and GD151 (BK/GN), respectively. Ground for the high mounted stoplamp is provided through circuit GD149 (BK/GY).

DTC Description	Fault Trigger Conditions
B2044 - Left Rear Stop Lamp Circuit Short to Ground	A continuous and on-demand DTC that sets when the SJB detects a short to ground on the LH rear stop/turn lamp voltage supply circuit.
B2045 - Left Rear Stop Lamp Circuit Open	An on-demand DTC that sets when the SJB detects an open on the LH rear stop/turn lamp voltage supply circuit.
B2046 - Right Rear Stop Lamp Circuit Short to Ground	A continuous and on-demand DTC that sets when the SJB detects a short to ground on the RH rear stop/turn lamp voltage supply circuit.
B2047 - Right Rear Stop Lamp Circuit Open	An on-demand DTC that sets when the SJB detects an open on the RH rear stop/turn lamp voltage supply circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Bulb holder
- High mounted stoplamp
- SJB

PINPOINT TEST I: ONE OR MORE STOPLAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: The battery ground cable must be disconnected for accurate test results when checking ground circuits for continuity to ground.

I1 DETERMINE THE INOPERATIVE STOPLAMP

- Key in OFF position.
- Apply the brake pedal and observe the stoplamps.
- **Is the high mounted stoplamp illuminated?**

  YES : Go to I4.

  NO : Go to I2.

I2 CHECK CIRCUIT GD149 (BK/GY) FOR AN OPEN

- Disconnect: High Mounted Stoplamp C904

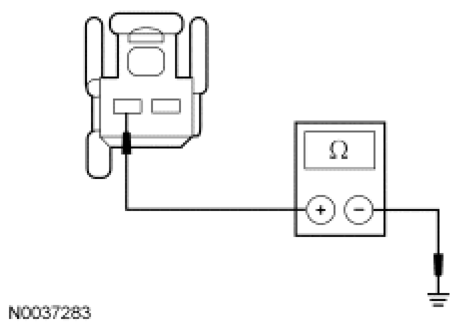


Fig. 49: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the high mounted stoplamp C904-2, circuit GD149 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to I3.

  NO : REPAIR the circuit. TEST the system for normal operation.

I3 CHECK CIRCUIT CCB08 (VT/WH) FOR AN OPEN (TO HIGH MOUNTED STOPLAMP)

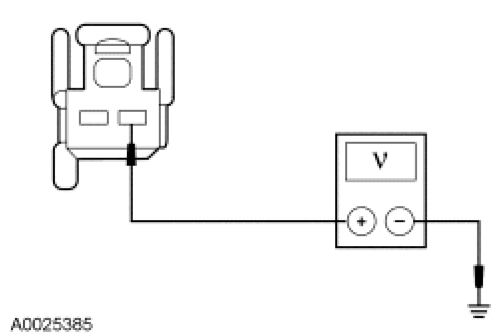


Fig. 50: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- While applying the brake pedal, measure the voltage between the high mounted stoplamp C904-1, circuit CCB08 (VT/WH), harness side and ground.

- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new high mounted stoplamp. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

I4 USE THE RECORDED DTCs FROM THE SJB SELF-TEST

- Check the recorded results from the SJB on-demand self-test.
- **Are any DTCs present?**

  YES : For DTCs B2044 or B2046, go to I6.

  For DTCs B2045 or B2047, go to I8.

  NO : Go to I5.

I5 CHECK CIRCUIT CCB08 (VT/WH) FOR AN OPEN (TO SJB)

- Disconnect: SJB C2280b

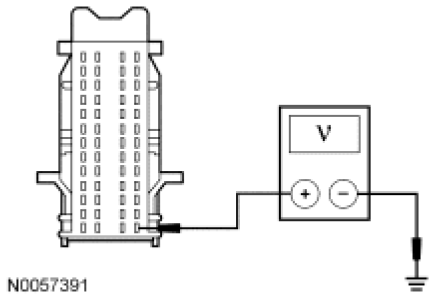


Fig. 51: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- While applying the brake pedal, measure the voltage between the SJB C2280b-40, circuit CCB08 (VT/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to I11.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

I6 CHECK THE BULB HOLDER

- Disconnect: LH Rear Lamp C412 (DTC B2044)
- Disconnect: RH Rear Lamp C415 (DTC B2046)
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB Self-Test
- Repeat the SJB on-demand self-test.
- **Is on-demand DTC B2044 or B2046 retrieved again?**

  YES : Go to I7.

  NO : INSTALL a new bulb holder. CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.

I7 CHECK CIRCUIT CLS18 (GY/BN) OR CIRCUIT CLS19 (VT/OG) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280d

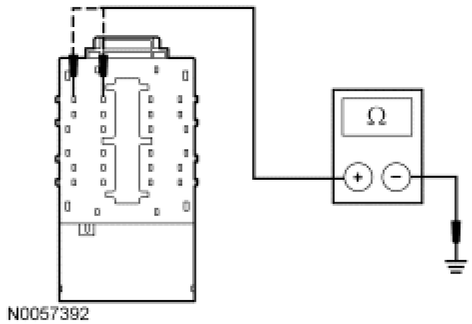


Fig. 52: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280d-25, circuit CLS18 (GY/BN), harness side and ground; or between the SJB C2280d-26, circuit CLS19 (VT/OG), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to I11.

  NO : REPAIR the circuit in question. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.

I8 CHECK CIRCUIT GD149 (BK/GY) (LH STOPLAMP) OR CIRCUIT GD151 (BK/GN) (RH STOPLAMP) FOR AN OPEN

- Disconnect: Inoperative Rear Lamp

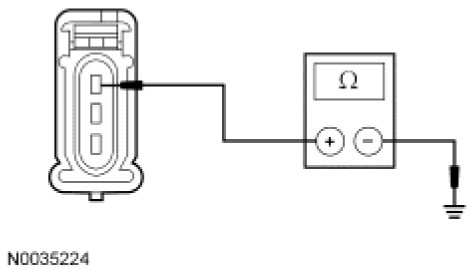


Fig. 53: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the LH rear lamp C412-1, circuit GD149 (BK/GY), harness side and ground; or between the RH rear lamp C415-1, circuit GD151 (BK/GN), harness side and ground.

- **Is the resistance less than 5 ohms?**

  YES : Go to I9.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

I9 CHECK FOR VOLTAGE TO THE BULB HOLDER

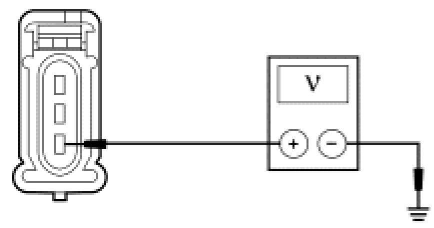


Fig. 54: Measuring Voltage Between LH Rear Lamp C412-3 & C415-3, Circuit CLS18 (GY/BN) & CLS19 (VT/OG)
Courtesy of FORD MOTOR CO.

- While applying the brake pedal, measure the voltage between the LH rear lamp C412-3, circuit CLS18 (GY/BN), harness side and ground; or between the RH rear lamp C415-3, circuit CLS19 (VT/OG), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new bulb holder. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to I10.

I10 CHECK THE CIRCUIT CLS18 (GY/BN) OR CIRCUIT CLS19 (VT/OG) FOR AN OPEN

- Disconnect: SJB C2280d

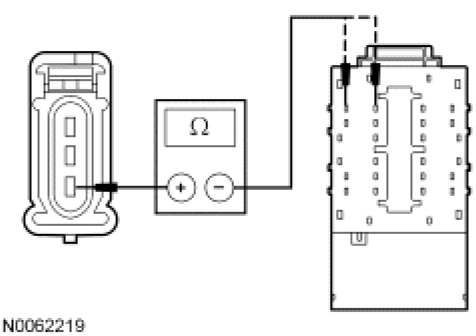


Fig. 55: Measuring Resistance Between LH Rear Lamp C412-3, Circuit CLS18 (GY/BN) & SJB C2280D-25
Courtesy of FORD MOTOR CO.

- Measure the resistance between the LH rear lamp C412-3, circuit CLS18 (GY/BN), harness side and the SJB C2280d-25, circuit CLS18 (GY/BN), harness side; or between the RH rear lamp C415-3, circuit CLS19 (VT/OG), harness side and the SJB C2280d-26, circuit CLS19 (VT/OG), harness side.

- **Is the resistance less than 5 ohms?**

  YES : Go to I11.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

I11 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test J: The Stoplamps Are On Continuously

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Turn Signal/Stop/Hazard Lamps for schematic and connector information.

When the brake pedal is applied, the stoplamp switch routes voltage to the smart junction box (SJB), the high mounted stoplamp and the PCM through circuit CCB08 (VT/WH). When the SJB detects the brake pedal applied, the SJB provides voltage to the LH and RH rear stoplamps through circuits CLS18 (GY/BN) and CLS19 (VT/OG), respectively. If equipped with trailer tow, voltage is also supplied to the respective trailer tow stop/turn relay.

- DTC B1485 (Brake Pedal Input Short to Battery) - is an on-demand DTC that sets when the SJB detects a short to voltage from the stoplamp switch input circuit.
- DTC B2045 (Left Rear Stop Lamp Circuit Open) - is an on-demand DTC that sets when the SJB detects a short to voltage on the LH rear stop/turn lamp voltage supply circuit.
- DTC B2047 (Right Rear Stop Lamp Circuit Open) - is an on-demand DTC that sets when the SJB detects a short to voltage on the RH rear stop/turn lamp voltage supply circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Stoplamp switch
- PCM
- SJB

PINPOINT TEST J: THE STOPLAMPS ARE ON CONTINUOUSLY

J1 DETERMINE IF ALL THE STOPLAMPS ARE ILLUMINATED

- Key in OFF position.
- Observe the stoplamps with the brake pedal released.
- **Are all of the stoplamps illuminated?**

  YES : Go to J3.

  NO : Go to J2.

J2 CHECK THE STOPLAMPS VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE

- Disconnect: SJB C2280d
- **Do the stoplamps continue to illuminate?**

  YES : If the LH rear lamp continues to illuminate, REPAIR circuit CLS18 (GY/BN). CLEAR the DTCs. REPEAT the self-test.

  If the RH rear lamp continues to illuminate, REPAIR circuit CLS19 (VT/OG). CLEAR the DTCs. REPEAT the self-test.

  NO : Go to J7.

J3 CHECK THE STOPLAMP SWITCH

- Disconnect: Stoplamp Switch C2064
- **Do the stoplamps continue to illuminate?**

  YES : Go to J4.

  NO : INSTALL a new stoplamp switch. REFER to **Stoplamp Switch**. CLEAR the DTCs. REPEAT the self-test.

J4 CHECK THE PCM

- Disconnect: PCM C175b
- **Do the stoplamps continue to illuminate?**

  YES : Go to J5.

  NO : Go to J6.

J5 CHECK CIRCUIT CCB08 (VT/WH) FOR A SHORT TO VOLTAGE

- Disconnect: SJB C2280b
- **Does the high mounted stoplamp continue to illuminate?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to J7.

J6 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins

  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

J7 CHECK FOR CORRECT SJB OPERATION

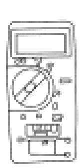
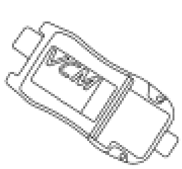
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

TURN SIGNAL AND HAZARD LAMPS

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
	Flex Probe Kit	105-R025C or equivalent

 ST2574-A		

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The SJB monitors the multifunction switch position by sending multiple voltage reference signals to the multifunction switch. When the multifunction switch is in the LH or RH TURN positions, or the hazard lamp switch is pressed, that input signal is routed to ground.

When the SJB receives a request for a turn signal or hazard lamps, the SJB supplies voltage to the appropriate turn lamps.

The timed on/off cycle is determined by the SJB and is set to flash approximately 80 times per minute if both the front and rear turn lamps operate correctly. If an individual turn signal lamp is inoperative, the SJB flashes the remaining turn lamp approximately 160 times per minute.

The timed on/off cycle for the hazard lamps is set to flash approximately 80 times per minute.

Field-Effect Transistor (FET) Protection

The SJB utilizes a FET protective circuit strategy for many of its outputs (for example, the headlamp output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault is detected. A continuous DTC is stored at that time of the fault. The circuit then resets after a customer demand of the function (switching the component on, battery saver being energized). When an excessive circuit load occurs several times, the module shuts down the output until a repair procedure is carried out. At the same time, the continuous DTC that was stored on the first failure, does not clear by a command to clear the continuous DTCs. The module does not allow this code to be cleared or the circuit restored to normal operation until a successful on-demand self-test proves that the fault has been repaired. After the on-demand self-test has successfully completed (no on-demand DTCs present), the continuous DTC clears and the circuit function returns.

Each circuit has 3 predefined levels of short circuit tolerance established in the module based on each circuits' capability. When the first or second level is reached, the continuous DTC associated with the circuit sets along with DTC B106E. These DTCs may be cleared using the Clear DTC operation on the scan tool as long as the fault itself has been corrected. If any of the circuits are shorted past the third level, then DTCs B106F and B1342 set along with the associated continuous DTC. This DTC cannot be cleared and the module must be replaced.

The SJB FET protected output circuits for the turn lamp system are for the LH front turn lamp output and the RH front turn lamp output circuits. The rear turn lamps utilize the stoplamp circuitry and are also protected. For information regarding the rear stoplamps, refer to **Stoplamps**.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Multifunction switch • Hazard flasher lamp switch	• Bulb(s) • Wiring, terminals or connectors • Smart junction box (SJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.

- If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B2071	Hazard Switch Signal Short to Ground	Go to **Pinpoint Test N** .
B2281	Right Turn Switch Short to Ground	Go to **Pinpoint Test L** .
B2282	Left Turn Switch Short to Ground	Go to **Pinpoint Test L** .
B2A27	Right Front Turn Lamp Circuit Open	Go to **Pinpoint Test M** .
B2A28	Right Front Turn Lamp Circuit Short to Ground	Go to **Pinpoint Test M** .
B2A29	Left Front Turn Lamp Circuit Open	Go to **Pinpoint Test M** .
B2A2A	Left Front Turn Lamp Circuit Short to Ground	Go to **Pinpoint Test M** .
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Fuse • Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The turn signal lamps are inoperative	• Wiring, terminals or connectors • Multifunction switch • SJB	• Go to **Pinpoint Test K** .
• The turn signal lamps are always on	• Wiring, terminals or connectors • Multifunction switch	• Go to **Pinpoint Test L** .

	• SJB	
• One turn signal/hazard lamp is inoperative/always on	• Wiring, terminals or connectors • Joint connector • Bulb holder (Edge) • Headlamp assembly (MKX) • SJB	• Go to **Pinpoint Test M** .
• The hazard lamps are inoperative/always on	• Wiring, terminals or connectors • Joint connector • Hazard flasher lamp switch • SJB	• Go to **Pinpoint Test N** .

Pinpoint Tests

Pinpoint Test K: The Turn Signal Lamps Are Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends reference signals to the multifunction switch through circuit CLS39 (VT/WH) (LH turn input) and circuit CLS41 (GY/YE) (RH turn input). When the multifunction switch is switched to the LH or RH TURN positions, the voltage signal is routed to ground. When the SJB detects the multifunction switch in the LH or RH TURN position, the SJB sends voltage to the appropriate turn lamps.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Multifunction switch
- SJB

PINPOINT TEST K: THE TURN SIGNAL LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

K1 CHECK FOR CORRECT HIGH BEAM OPERATION

- Place the headlamp switch in the HEADLAMPS ON position.

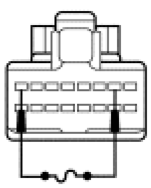
- Place the multifunction switch in the HIGH BEAM position while observing the high beam headlamps.
- **Do the high beams operate correctly?**

  YES : PLACE the headlamp switch in the OFF position. Go to K2.

  NO : REFER to **Headlamps**.

K2 CHECK THE MULTIFUNCTION SWITCH

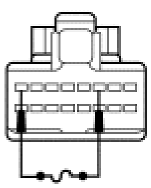
- Key in OFF position.
- Disconnect: Multifunction Switch C202



N0069012

Fig. 56: Connecting Fused (5A) Jumper Wire Between Multifunction Switch C202-2 & C202-8, CLS39 (VT/WH) & GD116 (BK/VT)
Courtesy of FORD MOTOR CO.

- For an inoperative LH turn signal, connect a fused (5A) jumper wire between the multifunction switch C202-2, circuit CLS39 (VT/WH), harness side and the multifunction switch C202-8, circuit GD116 (BK/VT), harness side.



N0069013

Fig. 57: Connecting Fused (5A) Jumper Wire Between Multifunction Switch C202-3, CLS41 (GY/YE) & GD116 (BK/VT)
Courtesy of FORD MOTOR CO.

- For an inoperative RH turn signal, connect a fused (5A) jumper wire between the multifunction switch C202-3, circuit CLS41 (GY/YE), harness side and the multifunction switch C202-3, circuit GD116 (BK/VT), harness side.
- Key in ON position.

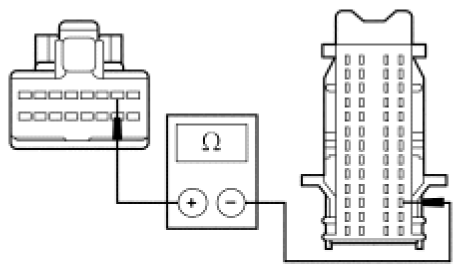
- **Do the turn signals in question flash on and off?**

  YES : REMOVE the jumper wire. INSTALL a new multifunction switch. REFER to **STEERING COLUMN SWITCHES** article. TEST the system for normal operation.

  NO : REMOVE the jumper wire. Go to K3.

K3 CHECK CIRCUIT CLS39 (VT/WH) (LH TURN SIGNAL) OR CLS41 (GY/YE) (RH TURN SIGNAL) FOR AN OPEN

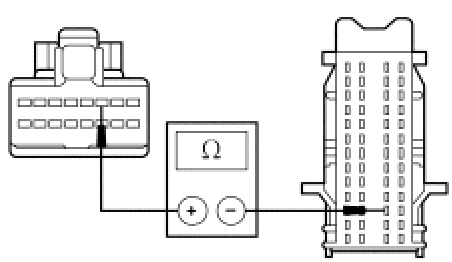
- Disconnect: SJB C2280b



N0072831

Fig. 58: Measuring Resistance Between Multifunction Switch C202-2, Circuit CLS39 (VT/WH) & SJB C2280B-42
Courtesy of FORD MOTOR CO.

- For an inoperative LH turn signal, measure the resistance between the multifunction switch C202-2, circuit CLS39 (VT/WH), harness side and the SJB C2280b-42, circuit CLS39 (VT/WH), harness side.



N0072832

Fig. 59: Measuring Resistance Between Multifunction Switch C202-3, Circuit CLS41 (GY/YE) & SJB C2280B-29
Courtesy of FORD MOTOR CO.

- For an inoperative RH turn signal, measure the resistance between the multifunction switch C202-3, circuit CLS41 (GY/YE), harness side and the SJB C2280b-29, circuit CLS41 (GY/YE), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to K4.

NO : REPAIR the circuit in question. TEST the system for normal operation.

K4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test L: The Turn Signal Lamps Are Always On

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends reference signals to the multifunction switch through circuits CLS39 (VT/WH) (LH turn input) and CLS41 (GY/YE) (RH turn input). When the multifunction switch is switched to the LH or RH TURN positions, the voltage signal is routed to ground. When the SJB detects the multifunction switch in the LH or RH TURN position, the SJB sends voltage to the appropriate turn lamps.

- DTC B2281 (Right Turn Switch Short to Ground) - is an on-demand DTC that sets when the SJB detects the RH turn signal switch input is short to ground.
- DTC B2282 (Left Turn Switch Short to Ground) - is an on-demand DTC that sets when the SJB detects the LH turn signal switch input is short to ground.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Multifunction switch
- SJB

PINPOINT TEST L: THE TURN SIGNAL LAMPS ARE ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

L1 CHECK THE MULTIFUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multifunction Switch C202
- Key in ON position.
- **Do the turn lamps continue to flash on and off?**

  YES : Go to L2.

  NO : INSTALL a new multifunction switch. REFER to **STEERING COLUMN SWITCHES** article. CLEAR the DTCs. REPEAT the self-test.

L2 CHECK CIRCUIT CLS39 (VT/WH) (LH TURN SIGNAL) OR CIRCUIT CLS41 (GY/YE) (RH TURN SIGNAL) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280b

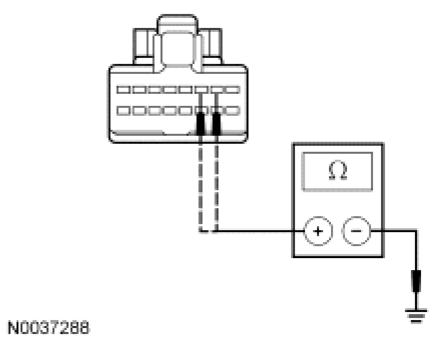


Fig. 60: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the multifunction switch C202-2 (LH turn lamps), circuit CLS39 (VT/WH), harness side and ground; or between the multifunction switch C202-3 (RH turn lamps), circuit CLS41 (GY/YE), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to L3.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

L3 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs. REPEAT the self-test.

Pinpoint Test M: One Turn Signal/Hazard Lamp Is Inoperative/Always On

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

When the smart junction box (SJB) detects the multifunction switch in the LH TURN position, the SJB provides voltage through circuit CLS21 (BU/GN) to the LH front turn lamp. When the SJB detects the multifunction switch in the RH TURN position, the SJB provides voltage through circuit CLS25 (YE/VT) to the RH front turn lamp. Circuits GD123 (BK/GY) and GD120 (BK/GN) provide ground for the LH and RH front turn lamps, respectively. The rear turn lamps are controlled utilizing the rear stoplamp circuitry.

DTC Description	Fault Trigger Conditions
B2A27 - Right Front Turn Lamp Circuit Open	An on-demand DTC that sets when the SJB detects an open or short to voltage on the RH front turn lamp voltage supply circuit.
B2A28 - Right Front Turn Lamp Circuit Short to Ground	A continuous and on-demand DTC that sets when the SJB detects a short to ground on the RH front turn lamp voltage supply circuit.
B2A29 - Left Front Turn Lamp Circuit Open	An on-demand DTC that sets when the SJB detects an open or short to voltage on the LH front turn lamp voltage supply circuit.
B2A2A - Left Front Turn Lamp Circuit Short to Ground	A continuous and on-demand DTC that sets when the SJB detects a short to ground on the LH front turn lamp voltage supply circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Joint connector
- Bulb holder (Edge)
- Headlamp assembly (MKX)
- SJB

PINPOINT TEST M: ONE TURN SIGNAL/HAZARD LAMP IS INOPERATIVE/ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: The battery ground cable must be disconnected for accurate test results when checking ground circuits for continuity to ground.

M1 CHECK THE STOPLAMPS

- Apply and release the brake pedal while observing the stoplamps.
- **Do the stoplamps operate correctly?**

  YES : Go to M2.

  NO : REFER to **Stoplamps**.

M2 DETERMINE IF A TURN LAMP IS ALWAYS ON

- Key in ON position.
- Monitor the turn lamps.
- **Is either front turn lamp always on?**

  YES : Go to M3.

  NO : Go to M4.

M3 CHECK CIRCUIT CLS21 (BU/GN) (LH TURN) OR CIRCUIT CLS25 (YE/VT) (RH TURN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280f
- Key in ON position.
- **Does the front turn lamp in question continue to illuminate?**

  YES : For the LH front turn lamp, REPAIR circuit CLS21 (BU/GN). CLEAR the DTCs. REPEAT the self-test.

  For the RH front turn lamp, REPAIR circuit CLS25 (YE/VT). CLEAR the DTCs. REPEAT the self-test.

  NO : Go to M11.

M4 USE THE RECORDED DTCs FROM THE SJB SELF-TEST

- Check the recorded results from the SJB on-demand self-test.
- **Was DTC B2A28 or B2A2A present?**

  YES : Go to M5.

  NO : Go to M7.

M5 CHECK THE BULB HOLDER FOR A SHORT TO GROUND

- Disconnect: Inoperative Front Turn Lamp
- Enter the following diagnostic mode on the diagnostic tool: SJB Self-Test
- Repeat the SJB on-demand self-test.
- **Is DTC B2A28 or B2A2A still present?**

  YES : Go to M6.

  NO : INSTALL a new bulb holder. TEST the system for normal operation.

M6 CHECK CIRCUIT CLS21 (BU/GN) (DTC B2A2A) OR CIRCUIT CLS25 (YE/VT) (DTC B2A28) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280f

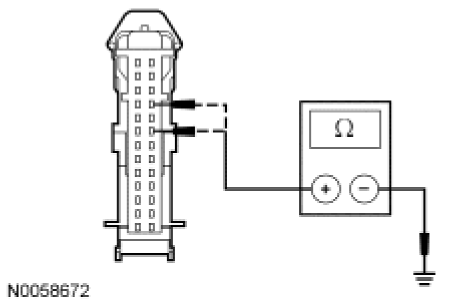


Fig. 61: Checking Circuits For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280f-21 (DTC B2A2A), circuit CLS21 (BU/GN), harness side and ground; or between the SJB C2280f-23 (DTC B2A28), circuit CLS25 (YE/VT), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to M11.

  NO : REPAIR the circuit in question. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.

M7 CHECK THE GROUND CIRCUIT FOR AN OPEN

NOTE:	**Make sure the headlamps operate correctly before continuing with diagnostics for the turn lamps.**

- Key in OFF position.
- Disconnect: Inoperative Turn Lamp

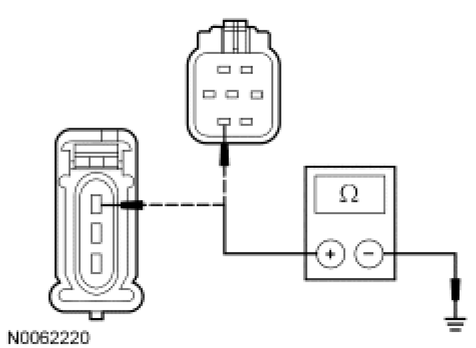


Fig. 62: Measuring Resistance Between Inoperative Turn Lamp, Harness Side & Ground

Courtesy of FORD MOTOR CO.

- Measure the resistance between the inoperative turn lamp, harness side and ground as follows

Inoperative Turn Lamp	Connector-Pin	Circuit
Edge		
LH front	C1023-1	GD123 (BK/GY)
RH front	C1043-1	GD120 (BK/GN)
MKX		
LH front headlamp	C1021a-6	GD123 (BK/GY)
RH front headlamp	C1041a-6	GD123 (BK/GY)

- **Is the resistance less than 5 ohms?**

YES : Go to M9.

NO : For MKX, REPAIR the ground circuit in question for an open. CLEAR the DTCs. REPEAT the self-test.

For Edge LH front turn lamp, REPAIR circuit GD123 (BK/GY) for an open. CLEAR the DTCs. REPEAT the self-test.

For the Edge RH front turn lamp, go to M8.

M8 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN

- Disconnect: Joint Connector 7 C2200

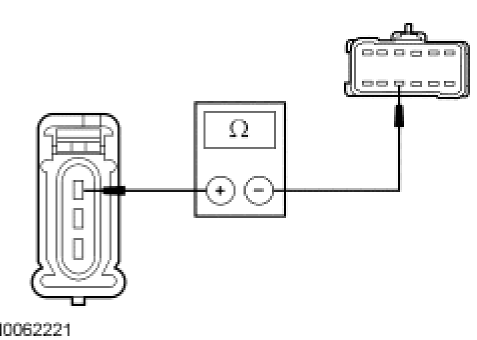


Fig. 63: Measuring Resistance Between RH Front Turn Lamp C1043-1, Circuit GD120 (BK/GN) & Joint Connector 7 C2200-C
Courtesy of FORD MOTOR CO.

- Measure the resistance between the RH front turn lamp C1043-1, circuit GD120 (BK/GN), harness side and the joint connector 7 C2200-C, circuit GD120 (BK/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new joint connector. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

M9 CHECK FOR VOLTAGE TO THE TURN LAMP

- Connect: SJB C2280e
- Turn the hazard lamps on.

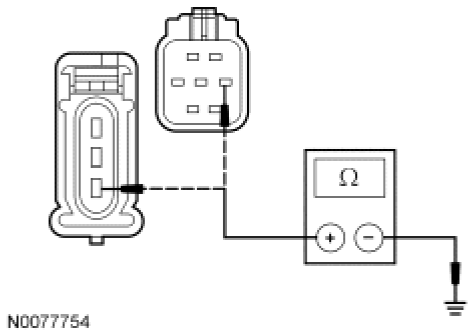


Fig. 64: Measuring Resistance Between Inoperative Turn Lamp, Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the inoperative turn lamp, harness side and ground as follows:

Inoperative Turn Lamp Connector-Pin	Circuit
Edge	
LH front C1023-3	CLS21 (BU/GN)
RH front C1043-3	CLS25 (YE/VT)
MKX	
LH front headlamp C1021a-5	CLS21 (BU/GN)
RH front headlamp C1041a-5	CLS25 (YE/VT)

- **Does the voltage alternate from 0 volts to greater than 10 volts?**

  YES : For Edge, INSTALL a new bulb holder. CLEAR the DTCs. REPEAT the self-test.

For MKX, REPAIR or INSTALL a new headlamp. REFER to **Headlamp Assembly**. CLEAR the DTCs. REPEAT the self-test.

NO : Go to M10.

M10 CHECK CIRCUIT CLS21 (BU/GN) (LH TURN) OR CIRCUIT CLS25 (YE/VT) (RH TURN) FOR AN OPEN

- Disconnect: SJB C2280f

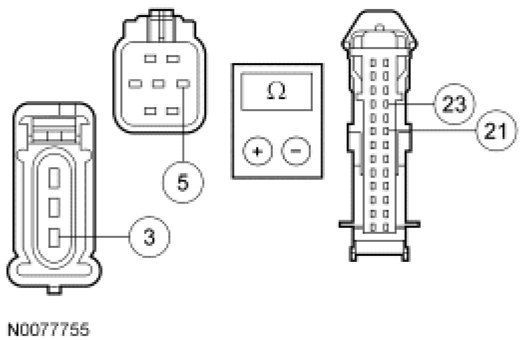


Fig. 65: Measuring Resistance Between Inoperative Turn Lamp, Harness Side & SJB
Courtesy of FORD MOTOR CO.

- Measure the resistance between the inoperative turn lamp, harness side and the SJB, harness side as follows:

Inoperative Turn Lamp Connector-Pin	SJB Connector-Pin	Circuit
Edge		
LH front C1023-3	C2280f-21	CLS21 (BU/GN)
RH front C1043-3	C2280f-23	CLS25 (YE/VT)
MKX		
LH front headlamp C1021a-5	C2280f-21	CLS21 (BU/GN)
RH front headlamp C1041a-5	C2280f-23	CLS25 (YE/VT)

- **Is the resistance less than 5 ohms?**

YES : Go to M11.

NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test

M11 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test N: The Hazard Lamps Are Inoperative/Always On

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a voltage reference signal to the hazard lamp switch through circuit CLS32 (BN/YE). The hazard flasher lamp switch is a momentary contact switch. When the hazard flasher lamp switch is engaged, the voltage signal is routed to ground through circuit GD116 (BK/VT). When the SJB detects a request for the hazard lamps, the SJB provides on/off voltage to all the turn lamps.

- DTC B2071 (Hazard Switch Signal Short to Ground) - is an on-demand DTC that sets when the SJB detects a short to ground from the hazard flasher lamp switch input circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Joint connector
- Hazard flasher lamp switch
- SJB

PINPOINT TEST N: THE HAZARD LAMPS ARE INOPERATIVE/ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: The battery ground cable must be disconnected for accurate test results when

checking ground circuits for continuity to ground.

N1 CHECK THE RECORDED DTCs FROM THE SJB SELF-TEST

- Check the recorded DTCs from the SJB self-test.
- **Is DTC B2071 present?**

  YES : Go to N2.

  NO : Go to N4.

N2 CHECK THE HAZARD FLASHER LAMP SWITCH

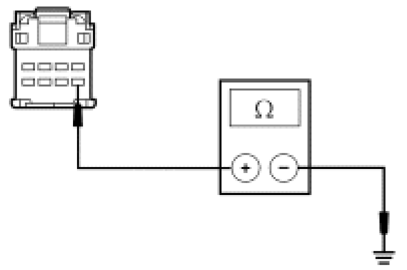
- Disconnect: Hazard Flasher Lamp Switch C2355
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB Self-Test
- Repeat the SJB self-test.
- **Is DTC B2071 still present?**

  YES : Go to N3.

  NO : INSTALL a new hazard flasher lamp switch. REFER to **Hazard Flasher Lamp Switch**. CLEAR the DTCs. REPEAT the self-test.

N3 CHECK CIRCUIT CLS32 (BN/YE) FOR A SHORT TO GROUND

- Disconnect: SJB C2280b



N0062225

Fig. 66: Measuring Resistance Between Hazard Flasher Lamp Switch C2355-5, Circuit CLS32 (BN/YE) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the hazard flasher lamp switch C2355-5, circuit CLS32 (BN/YE), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to N8.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

N4 CHECK CIRCUIT GD116 (BK/VT) FOR CONTINUITY TO GROUND

NOTE:	**Make sure the headlamps operate correctly before continuing with diagnostics for the hazard lamps.**

- Key in OFF position.
- Disconnect: Hazard Flasher Lamp Switch C2355

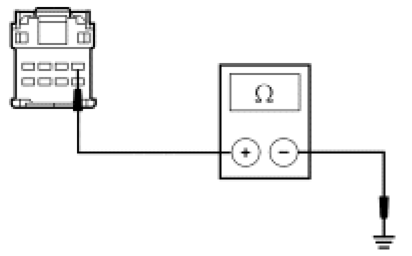


Fig. 67: Measuring Resistance Between Hazard Flasher Lamp Switch C2355-1, Circuit GD116 (BK/VT) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the hazard flasher lamp switch C2355-1, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to N6.

  NO : Go to N5.

N5 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

NOTE: **Make sure the headlamps operate correctly before continuing with diagnostics for the hazard lamps.**

- Key in OFF position.
- Disconnect: Joint Connector 6 C2365

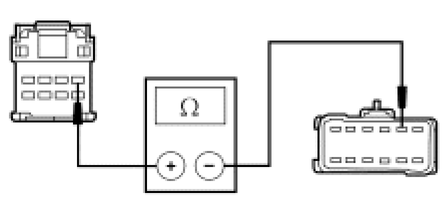


Fig. 68: Measuring Resistance Between Hazard Flasher Lamp Switch C2355-1, GD116 (BK/VT) & Joint Connector 6 C2365-H
Courtesy of FORD MOTOR CO.

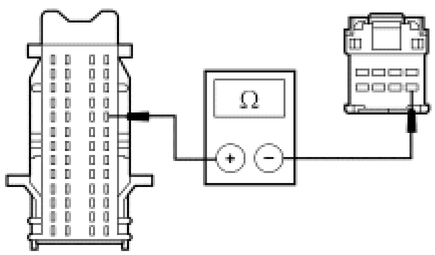
- Measure the resistance between the hazard flasher lamp switch C2355-1, circuit GD116 (BK/VT), harness side and the joint connector 6 C2365-H, circuit GD116 (BK/VT), harness side.

- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new joint connector. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

N6 CHECK CIRCUIT CLS32 (BN/YE) FOR AN OPEN



N0062226

Fig. 69: Measuring Resistance Between SJB C2280B-48, Circuit CLS32 (BN/YE) & Hazard Flasher Lamp Switch C2355-5
Courtesy of FORD MOTOR CO.

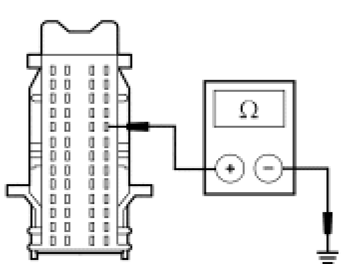
- Measure the resistance between the SJB C2280b-48, circuit CLS32 (BN/YE), harness side and the hazard flasher lamp switch C2355-5, circuit CLS32 (BN/YE), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to N7.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

N7 CHECK THE HAZARD FLASHER LAMP SWITCH

- Connect: Hazard Flasher Lamp Switch C2355



N0058676

Fig. 70: Checking Hazard Flasher Lamp Switch
Courtesy of FORD MOTOR CO.

- While pressing and releasing the hazard flasher lamp switch, measure the resistance between the SJB C2280b-48, circuit CLS32 (BN/YE), harness side and ground.
- **Is the resistance less than 5 ohms with the switch pressed and greater than 10,000 ohms with the switch released?**

YES : Go to N8.

NO : INSTALL a new hazard flasher lamp switch. REFER to **Hazard Flasher Lamp Switch**. CLEAR the DTCs. REPEAT the self-test.

N8 CHECK FOR CORRECT SJB OPERATION

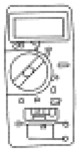
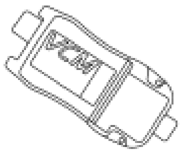
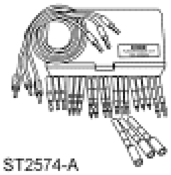
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

PARKING, REAR AND LICENSE PLATE LAMPS

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The SJB monitors the headlamp switch position by sending voltage reference signals on multiple circuits to the headlamp switch. There is one circuit for each headlamp switch position. At any given time, one of the signal circuits is routed to ground.

If the SJB does not detect any of the inputs to the headlamp switch are active (routed to ground) for 5 seconds, the SJB turns on the exterior lights and keeps them on for 10 minutes after the ignition switch is turned off (or 10 minutes from the time the SJB does not detect any headlamp switch input if the ignition switch was already off). Additionally, if the SJB detects multiple circuits short to ground, the SJB implements a planned strategy depending on the multiple inputs received.

If either of these situations occur, the SJB should **NOT** be ruled immediately as being at fault. This is normal behavior of the SJB design as it has detected a fault with the inputs from the headlamp switch.

When the SJB receives an input from the headlamp switch indicating a request for the parking lamps, the SJB energizes the parking lamp relay (internal to the SJB), which supplies voltage to the exterior lamps.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Headlamp switch	• Smart junction box (SJB) fuse 22 (15A) • Bulb(s) • Bulb holder(s) • Wiring, terminals or connectors • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
    - Check the VCM connection to the vehicle.
    - Check the scan tool connection to the VCM.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
    - Verify the ignition key is in the ON position.
    - Verify the scan tool operation with a known good vehicle.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1578	Lamp Park Input Circuit Short to Ground	Go to **Pinpoint Test P** .
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Fuse • Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• One or more parking, rear	• Fuse • Wiring, terminals or connectors • Bulb Holder	

or license plate lamps is inoperative	• Liftgate lamp • Liftgate release handle • Headlamp assembly • SJB	• Go to **Pinpoint Test O** .
• The parking, rear or license plate lamps are on continuously	• Wiring, terminals or connectors • Headlamp switch • SJB	• Go to **Pinpoint Test P** .

Pinpoint Tests

Pinpoint Test O: One Or More Parking, Rear or License Plate Lamps Is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Parking, Rear and License Lamps for schematic and connector information.

Normal Operation

When the headlamp switch is placed in the PARKING LAMPS ON position, the smart junction box (SJB) provides a ground for the parking lamp relay coil (integrated into the SJB). When the parking lamp relay is energized, voltage is routed through circuit CLS30 (VT/WH) to the rear and front parking lamps. Ground is provided to the rear parking, liftgate and license plate lamps through circuit GD149 (BK/GY) or circuit GD151 (BK/GN). Ground is provided to the front parking and side marker lamps through circuit GD120 (BK/GN) or circuit GD123 (BK/GY).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Bulb Holder
- Liftgate lamp
- Liftgate release handle
- Headlamp assembly
- SJB

PINPOINT TEST O: ONE OR MORE PARKING, REAR OR LICENSE PLATE LAMPS IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: **The battery ground cable must be disconnected for accurate test results when checking ground circuits for continuity to ground.**

O1 DETERMINE IF ALL THE PARKING LAMPS ARE INOPERATIVE

- Key in OFF position.
- Place the headlamp switch to the PARKING LAMPS ON position.
- **Are all the parking lamps inoperative?**

YES : PLACE the headlamp switch in the OFF position. VERIFY the SJB fuse 22 (15A) is OK. If OK, go to O6.

NO : If all the front parking lamps are inoperative, go to O2.

If all the rear parking and license plate lamps are inoperative, go to O3.

For all others, go to O4.

O2 CHECK CIRCUIT CLS30 (VT/WH) FOR AN OPEN (FRONT LAMPS)

- Disconnect: SJB C2280e

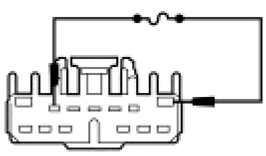


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Fig. 71: Connecting Fused Jumper Wire
Courtesy of FORD MOTOR CO.

- Connect a fused (5A) jumper wire between the SJB C2280e-1, circuit CBB53 (GY/BN), harness side and the SJB C2280e-6, circuit CLS30 (VT/WH), harness side.
- Key in ON position.
- **Do the front parking lamps illuminate?**

YES : REMOVE the jumper wire. Go to O6.

NO : REMOVE the jumper wire. REPAIR the circuit. TEST the system for normal operation.

O3 CHECK CIRCUIT CLS30 (VT/WH) FOR AN OPEN (REAR LAMPS)

- Disconnect: SJB C2280d

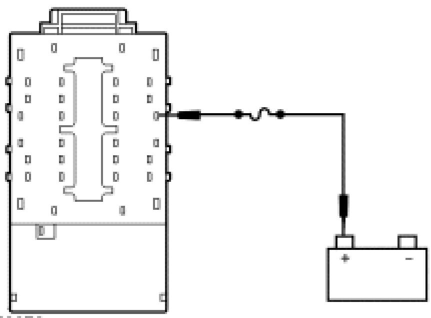


Fig. 72: Connecting Fused Jumper Wire
Courtesy of FORD MOTOR CO.

- Connect a fused (5A) jumper wire between the positive battery terminal and the SJB C2280d-20, circuit CLS30 (VT/WH), harness side.
- **Do the rear parking lamps illuminate?**

  YES : REMOVE the jumper wire. Go to O6.

  NO : REMOVE the jumper wire. REPAIR the circuit. TEST the system for normal operation.

O4 CHECK THE PARKING LAMP GROUND CIRCUIT FOR AN OPEN

NOTE: If a front parking lamp is inoperative, make sure the front turn signal operates correctly before continuing diagnostics for the front parking lamp.

- Disconnect: Inoperative Lamp
- Measure the resistance between the inoperative lamp, harness side and ground as follows:

EDGE

Inoperative Lamp	Connector-Pin	Circuit
LH front	C1023-1	GD123 (BK/GY)
RH front	C1043-1	GD120 (BK/GN)
LH rear	C412-1	GD149 (BK/GY)
RH rear	C415-1	GD151 (BK/GN)
LH rear side marker	C4136-1	GD149 (BK/GY)
RH rear side marker	C4138-1	GD151 (BK/GN)
Liftgate release		GD149

handle (license plate lamps)	C4353-2	(BK/GY)

MKX

Inoperative Lamp	Connector-Pin	Circuit
LH front (headlamp)	C1021a-6	GD123 (BK/GY)
RH front (headlamp)	C1041a-6	GD123 (BK/GY)
LH front side marker	C151-2	GD120 (BK/GN)
RH front side marker	C161-2	GD123 (BK/GY)
LH rear	C412-1	GD149 (BK/GY)
RH rear	C415-1	GD151 (BK/GN)
Liftgate (rear applique)	C4352-2	GD149 (BK/GY)
LH rear side marker	C4355-2	GD149 (BK/GY)
RH rear side marker	C4356-2	GD149 (BK/GY)
LH license plate	C452-2	GD149 (BK/GY)
RH license plate	C462-2	GD149 (BK/GY)

- **Is the resistance less than 5 ohms?**

  YES : Go to O5.

  NO : REPAIR the ground circuit in question. TEST the system for normal operation.

O5 CHECK CIRCUIT CLS30 (VT/WH) FOR AN OPEN

- Place the headlamp switch in the PARKING LAMPS ON position.
- Measure the voltage between the inoperative lamp, harness side and ground as follows:

EDGE

Inoperative Lamp	Connector-Pin	Circuit
LH front	C1023-2	CLS30 (VT/WH)

RH front	C1043-2	CLS30 (VT/WH)
LH rear	C412-2	CLS30 (VT/WH)
RH rear	C415-2	CLS30 (VT/WH)
LH rear side marker	C4136-2	CLS30 (VT/WH)
RH rear side marker	C4138-2	CLS30 (VT/WH)
Liftgate release handle (license plate lamps)	C4353-1	CLS30 (VT/WH)

MKX

Inoperative Lamp	Connector-Pin	Circuit
LH front (headlamp)	C1021a-7	CLS30 (VT/WH)
RH front (headlamp)	C1041a-7	CLS30 (VT/WH)
LH front side marker	C151-1	CLS30 (VT/WH)
RH front side marker	C161-1	CLS30 (VT/WH)
LH rear	C412-2	CLS30 (VT/WH)
RH rear	C415-2	CLS30 (VT/WH)
Liftgate (rear applique)	C4352-1	CLS30 (VT/WH)
LH rear side marker	C4355-1	CLS30 (VT/WH)
RH rear side marker	C4356-1	CLS30 (VT/WH)
LH license plate	C452-1	CLS30 (VT/WH)
RH license plate	C462-1	CLS30 (VT/WH)

- **Is the voltage greater than 10 volts?**

YES : REPAIR or INSTALL a new bulb holder or component in question. REFER to **Headlamp Assembly**, **Rear Lamp Assembly - Liftgate**, or **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article for the liftgate release handle. TEST the system for normal operation.

NO : REPAIR the circuit. TEST the system for normal operation.

O6 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test P: The Parking, Rear Or License Plate Lamps Are On Continuously

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Parking, Rear and License Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) monitors the parking lamp request input from the headlamp switch through circuit CLS34 (GY). The SJB provides a ground for the parking lamp relay coil (integrated into the SJB) when a request for the parking lamps is received. When the parking lamp relay is energized, voltage is routed through circuit CLS30 (VT/WH) to the rear and front parking lamps.

- DTC B1578 (Lamp Park Input Circuit Short to Ground) - is an on-demand DTC that sets when the SJB detects a short to ground in the parking lamps on input circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Headlamp switch
- SJB

PINPOINT TEST P: THE PARKING, REAR OR LICENSE PLATE LAMPS ARE ON CONTINUOUSLY

P1 USE THE RECORDED DTCs FROM THE SJB SELF-TEST

- Check the recorded results from the SJB self-test.
- **Was DTC B1578 recorded?**

  YES : Go to P2.

  NO : Go to P4.

P2 CHECK THE HEADLAMP SWITCH

- Key in OFF position.
- Disconnect: Headlamp Switch C205
- Carry out the headlamp switch component test. Refer to appropriate COMPONENT TESTING article.
- **Is the headlamp switch OK?**

  YES : Go to P3.

  NO : INSTALL a new headlamp switch. REFER to **Headlamp Switch**. CLEAR the DTCs. REPEAT the self-test.

P3 CHECK CIRCUIT CLS34 (GY) FOR A SHORT TO GROUND

- Disconnect: SJB C2280b

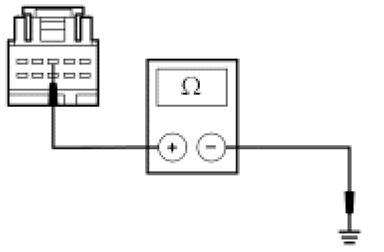


Fig. 73: Checking Circuit For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the headlamp switch C205-3, circuit CLS34 (GY), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to P6.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

P4 CHECK CIRCUIT CLS30 (VT/WH) FOR A SHORT TO VOLTAGE (TO REAR LAMPS)

- Key in OFF position.
- Disconnect: SJB C2280d
- Key in ON position.
- **Do the rear parking lamps continue to illuminate?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to P5.

P5 CHECK CIRCUIT CLS30 (VT/WH) FOR A SHORT TO VOLTAGE (TO FRONT LAMPS)

- Key in OFF position.
- Disconnect: SJB C2280e
- Key in ON position.
- **Do the front parking lamps continue to illuminate?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to P6.

P6 CHECK FOR CORRECT SJB OPERATION

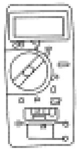
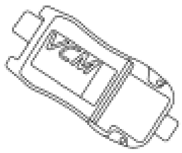
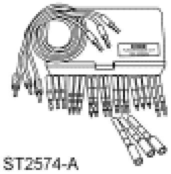
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

FOG LAMPS

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The SJB monitors the headlamp switch position by sending a voltage reference signal to the headlamp switch. When the fog lamp switch (part of the headlamp switch) is engaged, the voltage reference signal is routed to ground.

The fog lamps can be turned on when the following conditions are met:

- The ignition switch is in the RUN or START position.
- The low beam headlamps or the parking lamps are on.
- The high beams are off.

When the SJB receives an input from the headlamp switch indicating a request for the fog lamps, the SJB provides voltage to the fog lamp relay. When the fog lamp relay is energized, voltage is routed to the fog lamps.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

VISUAL INSPECTION CHART

Electrical
• Smart junction box (SJB) fuse 21 (15A) • Wiring, terminals or connectors • Bulb(s) • Headlamp switch • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power

and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
    - Check the VCM connection to the vehicle.
    - Check the scan tool connection to the VCM.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
    - Verify the ignition key is in the ON position.
    - Verify the scan tool operation with a known good vehicle.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B2254	Front Fog Lamp Switch Failure	Go to **Pinpoint Test S** .
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Fuse • Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• Both fog lamps are inoperative	• Fuse • Wiring, terminals or connectors • Headlamp switch	• Go to **Pinpoint Test Q** .

	• SJB	
• An individual fog lamp is inoperative • The fog lamps are on continuously	• Wiring, terminals or connectors • Joint connector • Wiring, terminals or connectors • Headlamp switch • SJB	**NOTE:** **Make sure the fog lamp bulb is OK before carrying out diagnostics.** • Go to **Pinpoint Test R** . • Go to **Pinpoint Test S** .
• The fog lamps on indicator is inoperative	• Wiring, terminals or connectors • Headlamp switch • SJB	• Go to **Pinpoint Test T** .

Pinpoint Tests

Pinpoint Test Q: Both Fog Lamps Are Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Fog Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a voltage reference signal to the headlamp switch through circuit CLF21 (GY/VT) to monitor the fog lamp request. When the fog lamp switch is engaged, the voltage signal is routed to ground.

When the SJB detects the fog lamps on request, the SJB provides ground to the fog lamp relay coil (integrated into the SJB). When the fog lamp relay is energized, voltage is routed through circuit CLF12 (BN/YE) to the fog lamps.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Headlamp switch
- SJB

PINPOINT TEST Q: BOTH FOG LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Q1 CHECK THE SJB FOG LAMP SWITCH PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB Data Logger
- Monitor the SJB fog lamp PID (FOG SW) while engaging the fog lamp switch.
- **Does the PID indicate the fog lamp switch is on?**

  YES : Go to Q4.

  NO : Go to Q2.

Q2 CHECK THE HEADLAMP SWITCH

- Key in OFF position.
- Disconnect: Headlamp Switch C205
- Carry out the headlamp switch component test. Refer to appropriate COMPONENT TESTING article.
- **Is the headlamp switch OK?**

  YES : Go to Q3.

  NO : INSTALL a new headlamp switch. REFER to **Headlamp Switch**. TEST the system for normal operation.

Q3 CHECK CIRCUIT CLF21 (GY/VT) FOR AN OPEN

- Disconnect: SJB C2280b

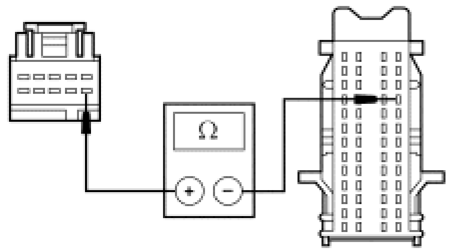


Fig. 74: Measuring Resistance Between Headlamp Switch C205-6, Circuit CLF21 (GY/VT) & SJB C2280B-49
Courtesy of FORD MOTOR CO.

- Measure the resistance between the headlamp switch C205-6, circuit CLF21 (GY/VT), harness side and the SJB C2280b-49, circuit CLF21 (GY/VT), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to Q5.

  NO : REPAIR the circuit. TEST the system for normal operation.

Q4 CHECK CIRCUIT CLF12 (BN/YE) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280e

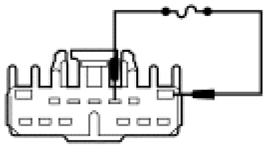


Fig. 75: Connecting Fused Jumper Wire
Courtesy of FORD MOTOR CO.

- Connect a fused (15A) jumper wire between the SJB C2280e-1, circuit CBB53 (GY/BN), harness side and the SJB C2280e-3, circuit CLF12 (BN/YE), harness side.
- Key in ON position.
- **Do the fog lamps illuminate?**

  YES : REMOVE the jumper wire. VERIFY the SJB fuse 21 (15A) is OK. If OK, go to Q5.

  NO : REPAIR the circuit. TEST the system for normal operation.

Q5 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test R: An Individual Fog Lamp Is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Fog Lamps for schematic and connector information.

Normal Operation

When the fog lamp relay is energized, voltage is routed through circuit CLF12 (BN/YE) to the fog lamps. Ground is provided on circuits GD120 (BK/GN) and GD123 (BK/GY) to the LH and RH fog lamps, respectively.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Joint connector

PINPOINT TEST R: AN INDIVIDUAL FOG LAMP IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: The battery ground cable must be disconnected for accurate test results when checking ground circuits for continuity to ground.

NOTE: Verify that the headlamps operate correctly before proceeding with this pinpoint test.

R1 CHECK THE GROUND CIRCUIT FOR CONTINUITY

- Key in OFF position.
- Disconnect: Inoperative Fog Lamp

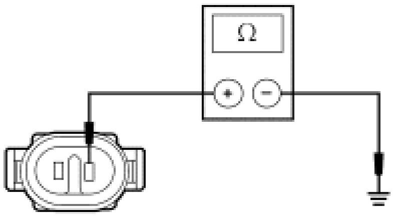


Fig. 76: Measuring Resistance Between LH Fog Lamp C152-B & C162-B, Circuit GD120 (BK/GN) & GD123 (BK/GY)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the LH fog lamp C152-B, circuit GD120 (BK/GN), harness side and ground; or between the RH fog lamp C162-B, circuit GD123 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : REPAIR circuit CLF12 (BN/YE) for an open. TEST the system for normal operation.

  NO : For the RH fog lamp, REPAIR circuit GD123 (BK/GY) for an open. TEST the system for normal operation.

  For the LH fog lamp, go to R2.

R2 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN

- Disconnect: Joint Connector 7 C2200

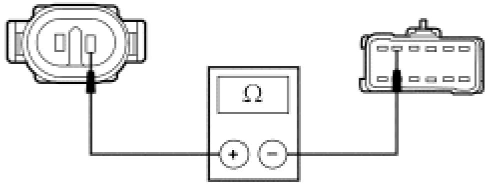


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Fig. 77: Measuring Resistance Between LH Fog Lamp C152-B, Circuit GD120 (BK/GN) & Joint Connector 7 C2200-K
Courtesy of FORD MOTOR CO.

- For Edge, measure the resistance between the LH fog lamp C152-B, circuit GD120 (BK/GN), harness side and the joint connector 7 C2200-K, circuit GD120 (BK/GN), harness side and ground.

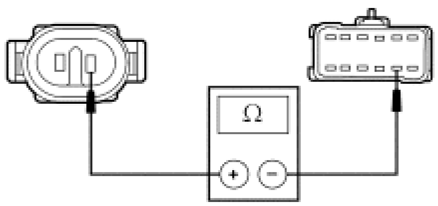

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Fig. 78: Measuring Resistance Between LH Fog Lamp C152-B, Circuit GD120 (BK/GN) & Joint Connector 7 C2200-E
Courtesy of FORD MOTOR CO.

- For MKX, measure the resistance between the LH fog lamp C152-B, circuit GD120 (BK/GN), harness side and the joint connector 7 C2200-E, circuit GD120 (BK/GN), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new joint connector. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test S: The Fog Lamps Are On Continuously

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Fog Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a voltage reference signal to the headlamp switch through circuit CLF21 (GY/VT) to monitor the fog lamp request. When the fog lamp switch is engaged, the voltage signal is routed to ground.

When the SJB detects the fog lamps on request, the SJB provides ground to the fog lamp relay coil (integrated into the SJB). When the fog lamp relay is energized, voltage is routed through circuit CLF12 (BN/YE) to the fog lamps, and on a separate output, circuit CLF12 (BN/YE) to the headlamp switch for the fog lamps on indicator.

- DTC B2254 (Front Fog Lamp Switch Failure) - is an on-demand DTC that sets when the SJB detects a short to ground on the fog lamp on input circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Headlamp switch
- SJB

PINPOINT TEST S: THE FOG LAMPS ARE ON CONTINUOUSLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

S1 CHECK FOR RECORDED SJB DTCs

- Check the recorded results from the SJB self-test.
- **Is DTC B2254 present?**

  YES : Go to S2.

  NO : Go to S4.

S2 CHECK THE HEADLAMP SWITCH

- Key in OFF position.
- Disconnect: Headlamp Switch C205
- Carry out the headlamp switch component test. Refer to appropriate COMPONENT TESTING article
- **Is the headlamp switch OK?**

  YES : Go to S3.

  NO : INSTALL a new headlamp switch. REFER to **Headlamp Switch**. CLEAR the DTCs. REPEAT the self-test.

S3 CHECK CIRCUIT CLF21 (GY/VT) FOR A SHORT TO GROUND

- Disconnect: SJB C2280b

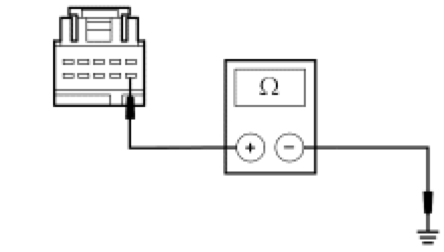


Fig. 79: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the headlamp switch C205-6, circuit CLF21 (GY/VT), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to S6.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

S4 CHECK CIRCUIT CLF12 (BN/YE) FOR A SHORT TO VOLTAGE (TO HEADLAMP SWITCH)

- Key in OFF position.
- Disconnect: SJB C2280a
- Key in ON position.
- **Do the fog lamps continue to illuminate?**

  YES : Go to S5.

  NO : REPAIR the circuit. TEST the system for normal operation.

S5 CHECK CIRCUIT CLF12 (BN/YE) FOR A SHORT TO VOLTAGE (TO THE FOG LAMPS)

- Key in OFF position.
- Disconnect: SJB C2280e
- Key in ON position.
- **Do the fog lamps continue to illuminate?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to S6.

S6 CHECK FOR CORRECT SJB OPERATION

- Key in OFF position.
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.

- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs. REPEAT the self-test.

Pinpoint Test T: The Fog Lamps On Indicator Is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Fog Lamps for schematic and connector information.

Normal Operation

When the smart junction box (SJB) detects the fog lamps on request, the SJB provides ground to the fog lamp relay coil (integrated into the SJB). When the fog lamp relay is energized, voltage is routed through circuit CLF12 (BN/YE) to the fog lamps, and on a separate output, circuit CLF12 (BN/YE) to the headlamp switch for the fog lamps on indicator.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Headlamp switch
- SJB

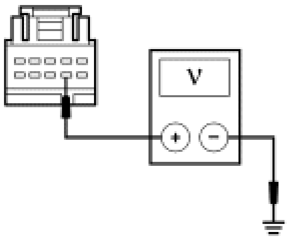
PINPOINT TEST T: THE FOG LAMPS ON INDICATOR IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

T1 CHECK THE HEADLAMP SWITCH

NOTE: Make sure the headlamp switch is in the OFF position.

- Key in OFF position.
- Disconnect: Headlamp Switch C205
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Select the SJB fog lamps (FOG_LMP) active command. Command the fog lamps on.



N0062231

Fig. 80: Measuring Voltage Between Headlamp Switch C205-7, Circuit CLF12 (BN/YE) & Ground
Courtesy of FORD MOTOR CO.

NOTE: Make sure the fog lamps are illuminated when taking a reading.

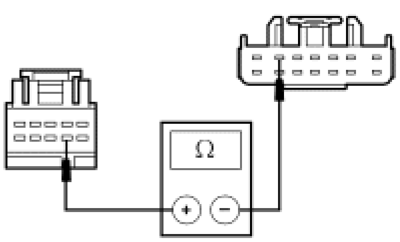
- Measure the voltage between the headlamp switch C205-7, circuit CLF12 (BN/YE), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new headlamp switch. REFER to **Headlamp Switch**. TEST the system for normal operation.

  NO : Go to T2.

T2 CHECK CIRCUIT CLF12 (BN/YE) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280a



N0062232

Fig. 81: Measuring Resistance Between Headlamp Switch C205-7, Circuit CLF12 (BN/YE) & SJB C2280A-6
Courtesy of FORD MOTOR CO.

- Measure the resistance between the headlamp switch C205-7, circuit CLF12 (BN/YE), harness side and the SJB C2280a-6, circuit CLF12 (BN/YE), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to T3.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

T3 CHECK FOR CORRECT SJB OPERATION

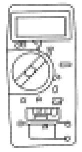
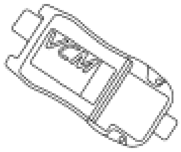
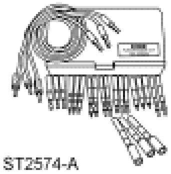
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs. REPEAT the self-test.

REVERSING LAMPS

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

The transaxle is hardwired to the PCM which monitors the transmission gear status. When the PCM detects the transaxle is in REVERSE (R), the PCM provides ground for the reversing lamps relay coil. When the reversing lamps relay is energized, voltage is routed to the reversing lamps.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

VISUAL INSPECTION CHART

Electrical
• Battery junction box (BJB) fuse 44 (10A) • Bulb(s) • Bulb holder(s) • Wiring, terminals or connectors • PCM

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: **Make sure to use the latest scan tool software release.**

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: **The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.**

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

PCM DTC CHART

DTC	Description	Action
P1910	Reverse Lamp Control Circuit/Open	If the reversing lamps are inoperative, go to **Pinpoint Test U** . If the reversing lamps are always on, go to **Pinpoint Test W** .
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The reversing lamps are inoperative	• Fuse • Wiring, terminals or connectors • Reversing lamps relay • Battery junction box (BJB) • PCM	• Go to **Pinpoint Test U** .
• The individual reversing lamp is inoperative	• Wiring, terminals or connectors • Bulb holder • Rear lamps assembly	• Go to **Pinpoint Test V** .
• The reversing lamps are on continuously	• Wiring, terminals or connectors • Reversing lamps relay • Auto-dimming interior mirror • PCM	• Go to **Pinpoint Test W** .

Pinpoint Tests

Pinpoint Test U: The Reversing Lamps Are Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Fuse and Relay Information for schematic and connector information.

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Reversing Lamps for schematic and connector information.

Normal Operation

The PCM monitors the transaxle gear status. When the PCM detects the transaxle in REVERSE (R), the PCM provides ground for the reversing lamps relay coil through circuit CLS28 (BU/WH). Voltage is supplied from the battery junction box (BJB) to the coil and the switched side of the reversing lamps relay. When the reversing lamps relay is energized, voltage is routed to the reversing lamps through circuit CLS10 (GN/BN).

- DTC P1910 (Reverse Lamp Control Circuit/Open) - sets when the PCM detects no voltage on the reversing lamp relay coil ground control circuit (if the coil voltage supply circuit or the coil ground control circuit is open).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Reversing lamps relay
- BJB
- PCM

PINPOINT TEST U: THE REVERSING LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

U1 CHECK FOR PCM TRANSMISSION RANGE (TR) SENSOR DTCs FROM THE SELF-TEST

- Review the DTCs from the PCM KOEO self-test.
- **Are any TR sensor DTCs present?**

  YES : REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article.

  NO : Go to U2.

U2 CHECK THE REVERSING LAMPS RELAY

- Key in OFF position.
- Disconnect: Reversing Lamps Relay
- Key in ON position.
- Substitute a known good relay and recheck the reversing lamps operation.
- **Do the reversing lamps operate correctly?**

  YES : REMOVE the known good relay. INSTALL a new reversing lamps relay. TEST the system for normal operation.

  NO : REMOVE the known good relay. Go to U3.

U3 CHECK THE BJB

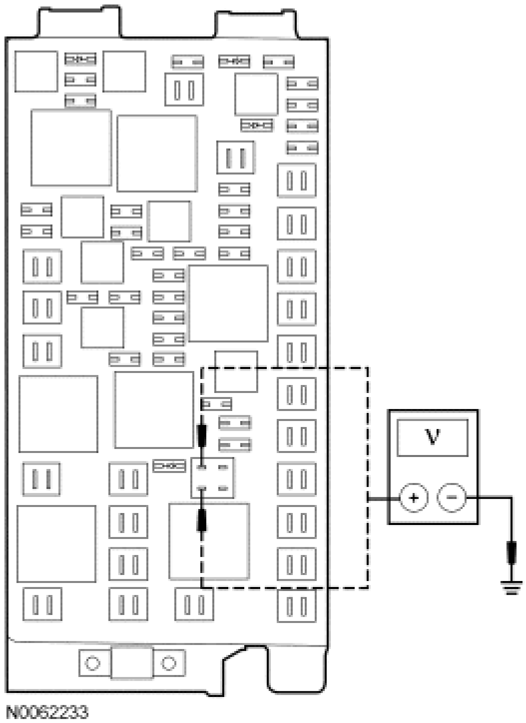


Fig. 82: Measuring Voltage Between Reversing Lamps Relay Pin 5, BJB Face Side & Reversing Lamps Relay Pin 1
Courtesy of FORD MOTOR CO.

- Measure the voltage between the reversing lamps relay pin 5, BJB face side and ground; and between the reversing lamps relay pin 1, BJB face side and ground.
- **Are the voltages greater than 10 volts?**

  YES : Go to U4.

  NO : INSTALL a new BJB. TEST the system for normal operation.

U4 CHECK CIRCUIT CLS10 (GN/BN) FOR AN OPEN

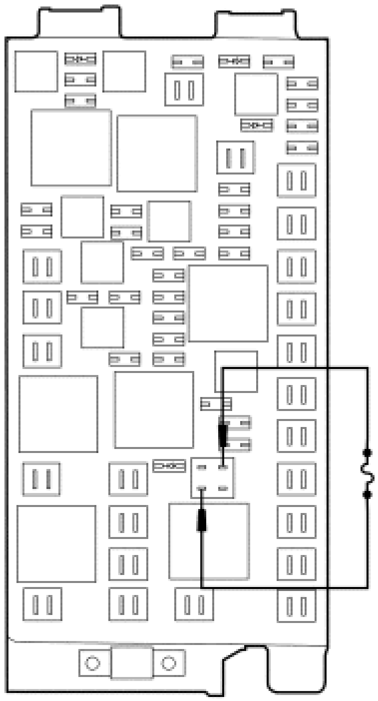


Fig. 83: Connecting Voltage Between Reversing Lamps Relay Pin 5, BJB Face Side & Reversing Lamps Relay Pin 3
Courtesy of FORD MOTOR CO.

- Connect a fused (5A) jumper wire between the reversing lamps relay pin 5, BJB face side and the reversing lamps relay pin 3, circuit CLS10 (GN/BN), BJB face side.
- **Do the reversing lamps illuminate?**

  YES : REMOVE the jumper wire. Go to U5.

  NO : VERIFY the BJB fuse 44 (10A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

U5 CHECK CIRCUIT CLS28 (BU/WH) FOR A SHORT TO VOLTAGE

- Disconnect: PCM C175t
- Key in ON position.

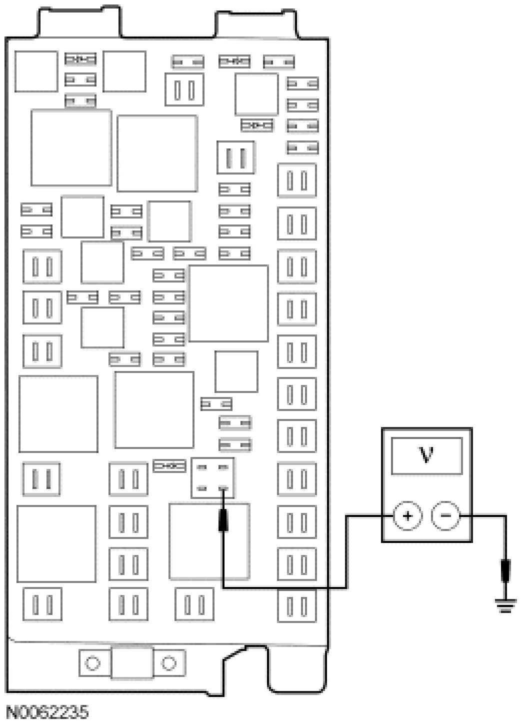


Fig. 84: Measuring Voltage Between Reversing Lamps Relay Pin 2, Circuit CLS28 (BU/WH), BJB Face Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the reversing lamps relay pin 2, circuit CLS28 (BU/WH), BJB face side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to U6.

U6 CHECK CIRCUITS CLS28 (BU/WH) FOR AN OPEN

- Key in OFF position.
- Connect: Reversing Lamps Relay

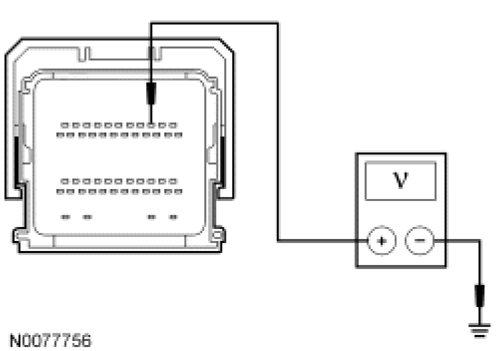


Fig. 85: Measuring Voltage Between PCM C175T-3, Circuit CLS28 (BU/WH), Harness Side & Ground

Courtesy of FORD MOTOR CO.

- Measure the voltage between the PCM C175t-3, circuit CLS28 (BU/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to U7.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

U7 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs. REPEAT the self-test.

Pinpoint Test V: The Individual Reversing Lamp Is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Reversing Lamps for schematic and connector information.

When the reversing lamps relay is energized, voltage is routed to the reversing lamps through circuit CLS10 (GN/BN). The LH and RH reversing lamps are provided ground through circuits GD149 (BK/GY) and GD151 (BK/GN), respectively.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Bulb holder
- Rear lamp assembly

PINPOINT TEST V: THE INDIVIDUAL REVERSING LAMP IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: The battery ground cable must be disconnected for accurate test results when checking ground circuits for continuity to ground.

V1 CHECK CIRCUIT GD149 (BK/GY) OR CIRCUIT GD151 (BK/GN) FOR AN OPEN

- Key in OFF position.
- Disconnect: Inoperative Reversing Lamp

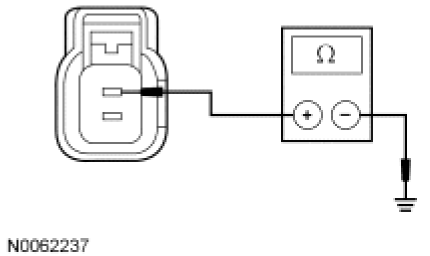


Fig. 86: Measuring Resistance Between LH Reversing Lamp C451-1 & C461-1, Circuit GD149 (BK/GY) & GD151 (BK/GN)
Courtesy of FORD MOTOR CO.

- For Edge, measure the resistance between the LH reversing lamp C451-1, circuit GD149 (BK/GY), harness side and ground, or between the RH reversing lamp C461-1, circuit GD151 (BK/GN), harness side and ground.

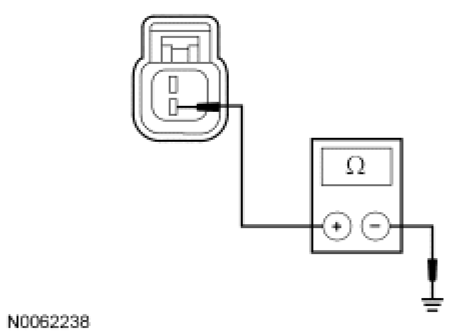


Fig. 87: Measuring Resistance Between LH Reversing Lamp C487-2 & C488-2, Circuit GD149 (BK/GY) & GD151 (BK/GN)
Courtesy of FORD MOTOR CO.

- For MKX, measure the resistance between the LH reversing lamp C487-2, circuit GD149 (BK/GY), harness side and ground, or between the RH reversing lamp C488-2, circuit GD151 (BK/GN), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to V2.

  NO : REPAIR the ground circuit in question. TEST the system for normal operation.

V2 CHECK CIRCUIT CLS10 (GN/BN) FOR AN OPEN

- Apply the parking brake.
- Select REVERSE.

- Key in ON position.

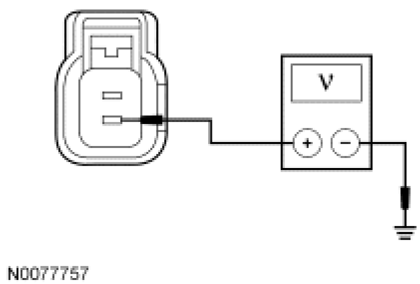


Fig. 88: Measuring Voltage Between LH Reversing Lamp C451-2, Circuit CLS10 (GN/BN) & RH Reversing Lamp C461-2
Courtesy of FORD MOTOR CO.

- For Edge, measure the voltage between the LH reversing lamp C451-2, circuit CLS10 (GN/BN), harness side and ground, or between the RH reversing lamp C461-2, circuit CLS10 (GN/BN), harness side and ground.

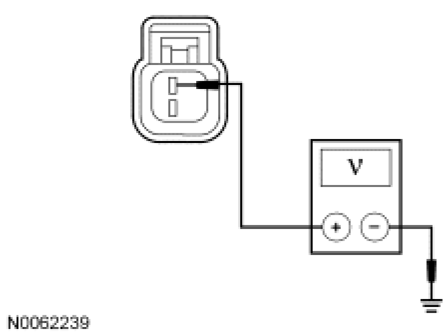


Fig. 89: Measuring Voltage Between LH Reversing Lamp C487-1, Circuit CLS10 (GN/BN) & RH Reversing Lamp C488-1
Courtesy of FORD MOTOR CO.

- For MKX, measure the voltage between the LH reversing lamp C487-1, circuit CLS10 (GN/BN), harness side and ground, or between the RH reversing lamp C488-1, circuit CLS10 (GN/BN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new bulb holder or rear lamp assembly. REFER to **Rear Lamp Assembly**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test W: The Reversing Lamps Are On Continuously

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Reversing Lamps for schematic and connector information.

Normal Operation

The PCM monitors the transaxle gear status. When the PCM detects the transaxle in REVERSE (R), the PCM provides ground for the reversing lamps relay coil through circuit CLS28 (BU/WH). Voltage is supplied from the battery junction box (BJB) to the coil and the switched side of the reversing lamps relay. When the reversing lamps relay is energized, voltage is routed to the reversing lamps through circuit CLS10 (GN/BN).

- DTC P1910 (Reverse Lamp Control Circuit/Open) - sets when the PCM detects no voltage on the reversing lamp relay coil ground control circuit (if the coil ground control circuit is short to ground).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Reversing lamps relay
- Auto-dimming interior mirror
- PCM

PINPOINT TEST W: THE REVERSING LAMPS ARE ON CONTINUOUSLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

W1 CHECK FOR PCM TRANSMISSION RANGE (TR) SENSOR DTCs FROM THE SELF-TEST

- Review the DTCs from the PCM KOEO self-test.
- **Are any TR sensor DTCs present?**

  YES : REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article.

  NO : Go to W2.

W2 CHECK THE REVERSING LAMPS RELAY OUTPUT

- Key in OFF position.
- Disconnect: Reversing Lamps Relay
- Key in ON position.
- **Do the reversing lamps continue to illuminate?**

  YES : Go to W3.

  NO : Go to W4.

W3 CHECK CIRCUIT CLS10 (GN/BN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Auto-Dimming Interior Mirror C911 or C9012
- Key in ON position.
- **Do the reversing lamps continue to illuminate?**

  YES : INSTALL a new auto-dimming interior mirror. REFER to **REAR VIEW MIRRORS**

article. TEST the system for normal operation.

NO : REPAIR the circuit. TEST the system for normal operation.

W4 CHECK THE REVERSING LAMPS RELAY

- Key in OFF position.
- Substitute a known good relay.
- Key in ON position.
- **Do the reversing lamps continue to illuminate?**

  YES : REMOVE the known good relay. Go to W5.

  NO : REMOVE the known good relay. INSTALL a new reversing lamps relay. TEST the system for normal operation.

W5 CHECK CIRCUIT CLS28 (BU/WH) FOR A SHORT TO GROUND

- Key in OFF position.
- Connect: Reversing Lamps Relay
- Disconnect: PCM C175t
- Key in ON position.
- **Do the reversing lamps continue to illuminate?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to W6.

W6 CHECK FOR CORRECT PCM OPERATION

- Disconnect the PCM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the PCM connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

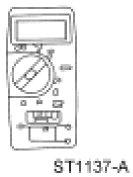
  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs. REPEAT the self-test.

TRAILER LAMPS

Special Tools

Illustration	Tool Name	Tool Number
	73III Automotive Meter	105-R0057 or equivalent

		
	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

The trailer lamps are supplied power by the trailer tow park lamp relay, the LH trailer tow stop/turn relay and the RH trailer tow stop/turn relay. They are energized to correspond with the exterior lighting functions of the vehicle. A common ground is provided to the trailer tow connector for the trailer lamps.

Inspection and Verification

1. Verify the customer concern.
2. Verify the exterior lighting system of the vehicle is operating correctly. If not, refer to the appropriate pinpoint test in this service information.
3. Visually inspect for obvious signs of electrical damage.

VISUAL INSPECTION CHART

Electrical
• Battery junction box (BJB) fuse(s): ○ 9 (20A) (trailer tow parking lamps) ○ 24 (15A) (trailer tow LH stop/turn relay) ○ 46 (15A) (trailer tow RH stop/turn relay) • Wiring, terminals or connectors • Trailer tow stop/turn relays • Trailer tow parking lamp relay • Trailer

4. If the concern is not visually evident, verify the symptom. Go to **Symptom Chart**.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
	• Wiring, terminals or	

• The trailer lamps are inoperative - all	connectors • Trailer	• Go to **Pinpoint Test X** .
• The individual trailer lamp is inoperative - trailer stop/turn lamp	• Fuse • Wiring, terminals or connectors • Joint connector • Trailer tow stop/turn relay • Battery junction box (BJB) • Trailer	• Go to **Pinpoint Test Y** .
• The trailer lamps are inoperative - trailer parking lamps	• Fuse • Wiring, terminals or connectors • Joint connector • Trailer tow parking lamp relay • BJB • Trailer	• Go to **Pinpoint Test Z** .
• The trailer lamps are on continuously	• Wiring, terminals or connectors • Trailer tow relay • Trailer	• Go to **Pinpoint Test AA** .

Pinpoint Tests

Pinpoint Test X: The Trailer Lamps Are Inoperative - All

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Trailer/Camper Adapter for schematic and connector information.

Normal Operation

The trailer tow connector receives ground through circuit RAT08 (WH)/GD149 (BK/GY) for all of the trailer lamps.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Trailer

PINPOINT TEST X: THE TRAILER LAMPS ARE INOPERATIVE - ALL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: The battery ground cable must be disconnected for accurate test results when checking ground circuits for continuity to ground.

X1 CHECK CIRCUIT RAT08 (WH)/GD149 (BK/GY) FOR AN OPEN

- Disconnect: Trailer Tow C439

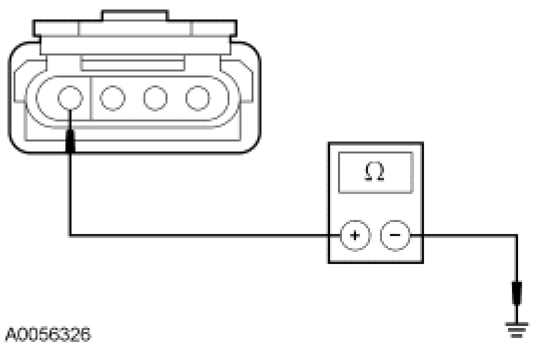


Fig. 90: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the trailer tow C439-4, circuit RAT08 (WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test Y: The Individual Trailer Lamp Is Inoperative - Trailer Stop/Turn Lamp

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Fuse and Relay Information for schematic and connector information.

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Trailer/Camper Adapter for schematic and connector information.

Normal Operation

The battery junction box (BJB) fuse 24 (15A) supplies voltage to the LH trailer tow stop/turn relay and BJB fuse 46 (15A) supplies voltage to the RH trailer tow stop/turn relay. The trailer tow stop/turn relay coils are grounded through circuit GD120 (BK/GN).

The trailer tow LH stop/turn relay coil receives voltage from circuit CLS18 (GY/BN) when the vehicle LH rear stoplamp is illuminated. When the trailer tow LH stop/turn relay is energized, voltage is routed to the trailer tow connector through circuit CAT06 (YE).

The trailer tow RH stop/turn relay coil receives voltage through circuit CLS19 (VT/OG) when the vehicle RH rear stoplamp is illuminated. When the trailer tow RH stop/turn relay is energized, voltage is routed to the trailer tow connector through circuit CAT09 (GN).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Joint connector
- Trailer tow stop/turn relay
- BJB
- Trailer

PINPOINT TEST Y: THE INDIVIDUAL TRAILER LAMP IS INOPERATIVE - TRAILER STOP/TURN LAMP

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: The battery ground cable must be disconnected for accurate test results when checking ground circuits for continuity to ground.

Y1 CHECK CIRCUIT CAT06 (YE) OR CIRCUIT CAT09 (GN) FOR VOLTAGE

- Key in OFF position.

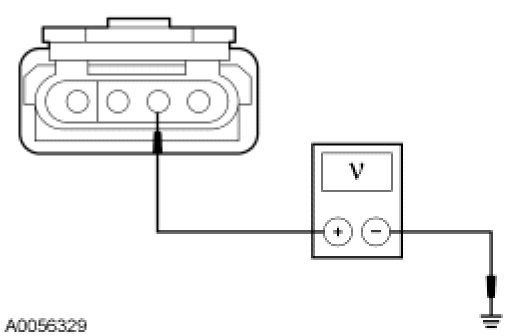


Fig. 91: Measuring Voltage Between Trailer Tow C439-2, Circuit CAT06 (YE), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- For the LH trailer turn/stoplamp, while applying the brake pedal, measure the voltage between the trailer tow C439-2, circuit CAT06 (YE), harness side and ground.

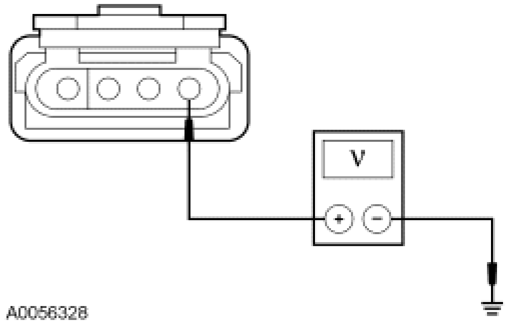


Fig. 92: Measuring Voltage Between Trailer Tow C439-1, Circuit CAT09 (GN), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- For the RH trailer turn/stoplamp, while applying the brake pedal, measure the voltage between the trailer tow C439-1, circuit CAT09 (GN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility.

  NO : Go to Y2.

Y2 CHECK THE TRAILER TOW STOP/TURN RELAY

- Disconnect: Suspect Trailer Tow Stop/Turn Relay
- Substitute a known good relay.

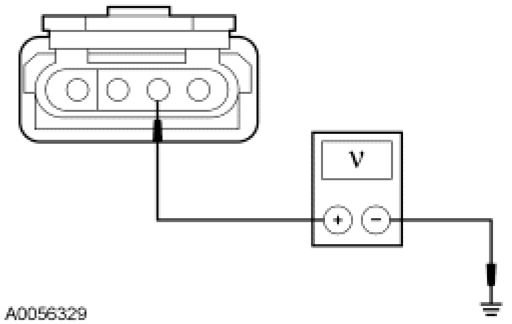


Fig. 93: Measuring Voltage Between Trailer Tow C439-2, Circuit CAT06 (YE), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- For the LH trailer turn/stoplamp, while applying the brake pedal, measure the voltage between the trailer tow C439-2, circuit CAT06 (YE), harness side and ground.

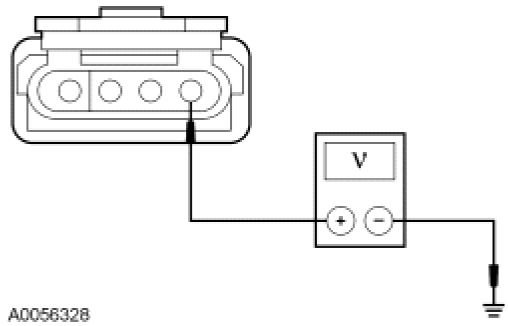


Fig. 94: Measuring Voltage Between Trailer Tow C439-1, Circuit CAT09 (GN), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- For the RH trailer turn/stoplamp, while applying the brake pedal, measure the voltage between the trailer tow C439-1, circuit CAT09 (GN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : REMOVE the known good relay. INSTALL a new trailer tow stop/turn relay. TEST the system for normal operation.

  NO : REMOVE the known good relay. Go to Y3.

Y3 CHECK CIRCUIT CLS18 (GY/BN) OR CIRCUIT CLS19 (VT/OG) FOR AN OPEN

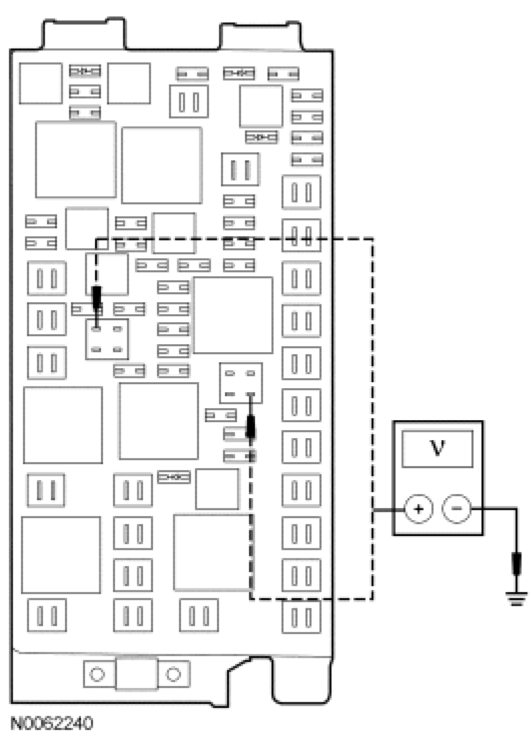


Fig. 95: Measuring Voltage Between Trailer Tow LH Stop/Turn Relay Pin 1 & Pin 2, CLS18 (GY/BN) & CLS19 (VT/OG)
Courtesy of FORD MOTOR CO.

- While applying the brake pedal, measure the voltage between the trailer tow LH stop/turn relay pin 1, circuit CLS18 (GY/BN), BJB face side and ground; or between the trailer tow RH stop/turn relay pin 2, circuit CLS19 (VT/OG), BJB face side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to Y4.

NO : REPAIR the circuit in question. TEST the system for normal operation.

Y4 CHECK THE BJB

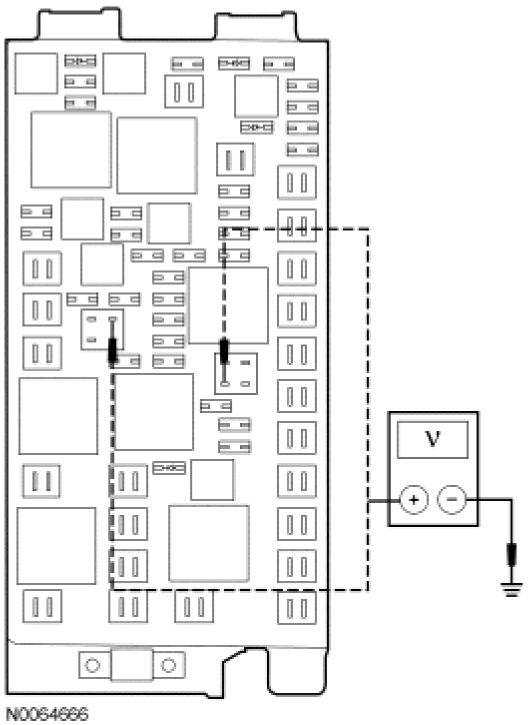


Fig. 96: Measuring Voltage Between Trailer Tow LH Stop/Turn Relay Pin 3, BJB Face Side & RH Stop/Turn Relay Pin 5,
Courtesy of FORD MOTOR CO.

- Measure the voltage between the trailer tow LH stop/turn relay pin 3, BJB face side and ground; or between the trailer tow RH stop/turn relay pin 5, BJB face side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to Y5.

NO : VERIFY the BJB fuse 24 (15A) (LH stop/turn relay) or fuse 46 (15A) (RH stop/turn relay) is OK. If OK, INSTALL a new BJB. TEST the system for normal operation.

Y5 CHECK CIRCUIT GD120 (BK/GN) FOR CONTINUITY TO GROUND

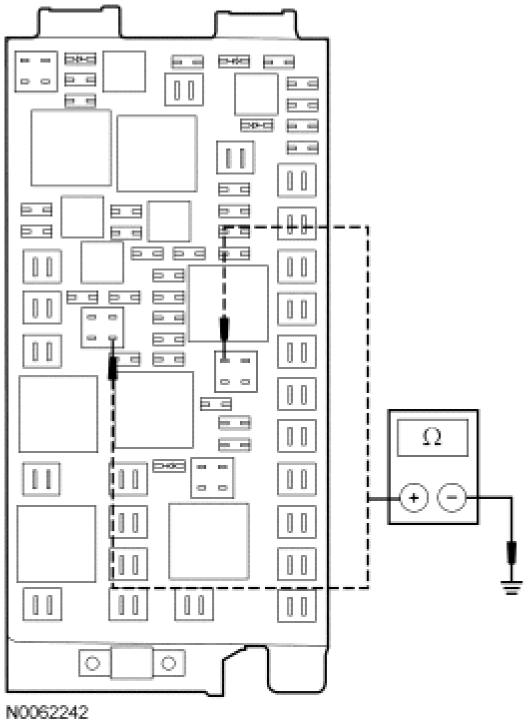


Fig. 97: Measuring Resistance Between Trailer Tow LH Turn Relay Pin 2, Circuit GD120 (BK/GN) & RH Turn Relay Pin 1
Courtesy of FORD MOTOR CO.

- Measure the resistance between the trailer tow LH turn relay pin 2, circuit GD120 (BK/GN), BJB face side and ground; or between the trailer tow RH turn relay pin 1, circuit GD120 (BK/GN), BJB face side and ground.
- **Is the resistance less than 5 ohms?**

  YES : REPAIR circuit CAT06 (YE) (LH trailer stop/turn) or circuit CAT09 (GN) (RH trailer stop/turn) for an open. TEST the system for normal operation.

  NO : Go to Y6.

Y6 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN

- Disconnect: Joint Connector 7 C2200

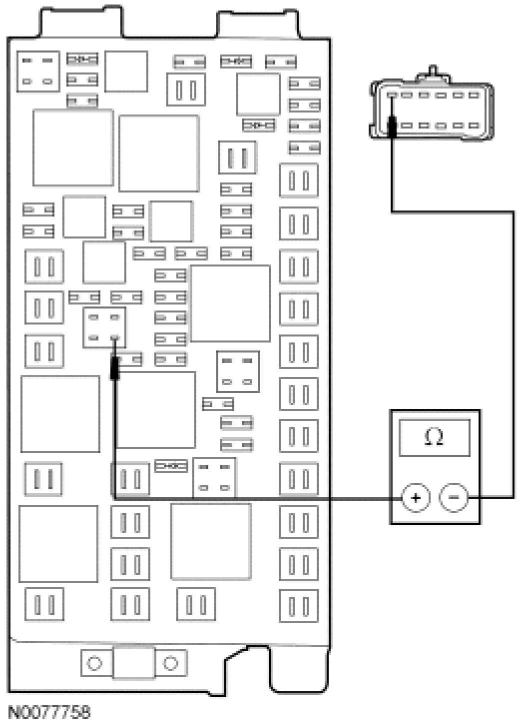


Fig. 98: Measuring Resistance Between Trailer Tow LH Stop/Turn Relay Pin 2, GD120 (BK/GN) & Joint Connector 7 C2200-M
Courtesy of FORD MOTOR CO.

- For the LH trailer turn, measure the resistance between the trailer tow LH stop/turn relay pin 2, circuit GD120 (BK/GN), BJB face side and the joint connector 7 C2200-M, circuit GD120 (BK/GN), harness side.

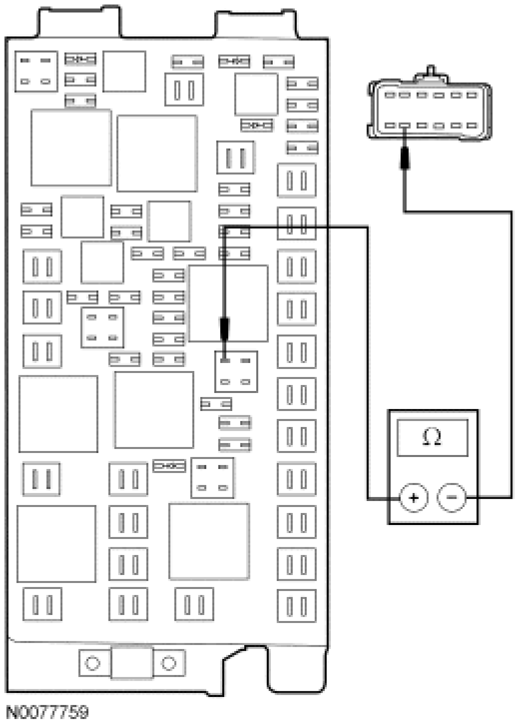


Fig. 99: Measuring Resistance Between Trailer Tow RH Stop/Turn Relay Pin 1, GD120 (BK/GN) & Joint Connector 7 C2200-B
Courtesy of FORD MOTOR CO.

- For the RH trailer turn, measure the resistance between the trailer tow RH stop/turn relay pin 1, circuit GD120 (BK/GN), BJB face side and the joint connector 7 C2200-B, circuit GD120 (BK/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new joint connector. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test Z: The Trailer Lamps Are Inoperative - Trailer Parking Lamps

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Fuse and Relay Information for schematic and connector information.

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Trailer/Camper Adapter for schematic and connector information.

Normal Operation

The trailer tow parking lamp relay coil receives voltage through circuit CLS30 (VT/WH) when the vehicle parking lamps are illuminated. The trailer tow parking lamp relay coil is grounded through circuit GD120 (BK/GN). The battery junction box (BJB) fuse 9 (20A) supplies voltage to the trailer tow parking lamp relay switch side. When the trailer tow parking lamp relay is energized, the voltage is routed to the trailer tow connector through circuit CAT11 (BN).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Joint connector
- Trailer tow parking lamp relay
- BJB
- Trailer

PINPOINT TEST Z: THE TRAILER LAMPS ARE INOPERATIVE - TRAILER PARKING LAMPS

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: The battery ground cable must be disconnected for accurate test results when checking ground circuits for continuity to ground.

Z1 CHECK CIRCUIT CAT11 (BN) FOR VOLTAGE

- Key in OFF position.
- Place the headlamp switch in the PARKING LAMPS ON position.

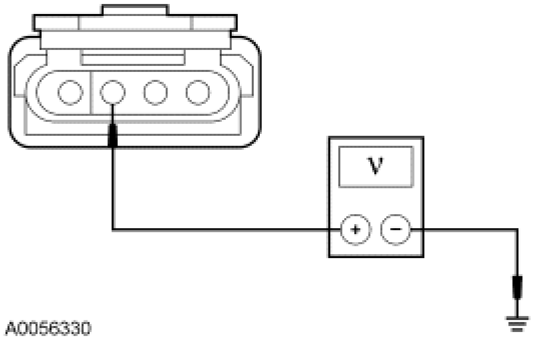


Fig. 100: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the trailer tow C439-3, circuit CAT11 (BN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility.

  NO : Go to Z2.

Z2 CHECK THE TRAILER TOW PARKING LAMP RELAY

- Place the headlamp switch in the OFF position.

- Disconnect: Trailer Tow Parking Lamp Relay
- Substitute a known good relay.
- Place the headlamp switch in the PARKING LAMPS ON position.

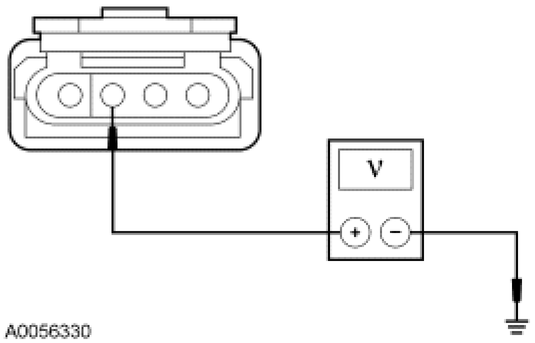


Fig. 101: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the trailer tow C439-3, circuit CAT11 (BN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : REMOVE the known good relay. Go to Z3.

  NO : REMOVE the known good relay. INSTALL a new trailer tow parking lamp relay. TEST the system for normal operation.

Z3 CHECK CIRCUIT CLS30 (VT/WH) FOR AN OPEN

NOTE: Make sure the parking lamps are still on.

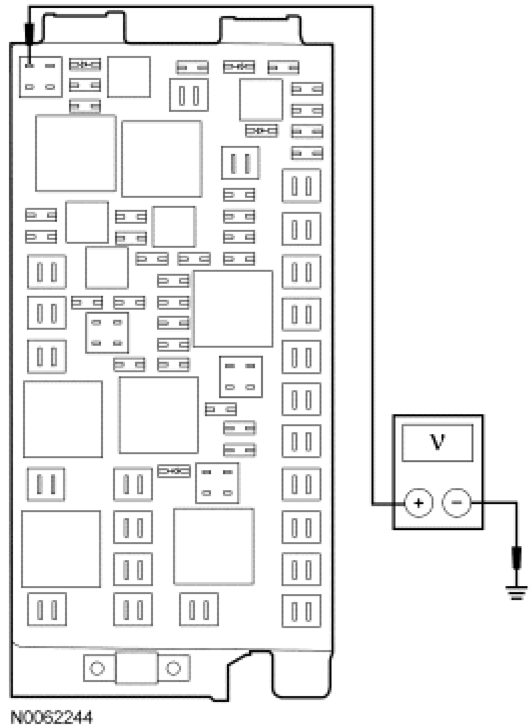


Fig. 102: Measuring Voltage Between Trailer Tow Parking Lamp Relay Pin 1, Circuit CLS30 (VT/WH) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the trailer tow parking lamp relay pin 1, circuit CLS30 (VT/WH), BJB face side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to Z4.

  NO : REPAIR the circuit. TEST the system for normal operation.

Z4 CHECK THE BJB

- Place the headlamp switch in the OFF position.

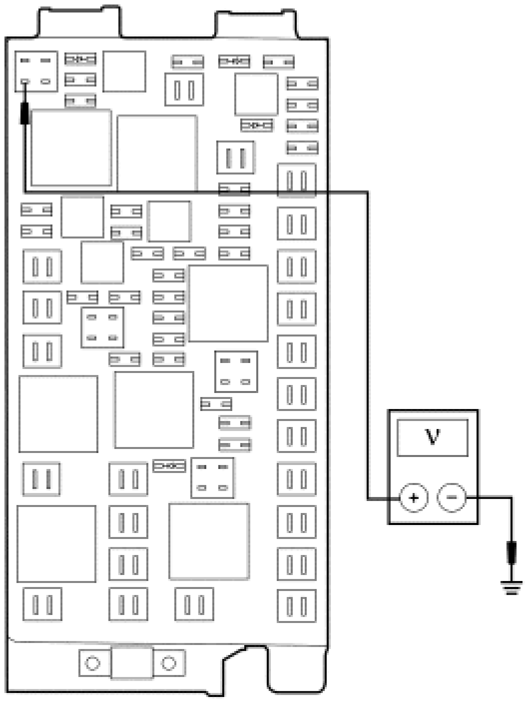


Fig. 103: Measuring Voltage Between Trailer Tow Parking Lamp Relay Pin 5, BJB Face Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the trailer tow parking lamp relay pin 5, BJB face side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to Z5.

  NO : VERIFY the BJB fuse 9 (20A) is OK. If OK, INSTALL a new BJB. TEST the system for normal operation.

Z5 CHECK CIRCUIT GD120 (BK/GN) FOR CONTINUITY TO GROUND

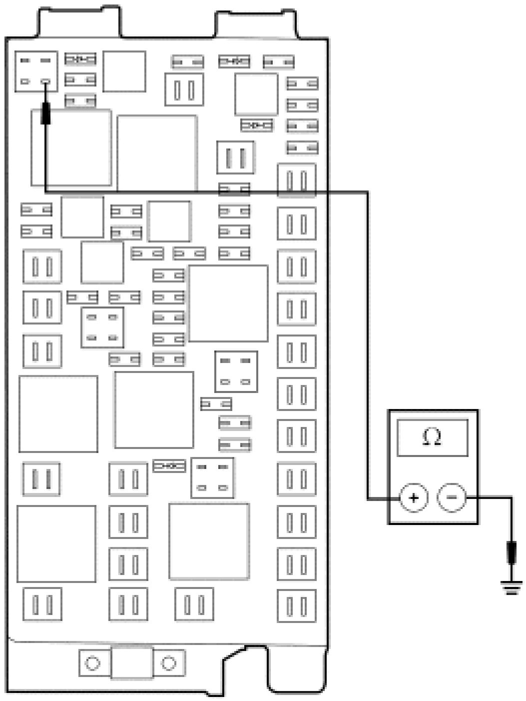


Fig. 104: Measuring Resistance Between Trailer Tow Parking Lamp Relay Pin 2, Circuit GD120 (BK/GN) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the trailer tow parking lamp relay pin 2, circuit GD120 (BK/GN), BJB face side and ground.
- **Is the resistance less than 5 ohms?**

  YES : REPAIR circuit CAT11 (BN) for an open. TEST the system for normal operation.

  NO : Go to Z6.

Z6 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN

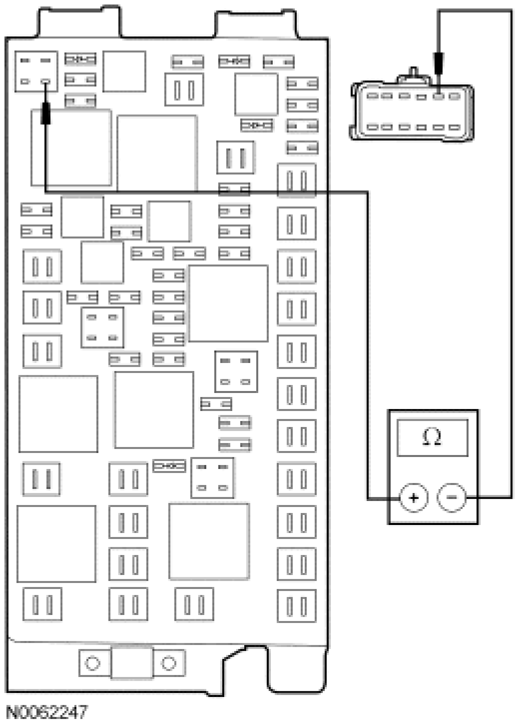


Fig. 105: Measuring Resistance Between Trailer Tow Parking Lamp Relay Pin 2, GD120 (BK/GN) & Joint Connector 7 C2200-H
Courtesy of FORD MOTOR CO.

- Measure the resistance between the trailer tow parking lamp relay pin 2, circuit GD120 (BK/GN), BJB face side and the joint connector 7 C2200-H, circuit GD120 (BK/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new joint connector. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test AA: The Trailer Lamps Are On Continuously

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Trailer/Camper Adapter for schematic and connector information.

Normal Operation - Trailer Tow Stop/Turn Lamp

The trailer tow LH stop/turn relay coil receives voltage through circuit CLS18 (GY/BN) when the vehicle LH rear stoplamp is illuminated. When the trailer tow LH stop/turn relay is energized, voltage is routed to the trailer tow connector through circuit CAT06 (YE).

The trailer tow RH stop/turn relay coil receives voltage through circuit CLS19 (VT/OG) when the vehicle RH rear stoplamp is illuminated. When the trailer tow RH stop/turn relay is energized, voltage is routed to the trailer tow connector through circuit CAT09 (GN).

Trailer Tow Parking

The trailer tow parking lamp relay coil receives voltage through circuit CLS30 (VT/WH) when the vehicle parking lamps are illuminated. When the trailer tow parking lamp relay is energized, voltage is routed to the trailer tow connector through circuit CAT11 (BN).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Trailer tow relay
- Trailer

PINPOINT TEST AA: THE TRAILER LAMPS ARE ON CONTINUOUSLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

AA1 CHECK FOR VOLTAGE AT THE TRAILER TOW CONNECTOR

- Key in ON position.
- Measure the voltage the between trailer tow connector, harness side and ground as follows:

Connector-Pin	Circuit
C439-2	CAT06 (YE)
C439-1	CAT09 (GN)
C439-3	CAT11 (BN)

- **Is any voltage present?**

  YES : Go to AA2.

  NO : The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility.

AA2 CHECK THE SUSPECT RELAY

- Key in OFF position.
- Disconnect: Suspect Trailer Tow Relay
- Measure the voltage the between trailer tow connector, harness side and ground as follows:

Connector-Pin	Circuit
C439-2	CAT06

	(YE)
C439-1	CAT09 (GN)
C439-3	CAT11 (BN)

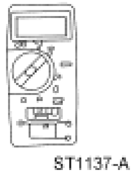
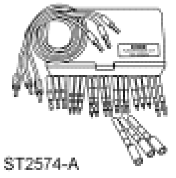
- **Is any voltage present?**

  YES : REPAIR circuit CAT06 (YE) (LH turn), circuit CAT09 (GN) (RH turn), or circuit CAT11 (BN) (parking lamps) for a short to voltage. TEST the system for normal operation.

  NO : INSTALL a new trailer tow relay in question. TEST the system for normal operation.

ADAPTIVE HEADLIGHTING

Special Tools

Illustration	Tool Name	Tool Number
	73III Automotive Meter	105-R0057 or equivalent
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The headlamp control module (HCM) receives information from the communication network such as vehicle speed, steering wheel angle and headlamps on status. Based on the information received, the HCM determines if the headlamps need to be angled left or right as well as the degree of angle.

The HCM does not operate the adaptive headlamps until the vehicle speed is above 5 km/h (3 mph).

When the ignition is placed in the RUN/START position, the HCM runs an initialization check to determine the straight-ahead position of the headlamps. The lamps track left to right, then back to center to signify that the system is operating correctly.

If the HCM does not receive the required information over the communication network or determines that there is a fault with the circuitry to the sensors or control motors, it defaults the headlamps to the straight-ahead position and sets DTC(s).

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Headlamp assembly	• Battery junction box (BJB) fuse 51 (5A) • Wiring, terminals or connectors • Headlamp control module (HCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.

7. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the HCM.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

HEADLAMP CONTROL MODULE (HCM) DTC CHART

DTC	Description	Action
B1342	ECU Is Faulted	INSTALL a new HCM. REFER to **Headlamp Control Module (HCM)**. TEST the system for normal operation.
B2609	ECU Output to Left Headlamp Stepper Motor Circuit Failure	Go to **Pinpoint Test AF** .
B2612	ECU Output to Right Headlamp Stepper Motor Circuit Failure	Go to **Pinpoint Test AF** .
B100B	Left Headlamp Swivel Control Failure	Go to **Pinpoint Test AF** .
B100C	Right Headlamp Swivel Control Failure	Go to **Pinpoint Test AF** .
C1278	Steering Wheel Angle 1 and 2 Signal Faulted	Go to **Pinpoint Test AF** .
U0073	Control Module Communication Bus A Off	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0100	Lost Communication With ECM/PCM	Go to **Pinpoint Test AB** .
U0126	Lost Communication With Steering Angle Sensor Module	Go to **Pinpoint Test AC** .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	Go to **Pinpoint Test AD** .
U2050	No Application Present	CARRY OUT the programmable module installation (PMI). REFER to **MODULE CONFIGURATION** article. TEST the system for normal operation.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action

• No communication with the adaptive front lighting module	• Fuse • Wiring, terminals or connectors • Headlamp control module (HCM)	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The adaptive front lighting is inoperative/does not operate correctly	• Wiring, terminals or connectors • Headlamp assembly • HCM	• Go to **Pinpoint Test AF** .

Pinpoint Tests

Pinpoint Test AB: DTC U0100 - Lost Communication With ECM/PCM

Normal Operation

The headlamp control module (HCM) receives vehicle speed information from the PCM. If the HCM does not receive communication from the PCM, DTC U0100 is set.

This pinpoint test is intended to diagnose the following:

- HCM
- PCM

PINPOINT TEST AB: DTC U0100 - LOST COMMUNICATION WITH ECM/PCM

AB1 REPEAT THE ON-DEMAND SELF-TEST

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: HCM Self-Test
- Clear the DTCs and repeat the HCM on-demand self-test.
- **Is DTC U0100 retrieved again?**

  YES : Go to AB2.

  NO : The vehicle is operating correctly at this time. The HCM may have temporarily lost communication with the PCM.

AB2 CHECK OTHER MODULES FOR DTC U0100

- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) Self-Test
- Carry out the on-demand self-test for other modules on the high speed controller area network (HS-CAN). The IC, ABS module and restraints control module (RCM), for example, communicate on the HS-CAN.
- **Is DTC U0100 retrieved from any other module?**

  YES : Go to AB3.

NO : Go to AB4.

AB3 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

AB4 CHECK FOR CORRECT HCM OPERATION

- Disconnect the HCM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the HCM connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new HCM. REFER to **Headlamp Control Module (HCM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AC: DTC U0126 - Lost Communication With Steering Wheel Angle Sensor Module

Normal Operation

The headlamp control module (HCM) receives steering wheel angle information from the steering angle sensor module (SASM). If the HCM does not receive communication from the SASM, DTC U0126 is set.

This pinpoint test is intended to diagnose the following:

- HCM
- SASM

PINPOINT TEST AC: DTC U0126 - LOST COMMUNICATION WITH STEERING WHEEL ANGLE

SENSOR MODULE

AC1 REPEAT THE ON-DEMAND SELF-TEST

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: HCM Self-Test
- Clear the DTCs and repeat the HCM on-demand self-test.
- **Is DTC U0126 retrieved again?**

  YES : Go to AC2.

  NO : The vehicle is operating correctly at this time. The HCM may have temporarily lost communication with the SASM.

AC2 CHECK THE ABS MODULE FOR DTC U0126

- Enter the following diagnostic mode on the diagnostic tool: ABS Module Self-Test
- Carry out the on-demand self-test for the ABS module.
- **Is DTC U0126 retrieved?**

  YES : REFER to **MODULE COMMUNICATIONS NETWORK** article.

  NO : Go to AC3.

AC3 CHECK FOR CORRECT HCM OPERATION

- Disconnect the HCM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the HCM connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new HCM. REFER to **Headlamp Control Module (HCM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AD: DTC U0155 - Lost Communication With Instrument Panel Cluster (IC) Control Module

Normal Operation

The smart junction box (SJB) communicates the headlamps on status to the instrument cluster (IC) over the medium speed controller area network (MS-CAN). The IC acts as a gateway module and relays the information through the high speed controller area network (HS-CAN). The headlamp control module (HCM) receives headlamps on status information from the IC gateway. If the HCM does not receive communication from the IC, DTC U0155 is set.

This pinpoint test is intended to diagnose the following:

- HCM
- IC

PINPOINT TEST AD: DTC U0155 - LOST COMMUNICATION WITH INSTRUMENT PANEL CLUSTER (IC) CONTROL MODULE

AD1 REPEAT THE ON-DEMAND SELF-TEST

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: HCM Self-Test
- Clear the DTCs and repeat the HCM on-demand self-test.
- **Is DTC U0155 retrieved again?**

  YES : Go to AD2.

  NO : The vehicle is operating correctly at this time. The HCM may have temporarily lost communication with the PCM.

AD2 CHECK OTHER MODULES FOR DTC U0155

- Enter the following diagnostic mode on the diagnostic tool: ABS Module Self-Test
- Carry out the on-demand self-test for other modules on the HS-CAN. The PCM, ABS module and restraints control module (RCM), for example, communicate on the HS-CAN.
- **Is DTC U0155 retrieved from any other module?**

  YES : REFER to **MODULE COMMUNICATIONS NETWORK** article.

  NO : Go to AD3.

AD3 CHECK FOR CORRECT HCM OPERATION

- Disconnect the HCM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the HCM connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new HCM. REFER to **Headlamp Control Module (HCM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AE: DTC C1278 - Steering Wheel Angle 1 and 2 Signal Faulted

Normal Operation

The headlamp control module (HCM) receives steering wheel angle information from the steering angle sensor module (SASM). If the HCM receives faulty steering wheel angle data from the SASM, DTC C1278 is set.

This pinpoint test is intended to diagnose the following:

- HCM
- SASM

PINPOINT TEST AE: DTC C1278 - STEERING WHEEL ANGLE 1 AND 2 SIGNAL FAULTED

AE1 REPEAT THE ON-DEMAND SELF-TEST

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: HCM Self-Test
- Clear the DTCs and repeat the HCM on-demand self-test.
- **Is DTC C1278 retrieved again?**

  YES : Go to AE2.

  NO : The vehicle is operating correctly at this time. The HCM may have temporarily received incorrect data from the steering wheel angle sensor module.

AE2 CHECK THE ABS MODULE FOR DTC C1278

- Carry out the on-demand self-test for the ABS module.
- **Is DTC C1278 retrieved?**

  YES : Go to AE3.

  NO : Go to AE4.

AE3 CHECK FOR CORRECT SASM OPERATION

- Disconnect the SASM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the SASM connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SASM. REFER to Steering Wheel Rotation Sensor in **VEHICLE DYNAMIC SYSTEMS** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

AE4 CHECK FOR CORRECT HCM OPERATION

- Disconnect the HCM connector.
- Check for:
  - corrosion

    - damaged pins
    - pushed-out pins
- Connect the HCM connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new HCM. REFER to **Headlamp Control Module (HCM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AF: The Adaptive Front Lighting Is Inoperative/Does Not Operate Correctly

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Headlamps/Autolamps for schematic and connector information.

Normal Operation

The headlamp control module (HCM) receives information from the high speed controller area network (HS-CAN), such as steering wheel angle, vehicle speed, and headlamps on status. Based on the information received, the HCM determines what angle (left to right of straight ahead) the headlamps should be.

The HCM does not operate the adaptive headlamps until the headlamps are on and the vehicle speed is above 5 km/h (3 mph). Depending on vehicle speed and steering wheel angle, the HCM determines and positions the headlamps at an angle to improve visibility while the vehicle is in a turn. At low and high vehicle speeds (8 km/h [5 mph] and 97 km/h [60 mph] for example), the angle of the headlamps is changed minimally. At vehicle speeds of 32-40 km/h (20-25 mph), the headlamp angle change is greater.

The HCM monitors the position of the headlamps and controls the motors, which changes the angle of the headlamps.

DTC Description	Fault Trigger Conditions
B2609 - ECU Output to Left Headlamp Stepper Motor Circuit Failure	A continuous and on-demand DTC that sets when the HCM detects a failure from the LH headlamp stepper motor or circuitry.
B2612 - ECU Output to Right Headlamp Stepper Motor Circuit Failure	A continuous and on-demand DTC that sets when the HCM detects a failure from the RH headlamp stepper motor or circuitry.
B100B - Left Headlamp Swivel Control Failure	A continuous and on-demand DTC that sets when the HCM detects a failure from the LH headlamp position sensor or circuitry.
B100C - Right Headlamp Swivel Control Failure	A continuous and on-demand DTC that sets when the HCM detects a failure from the RH headlamp position sensor or circuitry.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Headlamp assembly
- HCM

PINPOINT TEST AF: THE ADAPTIVE FRONT LIGHTING IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

AF1 CHECK THE RECORDED DTCs FROM THE HCM SELF-TEST

- Check the recorded results from the HCM self-test.
- **Are any DTCs recorded?**

  YES : For DTC B2612 or B100C, go to AF3.

  For DTC B2609 or B100B, go to AF11.

  For all other DTCs, REFER to DTC Charts in this service information.

  NO : Go to AF2.

AF2 ACTIVE COMMAND THE HEADLAMP ANGLE

- Key in ON position.
- Turn the headlamps on.
- Select the HCM headlamp angle control (BEAM_CTRL_LFT, BEAM_CTRL_RGT) active commands. Command the headlamps to the full left and full right positions while observing the headlamp beam patterns on a wall.
- **Do the headlamps move left and right?**

  YES : Go to AF10.

  NO : Go to AF11.

AF3 CHECK THE CIRCUITRY BETWEEN THE LH AND RH HEADLAMPS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: LH Headlamp C1021b and RH Headlamp C1041b
- Key in ON position.
- Measure the voltage between the LH headlamp, harness side and ground as follows:

Connector-Pin	Circuit
C1021b-1	CLF46 (YE/GY)

C1021b-2	CLF45 (VT/GY)
C1021b-4	LLF43 (GN/VT)
C1021b-5	LLF44 (BU/GY)
C1021b-7	CLF48 (GN/BN)
C1021b-8	CLF47 (BU/GN)
C1021b-10	RLF45 (GY/VT)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to AF4.

AF4 CHECK THE CIRCUITRY BETWEEN THE LH AND RH HEADLAMPS FOR A SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the LH headlamp, harness side and ground as follows:

Connector-Pin	Circuit
C1021b-1	CLF46 (YE/GY)
C1021b-2	CLF45 (VT/GY)
C1021b-4	LLF43 (GN/VT)
C1021b-5	LLF44 (BU/GY)
C1021b-7	CLF48 (GN/BN)
C1021b-8	CLF47 (BU/GN)
C1021b-10	RLF45 (GY/VT)

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to AF5.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

AF5 CHECK THE CIRCUITRY BETWEEN THE LH AND RH HEADLAMPS FOR AN OPEN

- Measure the resistance between the LH headlamp, harness side and RH headlamp, harness side:

LH Headlamp Connector-Pin	RH Headlamp Connector-Pin	Circuit
C1021b-1	C1041b-3	CLF46 (YE/GY)
C1021b-2	C1041b-2	CLF45 (VT/GY)
C1021b-4	C1041b-4	LLF43 (GN/VT)
C1021b-5	C1041b-5	LLF44 (BU/GY)
C1021b-7	C1041b-9	CLF48 (GN/BN)
C1021b-8	C1041b-8	CLF47 (BU/GN)
C1021b-10	C1041b-10	RLF45 (GY/VT)

- **Are the resistances less than 5 ohms?**

  YES : Go to AF6.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

AF6 CHECK FOR SHORTED TOGETHER CIRCUITS BETWEEN THE LH AND RH HEADLAMPS

- Measure the resistance between each circuit on the LH headlamp, harness side as follows:

Connector-Pin Circuit	Connector-Pin Circuit
C1021b-1 CLF46 (YE/GY)	C1021b-2 CLF45 (VT/GY) C1021b-4 LLF43 (GN/VT) C1021b-5 LLF44 (BU/GY) C1021b-7 CLF48 (GN/BN) C1021b-8 CLF47

	(BU/GN) C1021b-10 RLF45 (GY/VT)
C1021b-2 CLF45 (VT/GY)	C1021b-4 LLF43 (GN/VT) C1021b-5 LLF44 (BU/GY) C1021b-7 CLF48 (GN/BN) C1021b-8 CLF47 (BU/GN) C1021b-10 RLF45 (GY/VT)
C1021b-4 LLF43 (GN/VT)	C1021b-5 LLF44 (BU/GY) C1021b-7 CLF48 (GN/BN) C1021b-8 CLF47 (BU/GN) C1021b-10 RLF45 (GY/VT)
C1021b-5 LLF44 (BU/GY)	C1021b-7 CLF48 (GN/BN) C1021b-8 CLF47 (BU/GN) C1021b-10 RLF45 (GY/VT)
C1021b-7 CLF48 (GN/BN)	C1021b-8 CLF47 (BU/GN) C1021b-10 RLF45 (GY/VT)
C1021b-8	C1021b-10

CLF47 (BU/GN)	RLF45 (GY/VT)

- **Are the resistances greater than 10,000 ohms between each circuit?**

  YES : Go to AF7.

  NO : REPAIR the circuits in question. CLEAR the DTCs. REPEAT the self-test.

AF7 CHECK THE RH STEPPER MOTOR CIRCUITS FOR AN OPEN

- Remove the LH headlamp. Refer to **Headlamp Assembly**.
- Disconnect: HCM

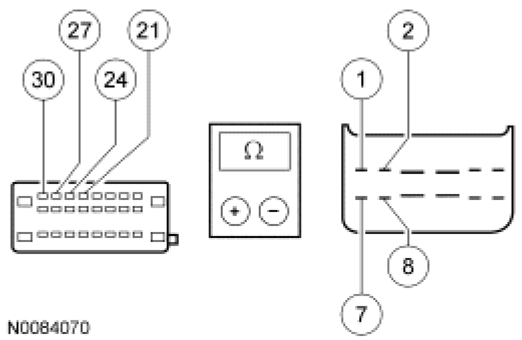


Fig. 106: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the HCM, harness side and the LH headlamp, component side as follows:

HCM Connector	LH Headlamp Connector	Circuit
Pin 21	Pin 1	CLF46
Pin 30	Pin 2	CLF45
Pin 24	Pin 7	CLF48
Pin 27	Pin 8	CLF47

- **Are the resistances less than 5 ohms?**

  YES : Go to AF8.

  NO : REPAIR or INSTALL a new LH headlamp. REFER to **Headlamp Assembly**. CLEAR the DTCs. REPEAT the self-test.

AF8 CHECK THE RH SENSOR CIRCUITS FOR AN OPEN

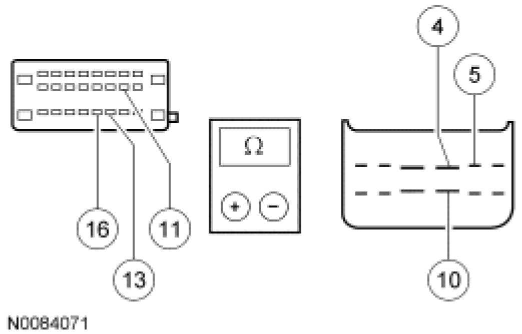


Fig. 107: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the HCM, harness side and the LH headlamp, component side as follows:

HCM Connector	LH Headlamp Connector	Circuit
Pin 13	Pin 4	LLF43
Pin 11	Pin 5	LLF44
Pin 16	Pin 10	RLF45

- **Are the resistances less than 5 ohms?**

  YES : Go to AF9.

  NO : REPAIR or INSTALL a new LH headlamp. REFER to **Headlamp Assembly**. CLEAR the DTCs. REPEAT the self-test.

AF9 CHECK FOR CORRECT HCM OPERATION (RH HEADLAMP DTCs)

- Disconnect the HCM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the HCM connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new HCM. REFER to **Headlamp Control Module (HCM)**. TEST the system for normal operation.

  If the concern remains, REINSTALL the original HCM. INSTALL a new RH headlamp. REFER to **Headlamp Assembly**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose

or corroded connector.

AF10 CHECK THE STEERING WHEEL ROTATION SENSOR FOR CORRECT INSTALLATION

NOTE: If the PID indicates that the steering wheel rotation sensor is out of synchronization by 360 degrees, this is an indication that the steering column shaft was disconnected and the steering wheel was rotated one full turn prior to reconnecting it. The clockspring may be damaged and should be checked for correct installation.

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Steering Angle Sensor Module (SASM) DataLogger
- Visually inspect the front wheels and make sure they are aligned to the straight-ahead position.

  NOTE: The PID could read +360 degrees or -360 degrees. The PID should indicate 0 when the wheels are in the straight-ahead position.

- Monitor the SASM steering wheel angle (SWA_SEN) PID.
- **Does the PID indicate the steering wheel at approximately 0 degrees?**

  YES : Go to AF11.

  NO : REMOVE and correctly INSTALL the steering wheel rotation sensor. REFER to **VEHICLE DYNAMIC SYSTEMS** article. MAKE SURE the clockspring is also correctly indexed. TEST the system for normal operation.

AF11 CHECK FOR CORRECT HCM OPERATION (LH HEADLAMP DTCs)

- Disconnect the HCM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the HCM connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

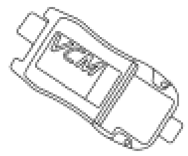
  YES : INSTALL a new HCM. REFER to **Headlamp Control Module (HCM)**. TEST the system for normal operation.

  If the concern remains, INSTALL a new LH headlamp. REFER to **Headlamp Assembly**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

DAYTIME RUNNING LAMPS (DRL)

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

NOTE: When installing a new SJB, it must be configured for this feature, if originally equipped. Refer to MODULE CONFIGURATION article.

The SJB controls the daytime running lamps (DRL) by using various inputs to determine whether or not the DRL should be illuminated. These inputs include:

- Ignition switch position
- Headlamp switch position
- Headlamps on or off
- Transaxle gear selection

When the DRL is active, the SJB provides a pulse-width modulated (PWM) voltage to the low beam headlamps. This illuminates the headlamps at a reduced intensity.

The SJB can be configured to turn the DRL on for this vehicle. Refer to **MODULE CONFIGURATION** article for additional information on this programmable parameter.

Inspection and Verification

1. Verify the customer concern.
2. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

   NOTE: Make sure the headlamp switch is in the OFF position.

   NOTE: Make sure the multifunction switch is not in the HIGH BEAM position.

   NOTE: Make sure to use the latest scan tool software release.

3. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

4. If the scan tool does not communicate with the VCM:
    - Check the VCM connection to the vehicle.
    - Check the scan tool connection to the VCM.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
5. If the scan tool does not communicate with the vehicle:
    - Verify the ignition key is in the ON position.
    - Verify the scan tool operation with a known good vehicle.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
6. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record the continuous memory DTCs.
7. Check the smart junction box (SJB) and make sure the daytime running lamps (DRL) configuration is enabled.
8. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The daytime running lamps (DRL) are inoperative	• Exterior lighting system input/output • Smart junction box (SJB) configuration • Ignition switch input • Transaxle gear input • SJB	• Go to **Pinpoint Test AG** .

Pinpoint Tests

Pinpoint Test AG: The Daytime Running Lamps (DRL) Are Inoperative

Normal Operation

When the ignition switch is in the RUN position, the headlamps are not on (from the autolamp system or manual control from the headlamp switch), the transaxle is not in PARK (P), the smart junction switch (SJB) provides a pulse-width modulated (PWM) voltage to the low beam headlamps. This illuminates the headlamps at a reduced intensity.

This pinpoint test is intended to diagnose the following:

- Exterior lighting system input/output
- SJB configuration
- Ignition switch input
- Transaxle gear input
- SJB

PINPOINT TEST AG: THE DAYTIME RUNNING LAMPS (DRL) ARE INOPERATIVE

AG1 VERIFY THE DRL OPERATION

- Place the gear selector lever in any gear other than PARK (P).
- **Are the DRL illuminated?**

  YES : The system is operating correctly. INFORM the customer of the conditions required for the DRL to operate correctly.

  NO : Go to AG2.

AG2 CHECK THE OPERATION OF THE HEADLAMPS

- Place the headlamp switch in the HEADLAMPS ON position and observe the headlamps.
- **Do the headlamps operate correctly?**

  YES : Go to AG3.

  NO : REFER to **Headlamps**.

AG3 CHECK THE IGNITION SWITCH INPUT

- Place the headlamp switch in the OFF position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB ignition switch PID (IGN SW) while cycling the ignition switch through all positions.
- **Does the PID agree with the ignition switch positions?**

  YES : Go to AG4.

  NO : REFER to **STEERING COLUMN SWITCHES** article to diagnose the input from the ignition switch.

AG4 CHECK THE TRANSAXLE GEAR INPUT

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger
- Monitor the PCM transmission gear status PID (TR) while placing the gear selector lever through all positions.
- **Does the PID agree with the gear selection?**

  YES : Go to AG5.

NO : REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article to diagnose the transmission range input.

AG5 CHECK SJB FOR DRL CONFIGURATION

- Enter the following diagnostic mode on the diagnostic tool: SJB Module Programming
- Check the SJB configuration and make sure the DRL feature is enabled.
- **Is the SJB DRL configuration enabled?**

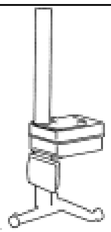
  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : ENABLE the DRL configuration. TEST the system for normal operation.

GENERAL PROCEDURES

HEADLAMP ADJUSTMENT

Special Tools

Illustration	Tool Name	Tool Number
 ST3041-A	Vision 100 Headlamp Aimer	196-00005 or equivalent

Headlamp Aiming

1. The headlamp aiming procedure depends on what type of beam pattern the headlamp is equipped with. Vehicles may come equipped with VOL or VOR headlamps. To identify the headlamp beam pattern, look on the headlamp lens. Molded in small letters on the headlamp lens is one of the following:
   - VOL and SAE
   - VOR and SAE
2. Once the headlamp beam pattern is identified, aim the headlamps using one of the following methods as applicable.
   - Photometric aimers can aim VOL- and VOR- headlamps. This is the preferred method of headlamp aiming.
   - Visual or screen method aiming can be used to aim VOL- and VOR- headlamps.
   - Mechanical aimers cannot be used with VOR- or VOL-type headlamps. Aerodynamic lamps that can be aimed mechanically have 3 nibs molded into the lens of the lamp.

Photometric Aiming

1. For the photometric aiming procedure, refer to the appropriate photometric headlamp aimer instruction manual.

Screen Method Aiming

All headlamp types

NOTE: Horizontal aim is not necessary for VOL or VOR headlamps.

NOTE: Consult your state vehicle inspection manual for recommended tolerance ranges for visual aiming.

NOTE: The sight shield may need to be positioned or removed for access to the adjusters.

1. Before starting headlamp adjustment:
    - check the tire inflation.
    - check that no other load is in the vehicle other than a half tank of fuel.
    - check that the headlamps are clean.
    - check for correct headlamp operation.
    - check that the vehicle is on level ground.
    - if the vehicle is equipped with air suspension, make sure that the switch is on.

    NOTE: The vertical wall or screen must be a minimum of 2.4-m (8-ft) wide.

2. Park the vehicle on a level surface approximately 7.6-m (25-ft) from the vertical wall or screen directly in front of it.

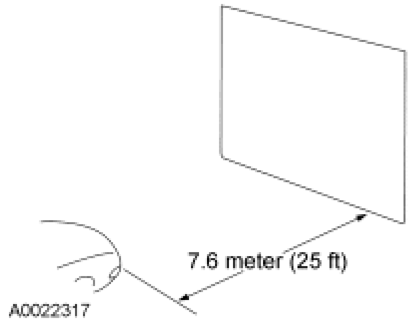


Fig. 108: Identifying Distance Between Vehicle And Vertical Wall Or Screen
Courtesy of FORD MOTOR CO.

NOTE: The center of the lamp is marked either on the lens (circle, crosshair or other mark) or on the bulb shield internal to the lamp (crosshair or other mark).

3. Mark a horizontal reference line on the vertical wall or screen.
    1. Measure the center of the headlamp height to ground and record the measurement.

2. Make a 2.4-meter (8-ft) horizontal mark (using masking tape) on the vertical wall or screen at the same distance from the ground as previously recorded.

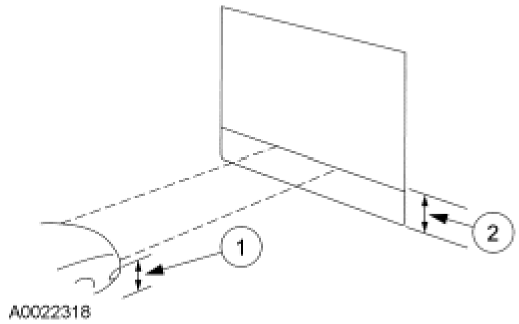


Fig. 109: Aiming Headlights
Courtesy of FORD MOTOR CO.

NOTE: This procedure should be done in a dark environment to effectively see the headlamp beam pattern.

4. Turn on the low beam headlamps to illuminate the wall or screen and open the hood.
5. On the wall or screen, locate the high intensity area of the beam pattern.

VOR-type headlamps

NOTE: The appearance of the VOR beam pattern may vary between vehicles.

6. Identify at the top edge of this high intensity area a distinct horizontal cutoff in the beam pattern. If the top edge of this cutoff is not even with the horizontal reference line, the headlamp beam needs to be adjusted using the headlamp adjusting screw.

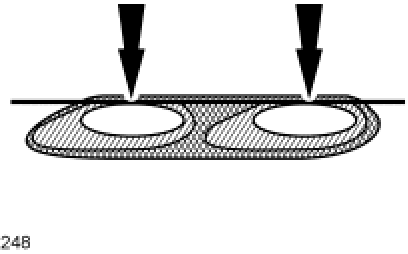


Fig. 110: Identifying High Intensity Area (VOR Type Headlamps)
Courtesy of FORD MOTOR CO.

VOL-type headlamps

7. For VOL-type headlamps, there is a distinct cutoff in the left portion of the beam pattern. The edge of this

cutoff should be positioned 50.2 mm (2 in) below the horizontal reference line. Adjust the headlamp as necessary using the headlamp adjusting screw.

1. Horizontal reference line.
2. Top edge of the beam pattern.
3. High intensity zone.

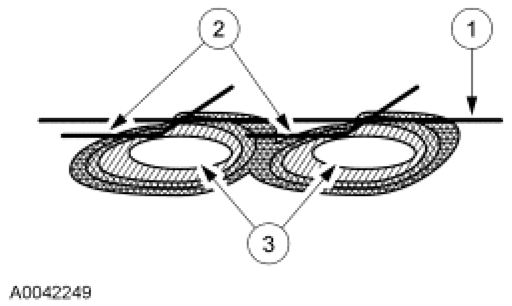


Fig. 111: Identifying VOL-Type Headlamps Beam Pattern
Courtesy of FORD MOTOR CO.

FRONT FOG LAMP ADJUSTMENT

NOTE: Horizontal aim is not required for this vehicle and is not adjustable. Consult your state vehicle inspection center for recommended tolerance ranges for visual aiming.

1. Before starting the fog lamp assembly adjustment:
   - check the tire inflation.
   - make sure there are no other loads in the vehicle other than a half tank of fuel.
   - make sure the vehicle is on level ground.
   - make sure the fog lamps and headlamps are clean.
   - make sure the headlamps are operating and are correctly aimed.

NOTE: The vertical wall screen must be a minimum of 2.4-m (8-ft) wide.

2. Park the vehicle on a level surface approximately 7.6 m (25 ft) from the vertical wall or screen directly in front of it.

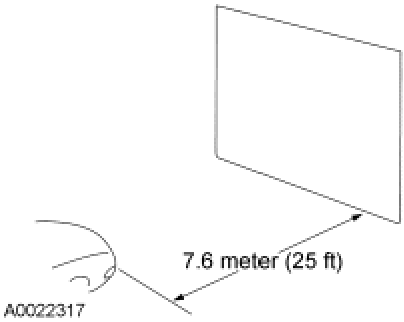


Fig. 112: Identifying Distance Between Vehicle And Vertical Wall Or Screen
Courtesy of FORD MOTOR CO.

3. The correct visual aim for the fog lamps is with the top edge of the high-intensity zone 10 cm (4 in) below the horizontal center of the fog lamps.

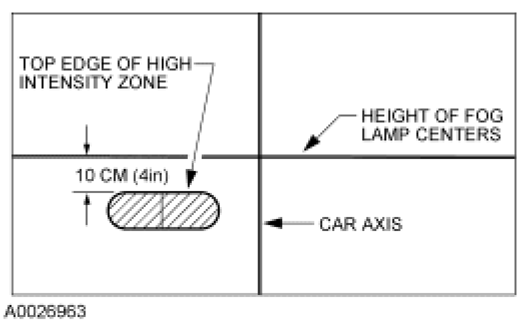


Fig. 113: Identifying Correct Visual Aim For Fog Lamps
Courtesy of FORD MOTOR CO.

AUTOLAMPS TIME DELAY ADJUSTMENT

NOTE: **The time delay can be programmed through the instrument cluster message center using the message center buttons (if equipped) or using the following steps.**

NOTE: **Steps 2 through 5 must be carried out within a 10-second period.**

1. Start with the ignition switch off and the headlamp switch in the AUTOLAMPS ON position.
2. Place the headlamp switch in the OFF position.
3. Place the ignition switch in the RUN position.
4. Place the ignition switch in the OFF position.
5. Place the headlamp switch in the AUTOLAMPS ON position. The exterior lamps turn on at this point.
6. Wait the desired amount of time and place the headlamp switch in the OFF position (maximum of 3 minutes). The exterior lamps turn off and the autolamp time delay is now set.

REMOVAL AND INSTALLATION

HEADLAMP ASSEMBLY

NOTE: Edge shown, MKX similar.

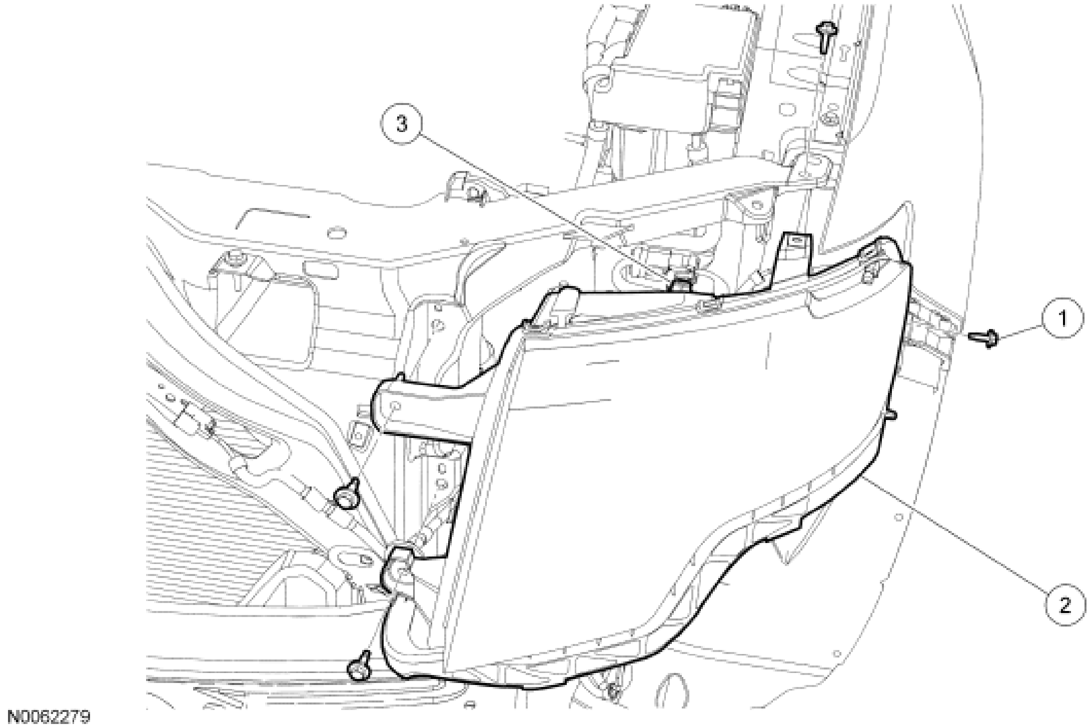


Fig. 114: Identifying Headlamp Assembly
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W711676	Headlamp assembly bolts (4 required)
2	13005/13006	Headlamp assembly (LH/RH)
3	-	Headlamp electrical connectors (part of 14290)

REMOVAL AND INSTALLATION

NOTE: Make sure the headlamp switch and the ignition switch are in the OFF position.

1. Remove the front bumper cover. For additional information, refer to **BUMPERS** article.
2. Remove the 4 bolts and the headlamp assembly.
   - Disconnect the electrical connectors.
3. To install, reverse the removal procedure.

HEADLAMP BULB

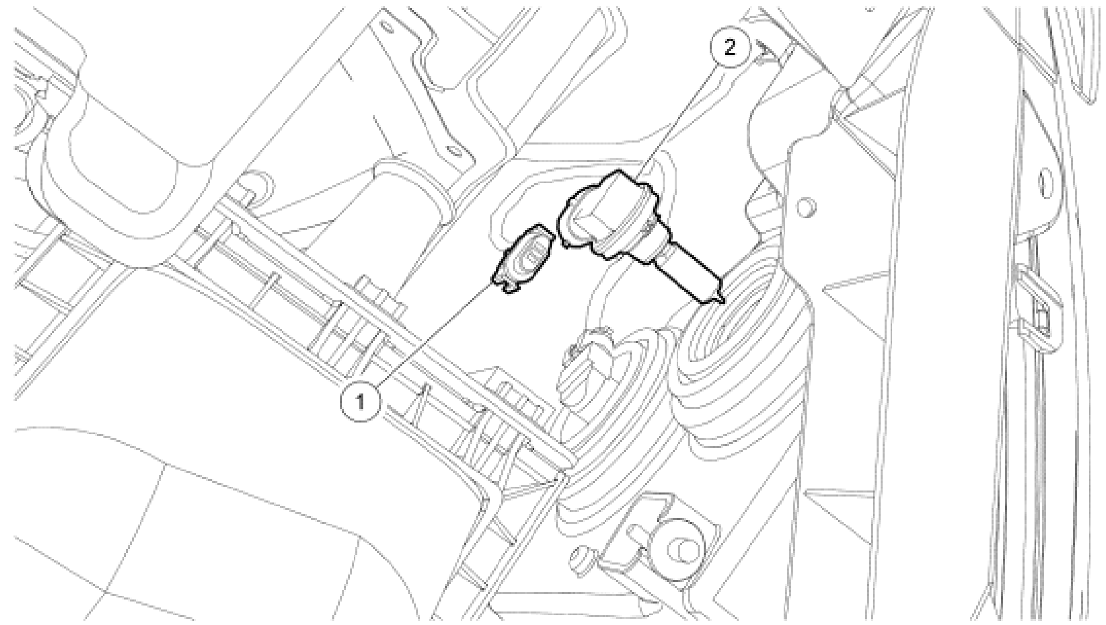


Fig. 115: Exploded View Of Headlamp Bulb Edge Low Beam
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Headlamp bulb electrical connector (part of 14290)
2	13N021	Headlamp bulb

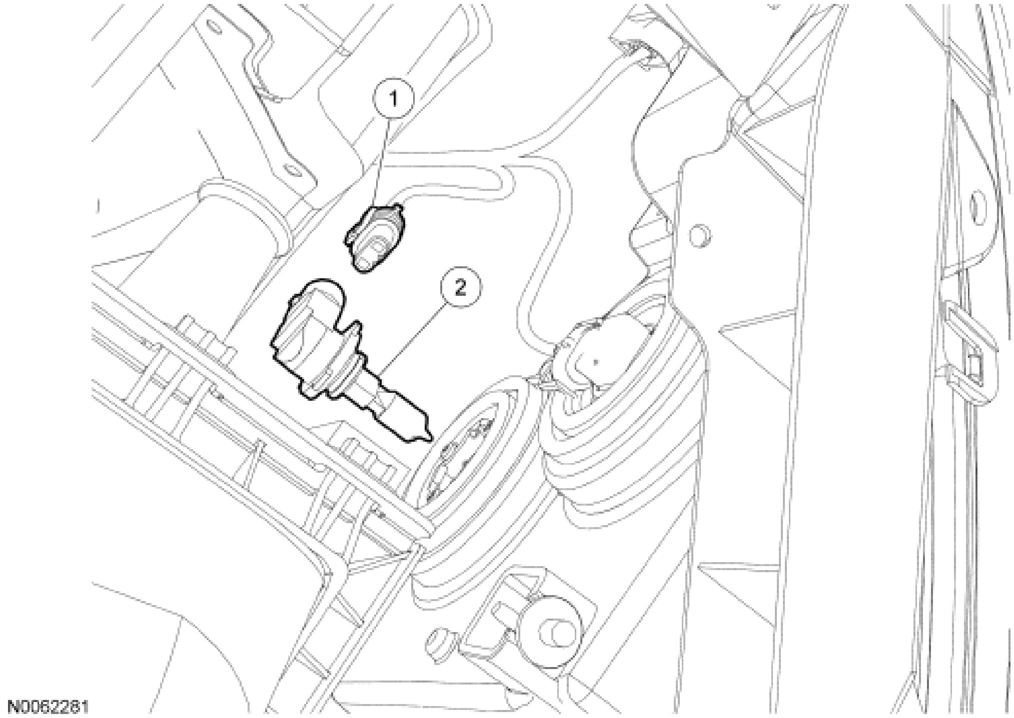


Fig. 116: Identifying Edge High Beam
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Headlamp bulb electrical connector (part of 14290)
2	13N021	Headlamp bulb

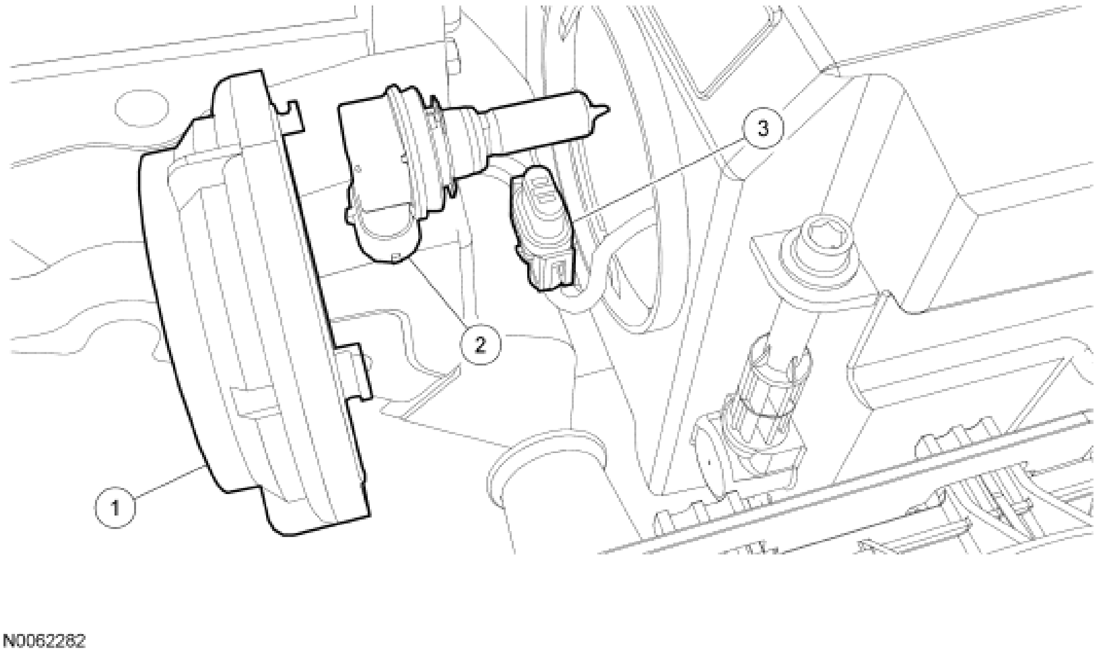


Fig. 117: Identifying MKX Low Beam
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Headlamp bulb access cover (part of 13005/13006)
2	13N021	Headlamp bulb
3	-	Headlamp bulb electrical connector (part of 13005/13006)

NOTE: The air cleaner assembly is shown removed for clarity.

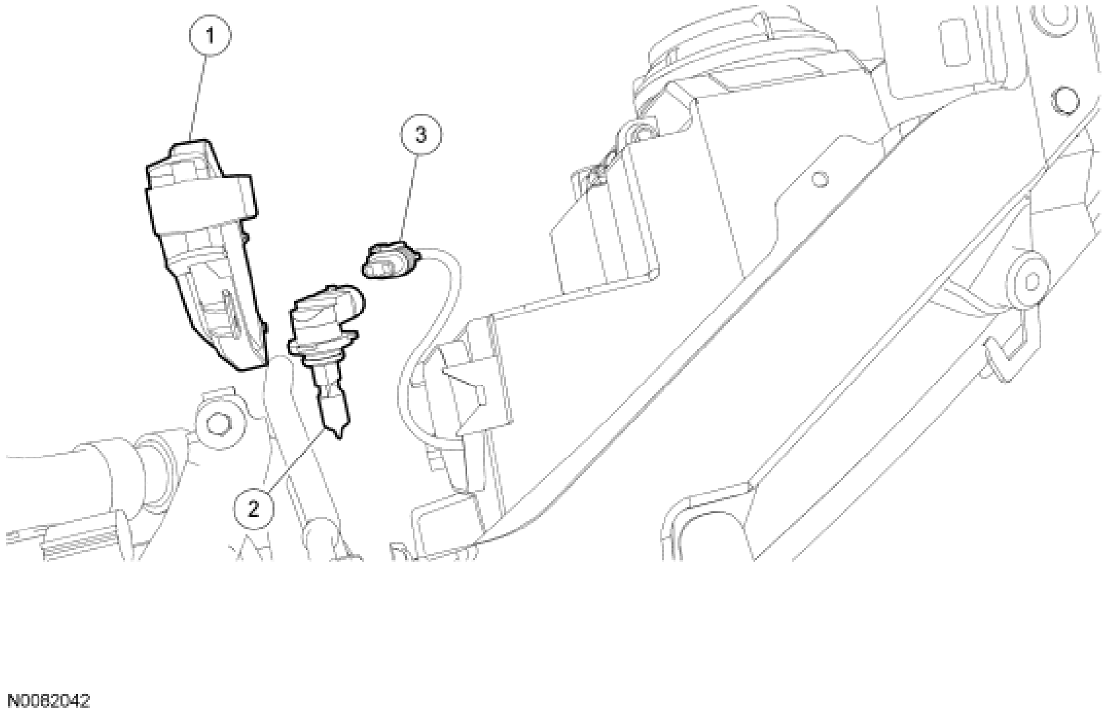


Fig. 118: Identifying MKX High Beam
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Headlamp bulb access cover (part of 13005/13006)
2	13N021	Headlamp bulb
3	-	Headlamp bulb electrical connector (part of 13005/13006)

REMOVAL AND INSTALLATION

WARNING: **The bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope. Failure to follow these instructions may result in personal injury.**

NOTE: **The headlamp bulb should not be removed from the headlamp until just before a new bulb is installed. Removing the bulb for an extended period of time may affect headlamp bulb performance. Contaminants may enter the headlamp where they can settle on the lens and reflector. Never turn on the headlamps with the bulb removed from the headlamp.**

NOTE: **Make sure the headlamp switch and the ignition switch are in the OFF position.**

MKX

1. Remove the headlamp bulb access cover.

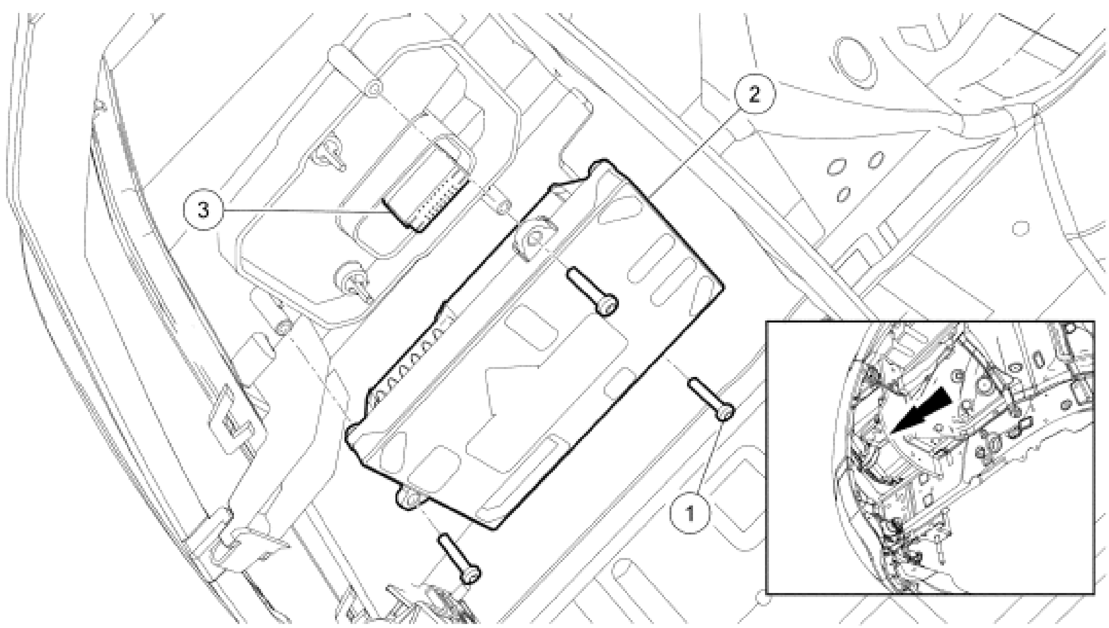
   All vehicles

   NOTE: **To remove, rotate the headlamp bulb approximately 1/8 turn counterclockwise.**

2. Remove the headlamp bulb.
   - Disconnect the electrical connector.
3. To install, reverse the removal procedure.

HEADLAMP CONTROL MODULE (HCM)

NOTE: **The headlamp control module (HCM) can be accessed from under the vehicle.**



N0062284

Fig. 119: Exploded View Of Headlamp Control Module (HCM)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Headlamp control module (HCM) screws (3 required) (part of 13005)
2	13C148	HCM

3	-	HCM electrical connector (part of 13005)

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the 2 screws and position the fender splash shield aside.

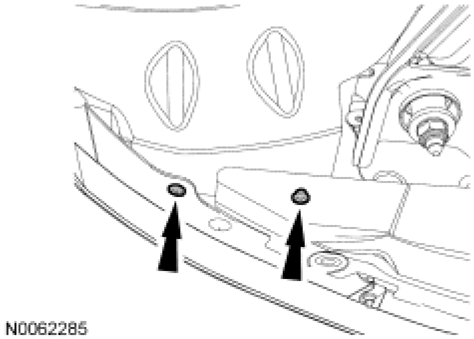


Fig. 120: Locating Screws On Fender Splash Shield
Courtesy of FORD MOTOR CO.

3. Remove the 3 screws and the HCM.
   - Disconnect the electrical connector.
4. To install, reverse the removal procedure.

FOG LAMP

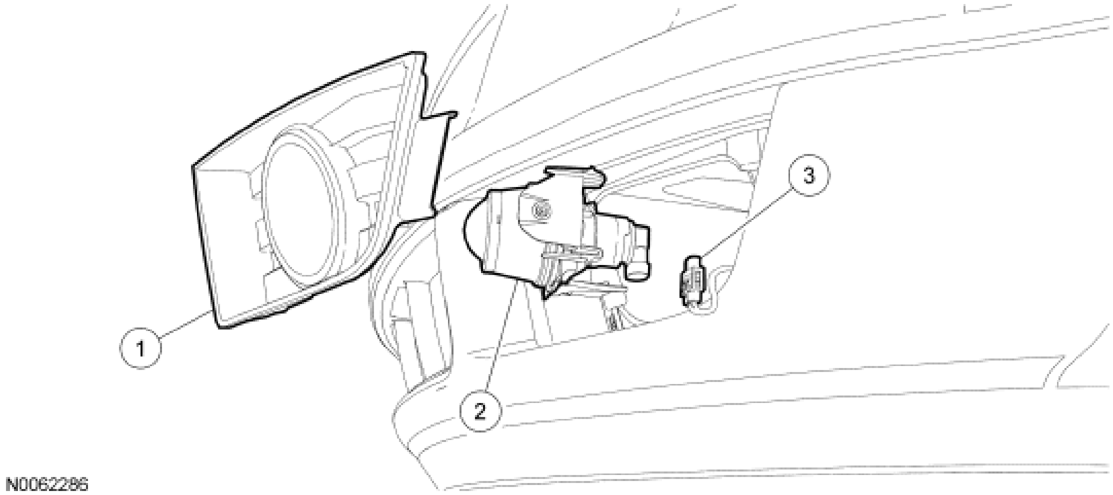


Fig. 121: Exploded View Of Fog Lamp
Courtesy of FORD MOTOR CO.

Item	Part Number	Description

1	17E811	Fog lamp bezel
2	15K200	Fog lamp
3	-	Fog lamp electrical connector (part of 14290)

REMOVAL AND INSTALLATION

NOTE: Make sure the headlamp switch and the ignition switch are in the OFF position.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the 2 screws and position the fender splash shield aside.

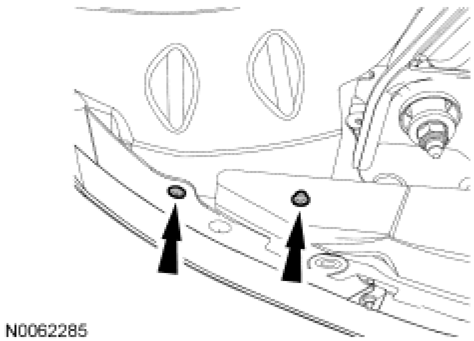


Fig. 122: Locating Screws On Fender Splash Shield
Courtesy of FORD MOTOR CO.

3. Release the tabs and remove the fog lamp bezel.
4. Release the locking tabs and remove the fog lamp.
    - Disconnect the electrical connector.
5. To install, reverse the removal procedure.

FOG LAMP BULB

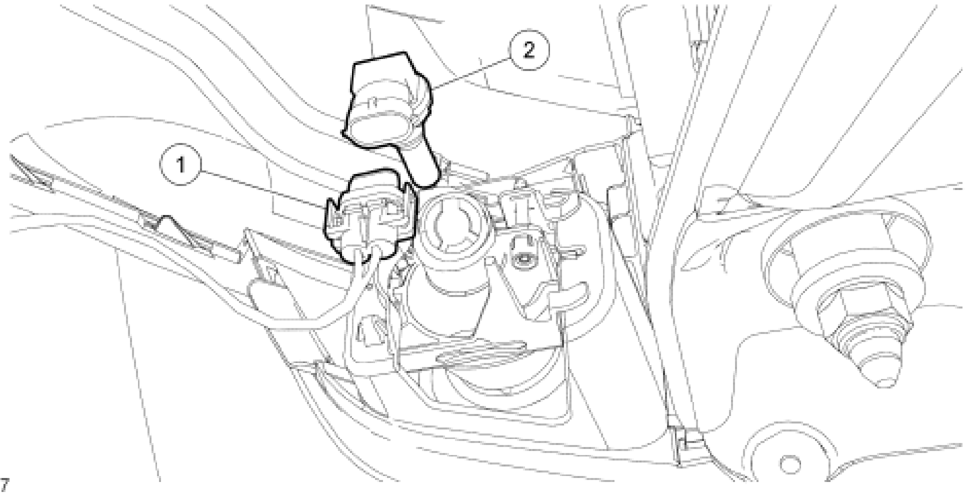


Fig. 123: Exploded View Of Fog Lamp Bulb
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Fog lamp electrical connector (part of 14290)
2	13N021	Fog lamp bulb

REMOVAL AND INSTALLATION

WARNING: **The bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope. Failure to follow these instructions may result in personal injury.**

NOTE: The fog lamp bulb should not be removed from the fog lamp until just before a new bulb is installed. Removing the bulb for an extended period of time may affect fog lamp bulb performance. Contaminants may enter the fog lamp where they can settle on the lens and reflector. Never turn on the fog lamps with the bulb removed.

NOTE: Make sure the headlamp switch and the ignition switch are in the OFF position.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the 2 screws and position the fender splash shield aside.

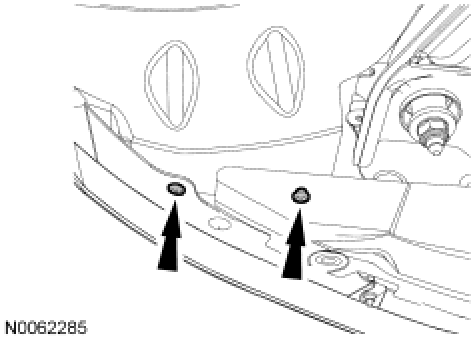


Fig. 124: Locating Screws On Fender Splash Shield
Courtesy of FORD MOTOR CO.

3. Disconnect the electrical connector and remove the fog lamp bulb.
4. To install, reverse the removal procedure.

PARKING LAMP BULB - FRONT

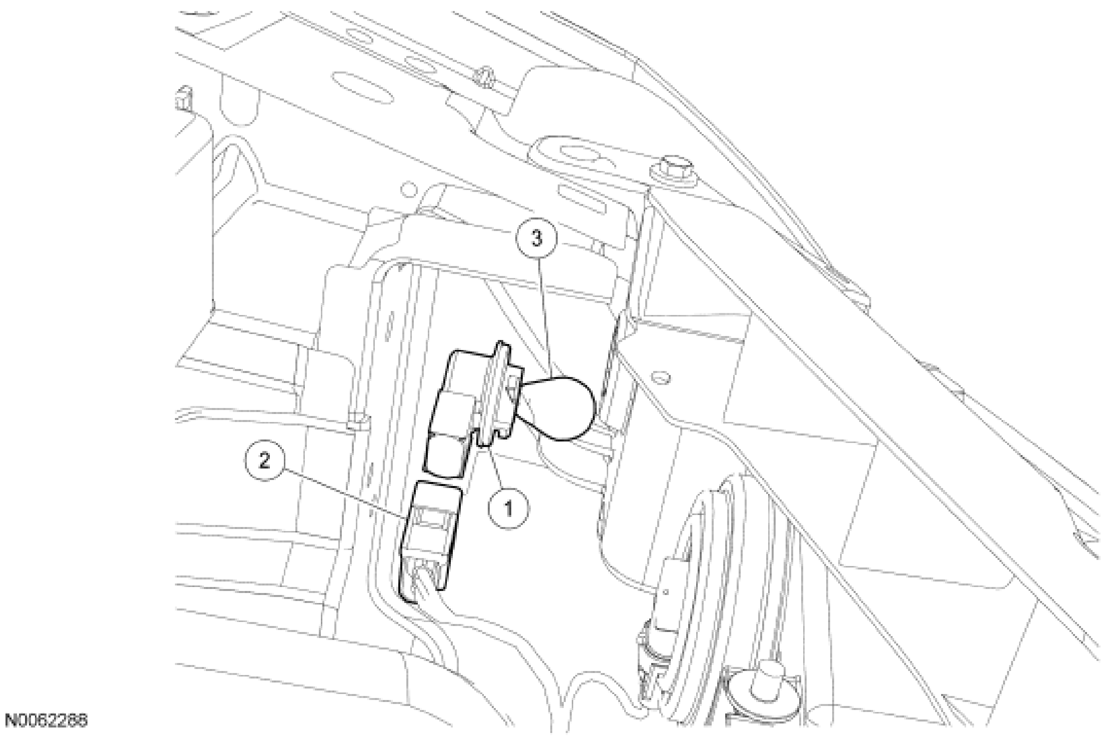


Fig. 125: Exploded View Of Front Parking Lamp Bulb - Edge
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	13411	Front parking lamp bulb holder
2	-	Front parking lamp electrical connector (part of 14290)

3	13466	Front parking lamp bulb

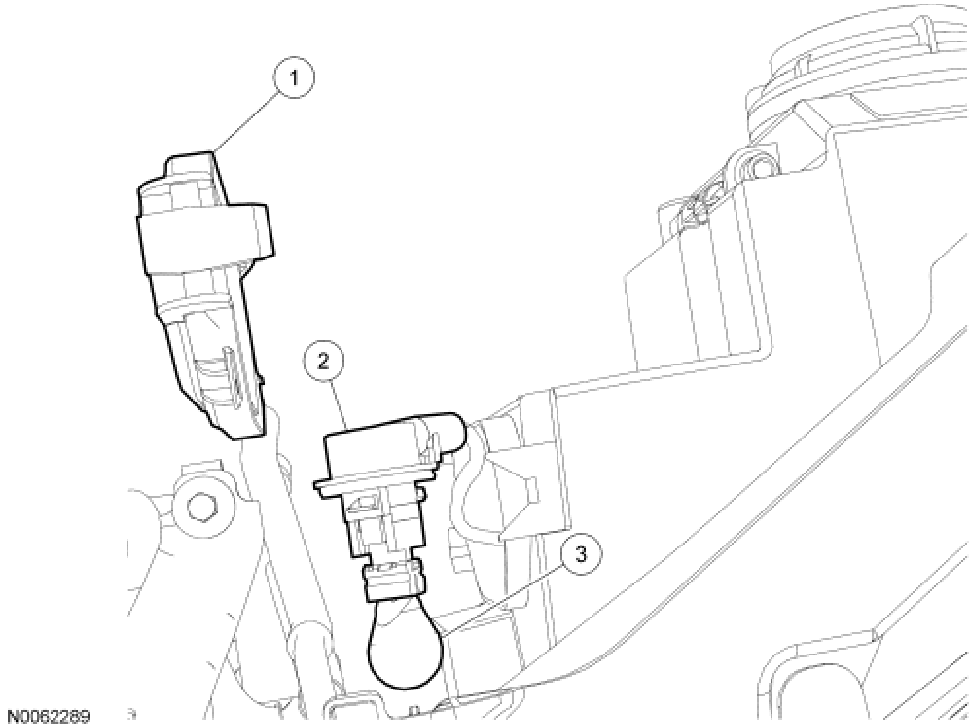


Fig. 126: Exploded View Of Front Parking Lamp Bulb - MKX
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Headlamp bulb access cover (part of 13005/13006)
2	-	Front parking lamp electrical connector (part of 13005/13006)
3	13466	Front parking lamp bulb

REMOVAL AND INSTALLATION

MKX

1. Remove the headlamp bulb access cover.

   All vehicles

2. Remove the front parking lamp holder from the headlamp assembly.
   - Remove the front parking lamp bulb.
3. To install, reverse the removal procedure.

SIDE MARKER LAMP - FRONT

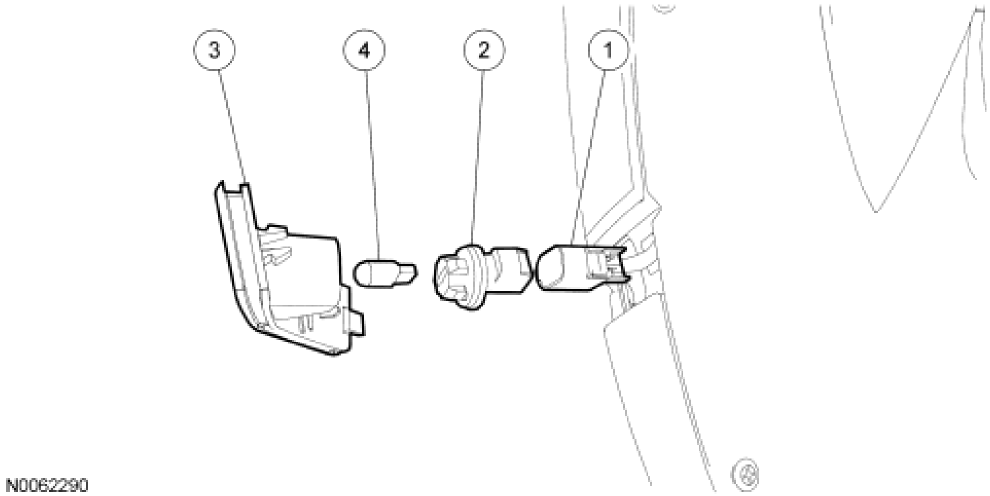


Fig. 127: Exploded View Of Front Side Marker Lamp
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Side marker lamp electrical connector (part of 14290)
2	-	Side marker bulb holder
3	13200/13201	Side marker lamp (LH/RH)
4	-	Side marker bulb

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the 2 screws and position the fender splash shield aside.

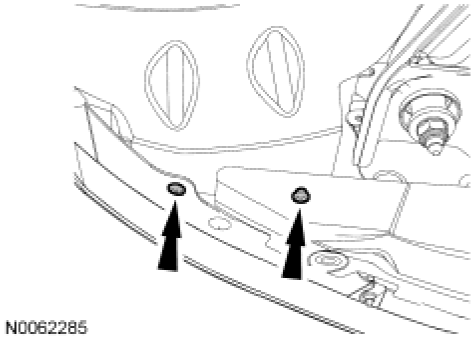


Fig. 128: Locating Screws On Fender Splash Shield
Courtesy of FORD MOTOR CO.

3. Release the tabs and remove the side marker lamp.
   - Disconnect the electrical connector.

4. To install, reverse the removal procedure.

LIGHT SENSOR

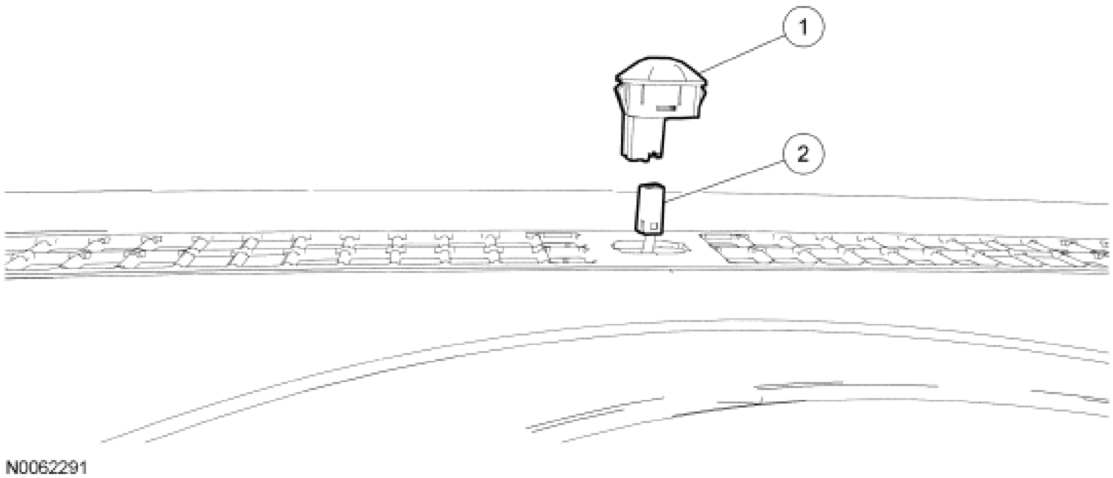


Fig. 129: Exploded View Of Light Sensor
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	13A018	Light sensor
2	-	Light sensor electrical connector (part of 14401)

REMOVAL AND INSTALLATION

1. Using a suitable tool, remove the light sensor.
   - Disconnect the electrical connector.
2. To install, reverse the removal procedure.

STOPLAMP SWITCH

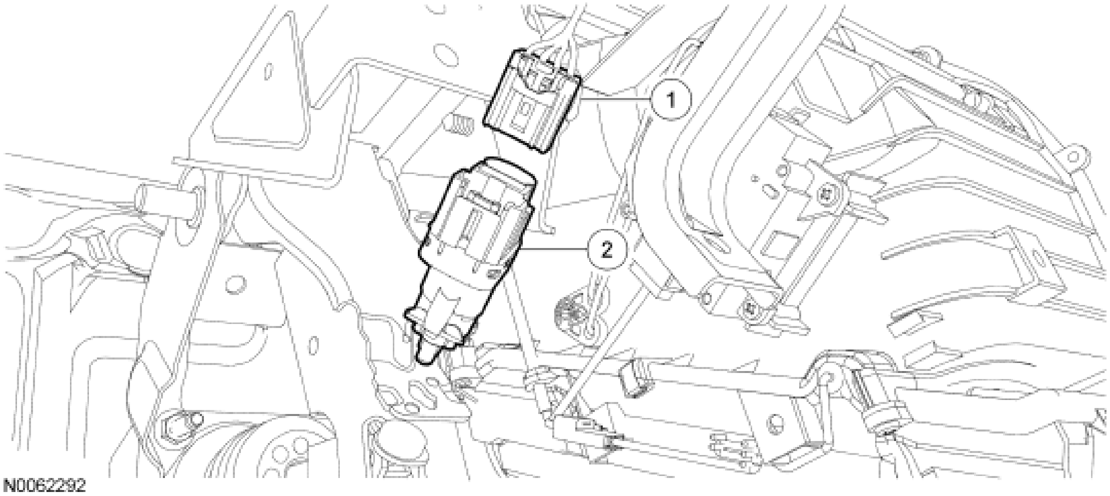


Fig. 130: Exploded View Of Stoplamp Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Stoplamp switch electrical connector (part of 14290)
2	9G854	Stoplamp switch

REMOVAL

1. Disconnect the stoplamp switch electrical connector.

NOTE: The stoplamp switch will be difficult to remove if the switch plunger is not depressed. A slight rearward force should be adequate to depress the plunger.

2. With a light force (approximately 1-4 N [1-3 lb]), pull rearward on the brake pedal, rotate the stoplamp switch 45 degrees clockwise and remove the stoplamp switch.

INSTALLATION

CAUTION: It is very important to not press, pull or touch the brake pedal assembly during the installation of the stoplamp switch. Failure to follow these instructions may damage the stoplamp switch.

1. Without movement to the brake pedal assembly, install the stoplamp switch and rotate 45 degrees counterclockwise.
2. Connect the stoplamp switch electrical connector.

HEADLAMP SWITCH

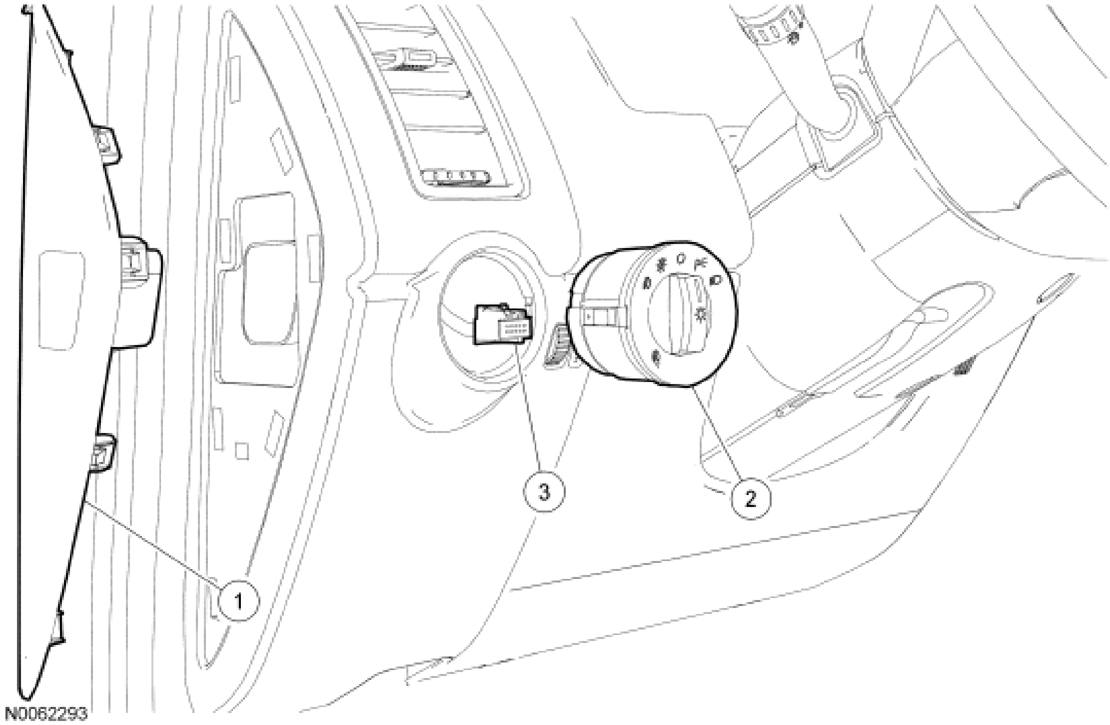


Fig. 131: Exploded View Of Headlamp Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7804481	Instrument panel side finish panel
2	11654	Headlamp switch
3	-	Headlamp switch electrical connector (part of 14401)

REMOVAL AND INSTALLATION

1. Remove the instrument panel side finish panel.

NOTE: The headlamp switch is removed by pushing from behind.

2. Release the tabs and remove the headlamp switch.
   - Disconnect the electrical connector.
3. To install, reverse the removal procedure.

HAZARD FLASHER LAMP SWITCH

NOTE: Edge shown, MKX similar.

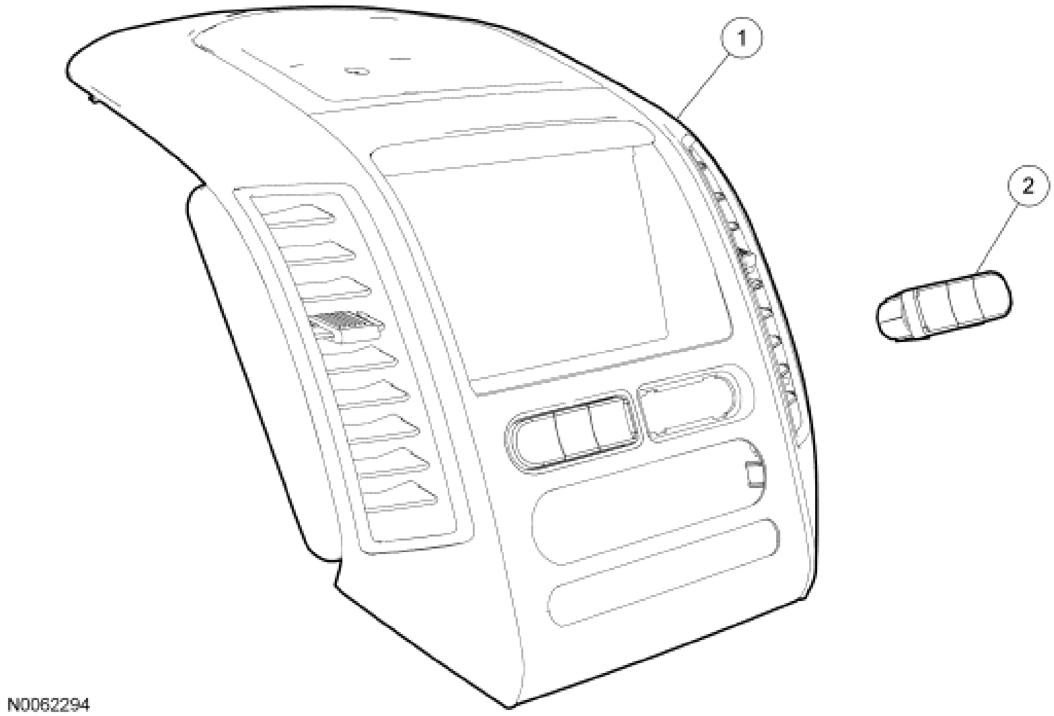


Fig. 132: Exploded View Of Hazard Flasher Lamp Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	78044D70	Instrument panel center finish panel
2	13D733	Hazard flasher lamp switch

REMOVAL AND INSTALLATION

1. Remove the instrument panel center finish panel. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
2. Release the tabs and remove the hazard flasher lamp switch.
3. To install, reverse the removal procedure.

PUDDLE LAMP

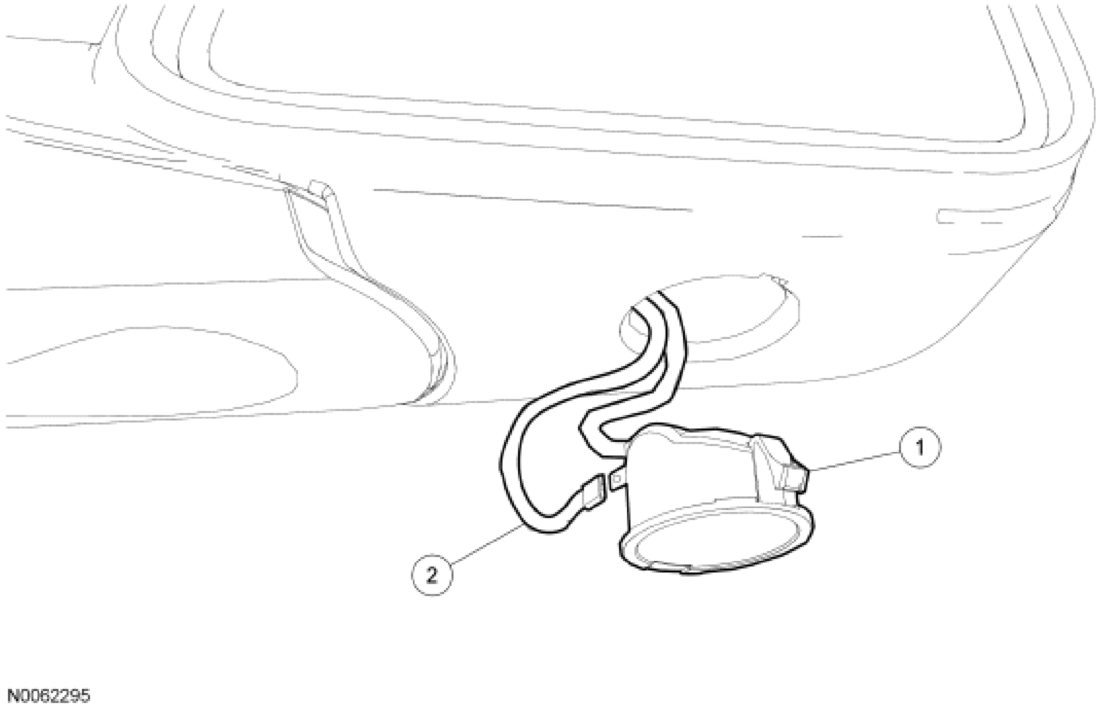


Fig. 133: Exploded View Of Puddle Lamp
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	13B375	Puddle lamp
2	-	Puddle lamp electrical connector (part of 17683)

REMOVAL AND INSTALLATION

1. Release the tab to remove the puddle lamp from the mirror housing.
   - Disconnect the electrical connector.

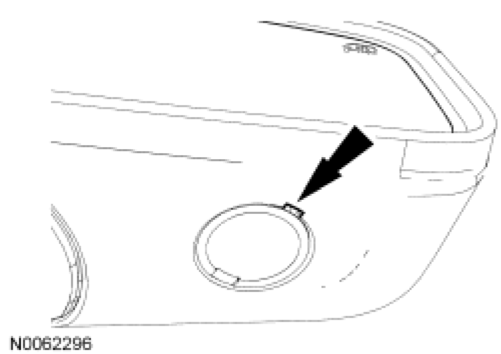


Fig. 134: Locating Puddle Lamp
Courtesy of FORD MOTOR CO.

NOTE: An audible click can be heard when the puddle lamp is fully seated.

2. To install, reverse the removal procedure.

REAR LAMP ASSEMBLY

NOTE: Edge shown, MKX similar.

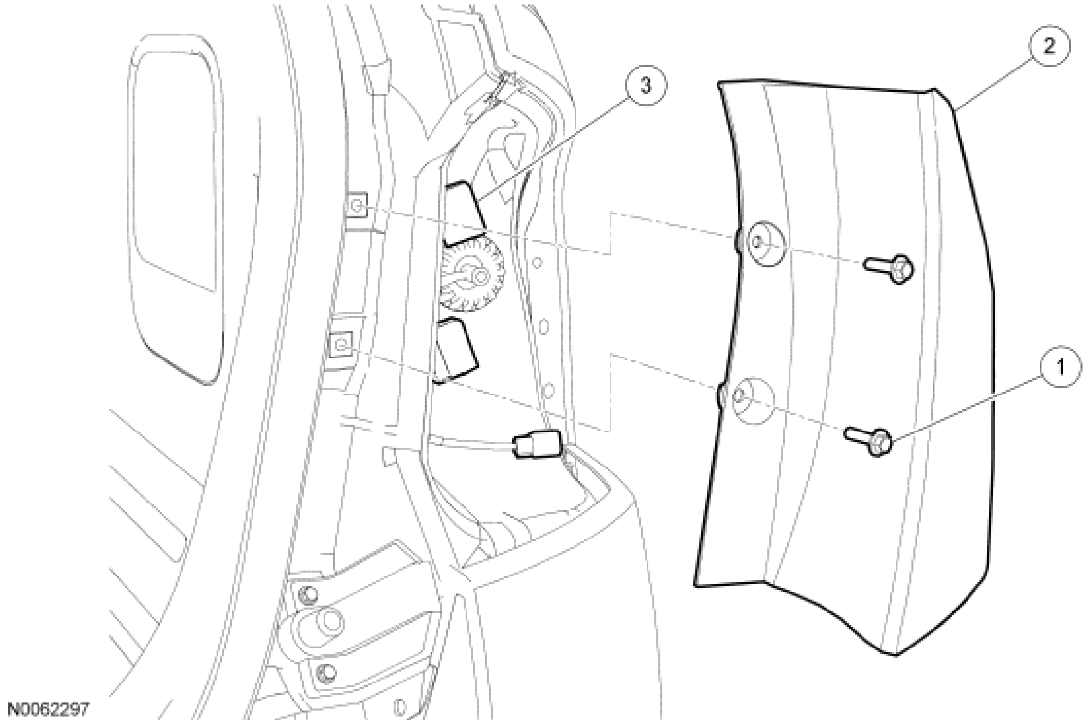


Fig. 135: Exploded View Of Rear Lamp Assembly
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W712801	Rear lamp assembly screws (2 required)
2	13A505/13A504	Rear lamp assembly (LH/RH)
3	-	Rear lamp assembly electrical connectors (part of 14A005)

REMOVAL AND INSTALLATION

NOTE: The rear lamp assembly is held in place by snap-type retainers. The lamp should be pulled straight and rearward to remove.

1. Remove the 2 screws and the rear lamp assembly.
   - Disconnect the electrical connectors.

2. To install, reverse the removal procedure.
   - An audible click should be heard when the rear lamp assembly is fully seated to the quarter panel.

REAR LAMP ASSEMBLY - LIFTGATE

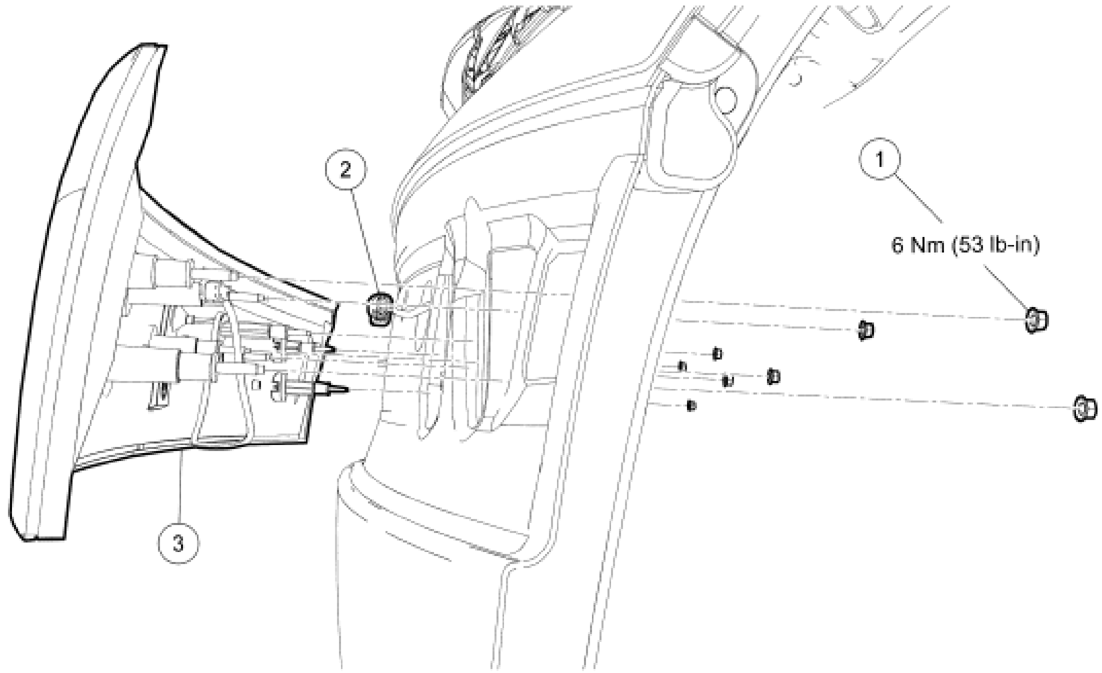


Fig. 136: Identifying Rear Lamp Assembly With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W704141	Liftgate lamp nuts (8 required)
2	-	Liftgate lamp electrical connector (part of 14A583)
3	13A565	Liftgate lamp

REMOVAL AND INSTALLATION

1. Remove the luggage trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Disconnect the liftgate lamp electrical connector.
3. Remove the 8 nuts and the liftgate lamp.
   - To install, tighten to 6 Nm (53 lb-in).
4. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Exterior Trim and Ornamentation - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Roof rack bolts	6	53
Spoiler nuts	6	53

REMOVAL AND INSTALLATION

RADIATOR GRILLE

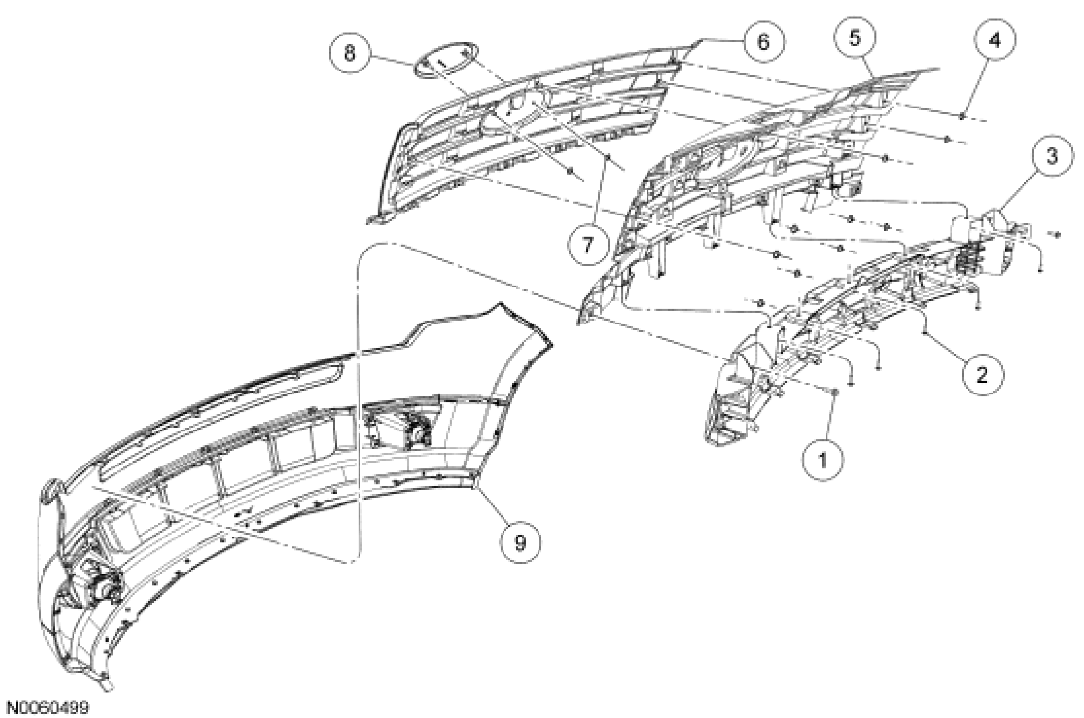


Fig. 1: Exploded View Of Edge Radiator Grille
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W506413-S	Isolator-to-bumper cover bolt (2 required)
2	W505003-S	Isolator-to-radiator grille reinforcement screw (5 required)
3	17E898	Isolator

4	N800488-S	Radiator grille reinforcement-to-radiator grille nut (11 required)
5	8A164	Radiator grille reinforcement
6	16A912	Radiator grille
7	N800488-S	Emblem retainer
8	8B262	Emblem
9	17D957	Front bumper cover

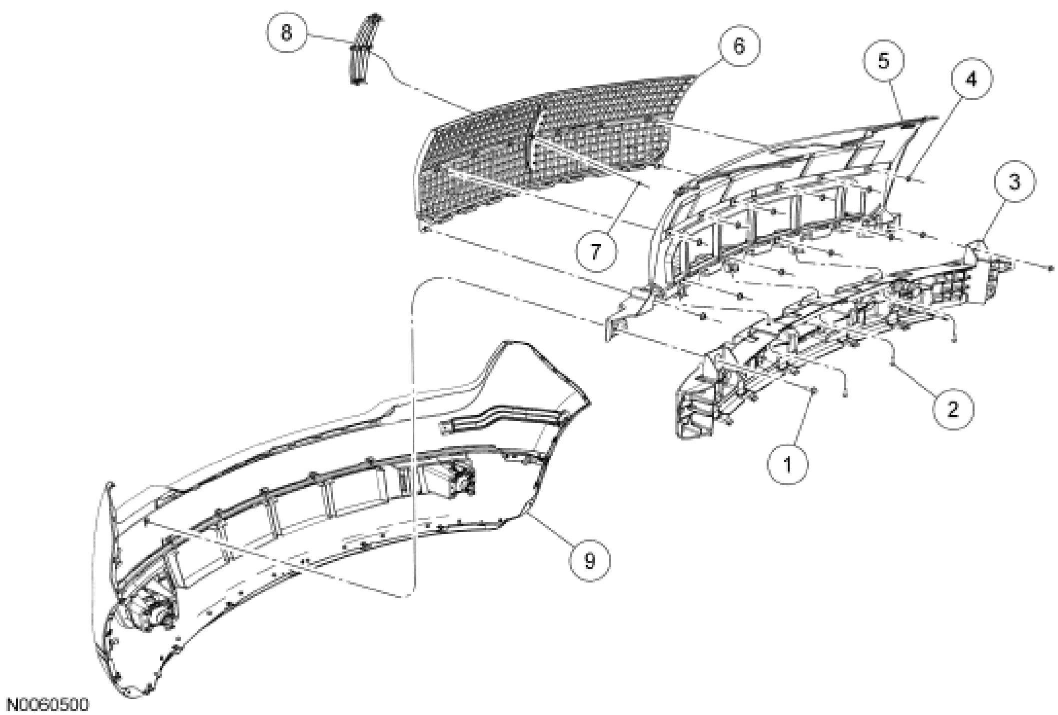


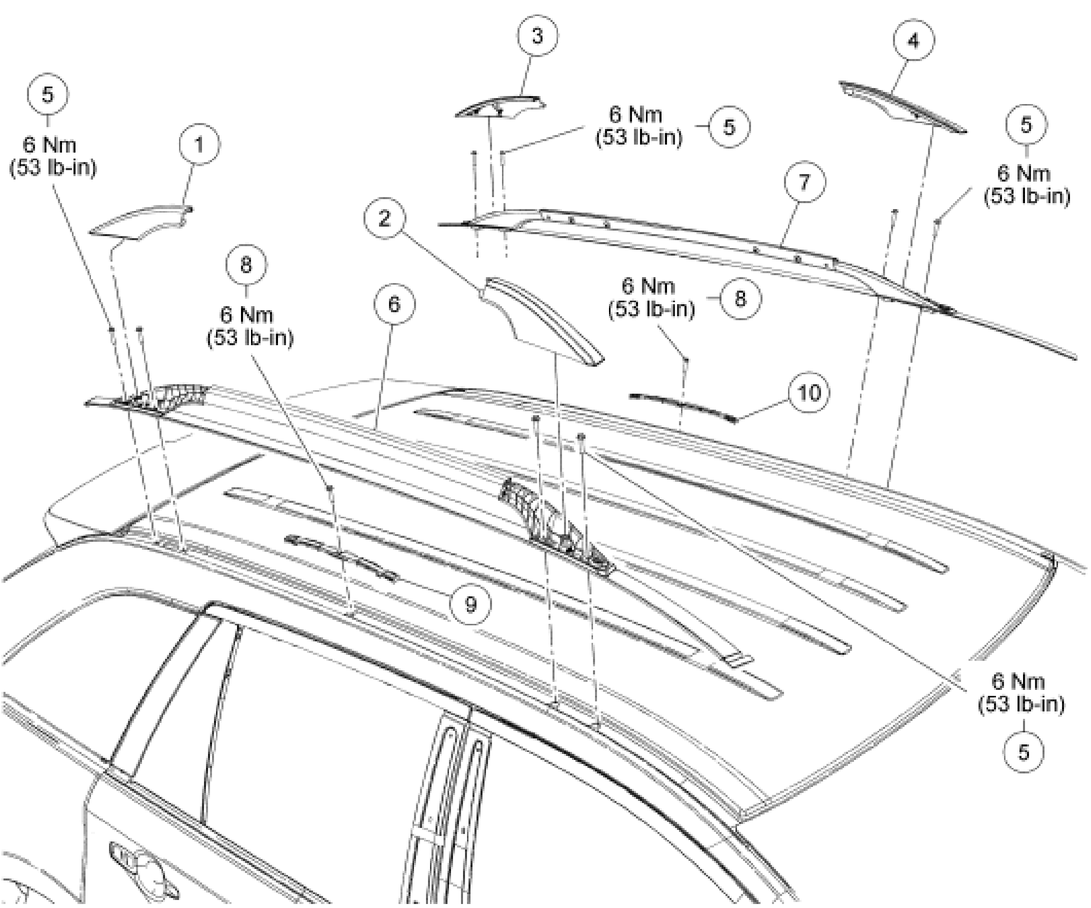
Fig. 2: Exploded View Of MKX Radiator Grille
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W506413-S	Isolator-to-bumper cover bolt (2 required)
2	W505003-S	Isolator-to-radiator grill reinforcement screw (3 required)
3	17E898	Isolator
4	N800488-S	Radiator grille reinforcement-to-radiator grille nut (12 required)
5	8A164	Radiator grill reinforcement
6	16A912	Radiator grille
7	-	Emblem retainer
8	8B262	Emblem
9	17D957	Bumper cover

REMOVAL AND INSTALLATION

1. Remove the front bumper cover. For additional information, refer to **BUMPERS** article.
2. Remove the isolator-to-bumper cover bolts.
3. Remove the isolator-to-radiator grille reinforcement screws.
4. Remove the isolator.
    - Release the isolator from the clips on the bumper cover.
5. Remove the radiator grille and radiator grille reinforcement.
    - Release the radiator grille reinforcement from the clips on the bumper cover.
6. Remove the radiator grille-to-radiator grille reinforcement nuts and remove the radiator grille.
7. To install, reverse the removal procedure.

ROOF RACK



N0060501

Fig. 3: Exploded View Of Roof Rack With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	551A92-3	Roof rack bolt cover rear (RH)
2	551A90-1	Roof rack bolt cover front (RH)
3	551A92-4	Roof rack bolt cover rear (LH)
4	551A90-2	Roof rack bolt cover front (LH)
5	W712668-S	Roof rack bolts (8 required)
6	55128-8	Roof rack side rail (RH)
7	55128-9	Roof rack side rail (LH)
8	W712668-S	Roof rack retainer bolts (2 required)
9	02684	Roof rack retainer (RH)
10	02684	Roof rack retainer (LH)

NOTE: LH shown, RH similar.

1. Remove the rear roof rack bolt cover.
   - Lift upward on the rear of the bolt cover and then pull rearward.

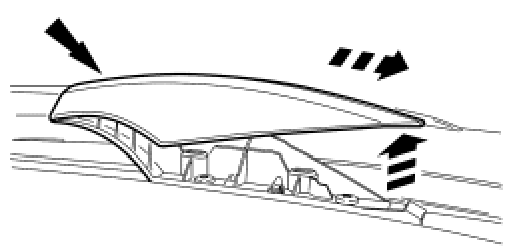


Fig. 4: Lifting Upward On Rear Of Bolt Cover & Pulling Rearward
Courtesy of FORD MOTOR CO.

2. Remove the front roof rack bolt cover.
   - Lift upward on the front of the bolt cover and then pull forward.

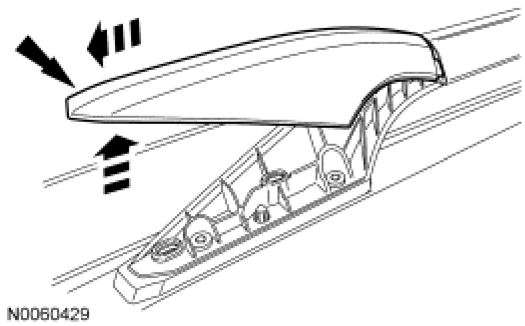


Fig. 5: Lifting Upward On Front Of Bolt Cover & Pulling Rearward
Courtesy of FORD MOTOR CO.

3. Remove the 2 front roof rack bolts.
   - To install, tighten to 6 N.m (53 lb-in).

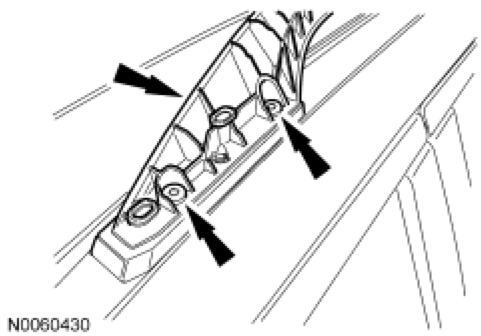


Fig. 6: Identifying Front Roof Rack Bolts
Courtesy of FORD MOTOR CO.

4. Remove the 2 rear roof rack bolts.
   - To install, tighten to 6 N.m (53 lb-in).

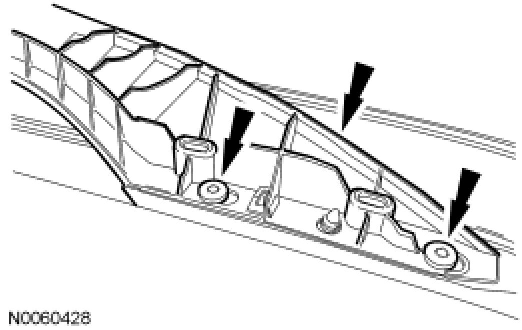


Fig. 7: Identifying Rear Roof Rack Bolts
Courtesy of FORD MOTOR CO.

NOTE: The roof rack side rail has a tab located at the front of the ditch moulding

and it is installed under the windshield moulding. When installing the roof rack side rail, start at the front of the vehicle and work toward the rear.

5. Remove the roof rack side rail.
   - Start at the rear of the roof rack side rail working toward the front of the vehicle.

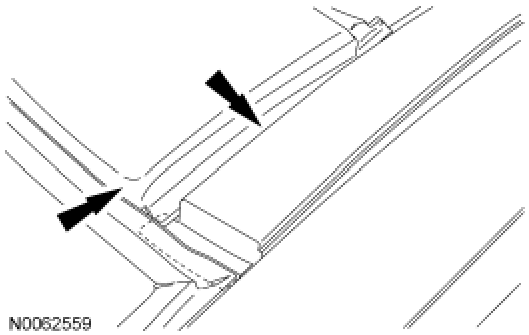


Fig. 8: Identifying Roof Rack Side Rail
Courtesy of FORD MOTOR CO.

6. To install, reverse the removal procedure.
   - The 4 roof rack bolts are installed in a specific order starting with the front bolt and working toward the rear of the vehicle. The bolts must be installed in that order to make sure the roof rack side rail is correctly aligned.

SPOILER

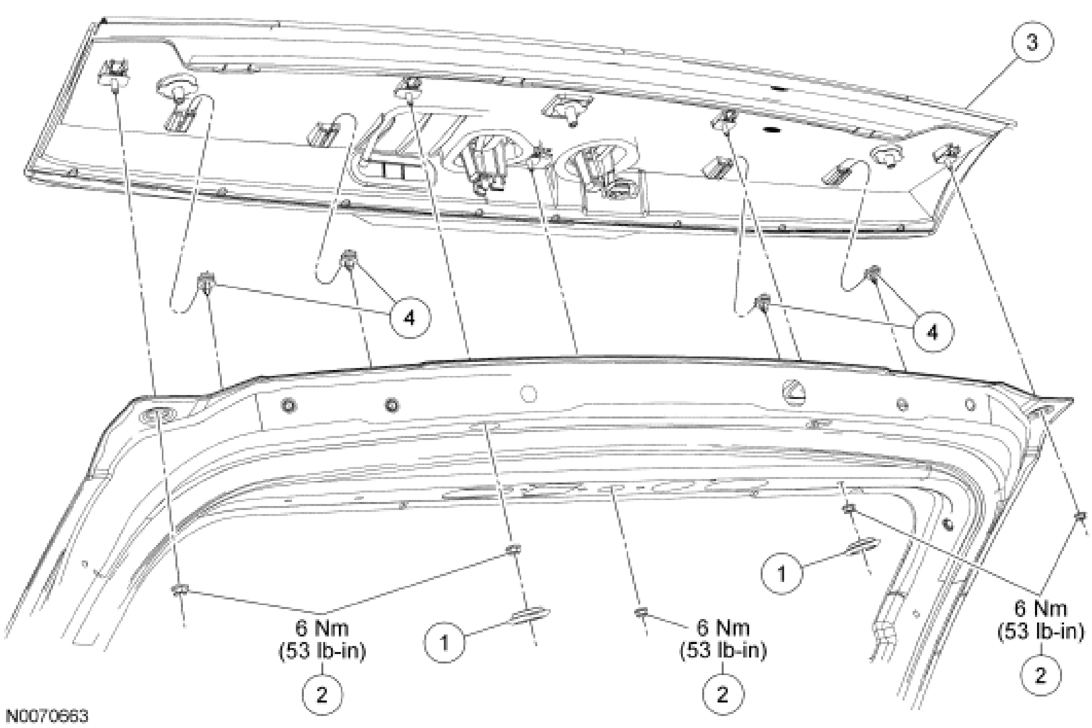


Fig. 9: Exploded View Of Spoiler With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W651016-S	Spoiler nut covers (2 required)
2	W621926-S	Spoiler nuts (5 required)
3	010807	Spoiler
4	7841602	Spoiler retainers (4 required)

1. Remove the liftgate trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Disconnect the electrical connector and the rear windshield washer hose from the rear spoiler.

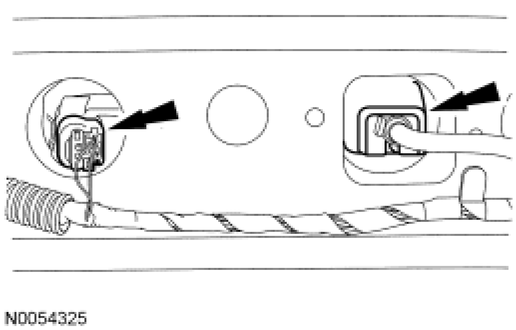


Fig. 10: Identifying Electrical Connector & Rear Windshield Washer Hose
Courtesy of FORD MOTOR CO.

3. Remove the 5 rear spoiler nuts.
    - Remove the 2 nut covers.
    - Remove the 5 nuts.
    - To install, tighten to 6 Nm (53 lb-in).

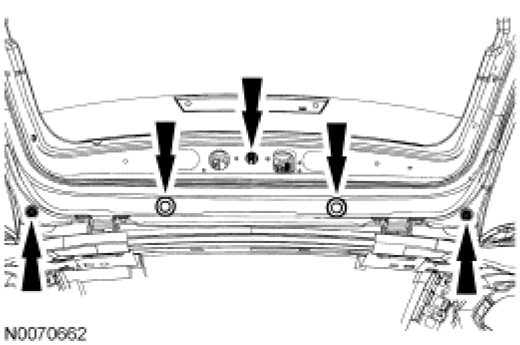


Fig. 11: Locating Rear Spoiler Nuts
Courtesy of FORD MOTOR CO.

4. Place a piece of tape on the liftgate to protect the paint.

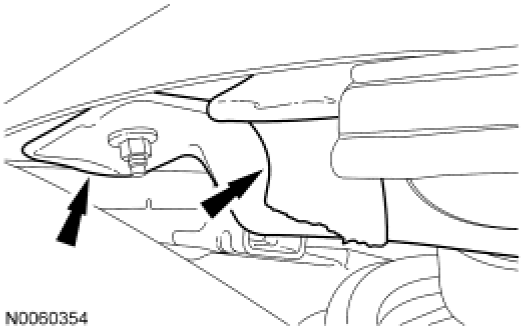


Fig. 12: Placing A Piece Of Tape On Liftgate To Protect Paint
Courtesy of FORD MOTOR CO.

NOTE: **There are 4 pin-type retainers on the bottom of the spoiler. When removing the spoiler it is difficult to access the retainers to release them from the liftgate. It may be necessary to pry upward on the rear spoiler to release it from the retainers. Do not pry on the window.**

5. Remove the rear spoiler.
   - Place a pry bar between the liftgate and the spoiler.

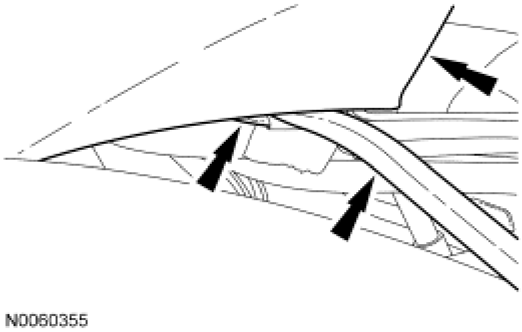


Fig. 13: Placing A Pry Bar Between Liftgate & Spoiler
Courtesy of FORD MOTOR CO.

6. To install, reverse the removal procedure.
   - Replace any retainers broken during removal.

ROCKER PANEL MOULDING

NOTE: **RH shown, LH similar.**

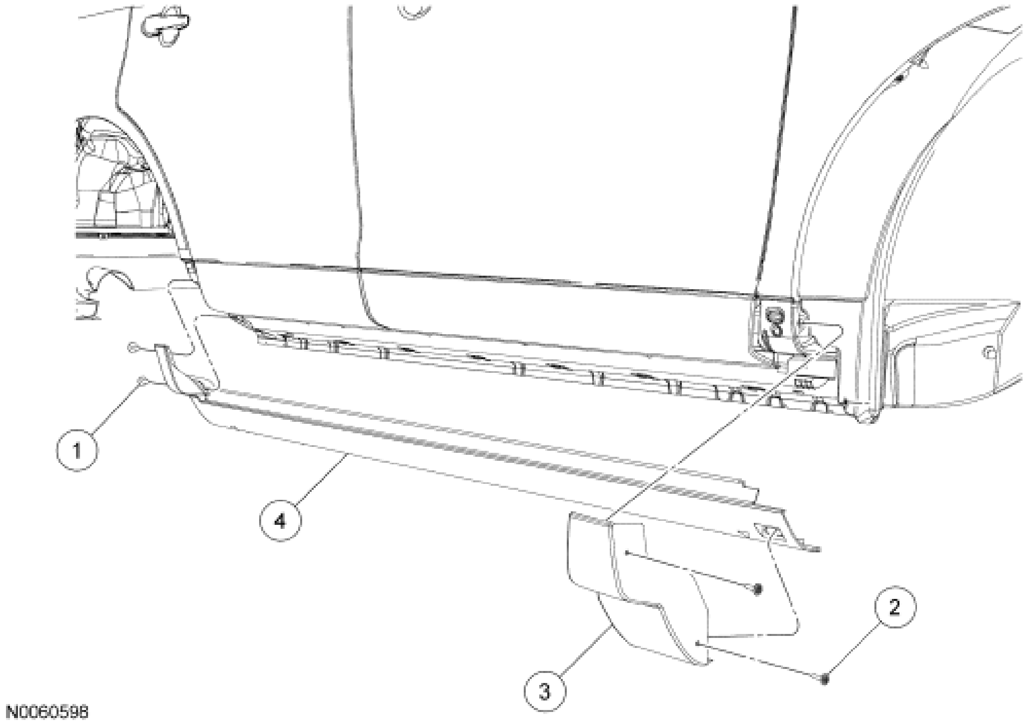


Fig. 14: Exploded View Of Rocker Panel Moulding
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W706805-S	Rocker panel moulding rear screw (2 required)
2	W706805-S	Rocker panel moulding cap front screw (2 required)
3	7810154 RH/ 7810155 LH	Rocker panel moulding cap
4	78101A04 RH/ 78101A05 LH	Rocker panel moulding

1. Remove the rocker panel moulding front cap.
   - Remove the 2 screws.
   - Remove the front cap.

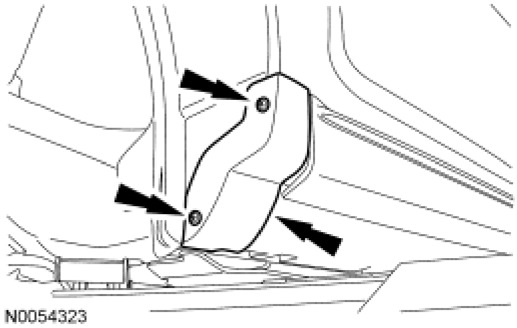


Fig. 15: Identifying Rocker Panel Molding End Cap & Screws
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

2. Remove the 2 screws from the rocker panel moulding inside the rear wheelhouse.

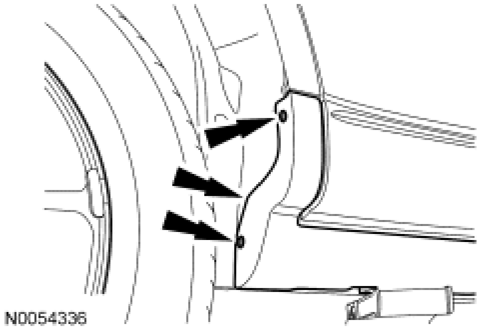


Fig. 16: Identifying Screws From Rocker Panel Moulding Inside Rear Wheelhouse
Courtesy of FORD MOTOR CO.

3. Open the front and rear doors.
4. Release the retainers on the bottom of the rocker panel moulding.

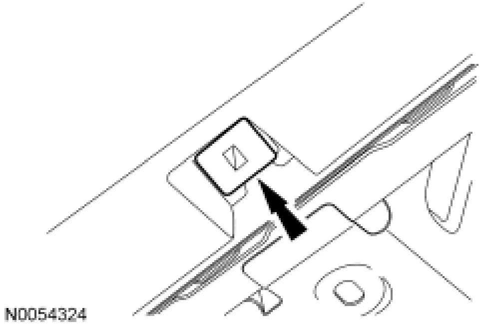


Fig. 17: Identifying Retainers On Bottom Of Rocker Panel Moulding
Courtesy of FORD MOTOR CO.

5. Pull outward to release the rocker panel moulding from the body, starting from the front of the vehicle moving rearward.
6. To install, reverse the removal procedure.

2008 BRAKES

Front Disc Brake - Edge & MKX

SPECIFICATIONS

MATERIAL SPECIFICATIONS

Item	Specification	Fill Capacity
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1	803-821 ml (1.70-1.74 pt)
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A	-
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-	-

GENERAL SPECIFICATIONS

Item	Specification
Brake disc minimum thickness	26 mm (1.023 in)
Brake pad maximum taper wear (in any direction)	3.0 mm (0.118 in)
Brake pad minimum thickness	3.0 mm (0.118 in)

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Bleeder screw	8	-	71
Brake caliper anchor plate bolts	133	98	-
Brake caliper flow bolt	25	18	-
Brake caliper guide pin bolts	88	65	-
Brake flexible hose bracket bolt	20	15	-
Brake tube fitting	17	13	-

DESCRIPTION AND OPERATION

FRONT DISC BRAKE

The front brake disc system consists of the following components:

- Brake caliper anchor plate
- Brake caliper
- Brake disc
- Brake disc shield

- Brake flexible hose

When mechanical force is applied by the driver to the brake pedal, the force is converted into hydraulic pressure by the master cylinder. The hydraulic force is directed to the disc brake calipers and transferred to the brake pads. The brake pads are then forced against the brake friction surfaces by the brake caliper pistons. The friction of the brake pads on the brake disc causes the slowing of wheel rotation and the vehicle.

DIAGNOSTIC TESTS

FRONT DISC BRAKE

Refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

BRAKE PADS

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

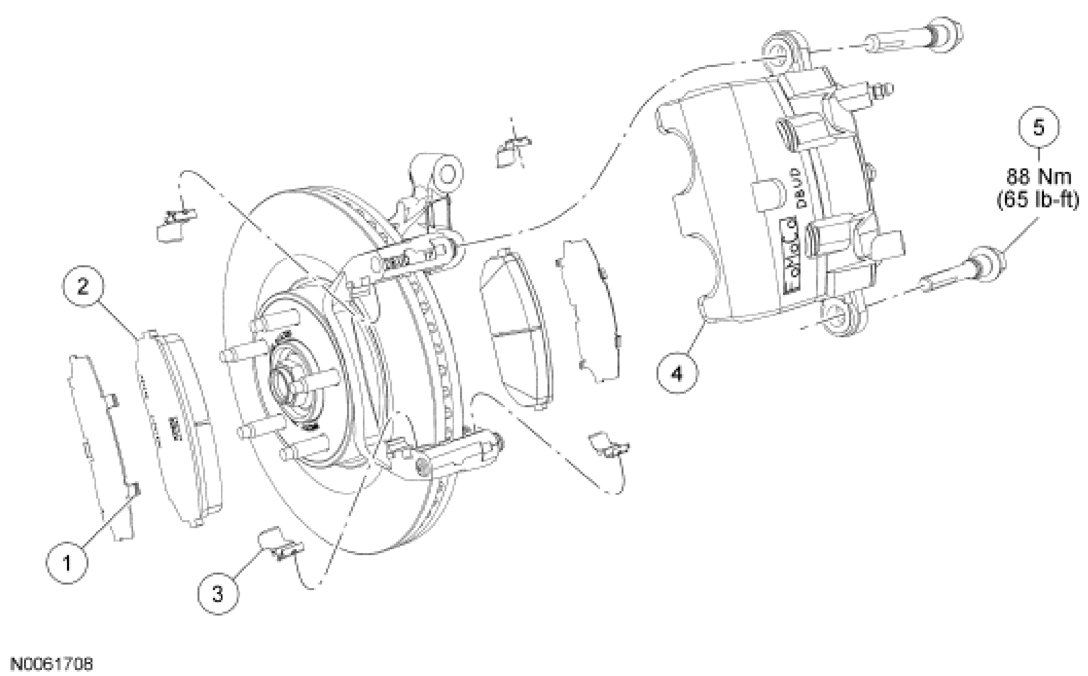


Fig. 1: Exploded View Of Brake Pads With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Stainless steel shim (2 required) (part of 2001)
2	2001	Brake pad (2 required)
3	-	Brake pad slide (4 required) (part of 2001)
4	2B120 RH/ 2B121 LH	Brake caliper
5	2C150	Brake caliper guide pin bolt (2 required)

REMOVAL

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always install new brake shoes or pads at both ends of an axle to reduce the possibility of brakes pulling vehicle to one side. Failure to follow this instruction may result in uneven braking and serious personal injury.**

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Check the brake fluid level in the brake master cylinder reservoir.
   - If required, remove the fluid until the brake master cylinder reservoir is 1/2 full.
2. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

   CAUTION: Do not pry in the caliper sight hole to retract the pistons as this can damage the pistons and boots.

   CAUTION: Do not allow the brake caliper to hang from the brake hose or damage to the hose can occur.

3. Remove the 2 brake caliper guide pin bolts and position the caliper aside.
   - Support the caliper using mechanic's wire.

4. Remove the brake pads, brake pad shims and stainless steel shims.
   - Inspect the brake pads and shims for wear or contamination.
5. Remove the brake pad slides.

INSTALLATION

CAUTION: Protect the caliper pistons and boots when pushing the caliper piston into the caliper piston bores or damage to components may occur.

CAUTION: Make sure that the caliper guide pin boots are fully seated or damage to the caliper guide pin boots can occur.

1. If installing new brake pads, using a suitable tool and a worn brake, compress the disc brake caliper pistons into the caliper.

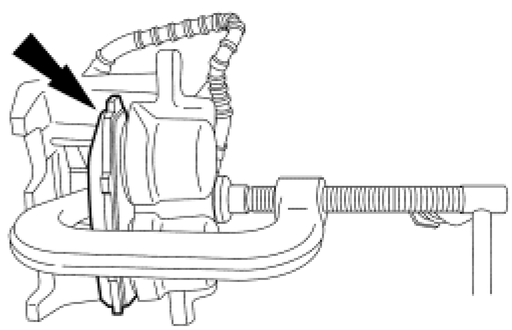


Fig. 2: Compressing Brake Caliper Pistons Into Caliper
Courtesy of FORD MOTOR CO.

2. Install the brake pad slides.
3. Apply a thin coating of the supplied grease to the shims and the shim contact area of the brake pads.
4. Install the stainless steel shims to the brake pads.

NOTE: The guide pin bolts are different sizes. The longer/bigger bolt is the upper guide pin bolt.

5. Position the brake caliper and install the 2 guide pin bolts.
   - Tighten to 88 Nm (65 lb-ft).
6. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
7. Fill the brake master cylinder reservoir with clean, specified brake fluid.
   - Apply brakes several times to verify correct brake operation.

BRAKE CALIPER

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

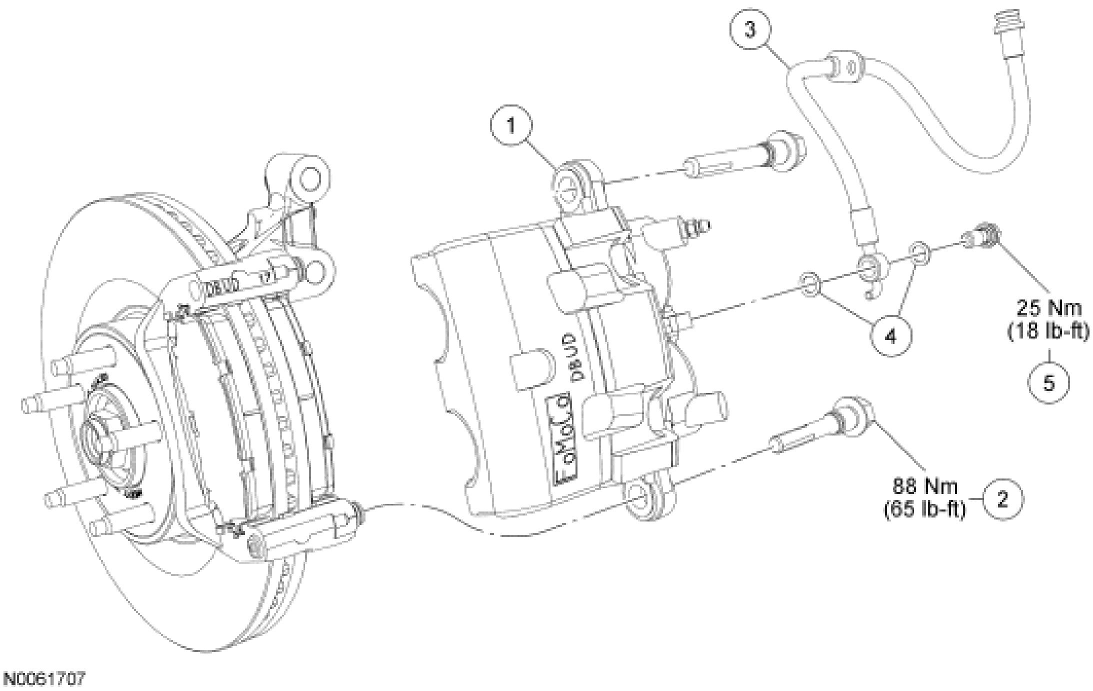


Fig. 3: Exploded View Of Brake Caliper With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2B120 RH/ 2B121 LH	Brake caliper
2	2C150	Brake caliper guide bolt (2 required)
3	2078 RH/ 2B557 LH	Front brake hose
4	W711784	Copper washers (2 required)
5	2M085	Brake caliper flow bolt

REMOVAL AND INSTALLATION

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
2. Remove the brake caliper flow bolt and position the hose aside.
   - Discard the 2 copper washers.
   - To install, tighten to 25 Nm (18 lb-ft).
   - Install new copper washers.

NOTE: The guide pin bolts are different sizes. The longer/bigger bolt is the upper guide pin bolt.

3. Remove the 2 brake caliper guide pin bolts.
   - To install, tighten to 88 Nm (65 lb-ft).
4. Remove the brake caliper.

NOTE: During installation, make sure that the brake caliper hose is not twisted.

5. To install, reverse the removal procedure.
   - Bleed the brake system. For additional information, refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.

BRAKE CALIPER ANCHOR PLATE

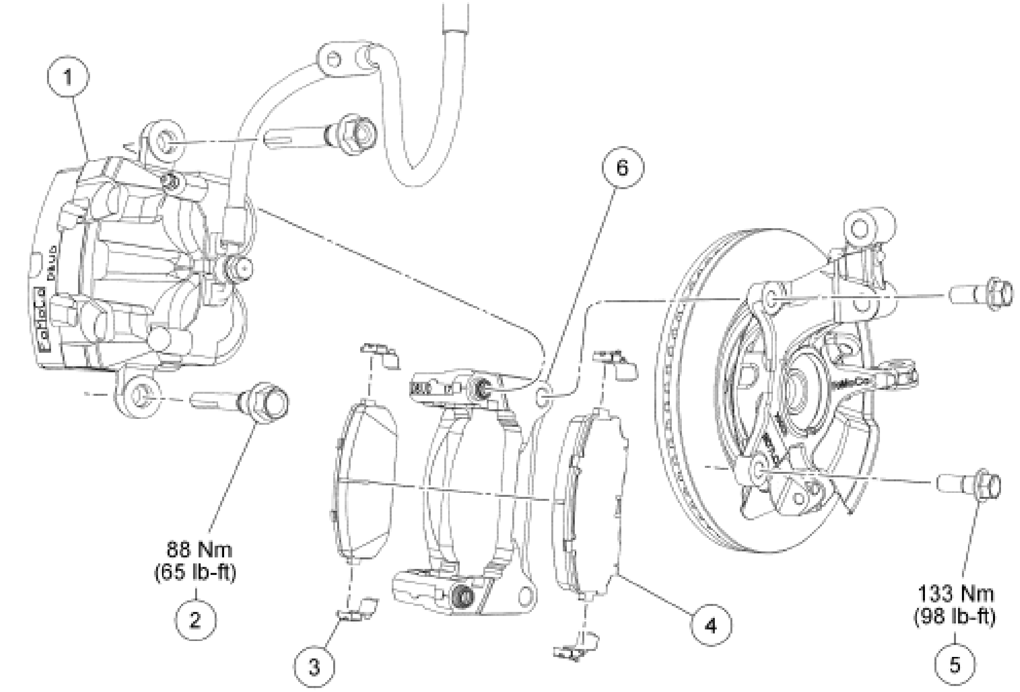


Fig. 4: Exploded View Of Brake Caliper Anchor Plate With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2B120 RH/ 2B121 LH	Brake caliper
2	2C150	Brake caliper guide pin bolt (2 required)
3	-	Brake pad slide (4 required) (part of 2001)
4	2001	Brake pad (2 required)
5	2248	Brake caliper anchor plate bolt (2 required)
6	2B292 RH/ 2B293 LH	Brake caliper anchor plate

REMOVAL AND INSTALLATION

1. Check the brake fluid level in the brake master cylinder reservoir.
    - If required, remove the fluid until the brake master cylinder reservoir is 1/2 full.
2. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

CAUTION: Do not pry in the caliper sight hole to retract the pistons as this can damage the pistons and boots.

CAUTION: Do not allow the brake caliper to hang from the brake hose or damage to the hose can occur.

3. Remove the 2 brake caliper guide pin bolts and position the caliper aside.
    - Support the caliper using mechanic's wire.
    - To install, tighten to 88 Nm (65 lb-ft).
4. Remove the brake pads, brake pad shims and stainless steel shims.
5. Remove the brake pad slides.
6. Remove the 2 brake caliper anchor plate bolts and the anchor plate.
    - To install, tighten to 133 Nm (98 lb-ft).
7. To install, reverse the removal procedure.
    - Apply brakes several times to verify correct brake operation.

BRAKE DISC

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-

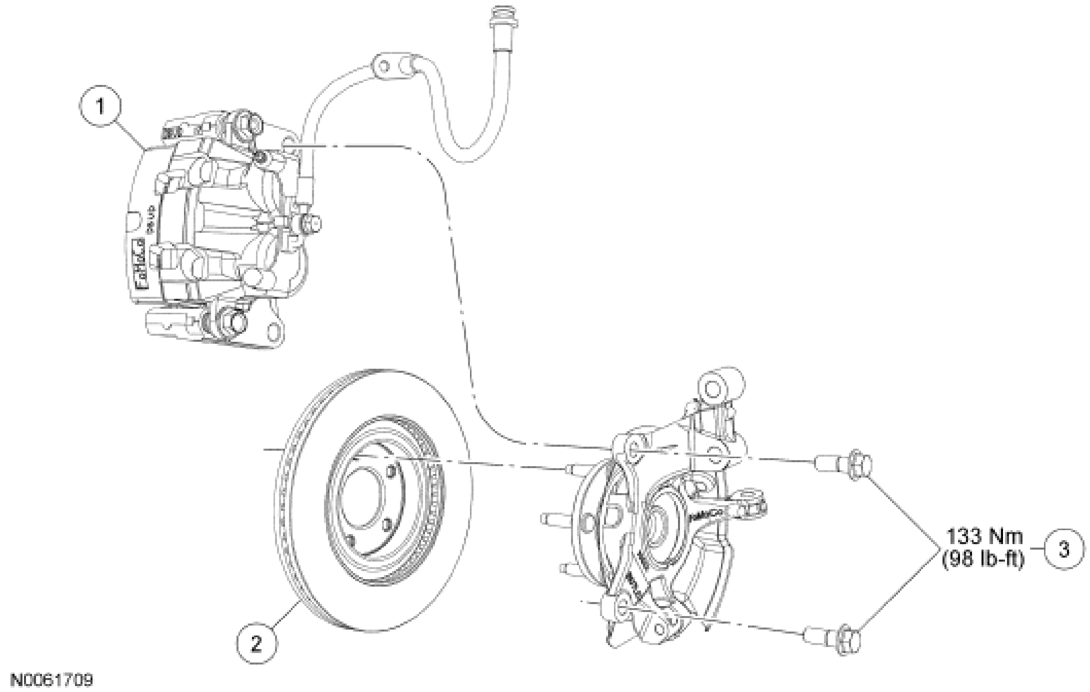


Fig. 5: Exploded View Of Brake Disc With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Brake caliper and anchor plate assembly
2	1032	Brake disc
3	2248	Brake caliper anchor plate bolts (2 required)

REMOVAL

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

CAUTION: Do not allow the brake caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.

2. Remove the brake caliper anchor plate bolts and position the brake caliper and anchor plate assembly aside.
   - Support the caliper and anchor plate assembly using mechanic's wire.
3. Remove the brake disc.

INSTALLATION

1. Clean and dry the brake disc-to-wheel hub mounting surface and apply a thin coat of anti-seize where indicated.

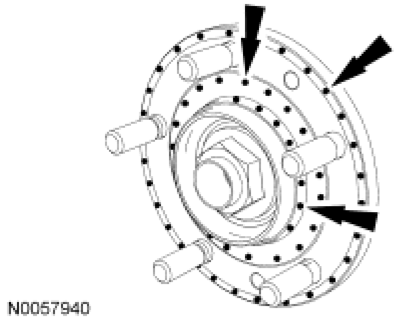


Fig. 6: Locating Brake Disc Screws
Courtesy of FORD MOTOR CO.

NOTE: Make sure the brake disc is clean and free of any foreign material.

2. Install the brake disc.
3. Position the brake caliper and anchor plate assembly and install the brake caliper anchor plate bolts.
   - Tighten to 133 Nm (98 lb-ft).
4. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
   - Apply brakes several times to verify correct brake operation.

BRAKE DISC SHIELD

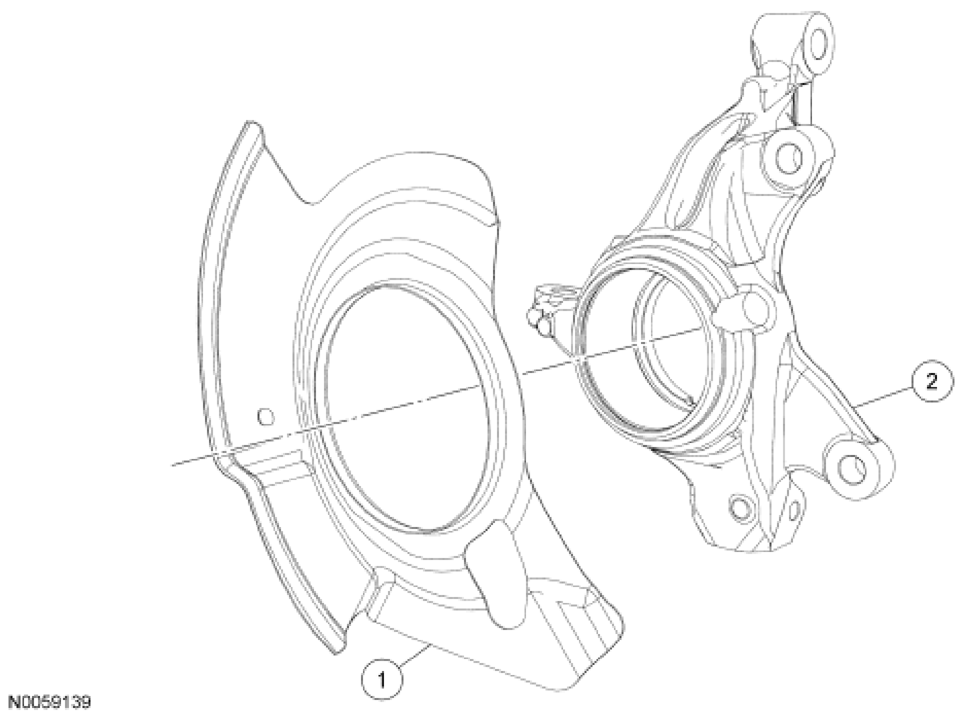
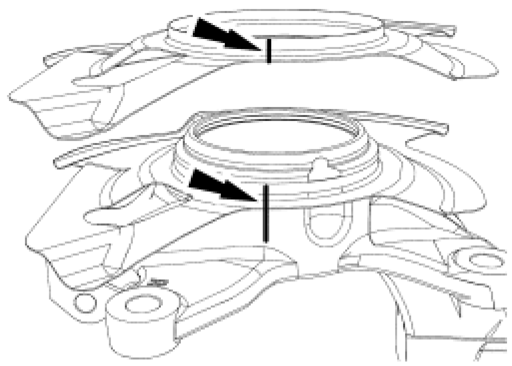


Fig. 7: Exploded View Of Brake Disc Shield
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2K005 LH/ 2K004 RH	Brake disc shield
2	3K186 LH/ 3K185 RH	Wheel knuckle

REMOVAL

1. Remove the wheel bearing and wheel hub. For additional information, refer to **FRONT SUSPENSION** article.
2. Index-mark the brake disc shield to the wheel knuckle, then align the new brake disc shield to the existing shield and transfer the index mark.



N0059140

Fig. 8: Locating Index-Mark On Brake Disc Shield
Courtesy of FORD MOTOR CO.

3. Cut the brake disc shield and remove it from the wheel knuckle.

INSTALLATION

1. Position the brake disc shield onto the wheel knuckle.
2. Align the index marks and install the brake disc shield onto the wheel knuckle.
3. Install the wheel bearing and wheel hub. For additional information, refer to **FRONT SUSPENSION** article.

BRAKE FLEXIBLE HOSE

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

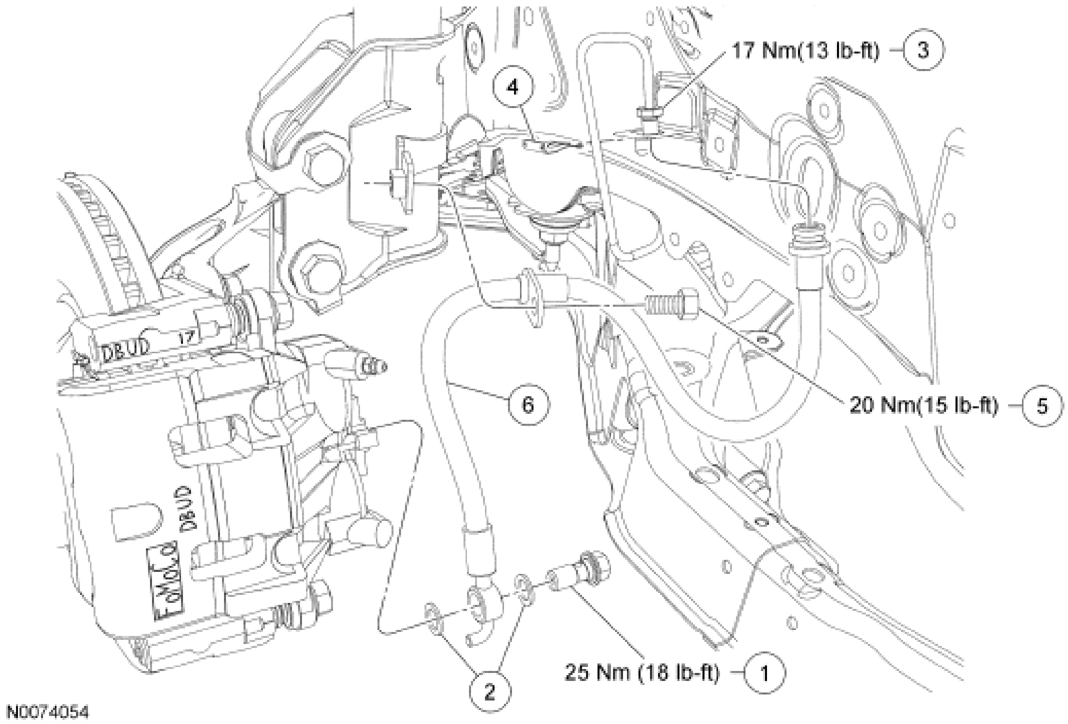


Fig. 9: Identifying Brake Flexible Hose With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2K573	Brake caliper flow bolt
2	W711784	Copper washers (2 required)
3	-	Brake tube fitting (part of 2263 RH/2264 LH)
4	2B223	Brake flexible hose retaining clip
5	W708004	Brake flexible hose bracket bolt
6	2078	Brake flexible hose

REMOVAL AND INSTALLATION

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure**

to follow these instructions may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the brake caliper flow bolt and discard the 2 copper washers.
    - To install, tighten to 25 Nm (18 lb-ft).
    - Install new copper washers.
2. Disconnect the brake tube fitting from the brake flexible hose.
    - To install, tighten to 17 Nm (13 lb-ft).
3. Remove the brake flexible hose retaining clip.
4. Remove the brake flexible hose bracket bolt and the brake flexible hose.
    - To install, tighten to 20 Nm (15 lb-ft).
5. To install, reverse the removal procedure.
    - Bleed the brake system. For additional information, refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.

2008 ACCESSORIES & BODY, CAB

Front End Body Panels - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Cowl grille panel extension bolts	6	-	53
Fender cowl bolt	9	-	80
Front fender bolts	9	-	80
Fender-to-stud nut	9	-	80
Hood hinge-to-body bolts	12	9	-
Hood hinge-to-hood bolts	23	17	-
Hood latch bolts	10	-	89
Hood striker bolts	11	8	-
Lower cowl grille panel bolts	9	-	80
Lower cowl panel-to-front of dash bolt	20	15	-
Lower fender bolt	9	-	80
Upper cowl grille panel bolts	6	-	53
Upper fender bolts	9	-	80
Upper rear fender bolt	9	-	80
Wiper mounting arm and pivot shaft assembly bolts	7	-	62
Wiper pivot arm nuts	20	15	-

REMOVAL AND INSTALLATION

FRONT END BODY PANELS - EXPLODED VIEW

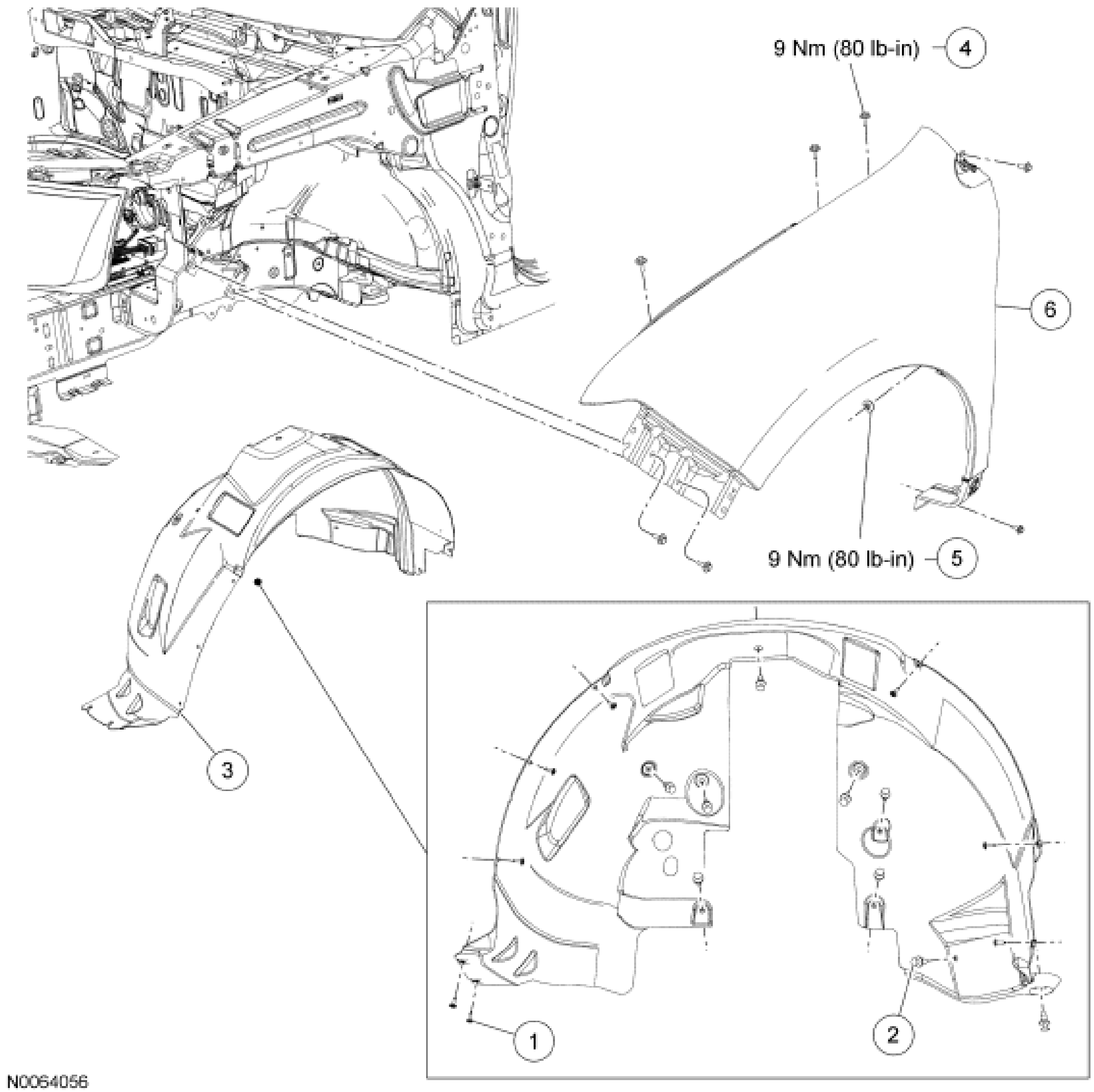


Fig. 1: Exploded View Of Front End Body Panels With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W706805	Splash shield screw (8 required)
2	W712196	Splash shield pin-type retainer (10 required)
3	16054 RH/ 16055 LH	Splash shield
4	W505421	Fender bolt (7 required)
5	W709603	Fender rear nut
6	16015 RH/ 16016 LH	Fender

1. For additional information, refer to the procedures in this article.

FENDER

REMOVAL AND INSTALLATION

1. Remove the 2 screws and the rocker panel moulding end cap.

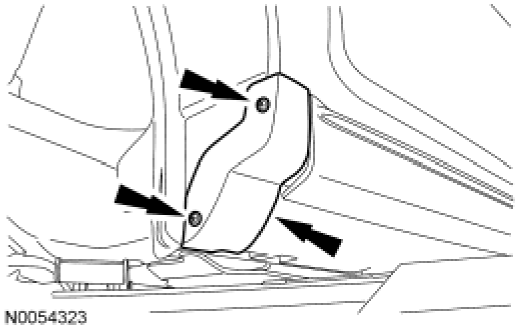


Fig. 2: Identifying Rocker Panel Molding End Cap & Screws
Courtesy of FORD MOTOR CO.

2. Remove the front fender splash shield. For additional information, refer to **Fender Splash Shield**.
3. Remove the lower fender bolt.
   - To install, tighten to 9 N.m (80 lb-in).

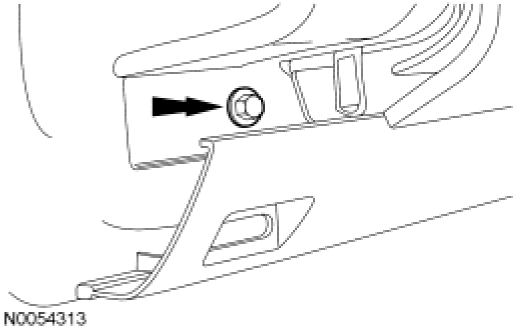


Fig. 3: Locating Lower Fender Bolt
Courtesy of FORD MOTOR CO.

4. Remove the nut from the stud inside the fender well.
   - To install, tighten to 9 N.m (80 lb-in).

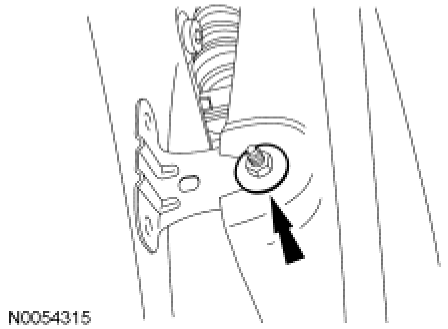


Fig. 4: Identifying Stud Inside Fender Well
Courtesy of FORD MOTOR CO.

CAUTION: The front bumper cover may be damaged if pulled outward too far while trying to access the bolts.

5. Remove the front fender bolts.
    - Remove the front bumper cover corner.
    - Remove the bolts.
        - To install, tighten to 9 N.m (80 lb-in).

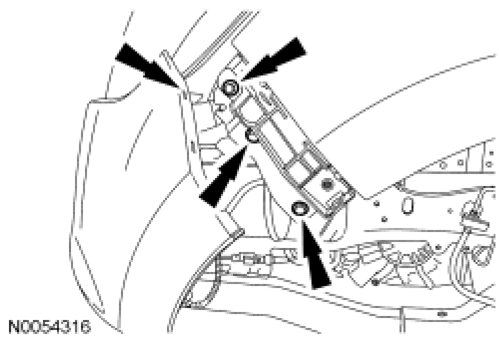


Fig. 5: Locating Front Bumper Cover Corner & Bolts
Courtesy of FORD MOTOR CO.

6. Remove the upper rear fender bolt cover.

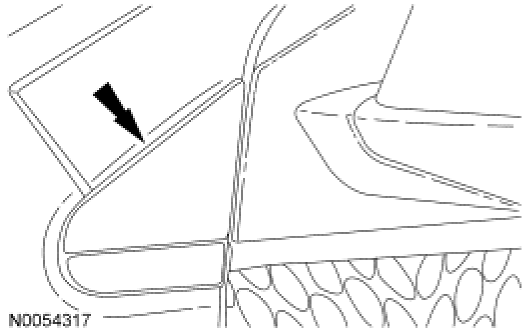


Fig. 6: Locating Upper Rear Fender Bolt Cover
Courtesy of FORD MOTOR CO.

7. Remove the upper rear fender bolt.
    - To install, tighten to 9 N.m (80 lb-in).

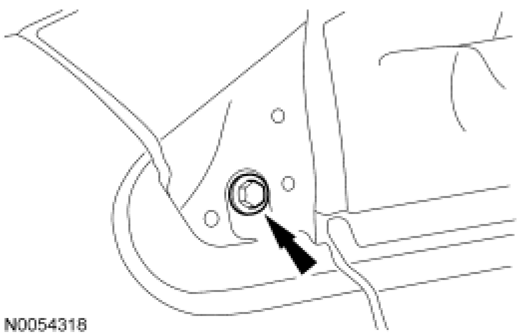


Fig. 7: Locating Upper Rear Fender Bolt
Courtesy of FORD MOTOR CO.

8. Remove the 2 upper fender bolts.
    - To install, tighten to 9 N.m (80 lb-in).

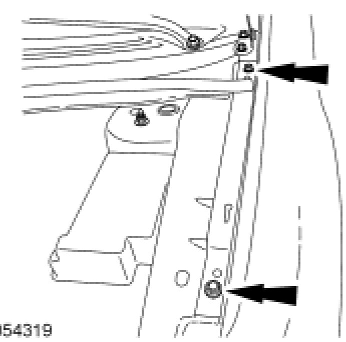


Fig. 8: Locating Upper Fender Bolts
Courtesy of FORD MOTOR CO.

9. Remove the fender cowl bolt.
    - Position the cowl cover aside.
    - Remove the bolt.
        - To install, tighten to 9 N.m (80 lb-in).

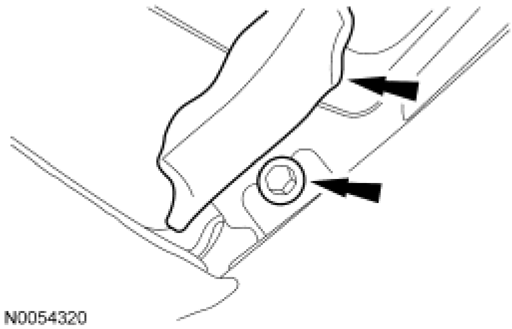


Fig. 9: Locating Fender Cowl Bolt
Courtesy of FORD MOTOR CO.

10. Remove the front fender.
11. To install, reverse the removal procedure.
    - If necessary, transfer parts.

FENDER SPLASH SHIELD

REMOVAL AND INSTALLATION

1. Remove the fender splash shield screws.
2. Remove the fender splash shield pin-type retainers.
3. To install, reverse the removal procedure.

COWL PANEL GRILLE

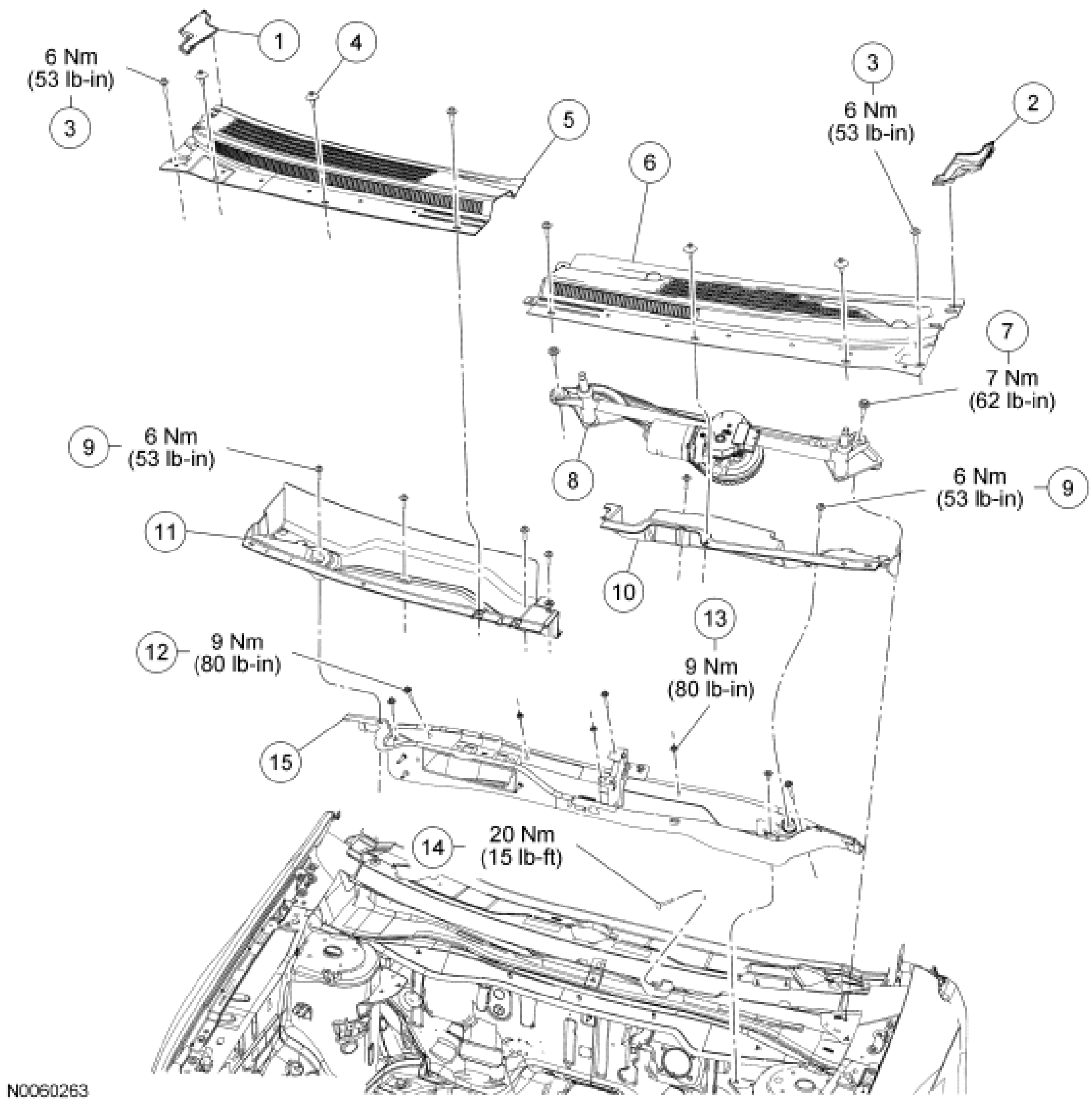


Fig. 10: Exploded View Of Cowl Panel Grille With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	020A26	RH cowl side outer panel
2	020A27	LH cowl side outer panel
3	W712648	Upper cowl grille panel screws (4 required)
4	N804837	Upper cowl grille panel scrivet (4 required)
5	02222	RH upper cowl panel
6	02223	LH upper cowl panel
7	17526	Wiper pivot arm assembly bolt (2 required)

8	17508B	Wiper pivot arm assembly
9	W707257	Cowl panel extension bolts (6 required)
10	021A37	LH cowl panel extension
11	W707257	RH cowl panel extension
12	W710593	Lower cowl panel bolt (5 required)
13	W702751	Lower cowl panel nut (3 required)
14	W710309	Lower cowl panel-to-front of dash bolt
15	02106	Lower cowl panel

Upper and lower cowl grille panel

NOTE: The upper cowl panel grille must be removed before the lower cowl panel grille can be removed.

1. Remove the LH and RH wiper pivot arms. For additional information, refer to **WIPERS AND WASHERS** article.

   Upper cowl panel grille

2. Remove the RH cowl side outer panel.
3. Remove the LH cowl side outer panel.
4. Remove the 2 scrivets from the RH upper cowl panel grille.
5. Remove the 2 bolts from the RH upper cowl grille panel and remove the RH upper cowl grille panel.
   - To install, tighten to 6 N.m (53 lb-in).
6. Remove the 2 scrivets from the LH upper cowl grille panel.
7. Remove the 2 bolts from the LH upper cowl grille panel and remove the LH upper cowl grille panel.
   - To install, tighten to 6 N.m (53 lb-in).

   Lower cowl panel grille

8. Remove the wiper arm and wiper pivot shaft assembly.
   - Disconnect the electrical connector.
   - Remove the 2 bolts.
     - To install, tighten to 7 N.m (62 lb-in).
9. Remove the 2 bolts from the upper left lower cowl grille panel extension and remove the panel.
   - To install, tighten to 6 N.m (53 lb-in).
10. Remove the 4 bolts from the upper right lower cowl panel extension and remove the panel.
    - To install, tighten to 6 N.m (53 lb-in).
11. Disconnect the wiring harness from the retainer on the left front of the lower cowl grille panel.

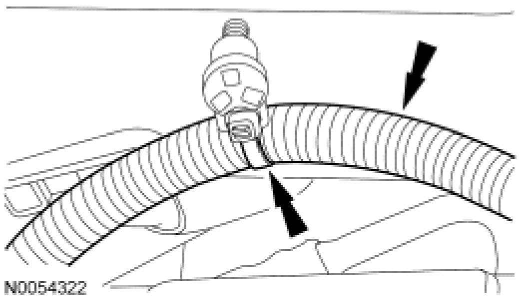


Fig. 11: Identifying Wiring Harness From Retainer
Courtesy of FORD MOTOR CO.

12. Disconnect the electrical connectors from the PCM.

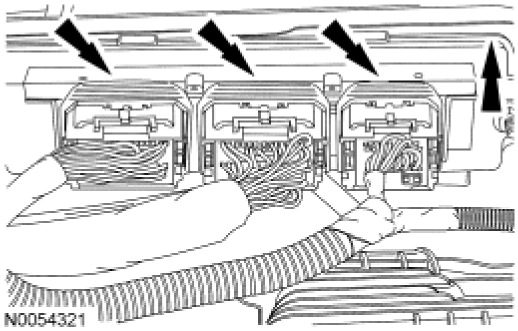


Fig. 12: Identifying Electrical Connectors From PCM
Courtesy of FORD MOTOR CO.

13. Remove the evaporative purge valve and bracket from the center of the lower cowl panel grille and set aside.
14. Remove the 5 bolts and 3 nuts from inside the lower cowl grille panel.
    - To install, tighten to 9 N.m (80 lb-in).
15. Remove the bolt from the lower cowl panel-to-front of dash.
    - To install, tighten to 20 N.m (15 lb-ft).
16. Remove the lower cowl grille panel and PCM from the vehicle.

Upper and lower cowl grille panel

CAUTION: Incorrect installation of the lower/upper cowl panel grille may cause damage to the windshield. Make sure the cowl panel grille clips are located under the windshield prior to installation.

17. To install, reverse the removal procedure.
    - Transfer the components as necessary.
    - Adjust the pivot arms. For additional information, refer to **WIPERS AND WASHERS** article.

2008 SUSPENSION

Front Suspension - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Brake caliper anchor plate bolt	133	98	-
Brake flexible hose bracket bolt	20	15	-
Driveshaft bolts	70	52	-
Engine roll restrictor heat shield nut	11	8	-
Engine roll restrictor-to-subframe bolt	103	76	-
Exhaust flexible pipe nuts	40	30	-
Front lower bumper-to-subframe nuts	9	-	80
Halfshaft nut	275	203	-
Lower arm-to-frame forward bolt	150	111	-
Lower arm-to-frame rearward bolt	80	59	-
Lower ball joint nut	55	41	-
Lower steering shaft coupler bolt	25	18	-
Outer tie-rod end nuts	48	35	-
Power steering fluid cooler hose bracket bolt	9	-	80
Steering shaft coupler bolt	25	18	-
Shock absorber lower nuts	225	166	-
Shock absorber rod nut	115	85	-
Shock absorber upper mount nuts	30	22	-
Stabilizer bar bracket bolts	63	46	-
Stabilizer bar link upper and lower nuts	90	66	-
Subframe nuts	133	98	-
Subframe support bracket bolts	90	66	-
Subframe support bracket nuts	133	98	-
Wheel speed sensor bolt	7	-	62
Y-pipe clamp	40	30	-

DESCRIPTION AND OPERATION

FRONT SUSPENSION

The front suspension consists of the following components:

- Wheel bearings
- Wheel hubs

- Wheel studs
- Lower arms
- Stabilizer bar
- Stabilizer bar brackets
- Stabilizer bar bushings
- Stabilizer bar links
- Shock absorber and spring assemblies
- Wheel knuckles

The front suspension system incorporates a strut assembly that takes the place of the upper arm and ball joint. The strut carries out the function of a shock absorber and is encompassed by a coil spring. The strut and spring assembly supports the weight of the vehicle and is also the pivot point for the steering spindle. This system uses a lower control arm and ball joint for the lower (unloaded) pivot point of the steering wheel knuckle. The stabilizer bar and links are included to control lean/sway during turns.

DIAGNOSTIC TESTS

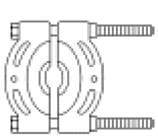
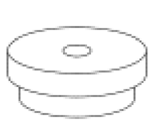
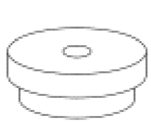
FRONT SUSPENSION

Refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

WHEEL BEARING AND WHEEL HUB

Special Tools

Illustration	Tool Name	Tool Number
 ST1895-A	Pinion Bearing Cone Remover	205-D002 (D79L-4621-A) or equivalent
 ST2446-A	Installer, Wheel Hub Bearing Cup	205-147
 ST2446-A	Remover/Installer, Wheel Hub Cup	204-020

	Stop Plate	205-117

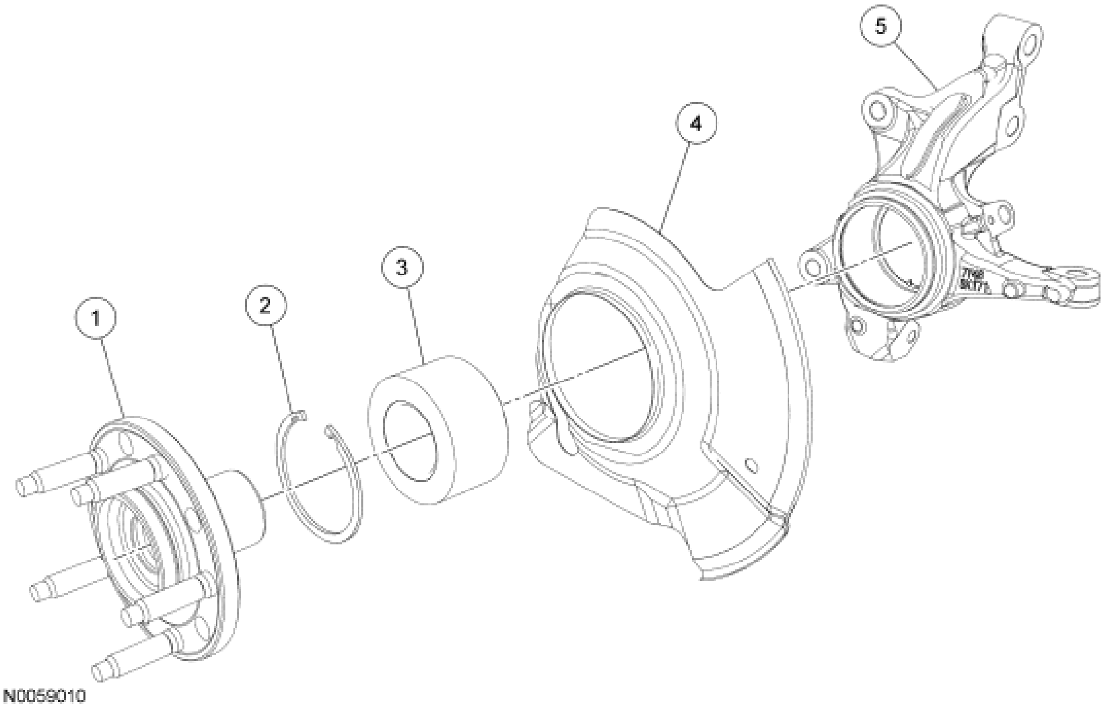


Fig. 1: Exploded View Of Wheel Bearing & Wheel Hub
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	1104	Wheel hub
2	3B625	Snap ring
3	1215	Wheel bearing
4	2K005 LH/ 2K004 RH	Brake disc shield
5	3K171 LH/ 3K170 RH	Wheel knuckle

REMOVAL

NOTE: If removing the wheel hub, the wheel bearing must be replaced.

1. Remove the wheel knuckle. For additional information, refer to **Wheel Knuckle**.
2. Using the special tool, press the wheel hub from the wheel bearing.

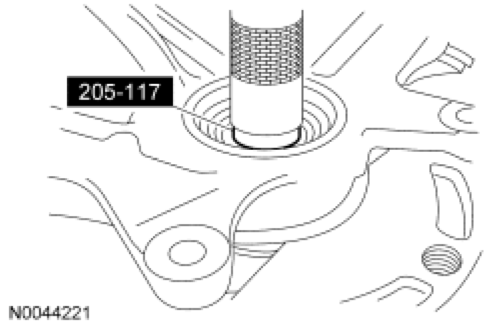


Fig. 2: Pressing Wheel Hub From Wheel Bearing Using Special Tool (205-117)
Courtesy of FORD MOTOR CO.

NOTE: **This step may not be necessary if the inner wheel bearing race remains in the wheel knuckle after removing the wheel hub.**

3. Using the special tool, press the inner wheel bearing race from the wheel hub.

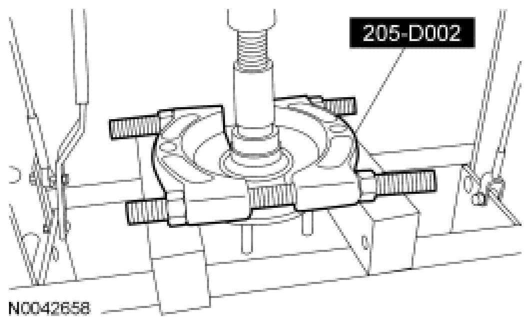


Fig. 3: Pressing Inner Wheel Bearing Race From Wheel Hub Using Special Tool (205-D002)
Courtesy of FORD MOTOR CO.

4. Remove the snap ring.
5. Using the special tool, press the outer wheel bearing race from the wheel knuckle.

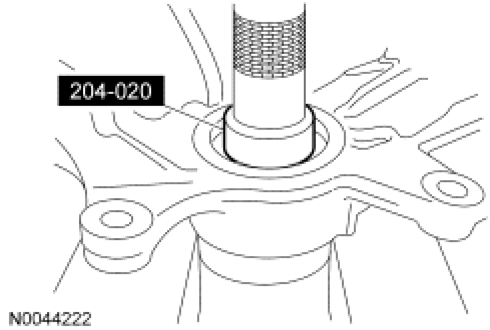


Fig. 4: Pressing Outer Wheel Bearing Race From Wheel Knuckle Using Special Tool (204-020)
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Using the special tool, press the wheel bearing into the wheel knuckle.

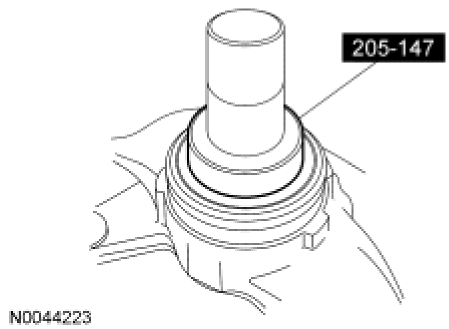


Fig. 5: Pressing Wheel Bearing Into Wheel Knuckle Using Special Tool (205-147)
Courtesy of FORD MOTOR CO.

2. Install the snap ring.
3. Using the special tools, press the wheel hub into the wheel bearing.

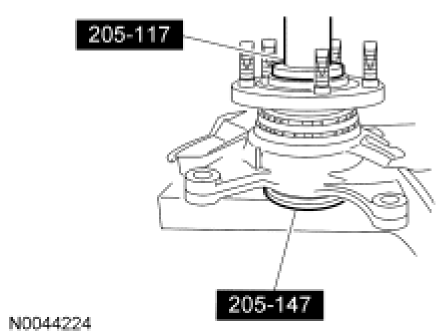


Fig. 6: Pressing Wheel Hub Into Wheel Bearing Using Special Tools (205-117) & (205-147)
Courtesy of FORD MOTOR CO.

4. Install the wheel knuckle. For additional information, refer to **Wheel Knuckle**.

WHEEL STUDS

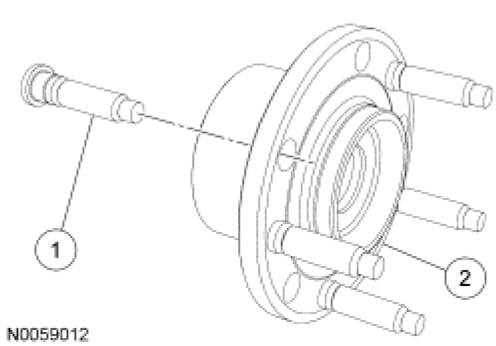
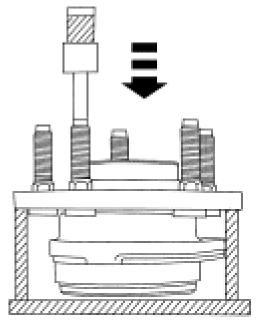


Fig. 7: Exploded View Of Wheel Studs
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	1107	Wheel stud
2	1104	Wheel hub

REMOVAL

1. Remove the wheel bearing and wheel hub. For additional information, refer to **Wheel Bearing and Wheel Hub**.
2. Using a press, remove the wheel stud from the wheel bearing and hub assembly.

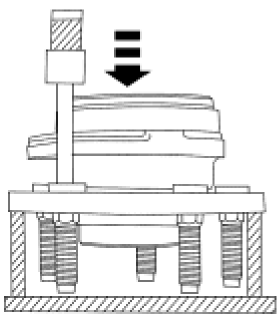


DF1279-A

Fig. 8: Removing Wheel Stud From Wheel Bearing & Hub Assembly
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Position the new wheel stud in the wheel hub, aligning the serrations in the wheel hub flange made by the original wheel stud.
2. Using a press, install a new wheel stud.



DF1280-A

Fig. 9: Installing New Wheel Stud Using A Press
Courtesy of FORD MOTOR CO.

3. Install the wheel bearing and wheel hub. For additional information, refer to **Wheel Bearing and Wheel**

Hub.

LOWER ARM

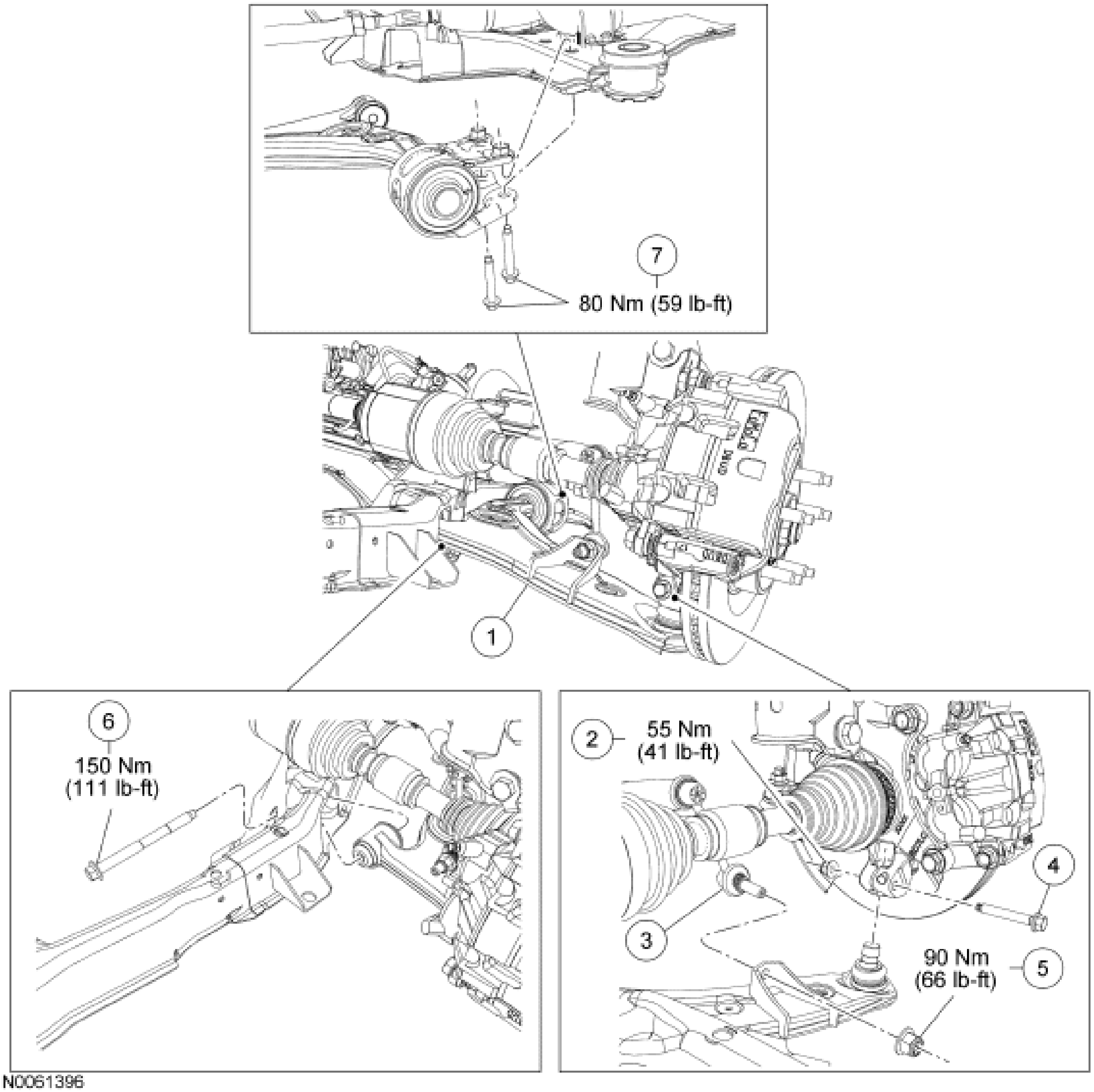


Fig. 10: Exploded View Of Lower Arm Components With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3A423 RH/ 3A424 LH	Lower arm
2	W520213	Lower ball joint nut
3	3B438	Stabilizer bar link
4	W712481	Lower ball joint bolt
5	W520214	Stabilizer bar link nut
6	W712734	Lower arm-to-frame forward bolt

7	W712850	Lower arm-to-frame rearward bolts (2 required)

REMOVAL

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure correct retention of these parts.

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
2. Remove and discard the stabilizer bar link lower nut.
3. Remove and discard the lower ball joint nut and bolt.
4. Remove the lower arm-to-frame forward bolt and spacer.
   - Discard the bolt.
5. Remove the 2 lower arm-to-frame rearward bolts and the lower arm.
   - Discard the 2 bolts.

INSTALLATION

NOTE: Do not tighten the bolt at this time.

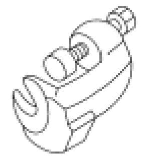
1. Position the lower arm and loosely install the 2 lower arm-to-frame rearward bolts.

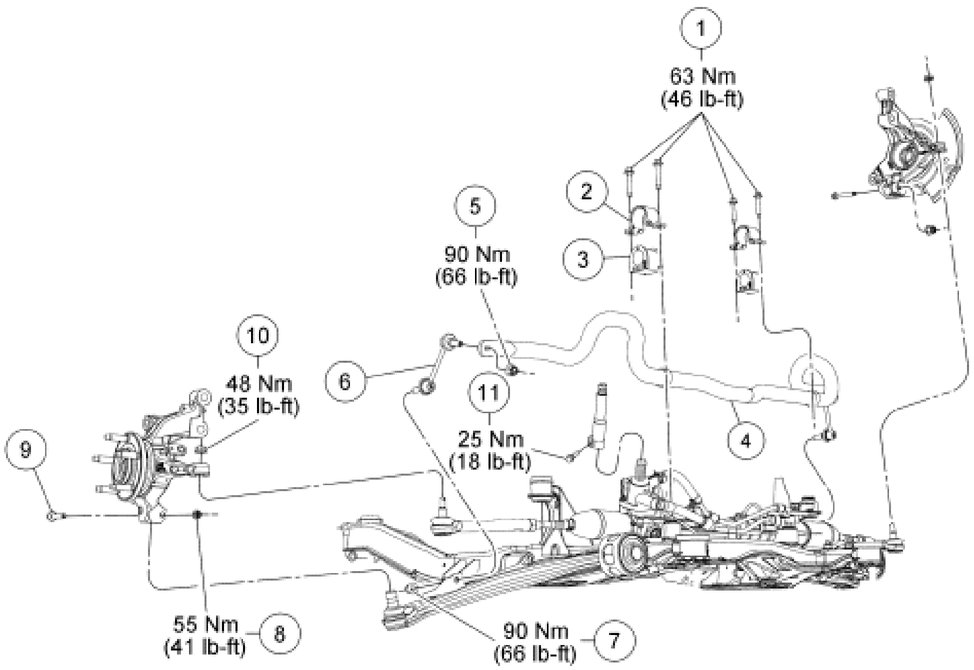
NOTE: Do not tighten the bolts at this time.

2. Loosely install the lower arm-to-frame forward bolt and spacer.
3. Install the lower arm ball joint bolt and nut.
   - Tighten to 55 Nm (41 lb-ft).
4. Install the stabilizer bar link lower nut.
   - Tighten to 90 Nm (66 lb-ft).
5. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
6. With the weight of the vehicle resting on the wheels and tires, tighten the lower arm-to-frame forward bolts to 150 Nm (111 lb-ft).
7. With the weight of the vehicle resting on the wheels and tires, tighten the 2 lower arm-to-frame rearward bolts to 80 Nm (59 lb-ft).
8. Check and, if necessary, align the front end. For additional information, refer to **WHEELS AND TIRES** article.

STABILIZER BAR AND LINK

Special Tools

Illustration	Tool Name	Tool Number
 ST1408-A	Tie-Rod End Remover	211-105 (T85M-3395-A)



N0074791

Fig. 11: Replacing Bar & Link With Torque Specifications (1 Of 4)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W712802	Stabilizer bar bracket bolts (4 required)
2	5486	Stabilizer bar bracket (2 required)
3	5484	Stabilizer bar bushing (2 required)
4	5494	Stabilizer bar
5	W520214	Stabilizer bar link upper nut (2 required)
6	3B438	Stabilizer bar link (2 required)
7	W520214	Stabilizer bar link lower nut (2 required)
8	W712481	Lower ball joint bolt
9	W520213	Lower ball joint nut (2 required)
10	W711889	Outer tie-rod end nut (2 required)
11	-	Lower steering shaft coupler bolt

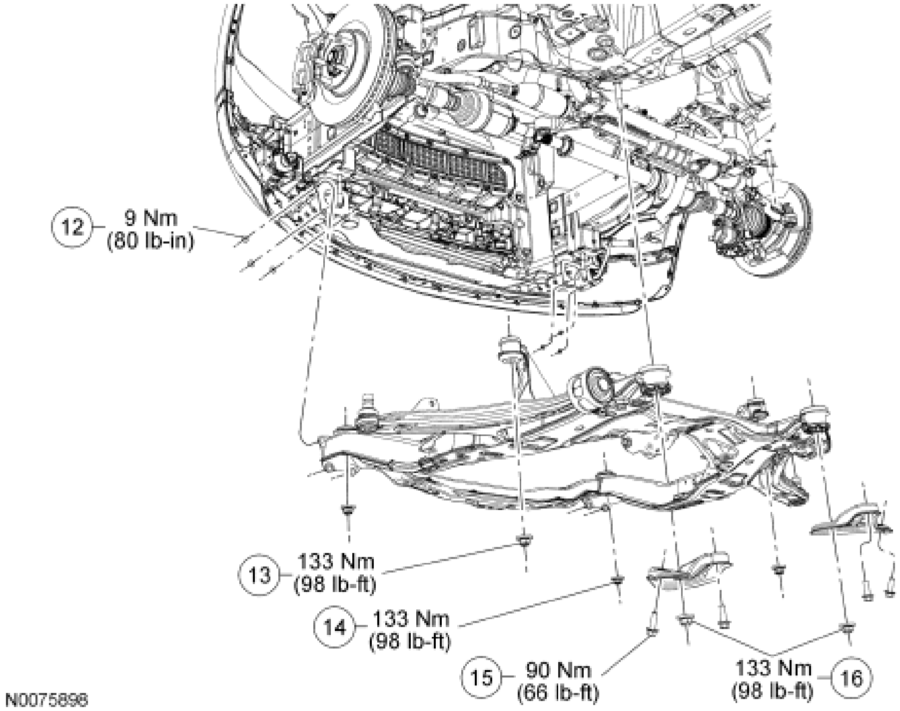


Fig. 12: Replacing Stabilizer Bar & Link With Torque Specifications (2 Of 4)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
12	W708229	Front lower bumper-to-subframe nut (6 required)
13	W712858	Front subframe mounting nut (2 required)
14	W712858	Front subframe mounting nut (2 required)
15	W712858	Subframe support bracket bolt (4 required)
16	W712733	Subframe support bracket nut (2 required)

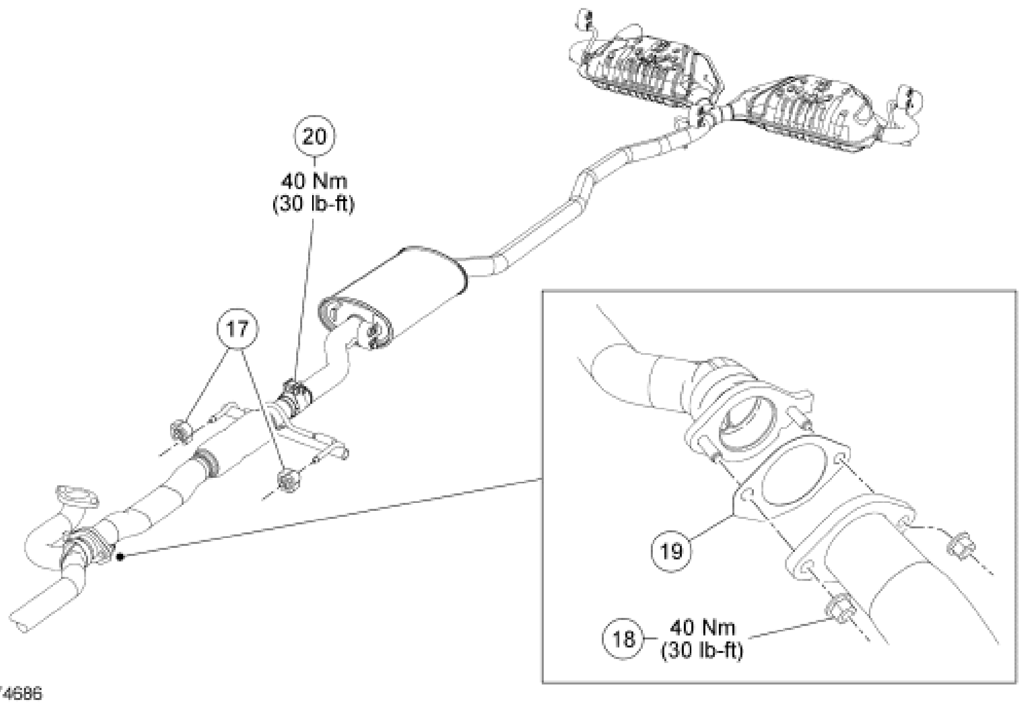


Fig. 13: Replacing Stabilizer Bar & Link With Torque Specifications (3 Of 4)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
17	5F262	Exhaust flexible pipe isolators (2 required)
18	W705443	Exhaust flexible pipe-to-exhaust Y-pipe nut (2 required)
19	9451	Gasket
20	9451	Y-pipe clamp

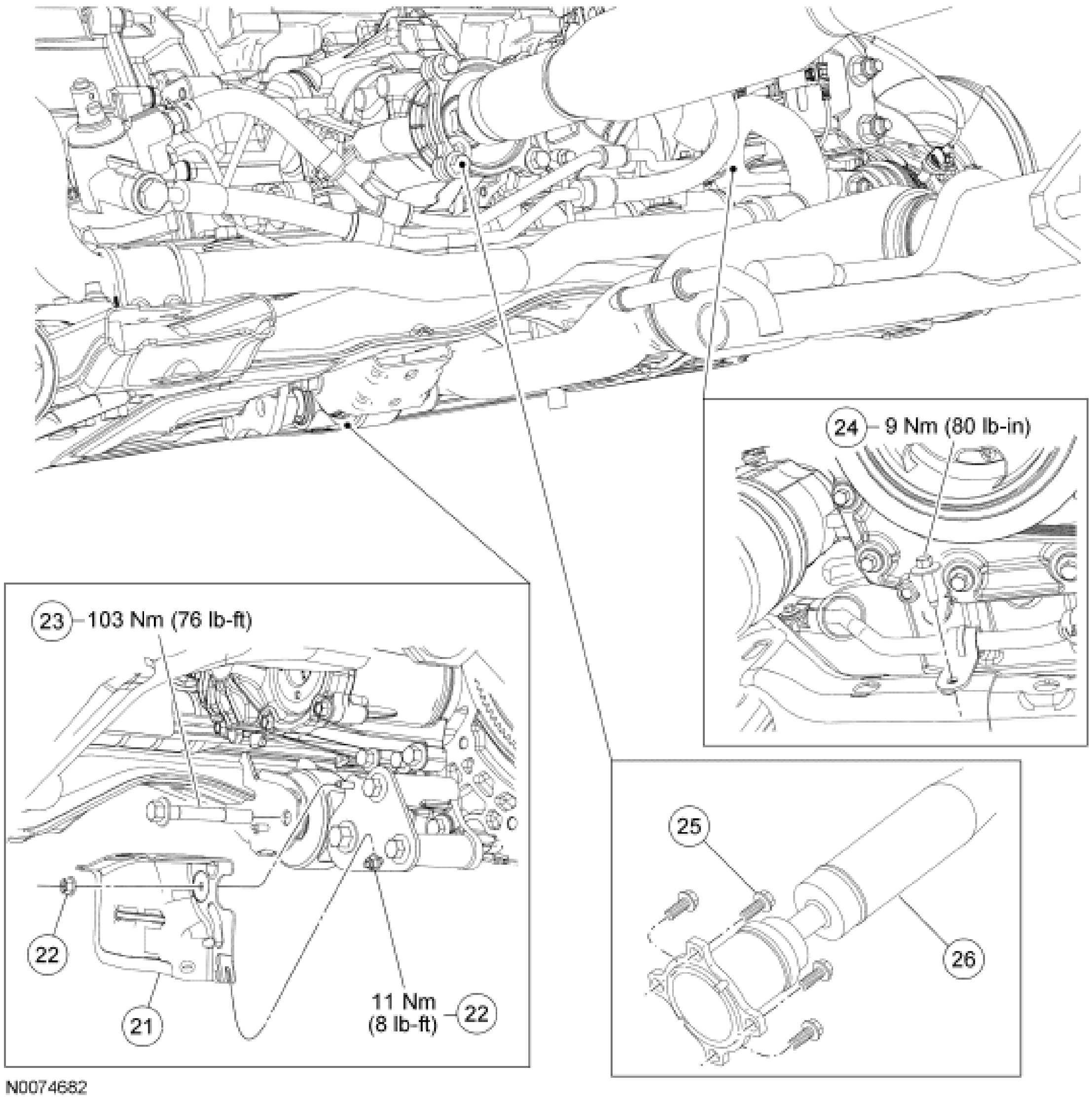


Fig. 14: Replacing Stabilizer Bar & Link With Torque Specifications (4 Of 4)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
21	6C038	Roll restrictor heat shield
22	W700101	Roll restrictor heat shield nuts (2 required)
23	W711843	Roll restrictor-to-subframe bolt
24	W711787	Power steering cooler hose bracket bolt
25	W711918	Driveshaft bolts (4 required)
26	4K357	Driveshaft assembly

REMOVAL AND INSTALLATION

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure correct retention of these parts.

NOTE: If replacing only the stabilizer bar bushings, proceed to Step 23 of this procedure.

All vehicles

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
2. Remove the lower steering shaft coupler bolt and disconnect the coupler from the steering gear.
   - To install, tighten to 25 Nm (18 lb-ft).
3. Index-mark the relationship of the front subframe to the underbody at the mounting locations.
4. Remove the 4 pin-type retainers and the RH fender splash shield.

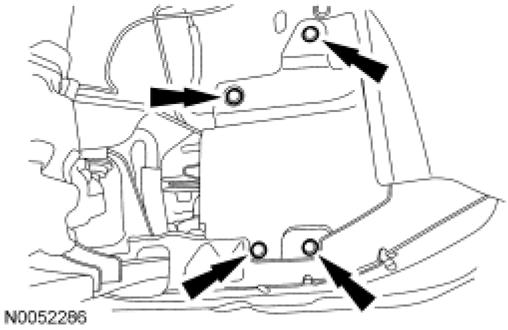


Fig. 15: Locating Pin-Type Retainers On RH Fender Splash Shield
Courtesy of FORD MOTOR CO.

5. Remove the 3 pushpin fasteners, the 7 screws and the front splash shield.

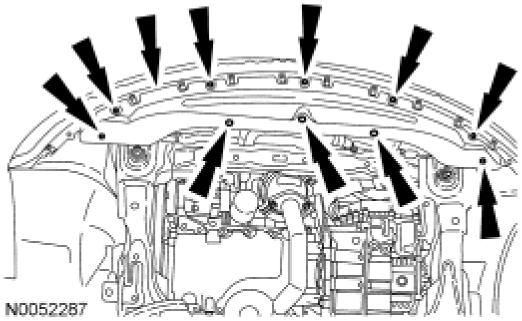


Fig. 16: Locating Push Pin Fasteners & Front Splash Shield Screws
Courtesy of FORD MOTOR CO.

6. Remove the 3 RH front lower bumper-to-subframe nuts.
   - To install, tighten to 9 Nm (80 lb-in).
7. Remove the 3 LH front lower bumper-to-subframe nuts and separate the lower bumper from the subframe.
   - To install, tighten to 9 Nm (80 lb-in).
8. Remove the power steering fluid cooler hose bracket bolt.
   - To install, tighten to 9 Nm (80 lb-in).
9. Loosen the Y-pipe clamp and disconnect the 2 exhaust hangers.
   - To install, tighten to 40 Nm (30 lb-ft).
10. Remove the 2 nuts and separate the flex pipe from the Y-pipe assembly.
    - To install, tighten to 40 Nm (30 lb-ft).

All wheel drive (AWD) vehicles

11. Index-mark the driveshaft, remove the 4 bolts and position the driveshaft aside.
    - To install, tighten to 70 Nm (52 lb-ft).

All vehicles

NOTE: Use the holding feature to prevent the ball stud from turning while removing or installing the stabilizer bar link nuts.

12. Remove the stabilizer link upper and lower nuts and the stabilizer links.
    - Discard the nuts.
    - To install, tighten to 90 Nm (66 lb-ft).
13. Remove the 2 outer tie-rod end nuts.
    - To install, tighten to 48 Nm (35 lb-ft).
14. Using the special tool, separate the outer tie-rod ends from the wheel knuckles.

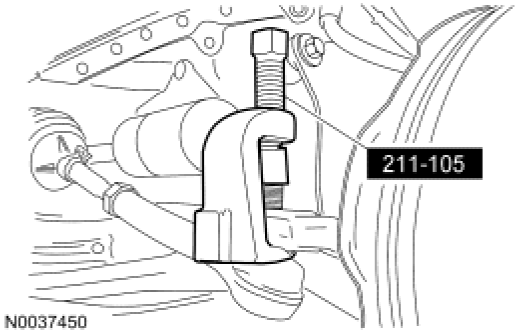


Fig. 17: Separating Tie-Rod Ends From Wheel Knuckles Using Special Tool (211-105)
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

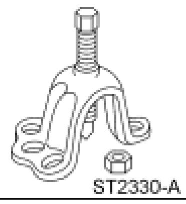
15. Remove the 2 lower ball joint bolts and nuts and separate the lower ball joints from the wheel knuckles.
    - Discard the bolts and nuts.
    - To install, tighten to 55 Nm (41 lb-ft).
16. Remove the upper nut, loosen the lower nut and remove the engine roll restrictor heat shield.
    - To install, tighten to 11 Nm (8 lb-ft).
17. Remove the engine roll restrictor-to-subframe bolt.
    - To install, tighten to 103 Nm (76 lb-ft).
18. Using a suitable jack, support the subframe.
    - Support the subframe in the center rear area of the subframe.

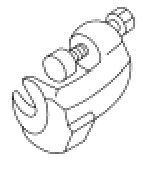
NOTE: During installation, the subframe brackets are loosely installed with the support bracket bolts. Align the index marks made in Step 2, then tighten the rear subframe nuts prior to tightening the support bracket bolts.

19. Remove the 2 nuts, 4 bolts and the subframe support brackets.
    - Discard the nuts and bolts.
    - To install, tighten the nuts to 133 Nm (98 lb-ft).
    - To install, tighten the bolts to 90 Nm (66 lb-ft).
20. Remove and discard the 4 subframe nuts.
    - To install, tighten to 133 Nm (98 lb-ft).
21. Using the jack, lower the subframe approximately 76.2 mm (3 in).
22. Remove the 4 bolts, 2 stabilizer bar brackets and bushings.
    - Discard the bolts.
    - To install, tighten to 63 Nm (46 lb-ft).
23. Remove the stabilizer bar.
24. To install, reverse the removal procedure.
25. Check and, if necessary, align the front end. For additional information, refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

WHEEL KNUCKLE

Special Tools

Illustration	Tool Name	Tool Number
	Remover, Front Hub	205-D070 (D93P-1175-B) or equivalent

 ST1408-A	Remover, Tie-Rod End	211-105 (T85M-3395-A)

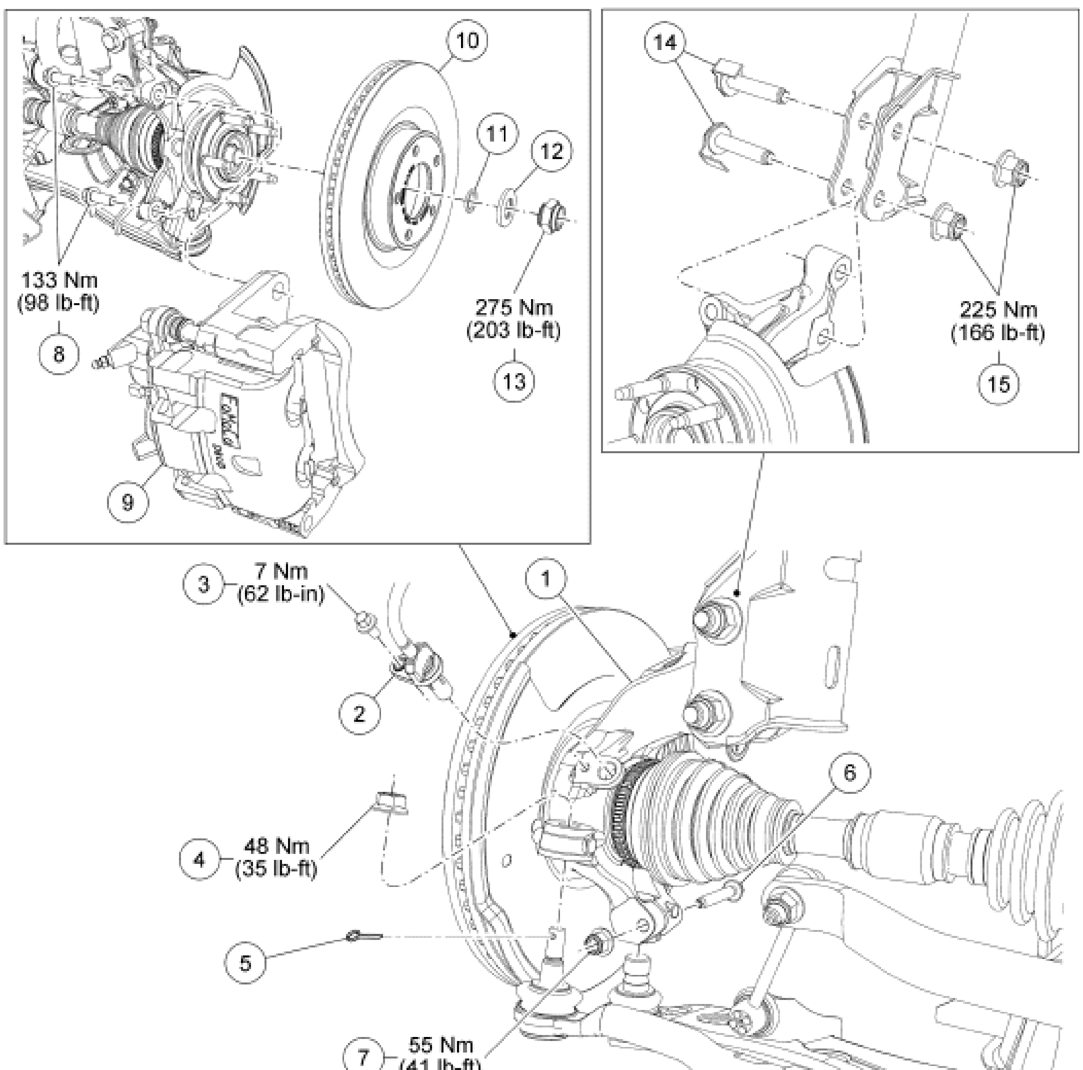


Fig. 18: Exploded View Of Wheel Knuckle With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3K171 LH/ 3K170 RH	Wheel knuckle
2	2C204 RH/ 2C205 LH	Wheel speed sensor
3	W500222	Wheel speed sensor bolt
4	W711889	Tie-rod end nut

5	3K176	Tie-rod end cotter pin
6	W520216	Lower ball joint bolt
7	W712981	Lower ball joint nut
8	2248	Brake caliper anchor plate bolts (2 required)
9	-	Brake caliper and anchor plate assembly
10	1032	Brake disc
11	-	Halfshaft hub seal
12	-	Halfshaft hub washer
13	3N404	Halfshaft nut
14	W713856	Lower shock absorber flag bolts (2 required)
15	W520216	Lower shock absorber nuts (2 required)

REMOVAL

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure correct retention of these parts.

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

NOTE: Apply the brake to keep the halfshaft from rotating.

2. Remove the halfshaft nut, halfshaft hub seal and halfshaft washer.
   - Discard the nut, seal and washer.
3. Remove the wheel speed sensor bolt and position the wheel speed sensor aside.

CAUTION: Do not allow the caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.

4. Remove the 2 bolts and position the caliper and anchor plate assembly aside.
   - Support the caliper and anchor plate assembly using mechanic's wire.
5. Remove the brake disc.
6. Using the special tool, separate the halfshaft from the wheel hub.

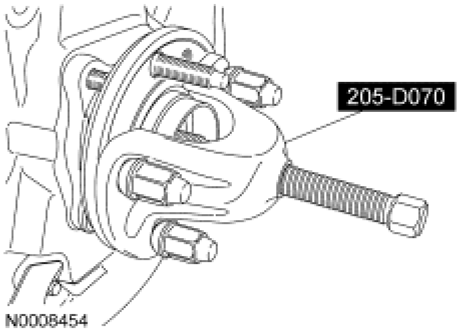


Fig. 19: Pressing Halfshaft From Wheel Bearing & Hub
Courtesy of FORD MOTOR CO.

7. Remove and discard the tie-rod end cotter pin and nut.

CAUTION: Do not use a hammer to separate the tie-rod end from the wheel knuckle or damage to the wheel knuckle can result.

8. Using the special tool, separate the tie-rod end from the wheel knuckle.

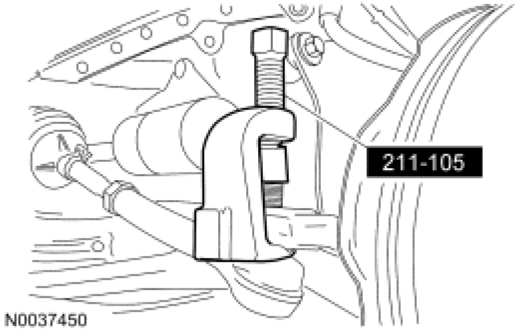


Fig. 20: Separating Tie-Rod Ends From Wheel Knuckles Using Special Tool (211-105)
Courtesy of FORD MOTOR CO.

9. Remove the shock absorber lower nuts and flag bolts.
   - Discard the nuts and flag bolts.
10. Remove the lower ball joint bolt, nut and the wheel knuckle.
   - Discard the bolt and nut.

INSTALLATION

1. Position the wheel knuckle and install the lower ball joint bolt and nut.
   - Tighten the nut to 55 Nm (41 lb-ft).
2. Install the shock absorber lower nuts and flag bolts.
   - Tighten to 225 Nm (166 lb-ft).
3. Position the tie-rod end and install the nut and cotter pin.

- Tighten to 48 Nm (35 lb-ft).

4. Position the wheel speed sensor and install the bolt.
    - Tighten to 7 Nm (62 lb-in).
5. Install the brake disc.
6. Position the brake caliper and anchor plate assembly and install the 2 bolts.
    - Tighten to 133 Nm (98 lb-ft).
7. Using a suitable installation tool, install the halfshaft into the wheel hub.

CAUTION: Do not tighten the halfshaft nut with the vehicle on the ground. The nut must be tightened to specification before the vehicle is lowered onto the wheels. Wheel bearing damage will occur if the wheel bearing is loaded with the weight of the vehicle applied.

NOTE: Apply the brake to keep the halfshaft from rotating.

8. Install the halfshaft hub seal, washer and nut.
    - Tighten to 275 Nm (203 lb-ft).
9. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
10. Check and, if necessary, align the front end. For additional information, refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

SHOCK ABSORBER AND SPRING ASSEMBLY

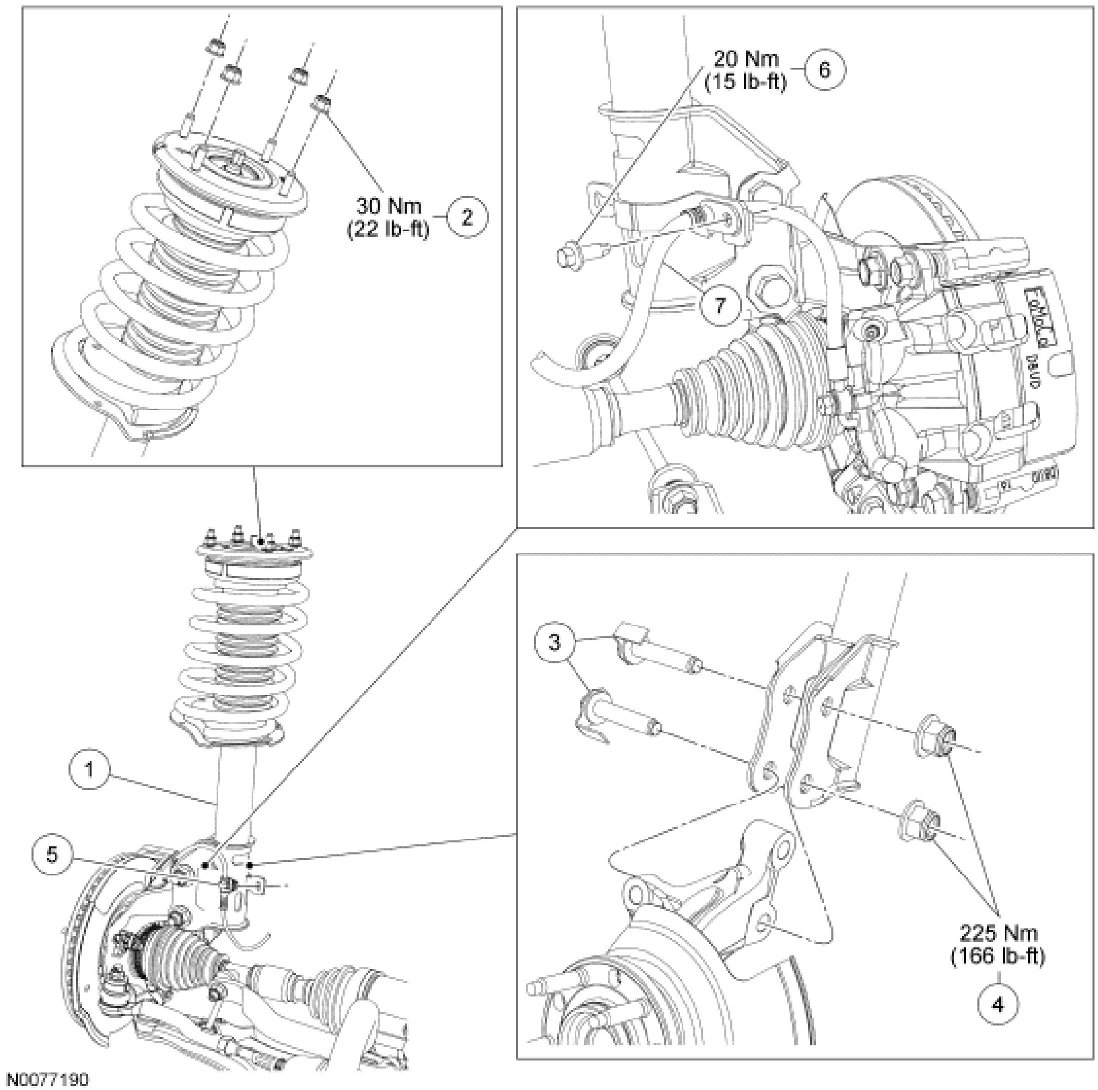


Fig. 21: Exploded View Of Shock Absorber & Spring Assembly With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Shock absorber and spring assembly
2	W704790	Shock absorber upper mount nut (4 required)
3	W713856	Shock absorber lower flag bolts (2 required)
4	W520216	Shock absorber lower nuts (2 required)
5	-	Wheel speed sensor harness clip
6	W708004	Brake flexible hose bracket bolt
7	2078	Brake flexible hose

REMOVAL AND INSTALLATION

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure correct retention of these parts.

1. Remove and discard the 4 shock absorber upper mount nuts.
   - To install, tighten to 30 Nm (22 lb-ft).
2. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
3. Remove the brake flexible hose bracket bolt and disconnect the hose from the shock absorber.
   - To install, tighten to 20 Nm (15 lb-ft).
4. Disconnect the wheel speed sensor harness from the shock absorber bracket.
5. Remove the shock absorber lower nuts, flag bolts and the shock absorber and spring assembly.
   - Discard the nuts and flag bolts.
   - To install, tighten to 225 Nm (166 lb-ft).
6. To install, reverse the removal procedure.
7. Check and, if necessary, align the front end. For additional information, refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

DISASSEMBLY AND ASSEMBLY

SHOCK ABSORBER AND SPRING ASSEMBLY

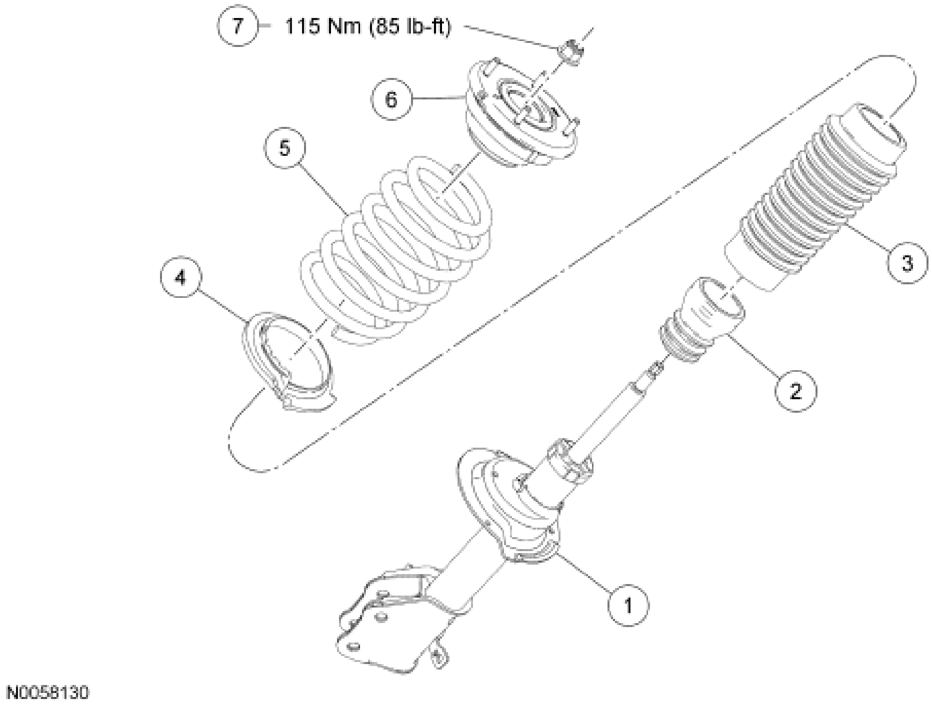


Fig. 22: Exploded View Of Shock Absorber & Spring Assembly With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	18K001 LH/ 18045 RH	Shock absorber
2	18061	Jounce bumper
3	3K036	Dust boot
4	5A307	Spring lower seat
5	5310	Spring
6	18183	Spring upper mount and seat
7	W520215	Shock absorber rod nut

DISASSEMBLY

WARNING: **Do not apply heat or flame to the shock absorber or strut tube. The shock absorber and strut tube are gas pressurized and could explode if heated. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Keep all body parts clear of shock absorbers or strut rods. Shock absorbers or struts can extend unassisted. Failure to follow this instruction may result in serious personal injury.**

WARNING: **The coil spring is under extreme load. Care must be taken at all times when removing or installing a loaded spring. Failure to follow this**

instruction may result in serious personal injury.

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

CAUTION: The coil spring is coated with long-term corrosion protective paint. Do not damage the paint during component servicing or spring failure may result.

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure correct retention of these parts.

1. Remove the shock absorber and spring assembly. For additional information, refer to **Shock Absorber and Spring Assembly**.

   WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

2. Position the shock and spring assembly in a suitable spring compressor.
3. Compress the spring enough to relieve the tension on the shock and spring assembly.

   CAUTION: Do not use an impact wrench on the shock absorber rod nut or damage to the shock absorber may occur.

   NOTE: Use the holding feature to prevent the shock absorber rod from turning while removing the nut.

4. While holding the shock absorber rod, remove and discard the rod nut.
5. Remove the shock absorber assembly and spring lower seat.
6. Remove the dust boot and jounce bumper.
7. Remove the shock absorber upper mount and spring upper seat.
8. Carefully release the tension on the spring compressor and remove the spring.

ASSEMBLY

1. Install the lower spring seat, jounce bumper and dust boot onto the shock absorber.
2. Position the shock and spring assembly in a suitable spring compressor.
3. Install the spring, shock absorber upper mount and spring upper seat.

4. Align the arrow on the upper mount perpendicular to the center of the shock absorber lower mount.

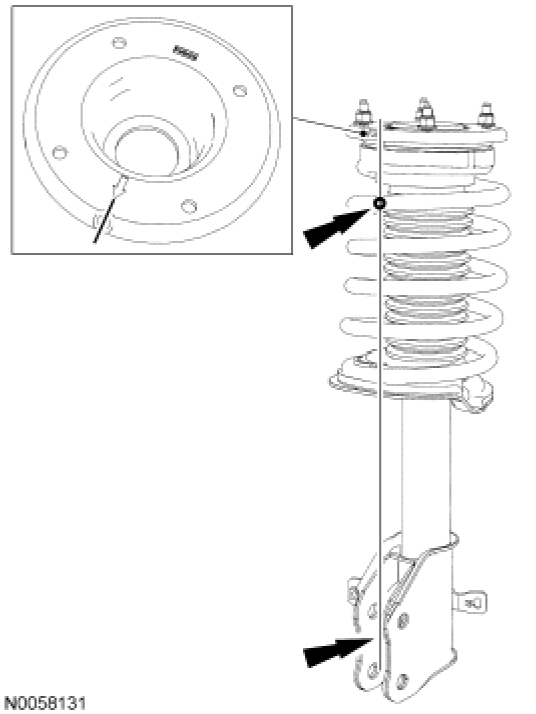


Fig. 23: Aligning Arrow On Upper Mount Perpendicular To Center Of Shock Absorber Lower Mount
Courtesy of FORD MOTOR CO.

5. Compress the spring enough to relieve the tension on the shock and spring assembly.
6. Position the end of spring within 0-10 mm (0-0.39 in) of the upper spring mount.

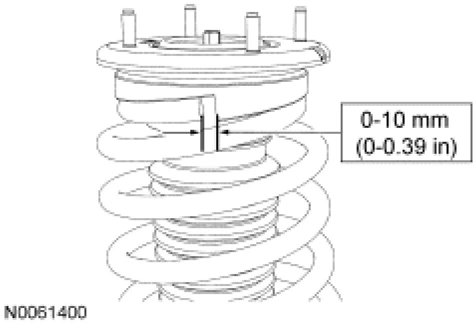


Fig. 24: Positioning End Of Spring With Specifications
Courtesy of FORD MOTOR CO.

NOTE:	**Before tightening the shock absorber rod nut, position the end of the spring within 0-10 mm (0-0.39 in) of the step on the lower spring mount.**

NOTE: **Use the holding feature to prevent the shock absorber rod from turning while installing the nut.**

7. Install the shock absorber rod nut.
   - Tighten to 115 Nm (85 lb-ft).

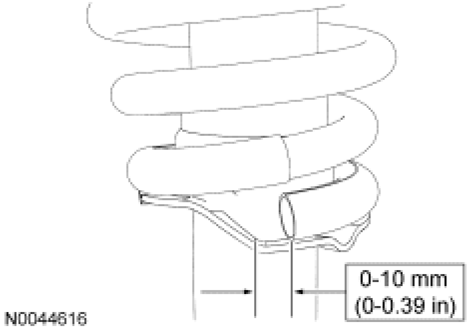


Fig. 25: Positioning End Of Spring Step With Specifications
Courtesy of FORD MOTOR CO.

8. Release the tension on the shock and spring assembly.
9. Install the shock absorber and spring assembly. For additional information, refer to **Shock Absorber and Spring Assembly**.

2008 ENGINE PERFORMANCE

Fuel Charging & Controls - 3.5L - Edge & MKX

SPECIFICATIONS

Material

Item	Specification	Fill Capacity
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	-

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Fuel rail bolts	10	89
Throttle Body (TB) bolts	10	89

DESCRIPTION AND OPERATION

FUEL CHARGING AND CONTROLS

Sequential Multi-Port Fuel Injection (SFI)

The fuel charging and controls system consists of the:

- Throttle Body (TB).
- fuel injectors.
- fuel rail.

The fuel charging and controls system is:

- a Sequential Multi-Port Fuel Injection (SFI) system.
- pulse-width modulated.
- Mass Air Flow (MAF) controlled.

Fuel is metered into each intake port in a sequential firing order. Fuel injectors pulse to follow engine firing order, in accordance with engine demand, on a tuned intake manifold.

The basic fuel requirement of the engine is determined from the data supplied to the PCM by the MAF sensor, which measures the amount of air being drawn into the engine.

The various sensors detect any changes in the operating conditions and send signals to the PCM. This permits the PCM to control the opening duration (pulse width) of the fuel injectors and maintain optimum exhaust emission control and engine performance for all operating conditions.

Throttle Body (TB)

The TB:

- controls air supply to the intake manifold by electronically positioning the throttle plate.
- is not adjustable.

Fuel Injectors

The fuel injectors:

- are electronically operated by the PCM.
- atomize the fuel as the fuel is delivered.
- each have an internal solenoid that opens a needle valve, which injects fuel into the intake port in the cylinder head.
- are deposit resistant.

Fuel Rail

The fuel rail:

- receives fuel from the fuel supply tube.
- delivers fuel to the fuel injectors.

DIAGNOSTIC TESTS

FUEL CHARGING AND CONTROLS

Refer to the **Introduction - Gasoline Engines** article.

REMOVAL AND INSTALLATION

THROTTLE BODY

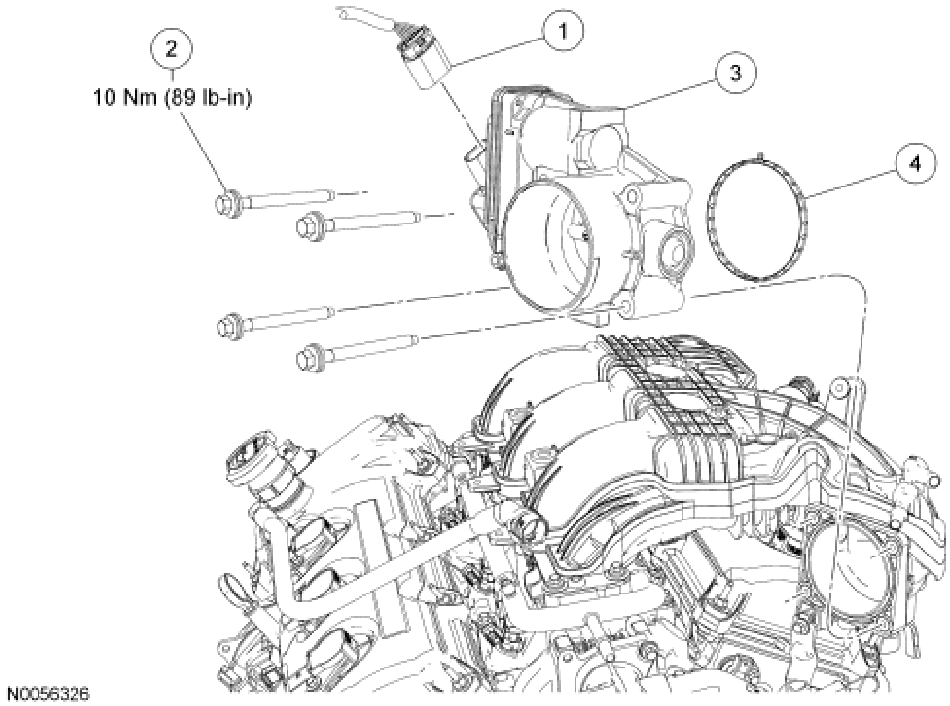


Fig. 1: Exploded View Of Throttle Body With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Electronic throttle control electrical connector (part of 12B637)
2	W503285	Throttle body (TB) bolt (4 required)
3	9E926	TB
4	9E936	TB gasket

REMOVAL AND INSTALLATION

CAUTION: The throttle body (TB) must be removed from the vehicle to be cleaned. Do not hold the throttle plate open with any object that could scratch the bore or plate while servicing or cleaning the TB.

1. Remove the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.
2. Disconnect the electronic throttle control electrical connector.
3. Remove the 4 bolts and the throttle body (TB).
   - Discard the TB gasket.
   - To install, tighten to 10 Nm (89 lb-in).

NOTE: Install a new TB gasket.

4. To install, reverse the removal procedure.

FUEL RAIL AND FUEL INJECTOR - EXPLODED VIEW

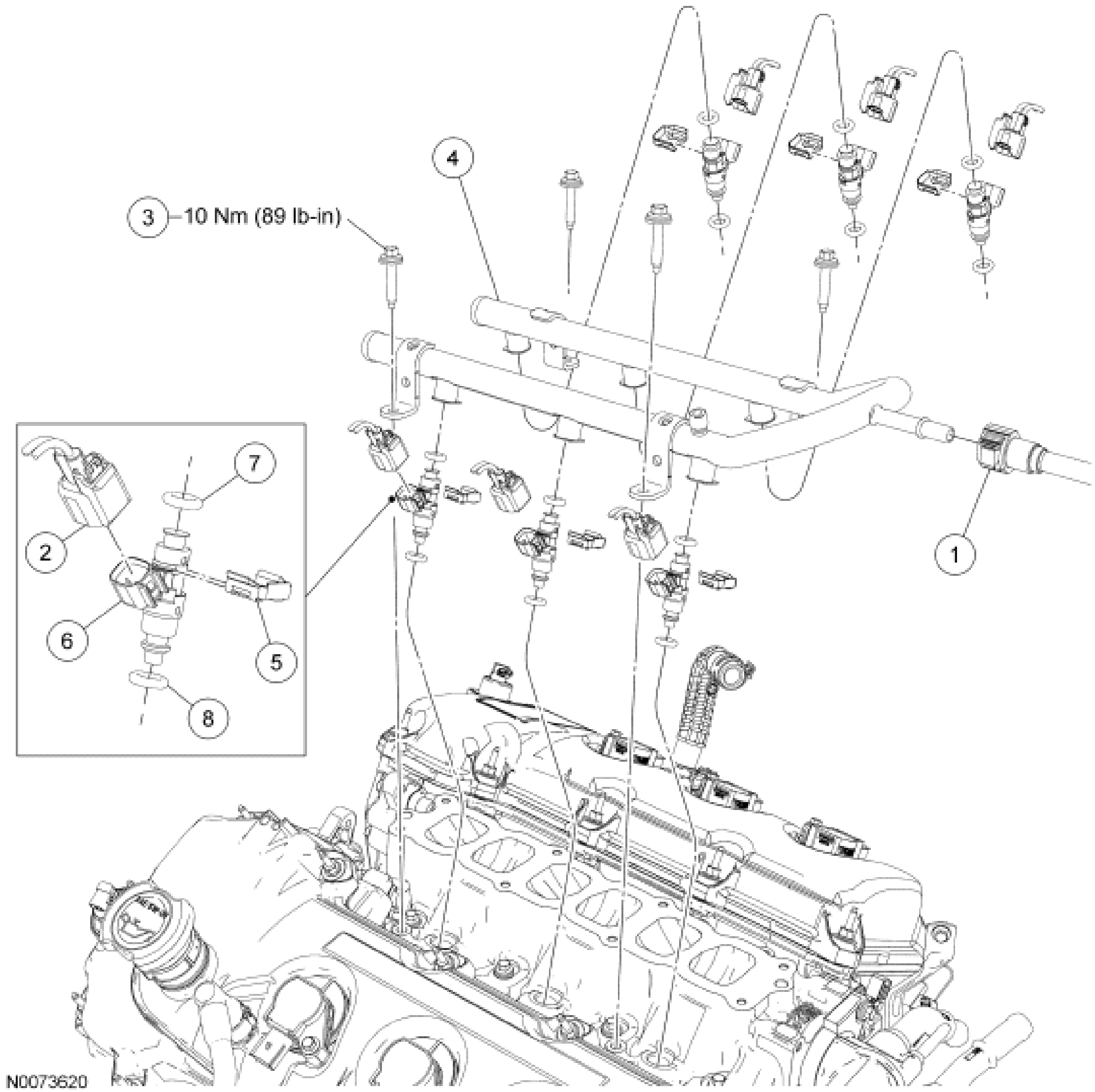


Fig. 2: Exploded View Of Fuel Rail & Fuel Injector With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	9J279	Fuel tube-to-fuel rail quick connect coupling
2	14A464	Fuel injector electrical connector (6 required) (part of 12B637)
3	W503279	Fuel rail bolt (4 required)
4	9F792	Fuel rail

5	9N976	Fuel injector clip (6 required)
6	9F593	Fuel injector (6 required)
7	9229	Upper fuel injector O-ring seal (6 required)
8	9229	Lower fuel injector O-ring seal (6 required)

1. For additional information, refer to the procedures in this article.

FUEL RAIL

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A

REMOVAL

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

1. Disconnect the battery ground cable. For additional information refer to **BATTERY, MOUNTING AND CABLES** article.
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
3. Remove the upper intake manifold. For additional information, refer to **ENGINE - 3.5L** article.
4. Disconnect the fuel tube-to-fuel rail quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
5. Disconnect the 6 fuel injector electrical connectors.
6. Remove the 4 fuel rail bolts.
7. Remove the fuel rail and injectors as an assembly.
8. Remove the 6 fuel injector clips and the 6 fuel injectors.

- Remove and discard the 12 fuel injector O-ring seals.

INSTALLATION

CAUTION: Use O-ring seals that are made of special fuel-resistant material. The use of ordinary O-rings seals can cause the fuel system to leak. Do not reuse the O-ring seals.

NOTE: The upper and lower O-ring seals are not interchangeable.

NOTE: Install new fuel injector O-ring seals and lubricate them with clean engine oil.

1. Install the 6 fuel injectors and the 6 fuel injector clips into the fuel rail.
2. Install the fuel rail and fuel injectors as an assembly.
3. Install the 4 fuel rail bolts.
   - Tighten to 10 Nm (89 lb-in).
4. Connect the 6 fuel injector electrical connectors.
5. Connect the fuel tube-to-fuel rail quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
6. Install the upper intake manifold. For additional information, refer to **ENGINE - 3.5L** article.
7. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

2008 GENERAL INFORMATION

Fuel System - General Information - Edge & MKX

SPECIFICATIONS

MATERIAL

Item	Specification	Fill Capacity
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	-

GENERAL SPECIFICATIONS

Item	Specification
Fuel tank capacity (all wheel drive [AWD] vehicles)	76L (20 gal)
Fuel tank capacity (front wheel drive [FWD] vehicles)	72L (19 gal)
Fuel Pressure	
Engine running fuel pressure	450 kPa (65 psi)

DESCRIPTION AND OPERATION

FUEL SYSTEM

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

The fuel system consists of:

- a mechanical returnless fuel system.
- a fuel rail.
- a multi-port fuel injection (MFI) system.
- an all wheel drive (AWD) saddle-type or front wheel drive (FWD) L-shaped fuel tank.
- fuel, vapor and brake tubes in an integrated bundle assembly.
- a fuel tank filler pipe assembly, which cannot be modified in any way.
- a 1/4 turn-type fuel tank filler cap.
- an inertia fuel shutoff (IFS) switch.
- a separate fuel level sensor assembly on AWD saddle-type fuel tank.
- a fuel pump (FP) module containing:
  - the electric FP module, which provides pressurized fuel to the fuel rail.
  - a serviceable fuel level sender.
  - a check valve, which maintains system pressure after the FP module is shut off.
  - a pressure relief valve for overpressure protection in the event of restricted fuel flow.
  - an in-tank fuel filter providing filtration to protect the fuel injectors from foreign material.

The FP module is controlled by the PCM. Electrical power to the FP is provided through the IFS switch located under the left rear quarter trim panel.

The engines are equipped with sequential MFI injection.

The fuel pressure is regulated to a constant pressure by a fuel pressure regulator.

DIAGNOSTIC TESTS

FUEL SYSTEM

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST2311-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	-

Principles of Operation

NOTE: The following procedure diagnoses a slow to fill concern only. For all other concerns, refer to the INTRODUCTION - GASOLINE ENGINES article.

The fuel tank filler pipe assembly is used to refuel the vehicle. The fuel tank filler pipe flapper valve prevents spitback of fuel during and after refueling. The fuel tank stores the fuel. The fuel tank contains a fuel pump (FP) module. The FP module consists of a fuel level sender and a FP. The fuel level sender sends a signal to the fuel gauge informing the driver of how much fuel is in the fuel tank. The FP provides fuel to the fuel tubes which supply the fuel rail.

During refueling, the fuel tank vents to the atmosphere through the vent and filler pipes, on vehicles without on-board refueling vapor recovery (ORVR) systems. In vehicles equipped with ORVR, the fuel tank and filler pipe are designed so that when the vehicle is being refueled, fuel vapors in the fuel tank travel to the evaporative emission (EVAP) canister, which absorbs the fuel vapors and vents the pressure from the fuel tank during refueling.

Inspection and Verification

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

1. Verify the customer's concern by refueling the vehicle and observe the fuel fill rate.
2. Inspect to determine if any of the following mechanical concerns apply.

VISUAL INSPECTION CHART

Mechanical
• Bent, kinked or damaged fuel tank filler pipe • Bent, kinked or damaged fuel tank filler pipe vent tube (if equipped) • Incorrect routing of the fuel tank filler pipe

- Incorrect routing of the fuel tank filler pipe vent tube (if equipped)
- Incorrect position of fuel tank filler pipe clamps
- Incorrect position of fuel tank filler pipe vent tube clamps (if equipped)
- Fuel tank mounted vapor tubes bent or damaged
- Evaporative emission (EVAP) system tubes or hoses bent or damaged
- Accident damage to the fuel tank
- Accident damage to the vehicle effecting the fuel tank filler pipe-to-body connection
- Unauthorized modifications and/or alterations to the vehicle
- EVAP system fresh air tube plugged (dirt, spider webbing)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the EVAP system.
9. If the DTCs retrieved are related to the concern, go to **EVAPORATIVE EMISSION SYSTEM DTC**

CHART. For PCM related DTCs, refer to the **INTRODUCTION - GASOLINE ENGINES** article. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.

10. If no DTCs related to the concern are retrieved, go to **SYMPTOM CHART**.

EVAPORATIVE EMISSION SYSTEM DTC CHART

DTC	Description	Action
P0446	Evaporative Emission System Vent Control Circuit	Go to **PINPOINT TEST A**.
P0451	Evaporative Emission System Pressure Sensor/Switch Range/Performance	Go to **PINPOINT TEST A**.
P0452	Evaporative Emission System Pressure Sensor/Switch Low	Go to **PINPOINT TEST A**.
P0453	Evaporative Emission System Pressure Sensor/Switch High	Go to **PINPOINT TEST A**.
P0454	Evaporative Emission System Pressure Sensor/Switch Intermittent	Go to **PINPOINT TEST A**.
P1443	Evaporative Emission System Control Valve (Low/No Flow)	Go to **PINPOINT TEST A**.
P1450	Unable to Bleed up Fuel Tank Vacuum	Go to **PINPOINT TEST A**.
P1451	Evaporative Emission System Vent Control Circuit	Go to **PINPOINT TEST A**.
P260F	Emission System Monitoring Processor Performance	Go to **PINPOINT TEST A**.

Symptom Chart

SYMPTOM CHART

Condition	Possible Sources	Action
• Slow to fill	• Fuel tank filler pipe • Fuel tank filler pipe vent tube, if equipped • Evaporative emission (EVAP) system • Fuel tank filler pipe flapper valve (part of the fuel tank filler pipe assembly) • Fuel level vent valve, if equipped (part of the fuel tank)	• Go to **PINPOINT TEST A**.
• All other fuel system concerns	• Fuel system components	• REFER to the **INTRODUCTION - GASOLINE ENGINES** article.

Pinpoint Test A

Pinpoint Test A: Slow to Fill

Normal Operation

Under normal operation, fuel should flow at a steady rate through the fuel tank filler pipe into the fuel tank. As fuel enters the fuel tank, air is vented through the filler pipe or the on-board refueling vapor recovery (ORVR) system.

This pinpoint test is intended to diagnose the following:

- Fuel tank filler pipe vent tube, if equipped
- Fuel tank filler pipe
- Evaporative emission (EVAP) system
- Fuel tank filler pipe flapper valve (part of the fuel tank filler pipe assembly)
- Fuel level vent valve, if equipped (part of the fuel tank)

PINPOINT TEST A: SLOW TO FILL

A1 CARRY OUT INSPECTION AND VERIFICATION

- Carry out inspection and verification.
- **Was the cause of the concern found?**

  YES : REPAIR or INSTALL new components to correct the concern.

  NO : Go to A2.

A2 CHECK THE SYSTEM FOR ANY EVAP DTCs

- Connect the scan tool.
- Check the system for any of the following EVAP DTCs: P0446, P0451, P0452, P0453, P0454, P1443, P1450, P1451 and P260F.
- **Are any of these DTCs present?**

  YES : REFER to **INTRODUCTION - GASOLINE ENGINES** article to diagnosis the EVAP system.

  NO : Go to A3.

A3 MONITOR THE FUEL TANK PRESSURE (FTP) WHILE FILLING THE FUEL TANK

- Monitor the FTP reference value while filling the fuel tank. Refer to **INTRODUCTION - GASOLINE ENGINES** article.
- **Is FTP within specification?**

  YES : Go to A5.

  NO : Go to A4.

A4 MONITOR THE FTP WHILE FILLING THE FUEL TANK WITH THE EVAP SYSTEM DISCONNECTED

- Disconnect the fuel tank-to-EVAP canister quick connect coupling at the EVAP canister.
- Monitor the FTP reference value while filling the fuel tank. Refer to **INTRODUCTION -**

GASOLINE ENGINES article.

- **Is FTP within specification?**

  YES : INSPECT the EVAP system for blockage or restrictions. REPAIR the blockage or restriction. If the blockage or restriction cannot be repaired, INSTALL new EVAP system components.

  NO : Go to A5.

A5 CHECK THE FUEL TANK FILLER PIPE ASSEMBLY FOR BLOCKAGE OR RESTRICTION

- Remove the fuel tank filler pipe assembly. Refer to **FUEL TANK AND LINES** article.
- Inspect the fuel tank filler pipe and fuel tank filler pipe vent tube (if equipped) for a blockage or restriction.
- **Is the fuel tank filler pipe or fuel tank filler pipe vent tube (if equipped) blocked or restricted?**

  YES : If possible, REPAIR the blockage or restriction. If the blockage or restriction cannot be repaired, INSTALL a new fuel tank filler pipe or fuel tank filler pipe vent tube.

  NO : INSTALL a new fuel tank. REFER to **FUEL TANK AND LINES** article.

GENERAL PROCEDURES

FUEL SYSTEM PRESSURE RELEASE

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

1. Remove the LH rear quarter trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

NOTE: **The inertia fuel shutoff (IFS) switch is located behind a shield and requires the use of a small screwdriver to release the electrical connector.**

2. Disconnect the IFS switch electrical connector.

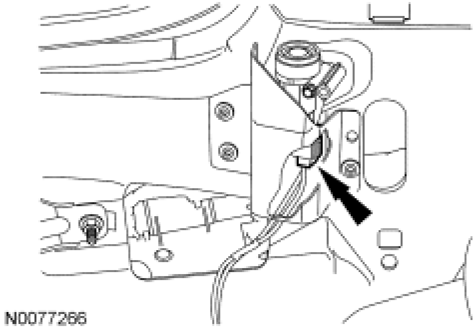


Fig. 1: Identifying IFS Switch Electrical Connector
Courtesy of FORD MOTOR CO.

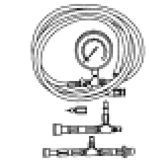
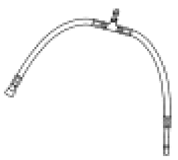
3. Start the engine and allow to idle until the engine stalls.
4. After the engine stalls, crank the engine for approximately 5 seconds to make sure the fuel injection supply manifold pressure has been released.
5. Turn the ignition switch to the OFF position.
6. When the fuel system service is complete, connect the IFS switch electrical connector.

NOTE: **It may take more than one key cycle to pressurize the fuel system. Cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks prior to starting the engine.**

7. Start the vehicle and check the fuel system for leaks.

FUEL SYSTEM PRESSURE TEST

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
	Fuel Pressure Test Kit	310-D009 (D95L-7211A)
	Adapter, Fuel Pressure Test	310-180

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type**

when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.**

1. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM PRESSURE RELEASE**.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Remove the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.
4. Disconnect the fuel tube-to-fuel rail quick connect coupling. For additional information, refer to **QUICK CONNECT COUPLING**.
5. Install the Fuel Pressure Test Adapter and the Fuel Pressure Test Kit between the fuel tube and the fuel rail.

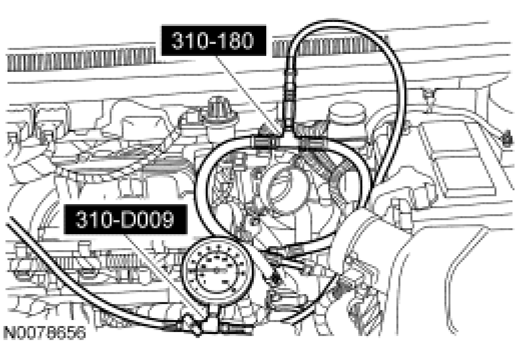


Fig. 2: Identifying Fuel Pressure Test Adapter Fuel Pressure Test Kit
Courtesy of FORD MOTOR CO.

NOTE: The air cleaner outlet pipe must be installed prior to completing the fuel system pressure test.

6. Install the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.

NOTE: The inertia fuel shutoff (IFS) switch electrical connector was previously disconnected to release the fuel system pressure and must be reconnected to test the fuel system pressure.

7. Connect the IFS switch electrical connector.
8. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

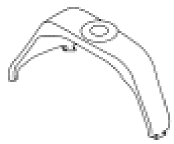
NOTE: Carry out a key ON engine OFF (KOEO) visual inspection for fuel leaks prior to the Fuel System Pressure Test.

NOTE: After completing the fuel system pressure test, open the drain valve on the special tool and release any residual fuel into a suitable container prior to removing the tool.

9. Test the fuel system pressure to make sure it is within the specified range. For additional information, refer to **SPECIFICATIONS**.

FUEL TANK DRAINING

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST2803-A	Fuel Storage Tanker	164-R3202 or equivalent

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: **When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.**

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM PRESSURE RELEASE**.
3. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
4. Release the fuel tank filler cap and position it aside.
5. Insert a suitable fuel drain tube into the fuel tank filler pipe until it enters the fuel tank.

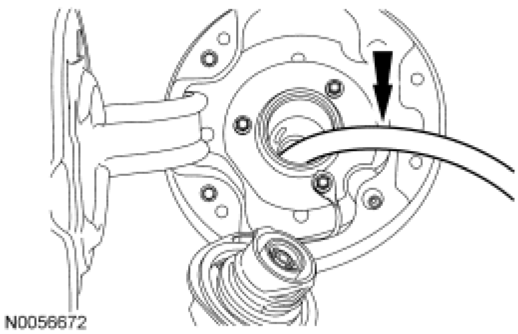


Fig. 3: Inserting Suitable Fuel Drain Tube Into Fuel Tank Filler Pipe
Courtesy of FORD MOTOR CO.

6. Attach the fuel storage tanker to the fuel drain tube and drain as much fuel as possible from the fuel tank.

All wheel drive (AWD) vehicles

7. Remove the rear seats. For additional information, refer to **SEATING** article.
8. Remove the 4 bolts and the fuel level sensor access cover.

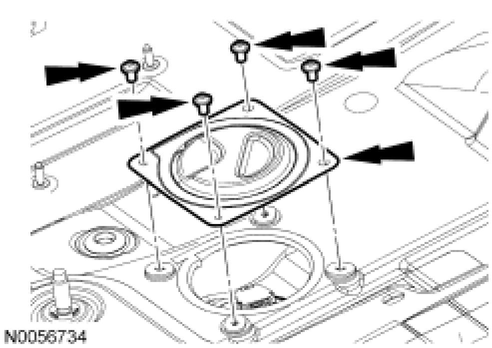


Fig. 4: Identifying Fuel Level Sensor Access Cover & Bolts
Courtesy of FORD MOTOR CO.

NOTE: **Clean the fuel level sensor connection, flange surface and the immediate surrounding area of any dirt or foreign material.**

9. Disconnect the fuel level sensor electrical connector.

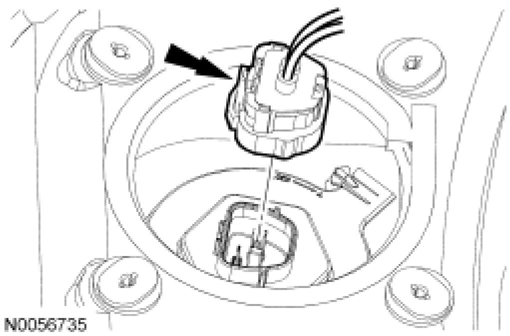


Fig. 5: Identifying Fuel Level Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: **Place absorbent pads in the general work area in case of fuel spillage.**

10. Release the lock tab, and using a suitable tool, rotate the fuel level sensor counterclockwise approximately 1/4 turn, lift and position aside.

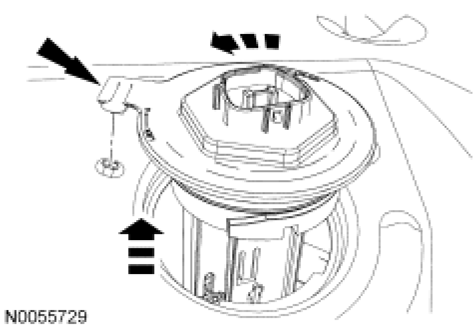


Fig. 6: Rotating Fuel Level Sensor Counterclockwise Approximately 1/4 Turn & Lift Upward
Courtesy of FORD MOTOR CO.

11. Using the special tool and a suitable fuel drain tube, drain the remaining fuel through the fuel level sensor aperture.

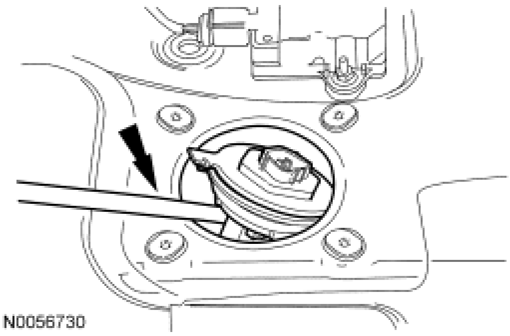


Fig. 7: Draining Remaining Fuel Through Fuel Level Sensor Aperture
Courtesy of FORD MOTOR CO.

QUICK CONNECT COUPLING

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
	Disconnect Tool, Fuel Pipe (5/16")	310-040

MATERIAL

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Disconnect - Type I

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system**

components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

WARNING: **When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.**

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip can occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage can occur. Always install plugs to any open orifices or tubes.

CAUTION: Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

1. If servicing a liquid fuel tube quick connect coupling, release the fuel system pressure. For additional information, refer to **FUEL SYSTEM PRESSURE RELEASE**.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Depress the locking tab and release the quick connect coupling from the tube.

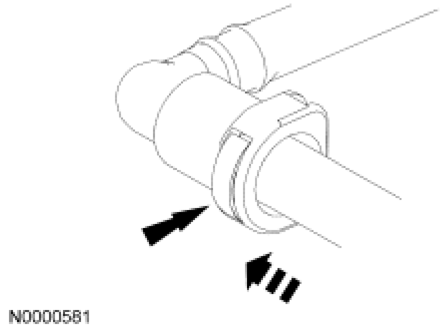


Fig. 8: Locating Fuel Tube Quick Connect Coupling Button
Courtesy of FORD MOTOR CO.

Connect - Type I

NOTE: **Make sure the fuel tube clicks into place when installing the quick connect coupling onto the tube.**

1. Install the quick connect coupling onto the tube until it is fully seated.

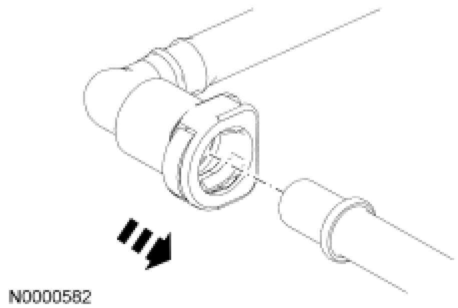


Fig. 9: Installing Quick Connect Coupling Onto Tube
Courtesy of FORD MOTOR CO.

2. Pull on the quick connect coupling and the tube to make sure it is securely fastened.
3. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

Disconnect - Type II

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in**

serious personal injury.

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip can occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage can occur. Always install plugs to any open orifices or tubes.

CAUTION: Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

1. If servicing a liquid fuel tube quick connect coupling, release the fuel system pressure. For additional information, refer to **FUEL SYSTEM PRESSURE RELEASE**.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Release the quick connect coupling primary locking tab.

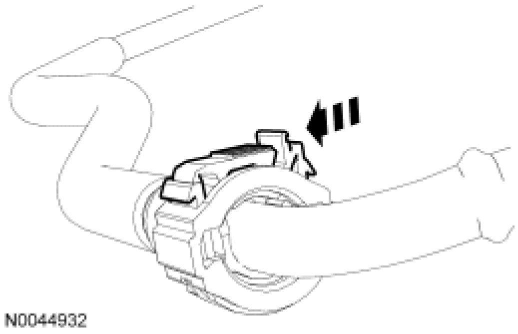


Fig. 10: Releasing Quick Connect Coupling Lock Tab
Courtesy of FORD MOTOR CO.

4. Rotate the primary locking tab to the fully opened position and squeeze the secondary locking tabs to release the locking mechanism.

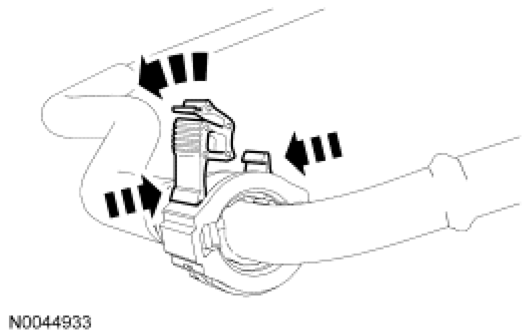


Fig. 11: Releasing Locking Mechanism
Courtesy of FORD MOTOR CO.

5. Push the locking mechanism outward and release the tube.

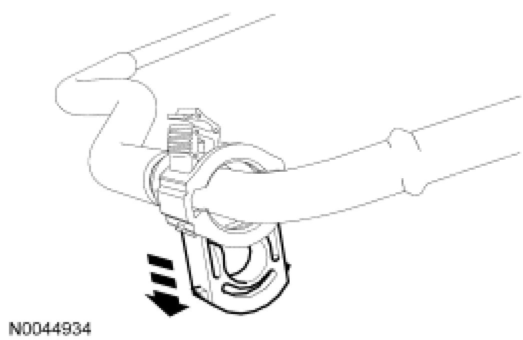


Fig. 12: Pushing Locking Mechanism Outward And Releasing Fuel Supply Tube
Courtesy of FORD MOTOR CO.

6. Remove the quick connect coupling from the tube.

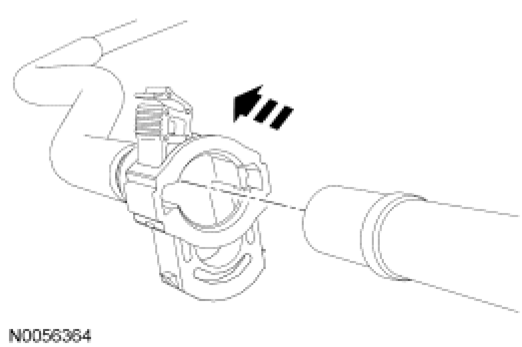


Fig. 13: Removing Quick Connect Coupling From Tube
Courtesy of FORD MOTOR CO.

Connect - Type II

1. Install the quick connect coupling onto the tube until it is fully seated.

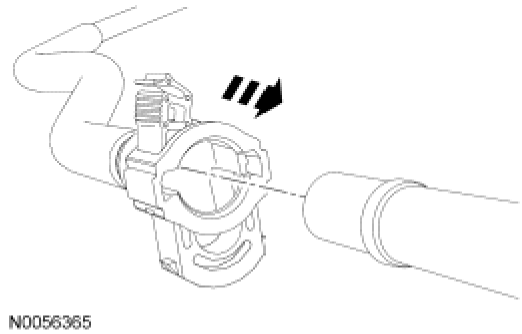


Fig. 14: Installing Quick Connect Coupling Onto Tube
Courtesy of FORD MOTOR CO.

NOTE: **Make sure the fuel tube clicks into place when installing the quick connect coupling onto the tube.**

2. Depress the locking mechanism until it is flush with the quick connect coupling housing and is fully seated onto the tube.

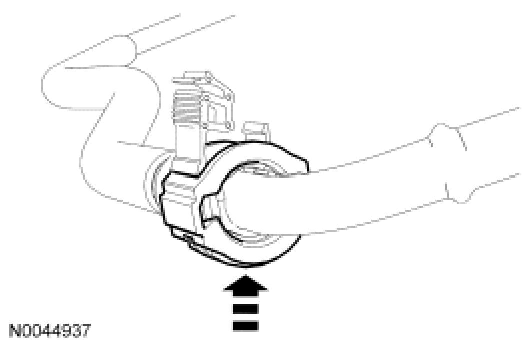


Fig. 15: Depressing Retainer Clip
Courtesy of FORD MOTOR CO.

3. Rotate the primary locking tab on the retainer clip to the closed position.

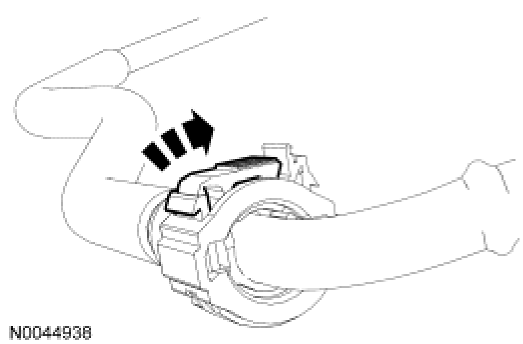


Fig. 16: Rotating Primary Locking Tab On Retainer Clip To Closed Position
Courtesy of FORD MOTOR CO.

4. Pull on the quick connect coupling and the tube to make sure it is securely fastened.
5. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

Disconnect - Type III

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.**

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip can occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage can occur. Always install plugs to any open orifices or tubes.

CAUTION: Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

1. If servicing a liquid fuel tube quick connect coupling, release the fuel system pressure. For additional

information, refer to **FUEL SYSTEM PRESSURE RELEASE**.

2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Squeeze the quick connect coupling retainer locking tabs to release the locking mechanism.

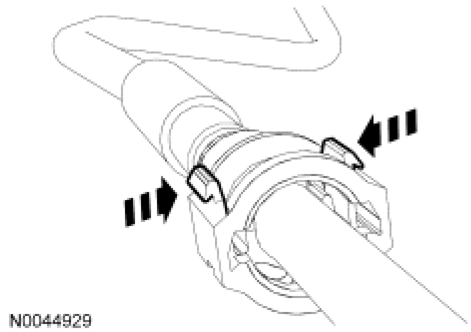


Fig. 17: Releasing Locking Mechanism
Courtesy of FORD MOTOR CO.

4. Push the locking mechanism outward to release the tube.

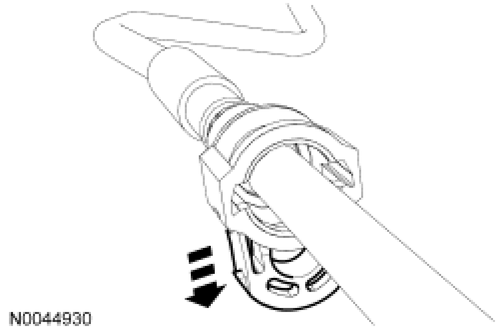


Fig. 18: Pushing Locking Mechanism Outward To Releasing Tube
Courtesy of FORD MOTOR CO.

5. Remove the quick connect coupling from the tube.

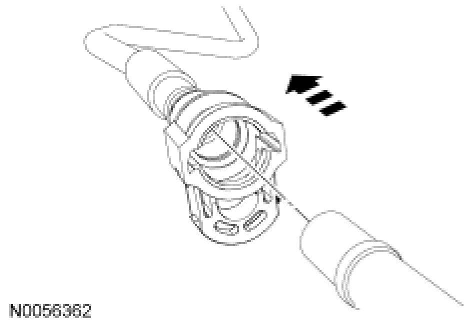


Fig. 19: Removing Quick Connect Coupling From Tube
Courtesy of FORD MOTOR CO.

Connect - Type III

NOTE: Make sure the fuel tube clicks into place when installing the quick connect coupling onto the tube.

1. Install the quick connect coupling onto the tube.

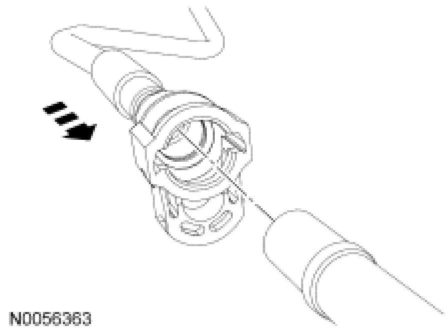


Fig. 20: Installing Quick Connect Coupling Onto Tube
Courtesy of FORD MOTOR CO.

2. Depress the quick connect coupling locking mechanism into the locked position.

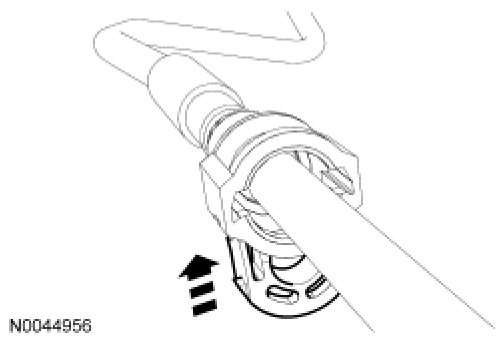


Fig. 21: Depressing Quick Connect Coupling Locking Mechanism Into Locked Position
Courtesy of FORD MOTOR CO.

3. Visually inspect and verify that the locking mechanism is flush with the quick connect coupling housing and that the locking tabs are securely fastened.

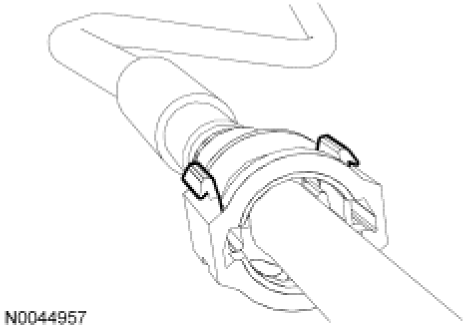


Fig. 22: Identifying Locking Mechanism And Quick Connect Coupling Housing
Courtesy of FORD MOTOR CO.

4. Pull on the quick connect coupling and the tube to make sure it is securely fastened.
5. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

Disconnect - Type IV

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.**

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube

or connector retaining clip can occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage can occur. Always install plugs to any open orifices or tubes.

1. If servicing a liquid fuel tube quick connect coupling, release the fuel system pressure. For additional information, refer to **FUEL SYSTEM PRESSURE RELEASE**.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Install the special tool on the tube and push into the quick connect coupling locking clip to release the locking tabs.

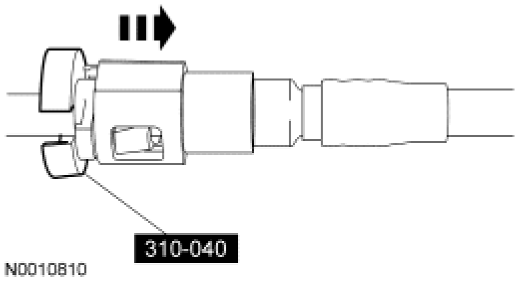


Fig. 23: Disconnecting Quick Connect Coupling From Tube Using Special Tool (310-040)
Courtesy of FORD MOTOR CO.

4. Remove the quick connect coupling from the tube.

Connect - Type IV

NOTE: Make sure the fuel tube clicks into place when installing the quick connect coupling onto the tube.

1. Install the quick connect coupling onto the tube until it is fully seated.

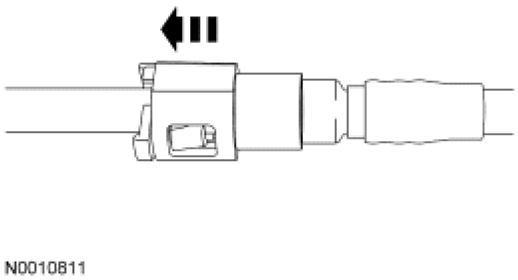


Fig. 24: Installing Quick Connect Coupling Onto Tube Until Fully Seated
Courtesy of FORD MOTOR CO.

2. Pull on the quick connect coupling and the tube to make sure it is securely fastened.
3. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

Disconnect - Type V

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.**

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube

or connector retaining clip can occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage can occur. Always install plugs to any open orifices or tubes.

CAUTION: Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

1. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
2. Squeeze the outer edges of the quick connect coupling to release the locking tabs.

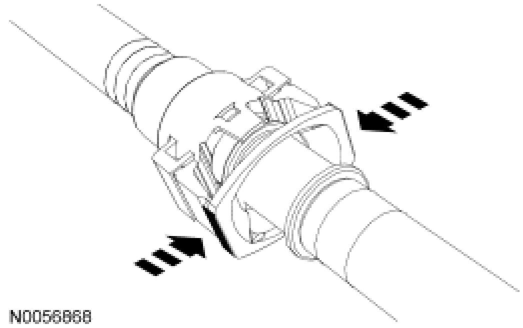


Fig. 25: Squeezing Outer Edges Of Quick Connect Coupling To Release Locking Tabs
Courtesy of FORD MOTOR CO.

3. Remove the quick connect coupling from the tube.

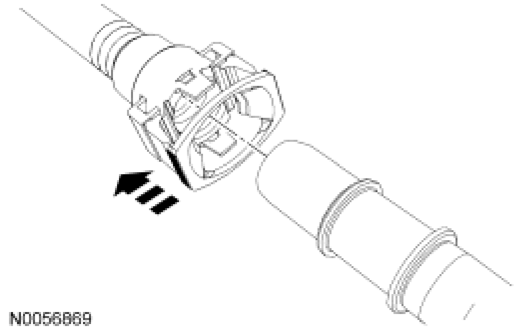


Fig. 26: Removing Quick Connect Coupling From Tube
Courtesy of FORD MOTOR CO.

Connect - Type V

NOTE: Make sure the fuel tube clicks into place when installing the quick connect coupling onto the tube.

1. Install the quick connect coupling onto the tube until it is fully seated.

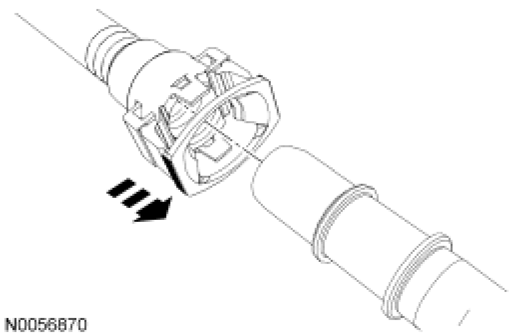


Fig. 27: Installing Quick Connect Coupling Onto Tube Until It Is Fully Seated
Courtesy of FORD MOTOR CO.

2. Pull on the quick connect coupling and the tube to make sure it is securely fastened.
3. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

Disconnect - Type VI

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in**

serious personal injury.

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip can occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage can occur. Always install plugs to any open orifices or tubes.

CAUTION: Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

1. Release the lock tab on the quick connect coupling.

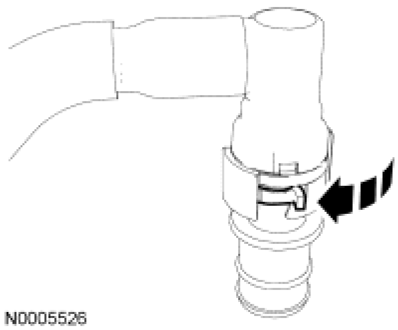


Fig. 28: Positioning Locking Tab Into Unlatched Position
Courtesy of FORD MOTOR CO.

2. Separate the quick connect coupling from the fitting.

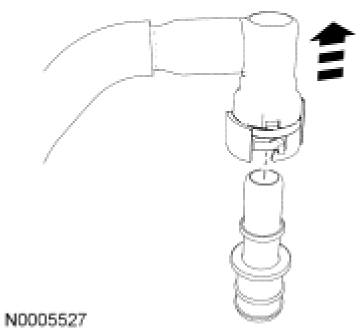


Fig. 29: Identifying Quick Connect Coupling
Courtesy of FORD MOTOR CO.

Connect - Type VI

1. Release the lock tab and install the quick connect coupling onto the fitting.

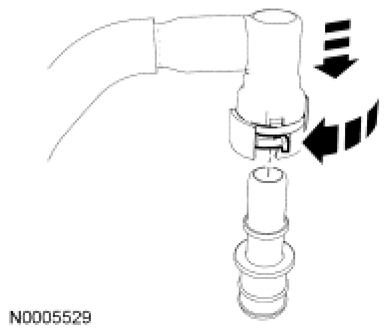


Fig. 30: Identifying Quick Connect Coupling
Courtesy of FORD MOTOR CO.

2. Apply the lock tab into the latched position.

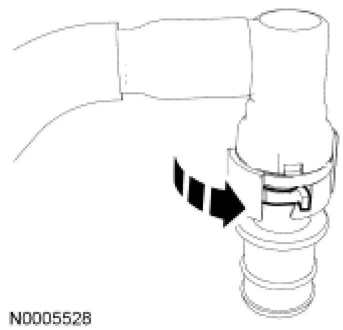


Fig. 31: Positioning Locking Tab Into Latched Position
Courtesy of FORD MOTOR CO.

3. Pull on the quick connect coupling to make sure it is securely fastened.

2008 ELECTRICAL

Fuse & Relay Information - Edge & MKX

IDENTIFICATION

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

BATTERY JUNCTION BOX (BJB)

NOTE: For component location, see appropriate ELECTRICAL COMPONENT LOCATIONS article.

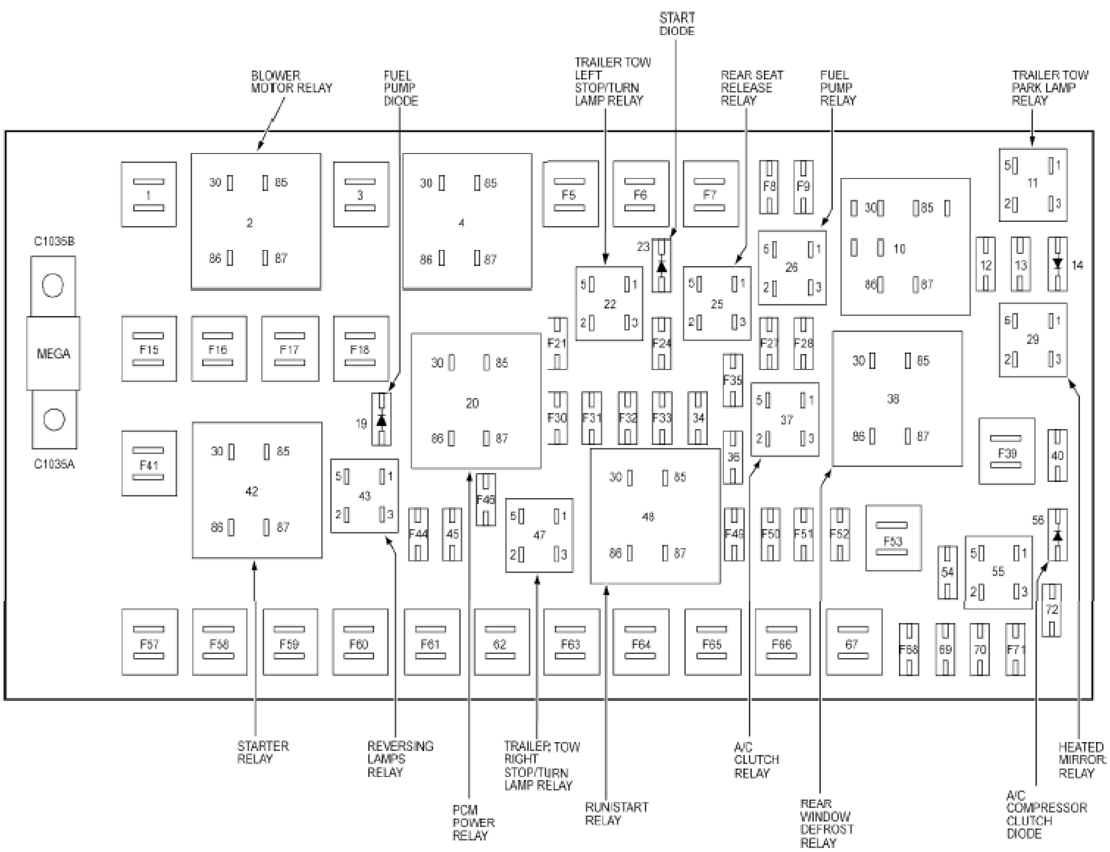


Fig. 1: Battery Junction Box Components
Courtesy of FORD MOTOR CO.

BATTERY JUNCTION BOX COMPONENTS LEGEND

Fuse/Relay Location	Fuse Amp Rating	Battery Junction Box Description
Mega	100	
F1	-	Not used
F3	-	Not used
F5	60[1]	Cooling fan module - without trailer tow
	40[1]	Cooling fan module - with trailer tow
F6	40[1]	Cooling fan module - with trailer tow
F7	30[1]	Heated seat module, left rear
F8	10[2]	Generator
F9	20[2]	Trailer tow park lamp relay
F12	-	Not used
F15	40[1]	Anti-lock Brake System (ABS) module
F16	30[1]	Dual Climate controlled Seat Module (DCSM). Heated seat module passenger side front
F17	20[1]	Power point, instrument panel - Edge, Power point, console 1 - MKX
F18	20[1]	Roof opening panel motor assembly
F21	7.5[2]	EVAP canister vent control solenoid. Powertrain Control Module (PCM)
F23	-	Not used
F24	10[2]	Trailer tow left stop/turn lamp relay
F27	10[2]	Rear seat release relay
F28	15[2]	Heated mirror relay
F30	15[2]	Powertrain Control Module (PCM)
F31	10[2]	Not Used
F32	10[2]	Brake Pedal Position (BPP) switch. Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor. EVAP canister purge valve. Variable Camshaft Timing (VCT valves. Heated oxygen sensors
F33	15[2]	Coil on Plugs, Ignition transformer capacitors - early production
F34	-	Not used
F35	10[2]	A/C clutch relay
F36	-	Not used
F39	40[1]	Rear window defrost grid
F40	-	Not used
F41	30[1]	Starter relay
F44	10[2]	Auto-dimming interior mirror, Reversing lamps
F45	-	Not used
F46	10[2]	Trailer tow right stop/turn lamp relay

F49	10[2]	Powertrain Control Module (PCM)
F50	10[2]	Anti-lock Brake System (ABS) module, ABS test connector
F51	5[2]	Headlamp, left-with adaptive headlamps
F52	5[2]	Fuel pump relay
F53	30[1]	Smart Junction Box (SJB) - F29, F30, F31, F32, F33, F34, F35, F36, F37, F46
F57	40[1]	Anti-lock Brake System (ABS) module, ABS test connector
F58	30[1]	Smart wiper module
F59	30[1]	Liftgate/Trunk Module (LTM)
F50	30[1]	Driver Seat Module (DSM) - with memory, Power seat switch, left - without memory
F61	30[1]	Power seat switch, right
F62	-	Not used
F63	40[1]	Blower motor relay
F64	20[1]	Power point console 2
F65	20[1]	Power point console, rear
F66	20[1]	Power point, cargo area
F67	-	Not used
F68	15[2]	Fuel pump relay
F69	-	Not used
F70	-	Not used
F71	10[2]	Brake Pedal Position (BPP) switch
F72	-	Not used

(1) Cartridge fuse

(2) Mini fuse

SMART JUNCTION BOX (SJB)

NOTE: **For component location, see appropriate ELECTRICAL COMPONENT LOCATIONS article.**

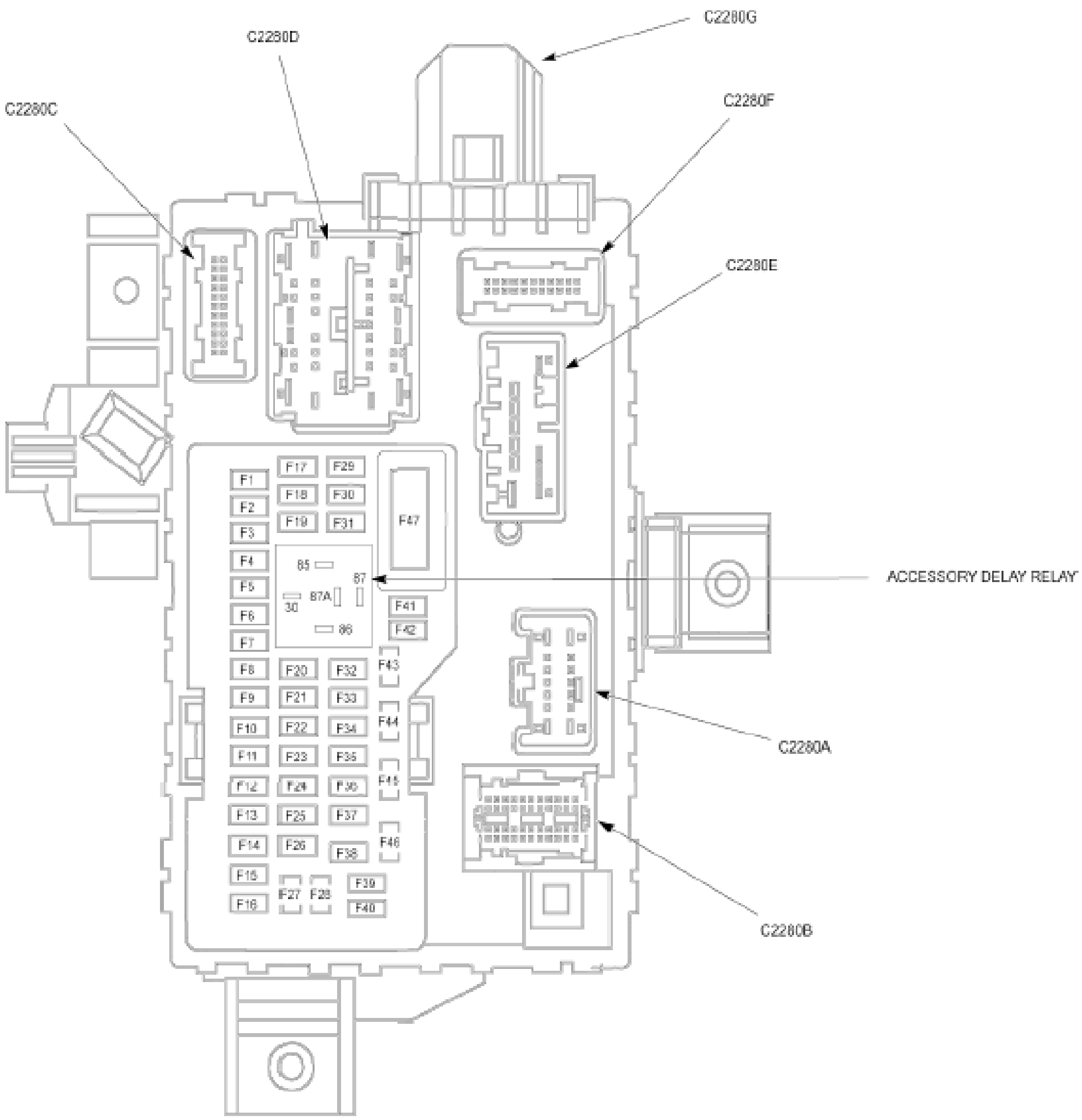


Fig. 2: Smart Junction Box Components
Courtesy of FORD MOTOR CO.

SMART JUNCTION BOX COMPONENTS LEGEND

Fuse/Relay Location	Fuse Amp Rating	Smart Junction Box Description
F1	30	Power window motor, passenger side front - MKX
F2	15	Not used
F3	15	Rear Entertainment Module (RETM) - with DVD rear entertainment center, Accessory Protocol Interface Module (APIM) - with SYNC
F4	30	Power window motor, driver side front
F5	10	Keyless entry keypad, Rear seat release relay, Floor shifter

F6	20	Rear park/stop/turn lamps. Trailer tow left stop/turn lamp relay, Trailer tow right stop/turn lamp relay, Front park/turn lamps - Edge, Headlamps - MKX
F7	10	Low beam lamp, left front - Edge, Headlamp, left - MKX
F8	10	Low beam lamp, right front - Edge, Headlamp, right - MKX
F9	15	Cargo lamp, Overhead console, Interior lamps
F10	15	Exterior rear view mirrors, Floor shifter, Message center switch, Hazard/PAD/Traction switch, Headlamp switch, HVAC module, EMTC - with manual a/c, Steering wheel switches, Roof opening panel switch, Window adjust switches, Seat heater switches, Door lock switches, Memory set switch, Power liftgate release switch
F11	10	All Wheel Drive (AWD) module
F12	7.5	Exterior rear view mirror switch, Driver Seat Module (DSM), Left power seat switch
F13	5	Satellite Digital Audio Receiver System (SDARS) module
F14	10	Liftgate/Trunk Module (LTM)
F15	10	HVAC module, EMTC-with manual a/c, HVAC module, DATC - with automatic a/c
F16	15	Not used
F17	20	Door lock actuators, Roof opening panel motor assembly, Power window motors, Liftgate ajar switch - without power liftgate, Liftgate/Trunk Module (LTM)
F18	20	Audio Digital Signal Processing (DSP) module
F19	25	Rear window wiper motor
F20	15	Data Link Connector (DLC)
F21	15	Headlamp switch, Fog lamps
F22	15	Side lamps, Front park/turn lamps - Edge, Headlamps - MKX, Trailer tow park lamp relay, Rear park/stop/turn lamps, Rear marker lamps, License lamps/liftgate release switch - Edge, License plate lamps - MKX Illuminated liftgate applique - MKX
F23	15	High beam lamps - Edge, Headlamps - MKX
F24	20	Horn
F25	10	Vanity mirror lamps, Overhead console, Interior lamps
F26	10	Instrument Cluster (C)
F27	20	Ignition switch
F28	5	Audio Control Module (ACM)
F29	5	Instrument Cluster (C)
F30	5	Floor shifter
F31	10	Not used
F32	10	Not used
F33	10	Not used
F34	5	Steering Angle Sensor Module (SASM)
F35	10	All Wheel Drive (AWD) module, Parking Aid Module (PAM), Stability control sensor cluster, Heated seat modules

F36	5	Passive anti-theft transceiver
F37	10	Air inlet door actuator, HVAC module, EMTC - with manual a/c, HVAC module, DATC - with automatic a/c
F38	20	Radio amplifier, Audio Digital Signal Processing (DSP) module
F39	20	Audio unit
F40	20	Not used
F41	15	Audio Control Module (ACM), Roof opening panel, Door lock switches Power window motors, Master window adjust switch, Auto-dimming interior mirror unit
F42	10	Not used
F43	10	Rear window wiper motor
F44	10	Not used
F45	5	Smart wiper module, Blower motor relay, Rear window defrost relay, Heated mirror relay
F46	7.5	Restraints Control Module (RCM), Hazard/Pad/Traction switch, Occupant Classification System Module (OCSM)
F47	30c.b.	Master window adjust switch

2008 ENGINE

Fuel Tank & Lines - Edge & MKX

SPECIFICATIONS

MATERIAL SPECIFICATIONS

Item	Specification	Fill Capacity
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	-

GENERAL SPECIFICATIONS

Item	Specification
Fuel tank capacity (all wheel drive [AWD] vehicles)	76L (20 gal)
Fuel tank capacity (front wheel drive [FWD] vehicles)	72L (19 gal)

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Evaporative emission (EVAP) shield bolts	9	-	80
Fuel tank bolts	25	18	-
Fuel tank bracket bolts	25	18	-
Fuel tank filler pipe bracket bolts	9	-	80
Fuel tank filler pipe flange screws	3	-	27
Fuel tank filler pipe hose clamps	4	-	35
Inertia fuel shutoff (IFS) switch bolts	2	-	18
Parking brake cable bracket bolts	23	17	-

DESCRIPTION AND OPERATION

FUEL TANK AND LINES

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related**

component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.**

The fuel system consists of:

- an all wheel drive (AWD) saddle-type or front wheel drive (FWD) L-shaped fuel tank.
- fuel, vapor and brake tubes in an integrated bundle assembly.
- quick connect fuel and vapor tube couplings.
- a fuel tank filler pipe assembly, which cannot be modified in any way, that also contains a restrictor plate to permit only unleaded fuel to be pumped into the tank.
- a 1/4 turn-type fuel tank filler cap.
- an inertia fuel shutoff (IFS) switch.
- a mechanical returnless fuel system.
- a separate fuel level sensor assembly on AWD saddle-type fuel tank.
- a fuel pump (FP) module containing:
  - the electric FP module which provides pressurized fuel to the engine.
  - a serviceable fuel level sender.
  - a check valve which maintains system pressure after the pump is shut off.
  - a pressure relief for overpressure protection in the event of restricted airflow.
  - a fuel filter providing filtration to protect the fuel injectors from foreign material.

The FP module is controlled by the PCM. Electrical power to the FP module is provided through the IFS switch located under the LH rear quarter trim panel.

DIAGNOSTIC TESTS

FUEL TANK AND LINES

Refer to the **Introduction - Gasoline Engines** article.

REMOVAL AND INSTALLATION

FUEL TANK AND FILLER PIPE - EXPLODED VIEW

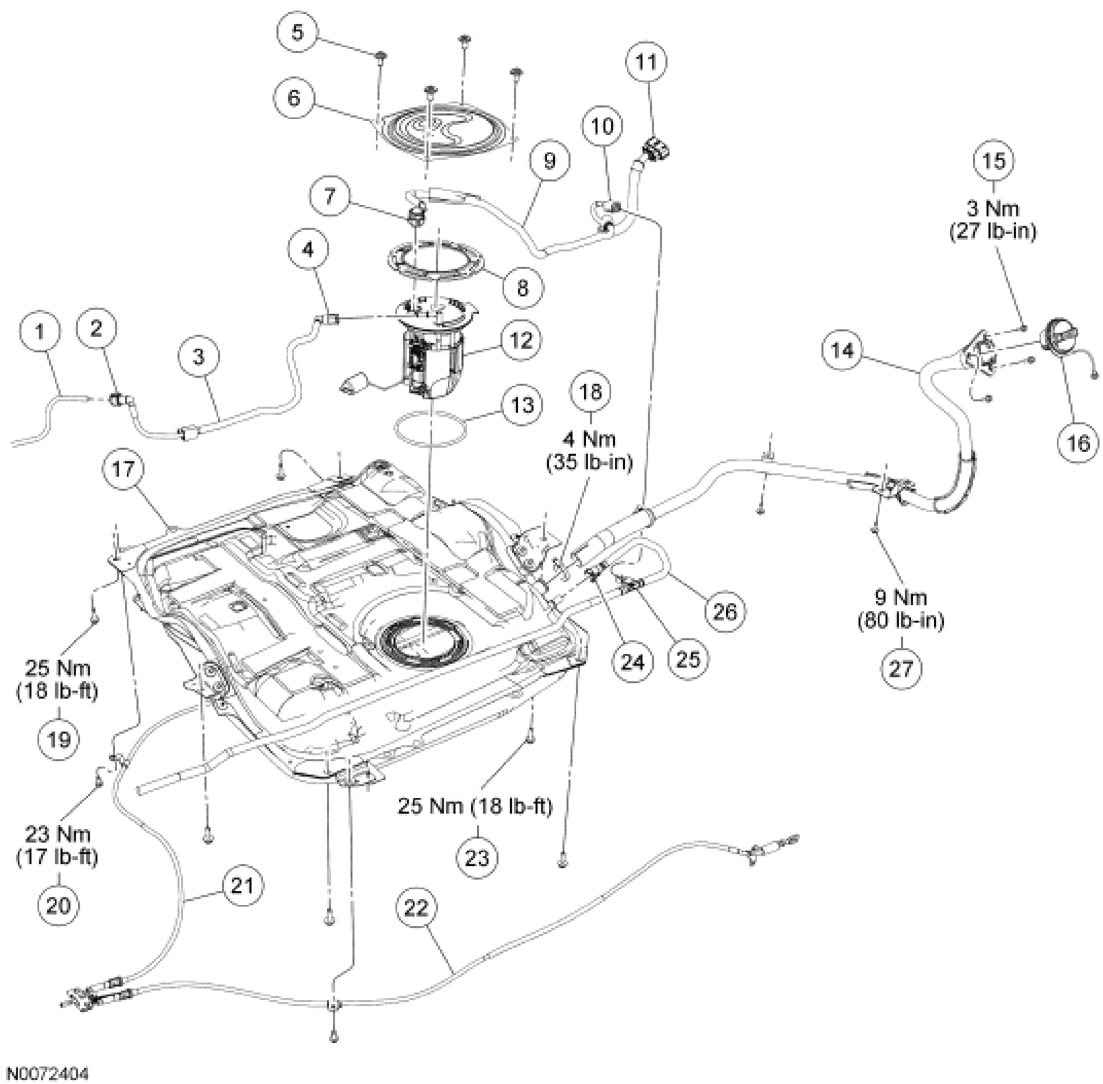


Fig. 1: Exploded View Of Fuel Tank & Filler Pipe With Torque Specifications - Front Wheel Drive (FWD) Vehicle
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	9S284	Fuel tube
2	-	Fuel tank jumper tube-to-fuel tube quick connect coupling (part of 9324A)
3	9324A	Fuel tank jumper tube
		Fuel tank jumper tube-to-fuel pump (FP)

4	-	module quick connect coupling (part of 9324A)
5	W705909	FP module access cover bolt (4 required)
6	9C335	FP module access cover
7	-	FP module electrical connector (part of 14407A)
8	9C385	FP module lock ring
9	14407A	Fuel tank wiring harness
10	-	Fuel tank pressure (FTP) sensor electrical connector (part of 14407A)
11	-	Fuel tank wiring harness electrical connector (part of 14407A)
12	9H307	FP module
13	9276A	FP module O-ring seal
14	9034A	Fuel tank filler pipe
15	W505253	Fuel tank filler pipe flange screw (3 required)
16	9030A	Fuel tank filler cap
17	9K007	Fuel tank
18	W525937	Fuel tank filler pipe hose clamp (2 required)
19	W713928	Fuel tank bolt (4 required)
20	W708004	Parking brake cable bracket bolt (2 required)
21	2A604	Rear, RH parking brake cable
22	2A823	Rear, LH parking brake cable
23	W713928	Fuel tank bracket bolt (2 required)
24	-	Fuel vapor tube assembly-to-fuel tank quick connect coupling (part of 9S284)
25	-	FTP sensor (part of 9S284)
26	9S284	Fuel vapor tube assembly
27	W710330	Fuel tank filler pipe bracket bolt (2 required)

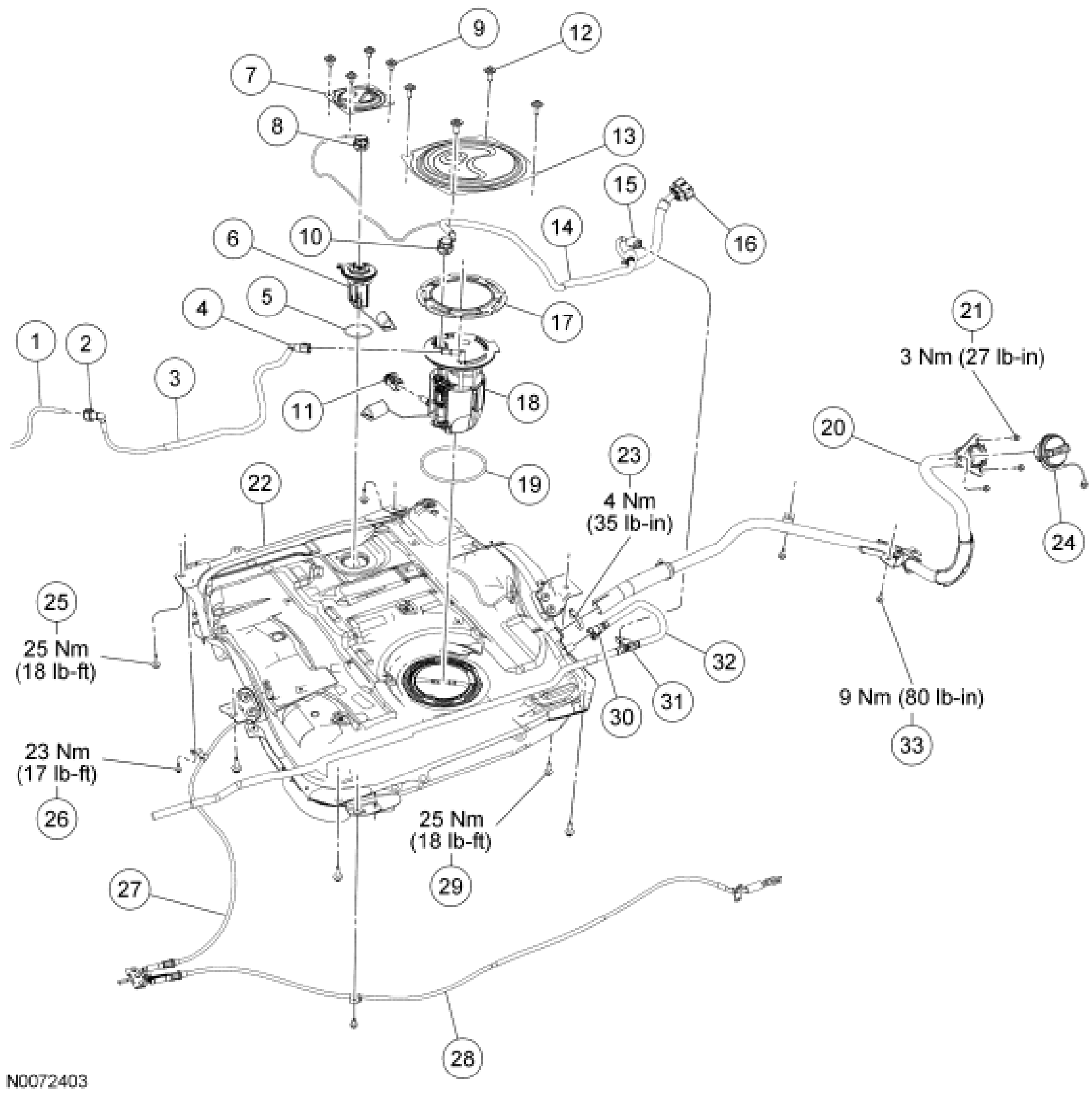


Fig. 2: Exploded View Of Fuel Tank & Filler Pipe With Torque Specifications - All Wheel Drive (AWD) Vehicle
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	9S284	Fuel tube
2	-	Fuel tank jumper tube-to-fuel tube quick connect coupling (part of 9324A)
3	9324A	Fuel tank jumper tube
4	-	Fuel tank jumper tube-to-fuel pump (FP) module quick connect coupling (part of 9324A)
5	-	Fuel level sensor O-ring seal (part of 9275B)

6	9275B	Fuel level sensor
7	9C335	Fuel level sensor access cover
8	-	Fuel level sensor electrical connector (part of 14407A)
9	W705909	Fuel level sensor access cover bolt (4 required)
10	-	FP module electrical connector (part of 14407A)
11	-	Internal fuel tube-to-FP module quick connect coupling (part of 9K007)
12	W705909	FP module access cover bolt (4 required)
13	9C355	FP module access cover
14	14407A	Fuel tank wiring harness
15	-	Fuel tank pressure (FTP) sensor electrical connector (part of 14407A)
16	-	Fuel tank wiring harness electrical connector (part of 14407A)
17	9C385	FP module lock ring
18	9H307	FP module
19	9276A	FP module O-ring seal
20	9034A	Fuel tank filler pipe
21	W505253	Fuel tank filler pipe flange screw (3 required)
22	9K007	Fuel tank
23	W525937	Fuel tank filler pipe hose clamp (2 required)
24	9030A	Fuel tank filler cap
25	W713928	Fuel tank bolt (4 required)
26	W708004	Parking brake cable bracket bolt (2 required)
27	2A604	Rear, RH parking brake cable
28	2A823	Rear, LH parking brake cable
29	W713928	Fuel tank bracket bolt (2 required)
30	-	Fuel vapor tube assembly-to-fuel tank quick connect coupling (part of 9S284)
31	-	FTP sensor (part of 9S284)
32	9S284	Fuel vapor tube assembly
33	W710330	Fuel tank filler pipe bracket bolt (2 required)

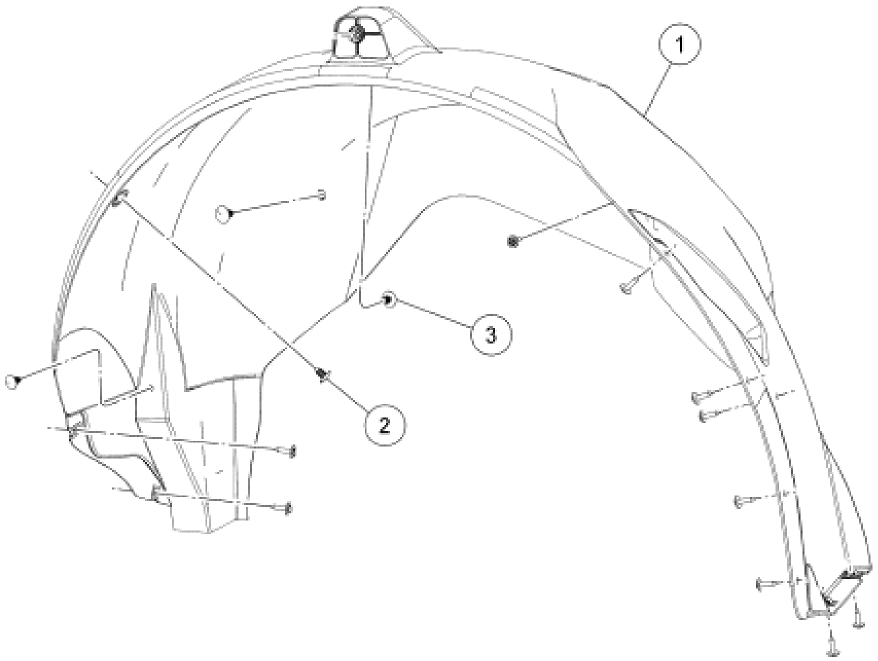


Fig. 3: Exploded View Of Fuel Tank & Filler Pipe - All Vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	LH rear splash shield
2	W712196	Splash shield pin-type retainer (4 required)
3	W706805	Splash shield screw (10 required)

1. For additional information, refer to the appropriate procedure.

FUEL TANK

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Remove the fuel filler cap slowly. The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise, fuel may spray out. Failure to follow these instructions may result in serious personal injury.**

WARNING: **When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.**

All vehicles

1. Drain the fuel tank. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

   All wheel drive (AWD) vehicles

2. Remove the muffler and tailpipe. For additional information, refer to **EXHAUST SYSTEM** article.
3. Remove the driveshaft. For additional information, refer to **DRIVESHAFT** article.

   All vehicles

4. Install a suitable lifting device under the fuel tank.
5. Disconnect the fuel tank wiring harness electrical connector.
6. Disconnect the fuel tank pressure (FTP) sensor electrical connector.
7. Disconnect the fuel vapor tube assembly-to-fuel tank quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
8. Release the clamp and disconnect the fuel tank filler pipe hose from the fuel tank.
   - To install, tighten to 4 Nm (35 lb-in).
9. Disconnect the fuel tank jumper tube-to-fuel tube quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
10. Remove the 2 parking brake cable bracket bolts and position cables aside.
    - To install, tighten to 23 Nm (17 lb-ft).

CAUTION: Remove all bolts prior to lowering the fuel tank. Fuel tank damage can occur if all of the bolts are not removed.

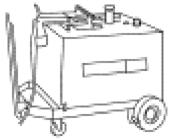
11. Remove the 2 fuel tank bracket bolts and the 4 fuel tank bolts.
    - To install, tighten to 25 Nm (18 lb-ft).

NOTE: All wheel drive (AWD) vehicles require the fuel tank to be positioned forward, past the rear differential unit (RDU), then lowered.

12. Completely lower and remove the fuel tank.
13. To install, reverse the removal procedure.

FUEL TANK FILLER PIPE

Special Tools

Illustration	Tool Name	Tool Number
 ST1134A	Fuel Storage Tanker	164-R3202 or equivalent

REMOVAL AND INSTALLATION

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WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Remove the fuel filler cap slowly. The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise, fuel may spray out. Failure to follow these instructions may result in serious personal injury.

WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Release the fuel tank filler cap and position aside.
4. Insert a suitable fuel drain tube into the fuel tank filler pipe until it enters the fuel tank.

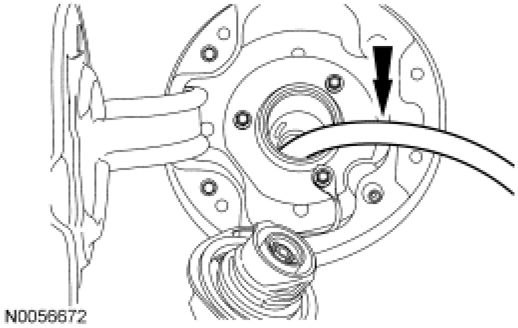


Fig. 4: Inserting Suitable Fuel Drain Tube Into Fuel Tank Filler Pipe
Courtesy of FORD MOTOR CO.

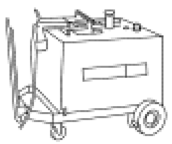
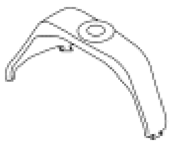
NOTE: If the fuel tank is completely full, this step will lower the fuel level below the fuel tank inlet.

5. Attach the fuel storage tanker to the fuel drain tube and drain approximately 1/8 of the fuel from the tank.
6. Remove the 3 fuel tank filler pipe flange retaining screws.
   - To install, tighten to 3 Nm (27 lb-in).
7. Remove the LH rear wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
8. Remove the 10 screws, 4 pin-type retainers and the LH rear splash shield.
9. Release the clamp and disconnect the fuel tank filler pipe from the fuel tank.
   - To install, tighten to 4 Nm (35 lb-in).
10. Remove the 2 fuel tank filler pipe bracket bolts.
    - To install, tighten to 9 Nm (80 lb-in).
11. Remove the fuel tank filler pipe from the vehicle.
12. To install, reverse the removal procedure.

FUEL PUMP MODULE

Special Tools

Illustration	Tool Name	Tool Number
	Fuel Storage Tanker	164-R3202 or equivalent

 ST1134A		
 ST2803-A	Wrench, Fuel Tank Sender Unit	310-123

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

REMOVAL AND INSTALLATION

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WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

NOTE: **The fuel pump (FP) module has a serviceable fuel level sender. For additional information, refer to Fuel Level Sender.**

All vehicles

1. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL**

INFORMATION article.

2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Release the fuel tank filler cap and position aside.
4. Insert a suitable fuel drain tube into the fuel tank filler pipe until it enters the fuel tank.

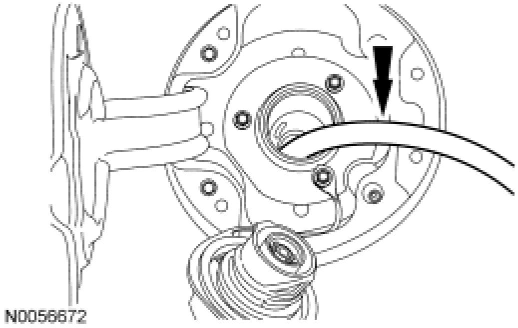


Fig. 5: Inserting Suitable Fuel Drain Tube Into Fuel Tank Filler Pipe
Courtesy of FORD MOTOR CO.

NOTE: If the fuel tank is completely full, this step will lower the fuel level below the FP module mounting flange.

5. Attach the fuel storage tanker to the fuel drain tube and drain approximately 1/8 of the fuel from the tank.
6. Remove the rear seat. For additional information, refer to **SEATING** article.
7. Remove the 4 bolts and the FP module access cover.

NOTE: Clean the FP module connection, coupling, flange surface and the immediate surrounding area of any dirt or foreign material.

8. Disconnect the FP module electrical connector.
9. Disconnect the fuel tank jumper tube-to-FP module quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

NOTE: Place absorbent pads on the floor pan in the immediate area in case of fuel spills. Carefully remove the FP module from the vehicle to avoid fuel spillage inside the vehicle.

10. Using the special tool, remove the FP module lock ring.

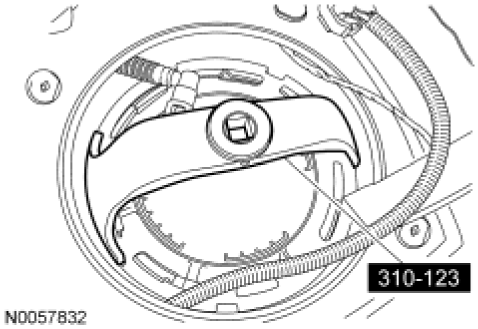


Fig. 6: Removing FP Module Lock Ring Using Special Tool (310-123)
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

CAUTION: The fuel pump (FP) module must be handled carefully to avoid damage to the FP module and/or float arm.

11. Carefully lift the FP module out of the fuel tank enough to access and disconnect the internal fuel tube-to-FP module quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

All vehicles

NOTE: The FP module will have residual fuel remaining internally, drain into a suitable container.

12. Completely remove the FP module from the fuel tank.

NOTE: Inspect the mating surfaces of the FP module flange and the fuel tank O-ring seal contact surfaces. Do not polish or adjust the O-ring seal contact area of the fuel tank flange or the fuel tank. Install a new FP module or fuel tank if the O-ring seal contact area is bent, scratched or corroded.

NOTE: Make sure to install a new FP module O-ring seal. Install a new lock ring if it is bent, damaged or corroded.

NOTE: To install, apply clean engine oil to the O-ring seal.

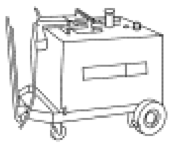
13. Remove the FP module O-ring seal.

NOTE: Make sure the alignment tab on the FP module and the fuel tank meet before tightening the FP module lock ring.

14. To install, reverse the removal procedure.

FUEL LEVEL SENSOR

Special Tools

Illustration	Tool Name	Tool Number
 ST1134A	Fuel Storage Tanker	164-R3202 or equivalent

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.**

WARNING: **When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.**

1. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Release the fuel tank filler cap and position aside.
4. Insert a suitable fuel drain tube into the fuel tank filler pipe until it enters the fuel tank.

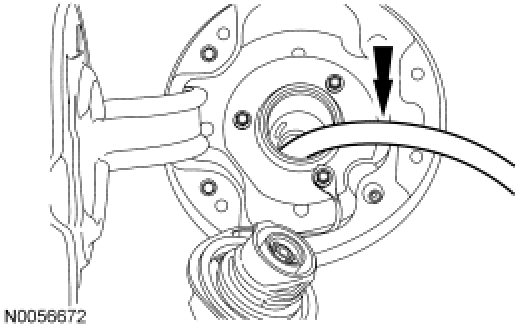


Fig. 7: Inserting Suitable Fuel Drain Tube Into Fuel Tank Filler Pipe
Courtesy of FORD MOTOR CO.

NOTE: **If the fuel tank is completely full, this step will lower the fuel level below the fuel level sensor mounting flange.**

5. Attach the fuel storage tanker to the fuel drain tube and drain approximately 1/8 of the fuel from the tank.
6. Remove the rear seat. For additional information, refer to **SEATING** article.
7. Remove the 4 bolts and the fuel level sensor access cover.

NOTE: **Clean the fuel level sensor connection, flange surface and the immediate surrounding area of any dirt or foreign material.**

8. Disconnect the fuel level sensor electrical connector.

NOTE: **Place absorbent pads in the general work area in case of fuel spillage.**

9. Release the lock tab, and using a suitable tool, rotate the fuel level sensor counterclockwise approximately 1/4 turn and lift upward.

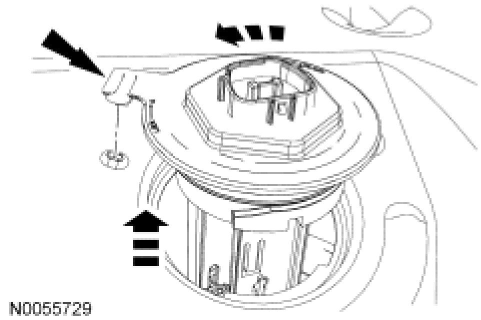


Fig. 8: Rotating Fuel Level Sensor Counterclockwise Approximately 1/4 Turn & Lift Upward
Courtesy of FORD MOTOR CO.

CAUTION: The fuel level sensor must be handled carefully to avoid damage to the float arm.

CAUTION: Carefully remove the fuel level sensor from the fuel tank to avoid fuel spillage inside the vehicle.

10. Carefully lift and remove the fuel level sensor from the fuel tank.

NOTE: Inspect the mating surfaces of the fuel level sensor flange and the fuel tank O-ring seal contact surfaces. Do not polish or adjust the O-ring seal contact area of the fuel tank flange or the fuel tank. Install a new fuel level sensor or fuel tank if the O-ring seal contact area is bent, scratched or corroded.

NOTE: To install, apply clean engine oil to the O-ring seal.

NOTE: Upon installation, correctly seat and press down firmly on the fuel level sensor, rotate it clockwise until the lock arrow on the sensor aligns with the notch on the tank. Torque should not exceed 15 Nm (11 lb-ft).

11. To install, reverse the removal procedure.

FUEL LEVEL SENDER

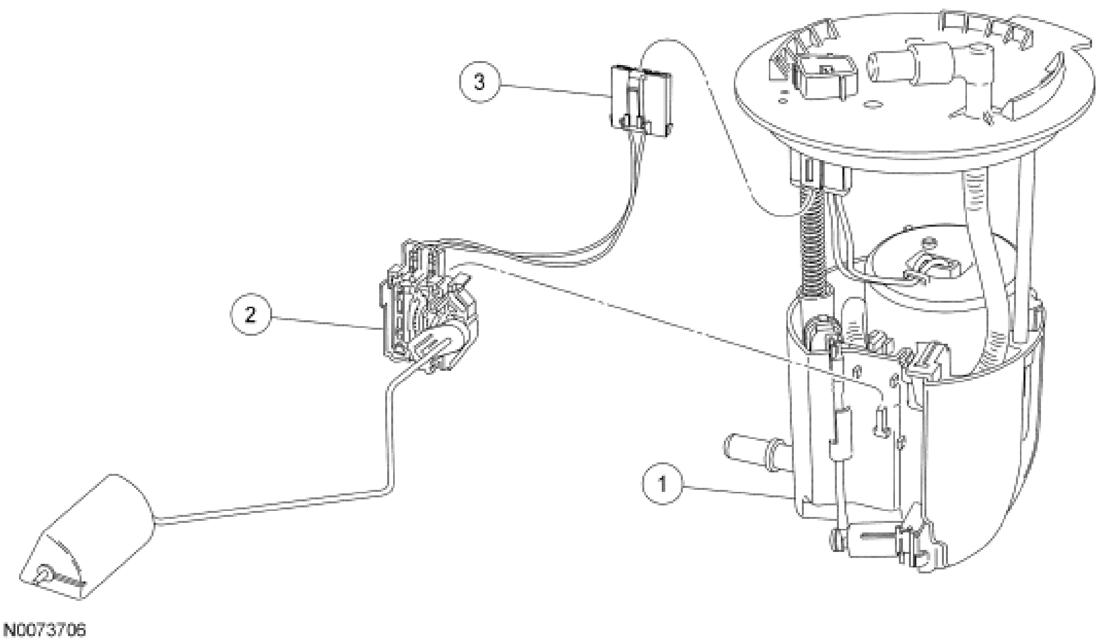


Fig. 9: Exploded View Of Fuel Level Sender
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	9H307	Fuel pump (FP) module
2	9A299	Fuel level sender
3	-	Fuel level sender electrical connector (part of 9A299)

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

1. Remove the fuel pump (FP) module. For additional information, refer to **Fuel Pump Module**.
2. Disconnect the fuel level sender electrical connector.

3. Depress the lock tab and slide the fuel level sender upwards and remove.

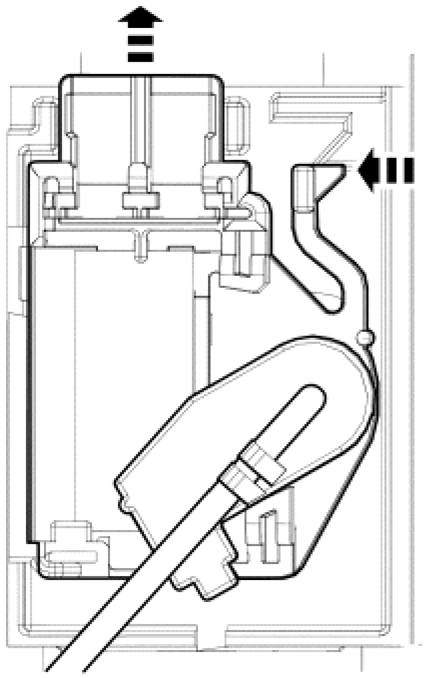


Fig. 10: Depressing Lock Tab & Sliding Fuel Level Sender Upwards
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.

FUEL LINES

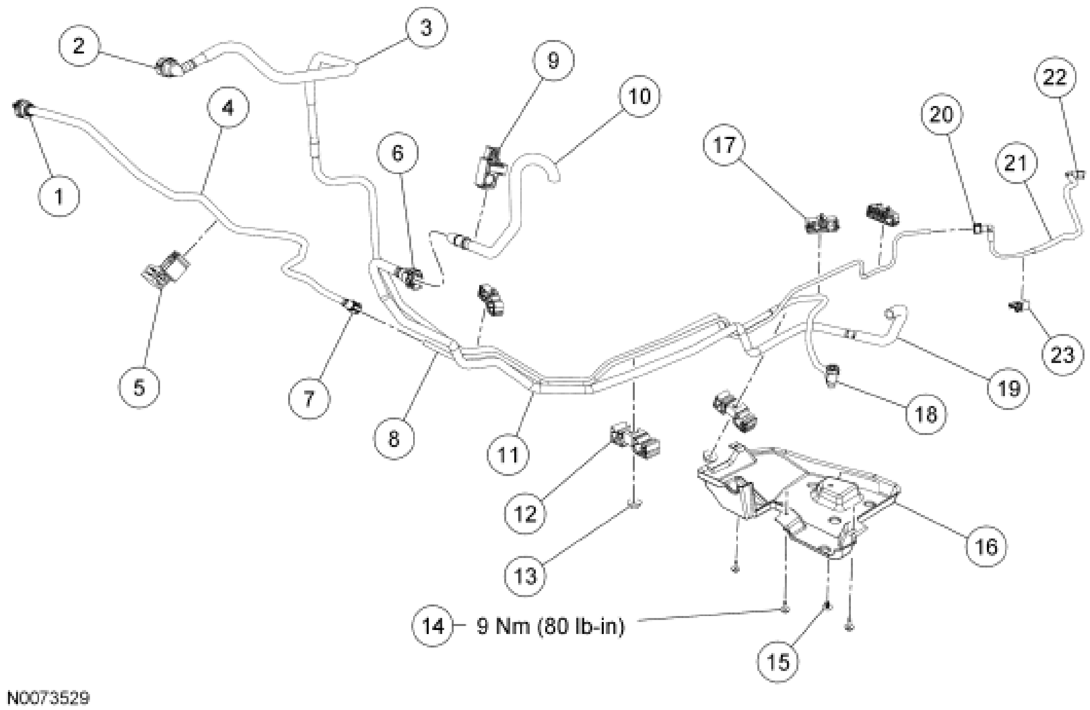


Fig. 11: Exploded View Of Fuel Lines With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Fuel supply tube-to-fuel rail quick connect coupling (part of 9J280)
2	-	Fuel vapor tube-to-evaporative emission (EVAP) canister purge valve quick connect coupling (part of 9S284)
3	9S284	Fuel vapor tube
4	9J280	Fuel supply tube
5	-	Fuel supply tube retainer clip (part of 9J280)
6	-	Fresh air tube-to-fuel vapor vent tube quick connect coupling (part of 9S284)
7	-	Fuel supply tube-to-fuel tube quick connect coupling (part of 9J280)
8	9S284	Fuel tube
9	-	Fuel vapor vent tube retainer clip (part of 9S327)
10	9S327	Fuel vapor vent tube
11	9S284	Fresh air tube
12	9F931	Bundle retainer clip (2 required)
13	W707137	Bundle retainer clip nut (2 required)

14	W710330	EVAP shield bolt (3 required)
15	W705681	EVAP shield pin-type retainer
16	9H296	EVAP shield
17	9F931	Bundle retainer clip (3 required)
18	-	Fuel vapor tube-to-EVAP canister quick connect coupling (part of 9S284)
19	9E857	Fuel vapor tube
20	-	Fuel tank jumper tube-to-fuel tube quick connect coupling (part of 9324)
21	9324	Fuel tank jumper tube
22	-	Fuel tank jumper tube-to-fuel pump (FP) module quick connect coupling (part of 9324)
23	9F931	Fuel tank jumper tube retainer clip

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
3. Disconnect the fuel supply tube-to-fuel rail quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
4. Disconnect the fuel supply tube-to-fuel tube quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
5. Release the retainer clip and remove the fuel supply tube.

6. Remove the 3 bolts, pin-type retainer and the evaporative emission (EVAP) shield.
   - To install, tighten to 9 Nm (80 lb-in).
7. Disconnect the fresh air tube-to-fuel vapor vent tube quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
8. Release the retainer clip and remove the fuel vapor vent tube.
9. Disconnect the fuel vapor tube-to-EVAP canister purge valve quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
10. Remove the 2 nuts and the 2 bundle retainer clips.
    - To install, tighten to 9 Nm (80 lb-in).
11. Disconnect the fuel vapor tube-to-EVAP canister quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
12. Disconnect the fuel vapor tube from the dust separator.
13. Disconnect the fuel tank jumper tube-to-fuel tube quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
14. Release the 3 bundle retainer clips and remove the fuel tube, fuel vapor tube and the fresh air tube.
15. Disconnect the fuel tank jumper tube-to-fuel pump (FP) module quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
16. Release the retainer clip and remove the fuel tank jumper tube.
17. To install, reverse the removal procedure.

INERTIA FUEL SHUTOFF (IFS) SWITCH

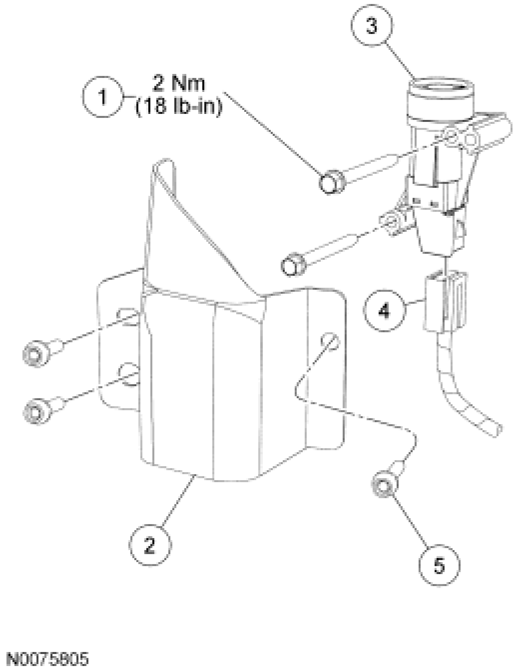


Fig. 12: Exploded View Of Inertia Fuel Shutoff (IFS) Switch With Torque Specification

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W504169	Inertia fuel shutoff (IFS) switch bolt (2 required)
2	-	IFS switch shield
3	9341	IFS switch
4	14489A	IFS switch electrical connector
5	-	IFS switch shield rivet (3 required)

REMOVAL AND INSTALLATION

1. Remove the LH rear quarter trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the 3 rivets and the inertia fuel shutoff (IFS) switch shield.
3. Disconnect the IFS switch electrical connector.

CAUTION: Do not overtighten the fasteners or damage to the switch will occur.

4. Remove the 2 bolts and the IFS switch.
    - To install, tighten to 2 Nm (18 lb-in).
5. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Horn - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Horn bolt	10	89

DESCRIPTION AND OPERATION

HORN

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The horn system consists of the following components:

- Horn switches (part of the steering wheel)
- Clockspring
- Horn relay (part of the SJB)
- Horn

For removal and installation of the steering wheel, refer to **STEERING COLUMN** article.

For removal and installation of the SJB, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.

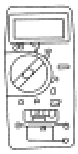
Horn Location

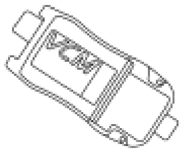
The horn is mounted on the side of the RH wheel well under the front fender splash shield.

DIAGNOSTIC TESTS

HORN

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The SJB supplies the control and switched voltage to the horn relay (part of the SJB). When the horn switches (part of the steering wheel) are pressed, ground is supplied through the clockspring to the horn relay. The horn relay is then energized, directing voltage to the horn and enabling the horn to sound.

The horn switch is comprised of 2 sets of contacts separated by springs. The lower set is connected to ground and the upper set is connected to the horn signal circuit. When the driver air bag module is pressed, it pushes down on the upper set of contacts, collapsing the springs and allowing the contacts to touch. When the contacts touch, it completes the circuit.

When the vehicle security system is armed, the SJB provides a momentary ground to the horn relay control side to indicate the system is armed, and an on and off ground when an intrusion is detected or the panic alarm is activated.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Horn • Steering wheel switch harness • Horn switches (part of the steering wheel)	• Smart junction box (SJB) fuse 24 (20A) • Wiring, terminals or connectors • Clockspring • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool release software.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the vehicle.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication with one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The horn is inoperative	• Fuse • Wiring, terminals or connectors • Horn • Clockspring • Steering wheel switch harness • Horn switches (part of the steering wheel)	• Go to **Pinpoint Test A** .

	• Smart junction box (SJB)	
• The horn is always on	• Wiring, terminals or connectors • Clockspring • Steering wheel switch harness • Horn switches (part of the steering wheel) • SJB	• Go to **Pinpoint Test B** .

Pinpoint Tests

Pinpoint Test A: The Horn Is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article , Horn/Cigar Lighter for schematic and connector information.

Normal Operation

The smart junction box (SJB) supplies the switched and control voltage to the horn relay (part of the SJB). When the horn switches (part of the steering wheel) are pressed, the switches are grounded to the steering wheel through circuit GD165 (BK), and the clockspring to the instrument panel cross-car beam through circuit GD116 (BK/VT). Ground is then supplied to the horn relay through circuit CRH02 (BU/WH), energizing the horn relay. The horn relay then sends voltage to the horn through circuit CRH04 (VT/GN), enabling the horn to sound. Ground for the horn is supplied through circuit GD123 (BK/GY).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Horn
- Clockspring
- Steering wheel switch harness
- Horn switches (part of the steering wheel)
- SJB

PINPOINT TEST A: THE HORN IS INOPERATIVE

> **CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

A1 CHECK THE SJB OUTPUT

- Key in ON position.

- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Select the SJB PID (HORN). Active command the horn on and then off.
- **Does the horn sound when commanded on?**

  YES : Go to A2.

  NO : Go to A7.

A2 CHECK CIRCUIT GD165 (BK) FOR AN OPEN

- Key in OFF position.
- Remove the driver air bag module. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Clockspring C218b

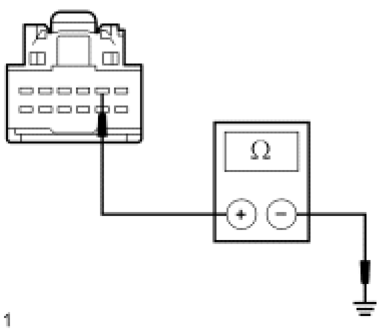


Fig. 1: Checking Circuit GD165 (BK) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218b-2, circuit GD165 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to A3.

  NO : REPAIR the circuit. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

A3 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

- Disconnect: Clockspring C218a

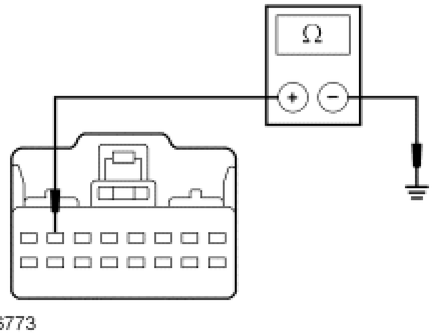


Fig. 2: Checking Circuit GD116 (BK/VT) For Open
Courtesy of FORD MOTOR CO.

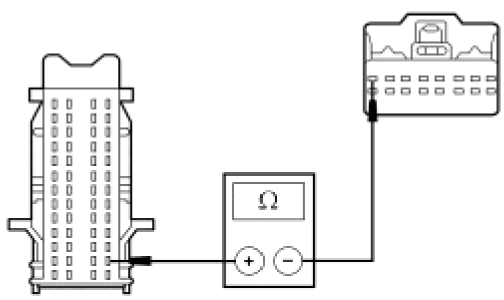
- Measure the resistance between the clockspring C218a-7, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to A4.

  NO : REPAIR the circuit. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

A4 CHECK CIRCUIT CRH02 (BU/WH) FOR AN OPEN

- Disconnect: SJB C2280b



N0060018

Fig. 3: Checking Circuit CRH02 (BU/WH) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218a-8, circuit CRH02 (BU/WH), harness side and the SJB C2280b-41, circuit CRH02 (BU/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A5.

  NO : REPAIR the circuit. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

A5 CHECK THE CLOCKSPRING FOR AN OPEN

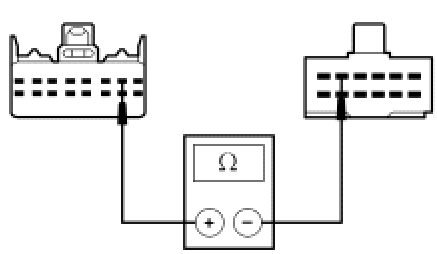


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Fig. 4: Checking Clockspring For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218a pin 7, component side and the clockspring C218b pin 2, component side.

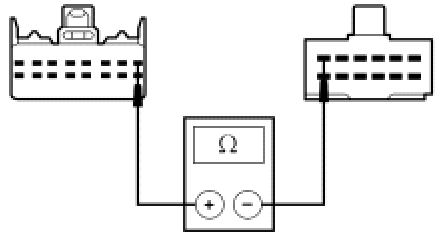


Fig. 5: Checking Clockspring For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218a pin 8, component side and the clockspring C218b pin 1, component side.
- **Are the resistances less than 5 ohms?**

  YES : Go to A6.

  NO : INSTALL a new clockspring. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

A6 CHECK THE STEERING WHEEL SWITCH HARNESS FOR AN OPEN

- Disconnect: Horn Switch C2996 and C2997

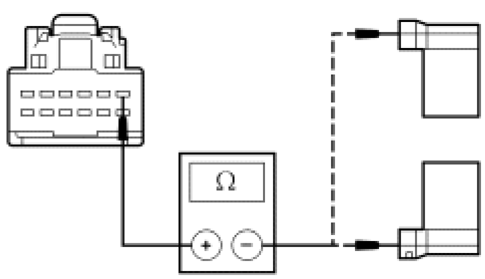


Fig. 6: Checking Steering Wheel Switch Harness For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218b-1, circuit CRH02 (BU/WH), harness side and the horn switch C2996-1, circuit CRH02 (BU/WH), harness side; and between the clockspring C218b-1, circuit CRH02 (BU/WH), harness side and the horn switch C2997-1, circuit CRH02 (BU/WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new steering wheel. REFER to **STEERING COLUMN** article. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

  NO : REPAIR the circuit. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

A7 CHECK CIRCUIT GD123 (BK/GY) FOR AN OPEN

- Key in OFF position.
- Disconnect: Horn C131

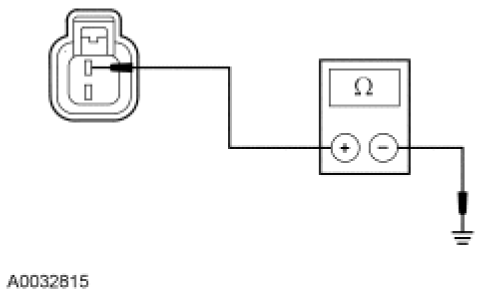


Fig. 7: Checking Circuit GD123 (BK/GY) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the horn C131-1, circuit GD123 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to A8.

  NO : REPAIR the circuit. TEST the system for normal operation.

A8 CHECK CIRCUIT CRH04 (VT/GN) FOR VOLTAGE

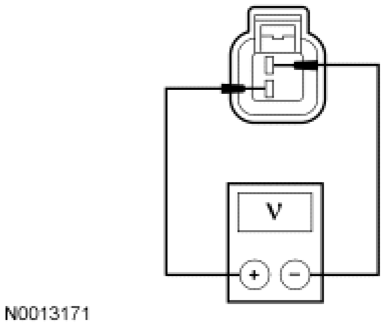


Fig. 8: Checking Circuit CRH04 (VT/GN) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the horn C131-2, circuit CRH04 (VT/GN), harness side, and the horn C131-1, circuit GD123 (BK/GY), harness side, while pressing the horn switch.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new horn. REFER to **Horn**. TEST the system for normal operation.

  NO : VERIFY the SJB fuse 24 (20A) is OK. If OK, go to A9.

A9 CHECK CIRCUIT CRH04 (VT/GN) FOR AN OPEN

- Disconnect: SJB C2280e

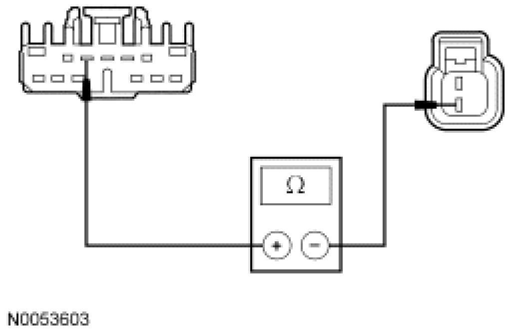


Fig. 9: Checking Circuit CRH04 (VT/GN) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280e-5 , circuit CRH04 (VT/GN), harness side, and the horn C131-2, circuit CRH04 (VT/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A10.

  NO : REPAIR the circuit. TEST the system for normal operation.

A10 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: The Horn Is Always On

Refer to appropriate SYSTEM WIRING DIAGRAMS article , Horn/Cigar Lighter for schematic and connector information.

Normal Operation

The smart junction box (SJB) supplies the switched and control voltage to the horn relay (part of the SJB). When the horn switches (part of the steering wheel) are pressed, the switches are grounded to the steering wheel, and the clockspring to the instrument panel cross-car beam. Ground is then supplied to the horn relay through circuit CRH02 (BU/WH), energizing the horn relay. The horn relay then sends voltage to the horn through circuit CRH04 (VT/GN), enabling the horn to sound.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Clockspring
- Steering wheel switch harness
- Horn switches (part of the steering wheel)
- SJB

PINPOINT TEST B: THE HORN IS ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

B1 CHECK CIRCUIT CRH04 (VT/GN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280e
- Key in ON position.
- **Does the horn continue to sound?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to B2.

B2 CHECK THE HORN SWITCH INPUT

- Key in OFF position.
- Disconnect: SJB C2280b
- Connect: SJB C2280e
- **Does the horn sound continuously?**

  YES : Go to B6.

  NO : Go to B3.

B3 CHECK CIRCUIT CRH02 (BU/WH) FOR A SHORT TO GROUND

- Depower the supplemental restraint system (SRS). Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Clockspring C218a

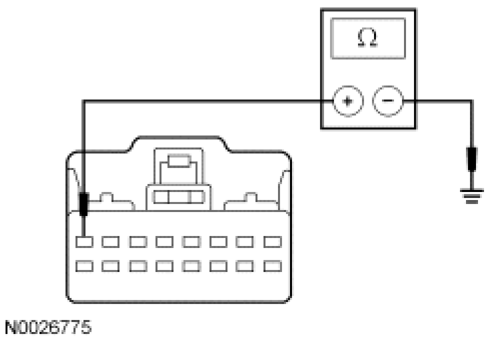


Fig. 10: Checking Circuit CRH02 (BU/WH) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218a-8, circuit CRH02 (BU/WH), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to B4.

  NO : REPAIR the circuit. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

B4 CHECK THE CLOCKSPRING FOR A SHORT TO GROUND

- Remove the driver air bag module. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Connect: Clockspring C218a
- Disconnect: Clockspring C218b

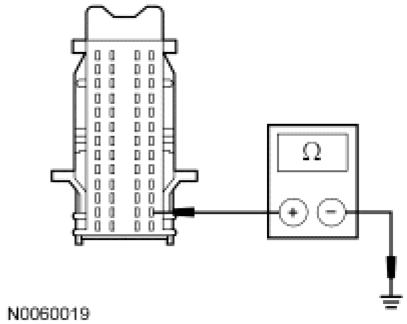


Fig. 11: Checking Clockspring For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280b-41, circuit CRH02 (BU/WH), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to B5.

  NO : INSTALL a new clockspring. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

B5 CHECK THE STEERING WHEEL SWITCH HARNESS FOR A SHORT TO GROUND

- Disconnect: Horn Switch C2996 and C2997

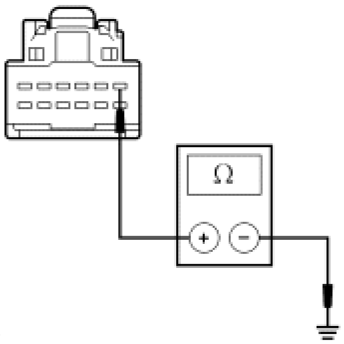


Fig. 12: Checking Steering Wheel Switch Harness For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring 218b-1, circuit CRH02 (BU/WH), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new steering wheel. REFER to **STEERING COLUMN** article. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

  NO : REPAIR the circuit. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

B6 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

REMOVAL AND INSTALLATION

HORN

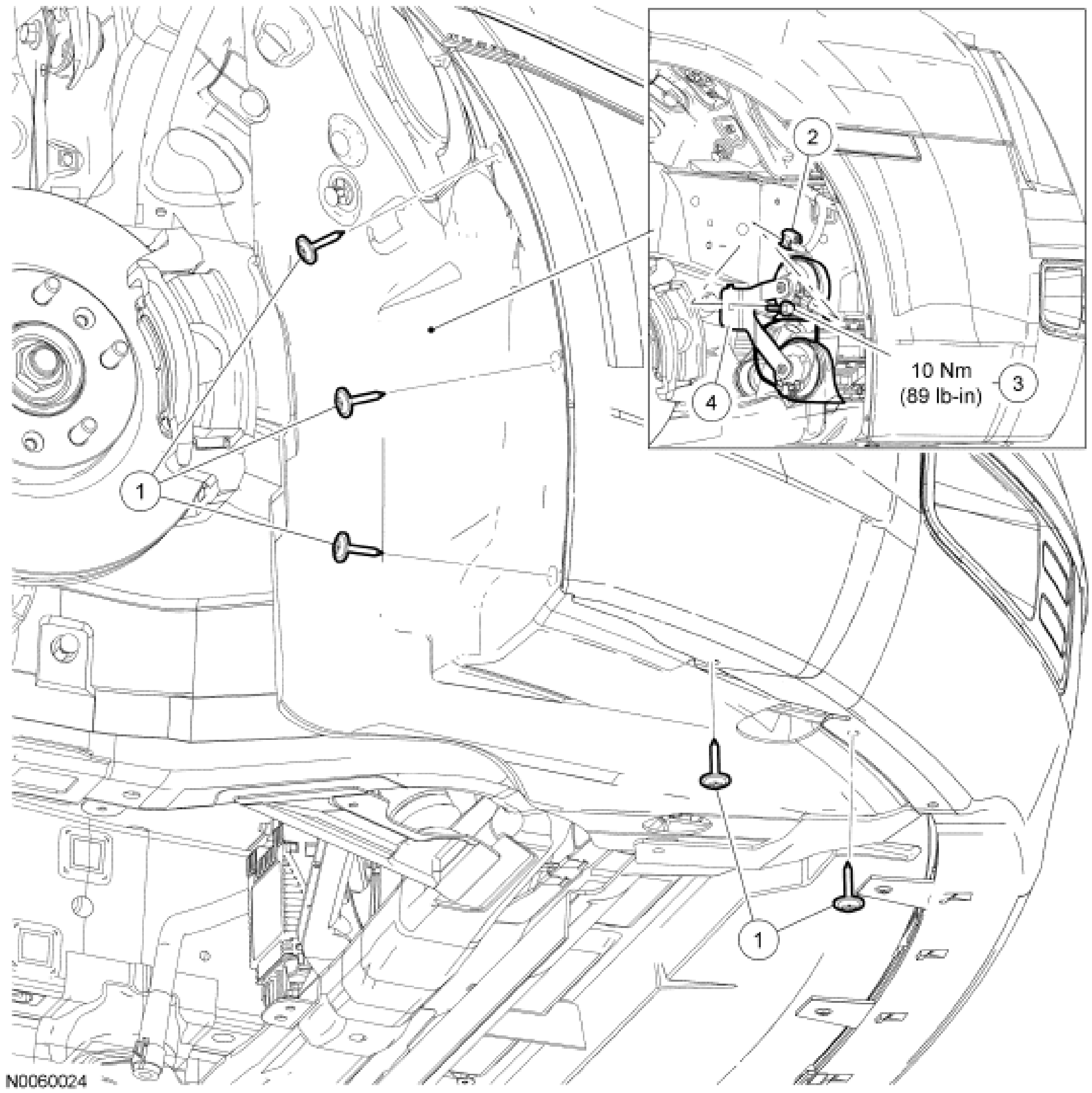


Fig. 13: Exploded View Of Horn Components (With Torque Specifications)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W706805	Front fender splash shield screws (RH) (5 required)
2	-	Horn electrical connector (part of 14290)
3	W605784	Horn bolt
4	13832	Horn

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

2. Remove the 5 RH front fender splash shield screws.
   - Pull the RH front fender splash shield downward to access the horn.
3. Disconnect the electrical connector.
4. Remove the bolt and the horn.
   - To install, tighten to 10 Nm (89 lb-in).
5. To install, reverse the removal procedure.

2008 HVAC

Climate Control System - General Information and Diagnostics - Edge & MKX

SPECIFICATIONS

MATERIAL SPECIFICATIONS

Item	Specification	Fill Capacity
A/C Cooling Coil Coating YN-29	-	-
A/C System Flushing Solvent YN-23	-	-
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B	118 ml (4 fl oz)
R-134a Refrigerant YN-19 (US); CYN-16-P or CYN-16-R (Canada)	WSH-M17B19-A	0.60kg (21 oz)

GENERAL SPECIFICATIONS

Item	Specification
A/C Compressor	
Type	10S20C
A/C Pressure Relief Valve[a]	
Open pressure	3,447-4,137 kPa (500-600 psi)
Close pressure	2758 kPa (400 psi)
Evaporator Temperature Sensor	
ON temperature	3°C (37°F)
OFF temperature	2°C (36°F)
Refrigerant System Dye	
R-134a Leak Detection Dye 164-R6060 or 164-R6081	-

[a] Manifold gauge set pressures may vary slightly depending on the distance between the service gauge port valve and the A/C pressure relief valve, the A/C cycling switch or the pressure cutoff switch location.

DESCRIPTION AND OPERATION

CLIMATE CONTROL SYSTEM

Climate Control System

WARNING: **Take the following precautions when repairing an air conditioning system containing R-134a:**

- **Always wear safety goggles.**
- **Avoid contact with liquid refrigerant R-134a. R-134a vaporizes at approximately -25°C (-13°F) under atmospheric pressure and will freeze skin tissue.**
- **Never allow refrigerant R-134a gas to escape in quantity in an occupied space. It will displace the oxygen needed to support life.**
- **Never use a torch in an atmosphere containing R-134a gas. R-134a is non-toxic at all normal conditions, but it decomposes when exposed to high temperatures such as a torch flame. During decomposition it releases irritating and toxic gasses (as described in the MSDS sheet from the manufacturer). Decomposition products are hydrofluoric acid, carbon dioxide and water.**

Failure to follow these instructions may result in serious personal injury.

CAUTION: To avoid damaging the vehicle or air conditioning (A/C) components, the following precautions must be observed.

- **The A/C refrigerant of all vehicles must be identified and analyzed prior to refrigerant charging. Failure to do so can contaminate the shop bulk refrigerant and other vehicles.**
- **Do not add R-12 refrigerant to an A/C system that requires the use of R-134a refrigerant. These 2 types of refrigerant must never be mixed. Doing so can damage the A/C system.**
- **Charge the A/C system with R-134a refrigerant gas while the engine is running only at the low-pressure side, to prevent refrigerant slugging from damaging the A/C compressor.**
- **Use only R-134a refrigerant. Due to environmental concerns, when the A/C system is drained, the refrigerant must be collected using refrigerant recovery/recycling equipment. Federal, State/Provincial and/or local laws REQUIRE that R-134a be recovered into appropriate recovery equipment and the process be conducted by qualified technicians who have been certified by an approved organization, such as ASE, MACS, HRAI, etc. Use of a recovery machine dedicated to R-134a is necessary to reduce the possibility of oil and refrigerant incompatibility concerns. Refer to the instructions provided by the equipment manufacturer when removing refrigerant from or charging the A/C system.**
- **Refrigerant R-134a must not be mixed with air for leak testing or used with air for any other purpose above atmospheric pressure. R-134a is combustible when mixed with high concentrations of air and higher pressures.**

- **A number of manufacturers are producing refrigerant products that are described as direct substitutes for refrigerant R-134a. The use of any unauthorized substitute refrigerant can severely damage the A/C components. If repair is required, use only new or recycled refrigerant R-134a.**

CAUTION: To avoid contamination of the air conditioning (A/C) system, the following precautions must be observed.

- **Never open or loosen a connection before recovering the refrigerant.**
- **When loosening a connection, if any residual pressure is evident, allow it to leak out before opening the fitting.**
- **Evacuate a system that has been opened to install a new component or one that has discharged through leakage before charging.**
- **Seal open fittings with a cap or plug immediately after disconnecting a component from the system.**
- **Clean the outside of the fittings thoroughly before disconnecting a component from the system.**
- **Do not remove the sealing caps from a new component until ready to install.**
- **Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open an oil container until ready to use and install the cap immediately after using. Store the oil in a clean, moisture-free container.**
- **Install a new O-ring seal before connecting an open fitting. Coat the fitting and O-ring seal with PAG oil before connecting.**
- **When installing a refrigerant line, avoid sharp bends. Position the line away from the exhaust or any sharp edges that can chafe the line.**
- **Tighten threaded fittings only to specifications. The steel and aluminum fittings used in the refrigerant system will not tolerate overtightening.**
- **When disconnecting a fitting, use a wrench on both halves of the fitting to prevent twisting of the refrigerant lines or tubes.**
- **Do not open a refrigerant system or uncap a new component unless it is as close as possible to room temperature. This will prevent condensation from forming inside a component that is cooler than the surrounding air.**

The electronic manual temperature control (EMTC) system heats or cools the vehicle depending on the HVAC module - EMTC control panel selection.

- The HVAC module - EMTC control panel selections determine heating or cooling, air distribution and

enables blower motor operation.
- The temperature control setting determines the air temperature.
- The blower motor switch varies the blower motor speed.
- During A/C operation the system also reduces the relative humidity of the air.

The dual automatic temperature control (DATC) system maintains the selected vehicle interior temperature by heating and/or cooling the air.

- During A/C operation the system also reduces the relative humidity of the air.
- The driver may override the automatic mode of operation.
- The temperature control setting determines the air temperature.
- The blower motor control override buttons vary the blower motor speed.
- The driver side and passenger side temperature settings can be individually controlled.

The system consists of the following components:

- A/C compressor
- A/C compressor clutch assembly
- A/C condenser core with A/C receiver/drier
- A/C evaporator core
- Connecting refrigerant lines
- Thermostatic expansion valve (TXV)
- A/C pressure transducer
- Heater core and evaporator core housing
- HVAC module - EMTC or HVAC module - DATC
- Blower switch (EMTC systems)
- Temperature blend door actuators
- Floor/defrost/panel door actuator
- Air inlet door actuator
- Blower motor resistor or speed control module
- Blower motor
- Ambient temperature sensor
- In-vehicle temperature sensor
- Solar radiation sensor
- Evaporator temperature sensor

External Temperature Display

The external temperature is displayed when the EXT button is pressed. While the actual external temperature can vary continuously, the value that is displayed will update at a specific rate depending on whether or not the engine is "hot" and whether or not the vehicle is moving.

When the external temperature is rising, the display will update slowly. Updates (when the actual external temperature is higher than currently displayed value) will be limited to 0.6°C (1°F) every 20 seconds while the vehicle is moving at 40 kph (25 mph) or greater for more than 90 seconds or 0.6°C (1°F) every 20 minutes if the vehicle is not moving at this speed. This is to prevent the heat from the engine compartment from affecting the accuracy of the display.

When the external temperature is dropping, the display will update quickly.

Updates (when the actual external temperature is lower than currently displayed value) will only be limited to 0.6°C (1°F) every 2 seconds (regardless of vehicle speed). Consequently, the display will essentially follow the drop experienced by the external temperature thermistor.

Climate Control System Operation

Electronic Manual Temperature Control (EMTC) System

The electronic manual temperature control (EMTC) system operation is determined by the settings on the HVAC module - EMTC. The EMTC system is composed of the HVAC module - EMTC, blower motor resistor, mode door actuator, air inlet door actuator and temperature blend door actuator to control the various functions.

The blower motor switch:

- sets the blower motor speed.
- directs the blower motor path to ground through the blower motor resistor to allow blower motor operation in LO, MED LO and MED HI.
- directs the blower motor path directly to ground, bypassing the blower motor resistor to allow blower motor operation in HI.

The A/C request button:

- can command the A/C compressor ON (when the function selector switch is in PANEL, FLOOR/PANEL, FLOOR/DEFROST and FLOOR) when the A/C request switch is pressed. Indicator illuminates when A/C request switch is toggled ON.
- is inoperative in MAX A/C, OFF and DEFROST.
- indicator illuminates when the function selector switch is in MAX A/C and cannot be toggled.
- indicator does not illuminate in OFF and cannot be toggled.
- indicator does not illuminate in DEFROST but can be toggled ON or OFF. The A/C compressor will operate regardless of indicator status if the outside air temperature is above 6°C (43°F).
- is serviced only with the climate control module.

The function selector knob:

- selects airflow direction.

The air recirculation button:

- selects either recirculated or outside air source.
- recirculates air in any mode except DEFROST, if requested.
- is disabled in MAX A/C or OFF mode where recirculated air only is used.
- is disabled in DEFROST mode where outside air only is used.
- is serviced only with the climate control module.

The temperature selector knob:

- selects full warm and full cool as well as blended outlet temperatures.

The HVAC module - EMTC also includes:

- a rear window DEFROST button. Refer to **GLASS, FRAMES & MECHANISMS** article.

Dual Automatic Temperature Control (DATC) System

The dual automatic temperature control (DATC) system operation is determined by the settings on the HVAC module - DATC. The DATC system automatically maintains a selected temperature for vehicle interior comfort. The DATC system is composed of the HVAC module - DATC, blower motor speed control, mode door actuator, air inlet door actuator, temperature blend door actuator, in-vehicle temperature sensor, ambient temperature sensor, evaporator temperature sensor and solar radiation sensor to control the various functions.

The HVAC module - DATC will display outside air temperature when the EXT button is pressed.

When the HVAC module - DATC is set to AUTO:

- the air distribution direction, blower motor speed and A/C compressor operation are automatically controlled based on the temperature(s) selected.

The HVAC module - DATC manual override settings:

- allow the air distribution direction to be manually selected.
- allow the blower motor speed to be manually selected.
- allow RECIRCULATION mode to be manually selected in all modes except DEFROST. The A/C request can be cancelled by pressing the A/C request switch, turning the indicator OFF.
- allow A/C compressor operation to be manually selected except in DEFROST.

The HVAC module - DATC also includes:

- a rear window DEFROST button. Refer to **GLASS, FRAMES & MECHANISMS** article.
- heated/cooled seat controls. Refer to **SEATING** article.

System Airflow Description - Electronic Manual Temperature Control (EMTC) System

Max A/C

When MAX A/C is selected:

- the air inlet door actuator closes off outside air and admits only recirculated air.
- the recirc button is disabled and the indicator is illuminated.
- the floor/defrost/panel door directs airflow to the instrument panel A/C registers.
- blended air temperature is available.
- the A/C request button is illuminated and will be disabled.
- the blower motor is ON.

PANEL

When PANEL is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the instrument panel A/C registers.
- blended air temperature is available.
- the A/C request button is enabled. The A/C compressor will operate and the indicator will illuminate if the A/C request button is selected.
- the blower motor is ON.

PANEL/FLOOR

When PANEL/FLOOR is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the floor duct and the instrument panel A/C registers. A small amount of airflow from the side window demisters and defrost duct will be present.
- blended air temperature is available.
- the A/C request button is enabled. The A/C compressor will operate and the indicator will illuminate if the A/C request button is selected.
- the blower motor is ON.

OFF

When OFF is selected:

- the recirc request button is disabled.
- the air inlet door actuator closes off outside air and admits only recirculated air.
- the A/C request button is disabled.
- the blower motor is OFF.

FLOOR

When FLOOR is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the floor duct. A small amount of airflow from the defroster duct and side window demisters will be present.
- blended air temperature is available.
- the A/C request button is enabled. The A/C compressor will operate and the indicator will illuminate if the A/C request button is selected.
- the blower motor is ON.

FLOOR/DEFROST

When FLOOR/DEFROST is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the floor duct, the defroster duct and the side window demisters.
- blended air temperature is available.
- the A/C request button will toggle the indicator on and off. To reduce fogging, the A/C compressor will operate automatically, regardless of indicator status.
- the blower motor is ON.

DEFROST

When DEFROST is selected:

- the air inlet door actuator opens, admitting only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the defroster duct and side window demisters. A small amount of airflow from the floor duct will be present.
- blended air temperature is available.

- to reduce fogging, the A/C compressor will operate automatically, regardless of indicator status.
- the blower motor is ON.

System Airflow Description - Dual Automatic Temperature Control (DATC) System

AUTO

When AUTO is selected:

- the temperature control setting is manually set to the desired setting.
- the air inlet door actuator is automatically controlled by the HVAC module - DATC, based on the temperature setting.
- the mode door actuators are automatically controlled by the HVAC module - DATC based on the temperature setting.
- the A/C compressor is automatically controlled by the HVAC module - DATC based on the temperature setting.
- the blower motor is ON. The blower motor speed is automatically controlled by the HVAC module - DATC based on the temperature setting, but can be manually overridden.

OFF

When OFF is selected:

- the air inlet door actuator closes off outside air and admits only recirculated air.
- the A/C request button is disabled.
- the blower motor is OFF.

PANEL

When PANEL is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the instrument panel A/C registers.
- blended air temperature is available. Only when A/C compressor operation has been selected by pressing the A/C request button (indicator ON), can the airflow temperature be cooled below the outside air temperature.
- the A/C request button is enabled. The A/C compressor will operate and the indicator will illuminate if the A/C request button is selected.
- the blower motor is ON.

PANEL/FLOOR

When PANEL/FLOOR is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the floor duct and the instrument panel A/C registers. A small amount of airflow from the side window demisters and defrost duct will be present.
- blended air temperature is available. Only when A/C compressor operation has been selected by pressing the A/C request button (indicator ON), can the airflow temperature be cooled below the outside air temperature.
- the A/C request button is enabled. The A/C compressor will operate and the indicator will illuminate if the A/C request button is selected.
- the blower motor is ON.

FLOOR

When FLOOR is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the floor duct. A small amount of airflow from the defroster duct and side window demisters will be present.
- blended air temperature is available. Only when A/C compressor operation has been selected by pressing the A/C request button (indicator ON), can the airflow temperature be cooled below the outside air temperature.
- the A/C request button is enabled. The A/C compressor will operate and the indicator will illuminate if the A/C request button is selected.
- the blower motor is ON.

FLOOR/DEFROST

When FLOOR/DEFROST is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the floor duct, the defroster duct and the side window demisters.
- blended air temperature is available.
- the A/C request button is enabled. The A/C compressor will operate automatically and the indicator will

illuminate if the A/C request button is selected.

- the blower motor is ON.

DEFROST

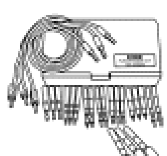
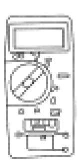
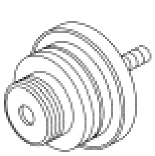
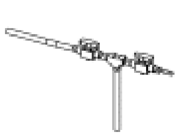
When DEFROST is selected:

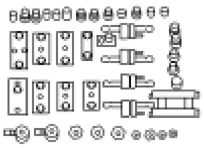
- the recirc request button and indicator is disabled. Regardless of button and indicator status, the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the defroster duct and side window demisters. A small amount of airflow from the floor duct will be present.
- blended air temperature is available.
- to reduce fogging, the A/C compressor will operate automatically, regardless of indicator status.
- the blower motor is ON.

DIAGNOSTIC TESTS

CLIMATE CONTROL SYSTEM

Special Tools

Illustration	Tool Name	Tool Number
 ST2574-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST1137-A	Fluke 77 III Automotive Meter	105-R0056 or equivalent
 ST2670-A	R-134a Manifold Gauge Set	176-R032A or equivalent
 ST2626-A	A/C Flush Adapter Kit	219-00074 or equivalent

 ST2469-A	A/C Flush and Purge Fitting Kit	219-00024 or equivalent
 ST1474-A	Pressure Test Kit	014-R1072 or equivalent

Principles of Operation

There are 4 main principles involved with the basic theory of operation:

- Heat transfer
- Latent heat of vaporization
- Relative humidity
- Effects of pressure

Heat Transfer

If 2 substances of different temperature are placed near each other, the heat in the warmer substance will transfer to the colder substance.

Latent Heat of Vaporization

When a liquid boils (converts to gas) it absorbs heat without raising the temperature of the resulting gas. When the gas condenses (converts back to a liquid), it gives off heat without lowering the temperature of the resulting liquid.

Relative Humidity

The amount of moisture (water vapor content) that the air can hold is directly related to the air temperature. The more heat there is in the air, the more moisture the air can hold. The lower the moisture content in the air, the more comfortable it is. Removing the moisture from the air lowers its relative humidity and improves personal comfort.

Effects of Pressure on Boiling or Condensation

As the pressure is increased on a liquid, the temperature at which the liquid boils (converts to gas) also increases. Conversely, when the pressure on a liquid is reduced, its boiling point is also reduced. When in the gas state, an increase in pressure causes an increase in temperature, while a decrease in pressure will decrease the temperature of the gas.

Compressor Anti-Slugging Strategy (CASS)

Liquid refrigerant may accumulate in the A/C compressor under certain conditions. To alleviate damage to the A/C compressor, the compressor anti-slugging strategy (CASS) is utilized.

CASS is initiated only under specific conditions:

- Ignition is OFF for more than 8 hours
- Ambient temperature is above -4°C (25°F)
- Battery voltage is above 8.5 volts during engine cranking

When these conditions are present, the PCM will activate the A/C control relay prior to cranking of the engine. The A/C control relay engages the A/C compressor for approximately 4-15 A/C compressor revolutions or a maximum of 2 seconds (depending upon vehicle application), allowing the liquid refrigerant to be pushed from the A/C compressor. CASS is initiated by the PCM regardless of the HVAC - EMTC or the HVAC - DATC system settings.

The Refrigerant Cycle

During stabilized conditions (A/C system shutdown), the refrigerant pressures are equal throughout the system. When the A/C compressor is in operation it increases pressure on the refrigerant vapor, raising its temperature. The high-pressure and high-temperature vapor is then released into the top of the A/C condenser core.

The A/C condenser, being close to ambient temperature, causes the refrigerant vapor to condense into a liquid when heat is removed from the refrigerant by ambient air passing over the fins and tubing. The now liquid refrigerant, still at high pressure, exits from the bottom of the A/C condenser and enters the inlet side of the A/C receiver/drier. The receiver/drier is designed to remove moisture from the refrigerant.

The outlet of the receiver/drier is connected to the thermostatic expansion valve (TXV). The TXV provides the orifice which is the restriction in the refrigerant system and separates the high and low pressure sides of the A/C system. As the liquid refrigerant passes across this restriction, its pressure and boiling point are reduced.

The liquid refrigerant is now at its lowest pressure and temperature. As it passes through the A/C evaporator, it absorbs heat from the airflow passing over the plate/fin sections of the A/C evaporator. This addition of heat causes the refrigerant to boil (convert to gas). The now cooler air can no longer support the same humidity level of the warmer air and this excess moisture condenses on the exterior of the evaporator coils and fins and drains outside the vehicle.

The refrigerant cycle is now repeated with the A/C compressor again increasing the pressure and temperature of the refrigerant.

A thermistor which monitors the temperature of the air that has passed through the evaporator core controls A/C clutch cycling. If the temperature of the evaporator core discharge air is low enough to cause the condensed water vapor to freeze, the A/C clutch is disengaged by the vehicle PCM.

The high-side line pressure is also monitored so that A/C compressor operation will be interrupted if the system pressure becomes too high or is determined to be too low (low charge condition).

The A/C compressor thermal protection switch will interrupt compressor operation if the compressor housing exceeds temperature limits.

The A/C compressor relief valve will open and vent refrigerant to relieve unusually high system pressure.

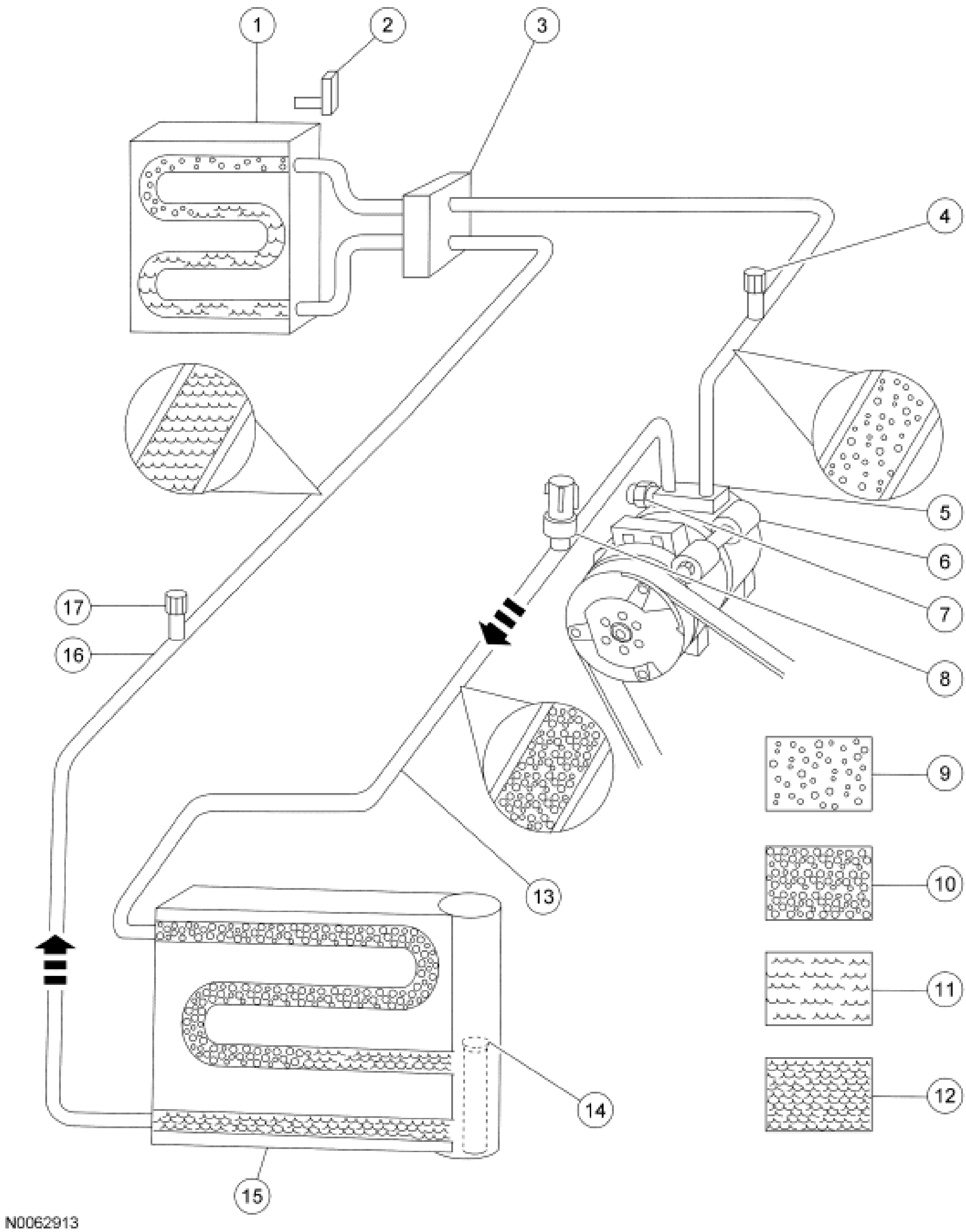


Fig. 1: Thermostatic Expansion Valve (TXV) Type Refrigerant System
Courtesy of FORD MOTOR CO.

Item	Description
1	A/C evaporator core
2	A/C evaporator core temperature sensor
3	Thermostatic expansion valve (TXV)
4	A/C charge valve port (low side)
5	A/C suction line
6	A/C compressor
7	A/C pressure relief valve
8	A/C pressure transducer
9	Low-pressure vapor
10	High-pressure vapor
11	Low-pressure liquid
12	High-pressure liquid
13	Compressor discharge line
14	A/C desiccant cartridge
15	A/C condenser core with A/C receiver/drier
16	Condenser-to-evaporator line
17	A/C charge valve port (high side)

Inspection and Verification

1. Verify the customer's concern by operating the climate control system to duplicate the condition.
2. Inspect to determine if one of the following mechanical or electrical concerns apply:

VISUAL INSPECTION CHART

Mechanical	Electrical

• Loose, missing or damaged A/C compressor drive belt
• Loose or disconnected A/C clutch
• Broken or binding door/actuator
• Broken or leaking refrigerant lines
• Obstructed in-vehicle temperature sensor
• Disconnected in-vehicle temperature aspirator hose
	• Smart junction box (SJB) fuse(s):
	  ○ 15 (10A)
	  ○ 37 (10A)
	  ○ 45 (5A)
	  ○ 66 (40A)
	• Battery junction box (BJB) fuse 35 (10A)
	• Blower motor inoperative
	• A/C compressor inoperative
	• Circuitry open/shorted
	• Disconnected electrical connectors

	• Cooling fan inoperative

3. As pinpoint tests and measurements are being carried out, be sure to inspect for any disconnected, loose-fitting or incorrectly installed component, module and in-line electrical connectors and pins.
4. If the inspection reveals obvious concerns that can be readily identified, repair as necessary.

NOTE: Make sure to use the latest scan tool software release.

5. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

6. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
7. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM, HVAC module - dual automatic temperature control (DATC).
8. Carry out the network test.
   - If the scan tool responds with no communication from one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
9. Clear the continuous DTCs and carry out the self-test diagnostics for the HVAC module - DATC.

NOTE: Some PCM DTCs may inhibit A/C operation. If any PCM DTCs are retrieved, diagnose those first. Refer to Introduction - Gasoline Engines article.

10. If the HVAC module - DATC DTCs retrieved are related to the concern, go to the **HVAC MODULE - DUAL AUTOMATIC TEMPERATURE CONTROL DTC CHART**. If the PCM DTCs retrieved are related to the concern, go to the **Introduction - Gasoline Engines** article. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
11. If no DTCs related to the concern are retrieved, go to **Symptom Chart - Climate Control System**.

HVAC Module - Dual Automatic Temperature Control (DATC) - Diagnostic Methods

The dual automatic temperature control (DATC) system must be diagnosed by first retrieving any DTCs, if present.

- An on-demand (hard fault) DTC indicates that the fault is currently present. An on-demand DTC suggests a wiring fault, disconnected connector or component failure.
- A continuous (intermittent) DTC alone (corresponding on-demand DTC is not present) indicates that the fault is an intermittent condition and may not be currently present. A continuous only DTC suggests a poor wiring connection, loose pin or terminal or intermittent component failure.

On-demand (hard fault) or continuous (intermittent fault) DTCs can be retrieved using a scan tool. If using a scan tool, refer to the scan tool operating manual.

On-demand DTCs can also be retrieved by carrying out the Dual Automatic Temperature Control Module On-Demand Self Test. To retrieve and/or clear continuous DTCs, carry out the HVAC Module - Dual Automatic Temperature Control (DATC) - Retrieve Continuous DTCs procedure. Always carry out the HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test before retrieving continuous DTCs.

If no DTCs are present, go to **Symptom Chart - Climate Control System** or Go to **Symptom Chart - Noise, Vibration and Harshness (NVH)** for the appropriate diagnostic action.

HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test

The HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test will retrieve on-demand (hard fault) DTCs only, it will not retrieve continuous DTCs. Continuous DTCs can be cleared when exiting the HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test. Make sure to retrieve continuous DTCs by carrying out the HVAC Module - Dual Automatic Temperature Control (DATC) - Retrieve Continuous DTCs procedure before clearing any continuous DTCs.

- The HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test will not detect concerns associated with data link messages like engine coolant temperature or vehicle speed signals. A scan tool must be used to retrieve these concerns.
- The HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test will detect concerns in the system control functions and will display on-demand (hard fault) DTCs for concerns that are present during the self-test. The vehicle interior temperature should be between 4°C-38°C (40°F-100°F) when carrying out the self-test. If the temperatures are not within the specified ranges, false DTCs may be displayed.
- The self-test can be initiated after cycling the ignition switch from OFF to ON. Normal operation of the climate control system stops when the self-test is activated.
- To enter the self-test, press the OFF and DEFROST buttons simultaneously and release, then press the AUTO button within 2 seconds. The display will show a flashing "----" for a maximum of 20 seconds, after which "8888" will be displayed if there are no on-demand DTCs present. If DTCs are present, the HVAC module - DATC will display the on-demand DTCs. Record all DTCs displayed.
- If any DTCs appear during the self-test, carry out the diagnostic procedure. Refer to the **HVAC MODULE - DUAL AUTOMATIC TEMPERATURE CONTROL DTC CHART** and follow the ACTION for each DTC given.
- If a condition exists, but no DTCs appear during the self-test, go to **Symptom Chart - Climate Control System** condition: The DATC System is Inoperative, Intermittent or Incorrect Operation.
- Always exit the self-test before powering the system down (system turned OFF).

- Continuous DTCs will be deleted after 80 ignition switch ON cycles after the intermittent fault occurs.

HVAC Module - Dual Automatic Temperature Control (DATC) - Retrieve Continuous DTCs

The HVAC module - DATC will retrieve only continuous (intermittent) DTCs when carrying out this procedure.

- Retrieval of continuous DTCs can be initiated after cycling the ignition switch from OFF to ON. Normal operation of the climate control system stops when retrieving continuous DTCs.
- To retrieve continuous DTCs, press the OFF and DEFROST buttons simultaneously and release, then press the RECIRC button within 2 seconds. The display will show a flashing "----" for a maximum of 20 seconds, after which "8888" will be displayed if there are no continuous DTCs present. If DTCs are present, the HVAC module - DATC will display the continuous DTCs present. Record all DTCs displayed.
- If any DTCs appear, carry out the diagnostic procedure. Refer to the **HVAC MODULE - DUAL AUTOMATIC TEMPERATURE CONTROL DTC CHART** and follow the ACTION for each DTC given.
- If a condition exists but no DTCs appear, go to **Symptom Chart - Climate Control System** condition: The Dual Automatic Temperature Control (DATC) System is Inoperative, Intermittent or Incorrect Operation.
- To exit and **retain** all continuous DTCs, press any button **except** DEFROST. The HVAC module - DATC will exit the retrieved continuous DTCs mode and retain all continuous DTCs.
- To exit and **clear** all continuous DTCs, press the DEFROST button. The HVAC module - DATC will exit the retrieve continuous DTCs mode and all continuous DTCs will be cleared.
- Always exit the procedure before powering the system down (system turned OFF).
- Continuous DTCs will be deleted after 80 ignition switch ON cycles after the intermittent fault occurs.

HVAC Module Cold Boot Process

The purpose of the cold boot process is to allow the HVAC module to reinitialize. To carry out the cold boot process, follow the steps below.

NOTE: HVAC module - DATC only.

1. Clear the DTCs.
2. Turn the ignition switch to the OFF position.
3. Disconnect the HVAC module electrical connectors.
4. Inspect module connectors for:
   - corrosion.
   - pushed-out connectors.
   - incorrectly seated connector.
5. Wait one minute.

6. Connect the HVAC module electrical connectors.
7. Turn the ignition switch to the ON position.
8. Select any position except OFF on the HVAC module.

   The HVAC module will now initialize.

HVAC Module - Dual Automatic Temperature Control (DATC) DTC Chart

NOTE: Some PCM DTCs may inhibit A/C operation. If any PCM DTCs are retrieved, diagnose those first. Refer to the Introduction - Gasoline Engines article.

HVAC MODULE - DUAL AUTOMATIC TEMPERATURE CONTROL DTC CHART

DTC	Description	Action to Take
B1251	Air Temperature Internal Sensor Circuit Open	Go to **Pinpoint Test A** .
B1253	Air Temperature Internal Sensor Circuit Short to Ground	Go to **Pinpoint Test A** .
B1255	Air Temperature External Sensor Circuit Open	Go to **Pinpoint Test B** .
B1257	Air Temperature External Sensor Circuit Short to Ground	Go to **Pinpoint Test B** .
B1317	Battery Voltage High	CLEAR the DTCs. REPEAT the self-test. If the DTC returns and the DTC is not present in other modules, MEASURE the voltage between ground and: HVAC module - dual automatic temperature control (DATC) C228a-12, circuit CBP37 (WH) and HVAC module - DATC C228a-13, circuit SBP15 (WH/RD). • If the voltage is less than 16 volts, INSTALL a new HVAC module - DATC. REFER to **CLIMATE CONTROL** article. • If the voltage is greater than 16 volts, INSTALL a new HVAC module - DATC. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article. If the DTC returns and the DTC is present in other modules, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1318	Battery Voltage Low	Go to **Pinpoint Test G** .
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If the DTC returns, INSTALL a new HVAC module - DATC. REFER to **CLIMATE CONTROL** article.

B1947	Climate Control A/C Post Evaporator Sensor Circuit Short to Ground	Go to **Pinpoint Test D** .
B2014	Climate Control A/C Post Evaporator Sensor Open Circuit	Go to **Pinpoint Test D** .
B226C	Left Blend Door Motor Stall	Go to **Pinpoint Test F** .
B226D	Right Blend Door Motor Stall	Go to **Pinpoint Test F** .
B226E	Mode Blend Door Motor Stall	Go to **Pinpoint Test F** .
B2426	Passenger Solar Radiation Sensor Circuit Open	Go to **Pinpoint Test C** .
B2427	Passenger Solar Radiation Sensor Circuit Short to Ground	Go to **Pinpoint Test C** .
B2795	Driver Solar Radiation Sensor Circuit Short to Ground	Go to **Pinpoint Test C** .
B2796	Driver Solar Radiation Sensor Circuit Open	Go to **Pinpoint Test C** .
B295A	Driver Blend Door Potentiometer Feedback Circuit Open	Go to **Pinpoint Test F** .
B295B	Driver Blend Door Potentiometer Feedback Circuit Short to Ground	Go to **Pinpoint Test F** .
B295C	Passenger Blend Door Potentiometer Feedback Circuit Open	Go to **Pinpoint Test F** .
B295D	Passenger Blend Door Potentiometer Feedback Circuit Short to Ground	Go to **Pinpoint Test F** .
B295E	Mode Door Potentiometer Feedback Circuit Open	Go to **Pinpoint Test F** .
B295F	Mode Door Potentiometer Feedback Circuit Short to Ground	Go to **Pinpoint Test F** .
U0073	Control Module Communication Bus A Off	CLEAR the DTCs. REPEAT the self-test. If the DTC returns, REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the network concern.
U0140	Lost Communication With Body Control Module (GEM)	CLEAR The DTCs. REPEAT the self-test. If the DTC returns, REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the lost communication with the smart junction box (SJB).
U0155	Lost Communication With Instrument Panel Cluster Control Module	CLEAR The DTCs. REPEAT the self-test. If the DTC returns, REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the lost communication with the instrument panel cluster.

U0246	Lost Communication With Seat Control Module (DCSM)	CLEAR The DTCs. REPEAT the self-test. If the DTC returns, REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the lost communication with the heated seat module.
U2050	No Application Present	REFLASH the HVAC module - DATC. REFER to **MODULE CONFIGURATION** article. If the DTC returns, INSTALL a new HVAC module - DATC. REFER to **CLIMATE CONTROL** article.
U2051	One or More Calibration Files Missing/Corrupt	REFLASH the HVAC module - DATC. REFER to **MODULE CONFIGURATION** article. If the DTC returns, INSTALL a new HVAC module - DATC. REFER to **CLIMATE CONTROL** article.

Symptom Chart - Climate Control System

Symptom Chart - Climate Control System

Condition	Possible Sources	Action
• No communication with the HVAC module - dual automatic temperature control (DATC)	• Fuse(s) • Circuitry open • HVAC module - DATC communication network	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• Air inlet door is inoperative	• Circuitry open/shorted • HVAC module - DATC • HVAC module - electronic manual temperature control (EMTC) • Air inlet door actuator/linkage	• Go to **Pinpoint Test E** .
• Incorrect/erratic direction of airflow from outlets	• Circuitry short/open • Door actuator • Defrost/panel/floor door actuator/linkage • LH or RH blend door actuator/linkage • HVAC module - EMTC or HVAC module - DATC	• Go to **Pinpoint Test F** .
• The temperature control is inoperative/does not operate correctly	• Circuitry open/shorted • Door actuator • LH or RH blend door actuator/linkage	• Go to **Pinpoint Test F** .

	• HVAC module - EMTC or HVAC module - DATC	
• The DATC system is inoperative, intermittent or incorrect operation	• Fuse(s) • Circuitry open	• Go to **Pinpoint Test H** .
• Insufficient, erratic or no heat	• Low engine coolant level • Engine overheating • Plugged or partially plugged heater core • Temperature blend door is binding or stuck • Temperature blend door actuator • Heater hose is kinked or binding	• Go to **Pinpoint Test I** .
• The air conditioning (A/C) is inoperative/does not operate correctly	• Open fuse • Circuitry short/open • PCM • HVAC module - EMTC or HVAC module - DATC • A/C compressor • A/C control relay • A/C evaporator temperature sensor • A/C pressure transducer • Battery junction box (BJB)	• Go to **Pinpoint Test J** .
• The air conditioning (A/C) is always on	• Circuitry shorted • PCM • HVAC module - EMTC or HVAC module - DATC • A/C compressor • A/C control relay • A/C evaporator temperature sensor • A/C pressure transducer	• Go to **Pinpoint Test K** .
• The blower motor is	• Fuse(s) • Circuitry open • A/C blower motor switch	

inoperative - EMTC	• Blower motor relay • A/C blower motor • HVAC module - EMTC	• Go to **Pinpoint Test L** .
• The blower motor does not operate correctly - EMTC	• Circuitry open/shorted • A/C blower motor resistor • A/C blower motor switch	• Go to **Pinpoint Test M** .
• The blower motor is inoperative - DATC	• Fuse(s) • Circuitry open/shorted • Blower motor relay • A/C blower motor • HVAC module - DATC • Blower motor speed control	• Go to **Pinpoint Test N** .
• The blower motor does not operate correctly - DATC	• Circuitry open/shorted • Blower motor speed control • HVAC module - DATC • A/C blower motor relay	• Go to **Pinpoint Test O** .
• The dual temperature control is inoperative/does not operate correctly	• Temperature blend door/actuator broken/binding • HVAC module - DATC • Low A/C refrigerant charge	• CHECK that the A/C system pressure is above 290 kPa (42 psi). If the pressure is below 290 kPa (42 psi), REFER to **Fluorescent Dye Leak Detection**. CHECK the temperature blend doors/actuators for a binding or broken condition. If no condition is found, INSTALL a new HVAC module - DATC.
• The temperature set point does not repeat after turning the ignition switch OFF	• Open fuse • Circuitry short/open • HVAC module - DATC	• CHECK circuit SBP15 (WH/RD) for a short or open and repair as necessary. If OK, INSTALL a new HVAC module - DATC.
• The temperature display will not switch between Celsius and Fahrenheit	• HVAC module - DATC • Instrument cluster module	• If the instrument cluster does not switch between English and Metric, REFER to **INSTRUMENT CLUSTER & PANEL ILLUMINATION** article. • If only the HVAC module - DATC does not switch between

		English and Metric, INSTALL a new HVAC module - DATC.
• Inaccurate external temperature display	• HVAC module - DATC • Ambient temperature sensor	• REFER to Description and Operation of the External Temperature Display. If the external temperature display is not operating as described and no DTC is present, CARRY OUT the ambient temperature sensor component test in this service information. If the sensor tests OK, CARRY OUT the HVAC Module Cold Boot Process. If the condition returns, INSTALL a new HVAC module - DATC. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

Symptom Chart - Noise, Vibration and Harshness (NVH)

NOTE: **Noise, vibration and harshness (NVH) symptoms will be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION & HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.**

Symptom Chart - Noise, Vibration and Harshness (NVH)

Condition	Possible Sources	Action
• Noisy A/C compressor clutch	• A/C compressor clutch air gap	• INSTALL a new A/C compressor. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

Pinpoint Tests

Pinpoint Test A: DTC B1251 or B1253 - Air Temperature Internal Sensor Circuit Open or Short to Ground

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the in-vehicle air temperature sensor receives a ground from the HVAC module - dual automatic temperature control (DATC) through circuit RH111 (GY/BU). A 5-volt reference voltage is supplied to the in-vehicle air temperature sensor from the HVAC module - DATC through circuit VH414 (GN/BU).

- DTC B1251 Air Temperature Internal Sensor Circuit Open - The module senses no voltage drop on the sensor reference voltage circuit, indicating an open circuit.
- DTC B1253 Air Temperature Internal Sensor Circuit Short to Ground - The module senses excessive voltage drop on the sensor reference voltage circuit, indicating a short directly to ground.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- In-vehicle air temperature sensor
- HVAC module - DATC

PINPOINT TEST A: DTC B1251 OR B1253 - AIR TEMPERATURE INTERNAL SENSOR CIRCUIT OPEN OR SHORT TO GROUND

A1 CHECK THE SENSOR RESISTANCE

- Key in OFF position.
- Disconnect: In-Vehicle Temperature Sensor C233
- Carry out the In-Vehicle Temperature Sensor component test in this service information.
- **Does the in-vehicle temperature sensor test OK?**

  YES : Go to A2.

  NO : INSTALL a new in-car temperature sensor. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

A2 CHECK THE HVAC MODULE - DATC SENSOR OUTPUT VOLTAGE

- Key in ON position.
- Press the AUTO button.

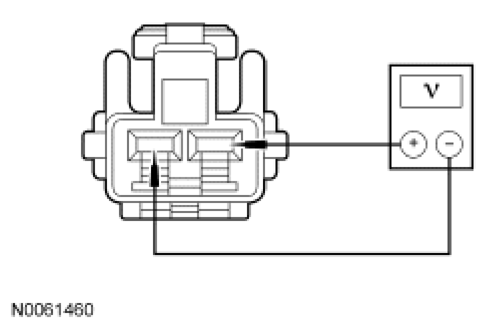


Fig. 2: Measuring Voltage Between In-Vehicle Temperature Sensor C233-2 & C233-1, Circuit VH414 (GN/BU) & RH111 (GY/BU)

Courtesy of FORD MOTOR CO.

- Measure the voltage between in-vehicle temperature sensor C233-2, circuit VH414 (GN/BU), harness side and C233-1, circuit RH111 (GY/BU), harness side.
- **Is the voltage between 4.7 and 5.1 volts?**

  YES : INSTALL a new in-vehicle sensor. CLEAR the DTCs. REPEAT the self-test. If code returns, go to A7.

  NO : If diagnosing DTC B1251, go to A3.

  If diagnosing DTC B1253, go to A5.

A3 CHECK CIRCUIT VH414 (GN/BU) FOR AN OPEN

- Key in OFF position.
- Disconnect: HVAC Module - DATC C228a

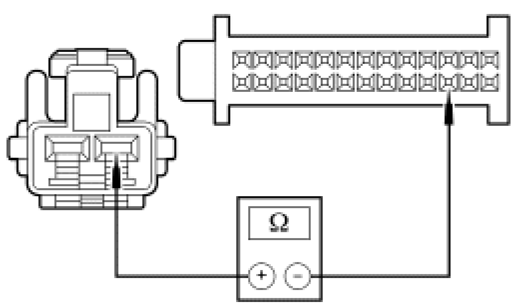


Fig. 3: Measuring Resistance Between EATC Module C228A-3, Circuit VH414 (GN/BU) & In-Vehicle Temperature Sensor C233-2
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - DATC C228a-3, circuit VH414 (GN/BU), harness side and in-vehicle temperature sensor C233-2, circuit VH414 (GN/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A4.

  NO : REPAIR circuit VH414 (GN/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

A4 CHECK CIRCUIT RH111 (GY/BU) FOR AN OPEN

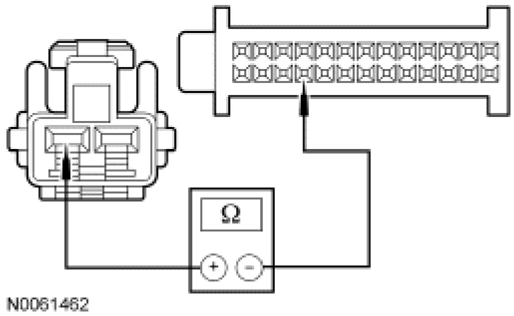


Fig. 4: Measuring Resistance Between EATC Module C228A-10, Circuit RH111 (GY/BU) & In-Vehicle Temperature Sensor C233-1
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - DATC C228a-10, circuit RH111 (GY/BU), harness side and in-vehicle temperature sensor C233-1, circuit RH111 (GY/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A7.

  NO : REPAIR circuit RH111 (GY/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

A5 CHECK CIRCUIT VH414 (GN/BU) FOR A SHORT TO CIRCUIT RH111 (GY/BU)

- Key in OFF position.
- Disconnect: HVAC Module - DATC C228a

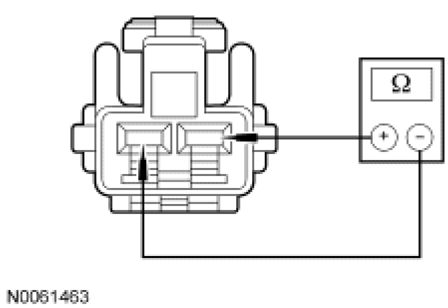


Fig. 5: Measuring Resistance Between In-Vehicle Temperature Sensor C233-2 & C233-1, Circuit VH414 (GN/BU) & RH111 (GY/BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between in-vehicle temperature sensor C233-2, circuit VH414 (GN/BU), harness side and C233-1, circuit RH111 (GY/BU), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to A6.

  NO : REPAIR circuit VH414 (GN/BU) for a short to circuit RH111 (GY/BU). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

A6 CHECK CIRCUIT VH414 (GN/BU) FOR A SHORT TO GROUND

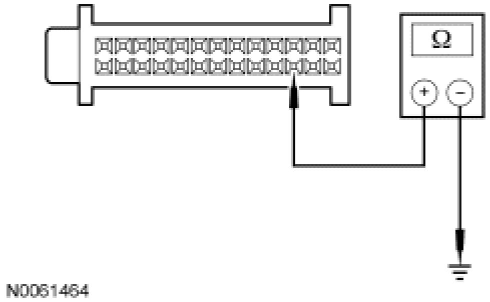


Fig. 6: Measuring Resistance Between EATC Module C228A-3, Circuit VH414 (GN/BU) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - DATC C228a-3, circuit VH414 (GN/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to A7.

  NO : REPAIR circuit VH414 (GN/BU) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

A7 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Carry out the HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module - DATC. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test B: DTC B1255 or B1257 - Air Temperature External Sensor Circuit Open or Short to Ground

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the ambient air temperature sensor receives a ground from the HVAC module - dual automatic temperature control (DATC) through circuit RH111 (GY/BU). A 5-volt reference voltage is supplied to the ambient air temperature sensor from the HVAC module - DATC through circuit VH407 (YE/GN).

- DTC B1255 Air Temperature External Sensor Circuit Open - The module senses no voltage drop on the sensor reference voltage circuit, indicating an open circuit.

- DTC B1257 Air Temperature External Sensor Circuit Short To Ground - The module senses excessive voltage drop on the sensor reference voltage circuit, indicating a short directly to ground.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Ambient air temperature sensor
- HVAC module - DATC

PINPOINT TEST B: DTC B1255 OR B1257 - AIR TEMPERATURE EXTERNAL SENSOR CIRCUIT OPEN OR SHORT TO GROUND

B1 CHECK THE SENSOR RESISTANCE

- Key in OFF position.
- Disconnect: Ambient Temperature Sensor C198
- Carry out the Ambient Temperature Sensor component test in this service information.
- **Does the ambient temperature sensor test OK?**

  YES : Go to B2.

  NO : INSTALL a new ambient temperature sensor. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B2 CHECK THE HVAC - DATC SENSOR OUTPUT VOLTAGE

- Key in ON position.
- Press the AUTO button.

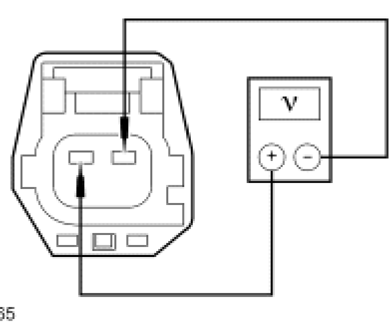


Fig. 7: Measuring Voltage Between Ambient Temperature Sensor C198-2 & C198-1, Circuit VH407 (YE/GN) & RH111 (GY/BU)
Courtesy of FORD MOTOR CO.

- Measure the voltage between ambient temperature sensor C198-2, circuit VH407 (YE/GN), harness side and C198-1, circuit RH111 (GY/BU), harness side.
- **Is the voltage between 4.7 and 5.1 volts?**

  YES : INSTALL a new ambient sensor. CLEAR the DTCs. REPEAT the self-test. If code returns, go to B7.

NO : If diagnosing DTC B1255, go to B3.

If diagnosing DTC B1257, go to B5.

B3 CHECK CIRCUIT VH407 (YE/GN) FOR AN OPEN

- Key in OFF position.
- Disconnect: HVAC Module - DATC C228a

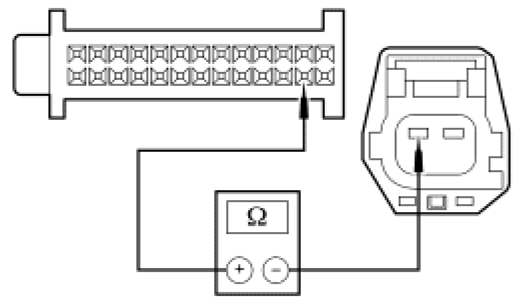


Fig. 8: Measuring Resistance Between EATC Module C228A-2, Circuit VH407 (YE/GN) & Ambient Temperature Sensor C198-2
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - DATC C228a-2, circuit VH407 (YE/GN), harness side and ambient temperature sensor C198-2, circuit VH407 (YE/GN), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to B4.

NO : REPAIR circuit VH407 (YE/GN) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B4 CHECK CIRCUIT RH111 (GY/BU) FOR AN OPEN

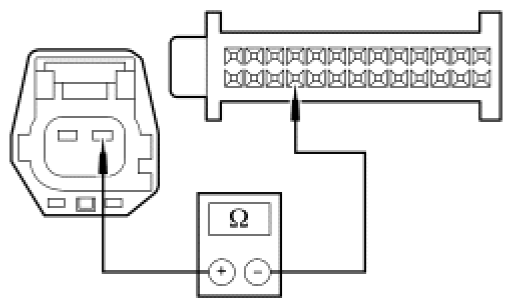


Fig. 9: Measuring Resistance Between EATC Module C228A-10, Circuit RH111 (GY/BU) & Ambient Temperature Sensor C198-1
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - DATC C228a-10, circuit RH111 (GY/BU), harness side and ambient temperature sensor C198-1, circuit RH111 (GY/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to B7.

  NO : REPAIR circuit RH111 (GY/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B5 CHECK CIRCUIT VH407 (YE/GN) FOR A SHORT TO CIRCUIT RH111 (GY/BU)

- Key in OFF position.
- Disconnect: HVAC Module - DATC C228a

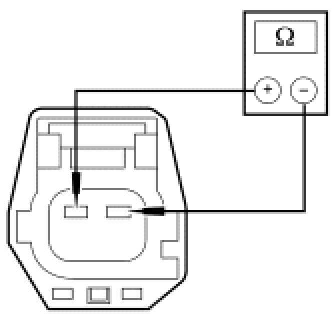


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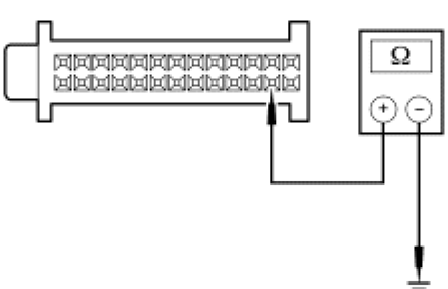
Fig. 10: Measuring Resistance Between Ambient Temperature Sensor C198-2 & C198-1, Circuit VH407 (YE/GN) & RH111 (GY/BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between ambient temperature sensor C198-2, circuit VH407 (YE/GN), harness side and C198-1, circuit RH111 (GY/BU), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to B6.

  NO : REPAIR circuit VH407 (YE/GN) for a short to circuit RH111 (GY/BU). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B6 CHECK CIRCUIT VH407 (YE/GN) FOR A SHORT TO GROUND



N0061469

Fig. 11: Measuring Resistance Between EATC Module C228A-2, Circuit VH407 (YE/GN) & Ground

Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - DATC C228a-2, circuit VH407 (YE/GN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to B7.

  NO : REPAIR circuit VH407 (YE/GN) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B7 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Carry out the HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module - DATC. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test C: DTC B2426, B2427, B2795 or B2796 - Solar Radiation Sensor Circuit Open or Short to Ground

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the solar radiation sensor receives a ground through circuit GD115 (BK/GY). A 5-volt reference voltage is supplied to the solar radiation sensor from the HVAC module - dual automatic temperature control (DATC) through circuit VH417 (YE/OG) (LH) and circuit VH416 (VT/GY) (RH).

DTC	Description	Fault Trigger Conditions
B2426	Passenger Solar Radiation Sensor Circuit Open	The module senses no voltage drop on the sensor reference voltage circuit, indicating an open circuit.
B2427	Passenger Solar Radiation Sensor Circuit Short to Ground	The module senses excessive voltage drop on the sensor reference voltage circuit, indicating a short directly to ground.
B2795	Driver Solar Radiation Sensor Circuit Short to Ground	The module senses no voltage drop on the sensor reference voltage circuit, indicating an open circuit.
		The module senses excessive voltage

B2796	Driver Solar Radiation Sensor Circuit Open	drop on the sensor reference voltage circuit, indicating a short directly to ground.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Solar radiation sensor
- HVAC module - DATC

PINPOINT TEST C: DTC B2426, DTC B2427, DTC B2795 OR DTC B2796 - A/C SOLAR RADIATION SENSOR OPEN CIRCUIT OR SHORT TO GROUND

C1 CHECK THE SOLAR RADIATION SENSOR RESISTANCE

- Key in OFF position.
- Disconnect: Solar Radiation Sensor C286

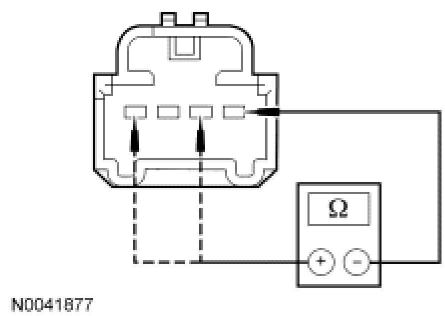


Fig. 12: Checking Sensor Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the solar radiation sensor terminals 1 and 4 and terminals 3 and 4.
- **Is continuity present and the resistance greater than 0 ohm?**

  YES : Go to C2.

  NO : INSTALL a new solar radiation sensor. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

C2 CHECK THE SOLAR RADIATION SENSOR REFERENCE VOLTAGE

- Key in ON position.
- Press the AUTO button.

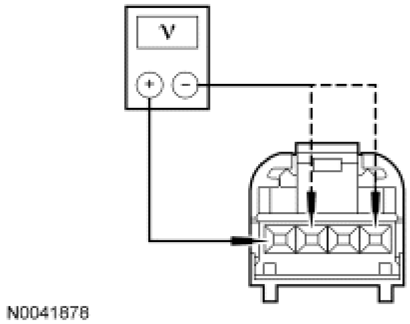


Fig. 13: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between solar radiation sensor C286-4, circuit GD115 (BK/GY), harness side and:
  - **DTC B2426 or B2427** , C286-1, circuit VH416 (VT/GY), harness side.
  - **DTC B2795 or B2796** , C286-3, circuit VH417 (YE/OG), harness side.
- **Are the voltages between 4.7 and 5.1 volts?**

  YES : Go to C6.

  NO : If diagnosing DTC B2426 or B2796, go to C3.

  If diagnosing DTC B2427 or B2795, go to C5.

C3 CHECK CIRCUIT GD115 (BK/GY) FOR AN OPEN

- Key in OFF position.

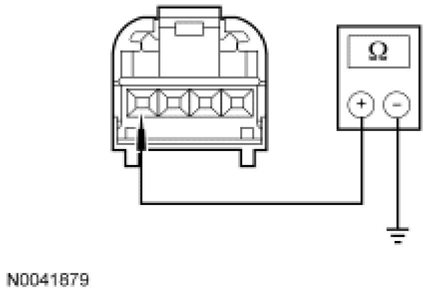


Fig. 14: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between solar radiation sensor C286-4, circuit GD115 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to C4.

  NO : REPAIR circuit GD115 (BK/GY) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

C4 CHECK CIRCUIT VH417 (YE/OG) OR VH416 (VT/GY) FOR AN OPEN

- Disconnect: HVAC Module - DATC C228a

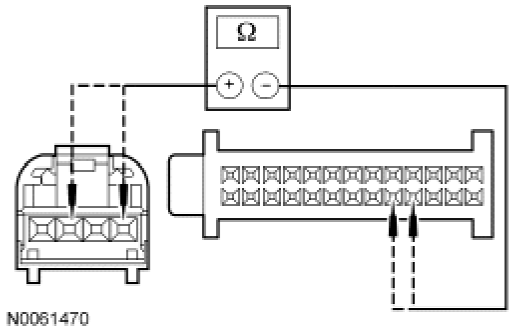


Fig. 15: Measuring Resistance Between EATC Module C228A-4 & C228A-5, Circuit VH416 (VT/GY) & VH417 (YE/OG)
Courtesy of FORD MOTOR CO.

- Measure the resistance between:
  - **DTC B2426** , HVAC module - DATC C228a-4, circuit VH416 (VT/GY), harness side and solar radiation sensor C286-1, circuit VH416 (VT/GY), harness side.
  - **DTC B2796** , HVAC module - DATC C228a-5, circuit VH417 (YE/OG), harness side and solar radiation sensor C286-3, circuit VH417 (YE/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to C6.

  NO : REPAIR circuit VH417 (YE/OG) or VH416 (VT/GY) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

C5 CHECK CIRCUIT VH417 (YE/OG) OR VH416 (VT/GY) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: HVAC Module - DATC C228a

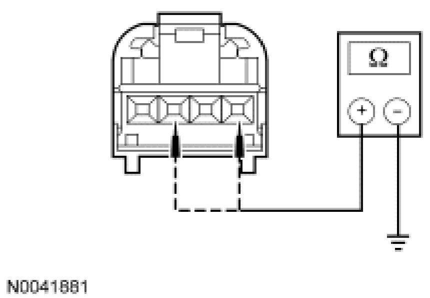


Fig. 16: Checking Circuits For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and:

    - **DTC B2427** , solar radiation sensor C286-1, circuit VH416 (VT/GY), harness side.
    - **DTC B2795** , solar radiation sensor C286-3, circuit VH417 (YE/OG), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to C6.

  NO : REPAIR circuit VH417 (YE/OG) or VH416 (VT/GY) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

C6 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Carry out the HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module - DATC. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test D: DTC B1947 or B2014 - Climate Control A/C Post Evaporator Sensor Circuit Open or Short to Ground

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the evaporator temperature sensor receives a ground from the HVAC module - dual automatic temperature control (DATC) through circuit RH111 (GY/BU)/(BK). A 5-volt reference voltage is supplied to the evaporator discharge air temperature sensor from the HVAC module - DATC through circuit VH406 (VT/BN)/(LG/BK).

- DTC B1947 Climate Control A/C Post Evaporator Sensor Circuit Short To Ground - The module senses excessive voltage drop on the sensor reference voltage circuit, indicating a short directly to ground.
- DTC B2014 Climate Control A/C Post Evaporator Sensor Open Circuit - The module senses no voltage drop on the sensor reference voltage circuit, indicating an open circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Evaporator temperature sensor
- HVAC module - electronic manual temperature control (EMTC) or HVAC module - DATC

PINPOINT TEST D: DTC B1947 OR DTC B2014 - CLIMATE CONTROL A/C POST EVAPORATOR

SENSOR CIRCUIT OPEN OR SHORT TO GROUND

NOTE: The evaporator temperature sensor cannot be installed independently of the heater core and evaporator core housing.

D1 CHECK THE SENSOR RESISTANCE

- Key in OFF position.
- Disconnect: Evaporator Temperature Sensor C296
- Carry out the evaporator temperature sensor component test in this service information.
- **Is the resistance within the specified values for the temperatures?**

  YES : Go to D2.

  NO : INSTALL a new heater core and evaporator core housing. REFER to **CLIMATE CONTROL** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

D2 CHECK THE HVAC MODULE - DATC SENSOR OUTPUT VOLTAGE

- Key in ON position.
- Press the AUTO button.

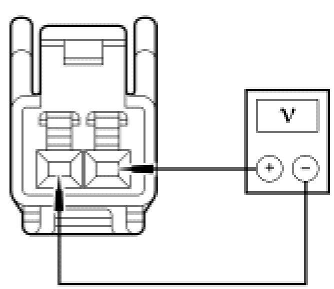


Fig. 17: Measuring Voltage Between Evaporator Temperature Sensor C296-2, Circuit (LG/BK) & C296-1, Circuit (BK)
Courtesy of FORD MOTOR CO.

- Measure the voltage between evaporator temperature sensor C296-2, circuit (LG/BK), harness side and C296-1, circuit (BK), harness side.
- **Is the voltage between 4.7 and 5.1 volts?**

  YES : Go to D7.

  NO : If diagnosing DTC B2826, go to D3.

  If diagnosing DTC B2827, go to D5.

D3 CHECK CIRCUIT VH406 (VT/BN)/(LG/BK) FOR AN OPEN

- Key in OFF position.
- Disconnect: HVAC Module - DATC C228a

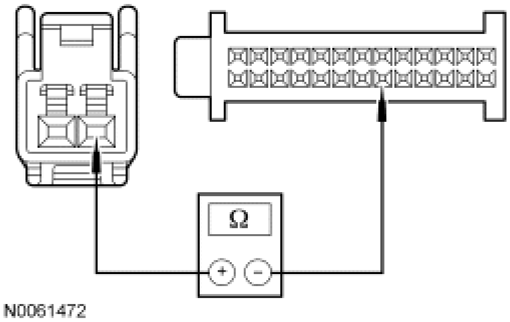


Fig. 18: Measuring Resistance Between EATC Module C228A-6 & C296-2, Circuit VH406 (VT/BN) & (LG/BK)
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - DATC C228a-6, circuit VH406 (VT/BN), harness side and evaporator temperature sensor C296-2, circuit (LG/BK), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to D4.

NO : REPAIR circuit VH406 (VT/BN)/(LG/BK) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

D4 CHECK CIRCUIT RH111 (GY/BU)/(BK) FOR AN OPEN

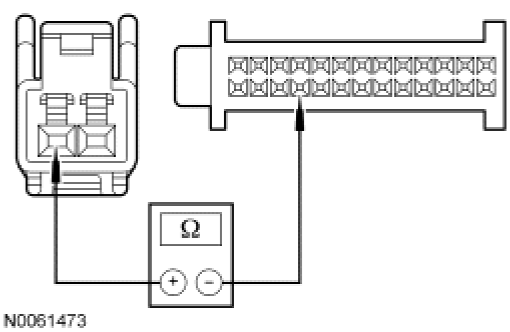


Fig. 19: Measuring Resistance Between EATC Module C228A-10 & C296-1, Circuit RH111 (GY/BU) & Circuit (BK)
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - DATC C228a-10, circuit RH111 (GY/BU), harness side and evaporator temperature sensor C296-1, circuit (BK), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to D7.

NO : REPAIR circuit RH111 (GY/BU)/(BK) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

D5 CHECK CIRCUIT VH406 (VT/BN)/(LG/BK) FOR A SHORT TO CIRCUIT RH111 (GY/BU)/(BK)

- Key in OFF position.

- Disconnect: HVAC Module - DATC C228a

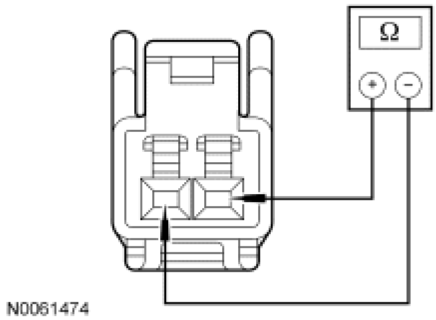


Fig. 20: Measuring Resistance Between Evaporator Temperature Sensor C296-2 & C296-1, Circuit (LG/BK) & Circuit (BK)
Courtesy of FORD MOTOR CO.

- Measure the resistance between evaporator temperature sensor C296-2, circuit (LG/BK), harness side and C296-1, circuit (BK), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to D6.

  NO : REPAIR circuit VH406 (VT/BN)/(LG/BK) for a short to circuit RH111 (GY/BU)/(BK). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

D6 CHECK CIRCUIT VH406 (VT/BN)/(LG/BK) FOR A SHORT TO GROUND

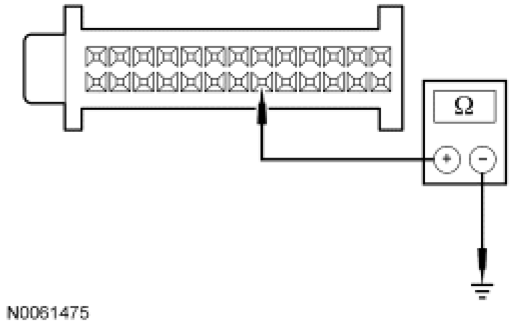


Fig. 21: Measuring Resistance Between EATC Module C228A-6, Circuit VH406 (VT/BN) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - DATC C228a-6, circuit VH406 (VT/BN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to D7.

  NO : REPAIR circuit VH406 (VT/BN)/(LG/BK) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

D7 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Carry out the HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module - DATC. REFER to **CLIMATE CONTROL** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. If the concern returns, INSTALL a new heater core and evaporator core housing. REFER to **CLIMATE CONTROL** article. CLEAR the DTCs. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test E: Air Inlet Door is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Manual Climate Control System for schematic and connector information.

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the HVAC module - electronic manual temperature control (EMTC) or HVAC module - dual automatic temperature control (DATC) supplies ground to the air inlet door actuator motor through circuit CH208 (GN/OG)/(GN) to rotate the air inlet door actuator 180 degrees to the outside air position, or circuit CH207 (BU/GY)/(BN) to rotate the air inlet door actuator 180 degrees to the recirculated air position. Ignition voltage is supplied to the air inlet door actuator through circuit CBP37 (WH)/(GY).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Air inlet door actuator
- HVAC module - DATC
- HVAC module - EMTC
- Stuck or damaged linkage or door

PINPOINT TEST E: AIR INLET DOOR IS INOPERATIVE

E1 CHECK THE DOOR ACTUATOR OPERATION

- Key in OFF position.
- Disconnect: HVAC Module - DATC C228a or HVAC Module - EMTC C2357a
- Remove the door actuator and disengage the actuator driveshaft from the actuator door.

- Mark the door actuator driveshaft position.
- Key in ON position.

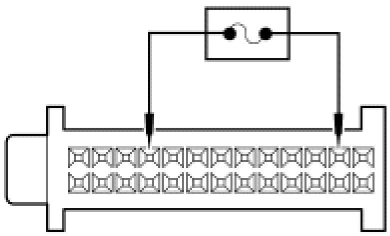


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Fig. 22: Connecting Fused Jumper Wire Between EATC C228A-23 & C2357A-15, Circuit GD115 (BK/GY) & CH207 (BU/GY)
Courtesy of FORD MOTOR CO.

NOTE: This step positions the actuator for the following steps.

- Connect a fused jumper wire between HVAC module - DATC C228a-23 or HVAC module - EMTC C2357a-23, circuit GD115 (BK/GY), harness side and HVAC module - DATC C228a-15 or HVAC module - EMTC C2357a-15, circuit CH207 (BU/GY), harness side.
- Remove the fused jumper wire.

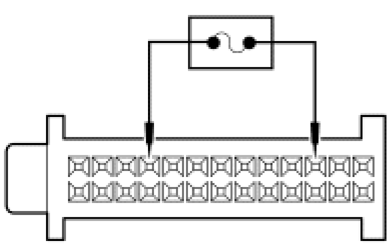

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Fig. 23: Connecting Fused Jumper Wire Between EATC C228A-23 & C2357A-16, Circuit GD115 (BK/GY) & CH208 (GN/OG)
Courtesy of FORD MOTOR CO.

- Connect a second fused jumper wire between: HVAC module - DATC C228a-23 or HVAC module - EMTC C2357a-23, circuit GD115 (BK/GY), harness side and HVAC module - DATC C228a-16 or HVAC module - EMTC C2357a-16, circuit CH208 (GN/OG), harness side.
- Remove the fused jumper wire.

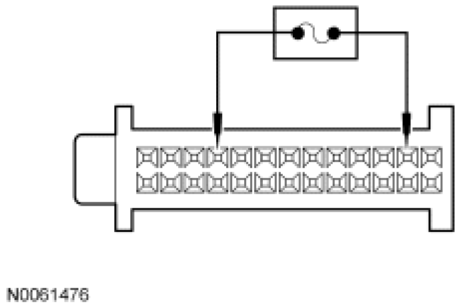

Fig. 24: Connecting Fused Jumper Wire Between EATC C228A-23 & C2357A-15, Circuit GD115 (BK/GY) & CH207 (BU/GY)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between HVAC module - DATC C228a-23 or HVAC module - EMTC C2357a-23, circuit GD115 (BK/GY), harness side and HVAC module - DATC C228a-15 or HVAC module - EMTC C2357a-15, circuit CH207 (BU/GY), harness side.
- **Does the actuator motor rotate 180 degrees in the previous steps (360 degrees total)?**

  YES : INSPECT for binding or broken linkage. If no condition is found, go to E7.

  NO : Go to E2.

E2 CHECK THE ACTUATOR MOTOR FOR VOLTAGE

- Key in OFF position.
- Disconnect: Air Inlet Door Actuator C2363
- Key in ON position.

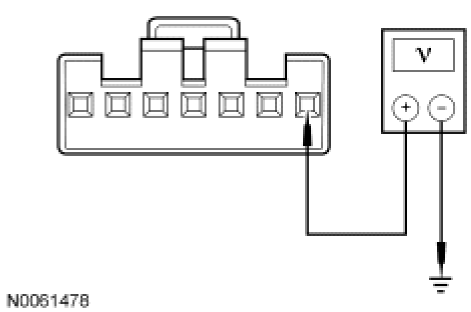

Fig. 25: Measuring Voltage Between Ground & Air Inlet Door Actuator C2363-7, Circuit (GY)
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and air inlet door actuator C2363-7, circuit (GY), harness side.
- **Is any voltage present?**

  YES : REPAIR circuit CBP37 (WH)/(GY) for an open. TEST the system for normal operation.

  NO : Go to E3.

E3 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR AN OPEN

- Key in OFF position.

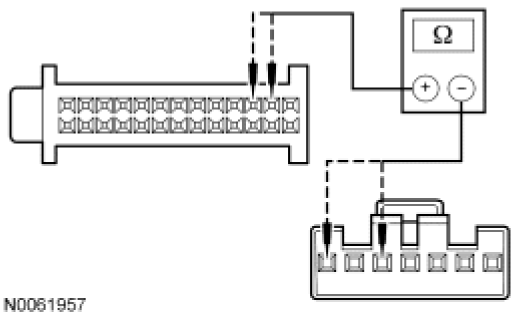

Fig. 26: Measuring Resistance Between EATC C228A-15 & C228A-16, Circuit CH207 (BU/GY) & CH208 (GN/OG)
Courtesy of FORD MOTOR CO.

- Measure the resistance between:
  - HVAC module - DATC C228a-15 or HVAC module - EMTC C2357a-15, circuit CH207 (BU/GY), harness side and air inlet door actuator C2363-1, circuit (BN), harness side.
  - HVAC module - DATC C228a-16 or HVAC module - EMTC C2357a-16, circuit CH208 (GN/OG), harness side and air inlet door actuator C2363-3, circuit (GN), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to E4.

  NO : REPAIR circuit CH207 (BU/GY)/(BN) or CH208 (GN/OG)/(GN) for an open. TEST the system for normal operation.

E4 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR A SHORT TO GROUND

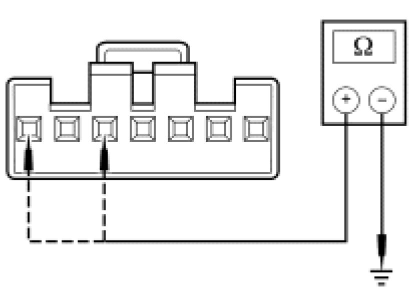

Fig. 27: Measuring Resistance Between Ground And Air Inlet Door Actuator C2363-1 & C2363-3, Circuit (BN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and:
  - air inlet door actuator C2363-1, circuit (BN), harness side.
  - air inlet door actuator C2363-3, circuit (GN), harness side.

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to E5.

  NO : REPAIR circuit CH207 (BU/GY)/(BN) or CH208 (GN/OG)/(GN) for a short to ground. TEST the system for normal operation.

E5 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR A SHORT TOGETHER

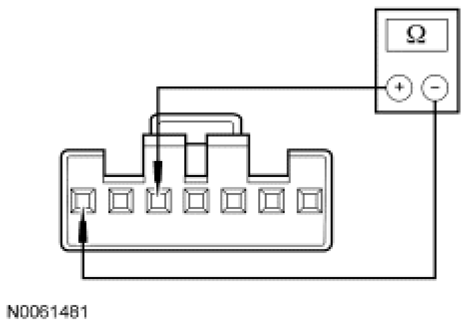

Fig. 28: Measuring Resistance Between Air Inlet Door Actuator C2363-1 & C2363-3, Circuit (BN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between air inlet door actuator C2363-1, circuit (BN), harness side and air inlet door actuator C2363-3, circuit (GN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to E6.

  NO : REPAIR circuits CH207 (BU/GY)/(BN) and CH208 (GN/OG)/(GN) for a short together. TEST the system for normal operation.

E6 CHECK THE ACTUATOR CONNECTION

NOTE: DATC systems only.

- Clear the DTCs.
- Disconnect the actuator connector.
- Check for:
  - corrosion.
  - pushed-out connectors.
  - incorrectly seated connector.
- Connect and correctly seat the actuator connector.
- Carry out the HVAC Module Cold Boot Process.

NOTE: DATC systems only.

- Carry out the HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self

Test.

- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new actuator. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs.

E7 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.

NOTE: DATC systems only.

- Carry out the HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module - DATC or HVAC module - EMTC. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test F: Incorrect/Erratic Direction of Airflow From Outlet(s)

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Manual Climate Control System for schematic and connector information.

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, to rotate the blend door actuator, the HVAC module - electronic manual temperature control (EMTC) or HVAC module - dual automatic temperature control (DATC) supplies voltage to the actuator motors through the door actuator clockwise circuits, and supplies ground through the door actuator counterclockwise circuits. To reverse the actuator rotation, the HVAC module - EMTC or HVAC module - DATC reverses the voltage and ground circuits.

The actuator feedback resistors are supplied a ground from the HVAC module - EMTC or HVAC module - DATC by the door actuator return circuits and a 5-volt reference voltage on the door actuator reference circuits. The HVAC module - EMTC or HVAC module - DATC reads the voltage on the blend door actuator feedback circuits to determine the door actuator position, by the position of the actuator feedback resistor wiper arm.

Door Actuator Clockwise Circuits

- (HVAC module - EMTC) Blend - CH233 (VT/BN)/(OG/BK)
- (HVAC module - DATC) LH Blend - CH238 (YE/OG)/(RD/YE)
- (HVAC module - DATC) RH Blend - CH213 (BN/GN)/(VT)
- Defrost/Panel/Floor - CH228 (YE/GN)/(GY/BK)

Door Actuator Counterclockwise Circuits

- (HVAC module - EMTC) Blend - CH234 (YE/GN)/(VT)
- (HVAC module - DATC) LH Blend - CH239 (BU/WH)/(WH)
- (HVAC module - DATC) RH Blend - CH212 (BU/OG)/(OG/BK)
- Defrost/Panel/Floor - CH229 (WH/BU)/(BU)

Door Actuator Return Circuits

- (HVAC module - EMTC) Blend - RH111 (GY/BU)/(BK)
- (HVAC module - DATC) LH Blend - RH111 (GY/BU)/(BK)
- (HVAC module - DATC) RH Blend - RH111 (GY/BU)/(BK)
- Defrost/Panel/Floor - RH111 (GY/BU)/(BK)

Door Actuator Reference Circuits

- (HVAC module - EMTC) Blend - LH111 (BN/WH)/(OG)
- (HVAC module - DATC) LH Blend - LH111 (BN/WH)/(OG)
- (HVAC module - DATC) RH Blend - LH111 (BN/WH)/(OG)
- Defrost/Panel/Floor - LH111 (BN/WH)/(OG)

Door Actuator Feedback Circuits

- (HVAC module - EMTC) Blend - VH439 (GY/VT)/(RD)
- (HVAC module - DATC) LH Blend - VH440 (BU/BN)/(YE)
- (HVAC module - DATC) RH Blend - VH441 (WH/BN)/(RD)
- Defrost/Panel/Floor - VH436 (YE/VT)/(BU/RD)

DTC	Description	Fault Trigger Conditions
B226C	Left Blend Door Motor Stall	The module senses no change in actuator feedback voltage when the actuator motor has been energized.
B226D	Right Blend Door Motor Stall	The module senses no change in actuator feedback voltage when the actuator motor has been energized.
B226E	Mode Blend Door Motor Stall	The module senses no change in actuator feedback voltage when the

		actuator motor has been energized.
B295A	Driver Blend Door Potentiometer Feedback Circuit Open	The module senses no voltage drop on the actuator feedback circuit, indicating an open or short to voltage.
B295B	Driver Blend Door Potentiometer Feedback Circuit short to ground	The module senses excessive voltage drop on the actuator feedback circuit, indicating a short directly to ground.
B295C	Passenger Blend Door Potentiometer Feedback Circuit Open	The module senses no voltage drop on the actuator feedback circuit, indicating an open or short to voltage.
B295D	Passenger Blend Door Potentiometer Feedback Circuit short to ground	The module senses excessive voltage drop on the actuator feedback circuit, indicating a short directly to ground.
B295E	Mode Door Potentiometer Feedback Circuit Open	The module senses no voltage drop on the actuator feedback circuit, indicating an open or short to voltage.
B295F	Mode Door Potentiometer Feedback Circuit short to ground	The module senses excessive voltage drop on the actuator feedback circuit, indicating a short directly to ground.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Defrost/panel/floor mode door actuator
- LH blend door actuator
- RH blend door actuator
- HVAC module - DATC
- HVAC module - EMTC
- Stuck or bound linkage or door

PINPOINT TEST F: INCORRECT/ERRATIC DIRECTION OF AIRFLOW FROM OUTLET(S)

F1 CHECK THE AIRFLOW

- Key in ON position.
- Check the air discharge temperature in full COOL and full WARM and airflow in the all modes.
- **Is the air discharge temperature and airflow correct in each setting?**

  YES : The system is operating normally.

NO : For DATC systems:

DTC B226C, go to F2.

DTC B226D, go to F3.

DTC B226E, go to F4.

DTC B295A, B295C or B295E, go to F9.

DTC B295B, B295D or B295F, go to F11.

If the RECIRC button does not change the air inlet door position, go to **Pinpoint Test E** .

For EMTC systems:

If the airflow is incorrect, follow diagnostics for defrost/panel/floor door actuator. Go to F2.

If the temperature control is inoperative/does not operate correctly, follow diagnostics for the LH blend door actuator. Go to F2.

If the MAX A/C selection does not change the air inlet door position, go to **Pinpoint Test E** .

F2 CHECK THE LH BLEND DOOR ACTUATOR OPERATION

- Key in OFF position.
- Disconnect: HVAC Module - DATC C228a or HVAC Module - EMTC C2357a

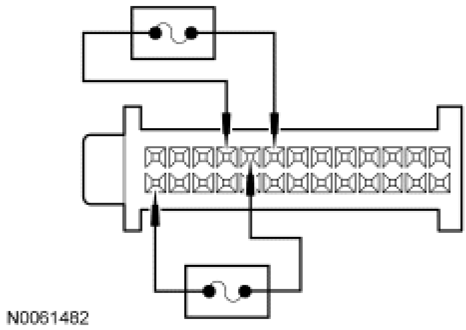

Fig. 29: Connect A Fused Jumper Wire For 5 Seconds Between EATC Module C228A-13, Circuit SBP15 (WH/RD)
Courtesy of FORD MOTOR CO.

NOTE: This step positions the actuator for the following steps.

- Connect a fused jumper wire for 5 seconds between:
  - HVAC module - DATC C228a-13 or HVAC module - EMTC C2357a-13, circuit SBP15

(WH/RD), harness side and HVAC module - DATC C228a-22, circuit CH238 (YE/OG), harness side or HVAC module - EMTC C2357a-22, circuit CH233 (VT/BN), harness side.
- HVAC module - DATC C228a-23 or HVAC module - EMTC C2357a-23, circuit GD115 (BK/GY), harness side and HVAC module - DATC C228a-21, circuit CH239 (BU/WH), harness side or HVAC module - EMTC C2357a-21, circuit CH234 (YE/GN), harness side.

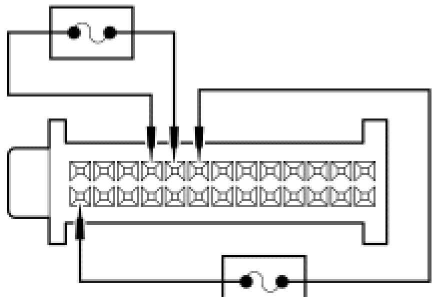

Fig. 30: Connect A Fused Jumper Wire For 5 Seconds Between EATC Module C228A-13, Circuit SBP15 (WH/RD)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire for 5 seconds between:
  - HVAC module - DATC C228a-13 or HVAC module - EMTC C2357a-13, circuit SBP15 (WH/RD), harness side and HVAC module - DATC C228a-21, circuit CH239 (BU/WH), harness side or HVAC module - EMTC C2357a-21, circuit CH234 (YE/GN), harness side.
  - HVAC module - DATC C228a-23 or HVAC module - EMTC C2357a-23, circuit GD115 (BK/GY), harness side and HVAC module - DATC C228a-22, circuit CH238 (YE/OG), harness side or HVAC module - EMTC C2357a-22, circuit CH233 (VT/BN), harness side.

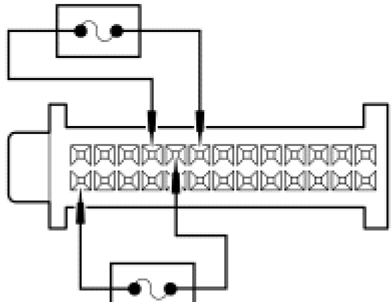

Fig. 31: Connect A Fused Jumper Wire For 5 Seconds Between EATC Module C228A-13, Circuit SBP15 (WH/RD)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire for 5 seconds between:
  - HVAC module - DATC C228a-13 or HVAC module - EMTC C2357a-13, circuit SBP15 (WH/RD), harness side and HVAC module - DATC C228a-22, circuit CH238 (YE/OG), harness side or HVAC module - EMTC C2357a-22, circuit CH233 (VT/BN), harness side.

- HVAC module - DATC C228a-23 or HVAC module - EMTC C2357a-23, circuit GD115 (BK/GY), harness side and HVAC module - DATC C228a-21, circuit CH239 (BU/WH), harness side or HVAC module - EMTC C2357a-21, circuit CH234 (YE/GN), harness side.

- **Does the actuator motor move at least 90 degrees in the clockwise and counterclockwise direction in the previous steps?**

  YES : DATC systems, INSPECT for binding or broken linkage. If no condition is found, CARRY OUT the actuator component test in this service information. If the actuator tests OK, go to F14.

  EMTC systems, INSPECT for binding or broken linkage. If no condition is found, CARRY OUT the actuator component test in this service information. If the actuator tests OK, go to F9.

  NO : Go to F5.

F3 CHECK THE RH BLEND DOOR ACTUATOR OPERATION

- Key in OFF position.
- Disconnect: HVAC Module - DATC C228a
- Disconnect: HVAC Module - DATC C228b

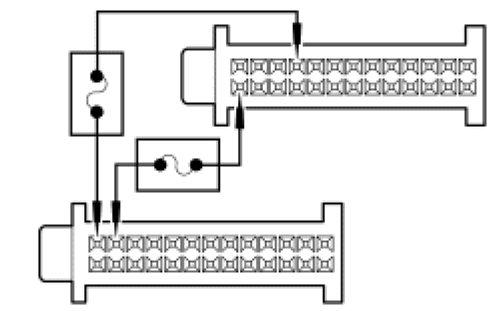

Fig. 32: Connect A Fused Jumper Wire For 5 Seconds Between EATC Module C228A-13, Circuit SBP15 (WH/RD)
Courtesy of FORD MOTOR CO.

NOTE: This step positions the actuator for the following steps.

- Connect a fused jumper wire for 5 seconds between:
  - HVAC module - DATC C228a-13, circuit SBP15 (WH/RD), harness side and HVAC module - DATC C228b-25, circuit CH213 (BN/GN), harness side.
  - HVAC module - DATC C228a-23, circuit GD115 (BK/GY), harness side and HVAC module - DATC C228b-26, circuit CH212 (BU/OG), harness side.

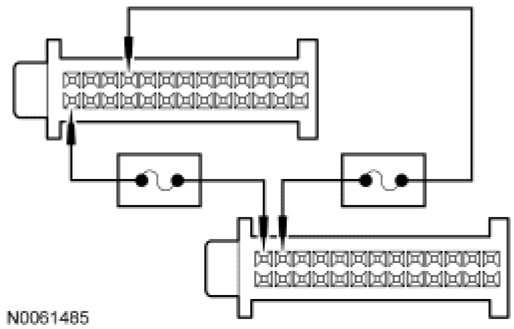

Fig. 33: Connect A Fused Jumper Wire For 5 Seconds Between EATC Module C228A-13, Circuit SBP15 (WH/RD)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire for 5 seconds between:
  - HVAC module - DATC C228a-13, circuit SBP15 (WH/RD), harness side and HVAC module - DATC C228b-26, circuit CH212 (BU/OG), harness side.
  - HVAC module - DATC C228a-23, circuit GD115 (BK/GY), harness side and HVAC module - DATC C228b-25, circuit CH213 (BN/GN), harness side.

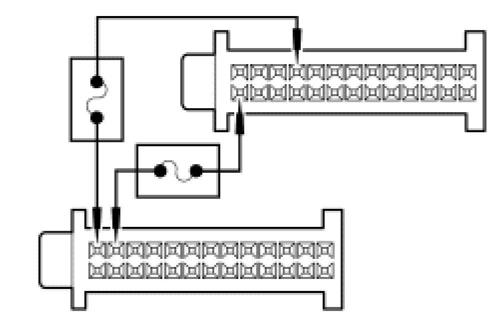

Fig. 34: Connect A Fused Jumper Wire For 5 Seconds Between EATC Module C228A-13, Circuit SBP15 (WH/RD)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire for 5 seconds between:
  - HVAC module - DATC C228a-13, circuit SBP15 (WH/RD), harness side and HVAC module - DATC C228b-25, circuit CH213 (BN/GN), harness side.
  - HVAC module - DATC C228a-23, circuit GD115 (BK/GY), harness side and HVAC module - DATC C228b-26, circuit CH212 (BU/OG), harness side.
- **Does the actuator motor move at least 90 degrees in the clockwise and counterclockwise direction in the previous steps?**

  YES : INSPECT for binding or broken linkage. If no condition is found, CARRY OUT the actuator component test in this service information. If the actuator tests OK, go to F14.

  NO : Go to F5.

F4 CHECK THE DEFROST/PANEL/FLOOR DOOR ACTUATOR OPERATION

- Key in OFF position.
- Disconnect: HVAC Module - DATC C228a or HVAC Module - EMTC C2357a

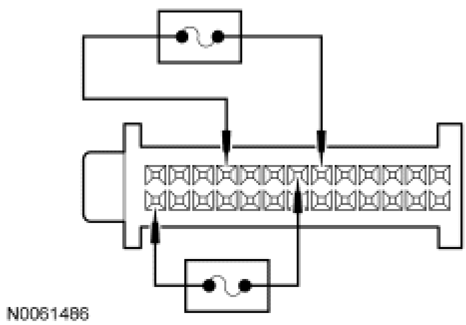

Fig. 35: Connect A Fused Jumper Wire For 5 Seconds Between EATC Module C228A-13, Circuit SBP15 (WH/RD)
Courtesy of FORD MOTOR CO.

NOTE: This step positions the actuator for the following steps.

- Connect a fused jumper wire for 5 seconds between:
  - HVAC module - DATC C228a-13 or HVAC module - EMTC C2357a-13, circuit SBP15 (WH/RD), harness side and HVAC module - DATC C228a-20 or HVAC module - EMTC C2357a-20, circuit CH228 (YE/GY), harness side.
  - HVAC module - DATC C228a-23 or HVAC module - EMTC C2357a-23, circuit GD115 (BK/GY), harness side and HVAC module - DATC C228a-19 or HVAC module - EMTC C2357a-19, circuit CH229 (WH/BU), harness side.

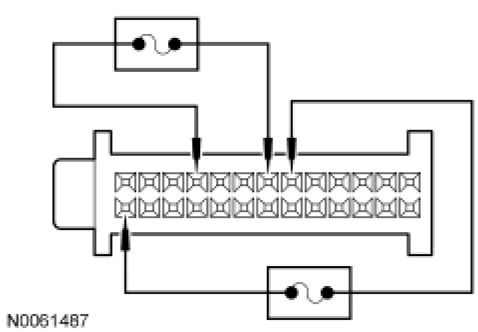

Fig. 36: Connect A Fused Jumper Wire For 5 Seconds Between EATC Module C228A-13, Circuit SBP15 (WH/RD)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire for 5 seconds between:
  - HVAC module - DATC C228a-13 or HVAC module - EMTC C2357a-13, circuit SBP15 (WH/RD), harness side and HVAC module - DATC C228a-19 or HVAC module - EMTC C2357a-19, circuit CH229 (WH/BU), harness side.

- HVAC module - DATC C228a-23 or HVAC module - EMTC C2357a-23, circuit GD115 (BK/GY), harness side and HVAC module - DATC C228a-20 or HVAC module - EMTC C2357a-20, circuit CH228 (YE/GY), harness side.

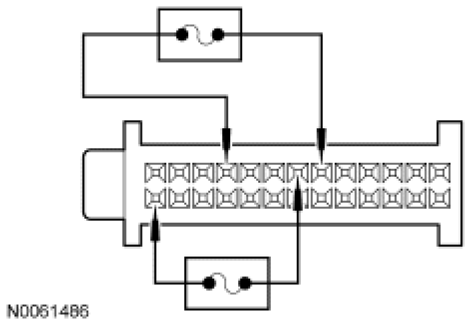

Fig. 37: Connect A Fused Jumper Wire For 5 Seconds Between EATC Module C228A-13, Circuit SBP15 (WH/RD)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire for 5 seconds between:
    - HVAC module - DATC C228a-13 or HVAC module - EMTC C2357a-13, circuit SBP15 (WH/RD), harness side and HVAC module - DATC C228a-20 or HVAC module - EMTC C2357a-20, circuit CH228 (YE/GY), harness side.
    - HVAC module - DATC C228a-23 or HVAC module - EMTC C2357a-23, circuit GD115 (BK/GY), harness side and HVAC module - DATC C228a-19 or HVAC module - EMTC C2357a-19, circuit CH229 (WH/BU), harness side.
- **Does the actuator motor move at least 90 degrees in the clockwise and counterclockwise direction in previous steps?**

  YES : DATC systems, INSPECT for binding or broken linkage. If no condition is found, CARRY OUT the actuator component test in this service information. If the actuator tests OK, go to F14.

  EMTC systems, INSPECT for binding or broken linkage. If no condition is found, CARRY OUT the actuator component test in this service information. If the actuator tests OK, go to F9.

  NO : Go to F5.

F5 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR AN OPEN

- Disconnect: For DTC B226C or LH Blend Door Actuator, LH Blend Door Actuator C2091
- Disconnect: For DTC B226D, RH Blend Door Actuator C2092
- Disconnect: For DTC B226E or Defrost/Panel/Floor Door Actuator, LH Defrost/Panel/Floor Door Actuator C2278

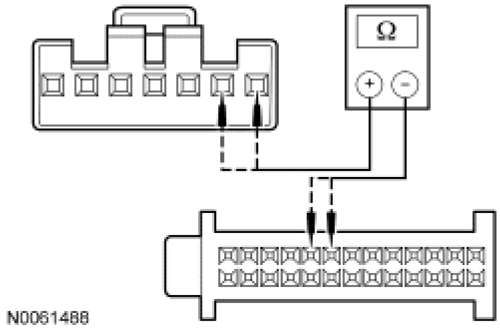

Fig. 38: Measuring Resistance Between EMTC Module C2357A-22 & C2357A-21, Circuit CH233 (VT/BN) & CH234 (YE/GN)
Courtesy of FORD MOTOR CO.

NOTE: **For DTC B226C or blend door actuator.**

- Measure the resistance between:
  - HVAC module - EMTC C2357a-22, circuit CH233 (VT/BN), harness side and blend door actuator C2091-7, circuit (OG/BK), harness side.
  - HVAC module - EMTC C2357a-21, circuit CH234 (YE/GN), harness side and blend door actuator C2091-6, circuit (VT), harness side.
  - HVAC module - DATC C228a-22, circuit CH238 (YE/OG), harness side and LH blend door actuator C2091-7, circuit (RD/YE), harness side.
  - HVAC module - DATC C228a-21, circuit CH239 (BU/WH), harness side and LH blend door actuator C2091-6, circuit (WH), harness side.

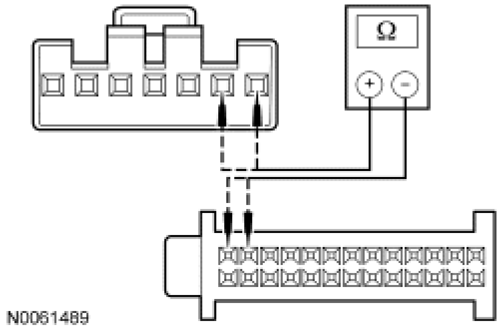

Fig. 39: Measuring Resistance Between EMTC Module C228B-25 & C228B-26, Circuit CH213 (BN/GN) & CH212 (BU/OG)
Courtesy of FORD MOTOR CO.

NOTE: **For DTC B226D.**

- Measure the resistance between:
  - HVAC module - DATC C228b-26, circuit CH212 (BU/OG), harness side and RH blend door actuator C2092-6, circuit (VT), harness side.

- HVAC module - DATC C228b-25, circuit CH213 (BN/GN), harness side and RH blend door actuator C2092-7, circuit (OG/BK), harness side.

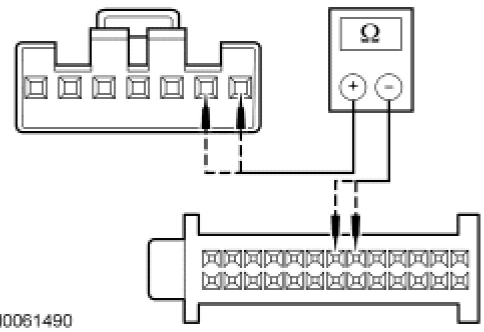

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Fig. 40: Measuring Resistance Between EMTC Module C228a-20 & C228a-19, Circuit CH228 (YE/GY) & CH229 (WH/BU)
Courtesy of FORD MOTOR CO.

NOTE: For DTC B226E or defrost/panel/floor door actuator.

- Measure the resistance between:
  - HVAC module - DATC C228a-20 or HVAC module - EMTC C2357a-20, circuit CH228 (YE/GY), harness side and defrost/panel/floor door actuator C2278-7, circuit (GY/BK), harness side.
  - HVAC module - DATC C228a-19 or HVAC module - EMTC C2357a-19, circuit CH229 (WH/BU), harness side and defrost/panel/floor door actuator C2278-6, circuit (BU), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to F6.

  NO : REPAIR the circuit(s) for an open. TEST the system for normal operation.

F6 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR A SHORT TO GROUND

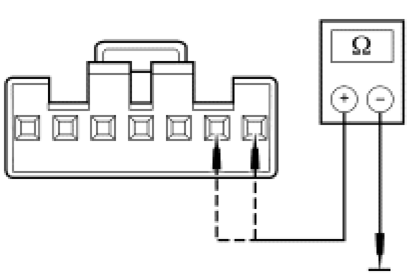

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Fig. 41: Measuring Resistance Between Ground (EMTC) Blend Door Actuator C2091-7 & C2091-6, Circuit (OG/BK) & Circuit (VT)
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and:
  - (EMTC) Blend door actuator C2091-7, circuit (OG/BK), harness side.
  - (EMTC) Blend door actuator C2091-6, circuit (VT), harness side.
  - **DTC B226C** , LH blend door actuator C2091-7, circuit (RD/YE), harness side.
  - **DTC B226C** , LH blend door actuator C2091-6, circuit (WH), harness side.
  - **DTC B226D** , RH blend door actuator C2092-6, circuit (VT), harness side.
  - **DTC B226D** , RH blend door actuator C2092-7, circuit (OG/BK), harness side.
  - **DTC B226E** or defrost/panel/floor door actuator, defrost/panel/floor door actuator C2278-7, circuit (GY/BK), harness side.
  - **DTC B226E** or defrost/panel/floor door actuator, defrost/panel/floor door actuator C2278-6, circuit (BU), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to F7.

  NO : REPAIR the circuit(s) for a short to ground. TEST the system for normal operation.

F7 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR A SHORT TO VOLTAGE

- Key in ON position.

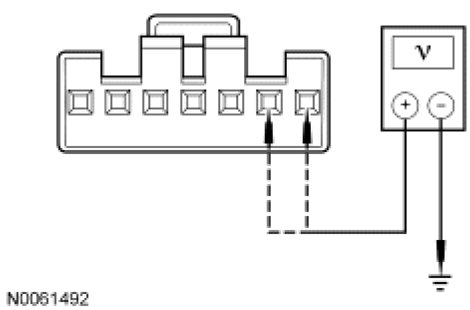

Fig. 42: Measuring Voltage Between Ground (EMTC) Blend Door Actuator C2091-7 & C2091-6, Circuit (OG/BK) & Circuit (VT)
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and:
  - (EMTC) Blend door actuator C2091-7, circuit (OG/BK), harness side.
  - (EMTC) Blend door actuator C2091-6, circuit (VT), harness side.
  - **DTC B226C** , LH blend door actuator C2091-7, circuit (RD/YE), harness side.
  - **DTC B226C** , LH blend door actuator C2091-6, circuit (WH), harness side.
  - **DTC B226D** , RH blend door actuator C2092-6, circuit (VT), harness side.
  - **DTC B226D** , RH blend door actuator C2092-7, circuit (OG/BK), harness side.
  - **DTC B226E** or defrost/panel/floor door actuator, defrost/panel/floor door actuator C2278-7, circuit (GY/BK), harness side.
  - **DTC B226E** or defrost/panel/floor door actuator, defrost/panel/floor door actuator C2278-6,

circuit (BU), harness side.

- **Is any voltage present?**

  YES : REPAIR the circuit(s) for a short to power. TEST the system for normal operation.

  NO : Go to F8.

F8 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR A SHORT TOGETHER

- Key in OFF position.

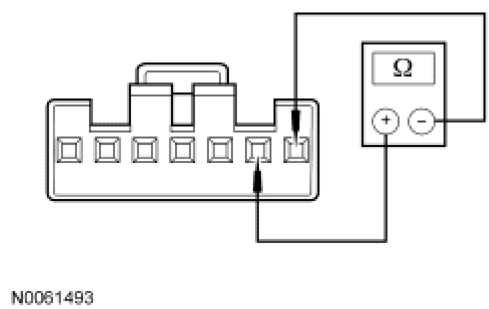

Fig. 43: Measuring Resistance Between (EMTC) LH Blend Door Actuator C2091-7, Circuit (OG/BK) & Circuit (RD/YE)
Courtesy of FORD MOTOR CO.

- Measure the resistance between:
  - (EMTC) For LH blend door actuator, LH blend door actuator C2091-7, circuit/ (OG/BK), harness side and LH blend door actuator C2091-6, circuit (VT), harness side.
  - **DTC B226C** or LH blend door actuator, LH blend door actuator C2091-7, circuit (RD/YE), harness side and LH blend door actuator C2091-6, circuit (WH), harness side.
  - **DTC B226D** , RH blend door actuator C2092-6, circuit (VT), harness side and RH blend door actuator C2092-7, circuit (OG/BK), harness side.
  - **DTC B226E** or defrost/panel/floor door actuator, defrost/panel/floor door actuator C2278-7, circuit (GY/BK), harness side and defrost/panel/floor door actuator C2278-6, circuit (BU), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : CARRY OUT the actuator component test in this service information. If the actuator tests OK, go to F13.

  NO : REPAIR circuit(s) for a short together. TEST the system for normal operation.

F9 CHECK THE ACTUATOR FEEDBACK CIRCUITS FOR AN OPEN

- Key in OFF position.
- Disconnect: HVAC Module - DATC C228a or HVAC Module - EMTC C2357a
- Disconnect: DATC Systems Only, HVAC Module - DATC C228b
- Disconnect: LH Blend Door Actuator C2091
- Disconnect: DATC Systems Only, RH Blend Door Actuator C2092
- Disconnect: Defrost/Panel/Floor Door Actuator C2278

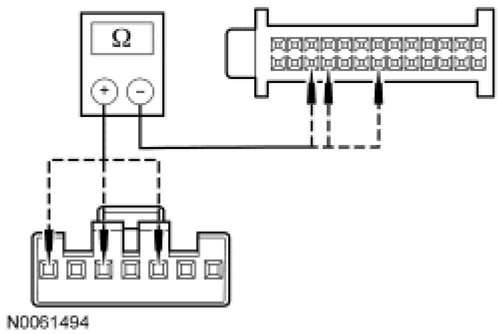

Fig. 44: Measuring Resistance Between EMTC Module C2357A-11 & C2357A-10, Circuit LH111 (BN/WH) & RH111 (GY/BU)
Courtesy of FORD MOTOR CO.

NOTE:	**For DTC B295A (DATC) or blend door actuator (EMTC).**

- Measure the resistance between:
  - HVAC module - EMTC C2357a-11, circuit LH111 (BN/WH), harness side and blend door actuator C2091-3, circuit (OG), harness side.
  - HVAC module - EMTC C2357a-10, circuit RH111 (GY/BU), harness side and blend door actuator C2091-1, circuit (BK), harness side.
  - HVAC module - EMTC C2357a-7, circuit VH439 (GY/VT), harness side and blend door actuator C2091-5, circuit (RD), harness side.
  - HVAC module - DATC C228a-11, circuit LH111 (BN/WH), harness side and LH blend door actuator C2091-3, circuit (OG), harness side.
  - HVAC module - DATC C228a-10, circuit RH111 (GY/BU), harness side and LH blend door actuator C2091-1, circuit (BK), harness side.
  - HVAC module - DATC C228a-7, circuit VH440 (BU/BN), harness side and LH blend door actuator C2091-5, circuit (YE), harness side.

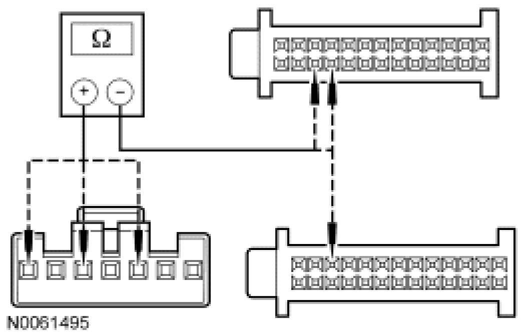

Fig. 45: Measuring Resistance Between RH Blend Door Actuator C2092-3, C2092-1 & C2092-5
Courtesy of FORD MOTOR CO.

NOTE:	**For DTC B295C.**

- Measure the resistance between:
  - HVAC module - DATC C228a-11 circuit LH111 (BN/WH), harness side and RH blend door actuator C2092-3, circuit (OG), harness side.
  - HVAC module - DATC C228a-10 circuit RH111 (GY/BU), harness side and RH blend door actuator C2092-1, circuit (BK), harness side.
  - HVAC module - DATC C228b-24 circuit VH441 (WH/BN), harness side and RH blend door actuator C2092-5, circuit (RD), harness side.

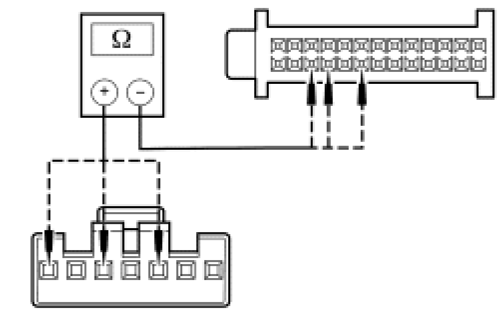

Fig. 46: Measuring Resistance Between Defrost/Panel/Floor Door Actuator C2278-3, C2278-1 & C2278-5
Courtesy of FORD MOTOR CO.

NOTE: For DTC B295E or defrost/panel/floor door actuator.

- Measure the resistance between:
  - HVAC module - DATC C228a-11 or HVAC module - EMTC C2357a-11, circuit LH111 (BN/WH), harness side and defrost/panel/floor door actuator C2278-3, circuit (OG), harness side.
  - HVAC module - DATC C228a-10 or HVAC module - EMTC C2357a-10, circuit RH111 (GY/BU), harness side and defrost/panel/floor door actuator C2278-1, circuit (BK), harness side.
  - HVAC module - DATC C228a-8 or HVAC module - EMTC C2357a-8, circuit VH436 (YE/VT), harness side and defrost/panel/floor door actuator C2278-5, circuit (BU/RD), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to F10.

  NO : REPAIR circuit(s) for an open. TEST the system for normal operation.

F10 CHECK THE ACTUATOR FEEDBACK CIRCUITS FOR A SHORT TO VOLTAGE

- Key in ON position.

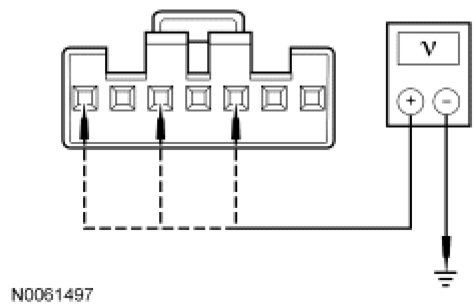

Fig. 47: Measuring Voltage Between (EMTC) Blend Door Actuator C2091-3, C2091-1 & C2091-5
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and:
  - (EMTC) Blend door actuator C2091-3, circuit (OG), harness side.
  - (EMTC) Blend door actuator C2091-1, circuit (BK), harness side.
  - (EMTC) Blend door actuator C2091-5, circuit (RD), harness side.
  - (EMTC) Defrost/panel/floor door actuator C2092-5, circuit (BU/RD), harness side.
  - **DTC B295A** , LH blend door actuator C2091-5, circuit (YE), harness side.
  - **DTC B295C** , RH blend door actuator C2092-5, circuit (RD), harness side.
  - **DTC B295E** defrost/panel/floor door actuator C2278-5, circuit (BU/RD), harness side.
- **Is any voltage present?**

  YES : REPAIR circuit(s) for a short to voltage. TEST the system for normal operation.

  NO : DATC systems, go to F12.

  EMTC systems, go to F11.

F11 CHECK THE ACTUATOR FEEDBACK CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.

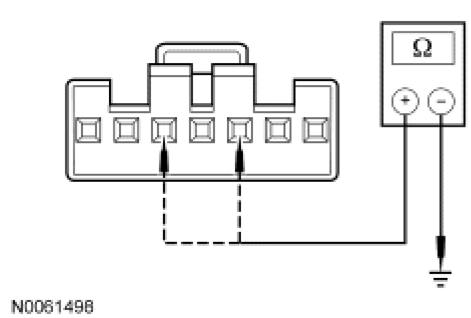

Fig. 48: Measuring Resistance Between (EMTC) Blend Door Actuator C2091-3, C2091-1 & C2091-5
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and:
  - (EMTC) Blend door actuator C2091-3, circuit (OG), harness side.
  - (EMTC) Blend door actuator C2091-5, circuit (RD), harness side.
  - (EMTC) Defrost/panel/floor door actuator C2092-5, circuit (BU/RD), harness side.
  - **DTC B295A** , LH blend door actuator C2091-5, circuit (YE), harness side.
  - **DTC B295C** , RH blend door actuator C2092-5, circuit (RD), harness side.
  - **DTC B295E** defrost/panel/floor door actuator C2278-5, circuit (BU/RD), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to F12.

  NO : REPAIR circuit(s) for a short to ground. TEST the system for normal operation.

F12 CHECK THE ACTUATOR FEEDBACK CIRCUITS FOR A SHORT TOGETHER

- Key in OFF position.

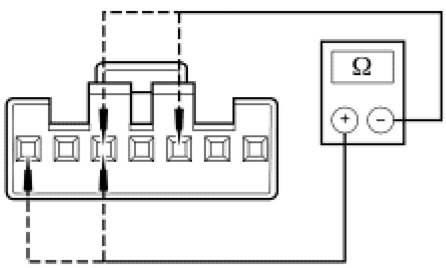

Fig. 49: Measuring Resistance Between (EMTC) Blend Door Actuator C2091-3 & C2091-5, Blend Door Actuator C2091-1
Courtesy of FORD MOTOR CO.

- Measure the resistance between:
  - (EMTC) Blend door actuator C2091-3, circuit (OG), harness side and blend door actuator C2091-1, circuit (BK), harness side.
  - (EMTC) Blend door actuator C2091-5, circuit (RD), harness side and blend door actuator C2091-1, circuit (BK), harness side.
  - (EMTC) Blend door actuator C2091-5, circuit (RD), harness side and blend door actuator C2091-3, circuit (OG), harness side.
  - (EMTC) Defrost/panel/floor door actuator C2278-5, circuit (BU/RD), harness side and defrost/panel/floor door actuator C2278-1, circuit (BK), harness side.
  - (EMTC) Defrost/panel/floor door actuator C2278-5, circuit (BU/RD), harness side and defrost/panel/floor door actuator C2278-3, circuit (OG), harness side.
  - **DTC B295A** , LH blend door actuator C2091-5, circuit (YE), harness side and LH blend door actuator C2091-1, circuit (BK), harness side.
  - **DTC B295A** , LH blend door actuator C2091-5, circuit/ (YE), harness side and LH blend door actuator C2091-3, circuit (OG), harness side.

- **DTC B295C** , RH blend door actuator C2092-5, circuit (RD), harness side and RH blend door actuator C2092-1, circuit (OG), harness side.
- **DTC B295C** , RH blend door actuator C2092-5, circuit (RD), harness side and RH blend door actuator C2092-3, circuit (BK), harness side.
- **DTC B295E** , defrost/panel/floor door actuator C2278-5, circuit (BU/RD), harness side and defrost/panel/floor door actuator C2278-1, circuit (BK), harness side.
- **DTC B295E** or defrost/panel/floor door actuator, defrost/panel/floor door actuator C2278-5, circuit (BU/RD), harness side and defrost/panel/floor door actuator C2278-3, circuit (OG), harness side.

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to F14.

  NO : REPAIR circuit(s) for a short together. TEST the system for normal operation.

F13 CHECK THE ACTUATOR CONNECTION

NOTE: DATC systems only.

- Clear the DTCs.
- Disconnect the actuator connector.
- Check for:
  - corrosion.
  - pushed-out connectors.
  - incorrectly seated connector.
- Connect and correctly seat the actuator connector.
- Carry out the HVAC Module Cold Boot Process.

NOTE: DATC systems only.

- Carry out the HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new actuator. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs.

F14 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.

NOTE: DATC systems only.

- Carry out the HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module - DATC or HVAC module - EMTC. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test G: DTC: B1318 - Battery Voltage Low

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the HVAC module - dual automatic temperature control (DATC) receives a ground through circuit GD115 (BK/GY). The HVAC module - DATC is supplied constant battery voltage through circuit SBP15 (WH/RD) and ignition switched voltage through circuit CBP37 (WH).

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- HVAC module - DATC

PINPOINT TEST G: DTC: B1318 - BATTERY VOLTAGE LOW

G1 CHECK CIRCUIT GD115 (BK/GY) FOR AN OPEN

- Key in OFF position.
- Disconnect: HVAC Module - DATC C228a

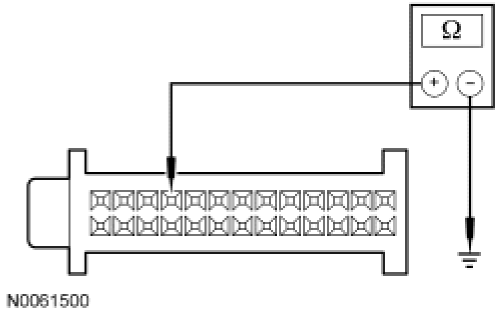

Fig. 50: Measuring Resistance Between EATC Module C228A-23, Circuit GD115 (BK/GY) & Ground

Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - DATC C228a-23, circuit GD115 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to G2.

  NO : REPAIR circuit GD115 (BK/GY). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

G2 CHECK CIRCUITS SBP15 (WH/RD) AND CBP37 (WH) FOR AN OPEN

- Key in ON position.

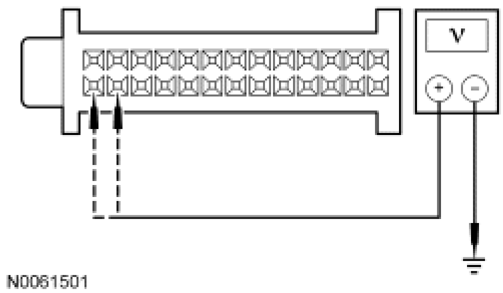

Fig. 51: Measuring Voltage Between EATC Module C228A-13 & C228A-12, Circuit SBP15 (WH/RD) & CBP37 (WH)
Courtesy of FORD MOTOR CO.

- Measure the voltage between HVAC module - DATC C228a-13, circuit SBP15 (WH/RD), harness side, HVAC module - DATC C228a-12, circuit CBP37 (WH), harness side and ground.
- **Are the voltages greater than 10 volts?**

  YES : Go to **MODULE COMMUNICATIONS NETWORK** article to diagnose the network concern.

  NO : VERIFY smart junction box (SJB) fuses 15 (10A) and 37 (10A) are OK. If OK, REPAIR circuit SBP15 (WH/RD) or CBP37 (WH) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test H: The DATC System is Inoperative, Intermittent or Incorrect Operation

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the HVAC module - dual automatic temperature control (DATC) receives a ground through circuit GD115 (BK/GY). The HVAC module - DATC is supplied constant battery voltage through circuit SBP15 (WH/RD) and ignition switched voltage through circuit CBP37 (WH).

NOTE: For a complete explanation of the DATC system functions, refer to Description and Operation in this service information.

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- HVAC module - DATC

PINPOINT TEST H: THE DATC SYSTEM IS INOPERATIVE, INTERMITTENT OR INCORRECT OPERATION

H1 VERIFY AUTOMATIC OPERATION

- Key in ON position.
- With the engine running, press the AUTO button.
- **Does the indicator above the AUTO button illuminate and the selected temperature for both the driver and passenger appear in the display window?**

  YES : Go to H2.

  NO : Go to H11.

H2 CARRY OUT THE HVAC MODULE - DATC SELF-TEST

- Key in ON position.
- Carry out the HVAC Module - Dual Automatic Temperature Control Module (DATC) Self-Test in this service information. Record the DTCs displayed, if any.
- **Were any DTCs displayed as a result of the self-test?**

  YES : REFER to the **HVAC MODULE - DUAL AUTOMATIC TEMPERATURE CONTROL DTC CHART**. CARRY OUT the necessary diagnosis and REPAIR as required.

  NO : Go to H3.

H3 CHECK THE VACUUM FLUORESCENT DISPLAY

- Exit the self-test. Refer to the HVAC Module - Dual Automatic Temperature Control Module (DATC) Self-Test in this service information. Observe the button indicators and function symbols displayed on the vacuum fluorescent display while changing the temperature, blower speed and functions.
- **Are the display and indicators correct and complete without any missing elements?**

  YES : Go to H4.

  NO : Go to H14.

H4 CHECK THE BLOWER MANUAL OVERRIDE OPERATION

- Press the blower motor speed override control fully up and fully down.
- **Does the blower motor speed increase from low speed to high and high speed to low?**

  YES : Go to H5.

  NO : If the blower motor is inoperative, go to **Pinpoint Test N** .

If the blower motor does not operate correctly, go to **Pinpoint Test O** .

H5 VERIFY THE DEFROST OVERRIDE OPERATION

- Press the override button for defrost operation.
- **Is outside air being discharged from the windshield defroster nozzle and the side window demisters?**

YES : Go to H6.

NO : Go to **Pinpoint Test F** .

H6 VERIFY THE FLOOR OVERRIDE OPERATION

- Press the mode override button until floor mode is indicated.
- **Is outside air being discharged from the floor duct?**

YES : Go to H7.

NO : Go to **Pinpoint Test E** .

H7 VERIFY THE PANEL OVERRIDE OPERATION

- Press the mode override button until panel mode is indicated.
- **Is outside air being discharged from the instrument panel registers?**

YES : Go to H8.

NO : Go to **Pinpoint Test F** .

H8 VERIFY THAT THE A/C CLUTCH DOES NOT ENGAGE IN THE PANEL MODE

- In panel operation and with the A/C OFF, listen for the compressor clutch to engage.
- **Does the A/C clutch engage with the PANEL override button pressed?**

YES : Go to **Pinpoint Test K** .

NO : Go to H9.

H9 VERIFY A/C CLUTCH ENGAGEMENT IN THE A/C MODE

- Make sure the ambient air temperature is above 6°C (43°F).
- Press the override button for A/C operation.
- **Does the A/C clutch engage when the A/C override button is pressed?**

YES : Go to H10.

NO : Go to **Pinpoint Test J** .

H10 VERIFY THE RECIRC OVERRIDE OPERATION

- While in PANEL mode, press the RECIRC override button.
- **Is recirculated air being discharged from the instrument panel registers?**

YES : The test is complete. The system is functioning normally.

NO : Go to **Pinpoint Test E** .

H11 CHECK THE HVAC MODULE - DATC MODULE FUNCTIONS

- Press each function button and observe the display.
- **Does the HVAC module - DATC carry out and display any functions?**

YES : Go to H14.

NO : Go to H12.

H12 CHECK CIRCUIT GD115 (BK/GY) FOR AN OPEN

- Key in OFF position.
- Disconnect: HVAC Module - DATC C228a

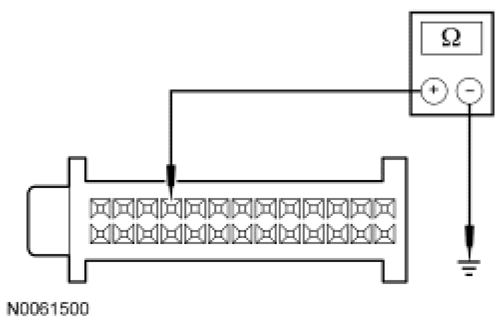

Fig. 52: Measuring Resistance Between EATC Module C228A-23, Circuit GD115 (BK/GY) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - DATC C228a-23, circuit GD115 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : Go to H13.

NO : REPAIR circuit GD115 (BK/GY). TEST the system for normal operation.

H13 CHECK CIRCUITS SBP15 (WH/RD) AND CBP37 (WH) FOR AN OPEN

- Key in ON position.

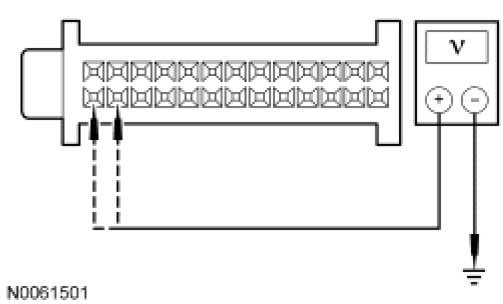

Fig. 53: Measuring Voltage Between EATC Module C228A-13 & C228A-12, Circuit SBP15 (WH/RD) & CBP37 (WH)
Courtesy of FORD MOTOR CO.

- Measure the voltage between HVAC module - DATC C228a-13, circuit SBP15 (WH/RD), harness side, HVAC module - DATC C228a-12, circuit CBP37 (WH), harness side and ground.
- **Are the voltages greater than 10 volts?**

YES : Go to H14.

NO : VERIFY smart junction box (SJB) fuses 15 (10A) and 37 (10A) are OK. If OK, REPAIR circuit SBP15 (WH/RD) or CBP37 (WH) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

H14 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Carry out the HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

YES : INSTALL a new HVAC module - DATC. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test I: Insufficient, Erratic or No Heat

Normal Operation

Under normal operation, warm coolant flows from the engine through the heater core and back to the engine.

This pinpoint test is intended to diagnose the following:

- Plugged heater core
- Coolant level
- Temperature blend door

PINPOINT TEST I: INSUFFICIENT, ERRATIC OR NO HEAT

I1 CHECK FOR CORRECT ENGINE COOLANT LEVEL

- Check the engine coolant level when hot and cold.
- **Is the engine coolant at the correct level (hot/cold) as indicated on the engine coolant recovery reservoir?**

YES : Go to I3.

NO : Go to I2.

I2 CHECK THE ENGINE COOLING SYSTEM FOR LEAKS

- Pressure test the cooling system for leaks. Refer to **ENGINE COOLING** article.
- **Does the engine cooling system leak?**

YES : REPAIR the engine coolant leak. TEST the system for normal operation.

NO : Go to I3.

I3 CHECK FOR COOLANT FLOW TO THE HEATER CORE

- Run the engine until it reaches normal operation temperature. Select the FLOOR position on the control assembly. Set the temperature control to full warm and the blower to the lowest setting.

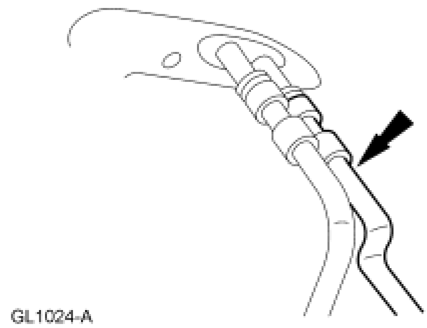

Fig. 54: Checking Coolant Flow To Heater Core
Courtesy of FORD MOTOR CO.

- Using a suitable thermo-couple temperature measuring device, check the heater core inlet hose to see if it is hot.
- **Is the heater core inlet hose hot?**

  YES : Go to I4.

  NO : REFER to **ENGINE COOLING** article to check cooling system function.

I4 CHECK FOR A PLUGGED OR RESTRICTED HEATER CORE

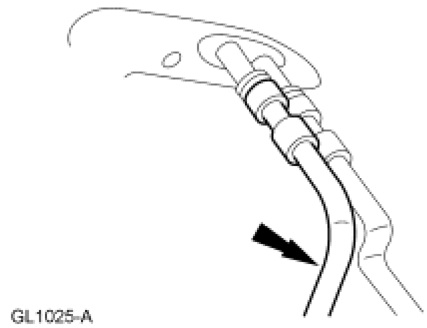

Fig. 55: Check Plugged Or Restricted Heater Core
Courtesy of FORD MOTOR CO.

- Using a suitable thermo-couple temperature measuring device, measure the heater core outlet hose temperature.
- **Is the heater core outlet hose temperature similar to the inlet hose temperature (within approximately 6-17°C [10-30°F])?**

  YES : Go to **Pinpoint Test F** and diagnose for a blend door actuator.

  NO : INSTALL a new heater core. TEST the system for normal operation.

Pinpoint Test J: The Air Conditioning (A/C) is Inoperative/Does Not Operate Correctly

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Manual Climate Control System for schematic and connector information.

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, when A/C is requested, in the dual automatic temperature control (DATC) system, a message is sent over the medium-speed controller area network (MS-CAN) bus to the instrument cluster, then from the instrument cluster through the high-speed controller area network (HS-CAN) bus to the PCM; or in electronic manual temperature control (EMTC) systems, voltage is sent to the instrument cluster through circuit CH434 (GY/YE), then a message is sent from the instrument cluster through the HS-CAN bus to the PCM.

Ignition voltage is provided to the A/C clutch relay switch. When the PCM energizes the relay, ignition voltage is supplied to the A/C clutch through circuit CH401 (VT/WH). Ground is supplied for the A/C clutch through circuit GD120 (BK/GN).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- PCM
- HVAC module - DATC
- HVAC module - EMTC
- A/C evaporator discharge temperature sensor
- A/C pressure transducer
- A/C compressor
- A/C control relay
- Battery junction box (BJB)

PINPOINT TEST J: THE AIR CONDITIONING (A/C) IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CAUTION: It is important to install relays in their correct position in the battery junction box (BJB). Installing a relay incorrectly may cause wiring shorts or damage to modules. While carrying out diagnostics on BJB relays, have only one BJB relay removed at a time. Failure to follow these instructions may result in damage to the vehicle circuitry or to control modules.

NOTE: Some PCM DTCs may inhibit A/C operation. If any PCM DTCs are retrieved, diagnose those first. Refer to Introduction - Gasoline Engines article.

NOTE: When disconnecting and reconnecting the pressure transducer electrical

connector, make sure that the connector-locking device is in place and that the locking device and connector are correctly and fully seated.

NOTE: **Before carrying out the following test, check that the A/C system pressure is above 290 kPa (42 psi). If the pressure is below 290 kPa (42 psi), refer to Fluorescent Dye Leak Detection.**

J1 CHECK THE A/C PRESSURE SENSOR (ACP_PSI) PCM PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: ACP_PSI PCM PID
- With the manifold gauge set connected, compare the pressure readings of the manifold gauge set and the ACP_PSI PID.
- **Are the pressure values of the manifold gauge set and the ACP_PSI PID similar?**

  YES : Go to J2.

  NO : INSTALL a new A/C pressure transducer. TEST the system for normal operation.

J2 CHECK THE POST EVAPORATOR TEMPERATURE SENSOR INPUT (PEVAP_TMP) HVAC PID

- Allow the vehicle exterior and interior to stabilize to an ambient temperature above 16°C (60°F).
- Enter the following diagnostic mode on the diagnostic tool: PEVAP_TMP HVAC PID
- **Does the PEVAP_TMP HVAC PID read similar to the ambient temperature?**

  YES : DATC systems, go to J3.

  EMTC systems, go to J4.

  NO : CARRY OUT the A/C evaporator discharge temperature sensor component test in this service information. If the sensor tests OK, go to J13. If the sensor does not test OK, INSTALL a new heater core and evaporator core housing. REFER to **CLIMATE CONTROL** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

J3 CHECK THE AIR CONDITIONING SWITCH STATUS (CC_AC) HVAC PID WITH THE A/C ON

- Enter the following diagnostic mode on the diagnostic tool: CC_AC HVAC PID
- Press the PANEL and A/C manual override buttons on the HVAC module - DATC.
- **Does the CC_AC HVAC PID read ON?**

  YES : Go to J5.

  NO : Go to J13.

J4 CHECK THE HVAC MODULE - EMTC A/C SIGNAL WITH THE A/C ON

- Key in OFF position.
- Disconnect: Instrument Cluster C220
- Key in ON position.
- Select PANEL mode and press the A/C button on the HVAC module - EMTC.

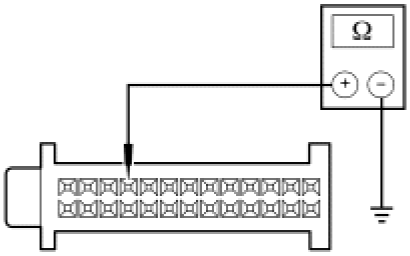

Fig. 56: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between instrument cluster C220-23, circuit CH434 (GY/YE), harness side and ground.
- **Is the resistance less than 30 ohms?**

  YES : Go to J5.

  NO : Go to J7.

J5 CHECK THE AIR CONDITIONING COMPRESSOR CYCLING SWITCH (ACCS) PCM PID WITH THE A/C ON

- Key in OFF position.

NOTE: EMTC systems only.

- Connect: Instrument Cluster C220

NOTE: EMTC systems only.

- Key in ON position.

NOTE: EMTC systems only.

- Enter the following diagnostic mode on the diagnostic tool: ACCS PCM PID
- With the engine running, press the PANEL and A/C manual override buttons on the HVAC module - DATC or select MAX A/C on the HVAC module - EMTC.
- **Does the ACCS PCM PID read ON?**

  YES : Go to J6.

  NO : Go to J14.

J6 CHECK THE AIR CONDITIONING CLUTCH (WAC/ACCR) PCM PID WITH THE A/C ON

- Enter the following diagnostic mode on the diagnostic tool: WAC/ACCR PCM PID
- **Does the WAC/ACCR PCM PID read ON?**

  YES : Go to J9.

NO : Go to J14.

J7 CHECK CIRCUIT CH434 (GY/YE) FOR AN OPEN

- Key in OFF position.
- Disconnect: HVAC Module - EMTC C2357a

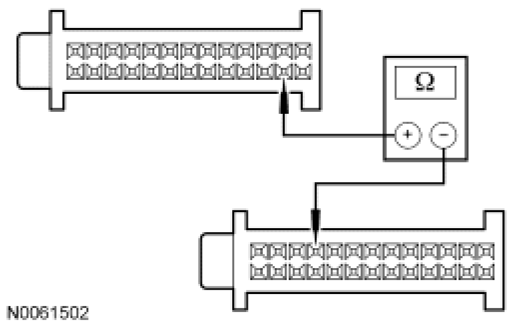

Fig. 57: Measuring Resistance Between EMTC Module C2357A-2, Circuit CH434 (GY/YE) & IC C220-23
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - EMTC C2357a-2, circuit CH434 (GY/YE), harness side and IC C220-23, circuit CH434 (GY/YE), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to J8.

  NO : REPAIR circuit CH434 (GY/YE) for an open. TEST the system for normal operation.

J8 CHECK CIRCUIT CH434 (GY/YE) FOR A SHORT TO VOLTAGE

- Key in ON position.

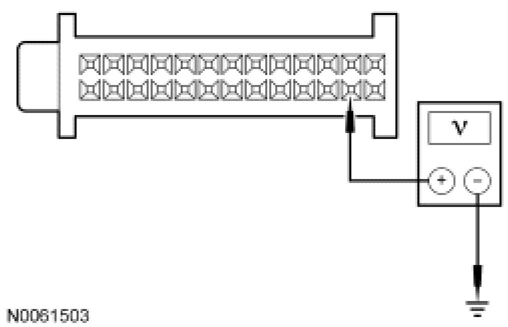

Fig. 58: Measuring Voltage Between EMTC Module C2357A-2, Circuit CH434 (GY/YE) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between HVAC module - EMTC C2357a-2, circuit CH434 (GY/YE), harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to J14.

NO : REPAIR circuit CH434 (GY/YE) for a short to voltage. TEST the system for normal operation.

J9 CHECK THE VOLTAGE AT THE A/C COMPRESSOR CLUTCH FIELD COIL

- Key in OFF position.
- Disconnect: A/C Compressor Clutch Field Coil C100
- Key in ON position.
- With the engine running, press the PANEL and A/C manual override buttons on the HVAC module - DATC or select MAX A/C on the HVAC module - EMTC.

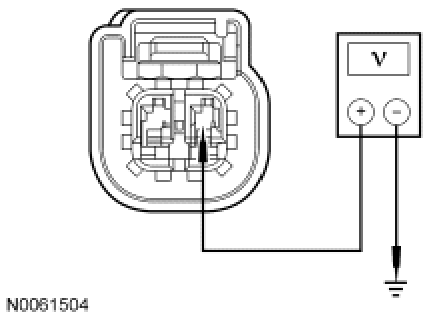

Fig. 59: Measuring Voltage Between A/C Compressor Clutch Field Coil C100-1, Circuit CH401 (VT/WH) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between A/C compressor clutch field coil C100-1, circuit CH401 (VT/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to J10.

NO : CARRY OUT the A/C Control Relay Component Test. Refer to appropriate COMPONENT TESTING article. If the relay tests OK, go to J11.

J10 CHECK THE GROUND AT THE A/C COMPRESSOR CLUTCH FIELD COIL

- Key in OFF position.

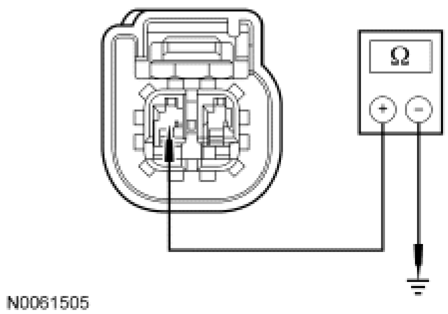

Fig. 60: Measuring Resistance Between A/C Compressor Clutch Field Coil C100-2, Circuit

GD120 (BK/GN) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between A/C compressor clutch field coil C100-2, circuit GD120 (BK/GN), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new A/C compressor. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : REPAIR circuit GD120 (BK/GN) for an open. TEST the system for normal operation.

J11 CHECK THE RELAY SWITCH FOR VOLTAGE

- Key in OFF position.
- Disconnect: A/C Clutch Relay
- Key in ON position.

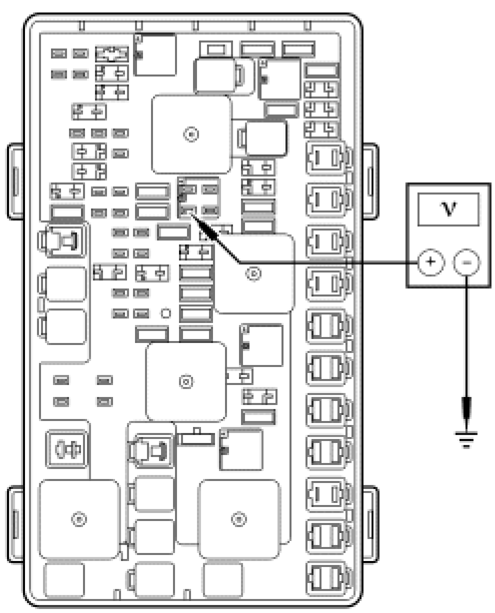

Fig. 61: Measuring Voltage Between A/C Clutch Relay Socket & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between A/C clutch relay socket and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to J12.

  NO : VERIFY BJB fuse 35 (10A) is OK. If OK, INSTALL a new BJB. TEST the system for normal operation.

J12 CHECK CIRCUIT CH401 (VT/WH) FOR AN OPEN

- Key in OFF position.

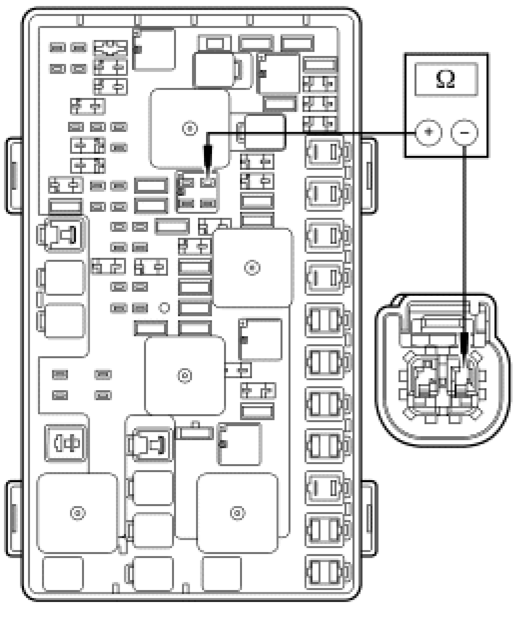

Fig. 62: Measuring Resistance Between A/C Clutch Relay Socket, Circuit CH401 (VT/WH) & A/C Compressor Clutch Field Coil C100-1
Courtesy of FORD MOTOR CO.

- Measure the resistance between A/C clutch relay socket, circuit CH401 (VT/WH) and A/C compressor clutch field coil C100-1, circuit CH401 (VT/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to J14.

  NO : REPAIR circuit CH401 (VT/WH) for an open. TEST the system for normal operation.

J13 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.

NOTE: DATC systems only.

- Carry out the HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module - DATC or HVAC module - EMTC. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose

or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

J14 CHECK THE PCM MODULE CONNECTION

- Check the DTCs.
- Disconnect all the PCM connectors.
- Check for:
    - corrosion.
    - pushed-out pins.
    - incorrectly seated connector.
- Connect and correctly seat all the PCM connectors.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new PCM. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been cause by a loose or corroded connector.

Pinpoint Test K: The Air Conditioning (A/C) is Always On

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Manual Climate Control System for schematic and connector information.

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, when A/C is requested, in the dual automatic temperature control (DATC) system, a message is sent over the medium-speed controller area network (MS-CAN) bus to the instrument cluster, then from the instrument cluster through the high-speed controller area network (HS-CAN) bus to the PCM; or in electronic manual temperature control (EMTC) systems, voltage is sent to the instrument cluster through circuit CH434 (GY/YE), then a message is sent from the instrument cluster through the HS-CAN bus to the PCM.

Ignition voltage is provided to the A/C clutch relay switch. When the PCM energizes the relay, ignition voltage is supplied to the A/C clutch through circuit CH401 (VT/WH). Ground is supplied for the A/C clutch through circuit GD120 (BK/GN).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- PCM
- HVAC module - DATC
- HVAC module - EMTC
- A/C evaporator discharge temperature sensor

- A/C pressure transducer
- A/C control relay
- A/C compressor

PINPOINT TEST K: THE AIR CONDITIONING (A/C) IS ALWAYS ON

NOTE: When disconnecting and reconnecting the pressure transducer electrical connector, make sure that the connector-locking device is in place and that the locking device and connector are correctly and fully seated.

K1 CHECK THE A/C PRESSURE SENSOR (ACP_PSI) PCM PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: A/C Pressure PCM PID
- With the manifold gauge set connected, compare the pressure readings of the manifold gauge set and the ACP_PSI PID.
- **Are the pressure values of the manifold gauge set and the ACP_PSI PCM PID similar?**

  YES : Go to K2.

  NO : INSTALL a new A/C pressure transducer. TEST the system for normal operation.

K2 CHECK THE POST EVAPORATOR TEMPERATURE SENSOR INPUT (PEVAP_TMP) HVAC PID

- Allow the vehicle exterior and interior to stabilize to an ambient temperature above 16°C (60°F).
- Enter the following diagnostic mode on the diagnostic tool: PEVAP_TMP HVAC PID
- **Does the PEVAP_TMP HVAC PID read similar to the ambient temperature?**

  YES : Go to K3.

  NO : CARRY OUT the A/C evaporator discharge temperature sensor component test in this service information. If the sensor tests OK, go to K11. If the sensor does not test OK, INSTALL a new heater core and evaporator core housing. REFER to **CLIMATE CONTROL** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

K3 CHECK THE AIR CONDITIONING COMPRESSOR CYCLING SWITCH (ACCS) PCM PID WITH THE A/C OFF

- Enter the following diagnostic mode on the diagnostic tool: ACCS PCM PID
- **Does the ACCS PCM PID read ON?**

  YES : DATC systems, go to K4.

  EMTC systems, go to K5.

  NO : Go to K7.

K4 CHECK THE AIR CONDITIONING SWITCH STATUS (CC_AC) HVAC PID WITH THE A/C OFF

- Enter the following diagnostic mode on the diagnostic tool: CC_AC HVAC PID
- **Does the CC_AC HVAC PID read ON?**

YES : Go to K10.

NO : Go to K11.

K5 CHECK HVAC - EMTC A/C REQUEST OUTPUT

- Key in OFF position.
- Disconnect: Instrument Cluster (IC) C220
- Key in ON position.
- Select the OFF position on the HVAC module - EMTC.

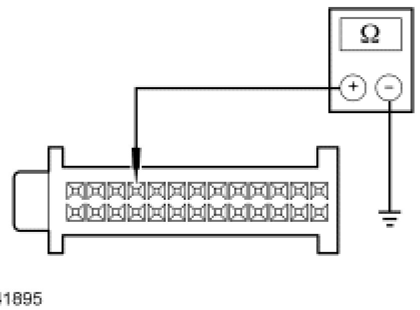

Fig. 63: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between IC C220-23, circuit CH434 (GY/YE), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

YES : Go to K11.

NO : Go to K6.

K6 CHECK CIRCUIT CH434 (GY/YE) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: HVAC Module - EMTC C2357a

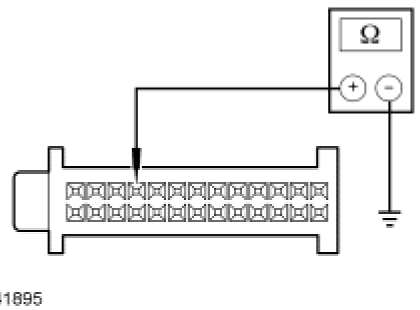

Fig. 64: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between IC C220-23, circuit CH434 (GY/YE), harness side and ground.

- **Is the resistance greater than 10,000 ohms?**

  YES : Go to K10.

  NO : REPAIR circuit CH434 (GY/YE) for a short to ground. TEST the system for normal operation.

K7 CHECK THE AIR CONDITIONING CLUTCH (WAC_ACCR) PCM PID WITH THE A/C OFF

- Enter the following diagnostic mode on the diagnostic tool: WAC_ACCR PCM PID
- **Does the WAC_ACCR PCM PID read ON?**

  YES : REFER to **Introduction - Gasoline Engines** article.

  NO : Go to K8.

K8 CHECK FOR VOLTAGE TO THE A/C COMPRESSOR CLUTCH FIELD COIL

- Key in OFF position.
- Disconnect: A/C Compressor Clutch Field Coil C100
- Key in ON position.
- Select the OFF position on the HVAC module - EMTC.

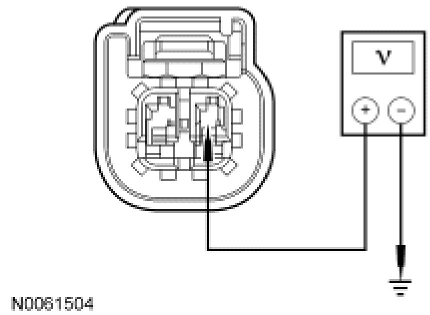

Fig. 65: Measuring Voltage Between A/C Compressor Clutch Field Coil C100-1, Circuit CH401 (VT/WH) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between A/C compressor clutch field coil C100-1, circuit CH401 (VT/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to K9.

  NO : INSTALL a new A/C compressor. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

K9 CHECK CIRCUIT CH401 (VT/WH) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: A/C Clutch Relay
- Key in ON position.

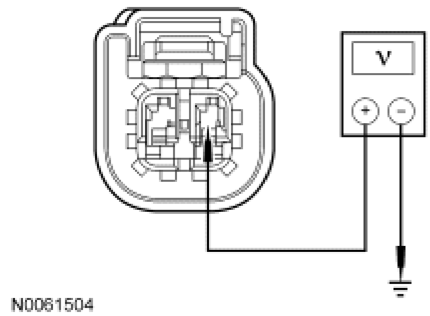

Fig. 66: Measuring Voltage Between A/C Compressor Clutch Field Coil C100-1, Circuit CH401 (VT/WH) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between A/C compressor clutch field coil C100-1, circuit CH401 (VT/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : REPAIR circuit CH401 (VT/WH) for a short to voltage. TEST the system for normal operation.

  NO : INSTALL a new A/C clutch relay. Check the A/C clutch diode. INSTALL a new diode if necessary. TEST the system for normal operation.

K10 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.

NOTE: DATC systems only.

- Carry out the HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module - DATC or HVAC module - EMTC. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

K11 CHECK THE PCM CONNECTION

- Clear the DTCs.
- Disconnect all the PCM connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
  - incorrectly seated connector.

- Connect and correctly seat all the PCM connectors.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new PCM. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test L: The Blower Motor is Inoperative - EMTC

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Manual Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the blower motor relay coil receives ignition voltage through circuit CBP45 (YE). The coil receives ground from the HVAC module - electronic manual temperature control (EMTC) through circuit CH123 (VT/GN) if any function selector position but OFF is selected. Voltage is supplied to the relay switch contact through circuit CH402 (YE/GN). When the relay coil is energized, voltage is delivered to the blower motor through circuit CH402 (YE/GN)/(BK). Ground for the blower motor is provided through circuit CH430 (VT/OG)/(BK/RD) from the blower resistor or the blower switch (HI). The blower resistor and blower switch are grounded through circuit GD116 (BK/VT).

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- HVAC module - EMTC
- Blower motor
- Blower motor relay
- Blower motor switch

PINPOINT TEST L: THE BLOWER MOTOR IS INOPERATIVE - EMTC

CAUTION: It is important to install relays in their correct position in the battery junction box (BJB). Installing a relay incorrectly may cause wiring shorts or damage to modules. While carrying out diagnostics on BJB relays, have only one BJB relay removed at a time. Failure to follow these instructions may result in damage to the vehicle circuitry or to control modules.

L1 CHECK CIRCUIT (BK/RD) FOR GROUND

- Key in OFF position.
- Disconnect: Blower Motor C288
- Turn the function selector switch to the PANEL position.

- Turn the blower motor switch to the HI position.

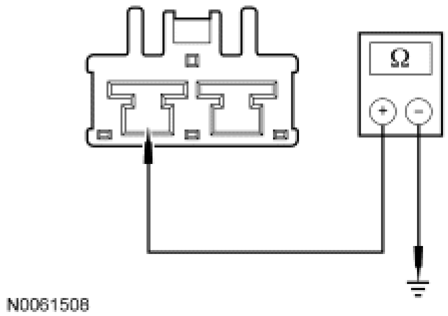

Fig. 67: Measuring Resistance Between A/C Blower Motor C288-2, Circuit (BK/RD) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between A/C blower motor C288-1, circuit (BK/RD), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to L4.

  NO : Go to L2.

L2 CHECK CIRCUIT CH430 (VT/OG)/(BK/RD) FOR AN OPEN

- Disconnect: Blower Motor Switch C2357b

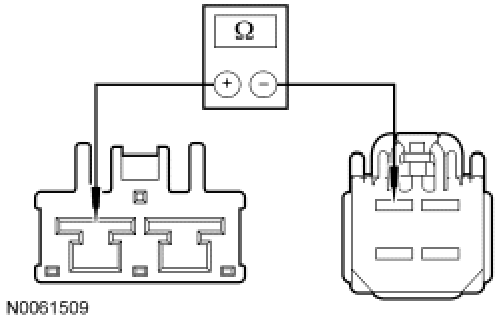

Fig. 68: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor switch C2357b-2, circuit CH430 (VT/OG), harness side and blower motor C288-1, circuit (BK/RD), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to L3.

  NO : REPAIR circuit CH430 (VT/OG)/(BK/RD) for an open. TEST the system for normal operation.

L3 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

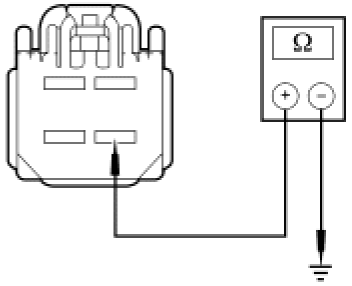

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Fig. 69: Measuring Resistance Between Blower Motor Switch C2357B-3, Circuit GD116 (BK/VT) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor switch C2357b-3, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new blower motor switch. TEST the system for normal operation.

  NO : REPAIR circuit GD116 (BK/VT) for an open. TEST the system for normal operation.

L4 CHECK A/C BLOWER MOTOR CIRCUIT (BK) FOR VOLTAGE

- Key in ON position.

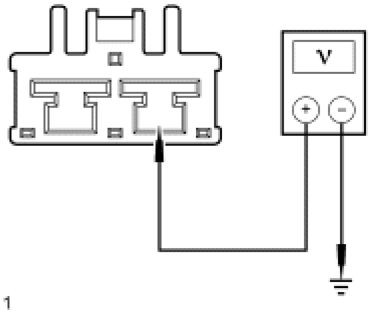

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Fig. 70: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between A/C blower motor connector C288-1, circuit (BK), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new blower motor. TEST the system for normal operation.

  NO : Go to L5.

L5 CHECK CIRCUIT CH402 (YE/GN)/(BK) FOR AN OPEN

- Key in OFF position.
- Disconnect: Blower Motor Relay

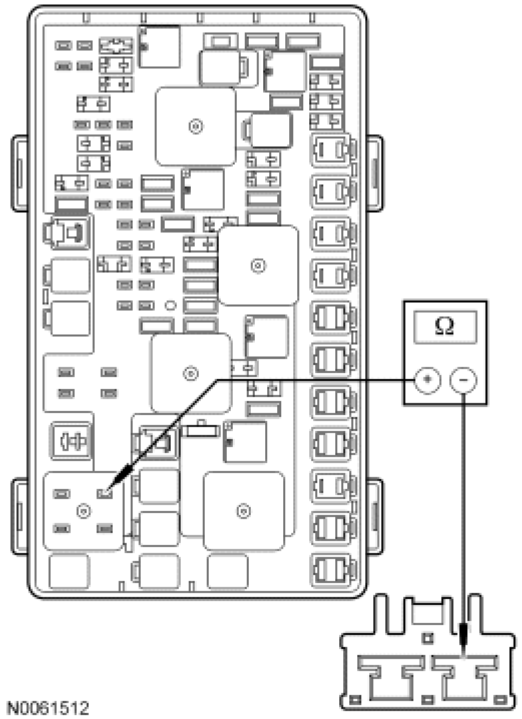


Fig. 71: Measuring Resistance Between Blower Motor Relay Socket, Circuit CH402 (YE/GN) & Blower Motor C288-1
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor relay socket, circuit CH402 (YE/GN) and blower motor C288-1, circuit (BK), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to L6.

  NO : REPAIR circuit CH402 (YE/GN)/(BK) for an open. TEST the system for normal operation.

L6 CHECK THE BLOWER MOTOR RELAY

- Connect: Blower Motor C288
- Key in ON position.

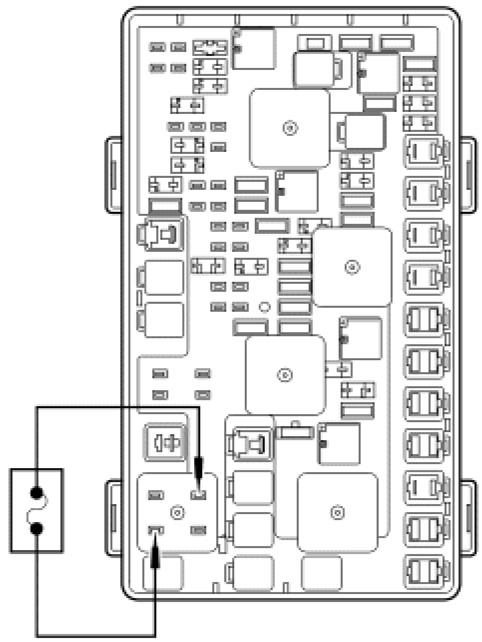


Fig. 72: Connecting Fused Jumper Lead Between Blower Motor Relay Socket, Circuit CH402 (YE/GN)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper lead between blower motor relay socket, circuit CH402 (YE/GN) and circuit CH402 (YE/GN).
- **Does the blower motor operate?**

  YES : Go to L7.

  NO : VERIFY battery junction box (BJB) fuse 66 (40A) is OK. If OK, REPAIR circuit CH402 (YE/GN) for an open. TEST the system for normal operation.

L7 CHECK THE RELAY COIL SUPPLY VOLTAGE

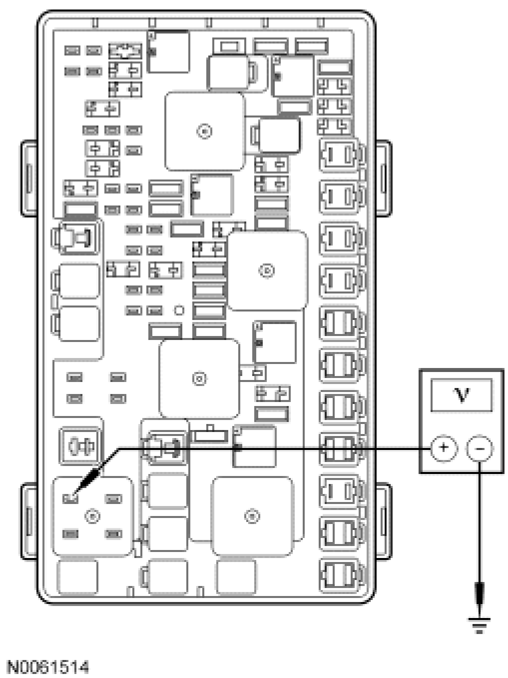


Fig. 73: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between blower motor relay socket, circuit CBP45 (YE) and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to L8.

  NO : VERIFY smart junction box (SJB) fuse 45 (5A) is OK. If OK, REPAIR circuit CBP45 (YE) for an open. TEST the system for normal operation.

L8 CHECK THE BLOWER MOTOR RELAY

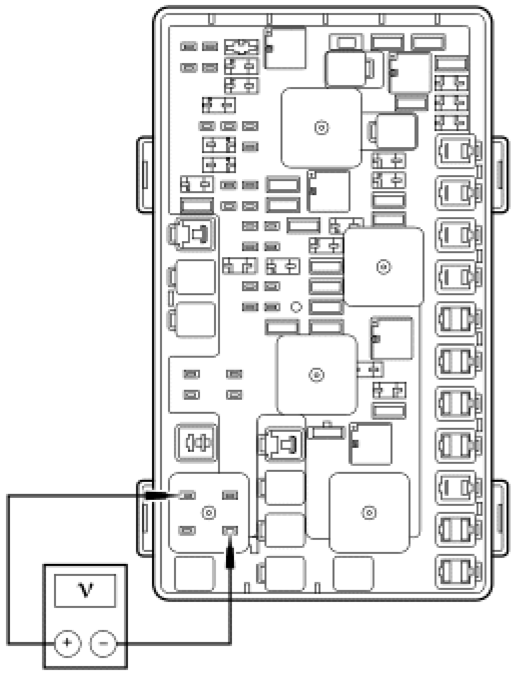


Fig. 74: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between blower motor relay socket, circuit CH123 (VT/GN) and circuit CBP45 (YE).
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new blower motor relay. TEST the system for normal operation.

  NO : Go to L9.

L9 CHECK CIRCUIT CH123 (VT/GN) FOR AN OPEN

- Key in OFF position.
- Disconnect: HVAC - Module EMTC C2357a

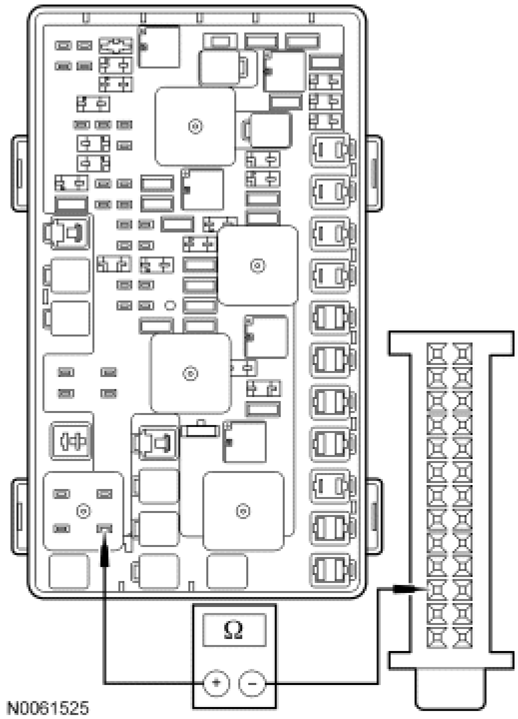


Fig. 75: Measuring Resistance Between & Blower Motor Relay Socket, Circuit CH123 (VT/GN) EATC Module C228A-24
Courtesy of FORD MOTOR CO.

- Measure the resistance between and blower motor relay socket, circuit CH123 (VT/GN) HVAC module - EMTC C2357a-24, circuit CH123 (VT/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to L10.

  NO : REPAIR circuit CH123 (VT/GN) for an open. TEST the system for normal operation.

L10 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module - EMTC. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test M: The Blower Motor Does Not Operate Correctly - EMTC

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Manual Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the blower motor is provided a ground from the blower resistor through circuit CH430 (VT/OG)/(BK/RD). The resistor gets a ground from circuit GD116 (BK/VT) in the lowest blower setting. In MED-LO and MED-HI the resistor gets a ground from the blower motor switch through circuit CH428 (GN/WH)/(RD) or CH429 (GY/BN)/(BN), depending on selected speed. In HI, the blower motor is grounded directly through the blower motor switch from circuit CH430 (VT/OG)/(BK/RD) to circuit GD116 (BK/VT). The blower switch receives its ground from circuit GD116 (BK/VT)/(GN).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Blower motor resistor
- Blower motor switch

PINPOINT TEST M: THE BLOWER MOTOR DOES NOT OPERATE CORRECTLY - EMTC

M1 CHECK THE BLOWER MOTOR OPERATION

- Key in ON position.
- Turn the function selector switch to the PANEL position.
- Select all blower speed positions.
- **Does the blower motor operate in any position?**

  YES : If the blower motor does not operate in HI, go to M2.

  If the blower motor does not operate in MED-HI, go to M3.

  If the blower motor does not operate in MED-LO, go to M4.

  If the blower motor does not operate in LO, go to M5.

  For all other symptoms, go to M8.

  NO : Go to **Pinpoint Test L** .

M2 CHECK CIRCUIT CH430 (VT/OG)/(BK/RD) FOR AN OPEN

- Key in OFF position.
- Disconnect: Blower Motor Switch C2357b
- Disconnect: Blower Motor C288
- Disconnect: Blower Motor Resistor C2185

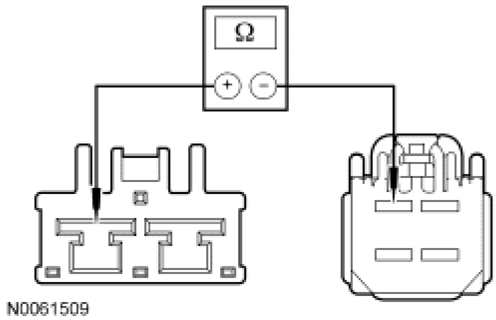


Fig. 76: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor switch C2357b-2, circuit CH430 (VT/OG), harness side and blower motor C288-1, circuit (BK/RD), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to M6.

  NO : REPAIR circuit CH430 (VT/OG)/(BK/RD) for an open. TEST the system for normal operation.

M3 CHECK CIRCUIT CH429 (GY/BN)/(BN) FOR AN OPEN

- Key in OFF position.
- Disconnect: Blower Motor Switch C2357b
- Disconnect: Blower Motor Resistor C2185

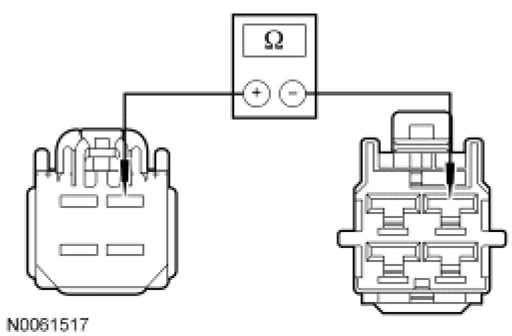


Fig. 77: Measuring Resistance Between Blower Motor Switch C2357B-1 & C2185-2, Circuit CH429 (GY/BN) & Circuit (BN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor switch C2357b-1, circuit CH429 (GY/BN), harness side and blower motor resistor C2185-2, circuit (BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to M6.

  NO : REPAIR circuit CH429 (GY/BN)/(BN) for an open. TEST the system for normal operation.

M4 CHECK CIRCUIT CH428 (GN/WH)/(RD) FOR AN OPEN

- Key in OFF position.
- Disconnect: Blower Motor Switch C2357b
- Disconnect: Blower Motor Resistor C2185

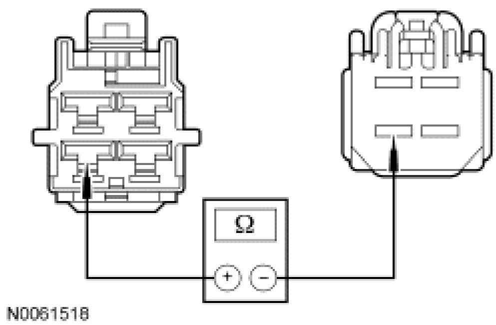


Fig. 78: Measuring Resistance Between Blower Motor Switch C2357B-4 & C2185-3, Circuit CH428 (GN/WH) & Circuit (RD)
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor switch C2357b-4, circuit CH428 (GN/WH), harness side and blower motor resistor C2185-3, circuit (RD), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to M6.

  NO : REPAIR circuit CH428 (GN/WH)/(RD) for an open. TEST the system for normal operation.

M5 CHECK BLOWER MOTOR RESISTOR GROUND CIRCUIT GD116 (BK/VT)/(GN) FOR AN OPEN

- Key in OFF position.
- Disconnect: Blower Motor Resistor C2185

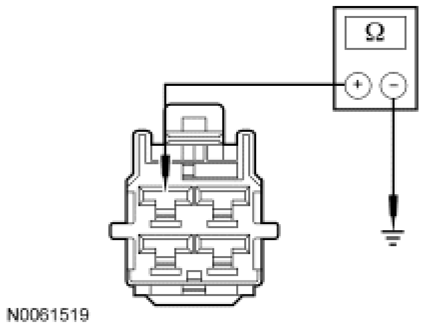


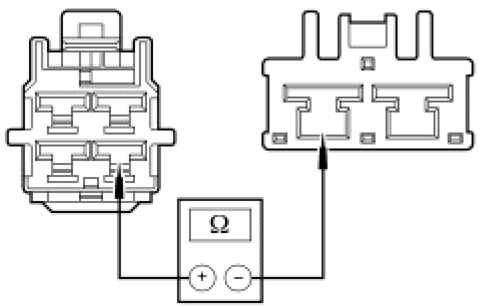
Fig. 79: Measuring Resistance Between Blower Motor Resistor C2185-1, Circuit GD116 (BK/VT)/(GN) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor resistor C2185-1, circuit GD116 (BK/VT)/(GN), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : Go to M6.

NO : REPAIR circuit GD116 (BK/VT)/(GN) for an open. TEST the system for normal operation.

M6 CHECK BLOWER MOTOR RESISTOR CIRCUIT (BK/RD) FOR AN OPEN



N0061520

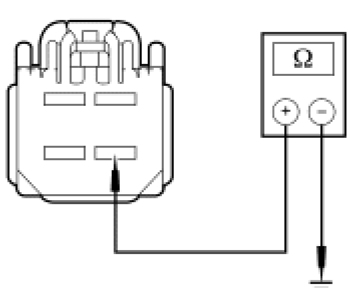
Fig. 80: Measuring Resistance Between Blower Motor Resistor C2185-4, Circuit (BK/RD) & Blower Motor C288-2
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor resistor C2185-4, circuit (BK/RD), harness side and blower motor C288-1, circuit (BK/RD), harness side.
- **Is the resistance less than 5 ohms?**

YES : CARRY OUT the blower motor resistor component test in this service information. If the resistor tests OK, go to M7.

NO : REPAIR circuit (BK/RD) for an open. TEST the system for normal operation.

M7 CHECK BLOWER MOTOR SWITCH CIRCUIT GD116 (BK/VT) FOR AN OPEN



N0061510

Fig. 81: Measuring Resistance Between Blower Motor Switch C2357B-3, Circuit GD116 (BK/VT) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor switch C2357b-3, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : INSTALL a new blower motor switch. TEST the system for normal operation.

NO : REPAIR circuit GD116 (BK/VT) for an open. TEST the system for normal operation.

M8 CHECK CIRCUITS CH430 (VT/OG)/(BK/RD), CH428 (GN/WH)/(RD) AND CH429 (GY/BN)/(BN) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: Blower Motor C288
- Disconnect: Blower Motor Switch C2357b
- Disconnect: Blower Motor Resistor C2185
- Place the blower switch in the lowest setting.

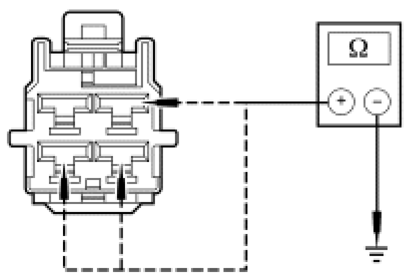


Fig. 82: Measuring Resistance Between Ground & Blower Motor Resistor, C2185-3, C2185-2 & C2185-4
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and blower motor resistor:
  - C2185-3, circuit (RD), harness side.
  - C2185-2, circuit (BN), harness side.
  - C2185-4, circuit (BK/RD), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to M9.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

M9 CHECK THE BLOWER MOTOR CIRCUITS FOR SHORTS TOGETHER

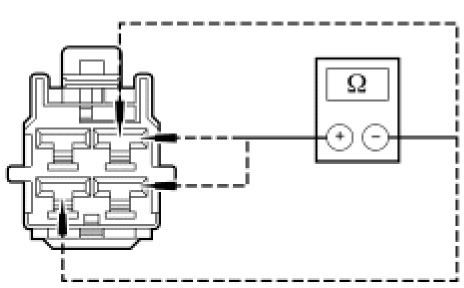


Fig. 83: Measuring Resistance Between Blower Motor Resistor C2185-2, C2185-4 & C2185-4
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor resistor:
  - C2185-3, circuit (RD), harness side and C2185-2, circuit (BN), harness side.
  - C2185-3, circuit (RD), harness side and C2185-4, circuit (BK/RD), harness side.
  - C2185-2, circuit (BN), harness side and C2185-4, circuit (BK/RD), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new blower motor switch. TEST the system for normal operation.

  NO : REPAIR the affected circuits. TEST the system for normal operation.

Pinpoint Test N: The Blower Motor is Inoperative - DATC

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the blower motor relay coil receives a ground from the HVAC module - dual automatic temperature control (DATC) through circuit CH123 (VT/GN). The coil receives ignition voltage through circuit CBP45 (YE). Voltage is supplied to the relay switch contact through circuit CH402 (YE/GN). When the relay coil is energized, voltage is delivered to the blower motor control module through circuit CH402 (YE/GN)/(BK). Ground for the blower motor speed control is provided by circuit GD116 (BK/VT)/(BK/RD). The HVAC module - DATC provides a blower target speed signal to the blower motor speed control through circuit VH101 (WH/VT)/(RD) to control the blower speed. The actual blower speed signal is provided to the HVAC module - DATC through circuit CH102 (YE/BU)/(BN) from the blower motor speed control. Ground for the motor is provided through circuit (BU) from the blower motor speed control.

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- Blower motor relay
- Blower motor speed control
- HVAC module - DATC
- Blower motor

PINPOINT TEST N: THE BLOWER MOTOR IS INOPERATIVE - DATC

CAUTION: It is important to install relays in their correct position in the battery junction box (BJB). Installing a relay incorrectly may cause wiring shorts or damage to modules. While carrying out diagnostics on BJB relays, have only one BJB relay removed at a time. Failure to follow these instructions may result in damage to the vehicle circuitry or to control modules.

N1 VERIFY THE BLOWER MOTOR OPERATION

- Key in ON position.
- Press the PANEL button on the HVAC module - DATC. Adjust the blower motor setting to LO and then to HI.
- **Is the blower motor inoperative in all settings?**

  YES : Go to N2.

  NO : Go to **Pinpoint Test O** .

N2 CHECK THE BLOWER MOTOR SPEED TARGET POSITION (BLWR_T#) HVAC PID

- Enter the following diagnostic mode on the diagnostic tool: BLWR_T# HVAC PID
- Observe the BLWR_T# HVAC PID while increasing and decreasing the blower speed.
- **Does the BLWR_T# HVAC PID reading change in all speeds between 0% and 100%?**

  YES : Go to N3.

  NO : Go to N16.

N3 CHECK FOR VOLTAGE TO THE BLOWER MOTOR

- Key in OFF position.
- Disconnect: Blower Motor C288
- Key in ON position.

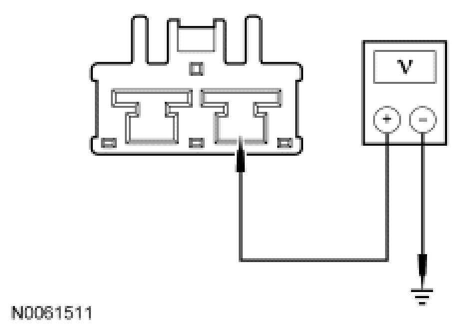


Fig. 84: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and blower motor C288-2, circuit (BK), harness side.
- **Is the voltage greater than 10 volts?**

  YES : Go to N9.

  NO : CARRY OUT the blower motor relay component test. Refer to appropriate COMPONENT TESTING article. If the relay tests OK, go to N4.

N4 CHECK THE RELAY SWITCH POWER CIRCUIT FOR AN OPEN

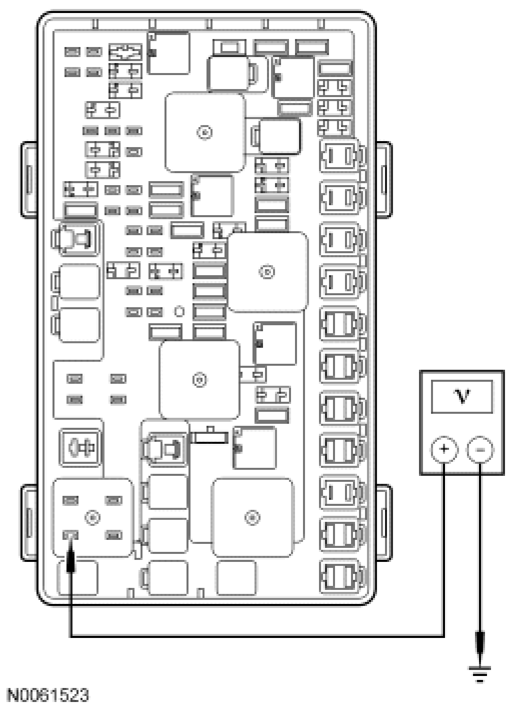


Fig. 85: Measuring Voltage Between Ground & Blower Motor Relay Socket, Circuit CH402 (YE/GN)
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and blower motor relay socket, circuit CH402 (YE/GN).
- **Is the voltage greater than 10 volts?**

  YES : Go to N5.

  NO : VERIFY battery junction box (BJB) fuse 66 (40A) is OK. If OK, REPAIR circuit CH402 (YE/GN) for an open. TEST the system for normal operation.

N5 CHECK THE RELAY COIL SUPPLY VOLTAGE

- Key in OFF position.
- Disconnect: Blower Motor Relay
- Key in ON position.

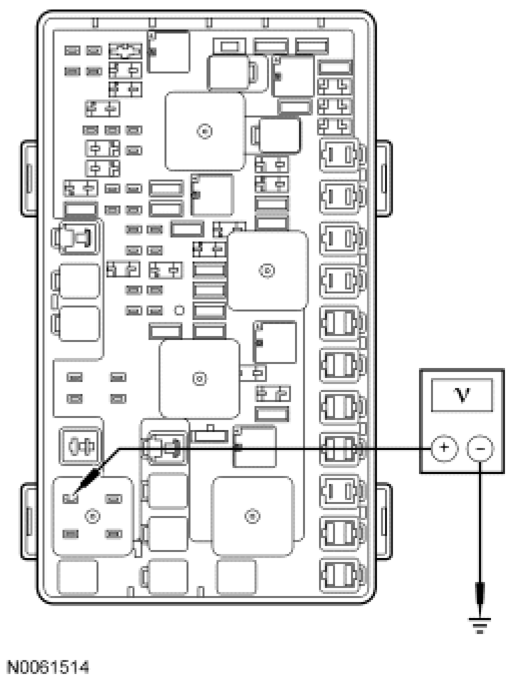


Fig. 86: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and blower motor relay socket, circuit CBP45 (YE).
- **Is the voltage greater than 10 volts?**

  YES : Go to N6.

  NO : VERIFY smart junction box (SJB) fuse 45 (5A) is OK. If OK, REPAIR circuit CBP45 (YE) for an open. TEST the system for normal operation.

N6 CHECK THE HVAC - DATC MODULE OUTPUT

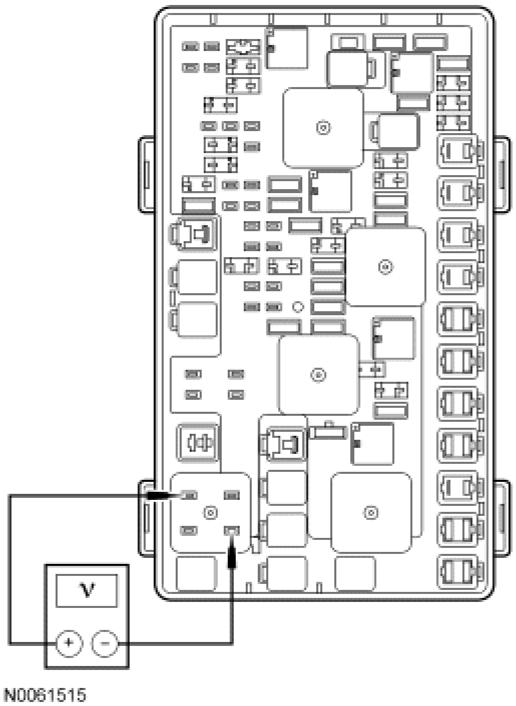


Fig. 87: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between blower motor relay socket, circuit CBP45 (YE) and blower motor relay socket, circuit CH123 (VT/GN).
- **Is the voltage greater than 10 volts?**

  YES : REPAIR circuit CH402 (YE/GN)/(BK) for an open. TEST the system for normal operation.

  NO : Go to N7.

N7 CHECK CIRCUIT CH123 (VT/GN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: HVAC Module - DATC C228a
- Key in ON position.

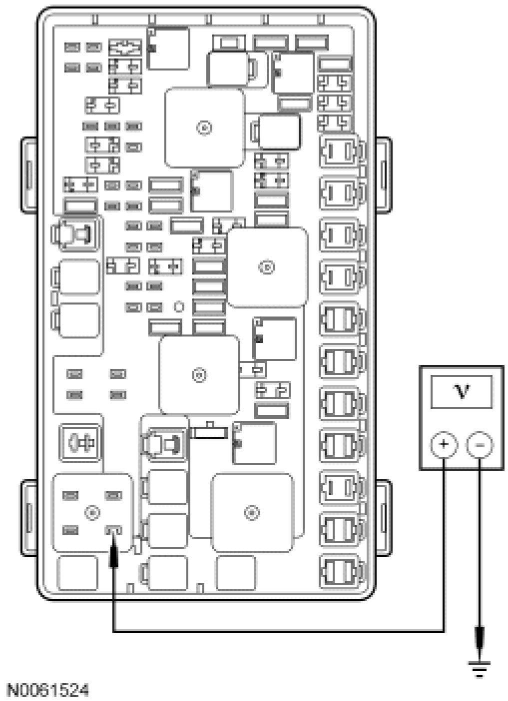


Fig. 88: Measuring Voltage Between Ground & Blower Motor Relay Socket, Circuit CH123 (VT/GN) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and blower motor relay socket, circuit CH123 (VT/GN) and ground.
- **Is any voltage present?**

  YES : REPAIR circuit CH123 (VT/GN) for a short to voltage. TEST the system for normal operation.

  NO : Go to N8.

N8 CHECK CIRCUIT CH123 (VT/GN) FOR AN OPEN

- Key in OFF position.

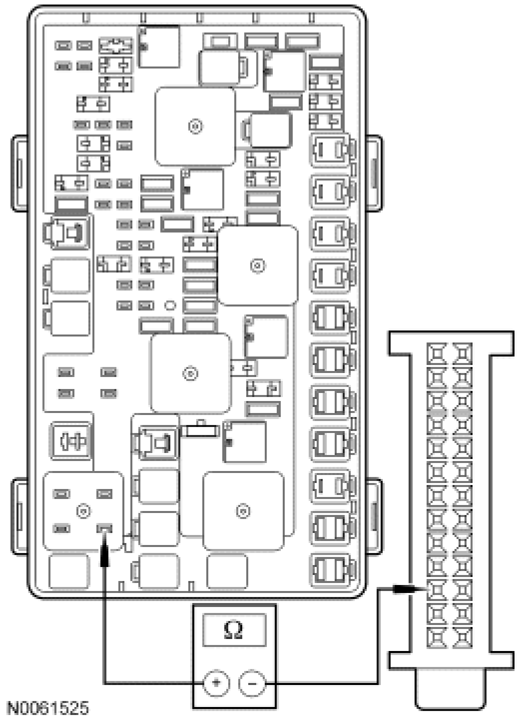


Fig. 89: Measuring Resistance Between & Blower Motor Relay Socket, Circuit CH123 (VT/GN) EATC Module C228A-24
Courtesy of FORD MOTOR CO.

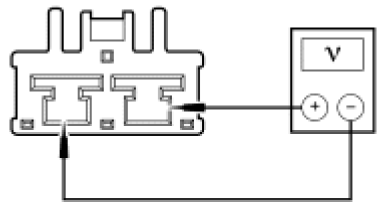
- Measure the resistance between and blower motor relay socket, circuit CH123 (VT/GN) HVAC module - DATC C228a-24, circuit CH123 (VT/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to N16.

  NO : REPAIR circuit CH123 (VT/GN) for an open. TEST the system for normal operation.

N9 CHECK FOR GROUND TO THE BLOWER MOTOR

- Key in OFF position.
- Disconnect: Blower Motor C288
- Key in ON position.
- Select the highest blower speed setting.



N0061602

Fig. 90: Measuring Voltage Between Blower Motor C288-1 & C288-2, Circuit (BK) & Circuit (BU)
Courtesy of FORD MOTOR CO.

- Measure the voltage between blower motor C288-2, circuit (BK), harness side and blower motor C288-1, circuit (BU), harness side.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new blower motor. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : Go to N10.

N10 CHECK CIRCUIT GD116 (BK/VT)/(BK/RD) FOR AN OPEN

- Key in OFF position.
- Disconnect: Blower Motor Speed Control C271

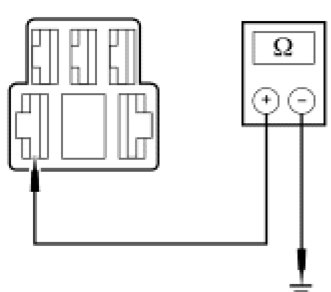


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Fig. 91: Measuring Resistance Between Blower Motor Speed Control Module C271-4, Circuit (BK/RD) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor speed control C271-4, circuit (BK/RD), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to N11.

  NO : REPAIR circuit GD116 (BK/VT)/(BK/RD) for an open. TEST the system for normal operation.

N11 CHECK CIRCUITS VH101 (WH/VT)/(RD) AND CH102 (YE/BU)/(BN) FOR A SHORT TO

GROUND

- Disconnect: HVAC Module - DATC C228b

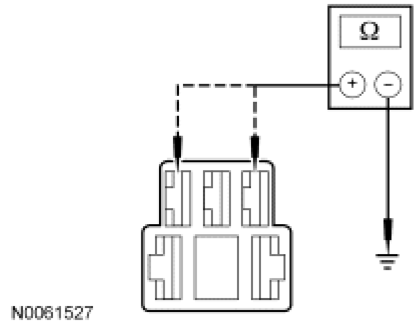


Fig. 92: Measuring Resistance Between Blower Motor Speed Control Module C271-1 & C271-3
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and:
  - blower motor speed control C271-1, circuit (RD), harness side.
  - blower motor speed control C271-3, circuit (BN), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to N12.

  NO : REPAIR circuit VH101 (WH/VT)/(RD) or CH102 (YE/BU)/(BN) for a short to ground. TEST the system for normal operation.

N12 CHECK CIRCUITS (BU), VH101 (WH/VT)/(RD) AND CH102 (YE/BU)/(BN) FOR A SHORT TO VOLTAGE

- Key in ON position.

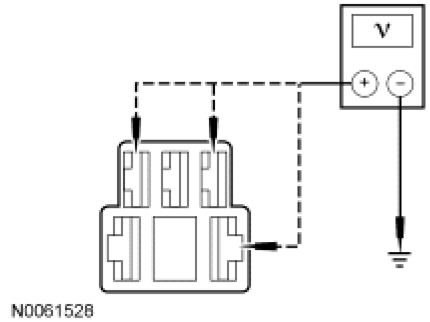


Fig. 93: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and:
  - blower motor speed control C271-1, circuit (RD), harness side.
  - blower motor speed control C271-3, circuit (BN), harness side.

- blower motor speed control C271-5, circuit (BU), harness side.

- **Is any voltage present?**

  YES : REPAIR circuit VH101 (WH/VT)/(RD), CH102 (YE/BU)/(BN) or (BU) for a short to voltage. TEST the system for normal operation.

  NO : Go to N13.

N13 CHECK CIRCUITS VH101 (WH/VT)/(RD) AND CH102 (YE/BU)/(BN) FOR A SHORT TOGETHER

- Key in OFF position.

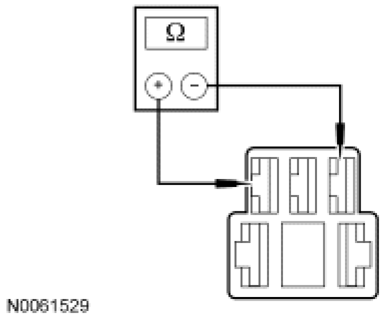


Fig. 94: Measuring Resistance Between Blower Motor Speed Control Module C271-1 & C271-3, Circuit (RD) & Circuit (BN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor speed control C271-1, circuit (RD), harness side and blower motor speed control module C271-3, circuit (BN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to N14.

  NO : REPAIR circuit VH101 (WH/VT)/(RD) or CH102 (YE/BU)/(BN) for a short together. TEST the system for normal operation.

N14 CHECK CIRCUIT (BU) FOR AN OPEN

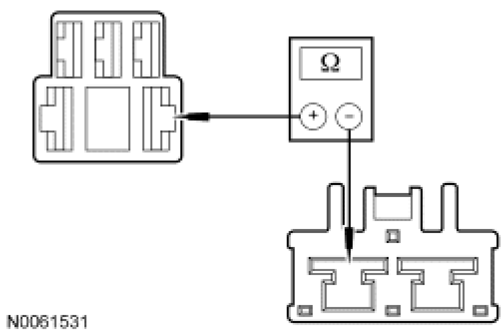


Fig. 95: Measuring Resistance Between Blower Motor C288-2 & C271-5, Circuit (BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor C288-1, circuit (BU), harness side and blower motor speed control C271-5, circuit (BU), harness side.

- **Is the resistance less than 5 ohms?**

  YES : Go to N15.

  NO : REPAIR circuit (BU) for an open. TEST the system for normal operation.

N15 CHECK CIRCUITS VH101 (WH/VT)/(RD) AND CH102 (YE/BU)/(BN) FOR AN OPEN

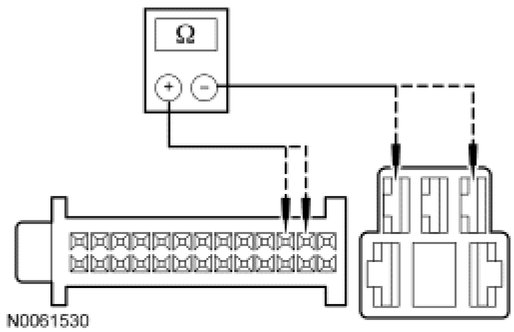


Fig. 96: Measuring Resistance Between Blower Motor Speed Control Module C271-1 & C271-3, EATC Module C228B-16 & C228B-15
Courtesy of FORD MOTOR CO.

- Measure the resistance between:
  - blower motor speed control C271-1, circuit (RD), harness side and HVAC module - DATC C228b-16, circuit VH101 (WH/VT), harness side.
  - blower motor speed control C271-3, circuit (BN), harness side and HVAC module - DATC C228b-15, circuit CH102 (YE/BU), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new blower motor speed control. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation. If the condition returns, INSTALL a new HVAC module - DATC. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : REPAIR circuit VH101 (WH/VT)/(RD) or CH102 (YE/BU)/(BN) for an open. TEST the system for normal operation.

N16 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Carry out the HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module - DATC. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test O: The Blower Motor Does Not Operate Correctly - DATC

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the blower motor relay coil receives a ground from the HVAC module - dual automatic temperature control (DATC) through circuit CH123 (VT/GN). The coil receives ignition voltage through circuit CBP45 (YE). Voltage is supplied to the relay switch contact through circuit CH402 (YE/GN)/(BK). When the relay coil is energized, voltage is delivered to the blower motor speed control through circuit CH402 (YE/GN)/(BK). Ground for the blower motor speed control is provided by circuit GD116 (BK/VT)/(BK/RD). The HVAC module - DATC provides a blower target speed signal to the blower motor speed control through circuit VH101 (WH/VT)/(RD) to control the blower speed. The actual blower speed signal is provided to the HVAC module - DATC through circuit CH102 (YE/BU)/(BN) from the blower motor speed control. Ground for the motor is provided through circuit (BU) from the blower motor speed control.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Blower motor speed control
- Blower motor relay
- HVAC module - DATC

PINPOINT TEST O: THE BLOWER MOTOR DOES NOT OPERATE CORRECTLY - HVAC - DATC

> **CAUTION: It is important to install relays in their correct position in the battery junction box (BJB). Installing a relay incorrectly may cause wiring shorts or damage to modules. While carrying out diagnostics on BJB relays, have only one BJB relay removed at a time. Failure to follow these instructions may result in damage to the vehicle circuitry or to control modules.**

O1 VERIFY THE BLOWER MOTOR OPERATION

- Key in ON position.
- Press the panel button on the HVAC module - DATC. Adjust the blower motor setting to LO and then to HI.
- **Does the blower motor operate at any setting?**

  YES : Go to O2.

  NO : Go to **Pinpoint Test N** .

O2 CHECK THE BLOWER MOTOR SPEED TARGET POSITION (BLWR_T#) HVAC PID

- Enter the following diagnostic mode on the diagnostic tool: BLWR_T# HVAC PID
- Observe the BLWR_T# HVAC PID while increasing and decreasing the blower speed.
- **Does the BLWR_T# HVAC PID reading change in all speeds between 0% and 100%?**

YES : If the blower motor is always on, CARRY OUT the blower motor relay component test. Refer to appropriate COMPONENT TESTING article. If the relay tests OK, go to O7.

All other symptoms, go to O3.

NO : Go to O9.

O3 CHECK CIRCUITS (BU), VH101 (WH/VT)/(RD) AND CH102 (YE/BU)/(BN) FOR A SHORT TO VOLTAGE

- Disconnect: HVAC Module - DATC C228a
- Disconnect: Blower Motor Speed Control C271
- Disconnect: Blower Motor C288
- Key in ON position.

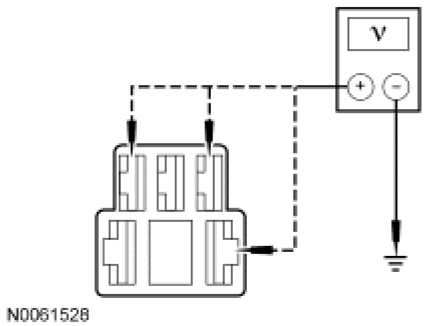


Fig. 97: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and:
  - blower motor speed control C271-1, circuit (RD), harness side.
  - blower motor speed control C271-3, circuit (BN), harness side.
  - blower motor speed control C271-5, circuit (BU), harness side.
- **Is any voltage present?**

  YES : REPAIR circuit VH101 (WH/VT)/(RD), CH102 (YE/BU)/(BN) or (BU) for a short to voltage. TEST the system for normal operation.

  NO : Go to O4.

O4 CHECK CIRCUITS (BU) AND CH102 (YE/BU)/(BN) FOR A SHORT TO GROUND

- Key in OFF position.

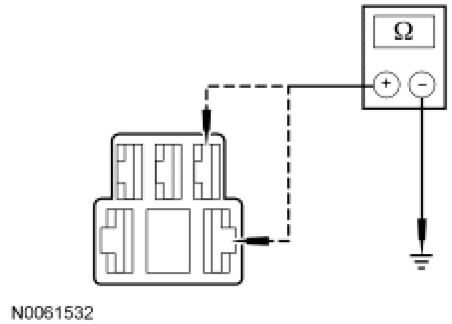


Fig. 98: Measuring Resistance Between Blower Motor Speed Control Module C271-5 & C271-3
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and:
  - blower motor speed control C271-5, circuit (BU), harness side.
  - blower motor speed control C271-3, circuit (BN), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to O5.

  NO : REPAIR circuit (BU) or CH102 (YE/BU)/(BN) for a short to ground. TEST the system for normal operation.

O5 CHECK CIRCUITS VH101 (WH/VT)/(RD) AND CH102 (YE/BU)/(BN) FOR A SHORT TOGETHER

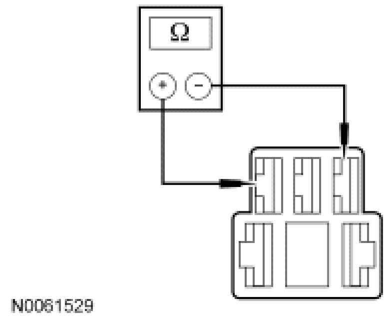


Fig. 99: Measuring Resistance Between Blower Motor Speed Control Module C271-1 & C271-3, Circuit (RD) & Circuit (BN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor speed control C271-1, circuit (RD), harness side and blower motor speed control C271-3, circuit (BN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to O6.

  NO : REPAIR circuit VH101 (WH/VT)/(RD) or CH102 (YE/BU)/(BN) for a short together. TEST the system for normal operation.

O6 CHECK CIRCUIT CH102 (YE/BU)/(BN) FOR AN OPEN

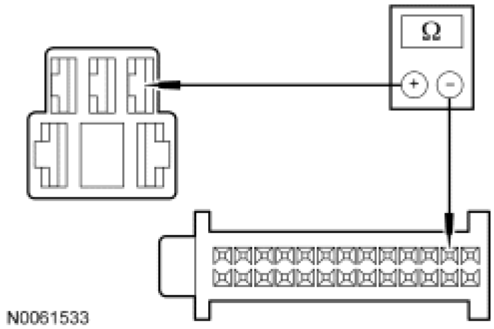


Fig. 100: Measuring Resistance Between Blower Motor Speed Control Module C271-3 & C228B-15, Circuit (BN) & CH102 (YE/BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor speed control C271-3, circuit (BN), harness side and HVAC module - DATC C228b-15, circuit CH102 (YE/BU), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new blower motor speed control. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation. If the condition returns, INSTALL a new HVAC module - DATC. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : REPAIR circuit CH102 (YE/BU)/(BN) for an open. TEST the system for normal operation.

O7 CHECK CIRCUIT CH402 (YE/GN)/(BK) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Blower Motor Relay
- Disconnect: Blower Motor C288
- Key in ON position.

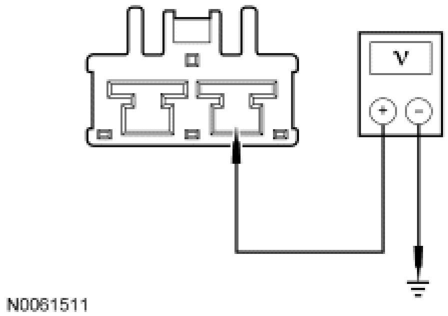


Fig. 101: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and blower motor C288-2, circuit (BK), harness side.
- **Is any voltage present?**

  YES : REPAIR circuit CH402 (YE/GN)/(BK) for a short to voltage. TEST the system for normal operation.

NO : Go to O8.

O8 CHECK CIRCUIT CH123 (VT/GN) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: HVAC Module - DATC C228a

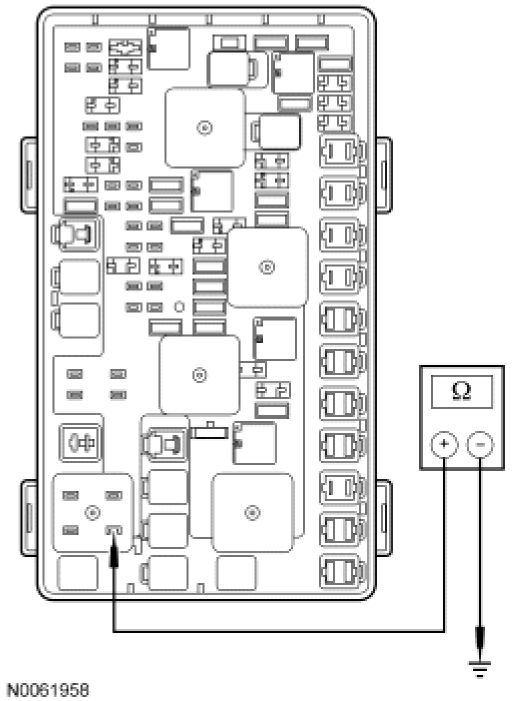


Fig. 102: Measuring Resistance Between Ground & Blower Motor Relay Socket, Circuit CH123 (VT/GN) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and blower motor relay socket, circuit CH123 (VT/GN) and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to O9.

  NO : REPAIR circuit CH123 (VT/GN) for a short to ground. TEST the system for normal operation.

O9 CHECK MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Carry out the HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module - DATC. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Component Tests

Temperature Sensor - Evaporator Discharge

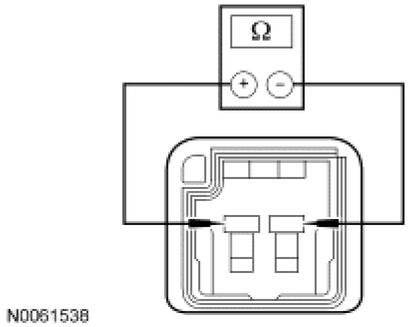


Fig. 103: Temperature Sensor - Evaporator Discharge
Courtesy of FORD MOTOR CO.

Ambient Temperature	Approximate Resistance
-10°C (14°F)	8,255 ohms
-5°C (23°F)	6,298 ohms
0°C (32°F)	4,852 ohms
5°C (41°F)	3,773 ohms
10°C (50°F)	2,961 ohms
15°C (59°F)	2,343 ohms
20°C (68°F)	1,869 ohms
25°C (77°F)	1,502 ohms
30°C (86°F)	1,216 ohms
35°C (95°F)	991 ohms
40°C (104°F)	813 ohms
45°C (113°F)	671 ohms
50°C (122°F)	557 ohms
55°C (131°F)	466 ohms
60°C (140°F)	391 ohms

In-Vehicle Temperature Sensor

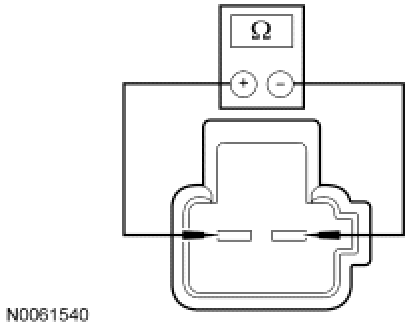


Fig. 104: In-Vehicle Temperature Sensor
Courtesy of FORD MOTOR CO.

Ambient Temperature	Approximate Resistance
-10°C (14°F)	9,683 ohms
-5°C (23°F)	7,345 ohms
0°C (32°F)	5,628 ohms
5°C (41°F)	4,354 ohms
10°C (50°F)	3,399 ohms
15°C (59°F)	2,677 ohms
20°C (68°F)	2,125 ohms
25°C (77°F)	1,700 ohms
30°C (86°F)	1,370 ohms
35°C (95°F)	1,112 ohms
40°C (104°F)	909 ohms
45°C (113°F)	747 ohms
50°C (122°F)	618 ohms
55°C (131°F)	514 ohms
60°C (140°F)	430 ohms

Ambient Temperature Sensor

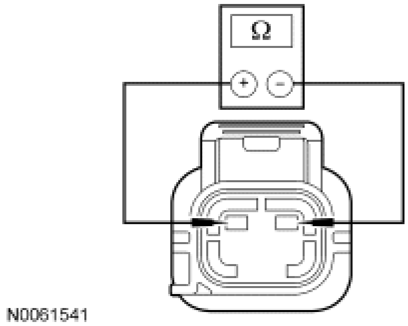


Fig. 105: Ambient Temperature Sensor
Courtesy of FORD MOTOR CO.

Ambient Temperature	Approximate Resistance
-50°C (-58°F)	19,336 ohms
-40°C (-40°F)	10,732 ohms
-30°C (-22°F)	6,177 ohms
-20°C (-4°F)	3,672 ohms
-10°C (14°F)	2,248 ohms
0°C (32°F)	1,413 ohms
10°C (50°F)	915 ohms
20°C (68°F)	608 ohms
25°C (77°F)	500 ohms
30°C (86°F)	413 ohms
40°C (104°F)	287 ohms
50°C (122°F)	203 ohms
60°C (140°F)	147 ohms
70°C (158°F)	108 ohms
80°C (176°F)	80 ohms
90°C (194°F)	61 ohms
100°C (212°F)	47 ohms
110°C (231°F)	36 ohms
120°C (248°F)	28 ohms

Defrost/Panel/Floor Door and Blend Door Mode Actuator

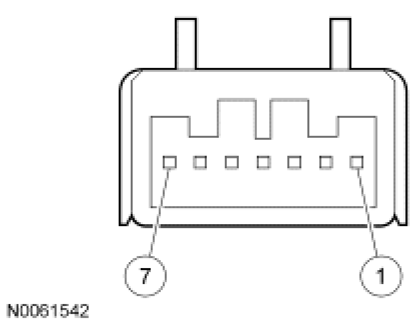


Fig. 106: Defrost/Panel/Floor Door and Blend Door Mode Actuator
Courtesy of FORD MOTOR CO.

Actuator Pins	Approx. Resistance
3 and 5	1.2K-4.8K ohms
1 and 5	1.2K-4.8K ohms
1 and 3	6K ohms

Blower Motor Resistor

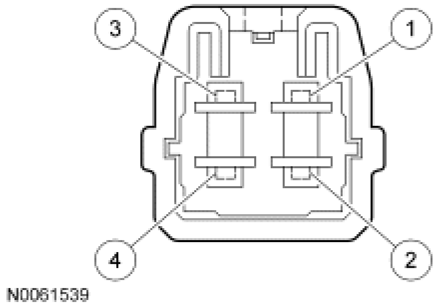


Fig. 107: Blower Motor Resistor
Courtesy of FORD MOTOR CO.

Blower Motor Resistor Pins	Approx. Resistance
4 and 3	0.25-0.29 ohm
4 and 2	0.88-1.02 ohm
4 and 1	2.0-2.30 ohms

Blower Motor Switch - HVAC - Electronic Manual Temperature Control (EMTC)

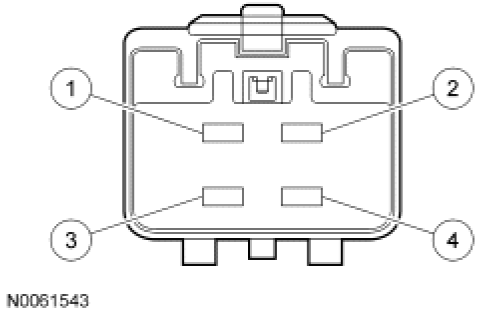


Fig. 108: Blower Motor Switch - EMTC
Courtesy of FORD MOTOR CO.

Blower Motor Switch Position	Continuity Between Pins
LOW	None
MED-LO	3 and 4
MED-HI	3 and 1
HI	3 and 2

Heater Core

NOTE: **Testing of returned heater cores reveals that a large percentage of heater cores are good and did not require the installation of a new heater core. If a heater core leak is suspected, the heater core must be tested by following the plugged heater core component test before the heater core**

pressure test. Carry out a system inspection by checking the heater system thoroughly as follows:

1. Inspect for evidence of coolant leakage at the heater hose to heater core attachments. A coolant leak in the heater hose could follow the heater core tube to the heater core and appear as a leak in the heater core.

NOTE: Spring-type clamps are installed as original equipment. Installation and overtightening of non-specified clamps can cause leakage at the heater hose connection and damage the heater core.

2. Check the integrity of the heater hose clamps.

Heater Core - Plugged

1. Check to see that the engine coolant is at the correct level.
2. Start the engine and turn on the heater.
3. When the engine coolant reaches operating temperature, feel the heater core inlet and outlet hoses to see if they are hot.
4. If the outlet only is not hot:
   - the heater core may have an air pocket.
   - the heater core may be plugged.
5. If the inlet only is not hot:
   - the thermostat may not be working correctly.

Heater Core - Pressure Test

Use the Pressure Test Kit to carry out the pressure test.

NOTE: Due to space limitations, a bench test may be necessary for pressure testing.

1. Drain the coolant from the cooling system.
2. Disconnect the heater hoses from the heater core.
3. Install a short piece of heater hose, approximately 101 mm (4 in) long on each heater core tube.
4. Fill the heater core and heater hoses with water and install the 2 plugs BT-7422-B and the adapter BT-7422-A from the Pressure Test Kit. Secure the heater hoses, plug and adapter with hose clamps.

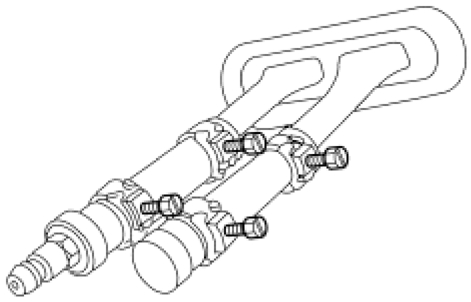


Fig. 109: Heater Core With Adapter & Plug
Courtesy of FORD MOTOR CO.

5. Attach the pump and gauge assembly from the Pressure Test Kit to the adapter.
6. Close the bleed valve at the base of the gauge. Pump 138 kPa (20 psi) of air pressure into the heater core.
7. Observe the pressure gauge for a minimum of 3 minutes.
8. If the pressure drops, check the heater hose connections to the core tubes for leaks. If the heater hoses do not leak, remove the heater core from the vehicle and carry out the bench test.

Heater Core - Bench Test

1. Remove the heater core from the vehicle.
2. Drain all of the coolant from the heater core.
3. Connect the 101 mm (4 in) test heater hoses with plug and adapter to the core tubes. Then connect the Pressure Test Kit to the adapter.
4. Apply 138 kPa (20 psi) of air pressure to the heater core. Submerge the heater core in water.
5. If a leak is observed, install a new heater core.

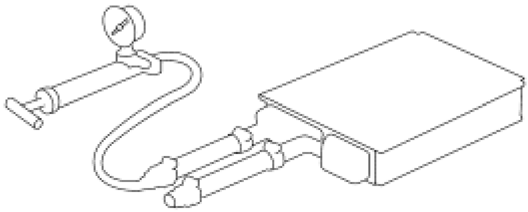


Fig. 110: Bench Testing Heater Core
Courtesy of FORD MOTOR CO.

Evaporator/Condenser Core - On-Vehicle Leak Test

1. Recover the refrigerant. Refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.

NOTE: For evaporator core testing only.

2. Remove the thermostatic expansion valve (TXV) from the evaporator core.

NOTE: For condenser core testing only.

3. Disconnect the condenser-to-evaporator line spring lock coupling and the compressor-to-condenser discharge line middle fitting.

NOTE: For evaporator core testing only.

4. Connect the appropriate test fitting to the evaporator core TXV connection.

NOTE: For condenser core testing only.

5. Connect the appropriate test fittings to the condenser-to-evaporator line spring lock coupling, condenser side and the compressor-to-condenser discharge line middle fitting, condenser side.

NOTE: The automatic shut-off valves on some gauge set hoses do not open when connected to the test fittings. If available, use hoses without shut-off valves. If hoses with shut-off valves are used, make sure the valve opens when attached to the test fittings or install an adapter that will activate the valve. The test is not valid if the shut-off valve does not open.

6. Connect the red and blue hoses from the R-134a Manifold Gauge Set to the test fittings on the evaporator core or condenser core. Connect the yellow hose to a known good vacuum pump.
7. Open both gauge set valves and start the vacuum pump. Allow the vacuum pump to operate for a minimum of 45 minutes after the gauge set low pressure gauge indicates 101 kPa (30 in-Hg). The 45-minute evacuation is necessary to remove any refrigerant from oil left in the evaporator core or condenser core. If the refrigerant is not completely removed from the oil, outgassing will degrade the vacuum and appear as a refrigerant leak.
8. If the low pressure gauge reading will not drop to 101 kPa (30 in-Hg) when the valves on the gauge and manifold set are open and the vacuum pump is operating, close the gauge set valves and observe the low pressure gauge. If the pressure rises rapidly to zero, a large leak is indicated. Recheck the test fitting connections and gauge set connections before installing a new evaporator core or condenser core.
9. After evacuating for 45 minutes, close the gauge set valves and stop the vacuum pump. Observe the low pressure gauge; it should remain at the 101 kPa (30 in-Hg) mark.
   - If the low pressure gauge reading rises 34 or more kPa (10 or more in-Hg) of vacuum from the 101 kPa (30 in-Hg) position in 10 minutes, a leak is indicated.
   - If a very small leak is suspected, wait 30 minutes and observe the vacuum gauge.
   - If a small amount of vacuum is lost, operate the vacuum pump with gauge valves open for an additional 30 minutes to remove any remaining refrigerant from the oil in the evaporator core or condenser core. Then recheck for loss of vacuum.

- If a very small leak is suspected, allow the system to sit overnight with vacuum applied and check for vacuum loss.

NOTE: For evaporator core testing only.

10. If the evaporator core does leak, as verified by the above procedure, install a new evaporator core.

NOTE: For condenser core testing only.

11. If the test indicates a leak, as verified by the above procedure, inspect and install new O-rings at the condenser line fittings as necessary. Retest the system. If the test again indicates a leak, install a new condenser core.

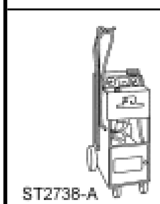
A/C Compressor - External Leak Test

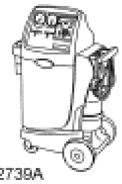
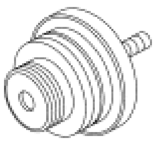
1. Disconnect the evaporator outlet line spring lock coupling and the compressor-to-condenser discharge line middle fitting.
2. Connect the appropriate test fittings to the evaporator outlet line spring lock coupling, compressor side and the compressor-to-condenser discharge line middle fitting, compressor side.
3. Connect the high and low pressure lines of a manifold gauge set or a refrigerant recovery/recycling station such as the R-134a A/C service center to the corresponding fittings on the A/C Pressure Test Adapter.
4. Attach the center hose of a manifold gauge set to a refrigerant container standing in an upright position.
5. Open the low pressure gauge valve, the high pressure gauge valve and the valve on the refrigerant container to allow the refrigerant vapor to flow into the A/C compressor.
6. Using the Refrigerant Leak Detector, check for external compressor leaks.
7. If an external leak is found, inspect and install new as necessary the O-rings at the compressor line fittings. Retest the system. If the test again indicates a leak, install a new compressor.
8. When the leak test is complete, recover the refrigerant from the compressor.

GENERAL PROCEDURES

REFRIGERANT SYSTEM TESTS

Special Tools

Illustration	Tool Name	Tool Number
	R-134a Refrigerant Center	176-00002 or equivalent

 ST2739A	R-134a Refrigerant Center	023-00174 or equivalent
 ST2670-A	R-134a Manifold Gauge Set	023-00047 or equivalent

Procedure 1 - Ambient Temperature at or Below 38°C (100°F)

NOTE: **The system performance can be evaluated and diagnosed by analysis of the compressor suction and discharge pressures. The following procedure is used to determine if the system is operating at normal pressures.**

NOTE: **The procedure varies depending on the ambient (shop) temperature. If the ambient temperature is 38°C (100°F) or lower, follow Procedure 1. If the ambient temperature is over 38°C (100°F), follow Procedure 2.**

NOTE: **If the A/C compressor cycles at any time during this test, refer to the diagnostic table.**

1. Drive the vehicle or run the engine until it reaches normal operating temperature.
2. Connect a manifold gauge set or refrigerant service center with high-pressure and low-pressure gauges to the refrigerant system.
3. Set the climate controls.
    - If equipped with manual climate control, set the A/C controls for normal A/C-PANEL mode, full COOL temperature, FRESH air, HI blower. If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.
    - If equipped with electronic automatic temperature control (EATC), set temperature to 15°C (60°F) (lowest possible temp setting) with the dual function disabled (if equipped). Manually set blower on HI. If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.
4. Open all vehicle windows and leave the hood open for the test. Open the rear doors.
5. Confirm the compressor clutch is engaged and the engine cooling fan(s) are operating or engaged. Allow the vehicle to idle until the suction (low-side) and discharge (high-side) pressures are stable or fluctuate in a range that repeats.
6. Record the ambient (shop) temperature.
7. Record the discharge pressure. If the pressure is fluctuating, record the average value.
8. Determine if the discharge pressure falls within the normal operating limits using the Normal Refrigerant

Discharge Pressures chart.

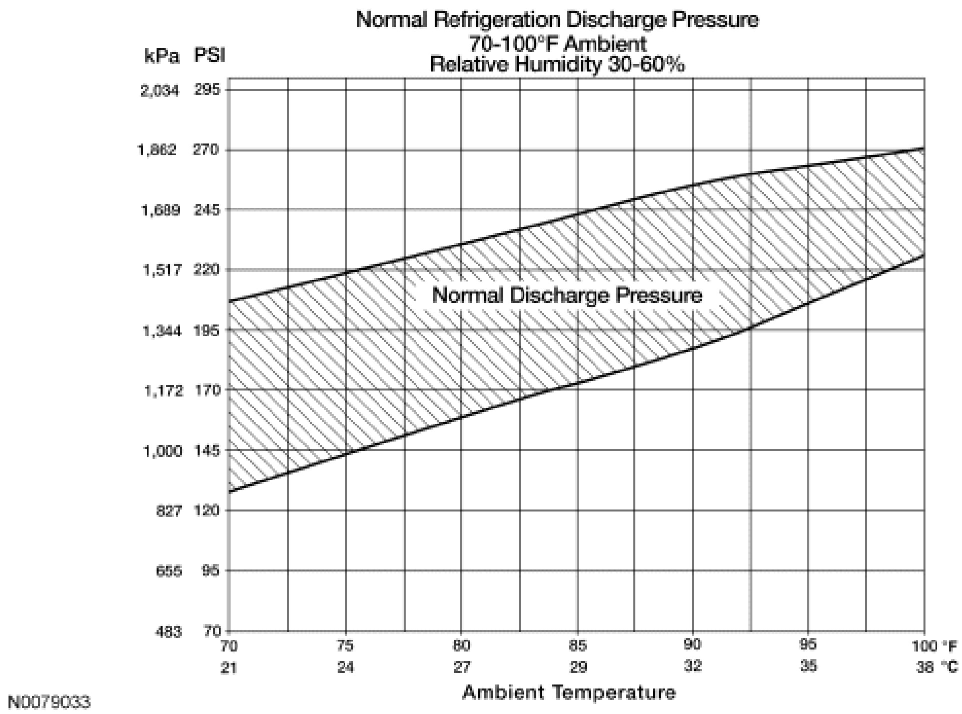


Fig. 111: Normal Refrigerant Discharge Pressures Chart - Relative Humidity 30-60%
Courtesy of FORD MOTOR CO.

9. Record the suction pressure. If the pressure is fluctuating, record the average value.
10. Determine if the suction pressure falls between normal operating limits using the Normal Refrigerant Suction Pressures chart.

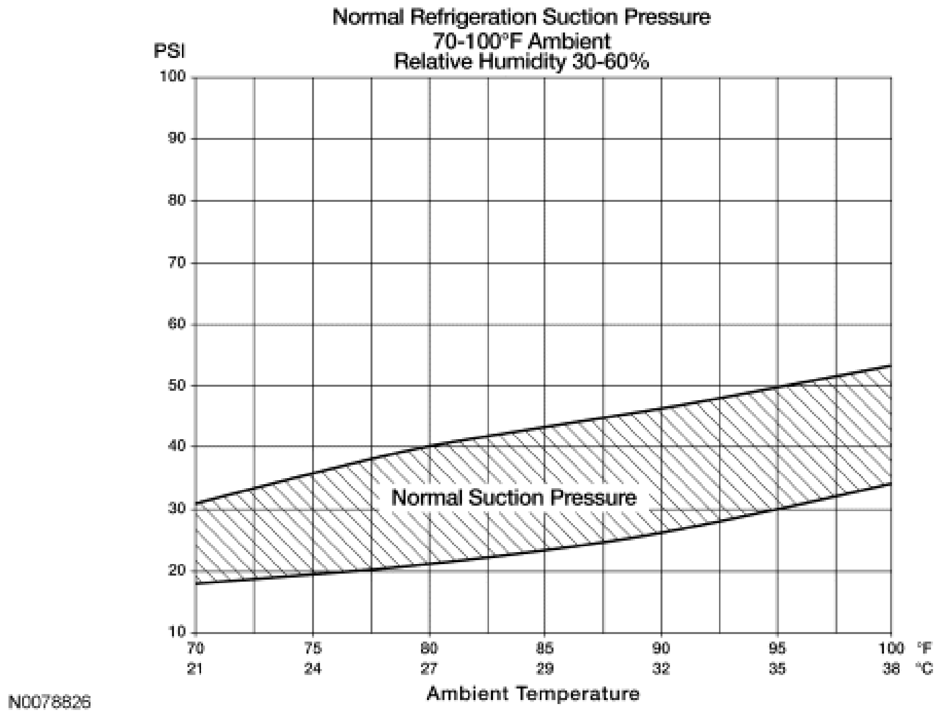


Fig. 112: Normal Refrigerant Suction Pressures Chart - Relative Humidity 30-60%
Courtesy of FORD MOTOR CO.

11. Proceed to the diagnostic table.

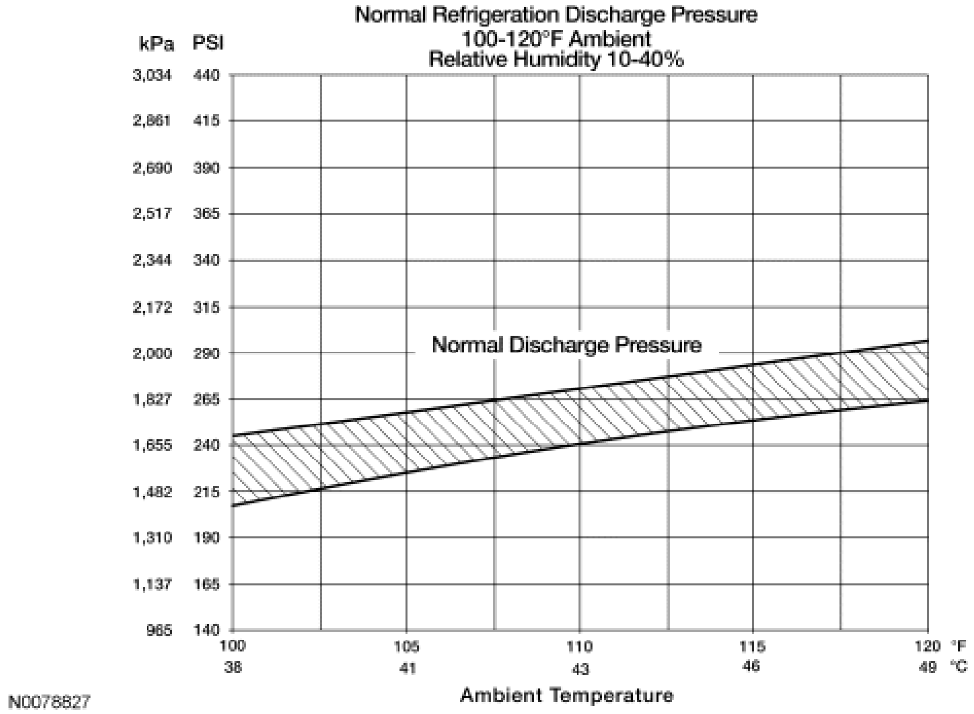
Procedure 2 - Ambient Temperature Above 38°C (100°F)

NOTE: **The system performance can be evaluated and diagnosed by analysis of the compressor suction and discharge pressures. The following procedure is used to determine if the system is operating at normal pressures.**

NOTE: **The procedure varies depending on the ambient (shop) temperature. If the ambient temperature is 38°C (100°F) or lower, follow Procedure 1. If the ambient temperature is over 38°C (100°F), follow Procedure 2.**

1. Drive the vehicle or run the engine until it reaches normal operating temperature.
2. Connect a manifold gauge set or refrigerant service center with high-pressure and low-pressure gauges to the refrigerant system.
3. Set the climate controls.
    - If equipped with manual climate control, set the A/C controls for normal A/C-PANEL mode, full COOL temperature, FRESH air, MED LO blower. If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.
    - If equipped with EATC, set temperature to 15°C (60°F) (lowest possible temp setting). Manually set blower to MED LO (3 to 4 bars). If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.

4. Open all vehicle windows and leave the hood open for the test. Open the rear hatch and/or rear doors (if equipped).
5. Confirm the compressor clutch is engaged and the engine cooling fan(s) are operating or engaged. Allow the vehicle to idle until the suction (low-side) and discharge (high-side) pressures are stable or fluctuate in a range that repeats.
6. Record the ambient (shop) temperature.
7. Record the discharge pressure. If the pressure is fluctuating, record the average value.
8. Determine if the discharge pressure falls within the normal operating limits using the Normal Refrigerant Discharge Pressures chart.



<u>Fig. 113: Normal Refrigerant Discharge Pressures Chart - Relative Humidity 10-40%</u>
Courtesy of FORD MOTOR CO.

9. Record the suction pressure. If the pressure is fluctuating, record the average value.
10. Determine if the suction pressure falls between normal operating limits using the Normal Refrigerant Suction Pressures chart.

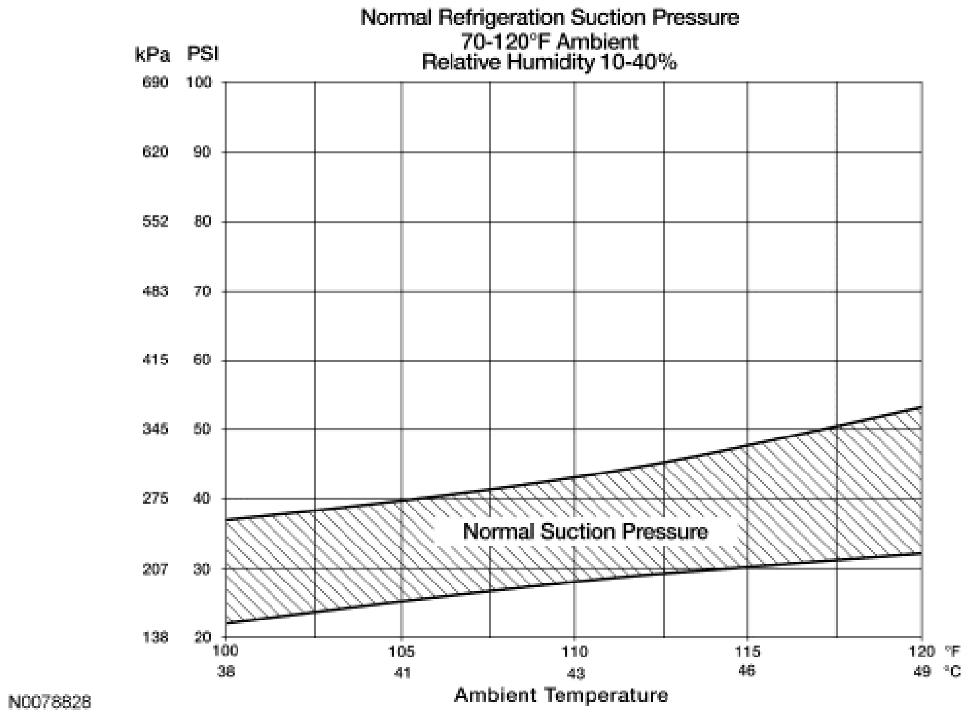


Fig. 114: Normal Refrigerant Suction Pressures Chart - Relative Humidity 10-40%
Courtesy of FORD MOTOR CO.

11. Proceed to the diagnostic table.

Diagnostic Table

NOTE: The following table is used to guide diagnosis of the refrigerant system if operating pressures are outside normal limits.

1. Refer to the chart below.

High (Discharge) Pressure	Low (Suction) Pressure	Component - Causes
High or Clutch Cycling	High	Condenser - inadequate airflow.
High	Normal to High	Engine - overheating.
Normal to High	Normal	Refrigerant overcharge - air in refrigerant.
		A/C suction

Normal to Low	Normal to High	line - partially restricted or plugged[a] .
Normal to Low	Low or Clutch Cycling	Low refrigerant charge, A/C suction line - partially restricted or plugged[b] A/C cycling switch - sticking closed (if equipped).
Erratic Operation or Compressor Not Running		Evaporator discharge air temperature sensor or A/C pressure transducer - poor connection at A/C clutch connector. A/C electrical circuit erratic - see A/C Electrical Circuit Wiring Diagram. Refer to appropriate SYSTEM WIRING DIAGRAMS article.
Normal to Low	High	Compressor - low performance.

Additional Possible Cause Components Associated With

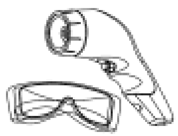
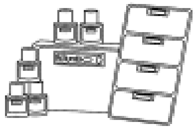
Inadequate Compressor Operation
• Compressor Drive Belt - loose • Compressor Clutch - slipping • Clutch Coil Open - shorted, or loose mounting • Control Assembly Switch - dirty contacts or sticking open • Clutch Wiring Circuit - high resistance, open or blown fuse • Compressor Operation Interrupted by Engine Computer
Additional Possible Cause Components Associated With a Damaged Compressor
• Incorrect Clutch Air-gap • Refrigerant Leaks

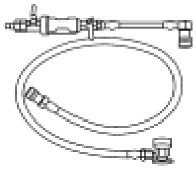
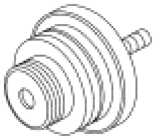
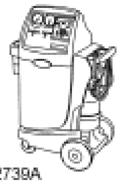
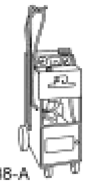
[a] Low pressure reading will be normal to high if pressure is taken at accumulator and if restriction is downstream of service access valve.

[b] Low pressure reading will be low if pressure is taken near the compressor and restriction is upstream of service access valve.

FLUORESCENT DYE LEAK DETECTION

Special Tools

Illustration	Tool Name	Tool Number
 ST3073-A	Cordless/Rechargable True UV LED Light ES	023-00182 or equivalent
 ST2650-A	R-134a Leak Detection Dye	164-R6060

 ST2649-A	R-134a Loop/Add On Injector Kit-Set	219-00069 or equivalent
 ST2670-A	R-134a Manifold Gauge Set	023-00047 or equivalent
 ST2739A	R-134a Refrigerant Center	023-00174 or equivalent
 ST2738-A	R-134a Refrigerant Center	176-00002 or equivalent

Fluorescent Dye Detection

NOTE: Ford Motor Company vehicles are produced with R-134a fluorescent dye installed in the refrigerant system from the factory. The location of leaks can be pinpointed by the bright yellow-green glow of the fluorescent dye under a UV lamp. Since more than one leak can exist, make sure to inspect each component, line and fitting in the refrigerant system for a leak.

1. Check for leaks using a Rotunda-approved UV lamp.
   - Inspect all components, lines and fittings of the refrigerant system.
2. If a leak is found, recover the refrigerant. For additional information, refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.
3. Repair the refrigerant system leak(s).
4. Evacuate and charge the refrigerant system. For additional information, refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.
5. After the leak(s) is/are repaired, remove any traces of fluorescent dye with a general purpose oil solvent.
6. Verify the repair by running the vehicle for a short period of time and rechecking the area of the leak with a Rotunda-approved UV lamp.

Fluorescent Dye Injection - Using an R-134a Refrigerant Management Center and Dye/Lubricant Injector

NOTE: **Fluorescent refrigerant system dye is added to the refrigerant system at the factory to assist in refrigerant system leak diagnosis using a Rotunda-approved ultraviolet blacklight. It is not necessary to add additional dye to the refrigerant system before diagnosing leaks, even if a significant amount of refrigerant has been removed from the system. Additional refrigerant system dye should only be added if more than 50% of the refrigerant system lubricant capacity has been lost due to a fitting separation, hose rupture or other damage.**

NOTE: **Before using the dye/lubricant injector from the R-134a Loop/Add On Injector Kit-Set for the first time, refer to the manufacturer's instructions on evacuation of any non-condensable gases from the hoses.**

NOTE: **Only connect the dye/lubricant injector when fluorescent dye is to be injected. The injector has a one-way check valve that will prevent refrigerant system recovery and evacuation.**

NOTE: **Refrigerant system pressure should be between 413-551 kPa (60-80 psi) at 24°C (75°F) with the engine off.**

1. Connect an R-134a Refrigerant Center or a R-134a Manifold Gauge Set to the refrigerant system service port valves.

   NOTE: **The dye/lubricant injector is included as part of the 219-00069 R-134a Loop/Add On Injector Kit-Set.**

2. Verify that the valves on the dye/lubricant injector are closed.

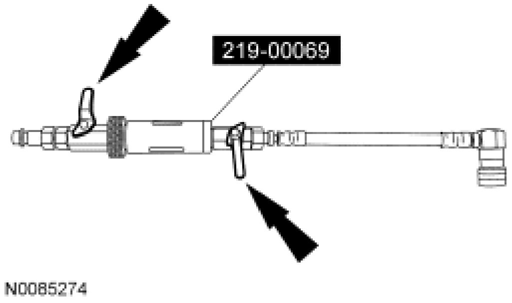


Fig. 115: Verifying Valves On Dye/Lubricant Injector Are Closed
Courtesy of FORD MOTOR CO.

3. Fill the fluorescent dye injector reservoir with 7 ml (0.25 oz) of fluorescent dye.

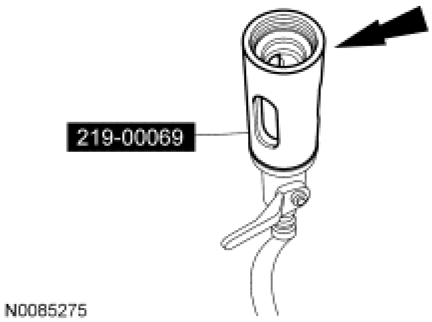


Fig. 116: Filling Fluorescent Dye Injector Reservoir With 7 ml (0.25 oz.) Of Fluorescent Dye
Courtesy of FORD MOTOR CO.

4. Install the dye/lubricant injector between the low-pressure service gauge port valve and the R-134a Refrigerant Center or R-134a Manifold Gauge Set.
5. Open all valves and inject the fluorescent dye into the refrigerant system.
6. When fluorescent dye injection is complete, close all valves.
7. Recover the refrigerant from the dye/lubricant injector.
8. Remove the dye/lubricant injector from the low-pressure service gauge port valve and the R-134a Refrigerant Center or R-134a Manifold Gauge Set.

Fluorescent Dye Injection - Using an R-134a Loop/Add On Injector Kit-Set

NOTE: **Fluorescent refrigerant system dye is added to the refrigerant system at the factory to assist in refrigerant system leak diagnosis using a Rotunda-approved ultraviolet blacklight. It is not necessary to add additional dye to the refrigerant system before diagnosing leaks, even if a significant amount of refrigerant has been removed from the system. Additional refrigerant system dye should only be added if more than 50% of the refrigerant system lubricant capacity has been lost due to a fitting separation, hose rupture or other damage.**

NOTE: **Before using the R-134a Loop/Add On Injector Kit-Set for the first time, refer to the equipment manufacturer's instructions on evacuation of non-condensable gases from the hoses.**

NOTE: **Refrigerant system pressure should be between 413-551 kPa (60-80 psi) at 24°C (75°F).**

1. Verify that the valves on the deluxe injector loop kit are closed.

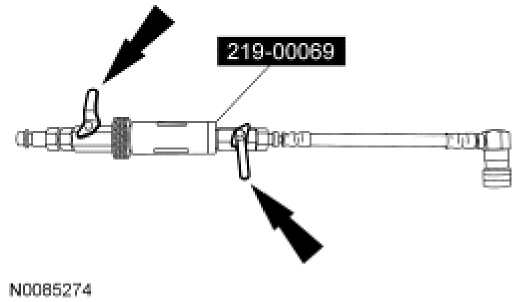


Fig. 117: Verifying Valves On Dye/Lubricant Injector Are Closed
Courtesy of FORD MOTOR CO.

2. Fill the R-134a Loop/Add On Injector Kit-Set reservoir with 7 ml (0.25 oz) of fluorescent dye.

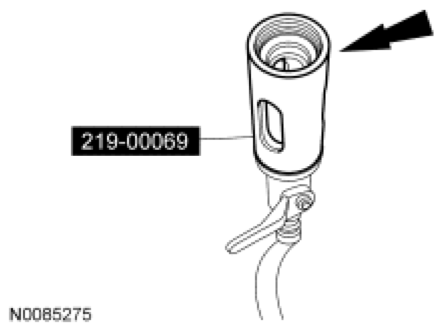


Fig. 118: Filling Fluorescent Dye Injector Reservoir With 7 ml (0.25 oz.) Of Fluorescent Dye
Courtesy of FORD MOTOR CO.

3. Install the R-134a Loop/Add On Injector Kit-Set between the high-pressure and low-pressure service gauge port valves.

NOTE: **Make sure all tools and hoses are clear of the engine cooling fan and drive belt before starting the engine.**

4. Start the engine.
5. Open the high-pressure service valve.

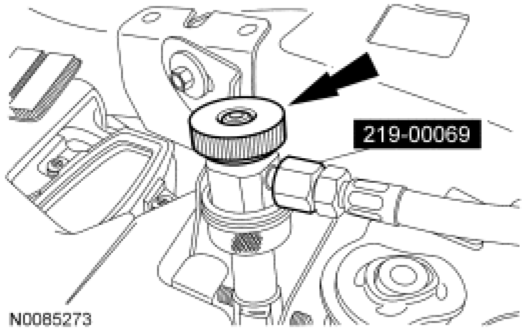


Fig. 119: Installing R-134A Loop/Add On Injector Kit-Set Between High-Pressure & Low-Pressure Service Gauge Port Valves
Courtesy of FORD MOTOR CO.

6. Open all valves and inject the fluorescent dye into the refrigerant system.

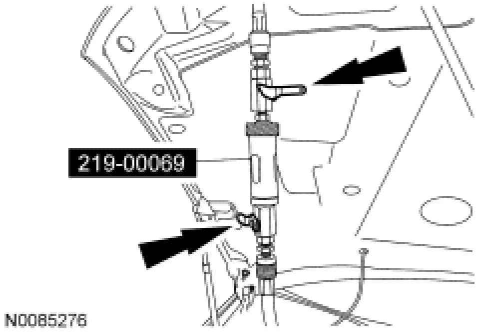


Fig. 120: Opening All Valves & Inject Fluorescent Dye Into Refrigerant System
Courtesy of FORD MOTOR CO.

7. Close the high-pressure service valve to allow the pressure inside the R-134a Loop/Add On Injector Kit-Set to equalize with the suction side of the refrigerant system.

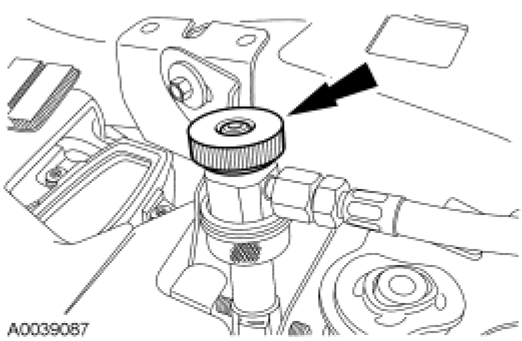


Fig. 121: Identifying High-Pressure Service Valve
Courtesy of FORD MOTOR CO.

NOTE: **Close the valves on the R-134a Loop/Add On Injector Kit-Set while the A/C compressor is operating.**

8. Close the valves on the R-134a Loop/Add On Injector Kit-Set.

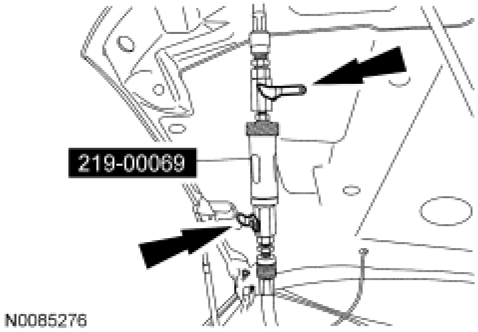


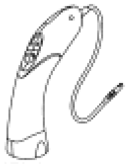
Fig. 122: Closing Valves On R-134A Loop/Add On Injector Kit-Set
Courtesy of FORD MOTOR CO.

NOTE: **Leave all valves on the R-134a Loop/Add On Injector Kit-Set closed when not in use.**

9. Disconnect the high-pressure and low-pressure service valves and remove the R-134a Loop/Add On Injector Kit-Set from the vehicle.

ELECTRONIC LEAK DETECTION

Special Tools

Illustration	Tool Name	Tool Number
 ST3072-A	Heated Pentode Halogen Leak Detector	023-00178 or equivalent

NOTE: **Good ventilation is necessary in the area where electronic A/C leak testing is to be carried out. If the surrounding air is contaminated with refrigerant gas, the Heated Pentode Halogen Leak Detector will indicate this gas all the time. Odors from other chemicals such as antifreeze, diesel fuel, disc brake cleaner or other cleaning solvents can cause the same problem. Using a fan to ventilate the area to be tested before proceeding with the leak detection procedure is helpful in removing small traces of contamination from the air, but the fan should be turned off during actual testing.**

NOTE: **R-134a is heavier than air, and will tend to move downward from the source of the leak if present. It is possible that a leak may not be detected if the leak detector tip is held above the leaking fitting, line or component. Always be sure to thoroughly leak test below the fitting, line or component for the presence of R-134a as well as leak testing above and around.**

NOTE: **The system pressure should be between 413-551 kPa (60-80 psi) at 24°C**

(75°F) with the engine off.

1. Leak test the refrigerant system using the leak detector. Follow the instructions included with the leak detector for handling and operation techniques.

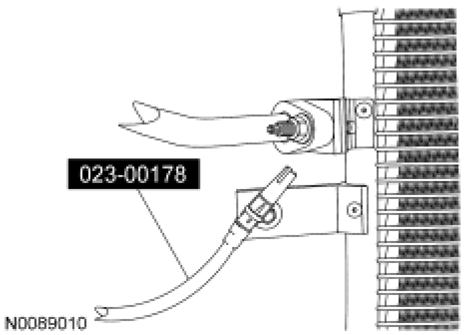
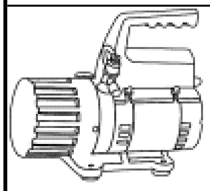
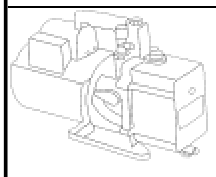
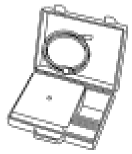


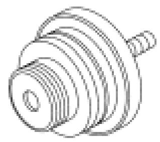
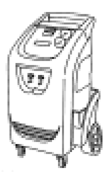
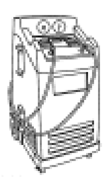
Fig. 123: Leak Test Refrigerant System Using Leak Detector
Courtesy of FORD MOTOR CO.

2. If a leak is found, recover the refrigerant. For additional information, refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.
   - Repair the system.
   - Test the system for normal operation.

AIR CONDITIONING (A/C) SYSTEM RECOVERY, EVACUATION AND CHARGING

Special Tools

Illustration	Tool Name	Tool Number
 ST1685-A	1.2 CFM Vacuum Pump	023-00162 or equivalent
 ST1686-A	4.0 CFM Vacuum Pump	023-00163 or equivalent
 ST2742-A	Automatic Refrigerant Charging Meter	023-00155 or equivalent

 ST2670-A	R-134a Manifold Gauge Set	023-00047 or equivalent
 ST3079A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant)	023-00181 or equivalent
 ST3081-A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant)	199-00067 or equivalent
 ST3080-A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant)	265-00012 or equivalent

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

Refrigerant System Recovery

NOTE: **An air conditioning (A/C) refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts the shop's bulk refrigerant at risk of contamination. If the vehicle's A/C refrigerant is contaminated, refer the customer to the service facility that carried out the last A/C service. If the customer wishes to pay the additional cost, use the A/C recovery equipment that is designated for recovering contaminated A/C refrigerant. All contaminated A/C refrigerant must be disposed of as hazardous waste. For all equipment, follow the equipment manufacturer procedures and instructions.**

NOTE: **Ford Motor Company recommends use of an R-134a Refrigerant Management Machine to carry out recovery. If an R-134a Refrigerant Management Machine is not available, refrigerant system recovery may be accomplished using a separate recovery station.**

NOTE: **Leaks in refrigerant system service equipment, hoses or gauges can cause a**

leak in vacuum that may be misinterpreted as a problem with the vehicle's refrigerant system. It is necessary to leak-test all refrigerant system service equipment, hoses and gauges on a weekly basis to verify that no leaks are present.

1. Prior to recovering, the purity of the refrigerant must be verified. For additional information, refer to **Refrigerant Identification Testing**.
2. Connect an R-134a Refrigerant Management Machine to the low- and high-pressure service gauge port valves following the operating instructions provided by the equipment manufacturer.
3. Recover the refrigerant from the system following the operating instructions provided by the equipment manufacturer. Note the amount of oil removed during the refrigerant recovery (if any). Add that same amount back into the system once repairs are complete.
4. Once the R-134a Refrigerant Center has recovered the refrigerant, switch OFF the power supply.
5. Allow the system to set for about 2 minutes, and observe the system vacuum reading. If the vacuum is not lost, disconnect the recovery equipment.
6. If the system does lose vacuum, repeat Steps 3 through 5 until the vacuum level remains stable for 2 minutes.
7. Carry out the required repairs.

Refrigerant System Evacuation Using an R-134a Refrigerant Management Machine

NOTE: **Ford Motor Company recommends use of an R-134a Refrigerant Management Machine to carry out recovery, evacuation and charging of the refrigerant system. If an R-134a Refrigerant Management Machine is not available, evacuation may be accomplished using a separate Vacuum Pump and R-134a Manifold Gauge Set.**

NOTE: **Leaks in refrigerant system service equipment, hoses or gauges can cause a leak in vacuum that may be misinterpreted as a problem with the vehicle's refrigerant system. It is necessary to leak-test all refrigerant system service equipment, hoses and gauges on a weekly basis to verify that no leaks are present.**

1. Connect an R-134a Refrigerant Management Machine to the low- and high-pressure service gauge port valves following the operating instructions provided by the equipment manufacturer.
2. Evacuate the system until the low-pressure gauge reads at least 99.4 kPa (29.5 in-Hg) of vacuum and as close to 101.1 kPa (30 in-Hg) as possible. Continue to operate the Vacuum Pump for a minimum of 45 minutes.
3. Turn OFF the Vacuum Pump. Observe the low-pressure gauge for 5 minutes to make sure that the system vacuum is held. If vacuum is not held for 5 minutes, leak test the system, repair the leak and evacuate the system again.

Refrigerant System Evacuation Using an R-134a Manifold Gauge Set

NOTE: Ford Motor Company recommends use of an R-134a Refrigerant Management Machine to carry out evacuation of the refrigerant system. If an R-134a Refrigerant Management Machine is not available, refrigerant system evacuation may be accomplished using a separate Vacuum Pump and R-134a Manifold Gauge Set.

NOTE: Leaks in refrigerant system service equipment, hoses or gauges can cause a leak in vacuum that may be misinterpreted as a problem with the vehicle's refrigerant system. It is necessary to leak-test all refrigerant system service equipment, hoses and gauges on a weekly basis to verify that no leaks are present.

1. Connect the R-134a Manifold Gauge Set to the low-side and high-side service gauge port valves.
2. Connect the center (yellow) hose from the R-134a Manifold Gauge Set to the suction port on the Vacuum Pump.
3. Open all valves on the R-134a Manifold Gauge Set and both service gauge port valves.
4. Turn on the Vacuum Pump and evacuate the system until the low-pressure gauge reads at least 99.4 kPa (29.5 in-Hg) of vacuum and as close to 101.1 kPa (30 in-Hg) as possible. Continue to operate the Vacuum Pump for a minimum of 45 minutes.
5. Close the high-side and low-side valves on the R-134a Manifold Gauge Set (not the service gauge port valves) and turn OFF the Vacuum Pump.
6. Observe the low-pressure gauge for 5 minutes to make sure that the system vacuum is held. If vacuum is not held for 5 minutes, leak test the system, repair the leak and evacuate the system again.

Refrigerant System Charging Using an R-134a Refrigerant Management Machine

NOTE: Ford Motor Company recommends use of an R-134a Refrigerant Management Machine to carry out charging of the refrigerant system. If an R-134a Refrigerant Management Machine is not available, refrigerant system charging may be accomplished using a separate Automatic Refrigerant Charging Meter and R-134a Manifold Gauge Set.

NOTE: Leaks in refrigerant system service equipment, hoses or gauges can cause a leak that may be misinterpreted as a problem with the vehicle's refrigerant system. It is necessary to leak-test all refrigerant system service equipment, hoses and gauges on a weekly basis to verify that no leaks are present.

1. Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **Refrigerant Oil Adding**.
2. Connect an R-134a Refrigerant Management Machine to the low-side and high-side service gauge port valves following the operating instructions provided by the equipment manufacturer.
3. Set the refrigerant charge amount, and charge the refrigerant system following the instructions provided by the equipment manufacturer.

Refrigerant System Charging Using an R-134a Manifold Gauge Set and Automatic Refrigerant Charging Motor

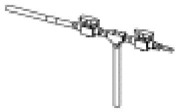
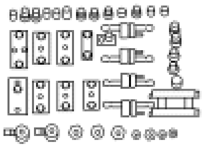
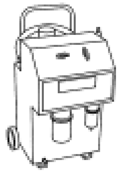
NOTE: Ford Motor Company recommends use of an R-134a Refrigerant Management Machine to carry out charging of the refrigerant system. If an R-134a Refrigerant Management Machine is not available, refrigerant system charging may be accomplished using a separate Automatic Refrigerant Charging Meter and R-134a Manifold Gauge Set.

NOTE: Leaks in refrigerant system service equipment, hoses or gauges can cause a leak that may be misinterpreted as a problem with the vehicle's refrigerant system. It is necessary to leak-test all refrigerant system service equipment, hoses and gauges on a weekly basis to verify that no leaks are present.

1. Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **Refrigerant Oil Adding**.
2. Assemble the R-134a Manifold Gauge Set, Automatic Refrigerant Charging Meter and R-134a supply tank following the Automatic Refrigerant Charging Meter operating instructions.
3. Charge the refrigerant system following the Automatic Refrigerant Charging Meter operating instructions.
4. If the refrigerant flow stops before the refrigerant charge is complete, start the engine, select MAX A/C operation and allow the refrigerant charge to complete.

AIR CONDITIONING (A/C) SYSTEM FLUSHING

Special Tools

Illustration	Tool Name	Tool Number
 ST2626-A	A/C Flush Adapter Kit	219-00074 or equivalent
 ST2469-A	A/C Flush and Purge Fitting Kit	219-00024 or equivalent
 ST2466-A	A/C Flush and Purge Machine	219-00022 (part of 219-00023) or equivalent

Material

Item	Specification
A/C System Flushing Solvent YN-23	-
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

WARNING: **Take the following precautions when repairing an air conditioning system containing R-134a:**

- **Always wear safety goggles.**
- **Avoid contact with liquid refrigerant R-134a. R-134a vaporizes at approximately -25°C (-13°F) under atmospheric pressure and will freeze skin tissue.**
- **Never allow refrigerant R-134a gas to escape in quantity in an occupied space. It will displace the oxygen needed to support life.**
- **Never use a torch in an atmosphere containing R-134a gas. R-134a is non-toxic at all normal conditions, but it decomposes when exposed to high temperatures such as a torch flame. During decomposition it releases irritating and toxic gasses (as described in the MSDS sheet from the manufacturer). Decomposition products are hydrofluoric acid, carbon dioxide and water.**

Failure to follow these instructions may result in serious personal injury.

CAUTION: An air conditioning (A/C) refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts the shop's bulk refrigerant at risk of contamination. If the vehicle's A/C refrigerant is contaminated, refer the customer to the service facility that carried out the last A/C service. If the customer wishes to pay the additional cost, use the A/C recovery equipment that is designated for recovering contaminated A/C refrigerant. All contaminated A/C refrigerant must be disposed of as hazardous waste. For all equipment, follow the equipment manufacturer procedures and instructions.

CAUTION: Receiver/drier desiccant bag, thermostatic expansion valve (TXV), and hoses with mufflers should be removed when flushing the air conditioning (A/C) system. Internal plumbing of these devices makes it impossible to correctly remove any residual-flushing agent. These components are typically discarded after A/C system contamination. Hoses without mufflers can normally be reused unless they are clogged with foreign material. The 3.785L (1 gal) of A/C System Flushing Solvent YN-23 and FL1-A filter used in A/C Flush and Purge Machine 219-00022 are intended for use on one vehicle only. They may be used to flush both the A/C condenser core and the A/C evaporator core on an individual vehicle, but under no circumstances should they be used on more than one vehicle.

CAUTION: Only the A/C Flush and Purge Machine 219-00022 and A/C Systems Flushing Solvent, is approved for use on Ford vehicles. No other flushing device or solvent is approved for flushing heat exchangers (air conditioning [A/C] condenser, A/C evaporator). Use of any other flusher or solvent may cause damage to the A/C system and the flushing unit.

NOTE: Prior to using the A/C Flush and Purge Machine 219-00022 for the first time, review the operating instructions.

NOTE: Ford Motor Company has approved a procedure to provide technicians with a non-CFC method of flushing contaminated A/C system heat exchangers. The procedure allows the specific components to be cleaned and flushed. The types of contamination flushed include particle matter that results from A/C compressor or desiccant failure and gummy residue that can form when refrigerant oil is overheated during A/C compressor seizure. The flushing process is a 2-step procedure that involves the use of an A/C Flush and Purge Machine 219-00022 to:

- **circulate the flushing solvent through the heat exchanger in the reverse direction of normal refrigerant flow (back-flushing). Particulate matter picked up during flushing is filtered from the returning solvent before the solvent is returned to the reservoir for continued circulation.**
- **remove the flushing solvent from the heat exchanger. In this step of the procedure, pressurized air 621-862 kPa (90-125 psi) is used to push and evaporate any remaining flush solvent from the heat exchanger.**

1. Remove the desiccant bag. For additional information, refer to **CLIMATE CONTROL** article.
2. Disconnect the compressor-to-condenser discharge line middle fitting and remove the condenser-side condenser-to-evaporator line.
3. Disconnect the condenser-to-evaporator line spring lock coupling.
4. Remove the condenser-to-evaporator line bracket bolt and remove the condenser side condenser-to-evaporator line.
5. With the condenser and lines out of the vehicle, reconnect the A/C lines to the condenser inlet and outlet fittings.
6. Connect the A/C Flush and Purge Machine to the A/C line fittings using the correct adapters from the A/C Flush and Purge Fitting Kit.

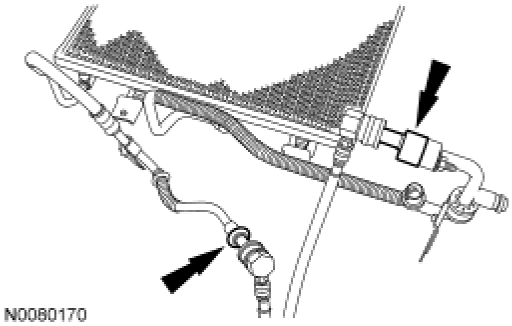


Fig. 124: Identifying A/C line fittings
Courtesy of FORD MOTOR CO.

NOTE: The condenser core must be flushed with the desiccant bag removed. Do not install a new desiccant bag at this time.

7. With the desiccant bag removed, reinstall the receiver/drier plug into the condenser core.
8. Flush the condenser core for a minimum of 30 minutes.
9. Turn the A/C Flush and Purge machine to the PURGE mode and run for a minimum of 20 minutes.
10. Disconnect the A/C Flush and Purge machine and adapters from the condenser core.
11. Disconnect the A/C lines from the condenser core.
12. Install the condenser-to-evaporator line and the condenser-to-evaporator line bracket bolt.
13. Connect the condenser-to-evaporator line spring lock coupling.
14. Install the compressor-to-condenser discharge line and connect the compressor-to-condenser discharge line middle fitting.
15. Remove the receiver/drier plug.

NOTE: Do not charge the refrigerant system after the condenser core is installed.

16. Install a new desiccant bag and reinstall the condenser core. For additional information, refer to **CLIMATE CONTROL** article.
17. Remove the front thermostatic expansion valve (TXV). For additional information, refer to **CLIMATE CONTROL** article.
18. Connect the A/C Flush and Purge Machine to the evaporator core fitting using the correct adapter from the A/C Flush Adapter Kit.
19. Flush the evaporator core for a minimum of 20 minutes.
20. Turn the A/C Flush and Purge Machine to the PURGE mode and run for a minimum of 20 minutes.
21. Disconnect the A/C Flush and Purge Machine and adapter from the evaporator core fitting.
22. Install a new front TXV. For additional information, refer to **CLIMATE CONTROL** article.

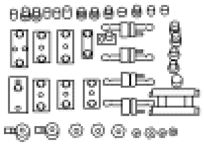
NOTE: It is necessary to evacuate the refrigerant system for a minimum of one hour to evaporate any trace amounts of flush solvent that may remain in

the system.

23. Evacuate the refrigerant system for one hour. For additional information, refer to**Air Conditioning (A/C) System Recovery, Evacuation and Charging**.
24. If a new A/C compressor is not to be installed, lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **Refrigerant Oil Adding**.
25. If a new A/C compressor is not to be installed, evacuate, leak test and charge the refrigerant system. For additional information, refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.

REFRIGERANT SYSTEM FILTERING FOLLOWING AIR CONDITIONING (A/C) COMPRESSOR INSTALLATION

Special Tools

Illustration	Tool Name	Tool Number
 ST2469-A	A/C Flush and Purge Fitting Kit	219-00024 or equivalent

CAUTION: On vehicles being serviced for an internal compressor or desiccant failure, a new thermostatic expansion valve (TXV) and any hoses containing mufflers must be installed prior to filtering the air conditioning (A/C) system. Internal plumbing of these devices makes it impossible to correctly remove any foreign material/debris. These components are typically discarded after A/C system contamination. Hoses without mufflers can normally be reused unless they are clogged with foreign material. The F8VZ-19E773-AB filter is intended for use on one vehicle only.

1. Remove the desiccant bag. For additional information, refer to **CLIMATE CONTROL** article.

NOTE: The refrigerant system must be filtered with the desiccant bag removed. Do not install a new desiccant bag at this time.

2. With the desiccant bag removed, reinstall the receiver/drier plug into the condenser core.

NOTE: Do not install the front bumper cover or evacuate and charge the refrigerant system at this time.

3. Install the condenser core back into the vehicle. For additional information, refer to **CLIMATE CONTROL** article.
4. Disconnect the condenser-to-evaporator line spring lock coupling.

- Discard the O-ring seals.

NOTE: Use flexible refrigerant hose of 17,238 kPa (2,500 psi) burst rating.

NOTE: Orient the filter inlet toward the A/C condenser core.

5. Using the correct adapters from the A/C Flush and Purge Fitting Kit and suitable A/C service hoses, install the pancake filter between the two halves of the condenser-to-evaporator line spring lock coupling.
6. Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **Refrigerant Oil Adding**.
7. Evacuate and charge the refrigerant system. For additional information, refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.
8. Provide adequate airflow to the front of the vehicle (with a fan, if necessary). Start the engine and allow it to idle briefly. Select A/C operation and set the blower speed to HI. Verify that the A/C is operating correctly.
9. Gradually bring the engine up to 1,200 RPM by running it at lower RPM for short periods (first at 800 RPM, then at 1,000 RPM). Set the engine at 1,200 RPM and run it for one hour with the A/C system operating.
10. Stop the engine.
11. Recover the refrigerant. For additional information, refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.
12. Remove the pancake filter, hoses and adapters from the vehicle.
13. Install new O-ring seals and connect the condenser-to-evaporator line spring lock coupling.
14. Remove the condenser core. For additional information, refer to **CLIMATE CONTROL** article.
15. Remove the receiver/drier plug and install a new desiccant bag.

NOTE: Lubricate the receiver/drier plug O-ring seal using residual PAG oil from inside the integrated receiver/drier.

16. Install the new receiver/drier plug included in the desiccant bag service kit.
17. Install the condenser core. For additional information, refer to **CLIMATE CONTROL** article.
18. Evacuate, leak test and charge the refrigerant system. For additional information refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.

REFRIGERANT OIL ADDING

Special Tools

Illustration	Tool Name	Tool Number
	Dye/Lubricant Injector	164-R0775

 ST2740A		
 ST2737-A	Add-On Module Kit	219-00069

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

Refrigerant Oil Adding

CAUTION: During normal air conditioning (A/C) operation, oil is circulated through the system with the refrigerant, and a small amount is retained in each component. If certain components of the system are removed, some of the refrigerant oil will go with the component. To maintain the original total oil charge, it is necessary to compensate for the oil lost by adding oil to the system with the new part.

1. Refer to the chart below for refrigerant oil adding amounts and methods of installation.

Component	PAG Oil Amount	Method of Adding
A/C Compressor	See heading below	Add directly to A/C compressor before installation
Receiver/Drier Desiccant Cartridge	60 ml (2 fl oz) added to the amount collected during refrigerant recovery	Inject to low-side service port during system charging

Evaporator Core	45 ml (1.5 fl oz) added to the amount collected during refrigerant recovery	Add directly to evaporator core inlet tube or inject to low-side service port during system charging
Condenser Core	60 ml (2 fl oz) added to the amount collected during refrigerant recovery	Add directly to condenser core inlet or inject to low-side service port during system charging
Evaporator Core Orifice or Thermostatic Expansion Valve	The amount collected during refrigerant recovery	Inject to low-side service port during system charging
A/C Pressure Relief Valve	60 ml (2 fl oz) added to the amount collected during refrigerant recovery	Inject to low-side service port during system charging
Refrigerant Hose/Line	60 ml (2 fl oz) added to the amount collected during refrigerant recovery[a]	Inject to low-side service port during system charging
	60 ml (2	

O-ring Leak Repair	fl oz) added to the amount collected during refrigerant recovery[b]	Inject to low-side service port during system charging
Service Port Leak Repair	60 ml (2 fl oz) added to the amount collected during refrigerant recovery	Inject to low-side service port during system charging

[a] If an excessive amount of refrigerant oil is lost due to a hose rupture/separation or other damage, the total system refrigerant oil capacity must be added.

[b] The amount specified may be used for one or multiple O-ring leak repairs. Do not multiply the refrigerant oil amount by the number of O-ring leaks being repaired.

Refrigerant Oil Adding for New A/C Compressor Installation

NOTE: The service A/C compressor for this vehicle is shipped from the factory with PAG oil installed. The refrigerant oil adding procedure specified for this vehicle must be followed to avoid installing excessive PAG oil in the refrigerant system.

1. Rotate the new A/C compressor shaft 8 to 10 revolutions while collecting the PAG oil in a clean measuring cup.
2. Rotate the oil A/C compressor shaft 8 to 10 revolutions while collecting the PAG oil in a separate clean measuring cup.
3. Remove enough PAG oil from the new compressor measuring cup to make the remaining amount of oil in the cup match the amount remove from the oil A/C compressor.
4. Add the PAG oil from the new A/C compressor measuring cup to the suction side of the A/C compressor.

Oil Injection Using a Dye/Lubricant Injector

NOTE: If fluorescent leak detection dye is also to be added during A/C charging, the dye may be added to the dye/lubricant injector along with the refrigerant oil.

1. Evacuate the refrigerant system. For additional information, refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.

2. Assemble the dye/lubricant injector using the correct adapters to match the amount of refrigerant compressor oil to be injected.
3. Verify that all the valves on the dye/lubricant injector are closed.

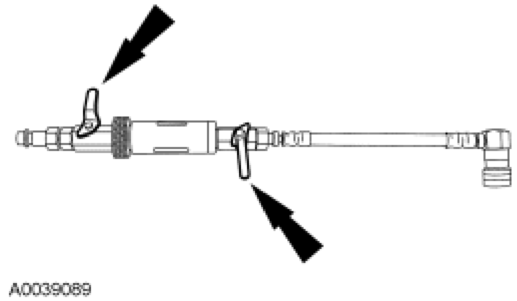


Fig. 125: Identifying Valves On Fluorescent Dye/Lubricant Injector
Courtesy of FORD MOTOR CO.

4. Fill the dye/lubricant injector with the correct amount of new refrigerant compressor oil.

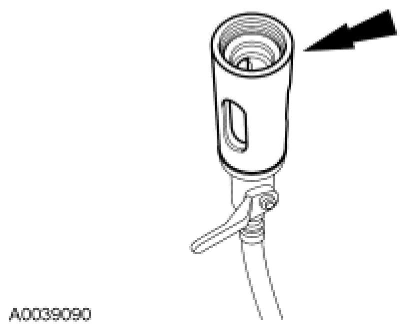


Fig. 126: Identifying Deluxe Injector Loop Kit Reservoir
Courtesy of FORD MOTOR CO.

5. Install the dye/lubricant injector between the low-side service gauge port valve and the refrigerant service station or manifold gauge set.
6. Open all valves and charge the refrigerant system. For additional information, refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.

REFRIGERANT IDENTIFICATION TESTING

Special Tools

Illustration	Tool Name	Tool Number
	Refrigerant Identifier with Air-Radiator	198-00003 or equivalent

 ST1457-A		

Refrigerant Identification

NOTE: A Refrigerant Identifier with Air-Radiator must be used to identify gas samples taken directly from the refrigeration system or storage containers prior to recovering or charging the refrigerant system.

1. Follow the instructions included with the Refrigerant Identifier with Air-Radiator to obtain the sample for testing.
2. The Refrigerant Identifier with Air-Radiator will display one of the following:
   - If the purity level of R-134a is 98% or greater by weight, the green PASS LED will light. The weight concentrations of R-134a, R-12, R-22, hydrocarbons and air will be displayed on the digital display.
   - If refrigerant R-134a does not meet the 98% purity level, the red FAIL LED will light and an alarm will sound alerting the user of potential hazards. The weight concentrations of R-134a, R-12, R-22 and hydrocarbons will be displayed on the digital display.
   - If hydrocarbon concentrations are 2% or greater by weight, the red FAIL LED will light, "Hydrocarbon High" will be displayed on the digital display, and an alarm will sound alerting the user of potential hazards. The weight concentrations of R-134a, R-12, R-22 and hydrocarbons will also be displayed on the digital display.
3. The percentage of air contained in the sample will be displayed if the R-134a content is 98% or greater. The scan tool eliminates the effect of air when determining the refrigerant sample content because air is not considered a contaminant, although air can affect A/C system performance. When the scan tool has determined that a refrigerant source is pure (R-134a is 98% or greater by weight) and air concentration levels are 2% or greater by weight, the scan tool will prompt the user if an air purge is desired.
4. If contaminated refrigerant is detected, repeat the refrigerant identification test to verify that the refrigerant is indeed contaminated.

Contaminated Refrigerant Handling

NOTE: If contaminated refrigerant is detected, DO NOT recover the refrigerant into R-134a recovery/recycling equipment. Recovery of contaminated refrigerant will contaminate the recovered refrigerant supply and may damage the recovery/recycling equipment.

NOTE: A new suction accumulator or receiver/drier must be installed as directed by the A/C system flushing procedure.

1. Recover the contaminated refrigerant using suitable recovery-only equipment designed for capturing and

storing contaminated refrigerant only.

- If this equipment is not available, contact an A/C service facility in the area with the correct equipment to carry out this service.

2. Determine and correct the cause of the customers initial concern.
3. Flush the A/C system.
4. Dispose of the contaminated refrigerant in accordance with all federal, state and local regulations.

2008 HVAC

Climate Control - Edge & MKX

SPECIFICATIONS

MATERIAL

Item	Specification	Fill Capacity
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B	118 ml (4 fl oz)
R-134a Refrigerant YN-19 (US); CYN-16-P or CYN-16-R (Canada)	WSH-M17B19-A	0.60 kg (21 oz)

TORQUE SPECIFICATIONS

Description	N.m	lb-ft	lb-in
A/C compressor bolt	25	18	-
A/C compressor discharge fitting bolt	9	-	80
A/C compressor nut	25	18	-
A/C compressor stud	9	-	80
A/C compressor suction fitting bolt	9	-	80
Compressor-to-condenser discharge line bracket bolt	7	-	62
Compressor-to-condenser discharge line fitting nut	8	-	71
Condenser bolt	6	-	53
Condenser inlet fitting bolt	6	-	53
Condenser outlet fitting bolt	6	-	53
Condenser-to-evaporator line bracket bolt	9	-	80
Evaporator outlet line bracket stud bolt	11	8	-
Heater core and evaporator core housing nuts	8	-	71
High-pressure Schrader-type valve	3.4	-	30
High-pressure service gauge port valve cap	0.8	-	7
Low-pressure Schrader-type valve	2.26	-	20
Low-pressure service gauge port valve cap	0.8	-	7
Receiver/drier plug	3	-	27
Thermostatic expansion valve (TXV) fitting nut	8	-	71

DESCRIPTION AND OPERATION

AIR CONDITIONING

The refrigerant system components include the following:

- A/C compressor and clutch assembly
- A/C condenser core
- A/C evaporator core
- Receiver/drier desiccant bag
- Connecting refrigerant lines
- Thermostatic expansion valve (TXV)

The refrigerant system incorporates an A/C compressor controlled by the PCM through an A/C clutch relay. The HVAC module sends an A/C request signal to the instrument cluster, which relays the request to the PCM. An evaporator temperature sensor is used to cycle the A/C compressor off when the evaporator core temperature falls below an acceptable temperature.

The HVAC module will send an A/C request signal to the instrument cluster if the following conditions are met:

- A mode which requires A/C operation has been manually selected by the driver or automatically selected by the HVAC module in AUTO mode.
- The A/C evaporator temperature sensor is reading an acceptable evaporator core temperature.

When an A/C request is received, the A/C compressor clutch will only be engaged by the PCM through the A/C clutch relay if all of the following conditions are met:

- The engine has been running for more than 5 seconds.
- Engine speed is above 425 RPM and below 5,800 RPM.
- The A/C pressure transducer is reading an acceptable pressure in the high side of the refrigerant system.
- The engine coolant temperature is not excessively high.
- The PCM has not detected a wide open throttle (WOT) condition.

An A/C pressure relief valve is installed in the A/C compressor to protect the refrigerant system against excessively high refrigerant pressures.

Refrigerant flow into the evaporator core is metered by a TXV.

A/C Compressor and Clutch Assembly

NOTE: A/C compressor components are not serviced separately. The A/C compressor is serviced only as an assembly.

The A/C compressor has the following characteristics:

- A non-serviceable shaft seal.
- A pressure relief valve is installed in the rear of the compressor to protect the refrigerant system against excessively high refrigerant pressures.
- The A/C compressor uses PAG oil or equivalent. This oil contains special additives required for the A/C

compressor.

- The A/C compressor oil may have some slightly dark-colored streaks while maintaining normal oil viscosity. This is normal for this A/C compressor because of break-in wear that can discolor the oil.
- Use the oil matching procedure specified for this vehicle when installing a new A/C compressor.

When battery voltage is applied to the A/C compressor clutch field coil, the clutch disc and hub assembly is drawn toward the A/C clutch pulley. The magnetic force locks the clutch plate and hub assembly and the A/C clutch pulley together as one unit, causing the compressor shaft to rotate. When battery voltage is removed from the A/C compressor clutch field coil, springs in the clutch plate and hub assembly move the clutch plate away from the A/C clutch pulley.

A/C Condenser

NOTE:	**The A/C condenser for this vehicle is produced from the factory with a receiver/drier desiccant bag installed in the integrated receiver/drier. This receiver/drier desiccant bag may become contaminated with moisture if the A/C condenser is not installed for an extended period of time. Since it cannot be determined how much time has elapsed between production and installation of the unit as a service part, the receiver/drier desiccant bag must be removed and replaced with the separate receiver/drier desiccant bag, which is supplied together with the A/C condenser service part kit.**

The A/C condenser is an aluminum fin-and-tube design heat exchanger located in front of the vehicle radiator. It cools compressed refrigerant gas by allowing air to pass over fins and tubes to extract heat and by condensing gas to liquid refrigerant as it is cooled.

The receiver/drier is incorporated onto the LH side of the A/C condenser. The receiver/drier desiccant bag is a separate component and can be separately removed and installed with the A/C condenser removed from the vehicle.

Evaporator Core

The evaporator core is an aluminum plate/fin type and is located in the heater core and evaporator core housing. A mixture of liquid refrigerant and oil enters the bottom of the evaporator core through the evaporator core inlet tube and continues out of the evaporator core through the evaporator core outlet tube as a vapor. During A/C compressor operation, airflow from the blower motor is cooled and dehumidified as it flows through the evaporator core fins.

Thermostatic Expansion Valve (TXV)

The thermostatic expansion valve (TXV) is located at the evaporator core inlet and outlet tubes at the center rear of the engine compartment. The TXV provides a restriction to the flow of refrigerant from the high-pressure side of the refrigerant system and separates the low-pressure and high-pressure sides of the refrigerant system. Refrigerant entering and exiting the evaporator core passes through the TXV through 2 separate flow paths. An internal temperature sensing bulb senses the temperature of the refrigerant flowing out of the evaporator core and adjusts an internal pin-type valve to meter the refrigerant flow into the evaporator core. The internal pin-type valve decreases the amount of refrigerant entering the evaporator core at lower temperatures and increases the amount of refrigerant entering the evaporator core at higher temperatures.

Receiver/Drier

NOTE: Installation of a new receiver/drier desiccant bag is not required when repairing the A/C system, except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier desiccant bag. Damage to the receiver/drier desiccant bag includes physical damage to the receiver/drier desiccant bag or moisture contamination. Moisture contamination results only from a complete loss of refrigerant and equalization of the refrigerant system pressure with atmospheric pressure for a period longer than one hour. If even a slight amount of positive refrigerant pressure is present in the system before repairs are carried out, the receiver/drier desiccant bag should not be replaced.

The receiver/drier is integral to the A/C condenser. It stores high-pressure liquid refrigerant after it leaves the condenser core. A receiver/drier desiccant bag installed inside the receiver/drier removes any retained moisture from the refrigerant. The receiver/drier desiccant bag is a separate component and can be separately removed and installed with the A/C condenser removed from the vehicle.

Evaporator Temperature Sensor

The evaporator temperature sensor contains a thermistor which receives a reference voltage from the HVAC module. The thermistor then varies the resistance to the reference voltage based on the evaporator fin temperature. The resulting voltage is returned to the HVAC module where it is interpreted as an evaporator fin temperature reading.

The HVAC module maintains evaporator core temperature and prevents icing of the evaporator core. It does this by switching off the A/C request signal to the instrument cluster when the evaporator temperature sensor reading falls below acceptable levels, and by switching on the A/C request when the evaporator temperature rises above acceptable levels.

The evaporator temperature sensor electrical connector is located outside of the heater core and evaporator core housing near the accelerator pedal, with the sensor pigtail leading into the housing to the sensor probe which is inserted between the evaporator core fins.

The evaporator temperature sensor is not available as a separate component. To install a new evaporator temperature sensor, a new heater core and evaporator core housing must be installed.

A/C Pressure Transducer

The A/C pressure transducer monitors the compressor discharge pressure and communicates with the PCM. The PCM will interrupt A/C compressor operation in the event that the A/C pressure transducer indicates high system discharge pressures. It is also used to sense low charge conditions. If the pressure is below a predetermined value for a given ambient temperature, the PCM will not allow the clutch to engage. It is not necessary to recover the refrigerant before removing the A/C pressure transducer.

Service Gauge Port Valves

The high-pressure service gauge port valve is located on the compressor-to-condenser discharge line.

The low-pressure service gauge port valve is located on the compressor suction line.

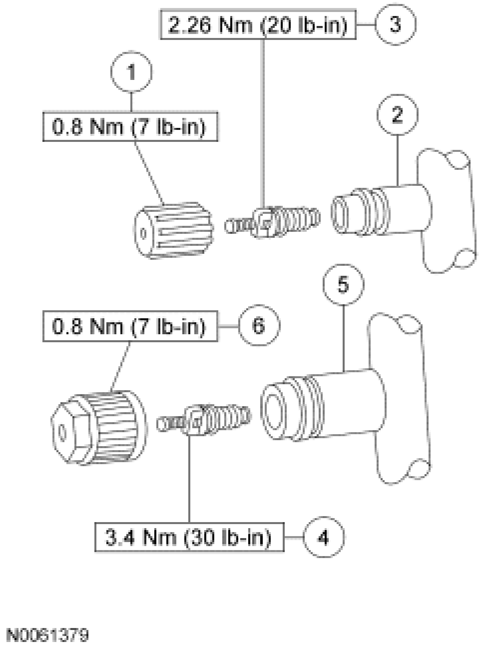


Fig. 1: Exploded View Of Service Gauge Port Valves With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	19D702	Low-pressure service gauge port valve cap
2	-	Low-pressure service gauge port valve
3	19D701	Low-pressure Schrader-type valve
4	19D701	High-pressure Schrader-type valve
5	-	High-pressure service gauge port valve
6	19D702	High-pressure service gauge port valve cap

The fitting is an integral part of the refrigerant line or component.

- Special couplings are required for both the high-side and low-side service gauge ports.
- A very small amount of leakage will always be detectable around the Schrader-type valve with the service gauge port valve cap removed, and is considered normal. A new Schrader-type valve core can be installed if the seal leaks excessively.

- The service gauge port valve caps are used as primary seals in the refrigerant system to prevent leakage through the Schrader-type valves from reaching the atmosphere. Always install and tighten the A/C service gauge port valve caps to the correct torque after they are removed.

Refrigerant System Dye

A fluorescent refrigerant system dye "wafer" is added to the receiver/drier desiccant bag to assist in refrigerant system leak diagnosis using a Rotunda-approved ultraviolet blacklight. This fluorescent dye "wafer" will dissolve after about 30 minutes of continued A/C operation. It is not necessary to add additional dye to the refrigerant system before diagnosing leaks, even if a significant amount of refrigerant has been removed from the system. Additional refrigerant system dye should only be added if more than 50% of the refrigerant system lubricant capacity has been lost due to a fitting separation or hose rupture. Refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

AIR DISTRIBUTION AND FILTERING

Air Distribution

There are 2 sources of air available to the air distribution system:

- Outside air
- Recirculated air

Recirculated air is always used when the climate control assembly is set to the MAX A/C mode on vehicles equipped with electronic manual temperature control (EMTC) and can be selected in any mode except DEFROST. Vehicles equipped with dual-zone electronic automatic temperature control (EATC) use recirculated air only when the RECIRC function is selected in any mode other than DEFROST, or when required by the HVAC module in the AUTOMATIC mode.

RECIRC is a timed function when selected while operating in FLOOR or FLOOR/DEFROST mode, and will automatically default back to fresh air inlet in 5 minutes if operating with A/C ON at an ambient temperature below 10°C (50°F). When operating with A/C OFF, the RECIRC function will always default back to fresh air inlet in 5 minutes regardless of ambient temperature.

Air distribution within the vehicle is determined by the airflow mode selected, or by the dual-zone EATC system in the AUTOMATIC mode. The air distribution mode on vehicles equipped with dual-zone EATC can be overridden by the driver if desired. Airflow mode control doors are used to direct airflow within the heater core and evaporator core housing. Electric mode door actuators are used to position these airflow mode doors.

Vehicles equipped with dual-zone EATC use 2 separate temperature blend doors. This allows individual temperature settings to be selected for the RH and LH air outlets. The airflow mode doors are not partitioned for separate RH and LH airflow positions. Therefore, the airflow mode will always remain similar for the RH and LH sides of the vehicle regardless of the temperatures selected.

Air enters the passenger compartment from the following outlets:

- Instrument panel registers

- Floor duct outlets
- Windshield defroster
- Side window demisters
- Rear footwell duct
- Center console registers

Passenger compartment air is exhausted from the vehicle through open windows or body air vents.

Cabin Air Filter

A cabin air filter is available as standard equipment on dual-zone EATC vehicles. EMTC vehicles are not equipped from the factory with a cabin air filter, but are equipped with a screen in place of the filter to prevent any large foreign material from entering the heater core and evaporator core housing. The cabin air filter or screen can be accessed by removing the glove compartment and removing the cabin air filter access cover.

A cabin air filter can be installed as a dealer accessory on vehicles not originally equipped with a filter, but only a screen or a filter should be installed, never both.

CONTROL COMPONENTS

Electronic Manual Temperature Control (EMTC)

The electronic manual temperature control (EMTC) components are used to select the following:

- Air inlet source (outside or recirculated)
- Blower motor speed
- Discharge air temperature (temperature blend)
- Discharge air location (defrost, panel, floor)
- A/C compressor operation

Control System Inputs

The EMTC system has 2 system control inputs.

HVAC Module

The HVAC module integrates the temperature control, airflow mode selection, A/C request button, recirculated air request button and rear defog switch into a single unit.

The temperature control selector setting determines air temperature. Movement of the temperature display from COOL (blue) to WARM (red) causes a corresponding movement of the temperature blend door and determines the discharge air temperature that the air distribution system will maintain. The temperature control selector is an integral part of the HVAC module and cannot be installed separately. The temperature selector knob is removable and can be separately replaced.

The airflow mode setting determines air discharge location. Movement of the airflow mode selector causes a corresponding movement of the airflow mode doors and determines the air discharge location. The airflow mode selector is an integral part of the HVAC module and cannot be installed separately. The airflow mode selector knob is removable and can be separately replaced.

The A/C request button determines A/C compressor operation, except when the airflow mode selector is in the OFF, MAX A/C or DEFROST mode. The A/C request button is an integral part of the HVAC module and cannot be installed separately.

The recirculated air request button can select recirculated air in any mode except DEFROST, and fresh air in any mode except MAX A/C or OFF. The recirculated air request button is an integral part of the HVAC module and cannot be installed separately.

The rear defog button signals activation of the heated backlight. The rear defog button is an integral part of the HVAC module and cannot be installed separately.

Blower Motor Switch

The blower motor switch is mounted in the HVAC module and controls blower motor speed by adding or bypassing resistors in the blower motor resistor in all modes except OFF. The blower motor switch knob is removable and can be separately replaced.

Control System Outputs

The EMTC system has 4 system outputs.

Blower Motor Resistor

The blower motor switch varies the blower motor ground circuit resistance by adding or bypassing series resistance in the blower motor resistor. Increased resistance will lower the blower motor speed, and lowered resistance will increase blower motor speed. When the blower motor is in the HI position, the blower motor resistor is bypassed.

The blower motor resistor is located on the heater core and evaporator core housing.

Temperature Blend Door Actuator

The temperature blend door actuator moves the temperature blend door on command from the HVAC module.

The temperature blend door actuator contains a reversible electric motor and a potentiometer. The potentiometer circuit consists of a 5-volt reference signal connected to one end of a variable resistor, and a signal ground connected to the other. A signal return circuit is connected to a contact wiper, which is driven along the variable resistor by the actuator shaft. The signal returned to the HVAC module from the contact wiper indicates the position of the temperature blend door. The HVAC module drives the actuator motor in whichever direction is necessary to make the actuator contact wiper voltage agree with the expected HVAC module contact wiper voltage value.

Airflow Mode Door Actuator

The airflow mode door actuator uses a cam and lever assembly to position the airflow mode doors on command from the HVAC module. The mode door actuator contains a reversible electric motor and potentiometer. The potentiometer allows the HVAC module to monitor the position of the airflow mode doors. The potentiometer circuit consists of a 5-volt reference signal connected to one end of a variable resistor, and a signal ground connected to the other. A signal return circuit is connected to a contact wiper, which is driven along the variable resistor by the actuator shaft. The signal returned to the HVAC module from the contact wiper indicates the position of the airflow mode doors.

Air Inlet Mode Door Actuator

The air inlet mode door actuator moves the air inlet door between the fresh and RECIRC positions on command from the HVAC module. The air inlet mode door actuator is driven to, and will automatically stop at, the full RECIRC or full fresh air inlet position and does not require a potentiometer circuit to monitor its position.

Electronic Automatic Temperature Control (EATC)

The dual-zone electronic automatic temperature control HVAC module analyzes input from the following major sources:

- Temperature, airflow mode, blower, A/C and RECIRC selection (made by the vehicle occupants)
- In-vehicle temperature sensor
- Ambient temperature sensor
- Solar radiation sensor
- Evaporator temperature sensor
- Vehicle speed
- Engine coolant temperature

Using these inputs, the dual-zone HVAC module determines the correct conditions for the following outputs:

- A/C compressor operation
- Blower speed
- Temperature blend door position
- Airflow mode door position
- Air inlet door position

Control System Inputs

The dual-zone EATC system has 4 control system inputs.

HVAC Module

The HVAC module provides an interface for the vehicle occupants to control the climate control system, or automatically controls the climate control system in the AUTO mode. The HVAC module has a vacuum fluorescent display for displaying set temperature, airflow direction, blower speed and DTCs. An on-board diagnostic (OBD) feature is incorporated to supply the technician with DTCs. These DTCs help direct the technician to the inoperative component.

In-Vehicle Temperature Sensor

The in-vehicle temperature sensor contains a thermistor, which measures the in-vehicle air temperature and sends that reading to the HVAC module. An aspirator hose is connected between the heater core and evaporator core housing and the in-vehicle temperature sensor. The aspirator hose uses airflow through the heater core and evaporator core housing to create a venturi-type suction to draw in-vehicle air through the in-vehicle temperature sensor (across the thermistor).

Solar Radiation Sensor (Sunload Sensor)

The solar radiation sensor supplies information to the HVAC module indicating sunload.

Ambient Temperature Sensor

The ambient temperature sensor signal is received by the HVAC module and indicates the outside air temperature. The ambient temperature sensor is located in front of the radiator on the radiator support bolster.

The ambient temperature sensor signal is not the sole factor considered by the HVAC module for the outside air temperature display. Therefore, the ambient temperature PID monitored with a scan tool may not exactly match the HVAC module display. For information regarding the HVAC module outside air temperature display, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

Control System Outputs

The EATC system has 4 control system outputs.

Blower Motor Speed Control

The blower motor speed control controls the blower motor speed by converting low power signals from the HVAC module to a high current, variable ground feed for the blower motor. A delay function is used to provide a gradual increase or decrease in blower motor speed under all conditions.

Temperature Blend Door Actuators

The dual-zone EATC system uses 2 temperature blend door actuators to control 2 separate temperature blend doors. The temperature blend doors independently vary the LH side and RH side temperature settings, as desired. The temperature blend door actuators each contain a reversible electric motor and a potentiometer. The potentiometer circuit consists of a 5-volt reference signal connected to one end of a variable resistor, and a signal ground connected to the other. A signal return circuit is connected to a contact wiper, which is driven along the variable resistor by the actuator shaft. The signal returned to the HVAC module from the contact wiper indicates the position of the temperature blend door. The HVAC module drives the actuator motor in whichever direction is necessary to make the actuator contact wiper voltage agree with the expected HVAC module contact wiper voltage value.

Airflow Mode Door Actuator

The airflow mode door actuator uses a cam and lever assembly to position the airflow mode doors on command from the HVAC module. The mode door actuator contains a reversible electric motor and potentiometer. The potentiometer allows the HVAC module to monitor the position of the airflow mode doors. The potentiometer circuit consists of a 5-volt reference signal connected to one end of a variable resistor, and a signal ground connected to the other. A signal return circuit is connected to a contact wiper, which is driven along the variable resistor by the actuator shaft. The signal returned to the HVAC module from the contact wiper indicates the position of the airflow mode doors.

Air Inlet Mode Door Actuator

The air inlet mode door actuator moves the air inlet door between the fresh and RECIRC positions on command from the HVAC module. The air inlet mode door actuator is driven to, and will automatically stop at, the full RECIRC or full fresh air inlet position and does not require a potentiometer circuit to monitor its position.

HEATING AND VENTILATION

The heating and ventilation system has the following features:

- Controls the temperature and, during A/C operation, reduces the relative humidity of the air inside the vehicle.
- Delivers heated or cooled air to maintain the vehicle interior temperature and comfort level.
- Cooling or heating can be adjusted to maintain the desired temperature.
- Uses a reheat method to provide conditioned air to the passenger compartment.
- All airflow from the blower motor passes through the A/C evaporator core.
- Temperature blending is controlled by the temperature blend door(s), which regulate(s) the amount of air that flows through and around the heater core, where it is then mixed and distributed.

Heater Core

The heater core consists of fins and tubes arranged to extract heat from the engine coolant and transfer the heat to air passing through the heater core.

Blower Motor

The blower motor pulls air from the air inlet and forces it into the heater core and evaporator core housing where it is mixed and distributed.

Heater Core and Evaporator Core Housing

The heater core and evaporator core housing directs airflow from the blower motor through the evaporator core and heater core. All airflow from the blower motor passes through the evaporator core. The airflow is then directed through or around the heater core by the temperature blend door(s). Vehicles equipped with dual-zone electronic automatic temperature control (EATC) use a partitioned heater core and evaporator core housing with 2 electric actuator-positioned temperature blend doors. This allows for separate temperatures to be selected for the driver and passenger sides of the passenger compartment. Manual systems use a single electric actuator-positioned temperature blend door to direct airflow through or around the heater core.

REMOVAL AND INSTALLATION

AIR CONDITIONING (A/C) COMPRESSOR

MATERIAL

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

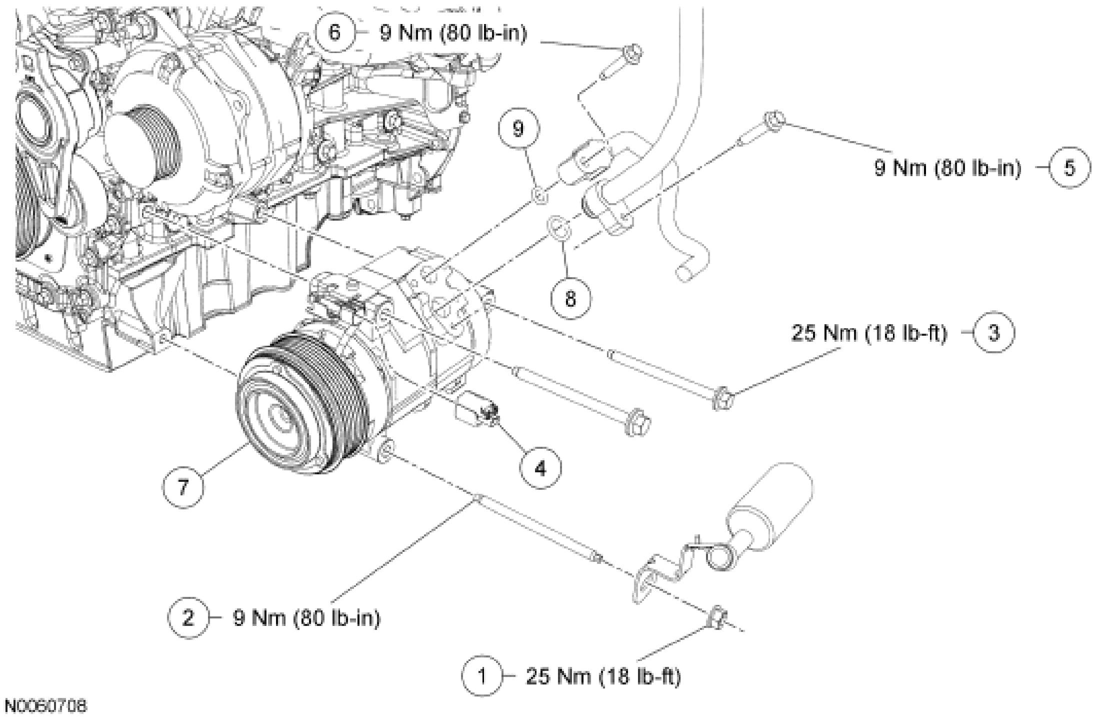


Fig. 2: Exploded View Of Air Conditioning (A/C) Compressor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W520413	A/C compressor nut
2	W712610	A/C compressor stud
3	W712611	A/C compressor bolt (2 required)
4	12B637	Clutch field coil electrical connector
5	W500215	A/C compressor suction fitting bolt
6	W500215	A/C compressor discharge fitting bolt
7	19703	A/C compressor
8	19E889	Compressor suction fitting O-ring seal

9	19E889	Compressor discharge fitting O-ring seal

REMOVAL

CAUTION: If installing a new air conditioning (A/C) compressor due to an internal failure of the old unit, you must carry out the following procedures to remove contamination from the A/C system.

- **If A/C flushing equipment is available, carry out flushing of the A/C system prior to installing a new A/C compressor. For additional information, refer to CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS article.**
- **If A/C flushing equipment is not available, carry out filtering of the A/C system after a new A/C compressor has been installed. For additional information, refer to CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS article.**
- **Install a new thermostatic expansion valve (TXV), as directed by the A/C flushing or filtering procedure.**
- **Install a new receiver/drier desiccant bag as directed by the A/C flushing or filtering procedure.**

NOTE: The O-ring seals used on this vehicle are not interchangeable with all similarly sized O-ring seals used on other Ford products. Use only the O-ring seals specified for this vehicle in the Ford master parts catalog.

NOTE: Installation of a new receiver/drier desiccant bag is not required when repairing the A/C system, except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier desiccant bag. Damage to the receiver/drier desiccant bag includes physical damage to the receiver/drier desiccant bag or moisture contamination. Moisture contamination results only from a complete loss of refrigerant and equalization of the refrigerant system pressure with atmospheric pressure for a period longer than one hour. If even a slight amount of positive refrigerant pressure is present in the system before repairs are carried out, the receiver/drier desiccant bag should not be replaced.

1. If flushing of the A/C system has not been carried out, recover the refrigerant. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
3. Remove the drive belt from the A/C compressor pulley.
4. Remove the RH fender splash shield. For additional information, refer to **FRONT END BODY PANELS** article.

5. Remove the A/C compressor nut and stud.
6. Remove the lower A/C compressor bolt.
7. Disconnect the field coil electrical connector.
8. Remove the upper A/C compressor bolt and reposition the A/C compressor to allow access to the compressor discharge and suction fittings.
9. Remove the A/C compressor suction fitting bolt and disconnect the fitting.
   - Discard the O-ring seal.
10. Remove the A/C compressor discharge fitting bolt and disconnect the fitting.
    - Discard the O-ring seal.
11. Remove the A/C compressor.

INSTALLATION

NOTE: The service A/C compressor for this vehicle is shipped from the factory with PAG oil installed. The refrigerant oil adding procedure specified for this vehicle must be followed to avoid installing excessive PAG oil in the refrigerant system.

1. If filtering of the A/C system is not to be carried out, lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
2. Connect the A/C compressor discharge fitting and install the A/C compressor discharge fitting bolt.
   - Install a new O-ring seal lubricated in clean PAG oil.
   - Tighten to 9 N.m (80 lb-in).
3. Connect the A/C compressor suction fitting and install the A/C compressor suction fitting bolt.
   - Install a new O-ring seal lubricated in clean PAG oil.
   - Tighten to 9 N.m (80 lb-in).
4. Install, but do not tighten the upper A/C compressor bolt.
5. Install, but do not tighten the lower A/C compressor bolt.
6. Install the A/C compressor stud.
   - Tighten to 9 N.m (80 lb-in).
7. Position the compressor-to-condenser discharge line and install, but do not tighten the A/C compressor nut.
8. Tighten the A/C compressor bolts and nut in the sequence shown in illustration.
   - Tighten to 25 N.m (18 lb-ft).

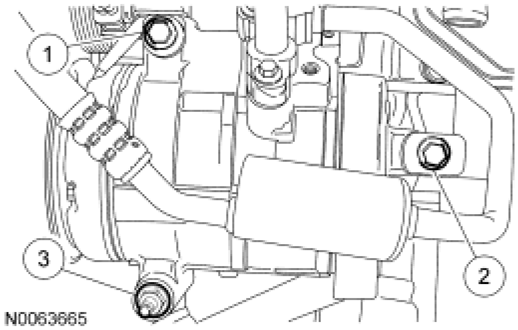


Fig. 3: Tightening A/C Compressor Bolts & Nut In Sequence
Courtesy of FORD MOTOR CO.

9. Connect the field coil electrical connector.
10. Install the RH fender splash shield. For additional information, refer to **FRONT END BODY PANELS** article.
11. Install the drive belt.
12. If filtering of the A/C system is not to be carried out, evacuate, leak test and charge the refrigerant system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

AIR INLET DUCT

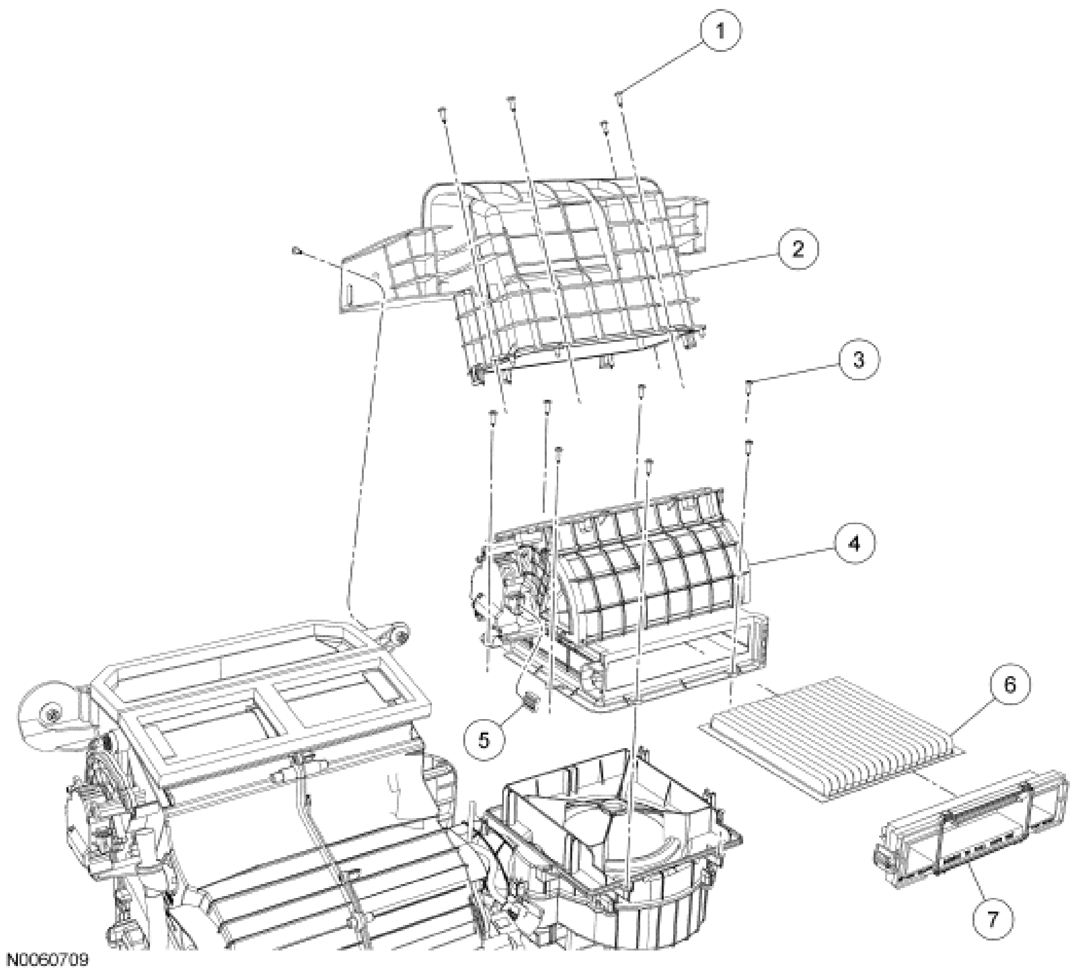


Fig. 4: Exploded View Of Air Inlet Duct
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Fresh air inlet duct screw (5 required)
2	-	Fresh air inlet duct (part of 19B555)
3	-	Air inlet duct screw (7 required)
4	-	Air inlet duct (part of 19B555)
5	19C603	Air inlet mode door actuator electrical connector
6	19N619	Cabin air filter
7	19B735	Cabin air filter cover

REMOVAL AND INSTALLATION

1. Remove the heater core and evaporator core housing. For additional information, refer to **HEATER CORE AND EVAPORATOR CORE HOUSING**.
2. Disconnect the air inlet mode door actuator electrical connector.
3. Remove the cabin air filter cover and the cabin air filter (if equipped) or air inlet screen (if equipped).
4. Remove the 5 fresh air inlet duct screws.
5. Detach the 4 fresh air inlet duct clips and remove the fresh air inlet duct.
6. Remove the 7 air inlet duct screws.
7. Remove the air inlet duct.
8. To install, reverse the removal procedure.

AMBIENT AIR TEMPERATURE SENSOR

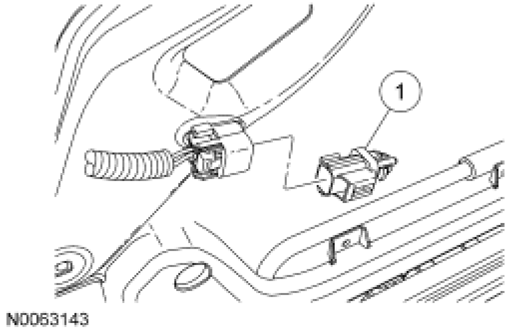


Fig. 5: Identifying Ambient Air Temperature Sensor
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	12A647	Ambient air temperature sensor

REMOVAL AND INSTALLATION

1. Remove the front bumper cover. For additional information, refer to **BUMPERS** article.
2. Disconnect the ambient air temperature sensor electrical connector and remove the ambient air temperature sensor.
3. To install, reverse the removal procedure.

BLOWER MOTOR

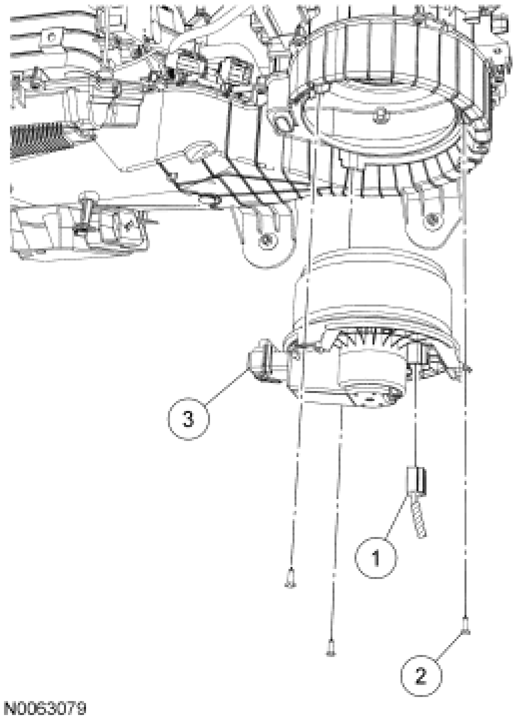


Fig. 6: Exploded View Of Blower Motor
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	19C603	Blower motor electrical connector
2	-	Blower motor screw (3 required)
3	19805	Blower motor

REMOVAL AND INSTALLATION

1. Remove the RH lower instrument panel insulator.
2. Disconnect the blower motor electrical connector.
3. Remove the 3 blower motor screws.
4. Remove the blower motor.
5. To install, reverse the removal procedure.

BLOWER MOTOR RESISTOR

REMOVAL AND INSTALLATION

1. For additional information, refer to **BLOWER MOTOR SPEED CONTROL**.

BLOWER MOTOR SPEED CONTROL

NOTE: Blower motor speed control shown in illustration, blower motor resistor similar.

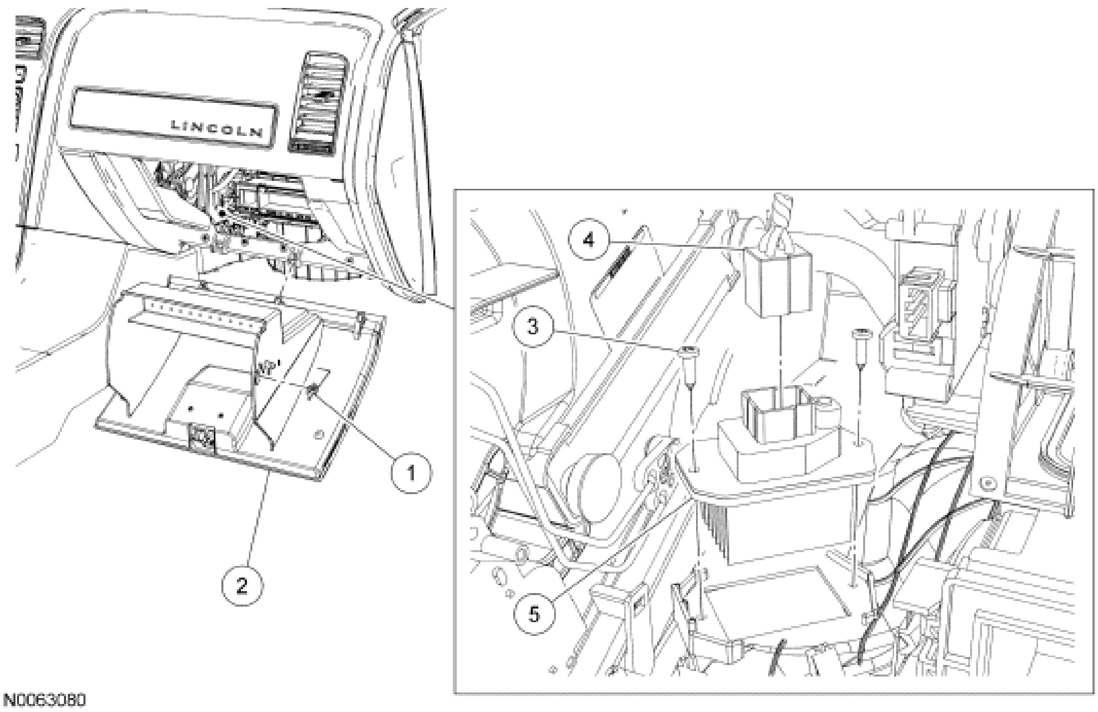


Fig. 7: Identifying Blower Motor Speed Control
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7806200	Glove compartment damper
2	7806024	Glove compartment
3	-	Blower motor speed control screw (2 required)
4	19C603	Blower motor speed control electrical connector
5	19E624	Blower motor speed control (dual-zone electronic automatic temperature control [EATC] vehicles)
5	19A706	Blower motor resistor (electronic manual temperature control [EMTC] vehicles)

REMOVAL AND INSTALLATION

1. Detach the glove compartment damper from the glove compartment.
2. Remove the glove compartment.
3. Disconnect the blower motor speed control electrical connector.
4. Remove the 2 blower motor speed control screws.

5. Remove the blower motor speed control.
6. To install, reverse the removal procedure.

BLOWER MOTOR SWITCH

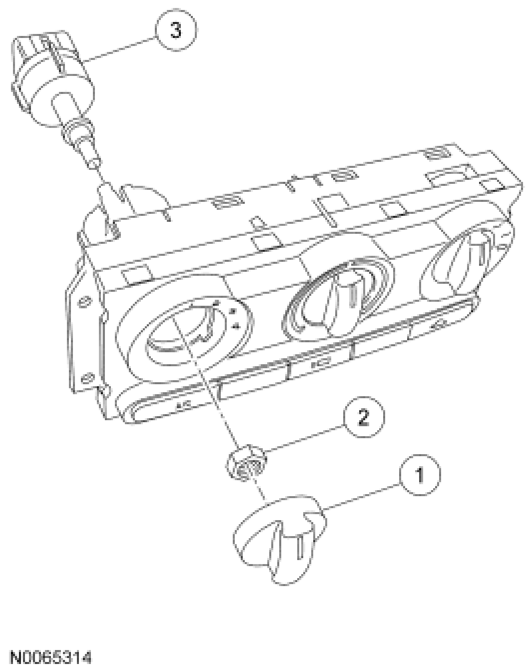


Fig. 8: Exploded View Of Blower Motor Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	18519	Blower motor switch knob
2	-	Blower motor switch nut (part of 18578)
3	18578	Blower motor switch

REMOVAL AND INSTALLATION

1. Remove the climate control module. For additional information, refer to **HEATING VENTILATION AIR CONDITIONING (HVAC) MODULE - EDGE**.
2. Pull to remove the blower motor switch knob.
3. Remove the blower motor switch nut.

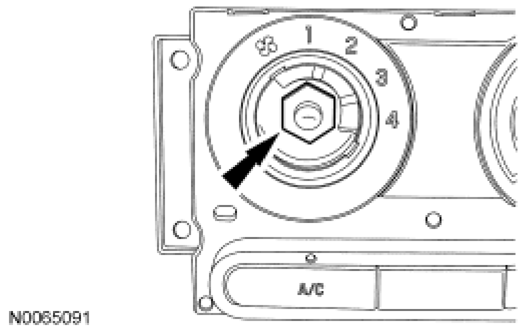


Fig. 9: Identifying Blower Motor Switch Knob
Courtesy of FORD MOTOR CO.

4. Release the 2 retaining tabs with the index finger on each hand, while depressing the blower motor switch shaft with the thumbs to remove the blower motor switch.

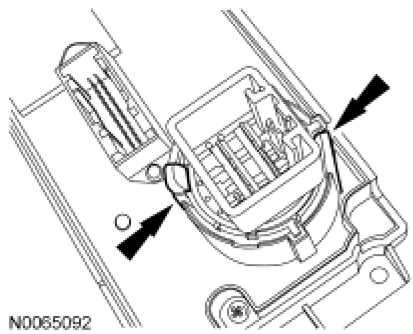


Fig. 10: Identifying Blower Motor Switch Shaft
Courtesy of FORD MOTOR CO.

5. To install, reverse the removal procedure.

COMPRESSOR TO CONDENSER DISCHARGE LINE

MATERIAL

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

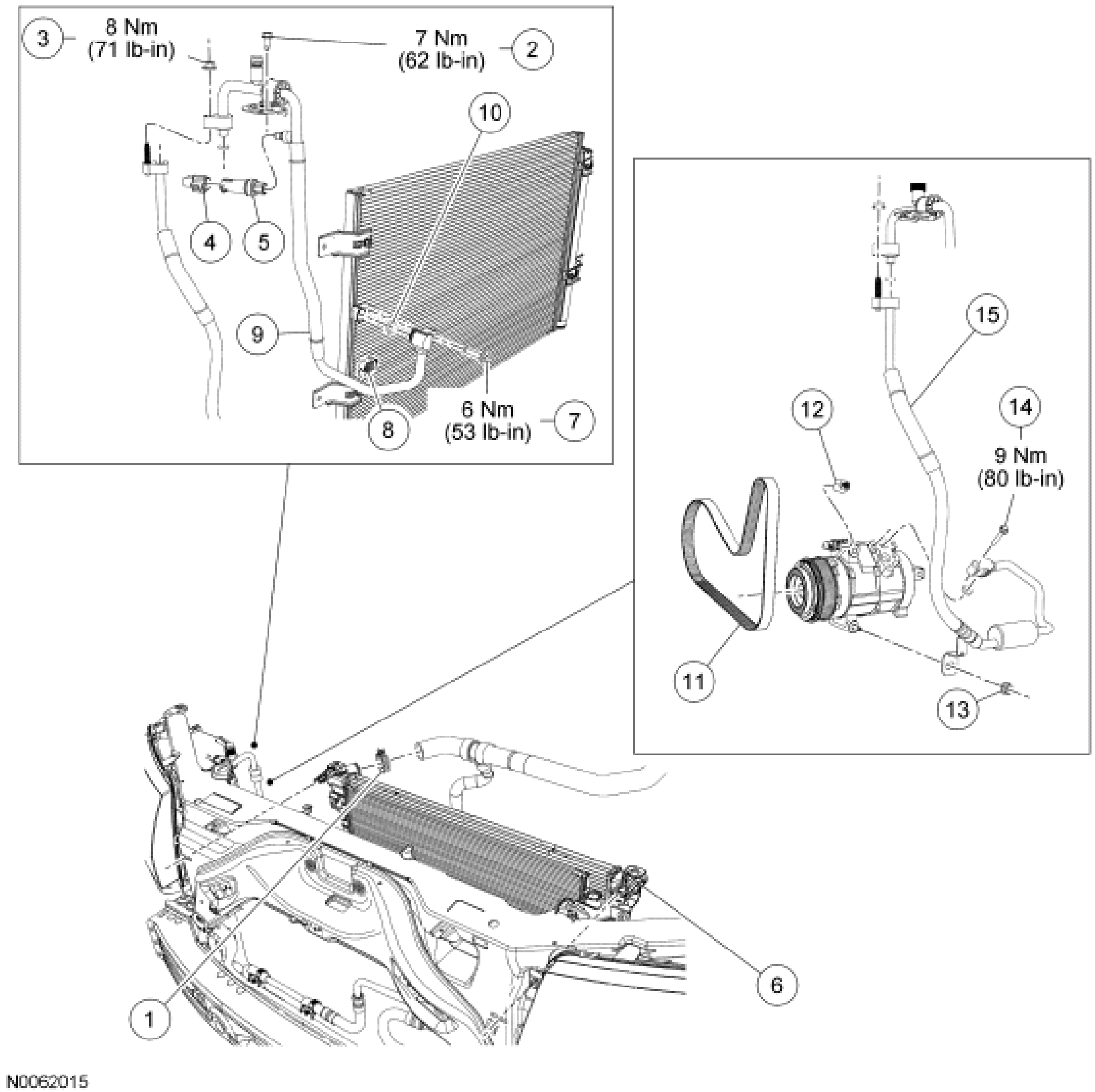


Fig. 11: Identifying Compressor To Condenser Discharge Line With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Upper radiator hose clamp
2	W707400	Compressor-to-condenser discharge line bracket bolt
3	W520413	Compressor-to-condenser discharge line fitting nut
4	12B637	A/C pressure transducer electrical connector
5	19D594	A/C pressure transducer
6	8A193	Radiator bracket
7	W500215	Condenser inlet fitting bolt

8	W704005	Compressor-to-condenser discharge line-to-radiator clip
9	19972	Compressor-to-condenser discharge line (condenser side)
10	19E889	O-ring seal (3 required)
11	8620	Accessory drive belt
12	12A581	Clutch field coil electrical connector
13	W520413	Compressor-to-condenser discharge line bracket nut
14	W500215	A/C compressor discharge fitting bolt
15	19972	Compressor-to-condenser discharge line (compressor side)

REMOVAL AND INSTALLATION

NOTE: **The O-ring seals used on this vehicle are not interchangeable with all similarly sized O-ring seals used on other Ford products. Use only the O-ring seals specified for this vehicle in the Ford master parts catalog.**

NOTE: **The compressor-to-condenser discharge line consists of 2 separately serviceable lines. If only one line is to be removed, only carry out the steps qualified for that line.**

Both compressor-to-condenser discharge lines

1. Recover the refrigerant. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
3. Remove the compressor-to-condenser discharge line fitting nut and disconnect the fitting.
   - Discard the O-ring seal.
   - To install, tighten to 8 N.m (71 lb-in).

   Condenser side compressor-to-condenser discharge line

4. Remove the front bumper cover. For additional information, refer to **BUMPERS** article.
5. Drain the engine coolant. For additional information, refer to **ENGINE COOLING** article.
6. Release the upper radiator hose clamp and disconnect the upper radiator hose from the radiator.
7. Remove the engine cooling fan. For additional information, refer to **ENGINE COOLING** article.
8. Remove the compressor-to-condenser discharge line bracket bolt.
   - To install, tighten to 7 N.m (62 lb-in).
9. Disconnect the A/C pressure transducer electrical connector.

10. Detach the 2 radiator brackets from the core support and position the radiator rearward.
11. Remove the condenser inlet fitting bolt and disconnect the fitting.
    - Discard the O-ring seal.
    - To install, tighten to 6 N.m (53 lb-in).
12. Detach the compressor-to-condenser discharge line-to-radiator clip.
13. Remove the condenser side compressor-to-condenser discharge line.

Compressor side compressor-to-condenser discharge line

14. Remove the drive belt from the A/C compressor pulley.
15. Remove the RH inner fender splash shield.
16. Disconnect the clutch field coil electrical connector.
17. Remove the compressor-to-condenser discharge line bracket nut.
18. Remove the A/C compressor discharge fitting bolt and disconnect the fitting.
    - Discard the O-ring seal.
    - To install, tighten to 9 N.m (80 lb-in).
19. Remove the compressor-to-condenser discharge line.

Both compressor-to-condenser discharge lines

20. To install, reverse the removal procedure.
    - Install new O-ring seals lubricated in clean PAG oil.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
21. Evacuate, leak test and charge the refrigerant system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

CONDENSER CORE

MATERIAL

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

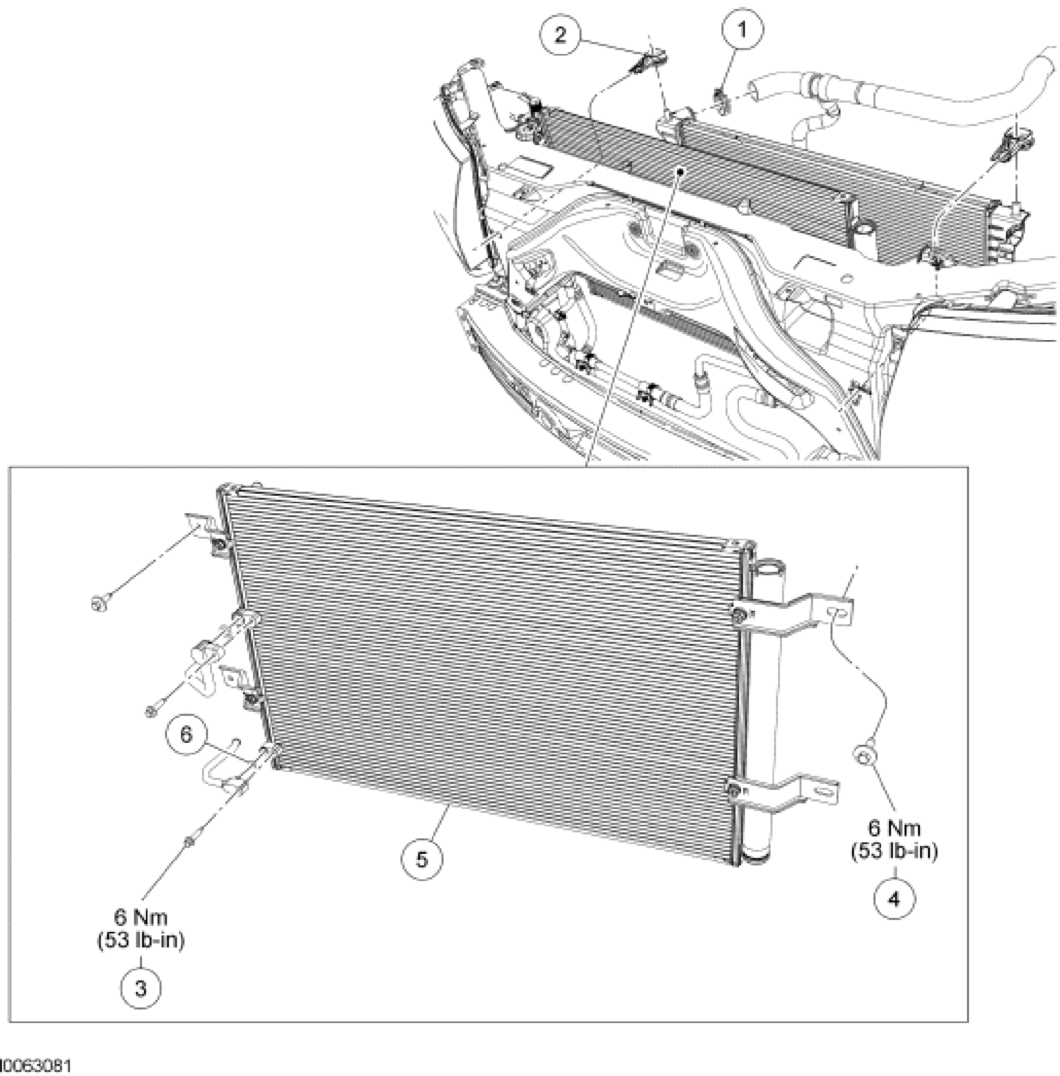


Fig. 12: Exploded View Of Condenser Core With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Upper radiator hose clamp
2	8A193	Radiator bracket (2 required)
3	W500215	Condenser fitting bolt (2 required)
4	W704652	Condenser bolt (2 required)
5	19710	Condenser core
6	19E889	O-ring seal (2 required)

REMOVAL AND INSTALLATION

NOTE: The A/C condenser for this vehicle is produced from the factory with a

receiver/drier desiccant bag installed in the integrated receiver/drier. This receiver/drier desiccant bag may become contaminated with moisture if the A/C condenser is not installed for an extended period of time. Since it cannot be determined how much time has elapsed between production and installation of the unit as a service part, the receiver/drier desiccant bag must be removed and replaced with the separate receiver/drier desiccant bag, which is supplied together with the A/C condenser service part kit. For additional information, refer to DESICCANT BAG.

NOTE: **The O-ring seals used on this vehicle are not interchangeable with all similarly sized O-ring seals used on other Ford products. Use only the O-ring seals specified for this vehicle in the Ford master parts catalog.**

1. Recover the refrigerant. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
2. With the vehicle in NEUTRAL position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
3. Drain the engine coolant. For additional information, refer to **ENGINE COOLING** article.
4. Remove the front bumper cover. For additional information, refer to **BUMPERS** article.
5. Remove the cooling fan. For additional information, refer to **ENGINE COOLING** article.
6. Release the upper radiator hose clamp at the radiator and disconnect the hose.
7. Release the 2 radiator bracket clips from the radiator support and position the radiator rearward.
8. Release the 2 condenser lines from the clips at the radiator.
9. Remove the condenser outlet and inlet fitting bolts and disconnect the fittings.
   - Discard the O-ring seals.
   - To install, tighten to 6 N.m (53 lb-in).
10. Remove the 2 condenser bolts.
    - To install, tighten to 6 N.m (53 lb-in).

NOTE: **The condenser core must be removed from above the vehicle.**

11. Remove the condenser core.
12. To install, reverse the removal procedure.
    - Install new O-ring seals lubricated in clean PAG oil.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
13. Fill the engine cooling system. For additional information, refer to **ENGINE COOLING** article.
14. Evacuate, leak test and charge the refrigerant system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

DESICCANT BAG

MATERIAL

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

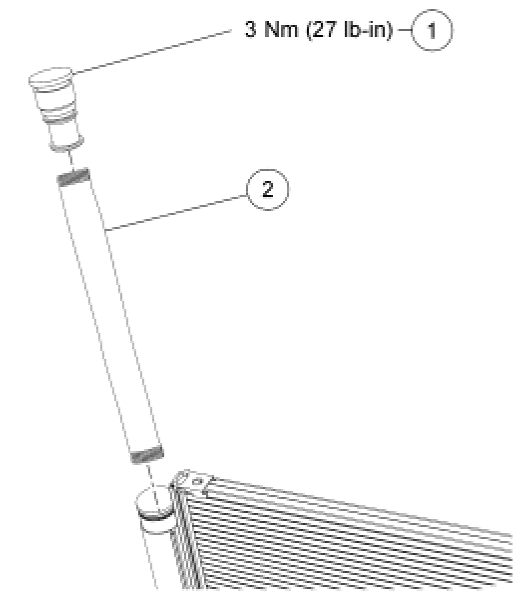


Fig. 13: Exploded View Of Desiccant Bag With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Receiver/drier plug (part of 19E989 kit)
2	19C836	Receiver/drier desiccant bag

REMOVAL AND INSTALLATION

NOTE: **Installation of a new receiver/drier desiccant bag is not required when repairing the A/C system, except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier desiccant bag. Damage to the receiver/drier desiccant bag includes physical damage to the receiver/drier desiccant bag or moisture contamination. Moisture contamination results only from a complete loss of refrigerant and equalization of the refrigerant system pressure with atmospheric pressure for a period longer than one hour. If even a slight amount of positive refrigerant pressure is present in the system before repairs are carried out, the receiver/drier desiccant bag should not be replaced.**

1. Remove the A/C condenser core. For additional information, refer to **CONDENSER CORE**.
2. Remove the receiver/drier plug.
    - To install, tighten to 3 N.m (27 lb-in).
3. Using a suitable tool. Grasp and remove the receiver/drier desiccant bag.
4. To install, reverse the removal procedure.
    - Lubricate the O-ring seal on the new receiver/drier plug with clean PAG oil.

EVAPORATOR OUTLET LINE

MATERIAL

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

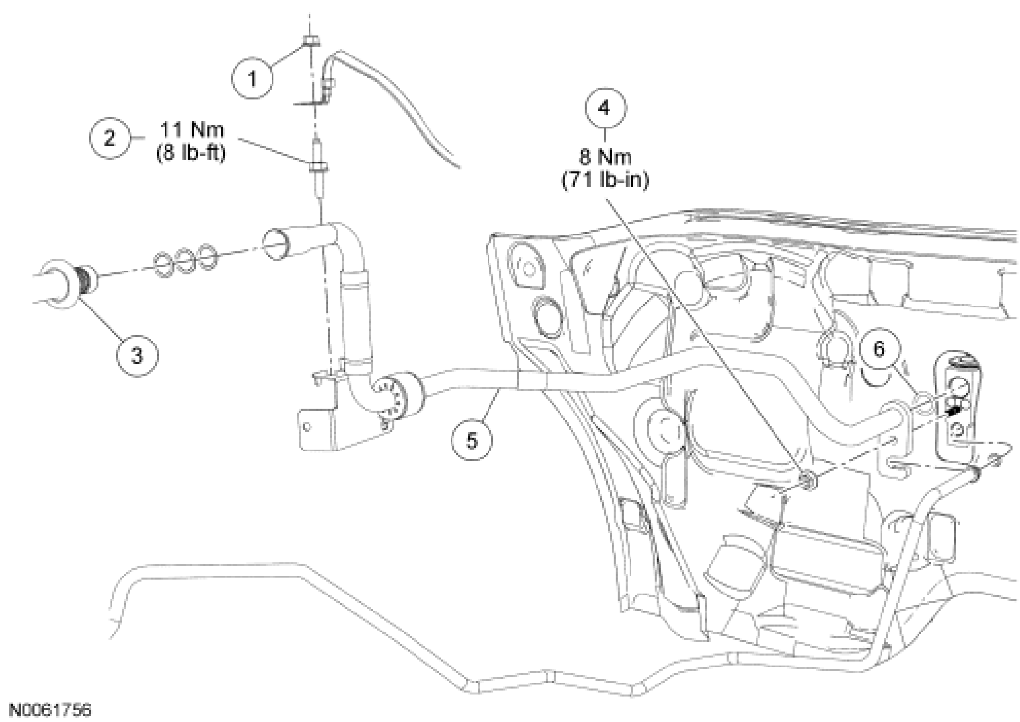


Fig. 14: Exploded View Of Evaporator Outlet Line With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W520413	Ground strap nut
2	N806925	Evaporator outlet line bracket stud bolt
3	-	Evaporator outlet line spring lock coupling (part of 19835)
4	W707142	Thermostatic expansion valve (TXV)

		fitting nut
5	19835	Evaporator outlet line
6	19E889	O-ring seal (5 required)

REMOVAL AND INSTALLATION

NOTE: The O-ring seals used on this vehicle are not interchangeable with all similarly sized O-ring seals used on other Ford products. Use only the O-ring seals specified for this vehicle in the Ford master parts catalog.

NOTE: Installation of a new receiver/drier desiccant bag is not required when repairing the A/C system, except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier desiccant bag. Damage to the receiver/drier desiccant bag includes physical damage to the receiver/drier desiccant bag or moisture contamination. Moisture contamination results only from a complete loss of refrigerant and equalization of the refrigerant system pressure with atmospheric pressure for a period longer than one hour. If even a slight amount of positive refrigerant pressure is present in the system before repairs are carried out, the receiver/drier desiccant bag should not be replaced.

1. Recover the refrigerant. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
2. Remove the ground strap nut at the RH shock tower.
3. Remove the evaporator outlet line bracket stud bolt.
   - To install, tighten to 11 N.m (8 lb-ft).
4. Disconnect the evaporator outlet line spring lock coupling.
   - Discard the O-ring seals.
5. Remove the thermostatic expansion valve (TXV) fitting nut and disconnect the fitting.
   - Discard the O-ring seals.
   - To install, tighten to 8 N.m (71 lb-in).
6. Remove the evaporator outlet line.
7. To install, reverse the removal procedure.
   - Install new O-ring seals lubricated in clean PAG oil.
   - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
8. Evacuate, leak test and charge the refrigerant system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

FOOTWELL DUCT - REAR

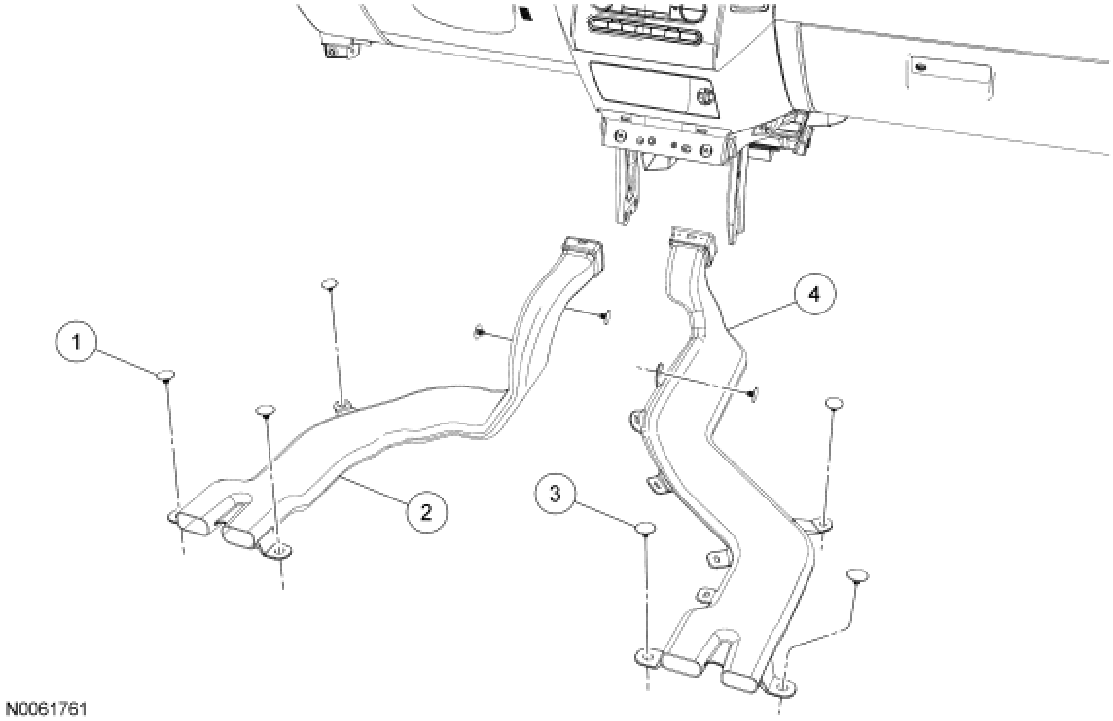


Fig. 15: Exploded View Of Rear Footwell Duct
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N806113	LH rear footwell duct pin-type retainer (5 required)
2	18C420	LH rear footwell duct
3	N806113	RH rear footwell duct pin-type retainer (4 required)
4	18C420	RH rear footwell duct

REMOVAL AND INSTALLATION

LH rear footwell duct only

1. Remove the LH front seat. For additional information, refer to **SEATING** article.
2. Remove the floor console. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
3. Remove the LH front door sill plate.
4. Remove the driver floor carpet pin-type retainers and position the carpet away from the LH rear footwell duct.
5. Remove the 5 LH rear footwell duct pin-type retainers.
6. Remove the 7 floor console support bracket bolts.

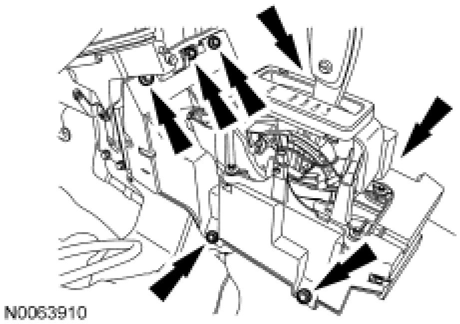


Fig. 16: Identifying Floor Console Support Bracket Bolts
Courtesy of FORD MOTOR CO.

NOTE: **The floor console support bracket will have to be repositioned to remove the LH rear footwell duct.**

7. Remove the LH rear footwell duct.

RH rear footwell duct only

8. Remove the RH floor console side finish panel.
9. Remove the RH front seat. For additional information, refer to **SEATING** article.
10. Remove the RH front door sill plate.
11. Remove the passenger front floor carpet pin-type retainers and position the carpet away from the RH rear footwell duct.
12. Remove the 5 RH rear footwell duct pin-type retainers.
13. Remove the RH rear footwell duct.

Both rear footwell ducts

14. To install, reverse the removal procedure.

HEATER CORE

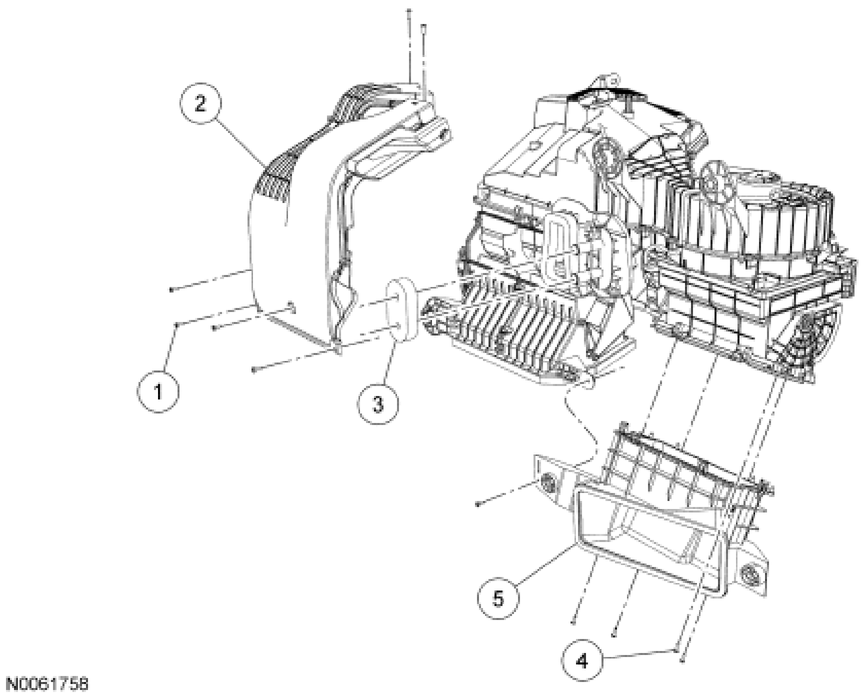


Fig. 17: Exploded View Of Heater Core (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Floor duct screw (6 required)
2	-	Floor duct (part of 19B555)
3	-	Dash panel seal (part of 18529 kit)
4	-	Fresh air inlet duct screw (5 required)
5	-	Fresh air inlet duct (part of 19B555)

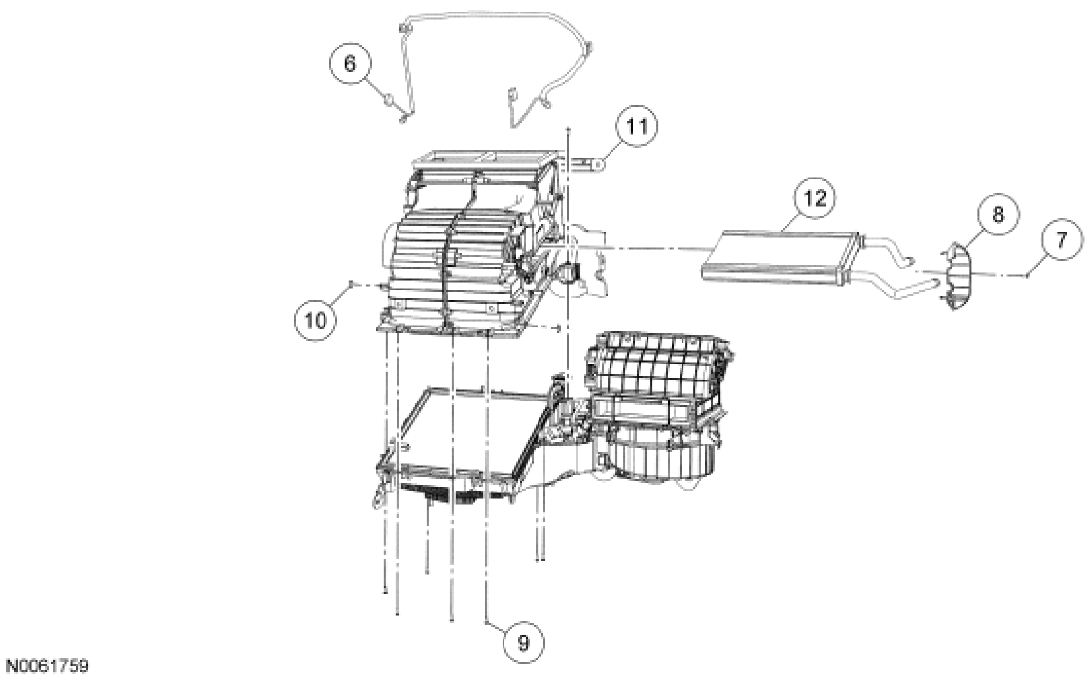


Fig. 18: Exploded View Of Heater Core (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
6	19C603	Plenum chamber wire harness
7	-	Heater core tube bracket screw
8	-	Heater core tube bracket (part of 19B555)
9	-	Plenum chamber screw (8 required)
10	-	Plenum chamber clip (2 required)
11	-	Plenum chamber
12	18476	Heater core

REMOVAL AND INSTALLATION

NOTE: **If a heater core leak is suspected, the heater core must be pressure leak tested before it is removed from the vehicle. For additional information, refer to CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS article.**

1. Remove the heater core and evaporator core housing. For additional information, refer to **HEATER CORE AND EVAPORATOR CORE HOUSING**.
2. Remove the 6 floor duct screws and the floor duct.
3. Remove the heater core tube dash panel seal.
4. Remove the heater tube bracket screw and the heater tube bracket.

5. Remove the 5 fresh air inlet duct screws and the fresh air inlet duct.
6. Disconnect the wire harness from the plenum chamber.
7. Remove the 7 lower facing plenum chamber screws.
8. Orient the heater core and evaporator core housing with the plenum chamber upright.
9. Remove the upper facing plenum chamber screw.
10. Remove the 2 plenum chamber clips and remove the plenum chamber being careful not to allow the evaporator core to become dislodged from the installed position.

CAUTION: Do not handle the heater core by the inlet and/or outlet tube to remove. Handling the heater core by the tubes may damage the joints and lead to failure of the heater core.

11. Remove the heater core in the following sequence.
    1. Grasp the heater core by the core-side of the heater tube connections and partially remove it from the plenum chamber.
    2. Grasp the heater core by the top of the core and remove it from the plenum chamber.

NOTE: It is not necessary to carry out this step if the evaporator core has not become dislodged from the installed position during this procedure.

12. If the evaporator core has been moved at any point during heater core removal, remove the evaporator core, verify that the drain seal is installed in the correct position and install the evaporator core in the correct position.

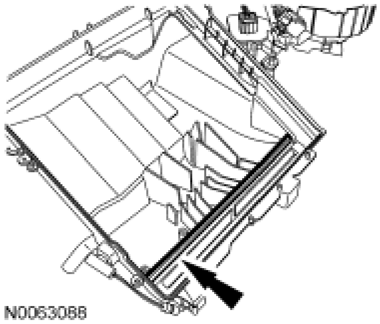


Fig. 19: Identifying Heater Core
Courtesy of FORD MOTOR CO.

13. To install, reverse the removal procedure.

HEATER CORE AND EVAPORATOR CORE HOUSING

MATERIAL

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems)	WSH-M1C231-B

YN-12-D	

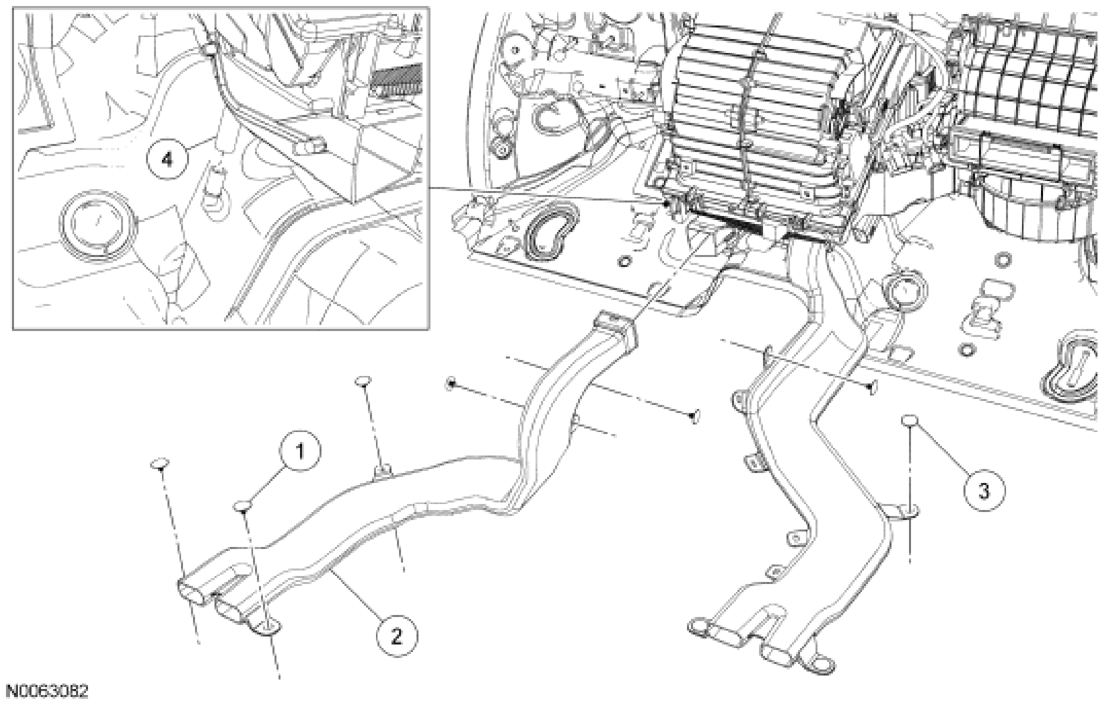


Fig. 20: Exploded View Of Heater Core & Evaporator Core Housing (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N806113	LH rear footwell duct pin-type retainer (5 required)
2	18C420	LH rear footwell duct
3	N806113	RH rear footwell duct front pin-type retainer (2 required)
4	19728	Evaporator drain tube

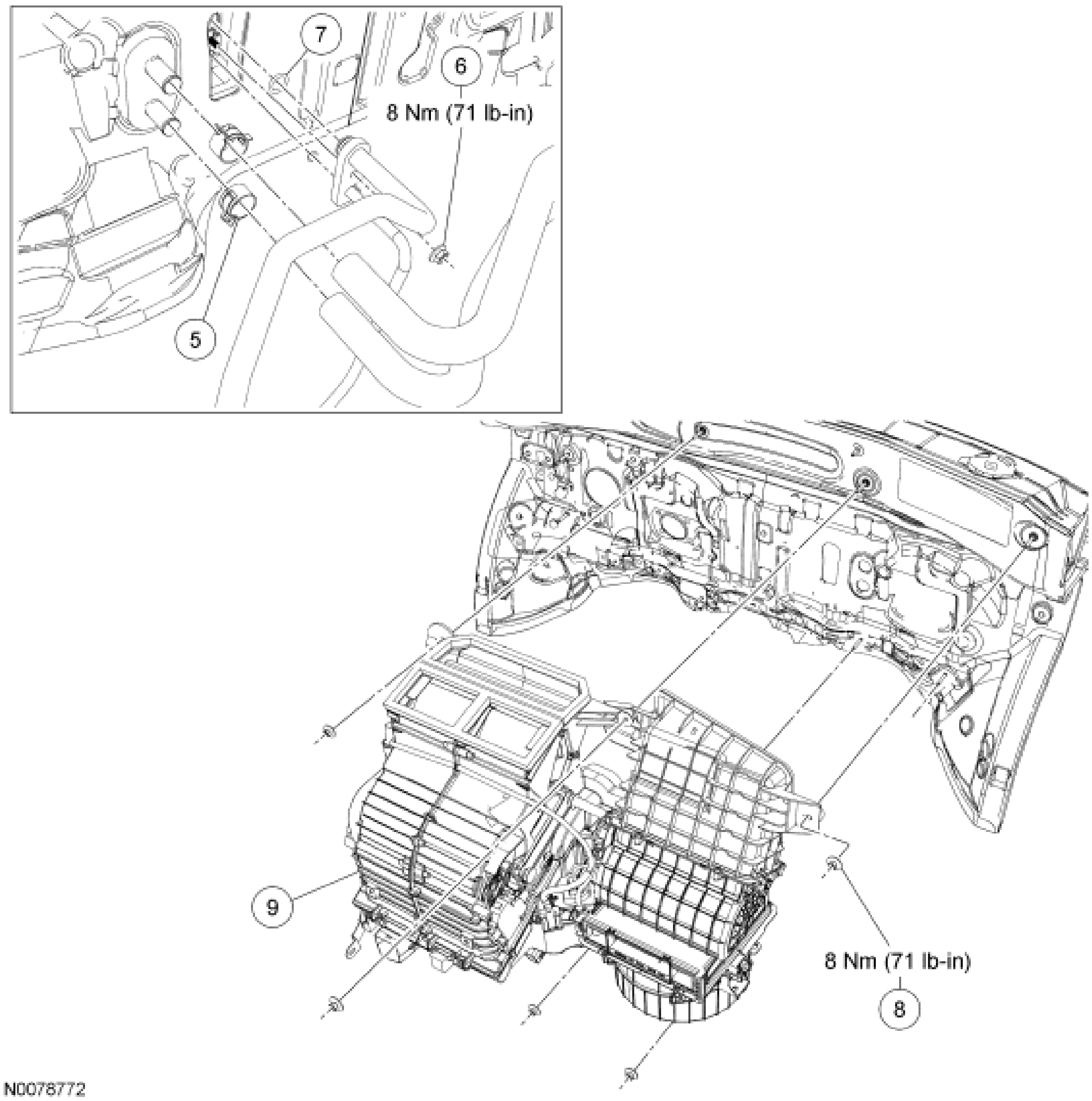


Fig. 21: Identifying Heater Core And Evaporator Core Housing With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
5	W525859	Heater hose clamp (2 required)
6	W707142	Thermostatic expansion valve (TXV) fitting nut
7	19E889	O-ring seal (2 required)
8	W709450	Heater core and evaporator core housing nut (5 required)
9	19B555	Heater core and evaporator core housing

REMOVAL AND INSTALLATION

NOTE: **Installation of a new receiver/drier desiccant bag is not required when repairing the A/C system, except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier desiccant bag. Damage to the receiver/drier desiccant bag includes physical damage to the receiver/drier desiccant bag or moisture contamination. Moisture contamination results only from a complete loss of refrigerant and equalization of the refrigerant system pressure with atmospheric pressure for a period longer than one hour. If even a slight amount of positive refrigerant pressure is present in the system before repairs are carried out, the receiver/drier desiccant bag should not be replaced.**

NOTE: **The O-ring seals used on this vehicle are not interchangeable with all similarly sized O-ring seals used on other Ford products. Use only the O-ring seals specified for this vehicle in the Ford master parts catalog.**

1. Recover the refrigerant. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
2. Drain the engine coolant. For additional information, refer to **ENGINE COOLING** article.
3. Remove the instrument panel. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
4. Remove the 3 driver side carpet pin-type retainers and position the driver side front carpet aside.
5. Remove the 4 LH rear footwell duct pin-type retainers and the LH rear footwell duct.
6. Remove the 2 passenger front carpet pin-type retainers and position the passenger front carpet aside enough to access the 2 front pin-type retainers on the RH rear footwell duct.
7. Remove the 2 front pin-type retainers on the RH rear footwell duct and detach the RH rear footwell duct from the heater core and evaporator core housing.
8. Release the 2 heater hose clamps at the heater core and disconnect the heater hoses.
9. Remove the thermostatic expansion valve (TXV) fitting nut and detach the A/C lines from the TXV.
    - Discard the O-ring seals.
    - To install, tighten to 8 N.m (71 lb-in).

    CAUTION: **The retaining clips on the plastic evaporator drain tube elbow will break if the elbow is removed from inside the vehicle. If the evaporator drain tube elbow must be removed, the retaining clips must be detached from below the vehicle. If the plastic evaporator drain tube elbow does not need to be removed, only detach the evaporator drain tube from the elbow.**

10. Disconnect the evaporator drain tube from the elbow at the floorpan.
11. Remove the 5 heater core and evaporator core housing nuts.
    - To install, tighten to 8 N.m (71 lb-in).
12. Remove the heater core and evaporator core housing.

13. To install, reverse the removal procedure.
    - Install new O-ring seals lubricated in clean PAG oil.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
14. Fill the engine coolant level. For additional information, refer to **ENGINE COOLING** article.
15. Evacuate, leak test and charge the refrigerant system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

HEATING VENTILATION AIR CONDITIONING (HVAC) MODULE - EDGE

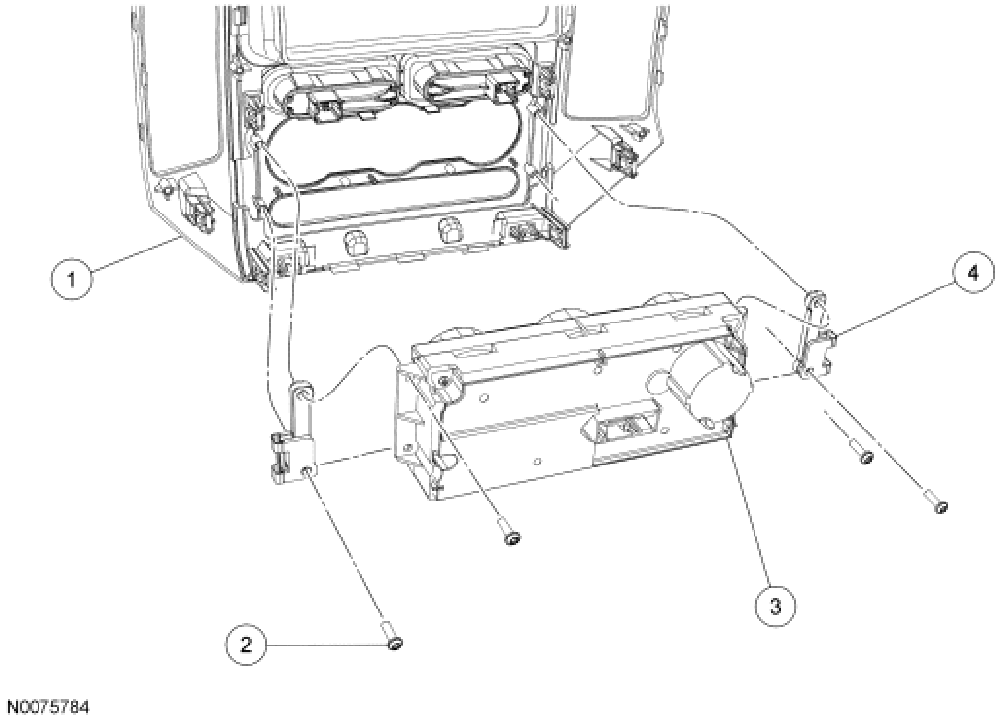


Fig. 22: Exploded View Of Climate Control Module - Edge
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	04302	Upper center instrument panel finish panel
2	W505945	HVAC module screw (4 required)
3	19980	HVAC module
4	78042K50	HVAC module spacer (2 required)

REMOVAL AND INSTALLATION

1. Using a suitable tool, gently pry out the upper center instrument panel finish panel to disengage the clips

and remove the panel.

- Disconnect the electrical connectors.

2. Remove the 4 HVAC module screws.
3. Remove the HVAC module.

NOTE: Be sure the HVAC module spacers are correctly positioned before installing the HVAC module.

4. To install, reverse the removal procedure.

HEATING VENTILATION AIR CONDITIONING (HVAC) MODULE - MKX

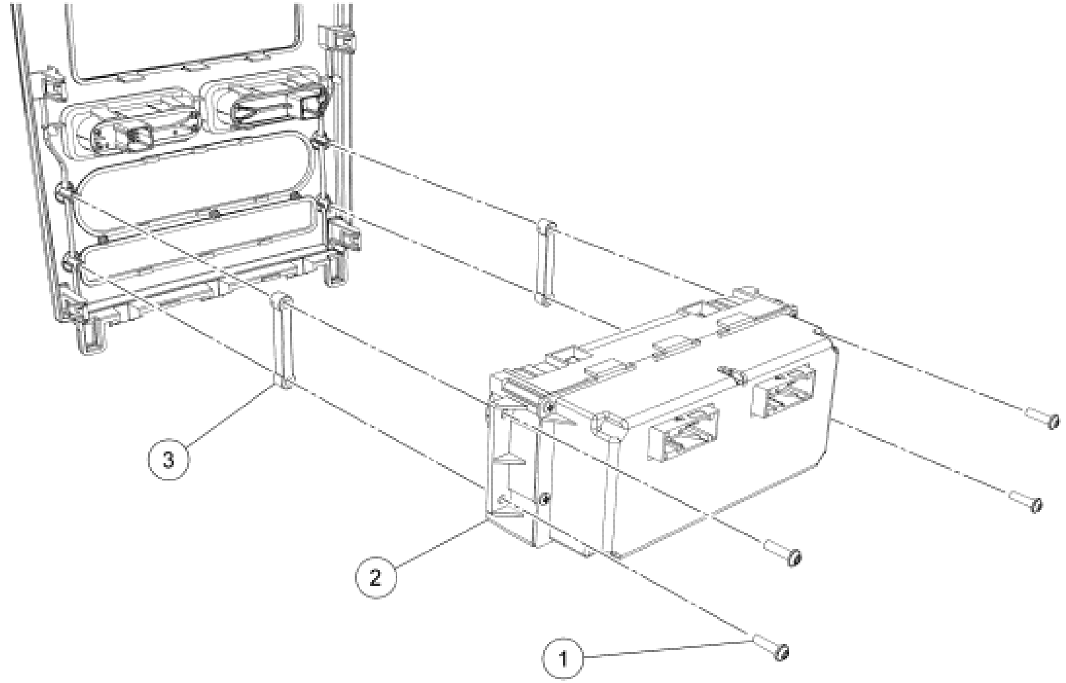


Fig. 23: Exploded View Of Climate Control Module - MKX
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W505945	HVAC module screw (4 required)
2	19980	HVAC module
3	78042K50	HVAC module spacer (2 required)

REMOVAL AND INSTALLATION

1. Remove the center instrument panel finish panel. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.

2. Remove the 4 HVAC module screws.
3. Remove the HVAC module.

NOTE: Be sure the HVAC module spacers are correctly positioned before installing the HVAC module.

4. To install, reverse the removal procedure.

IN-VEHICLE TEMPERATURE SENSOR

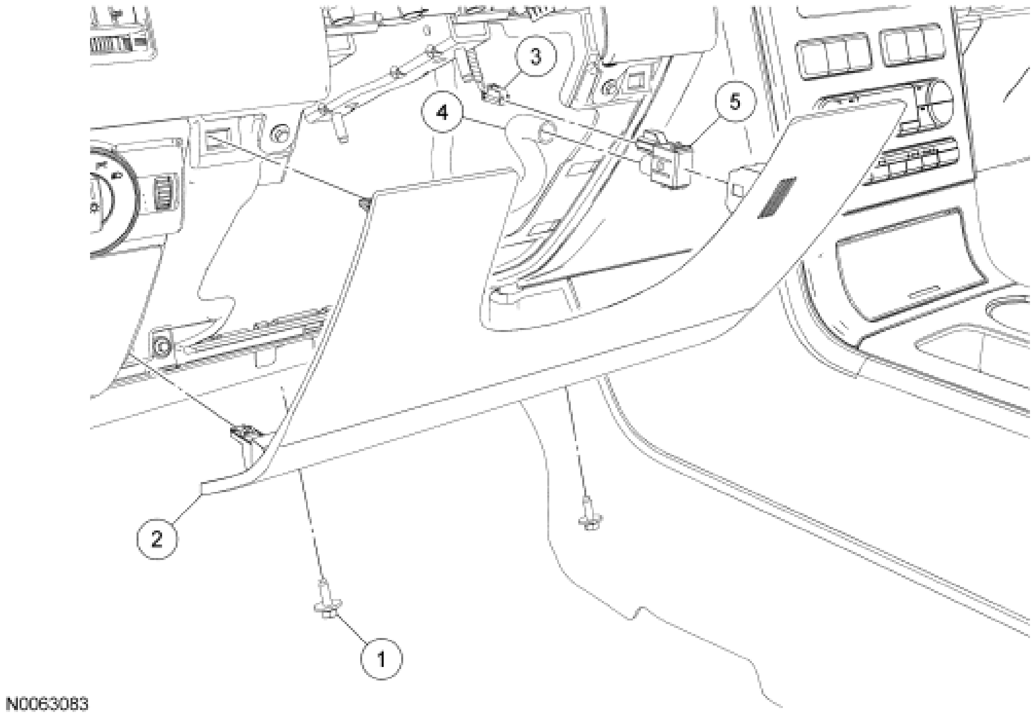


Fig. 24: Exploded View Of In-Vehicle Temperature Sensor
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W708268	Lower steering column opening cover bolt (2 required)
2	7804459	Lower steering column opening cover
3	14401	In-vehicle temperature sensor electrical connector
4	-	In-vehicle temperature hose and venturi assembly (part of 19C734 kit)
5	19C734	In-vehicle temperature sensor

REMOVAL AND INSTALLATION

1. Remove the 2 lower steering column opening cover bolts.
2. Detach the lower steering column opening cover.
3. Disconnect the in-vehicle temperature sensor aspirator hose.
4. Disconnect the in-vehicle temperature sensor electrical connector.
5. Release the 2 in-vehicle temperature sensor clips and remove the in-vehicle temperature sensor.

NOTE: **The in-vehicle temperature sensor hose and venturi assembly can be accessed from below the driver side of the instrument panel.**

6. Remove the in-vehicle temperature sensor hose and venturi assembly.
7. To install, reverse the removal procedure.

MODE DOOR ACTUATOR - AIR INLET DOOR

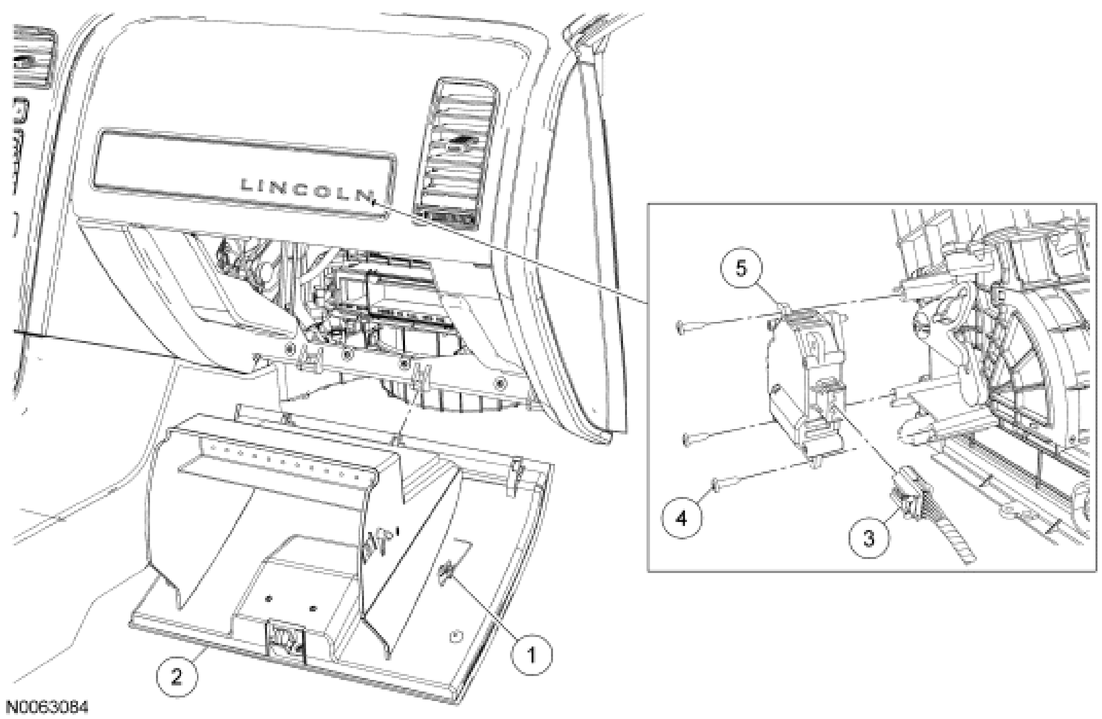


Fig. 25: Air Inlet Mode Door Actuator
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7806200	Glove compartment damper
2	7806024	Glove compartment
3	19C603	Air inlet mode door actuator electrical connector
4	-	Air inlet mode door actuator screw (2

		required)
5	19E616	Air inlet mode door actuator

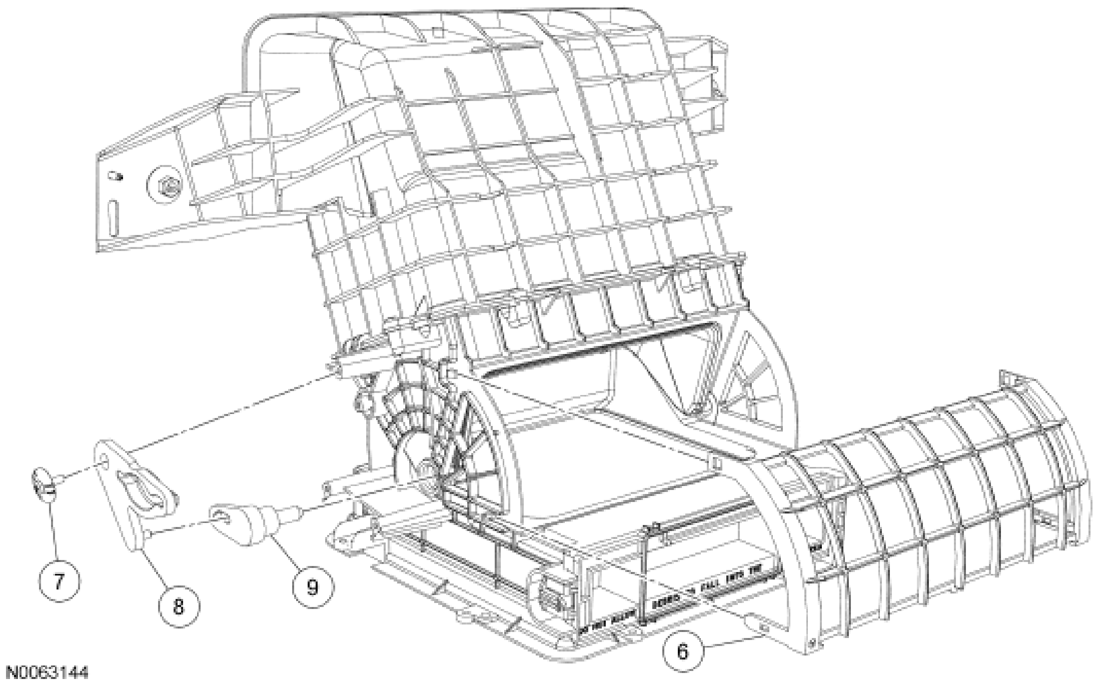


Fig. 26: Air Inlet Mode Door Actuator Linkage
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
6	-	Air inlet duct grille (part of 19B555)
7	-	Air inlet mode door intermediate lever screw (part of 19E616 kit)
8	-	Air inlet mode door intermediate lever (part of 19E616 kit)
9	-	Air inlet mode door lever (part of 19E616 kit)

REMOVAL AND INSTALLATION

NOTE: **It is not required to install the new air inlet door linkage parts included in the air inlet mode door actuator service part kit if only the mode door actuator requires replacement and the linkage parts are not broken or binding.**

Air inlet mode door actuator and linkage

1. Disconnect the glove compartment damper from the glove compartment.

2. Remove the glove compartment.
3. Remove the 3 air inlet mode door actuator screws.
4. Disconnect the air inlet mode door actuator electrical connector.
5. Remove the air inlet mode door actuator.
6. Manually operate and inspect the air inlet mode door and air inlet mode door linkage for incorrect placement or damage.

Air inlet mode door linkage only

7. Remove the air inlet mode door intermediate lever screw.
8. Remove the air inlet mode door intermediate lever.
9. Working through the air inlet duct grille opening, depress the clip and detach the air inlet mode door lever from the air inlet mode door.

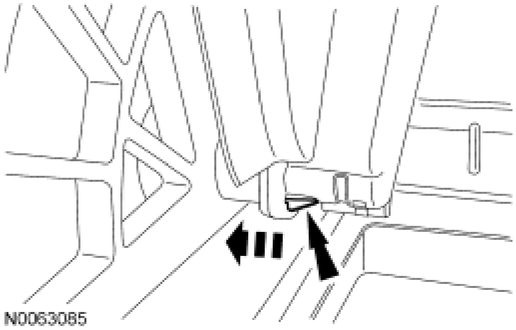


Fig. 27: Depressing Clip & Detaching Air Inlet Mode Door Lever From Air Inlet Mode Door
Courtesy of FORD MOTOR CO.

Air inlet mode door actuator and linkage

NOTE:	**The air inlet mode door must be fully seated in the correct position during installation. If the air inlet mode door is not fully seated, excessive noise will result when the climate control system is operated.**

10. To install, reverse the removal procedure.

MODE DOOR ACTUATOR - DEFROST/PANEL/FLOOR DOOR

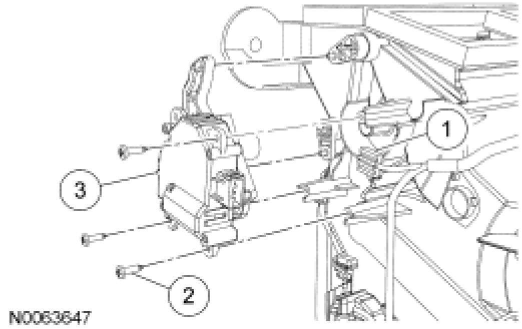


Fig. 28: Exploded View Of Mode Door Actuator - Defrost/Panel/Floor Door
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	19C603	Defrost/panel/floor mode door actuator electrical connector
2	-	Defrost/panel/floor mode door actuator screw (3 required)
3	19C772	Defrost/panel/floor mode door actuator

REMOVAL AND INSTALLATION

NOTE: The defrost/panel/floor mode door actuator can be accessed from below the driver side of the instrument panel.

NOTE: It is not required to install the new defrost/panel/floor mode door linkage parts included in the defrost/panel/floor mode door actuator service part kit if only the mode door actuator requires replacement and the linkage parts are not broken or binding.

Mode door actuator and linkage

1. Remove the 3 defrost/panel/floor mode door actuator screws.
2. Disconnect the defrost/panel/floor mode door actuator electrical connector.
3. Remove the defrost/panel/floor mode door actuator.
4. Manually operate, and inspect the defrost/panel/floor mode door linkage for incorrect placement or damage.

   Mode door actuator linkage only

5. Remove the mode door linkage.
   1. Depress the tab and remove the panel door lever.
   2. Remove the floor/defrost door intermediate lever screw and floor/defrost door intermediate lever.
   3. Pull straight outward to remove the floor/defrost door lever.

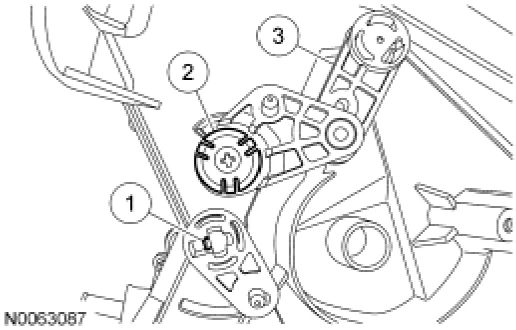


Fig. 29: Identifying Floor/Defrost Door Intermediate Lever
Courtesy of FORD MOTOR CO.

Mode door actuator and linkage

NOTE:	**When installing the mode door actuator, make sure that the panel door lever and floor/defrost intermediate lever are correctly aligned with the mode door actuator cam.**

6. To install, reverse the removal procedure.

REGISTER - CENTER, EDGE

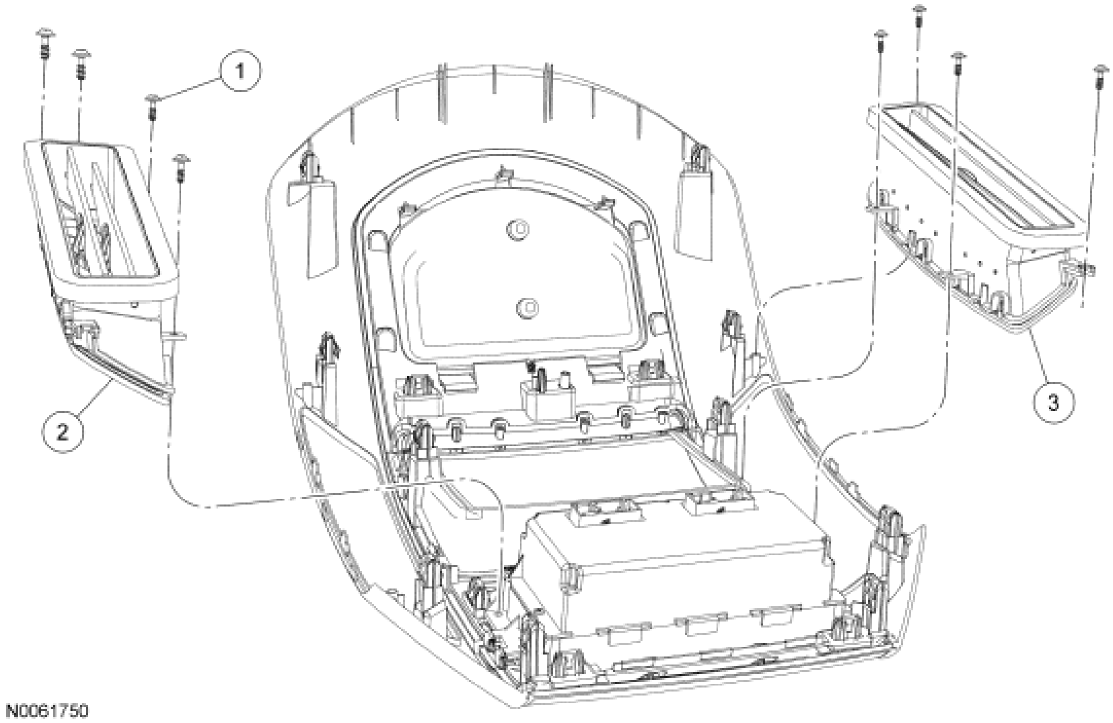


Fig. 30: Exploded View Of Register - Center, Edge
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Center register screw (8 required)
2	19893	RH center register
3	19893	LH center register

REMOVAL AND INSTALLATION

1. Remove the center instrument panel finish panel. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
2. Remove the 8 center register screws.
3. Remove the center registers.
4. To install, reverse the removal procedure.

REGISTER - CENTER, MKX

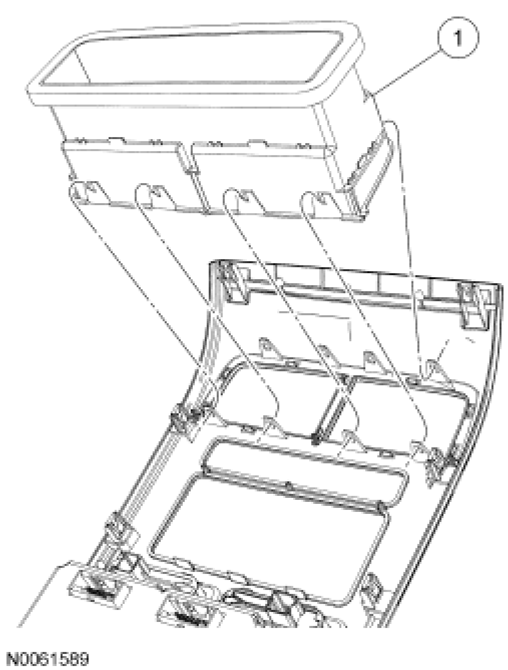


Fig. 31: Exploded View Of Register - Center, MKX
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	19893	Center register

REMOVAL AND INSTALLATION

1. Remove the center instrument panel finish panel. For additional information, refer to **INSTRUMENT**

PANEL AND CONSOLE article.

2. Release the 8 center register clips and remove the center register assembly.
3. To install, reverse the removal procedure.

REGISTER - DRIVER AND PASSENGER SIDE, EDGE

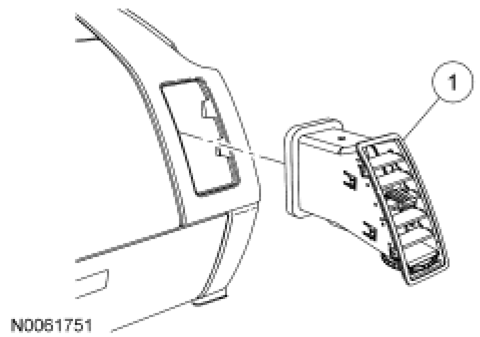


Fig. 32: Exploded View Of Register - Driver and Passenger Side, Edge
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	19893	Register

REMOVAL AND INSTALLATION

NOTE: **Passenger side register shown in illustration, driver side similar.**

CAUTION: **Do not pry on the outer register trim bezel. The clips on the outer register trim bezel break if pried on to remove the register.**

1. Working through the register vein openings, insert a suitable hook shaped pick behind each of the 4 register clips while gently pulling the register rearward with the hook to disengage the clip.
2. Remove the driver or passenger side instrument panel register.
3. To install, reverse the removal procedure.

REGISTER - DRIVER SIDE, MKX

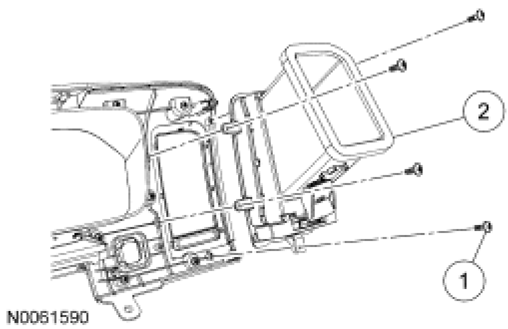


Fig. 33: Exploded View Of Register - Driver Side, MKX
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701679	Driver side register screw (4 required)
2	19893	Driver side register

REMOVAL AND INSTALLATION

1. Remove the instrument cluster finish panel. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
2. Remove the 4 driver side register screws and the driver side register.
3. To install, reverse the removal procedure.

REGISTER - PASSENGER SIDE, MKX

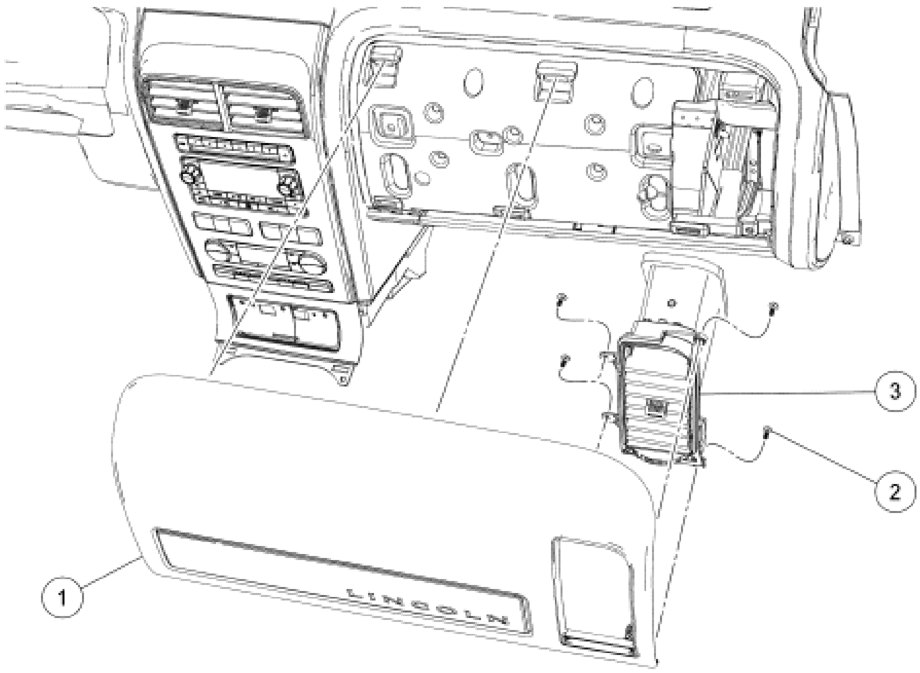


Fig. 34: Exploded View Of Register - Passenger Side, MKX
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7804338	RH instrument panel finish panel
2	W701679	Passenger side register screw (4 required)
3	19893	Passenger side register

REMOVAL AND INSTALLATION

1. Disengage the 6 clips and remove the RH instrument panel finish panel.
2. Remove the 4 passenger side register screws and the passenger side register.
3. To install, reverse the removal procedure.

TEMPERATURE BLEND DOOR ACTUATOR - LH

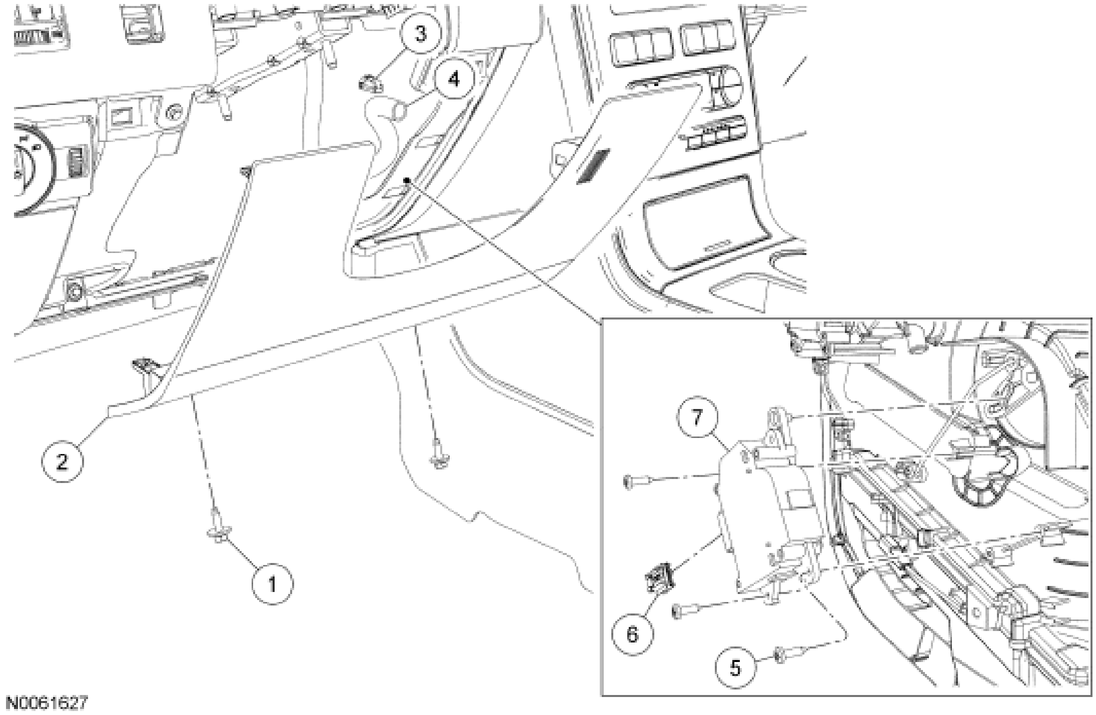


Fig. 35: Exploded View Of Temperature Blend Door Actuator - LH
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W708268	Lower steering column opening cover bolt (2 required)
2	7804459	Lower steering column opening cover
3	14401	In-vehicle temperature sensor electrical connector
4	19C739	In-vehicle temperature sensor aspirator hose
5	-	LH temperature blend door actuator screw (3 required)
6	19C603	LH temperature blend door actuator electrical connector
7	19E616	LH temperature blend door actuator

REMOVAL AND INSTALLATION

NOTE: **It is not required to install the new LH temperature blend door linkage parts included in the LH temperature blend door actuator service part kit if only the temperature blend door actuator requires replacement and the linkage parts are not broken or binding.**

LH temperature blend door actuator and linkage

1. Remove the 2 lower steering column opening cover bolts.
2. Detach the lower steering column opening cover.
3. Disconnect the in-vehicle temperature sensor aspirator hose and electrical connector.
4. Position the instrument panel wire harness away from the LH temperature blend door actuator.
5. Remove the 3 LH temperature blend door actuator screws.
6. Disconnect the LH temperature blend door actuator electrical connector.
7. Remove the LH temperature blend door actuator.
8. Manually operate, and inspect the LH temperature blend door linkage for incorrect placement, binding or damage.

   LH temperature blend door linkage only

9. Detach the 2 retaining tabs and remove the LH temperature blend door linkage.

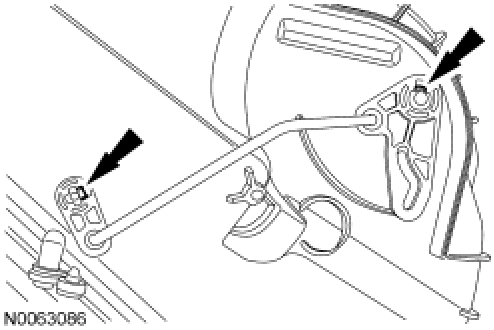


Fig. 36: Locating Retaining Tabs
Courtesy of FORD MOTOR CO.

LH temperature blend door actuator and linkage

10. To install, reverse the removal procedure.

TEMPERATURE BLEND DOOR ACTUATOR - RH, DUAL-ZONE EATC

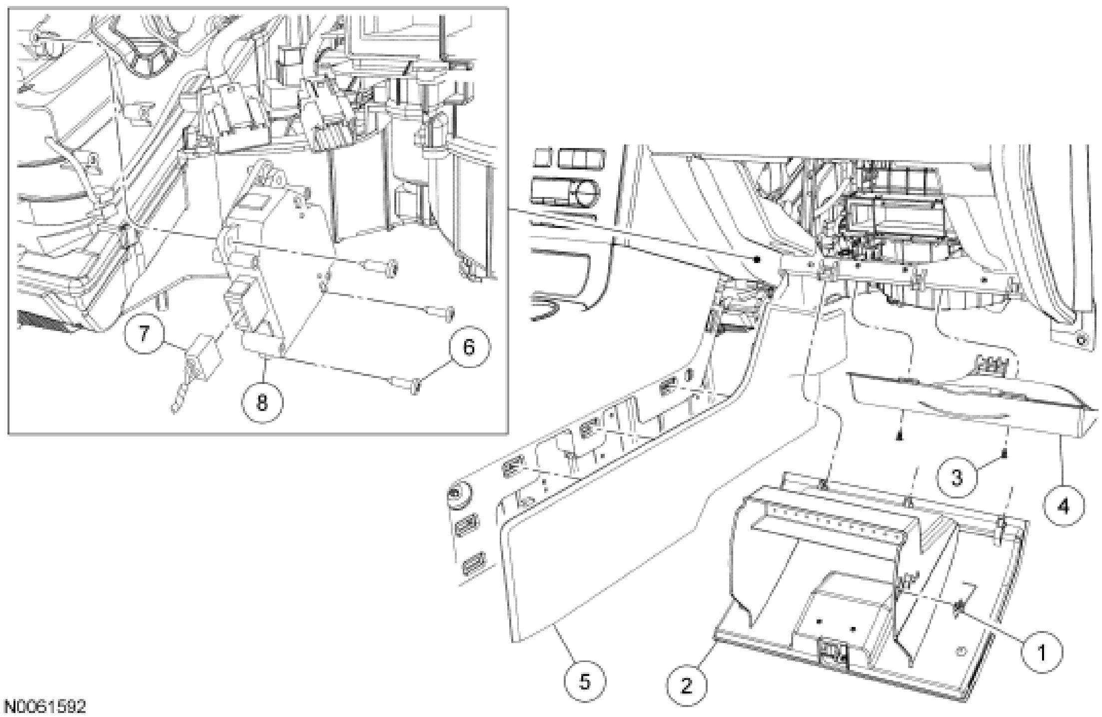


Fig. 37: Exploded View Of Temperature Blend Door Actuator - RH, Dual-Zone EATC
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7806200	Glove compartment damper
2	7806024	Glove compartment
3	-	RH lower instrument panel insulator pin-type retainer (2 required)
4	-	RH lower instrument panel insulator
5	7804608	RH lower floor console trim panel
6	-	RH temperature blend door actuator screw (3 required)
7	19C603	RH temperature blend door actuator electrical connector
8	19E616	RH temperature blend door actuator

REMOVAL AND INSTALLATION

NOTE: **It is not required to install the new RH temperature blend door linkage parts included in the RH temperature blend door actuator service part kit if only the temperature blend door actuator requires replacement and the linkage parts are not broken or binding.**

RH temperature blend door actuator and linkage

1. Disconnect the glove compartment damper from the glove compartment.
2. Remove the glove compartment.
3. Remove the RH lower instrument panel insulator.
4. Remove the RH lower floor console trim panel.
5. Remove the 3 RH temperature blend door actuator screws.
6. Disconnect the RH temperature blend door actuator electrical connector.
7. Remove the RH temperature blend door actuator.
8. Manually operate, and inspect the RH temperature blend door linkage for incorrect placement, binding or damage.

   RH temperature blend door actuator linkage only

9. Detach the 2 retaining tabs and remove the RH temperature blend door linkage.

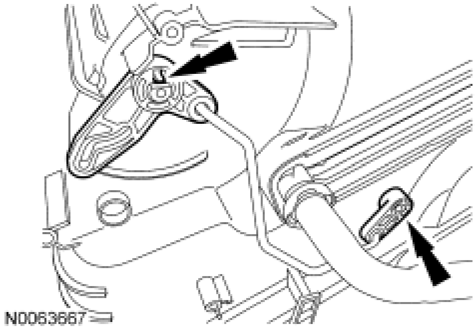


Fig. 38: Locating Retaining Tabs
Courtesy of FORD MOTOR CO.

All vehicles

10. To install, reverse the removal procedure.

THERMOSTATIC EXPANSION VALVE

MATERIAL

Item	**Specification**
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

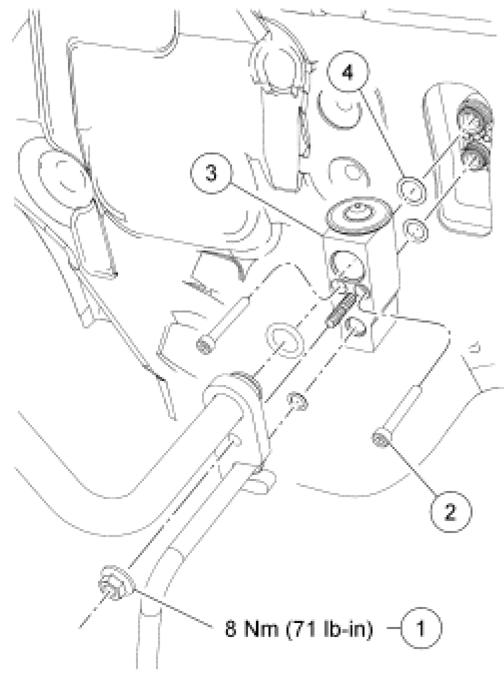


Fig. 39:
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W707142	Thermostatic expansion valve (TXV) fitting nut
2	-	TXV bolt (2 required) (part of 19849 service kit)
3	19849	TXV
4	19E889	O-ring seal (4 required)

REMOVAL AND INSTALLATION

NOTE: **Installation of a new receiver/drier desiccant bag is not required when repairing the A/C system, except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier desiccant bag. Damage to the receiver/drier desiccant bag includes physical damage to the receiver/drier desiccant bag or moisture contamination. Moisture contamination results only from a complete loss of refrigerant and equalization of the refrigerant system pressure with atmospheric pressure for a period longer than one hour. If even a slight amount of positive refrigerant pressure is present in the system before repairs are carried out, the receiver/drier desiccant bag should not be replaced.**

NOTE: **The O-ring seals used on this vehicle are not interchangeable with all similarly**

sized O-ring seals used on other Ford products. Use only the O-ring seals specified for this vehicle in the Ford master parts catalog.

1. Recover the refrigerant. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
2. Remove the thermostatic expansion valve (TXV) fitting nut and disconnect the fitting.
    - Discard the O-ring seals.
    - To install, tighten to 8 N.m (71 lb-in).
3. Remove the 2 TXV bolts.
4. Remove the TXV.
    - Discard the O-ring seals.
5. To install, reverse the removal procedure.
    - Install new O-ring seals lubricated in clean PAG oil.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
6. Evacuate, leak test and charge the refrigerant system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

2008 BRAKES

Hydraulic Brake Actuation - Edge & MKX

SPECIFICATIONS

Material

Item	Specification	Fill Capacity
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1	803-821 ml (1.697-1.735 pt)

TORQUE SPECIFICATIONS

Description	Nm	lb-ft
Brake master cylinder nuts	25	18
Brake pedal bracket nuts	22	16
Master cylinder brake tube fittings	28	21

DESCRIPTION AND OPERATION

HYDRAULIC BRAKE ACTUATION

The hydraulic brake actuation system consists of the following components:

- Brake master cylinder
- Brake fluid reservoir
- Brake pedal and bracket assembly
- Brake tubes and hoses
- Hydraulic control unit (HCU)

Hydraulic Brake Actuation - The brake pedal is connected to the power brake booster, which is connected to the brake master cylinder. When the brake pedal is pressed, brake fluid is forced from the master cylinder through the steel tubing and flexible hoses to the front disc brake calipers and the rear disc brake calipers. The front disc brake caliper pistons are forced outward against the brake pads, which contact the braking surface of the brake discs. The brake fluid calipers are pressurized by the master cylinder, forcing the disc brake caliper pistons outward against the brake pads. The brake pads press against the braking surface on the brake discs. When the brake pedal is released, the pressure is relieved, returning the brake caliper pistons and the brake pads to the at-rest position.

The dual brake system is split front and rear with the front wheel brakes comprising one circuit and the rear wheel brakes the other circuit.

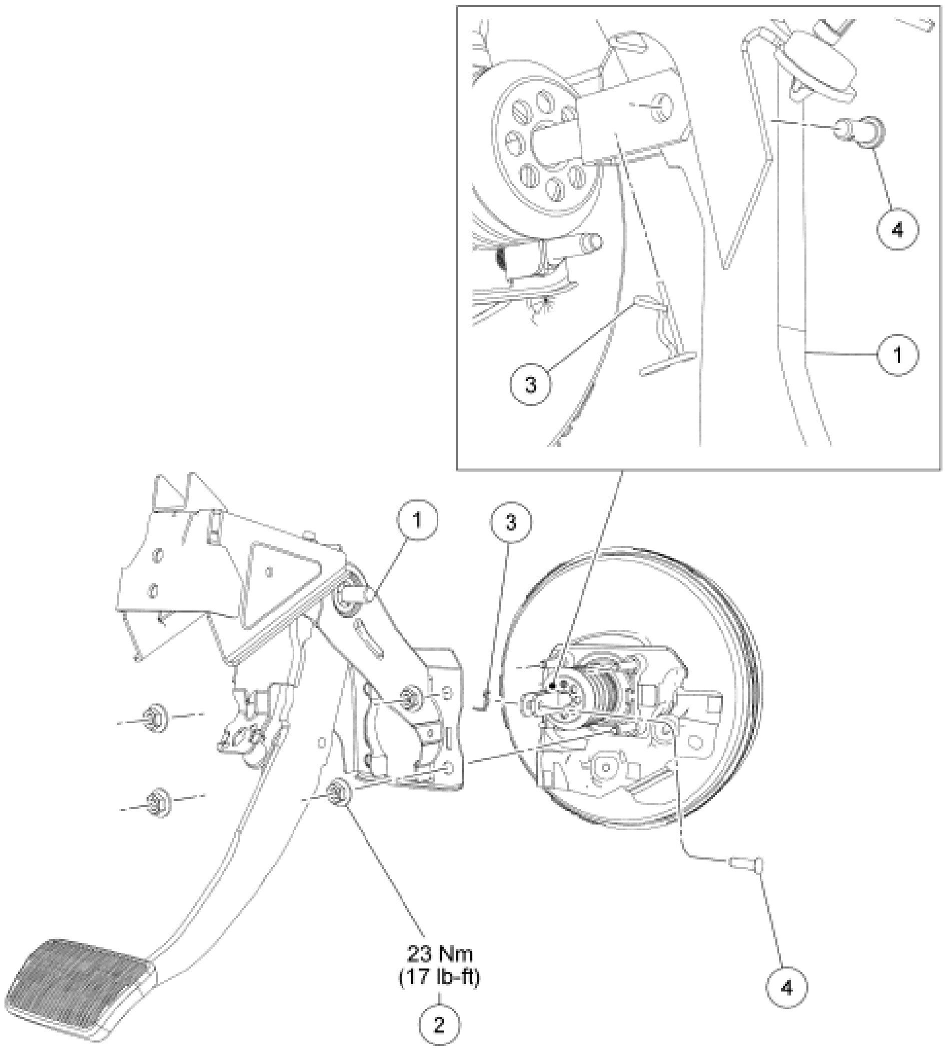
DIAGNOSTIC TESTS

HYDRAULIC BRAKE ACTUATION

Refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

BRAKE PEDAL AND BRACKET



N0076975

Fig. 1: Identifying Brake Pedal and Bracket
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2455	Brake pedal and bracket
2	W707144	Brake pedal bracket nut (4 required)

3	7B096	Brake booster push rod pin clip
4	2N513	Brake booster push rod pin

CAUTION: Do not remove or loosen the fasteners that hold the 2 brake pedal bracket halves together. Failure to follow these instructions may result in damage to the brake pedal bracket.

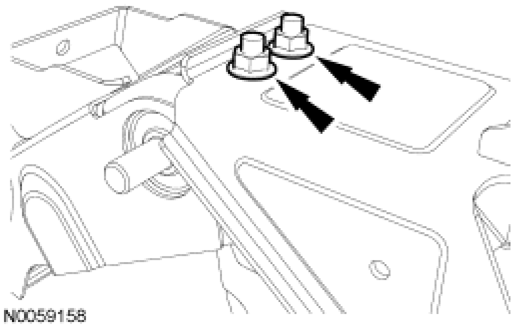


Fig. 2: Locating Fasteners On Brake Pedal Bracket Halves

REMOVAL AND INSTALLATION

CAUTION: Do not service the brake pedal or brake booster without first removing the stoplamp switch and speed control deactivator switch. These switches must be removed with the brake pedal in the at-rest position. Switch plungers must be compressed for the switch to rotate in the bracket. Attempting to remove the switch when the plunger is extended (during pedal apply) will result in damage to the switch.

1. Remove the stoplamp switch. For additional information, refer to **EXTERIOR LIGHTING** article.
2. Remove the instrument panel. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
3. Remove the brake booster push rod pin clip and pin, then disconnect the push rod from the brake pedal arm.
4. Remove the 4 brake pedal bracket nuts.
   - To install, tighten to 22 Nm (16 lb-ft).
5. Lift the brake pedal and bracket off of the hangers and remove the brake pedal and bracket.

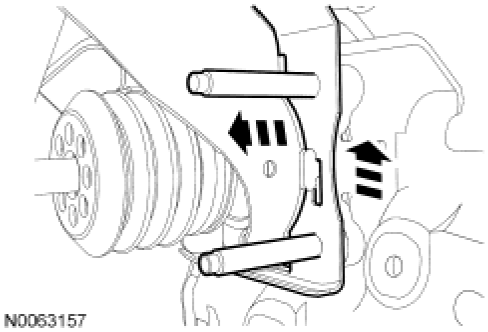


Fig. 3: Lifting Brake Pedal & Bracket Off Of Hangers & Removing Brake Pedal & Bracket
Courtesy of FORD MOTOR CO.

CAUTION: Do not press, pull or otherwise move the brake pedal while installing the stoplamp switch or the speed control deactivator switch. These switches must be installed with the booster push rod attached to the brake pedal and with the brake pedal in the at-rest position. Installing these switches with the brake pedal in any other position will result in incorrect adjustment and may damage the switches.

6. To install, reverse the removal procedure.
    - Apply brakes several times to verify correct brake operation.

BRAKE MASTER CYLINDER

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

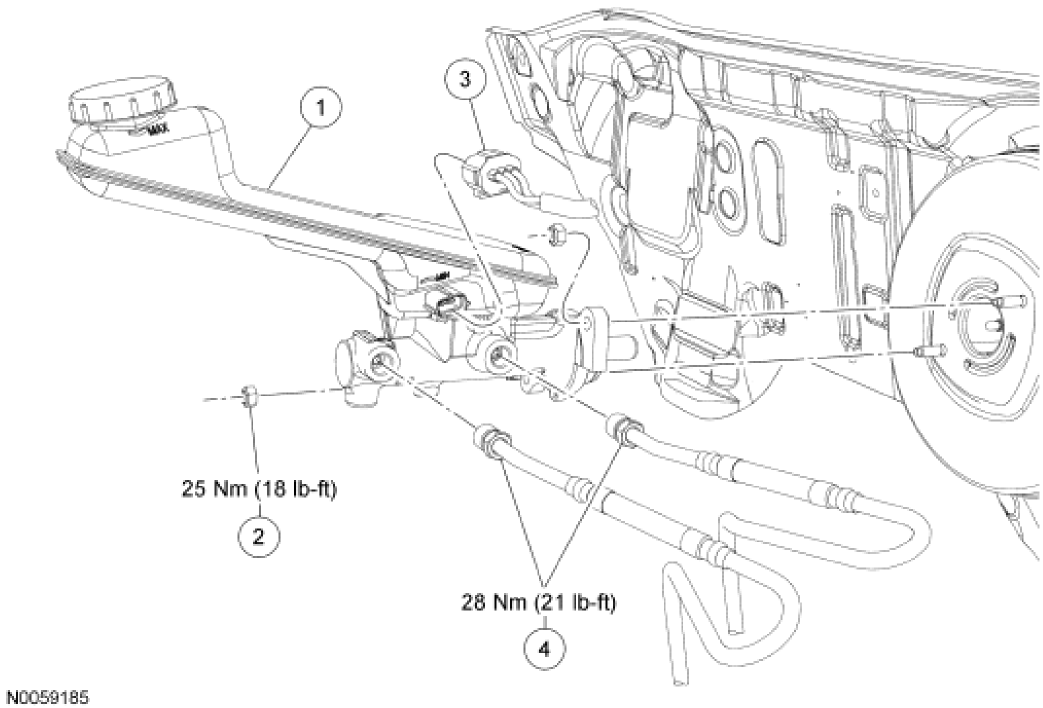


Fig. 4: Exploded View Of Brake Master Cylinder With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2B195	Brake master cylinder and reservoir assembly
2	W520011	Brake master cylinder nut (2 required)
3	-	Brake fluid level switch electrical connector (part of 14A290)
4	2A335 RH/ 2286 LH	Master cylinder brake tube fittings

REMOVAL AND INSTALLATION

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the air cleaner and air cleaner outlet tube. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.
2. Remove the battery and battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Disconnect the brake fluid level switch electrical connector.
4. Using a suitable suction device, remove the brake fluid from the brake master cylinder reservoir.
5. Disconnect the master cylinder brake tube fittings, plug the brake tubes and the brake master cylinder ports.
    - To install, tighten to 28 Nm (21 lb-ft).
6. Remove the 2 brake master cylinder nuts.
    - To install, tighten to 25 Nm (18 lb-ft).
7. Remove the brake master cylinder and reservoir.
8. To install, reverse the removal procedure.
    - Bleed the master cylinder and brake system. For additional information, refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.

2008 ENGINE

Engine Ignition - 3.5L - Edge & MKX

SPECIFICATIONS

MATERIAL SPECIFICATIONS

Item	Specification	Fill Capacity
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A	-

GENERAL SPECIFICATIONS

Item	Specification
Engine Ignition	
Spark plug	AYFS-22FM
Spark plug gap	1.29-1.45 mm (0.051-0.057 in)

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Ignition coil-on-plug bolts	7	62
Spark plugs	15	133

DESCRIPTION AND OPERATION

ENGINE IGNITION

The Electronic Ignition (EI) system is a coil-on-plug ignition system. The coil-on-plug ignition system consists of:

- Camshaft Position (CMP) sensors.
- a Crankshaft Position (CKP) sensor.
- ignition coil-on-plugs.
- spark plugs.

The CMP sensors:

- are variable reluctance sensors.
- are mounted in the rear of the cylinder head.
- are triggered by a 3-plus-1 timing wheel on each intake camshaft.
- provides camshaft rotational location information to the PCM.

The CKP sensor:

- is a variable reluctance sensor.
- is triggered by a 36-minus-1 tooth trigger wheel mounted on the crankshaft, at the rear of the engine.
- provides base timing and crankshaft speed (RPM) to the PCM.

The ignition coil-on-plugs:

- change low voltage signals from the PCM to high voltage pulses.
- produce the high voltage pulses to the spark plugs.
- are connected directly to each spark plug.
- have replaceable coil seals.

The spark plugs:

- change high voltage pulses into a spark which ignites the fuel and air mixture.
- originally equipped on the vehicle have a platinum-enhanced fine wire electrode for long life.

DIAGNOSTIC TESTS

ENGINE IGNITION

Refer to the **Introduction - Gasoline Engines** article.

REMOVAL AND INSTALLATION

ENGINE IGNITION COMPONENTS - EXPLODED VIEW

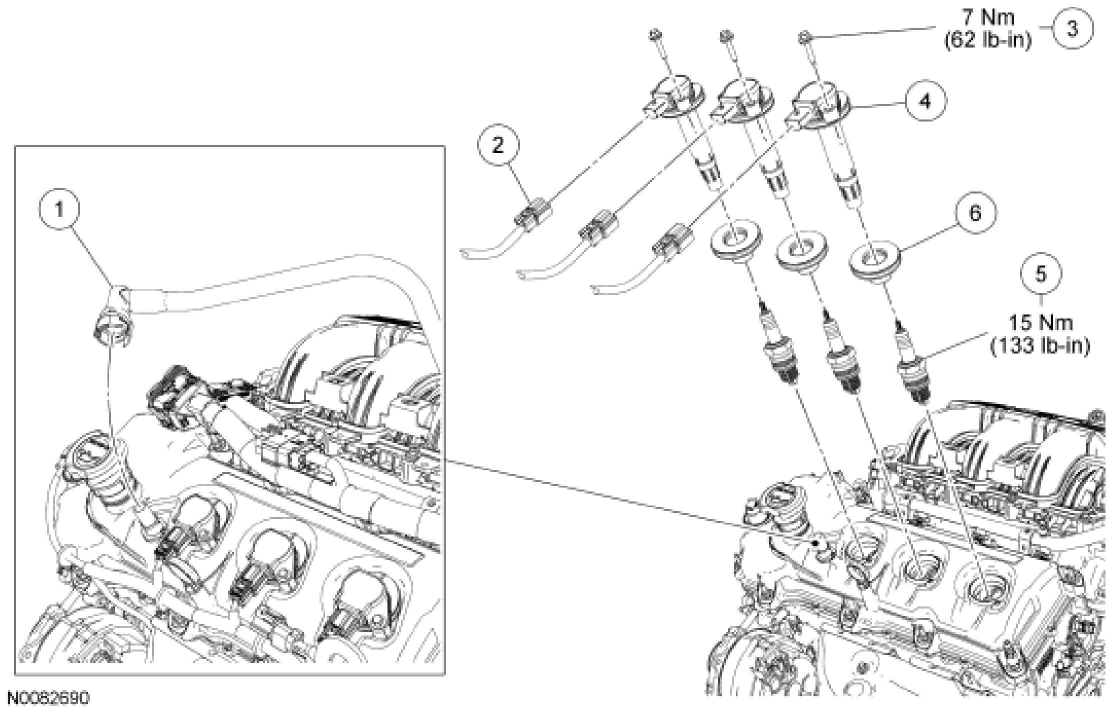


Fig. 1: Identifying LH Side Engine Ignition Components (With Torque Specifications)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6758	Crankcase vent tube-to-valve cover fitting quick connect coupling
2	-	Ignition coil-on-plug electrical connector (3 required) (part of 12A581)
3	W708833	Ignition coil-on-plug bolt (3 required)
4	12A375	Ignition coil-on-plug (3 required)
5	12405	Spark plug (3 required)
6	12A384	Coil seal (3 required)

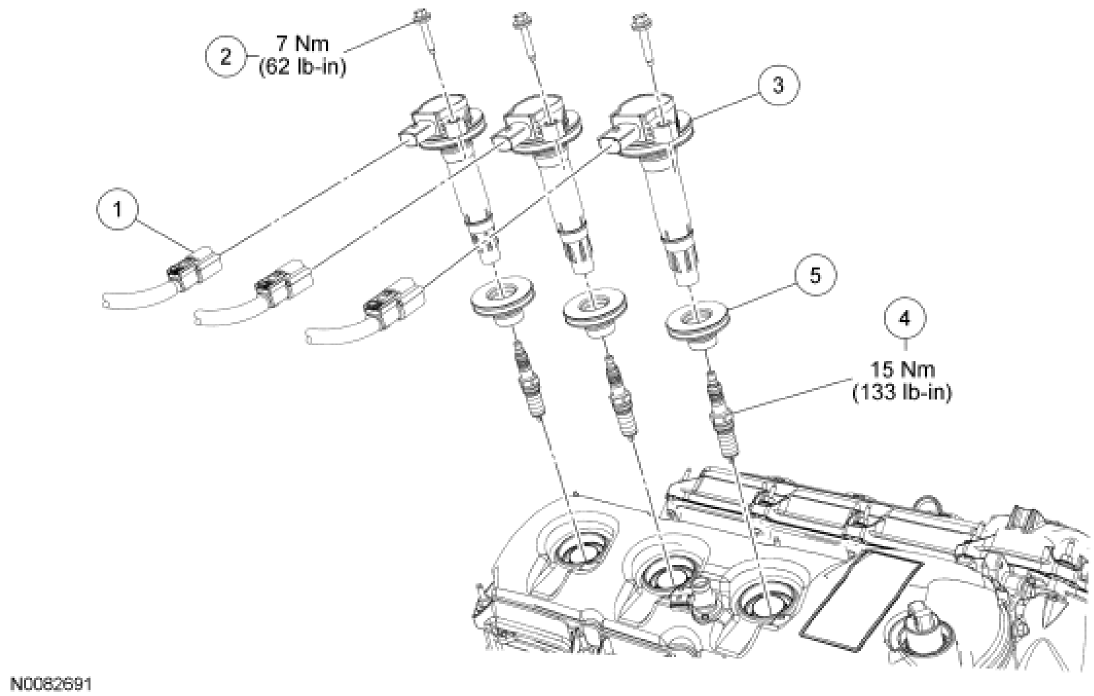


Fig. 2: Identifying RH Side Engine Ignition Components (With Torque Specifications)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Ignition coil-on-plug electrical connector (3 required) (part of 12A581)
2	W708833	Ignition coil-on-plug bolt (3 required)
3	12A375	Ignition coil-on-plug (3 required)
4	12405	Spark plug (3 required)
5	12A384	Coil seal (3 required)

1. For additional information, refer to the procedures in this article.

IGNITION COIL-ON-PLUG

Material

Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

REMOVAL AND INSTALLATION

LH side

1. Disconnect the crankcase vent tube quick connect coupling from the valve cover fitting and position aside. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

   RH side

   NOTE: The upper intake manifold must be removed to access the RH ignition coil-on-plugs.

2. Remove the upper intake manifold. For additional information, refer to **ENGINE - 3.5L** article.

   Both sides

3. Disconnect the 6 ignition coil-on-plug electrical connectors.

   NOTE: When removing the ignition coil-on-plugs, a slight twisting motion will break the seal and ease removal.

4. Remove the 6 bolts and the 6 ignition coil-on-plugs.
   - To install, tighten to 7 Nm (62 lb-in).
5. Inspect the coil seals for rips, nicks or tears. Remove and discard any damaged coil seals.
   - To install, slide the new coil seal onto the coil until it is fully seated at the top of the coil.

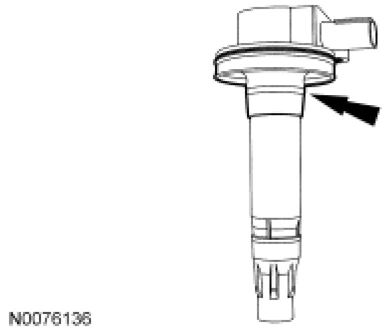


Fig. 3: Identifying Coil Seal On Coil
Courtesy of FORD MOTOR CO.

6. To install, reverse the removal procedure.
   - Apply a small amount of dielectric grease to the inside of the ignition coil-on-plug boots before attaching to the spark plugs.

SPARK PLUGS

Material

Item	Specification
Silicone Brake Caliper Grease and Dielectric	

Compound XG-3-A	ESE-M1C171-A

REMOVAL

LH side

1. Disconnect the crankcase vent tube quick connect coupling from the valve cover fitting and position aside. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

   RH side

   NOTE: **The upper intake manifold must be removed to access the RH spark plugs only.**

2. Remove the upper intake manifold. For additional information, refer to **ENGINE - 3.5L** article.

   Both sides

3. Disconnect the 6 ignition coil-on-plug electrical connectors.

   NOTE: **When removing the ignition coil-on-plugs, a slight twisting motion will break the seal and ease removal.**

4. Remove the 6 bolts and the 6 ignition coil-on-plugs.

   CAUTION: **Only use hand tools when removing or installing the spark plugs or damage can occur to the cylinder head or spark plug.**

   NOTE: **Use compressed air to remove any foreign material in the spark plug well before removing the spark plugs.**

5. Remove the 6 spark plugs.

INSTALLATION

Both sides

1. Inspect the 6 spark plugs.

Item	Part Number	Description
1	-	Deposits bridging spark plug gap

2	-	Wet black deposits (oil fouling)
3	-	Dry black deposits (carbon fouling)
4	-	Normal spark plug
5	-	Pre-ignition
6	-	Overheating
7	-	Fused spot deposits

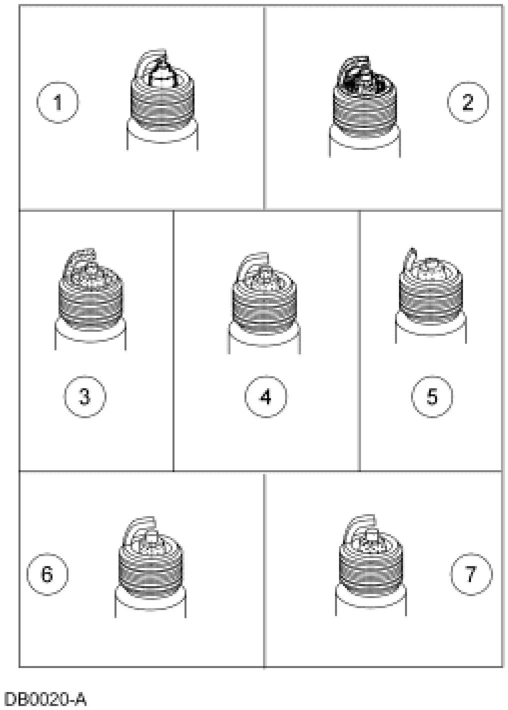


Fig. 4: Identifying Spark Plugs Condition
Courtesy of FORD MOTOR CO.

2. Adjust the spark plug gap as necessary.

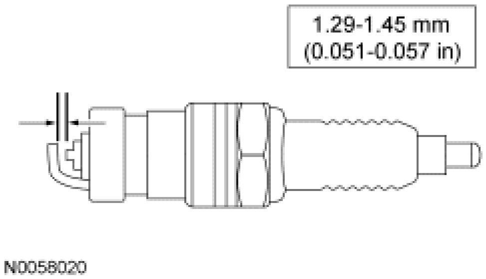


Fig. 5: Identifying Spark Plug Gap (With Specifications)
Courtesy of FORD MOTOR CO.

CAUTION: Only use hand tools when removing or installing the spark plugs, or damage can occur to the cylinder head or spark plug.

3. Install the 6 spark plugs.
   - Tighten to 15 Nm (11 lb-ft).

NOTE: Apply a small amount of dielectric grease to the inside of the ignition coil-on-plug boots before attaching to the spark plugs.

4. Install the 6 ignition coil-on-plugs and the 6 bolts.
   - Tighten to 7 Nm (62 lb-in).
5. Connect the 6 ignition coil-on-plug electrical connectors.

RH side

6. Install the upper intake manifold. For additional information, refer to **ENGINE - 3.5L** article.

LH side

7. Position and connect the crankcase vent tube quick connect coupling to the valve cover fitting. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

2008 ACCESSORIES & BODY, CAB

Instrument Cluster And Panel Illumination - Edge & MKX

DESCRIPTION AND OPERATION

INSTRUMENT CLUSTER AND PANEL ILLUMINATION

The instrument cluster (IC) and panel illumination is used to provide backlighting to the dimmable and non-dimmable switches and control components.

For Edge vehicles equipped with autolamps, if the exterior lamps are activated during daytime sunload conditions, the message center illumination remains at full intensity and does not dim from the instrument panel dimmer switch during this condition. If the vehicle travels under a bridge or a tunnel, the low level of ambient light causes the illumination level of the message center to change to the level set by the instrument panel dimmer switch. The message center illumination changes back to full intensity when the intense ambient light is restored.

For MKX vehicles equipped with autolamps, if the exterior lamps are activated during daytime sunload conditions, the message center, audio control module (ACM), heating ventilation air conditioning (HVAC) module and switch illumination remain at full intensity and do not dim from the instrument panel dimmer switch during this condition. If the vehicle travels under a bridge or a tunnel, the low level of ambient light causes the illumination level of the message center, ACM, HVAC module and switch to change to the level set by the instrument panel dimmer switch. The message center, ACM, HVAC module and switch illumination change back to full intensity when the intense ambient light is restored.

Dimmable Backlighting

NOTE:	**If the battery is disconnected or discharged, the instrument panel dimmer switch requires re-calibration. Rotate the instrument panel dimmer switch from the full dim position to the dome ON position. This will make sure that all displays are visible under all lighting conditions.**

The dimmable switches and components are illuminated when the headlamp switch is in either the PARKING LAMPS ON or HEADLAMPS ON position. The level of intensity is adjustable by rotating the instrument panel dimmer switch either up to increase intensity or down to decrease intensity.

The dimmable switches and components consist of:

- HVAC module - EATC (if equipped)
- HVAC module - EMTC (if equipped)
- Floor shifter
- Heated driver seat switch (if equipped)
- Heated passenger seat switch (if equipped)
- LH rear heated seat switch (if equipped)

- RH rear heated seat switch (if equipped)
- Message center switch (if equipped)
- Memory set switch (MKX)
- Window adjust switches (MKX)
- Door lock control switches (MKX)
- Headlamp switch
- Instrument panel dimmer switch
- IC
- Speed control switches
- Steering wheel audio control switches
- Hazard/passenger air bag disable/traction control switch
- Audio control module (ACM)
- Power liftgate release switch
- Roof opening panel switch (if equipped)
- Rear entertainment module (RETM) (if equipped)

Non-Dimmable Backlighting

The non-dimmable (fixed) lighting switches and components are illuminated when the delayed accessory relay is energized. The non-dimmable switches and components are illuminated at full lamp intensity.

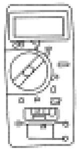
The non-dimmable lighting switches and components consist of:

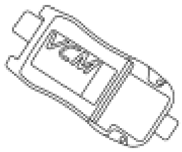
- Door lock control switches (Edge)
- Window adjust switches (Edge)

DIAGNOSTIC TESTS

INSTRUMENT CLUSTER AND PANEL ILLUMINATION

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
	73III Automotive Meter	105-R0057 or equivalent
	Vehicle Communications Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent	-

 ST2834-A	scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

Dimmable Backlighting

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

When the parking lamps are on, the SJB monitors the input from the instrument panel dimmer switch. The SJB sends a pulse-width modulated (PWM) voltage to the dimmable components and switches based on input received from the instrument panel dimmer switch.

The SJB also sends a message over the network to the audio control module (ACM), the rear entertainment module (RETM), the HVAC module - EATC, and the instrument cluster (IC) to indicate the backlighting intensity level. If the receiving module receives invalid backlighting data from the SJB for 5 seconds or less, the receiving module defaults the backlighting to the last setting.

If the receiving module does not receive the backlighting status message from the SJB or if the data received is deemed invalid for more than 5 seconds, the receiving module sets DTC U0140 in continuous memory (except the HVAC module - EATC) and defaults the backlighting to full intensity.

Fixed Backlighting

For Edge, when the accessory delay relay is energized, switched voltage is supplied to the window control and door lock switches.

The MKX is not equipped with any fixed backlighting components.

Field-Effect Transistor (FET) Protection

The SJB utilizes a FET protective circuit strategy for many of its outputs (for example, the LED backlighting output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault is detected. A continuous DTC is stored at that time for the fault. The circuit will then reset after a customer demand of the function (switching the component on, battery saver being energized). When an excessive circuit load occurs several times, the module shuts down the output until a repair procedure is carried out. At the same time, the continuous DTC that was stored on the first failure will not clear by a command to clear the continuous DTCs. The module will not allow this code to be cleared or the circuit restored to normal until a successful on-demand self-test proves that the fault has been repaired. After the on-demand self-test has successfully completed (no on-demand DTCs present), the continuous DTC will have been cleared and the circuit function will return.

Each circuit has 3 predefined levels of short circuit tolerance established in the module based on each circuits' capability. When the first or second level is reached, the continuous DTC associated with the circuit sets along with DTC B106E. These DTCs may be cleared using the Clear DTC operation on the scan tool as long as the fault itself has been corrected. If any of the circuits are shorted past the third level, then DTCs B106F and B1342 set along with the associated continuous DTC. These DTCs cannot be cleared and the module must be replaced.

The SJB FET protected output circuits for the instrument panel illumination system are for the white lighting (MKX) and LED backlighting (Edge) output circuits.

Instrument Panel Dimmer Switch Calibration

If the battery is disconnected or discharged, the instrument panel dimmer switch requires re-calibration. Rotate the instrument panel dimmer switch from the full dim position to the dome ON position. This will make sure that all displays are visible under all lighting conditions.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

VISUAL INSPECTION CHART

Electrical

• Smart junction box (SJB) fuse(s):
  ○ 10 (15A) (dimmable illumination)
  ○ 41 (15A) (non-dimmable illumination)
• Wiring, terminals or connectors
• Illuminated components
• SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool release software.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power

and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
    - Check the VCM connection to the vehicle.
    - Check the scan tool connection to the VCM.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
    - Verify the ignition key is in the ON position.
    - Verify the scan tool operation with a known good vehicle.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
    - If the scan tool responds with no communication with the SJB, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **SYMPTOM CHART** table.

DTC Charts

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B2212	Panel Dim Switch Out of Range	Go to **Pinpoint Test C** .
B2A32	LED Backlighting Output Circuit Open	If the backlighting components are inoperative, go to **Pinpoint Test A** . If the backlighting components are always on, go to **Pinpoint Test B** .
B2A33	LED Backlighting Output Circuit Short to Ground	Go to **Pinpoint Test A** .
B29B7	White Lighting Output Circuit Open	If the backlighting components are inoperative, go to **Pinpoint Test A** . If the backlighting components are always on, go to **Pinpoint Test B** .
B29B8	White Lighting Output Circuit Short to Ground	Go to **Pinpoint Test A** .
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

SYMPTOM CHART

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Fuse(s) • Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The control illumination is inoperative - all hardwired illumination	• Fuse • Wiring, terminals or connectors • SJB	• Go to **Pinpoint Test a** .
• The control illumination is always on - all hardwired illumination	• Wiring, terminals or connectors • SJB	• Go to **Pinpoint Test B** .
• All instrument panel illumination does not dim	• Wiring, terminals or connectors • Instrument panel dimmer switch • SJB	• Go to **Pinpoint Test C** .
• The steering wheel control illumination is inoperative	• Wiring, terminals or connectors • Steering wheel control switch(es) • Steering wheel control switch harness • Clockspring	• Go to **Pinpoint Test D** .

• The window control switch illumination is inoperative	• Wiring, terminals or connectors
	• Window control switch
		• For MKX, go to **Pinpoint Test E** .
		• For Edge, CHECK the operation of the power windows.
		    ◦ If the power windows operate correctly, INSTALL a new window control switch. REFER to **GLASS, FRAMES AND MECHANISMS** article. TEST the system for normal operation.
		    ◦ If the power windows do not operate correctly, REFER to **GLASS, FRAMES AND MECHANISMS** article.
		• CARRY OUT the network test.

• All network-controlled illumination does not dim	• Medium speed controller area network (MS-CAN) • SJB	• If the scan tool responds with no communication to any module on the MS-CAN, REFER to **MODULE COMMUNICATIONS NETWORK** article. • If the scan tool communicates with the modules on the MS-CAN, INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

• The instrument cluster (IC) illumination is inoperative	• IC	• CHECK the audio control module (ACM) illumination for correct operation.
		  • If the ACM illumination operates correctly, INSTALL a new IC. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. TEST the system for normal operation.
		  • If the ACM illumination does not operate correctly, REFER to **MODULE COMMUNICATIONS NETWORK** article to continue diagnosis of the communications network.

• The audio control module (ACM) illumination is inoperative	• ACM	• CHECK the IC illumination for correct operation.
		  • If the IC illumination operates correctly, REMOVE the ACM. REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article. SEND it to an authorized repair facility. TEST the system for normal operation after the repair.
		  • If the IC illumination does not operate correctly, REFER to **MODULE COMMUNICATIONS NETWORK** article to continue

		diagnosis of the communications network.
• The rear entertainment module (RETM) illumination is inoperative	• RETM	• REMOVE the RETM. REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article. SEND it to an authorized repair facility. TEST the system for normal operation.
• The HVAC module - EATC illumination is inoperative	• HVAC module	• CHECK the IC illumination for correct operation. ◦ If the IC illumination operates correctly, INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation. ◦ If the IC illumination does not operate correctly, REFER to **MODULE COMMUNICATIONS NETWORK** article to continue diagnosis of the communications network.
• The individual component illumination is inoperative	• Wiring, terminals or connectors • Floor shifter • LH rear heated seat switch (if equipped) • RH rear heated seat switch (if equipped) • Manual temperature control (if equipped) • Message center switch (if equipped) • Memory set switch (MKX) • Window adjust switches (MKX) • Headlamp switch • Hazard/passenger air bag disable/traction control switch (if equipped)	• Go to **Pinpoint Test E** .

	• Door lock control switches • Power liftgate release switch • Roof opening panel switch (if equipped)	

Pinpoint Tests

Pinpoint Test A: The Control Illumination Is Inoperative - All Hardwired Illumination

Refer to appropriate SYSTEM WIRING DIAGRAM article for Cluster and Panel Illumination schematic and connector information.

Normal Operation

Based on input received from the instrument panel dimmer switch, the smart junction box (SJB) sends a pulse-width modulated (PWM) voltage to the hardwired dimmable illumination sources through circuit VLN37 (BU/WH) (MKX) or circuit VLN04 (VT/GY) (Edge).

DTC Description	Fault Trigger Conditions
B2A32 - LED Backlighting Output Circuit Open	An on-demand DTC that sets when the SJB detects an open on the LED backlighting output circuit.
B2A33 - LED Backlighting Output Circuit Short to Ground	A continuous and on-demand DTC that sets when the SJB detects a short to ground on the LED backlighting output circuit. This DTC also sets when fuse 10 (15A) has failed or is removed.
B29B7 - White Lighting Output Circuit Open	An on-demand DTC that sets when the SJB detects an open on the white lighting output circuit.
B29B8 - White Lighting Output Circuit Short to Ground	A continuous and on-demand DTC that sets when the SJB detects a short to ground on the white lighting output circuit. This DTC also sets when fuse 10 (15A) has failed or is removed.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- SJB

PINPOINT TEST A: THE CONTROL ILLUMINATION IS INOPERATIVE - ALL HARDWIRED ILLUMINATION

A1 CHECK FOR RECORDED SJB DTCs FROM THE ON-DEMAND SELF-TEST

- Use the recorded results from the SJB self-test.
- **Are any DTCs recorded?**

  YES : For DTC B2A33, B2A32, B29B7 or B29B8, go to A3.

  NO : Go to A2.

A2 CHECK THE INSTRUMENT PANEL DIMMER SWITCH

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB PID (DIM_SW_3) while rotating the instrument panel dimmer switch from the lowest setting to the highest setting.
- **Does the PID indicate the switch is operating correctly?**

  YES : Go to A4.

  NO : INSTALL a new instrument panel dimmer switch. REFER to **INSTRUMENT PANEL DIMMER SWITCH**. TEST the system for normal operation.

A3 CHECK CIRCUIT VLN37 (BU/WH) OR CIRCUIT VLN04 (VT/GY) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280b

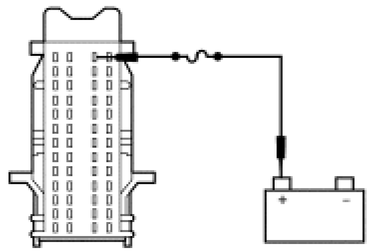


Fig. 1: Connecting Fused (5A) Jumper Wire Between SJB C2280B-39, Circuit VLN04 (VT/GY) & Battery Positive
Courtesy of FORD MOTOR CO.

NOTE: **If the jumper wire fails, repair circuit VLN04 (VT/GY) for a short to ground.**

- For Edge, connect a fused (5A) jumper wire between the SJB C2280b-39, circuit VLN04 (VT/GY) and battery positive.

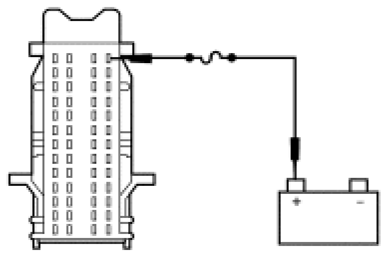


Fig. 2: Connecting Fused (5A) Jumper Wire Between SJB C2280B-52, Circuit VLN37 (BU/WH) & Battery Positive
Courtesy of FORD MOTOR CO.

NOTE: **If the jumper wire fails, repair circuit VLN37 (BU/WH) for a short to ground.**

- For MKX, connect a fused (5A) jumper wire between the SJB C2280b-52, circuit VLN37 (BU/WH) and battery positive.
- **Do the backlighting components illuminate?**

  YES : REMOVE the jumper wire. Go to A4.

  NO : REMOVE the jumper wire. VERIFY the BJB fuse 10 (15A) is OK. REPAIR the circuit in question for a short to ground. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.

A4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.

Pinpoint Test B: The Control Illumination Is Always On - All Hardwired Illumination

Refer to appropriate SYSTEM WIRING DIAGRAM article for Cluster and Panel Illumination schematic and connector information.

Normal Operation

The smart junction box (SJB) supplies a pulse-width modulated (PWM) voltage signal to the dimmable illumination sources on circuit VLN04 (VT/GY) (Edge) and VLN37 (BU/WH) (MKX).

- DTC B2A32 (LED Backlighting Output Circuit Open) - is an on-demand DTC that sets when the SJB detects a short to voltage on the LED backlighting output circuit.
- DTC B29B7 (White Lighting Output Circuit Open) - is an on-demand DTC that sets when the SJB detects a short to voltage on the white lighting output circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- SJB

PINPOINT TEST B: THE CONTROL ILLUMINATION IS ALWAYS ON - ALL HARDWIRED ILLUMINATION

B1 CHECK THE EXTERIOR LIGHTING

- Key in OFF position.
- Place the headlamp switch in the OFF position.
- Observe the exterior lighting components.
- Key in ON position.
- **Are any exterior lighting components illuminated?**

  YES : REFER to **EXTERIOR LIGHTING** article.

  NO : Go to B2.

B2 CHECK CIRCUITS VLN04 (VT/GY) (EDGE) AND VLN37 (BU/WH) (MKX) FOR A SHORT TO VOLTAGE

- Disconnect: SJB C2280b
- Key in ON position.
- **Do the dimmable backlighted components continue to illuminate?**

  YES : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to B3.

B3 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.

- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test C: All Instrument Panel Illumination Does Not Dim

Refer to appropriate SYSTEM WIRING DIAGRAM article for Cluster and Panel Illumination schematic and connector information.

Normal Operation

The smart junction box (SJB) monitors the input from the instrument panel dimmer switch by sending a voltage reference signal through circuit VLN18 (BU/WH) to the instrument panel dimmer switch. The return signal is sent through circuit CLN27 (WH/BN) back to the SJB. Based on the input from the instrument panel dimmer switch, the SJB sends a pulse-width modulated (PWM) voltage signal to the dimmable illumination sources. If the SJB detects a concern with the circuitry to the instrument panel dimmer switch, the SJB defaults the backlighting to a full intensity level.

The SJB also sends a message over the network to the audio control module (ACM), the rear entertainment module (RETM), the HVAC module - EATC, and the instrument cluster (IC) to indicate the backlighting intensity level. If the receiving module receives invalid backlighting data from the SJB for 5 seconds or less, the receiving module defaults the backlighting to the last setting.

If the receiving module does not receive the backlighting status message from the SJB or if the data received is deemed invalid for more than 5 seconds, the receiving module sets DTC U0140 in continuous memory (except the climate control module) and defaults the backlighting to full intensity.

- DTC B2212 (Panel Dim Switch Out Of Range) - is an on-demand DTC that sets when the SJB detects an out of range condition on the dimmer input switch circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals, or connectors
- Instrument panel dimmer switch
- SJB

PINPOINT TEST C: ALL INSTRUMENT PANEL ILLUMINATION DOES NOT DIM

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Calibrate the instrument panel dimmer switch by rotating the dimmer switch from the full dim position to the dome ON position before continuing

diagnostics.

C1 CHECK THE EXTERIOR LIGHTING OPERATION

- Place the headlamp switch in each of its positions while observing the exterior lamps.
- **Do the exterior lamps operate correctly?**

  YES : Go to C2.

  NO : REFER to **EXTERIOR LIGHTING** article.

C2 CHECK THE RECORDED RESULTS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS

- Check for recorded DTCs from the continuous and on-demand self-tests.
- **Are any DTCs present?**

  YES : If DTC B2212 is retrieved, go to C4.

  For all other DTCs, REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

  NO : Go to C3.

C3 CHECK THE INSTRUMENT PANEL DIMMER SWITCH INPUT

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB PID (DIM_SW_3) while rotating the instrument panel dimmer switch from the lowest setting to the highest setting.
- **Does the PID indicate the switch is operating correctly?**

  YES : Go to C9.

  NO : INSTALL a new instrument panel dimmer switch. REFER to **INSTRUMENT PANEL DIMMER SWITCH**.

C4 CHECK CIRCUIT CLN27 (WH/BN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280b
- Disconnect: Instrument Panel Dimmer Switch C2298
- Key in ON position.

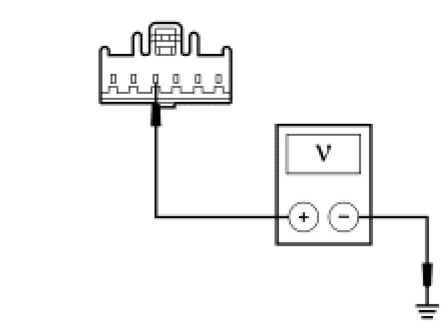


Fig. 3: Measuring Voltage Between Instrument Panel Dimmer Switch C2298-4, Circuit

CLN27 (WH/BN) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument panel dimmer switch C2298-4, circuit CLN27 (WH/BN), harness side and ground.
- **Is any voltage indicated?**

YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

NO : Go to C5.

C5 CHECK CIRCUIT VLN18 (BU/WH) FOR A SHORT TO VOLTAGE

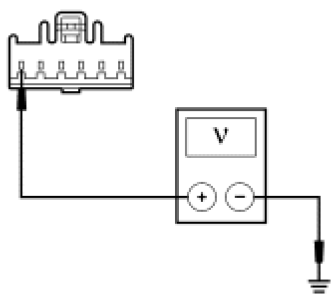


Fig. 4: Measuring Voltage Between Instrument Panel Dimmer Switch C2298-6, Circuit VLN18 (BU/WH) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument panel dimmer switch C2298-6, circuit VLN18 (BU/WH), harness side and ground.
- **Is any voltage indicated?**

YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

NO : Go to C6.

C6 CHECK CIRCUIT CLN27 (WH/BN) FOR AN OPEN OR A SHORT TO GROUND

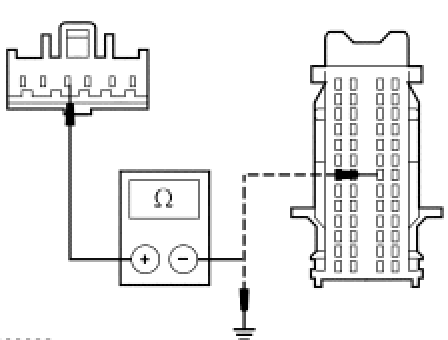


Fig. 5: Measuring Resistance Between Instrument Panel Dimmer Switch C2298-4, Circuit CLN27 (WH/BN) & SJB C2280B-33
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument panel dimmer switch C2298-4, circuit CLN27 (WH/BN), harness side and the SJB C2280b-33, circuit CLN27 (WH/BN), harness side; and between the instrument panel dimmer switch C2298-4, circuit CLN27 (WH/BN), harness side and ground.
- **Is the resistance less than 5 ohms between the instrument panel dimmer switch and the SJB, and greater than 10,000 ohms between the instrument panel dimmer switch and ground?**

  YES : Go to C7.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C7 CHECK CIRCUIT VLN18 (BU/WH) FOR AN OPEN OR A SHORT TO GROUND

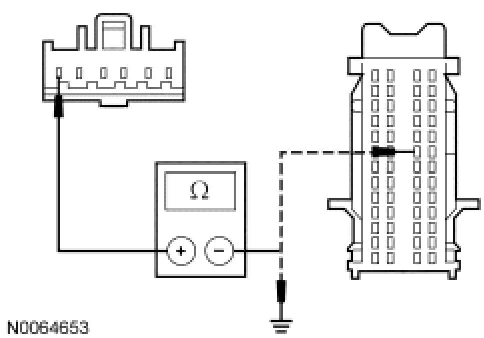


Fig. 6: Measuring Resistance Between Instrument Panel Dimmer Switch C2298-6, Circuit VLN18 (BU/WH) & SJB C2280B-34
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument panel dimmer switch C2298-6, circuit VLN18 (BU/WH), harness side and the SJB C2280b-34, circuit VLN18 (BU/WH), harness side; and between the instrument panel dimmer switch C2298-6, circuit VLN18 (BU/WH), harness side and ground.
- **Is the resistance less than 5 ohms between the instrument panel dimmer switch and the SJB, and greater than 10,000 ohms between the instrument panel dimmer switch and ground?**

  YES : Go to C8.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C8 CHECK THE INSTRUMENT PANEL DIMMER SWITCH

- Carry out the component test for the instrument panel dimmer switch. Refer to COMPONENT TESTING.
- **Is the instrument panel dimmer switch OK?**

  YES : Go to C9.

  NO : INSTALL a new instrument panel dimmer switch. REFER to **INSTRUMENT PANEL DIMMER SWITCH**. TEST the system for normal operation.

C9 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion

        - damaged pins
        - pushed-out pins
    - Connect all the SJB connectors and make sure they seat correctly.
    - Operate the system and verify the concern is still present.
    - **Is the concern still present?**

      YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

      NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test D: The Steering Wheel Control Illumination Is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAM article for Cluster and Panel Illumination schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a pulse width modulated (PWM) voltage to the steering wheel controls through circuit VLN04 (VT/GY) (Edge) or circuit VLN37 (BU/WH) (MKX) to the clockspring. The voltage passes through the clockspring to the steering wheel control switches. Ground to the clockspring is supplied through circuit GD116 (BK/VT).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Steering wheel control switch(es)
- Steering wheel control switch harness
- Clockspring

PINPOINT TEST D: THE STEERING WHEEL CONTROL ILLUMINATION IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

D1 CHECK THE OTHER DIMMABLE LIGHTING SWITCHES

- Key in OFF position.
- Place the headlamp switch in the PARKING LAMPS ON position.
- Rotate the instrument panel dimmer switch to the full illumination position and observe other dimmable switches (door lock switches, hazard lamp switch, headlamp switch for example).
- **Are all the dimmable switches inoperative?**

  YES : Go to **Pinpoint Test A** .

  NO : Go to D2.

D2 CHECK CIRCUIT VLN04 (VT/GY) (EDGE) OR CIRCUIT VLN37 (BU/WH) (MKX) FOR AN OPEN

- Place the headlamp switch in the OFF position.
- Depower the supplemental restraint system (SRS). Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Clockspring C218a
- Connect the battery ground cable.
- Place the headlamp switch in the PARKING LAMPS ON position.
- Rotate the instrument panel dimmer switch to the full illumination position.

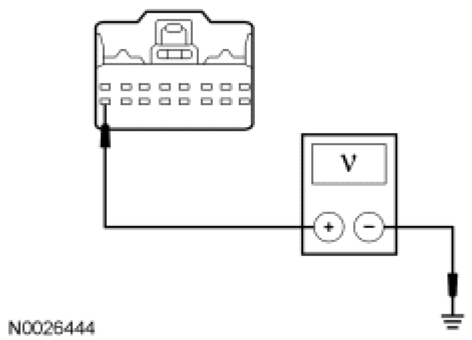


Fig. 7: Measuring Voltage Between Clockspring C218A-16, Circuit VLN04 (VT/GY) (Edge) Or Circuit VLN37 (BU/WH) (MKX)
Courtesy of FORD MOTOR CO.

- Measure the voltage between the clockspring C218a-16, circuit VLN04 (VT/GY) (Edge) or circuit VLN37 (BU/WH) (MKX), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : TURN the parking lamps off. Go to D3.

  NO : REPAIR the circuit. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

D3 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

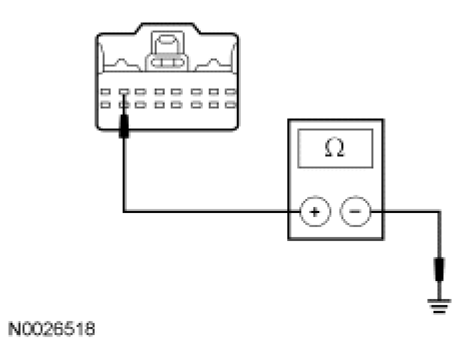


Fig. 8: Measuring Resistance Between Clockspring C218A-7, Circuit GD116 (BK/VT) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218a-7, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to D4.

  NO : REPAIR the circuit. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

D4 CHECK THE CLOCKSPRING FOR AN OPEN

- Remove the driver air bag module. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Upper Clockspring Connector C218b

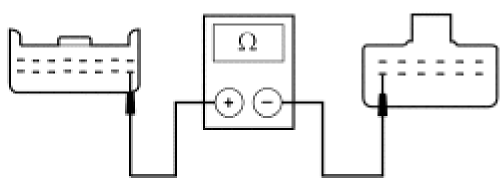


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Fig. 9: Measuring Resistance Between Clockspring C218A Pin 16 And Upper Clockspring C218B Pin 7
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218a pin 16, component side and the upper clockspring C218b pin 7, component side.

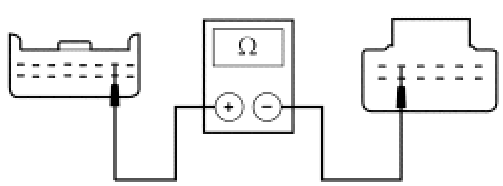

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Fig. 10: Measuring Resistance Between Clockspring C218A Pin 7 And Upper Clockspring C218B Pin 2
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218a pin 7, component side and the upper clockspring C218b pin 2, component side.
- **Are the resistances less than 5 ohms?**

  YES : Go to D5.

NO : INSTALL a new clockspring. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

D5 CHECK THE STEERING WHEEL HARNESS CIRCUIT VLN04 (VT/GY) (EDGE) OR CIRCUIT VLN37 (BU/WH) (MKX) FOR AN OPEN

- Disconnect: LH Steering Wheel Switches C2998
- Disconnect: RH Steering Wheel Switches C2999

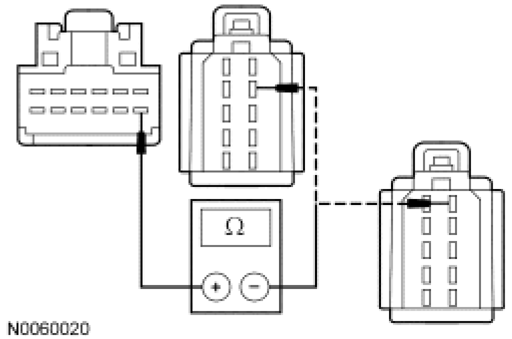


Fig. 11: Measuring Resistance Between Upper Clockspring Connector C218B-7, Circuit VLN04 (VT/GY) & LH Steering Wheel Switches C2998-2
Courtesy of FORD MOTOR CO.

- Measure the resistance between the upper clockspring connector C218b-7, circuit VLN04 (VT/GY), harness side and the LH steering wheel switches C2998-2, circuit VLN04 (VT/GY), harness side; and between the upper clockspring connector C218b-7, circuit VLN04 (VT/GY), harness side and the RH steering wheel switches C2999-1, circuit VLN04 (VT/GY), harness side.
- **Are the resistances less than 5 ohms?**

YES : Go to D6.

NO : REPAIR the circuit in question. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

D6 CHECK CIRCUIT GD165 (BK) FOR AN OPEN

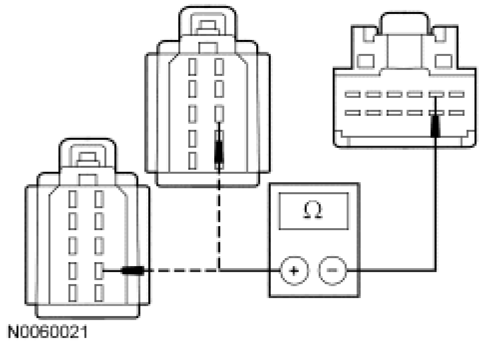


Fig. 12: Measuring Resistance Between Clockspring C218B-2, Circuit GD165 (BK) & LH Steering Wheel Switch C2998-4
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218b-2, circuit GD165 (BK), harness side, and the LH steering wheel switch C2998-4, circuit GD165 (BK), harness side; and between the clockspring C218b-2, circuit GD165 (BK), harness side, and the RH steering wheel switch C2999-3, circuit GD165 (BK), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new speed control switch or steering wheel controls as necessary. REFER to **SPEED CONTROL** article or **INFORMATION AND ENTERTAINMENT SYSTEMS** article. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

  NO : REPAIR the circuit. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

Pinpoint Test E: The Individual Component Illumination Is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAM article for Cluster and Panel Illumination schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a pulse-width modulated (PWM) voltage to the dimmable components through circuit VLN04 (VT/GY) (Edge) or circuit VLN37 (BU/WH) (MKX). Ground is provided through circuits GD116 (BK/VT), GD126 (BK/WH) and GD139 (BK/YE).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Floor shifter
- LH rear heated seat switch (if equipped)
- RH rear heated seat switch (if equipped)
- Manual temperature control (if equipped)
- Message center switch (if equipped)
- Memory set switch (MKX)
- Window adjust switches (MKX)
- Door lock control switches
- Headlamp switch
- Hazard/passenger air bag disable/traction control switch (if equipped)
- Power liftgate release switch
- Roof opening panel switch (if equipped)

PINPOINT TEST E: THE INDIVIDUAL COMPONENT ILLUMINATION IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to

use the correct probe adapter(s) may damage the connector.

E1 CHECK THE VOLTAGE TO THE SINGLE ILLUMINATION SOURCE

- Key in OFF position.
- Disconnect: Inoperative Illumination Source
- Key in ON position.
- With the parking lamps on, rotate the instrument panel dimmer switch to the full illumination position.
- Measure the voltage between the inoperative illumination source, harness side and ground as follows:

EDGE

Component	Connector-Pin	Circuit
Floor shifter	C3245-3	VLN04 (VT/GY)
Manual climate control	C2357a-4	VLN04 (VT/GY)
Headlamp switch	C205-5	VLN04 (VT/GY)
Message center switch	C253-1	VLN04 (VT/GY)
Hazard/passenger air bag disable/traction control switch	C2355-6	VLN04 (VT/GY)
LH door lock control switch	C505-2	CBP41 (BU)
RH door lock control switch	C605-2	CBP41 (BU)
Power liftgate release switch	C2269-3	VLN04 (VT/GY)

MKX

Component	Connector-Pin	Circuit
Floor shifter	C3245-3	VLN37 (BU/WH)
Memory set switch	C503-3	VLN37 (BU/WH)
Headlamp switch	C205-5	VLN37 (BU/WH)
Message center	C253-1	VLN37

switch		(BU/WH)
Hazard/passenger air bag disable/traction control switch	C2355-6	VLN37 (BU/WH)
Power liftgate release switch	C2269-3	VLN37 (BU/WH)
Roof opening panel switch	C912-2	VLN37 (BU/WH)
LH front window control switch	C535a-6	VLN37 (BU/WH)
RH front window control switch	C648-1	VLN37 (BU/WH)
LH rear window control switch	C701-4	VLN37 (BU/WH)
RH rear window control switch	C801-4	VLN37 (BU/WH)
LH door lock control switch	C505-2	VLN37 (BU/WH)
RH door lock control switch	C605-2	VLN37 (BU/WH)
LH rear heated seat switch	C722-5	VLN37 (BU/WH)
RH rear heated seat switch	C822-5	VLN37 (BU/WH)

- **Is the voltage greater than 10 volts?**

  YES : For LH or RH rear window switches, INSTALL a new switch for the switch in question. REFER to **GLASS, FRAMES AND MECHANISMS** article.

  For all other components, go to E2.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

E2 CHECK ILLUMINATION SOURCE GROUND CIRCUIT FOR AN OPEN

- Key in OFF position.
- Measure the resistance between the inoperative illumination source, harness side and ground as follows:

EDGE

Component	Connector-Pin	Circuit
Floor shifter	C3245-4	GD140 (BK/GN)
Manual climate		GD115

control	C2357a-23	(BK/GY)
Headlamp switch	C205-10	GD116 (BK/VT)
Message center switch	C253-4	GD116 (BK/VT)
Hazard/passenger air bag disable/traction control switch	C2355-1	GD116 (BK/VT)
LH door lock control switch	C505-4	GD133 (BK)
RH door lock control switch	C605-4	GD140 (BK/GN)
Power liftgate release switch	C2269-2	GD116 (BK/VT)

MKX

Component	**Connector-Pin**	**Circuit**
Floor shifter	C3245-4	GD140 (BK/GN)
Memory set switch	C503-7	GD133 (BK)
Headlamp switch	C205-10	GD116 (BK/VT)
Message center switch	C253-4	GD116 (BK/VT)
Hazard/pad/traction control switch	C2355-1	GD116 (BK/VT)
Power liftgate release switch	C2269-2	GD116 (BK/VT)
Roof opening panel switch	C912-1	GD133 (BK)
LH front window control switch	C535b-6	GD133 (BK)
RH front window control switch	C648-6	GD140 (BK/GN)
LH door lock control switch	C505- 4	GD133 (BK)
RH door lock control switch	C605-4	GD140 (BK/GN)
LH rear heated seat switch	C722-1	GD126 (BK/WH)
RH rear heated seat		GD145

switch	C822-1	(BK/BU)

- **Is the resistance less than 5 ohms?**
  YES : INSTALL a new component in question. TEST the system for normal operation.
  NO : REPAIR the circuit. TEST the system for normal operation.

REMOVAL AND INSTALLATION

INSTRUMENT PANEL DIMMER SWITCH

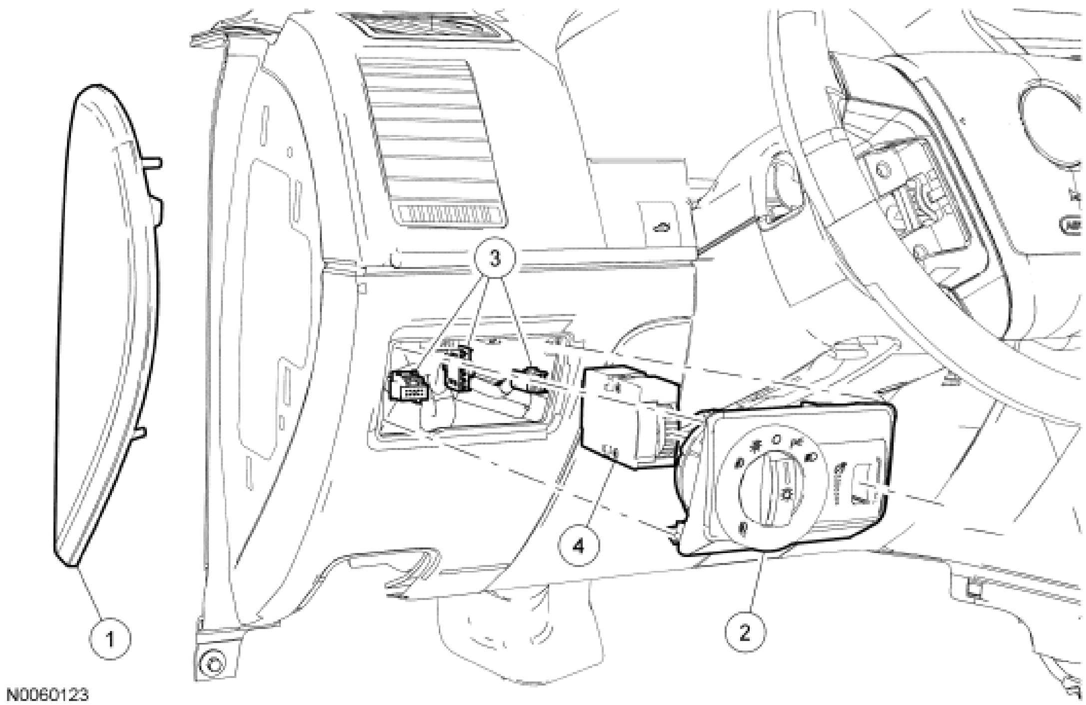


Fig. 13: Exploded View Of Instrument Panel Dimmer Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5404481	Instrument panel side finish panel
2	14K147	Headlamp switch assembly
3	-	Headlamp switch assembly electrical connectors (part of 14401)
4	11691	Instrument panel dimmer switch

REMOVAL AND INSTALLATION

1. Remove the instrument panel side finish panel.

NOTE: The switch is removed by pushing from behind.

2. Release the tabs and remove the headlamp switch assembly.
    - Disconnect the electrical connectors.
3. Release the 4 tabs and remove the instrument panel dimmer switch.

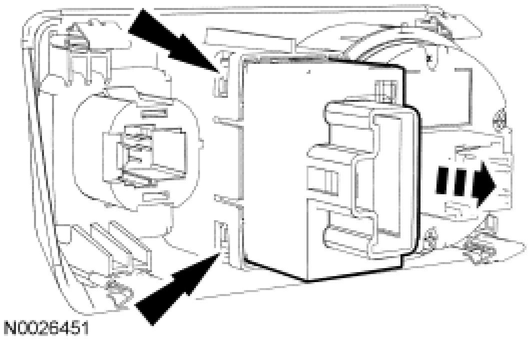


Fig. 14: Releasing Tabs & Removing Instrument Panel Dimmer Switch
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Instrument Panel & Console - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Floor console center bolts	6	-	53
Floor console front side bolts	6	-	53
Floor console rear bolts	6	-	53
Floor console-to-instrument panel bolts	6	-	53
Front of dash bolt	20	15	-
Instrument panel-to-steering column bracket bolts	22	16	-
LH instrument panel bolts	20	15	-
LH instrument panel-to-body bolt	7	-	62
LH instrument panel-to-floor bolts	22	16	-
RH instrument panel bolt	22	16	-
RH instrument panel-to-body bolt	7	-	62
RH instrument panel-to-floor bolt	22	16	-
Steering column pinch bolt	23	17	-
Torx head bolt	30	22	-

REMOVAL AND INSTALLATION

INSTRUMENT PANEL - EXPLODED VIEW

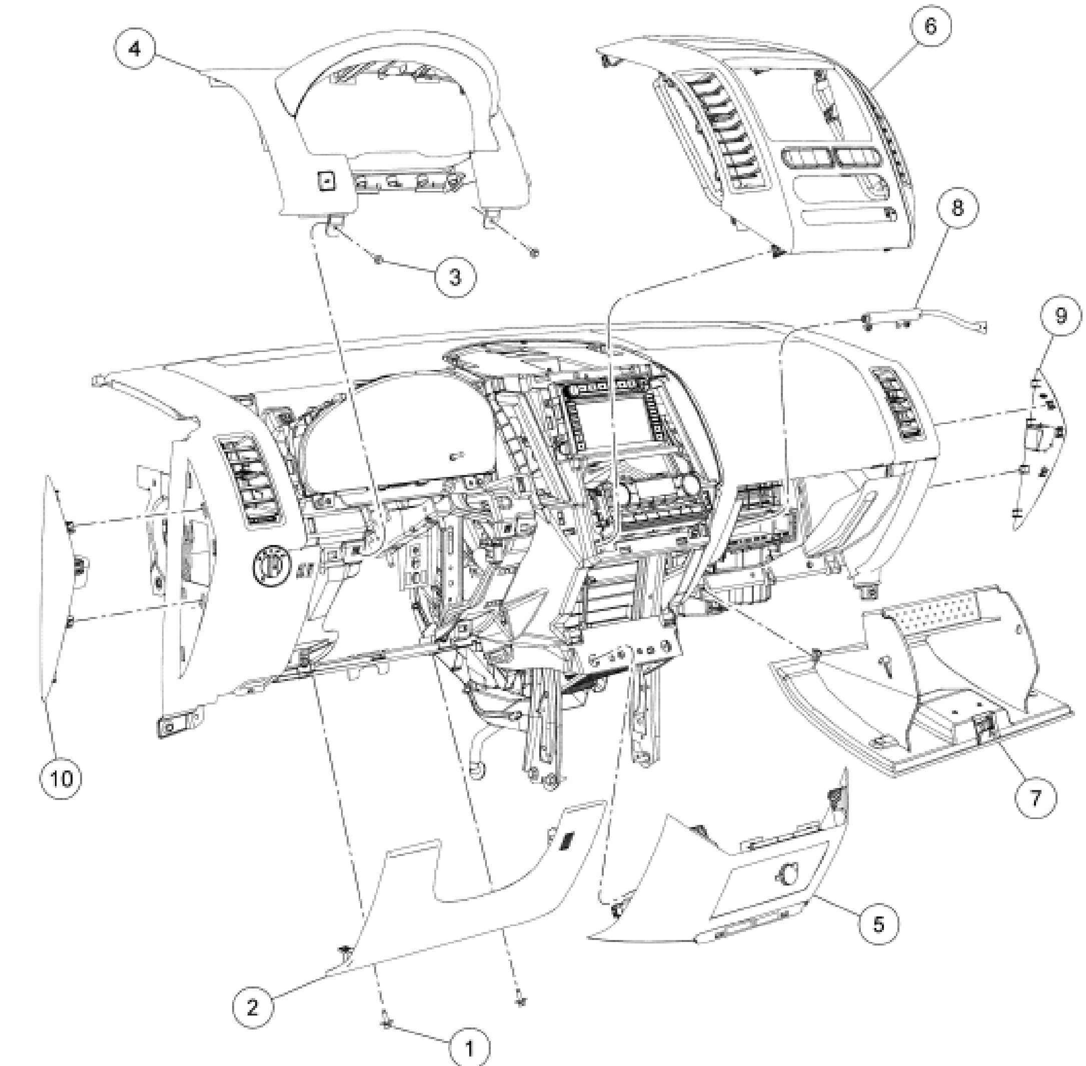


Fig. 1: Identifying Edge Instrument Panel (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W505002	Steering column cover screw (2 required)
2	04459	Steering column opening cover
3	W707628	Instrument panel cluster finish panel screw (2 required)
4	044D70	Instrument panel cluster finish panel
5	04608	Instrument panel lower center finish panel
6	04302	Instrument panel upper center finish panel
7	06024	Glove compartment

8	061A58	Glove compartment dampener
9	04480	RH instrument panel end trim panel
10	04481	LH instrument panel end trim panel

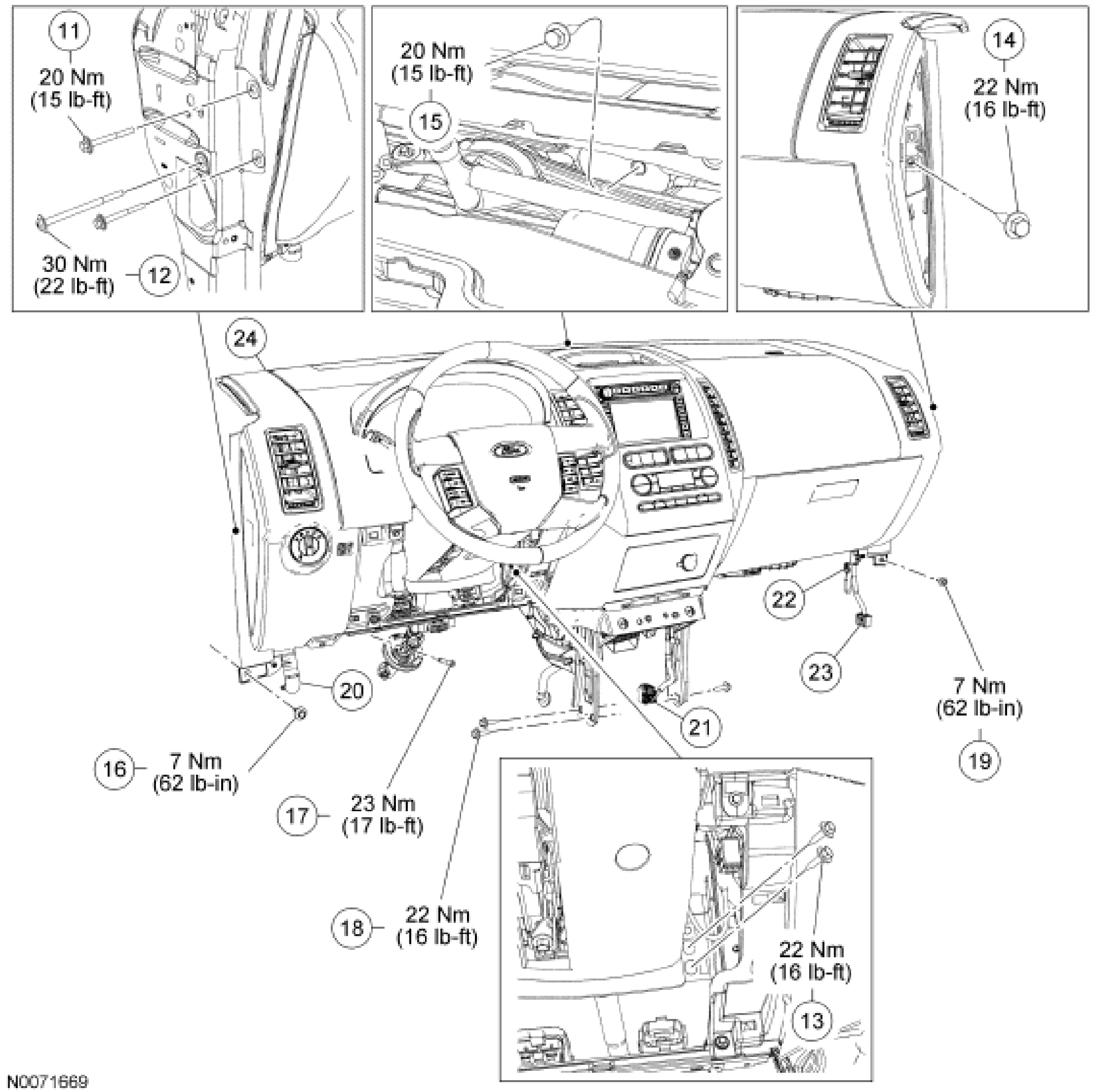


Fig. 2: Identifying Edge Instrument Panel (2 Of 2) With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
11	W712386	LH instrument panel bolt (2 required)
12	W712387	Torx head bolt
13	W711648	Instrument panel-to-steering column bracket bolt (2 required)
14	W706246	RH instrument panel bolt
15	W710309	Instrument panel-to-front of dash bolt

16	W712403	LH instrument panel-to-body bolt
17	3RA27	Steering column pinch bolt
18	W706246	Instrument panel-to-floor bolt (3 required)
19	W706246	RH instrument panel-to-body bolt
20	14401	LH instrument panel electrical connectors
21	14401	Restraints control module (RCM) electrical connector
22	-	Antenna lead-in
23	14401	RH instrument panel electrical connector
24	04320	Instrument panel

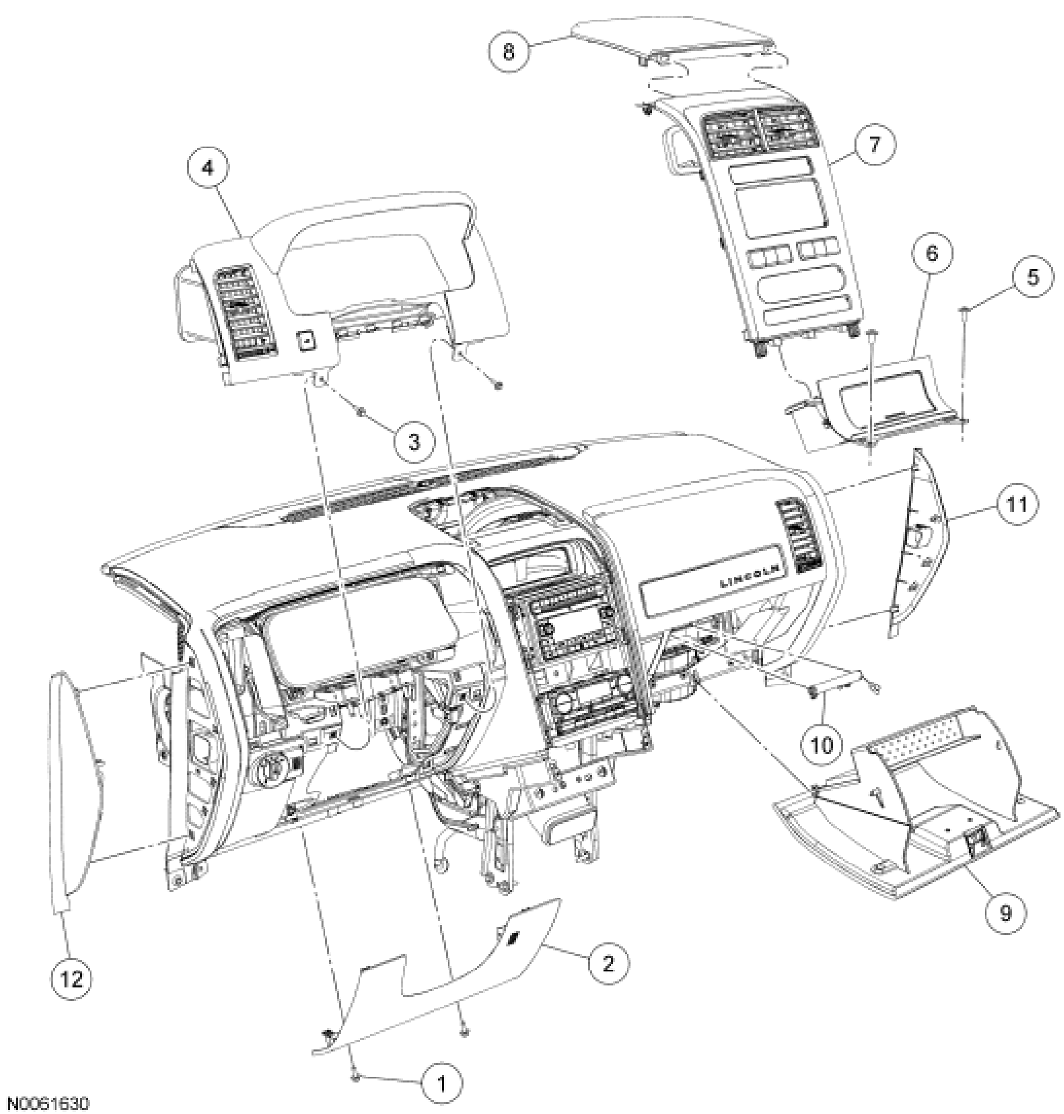


Fig. 3: Identifying MKX Instrument Panel (1 Of 2)

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W505002	Steering column cover screw (2 required)
2	04459	Steering column opening cover
3	W707628	Instrument panel cluster finish panel screw (2 required)
4	044D70	Instrument panel cluster finish panel
5	N811283	Instrument panel storage bin screw (2 required)
6	047A04	Instrument panel storage bin
7	04302	Instrument panel lower center finish panel
8	042A82	Instrument panel upper center finish panel
9	06024	Glove compartment
10	061A58	Glove compartment dampener
11	04480	RH instrument panel end trim panel
12	04481	LH instrument panel end trim panel

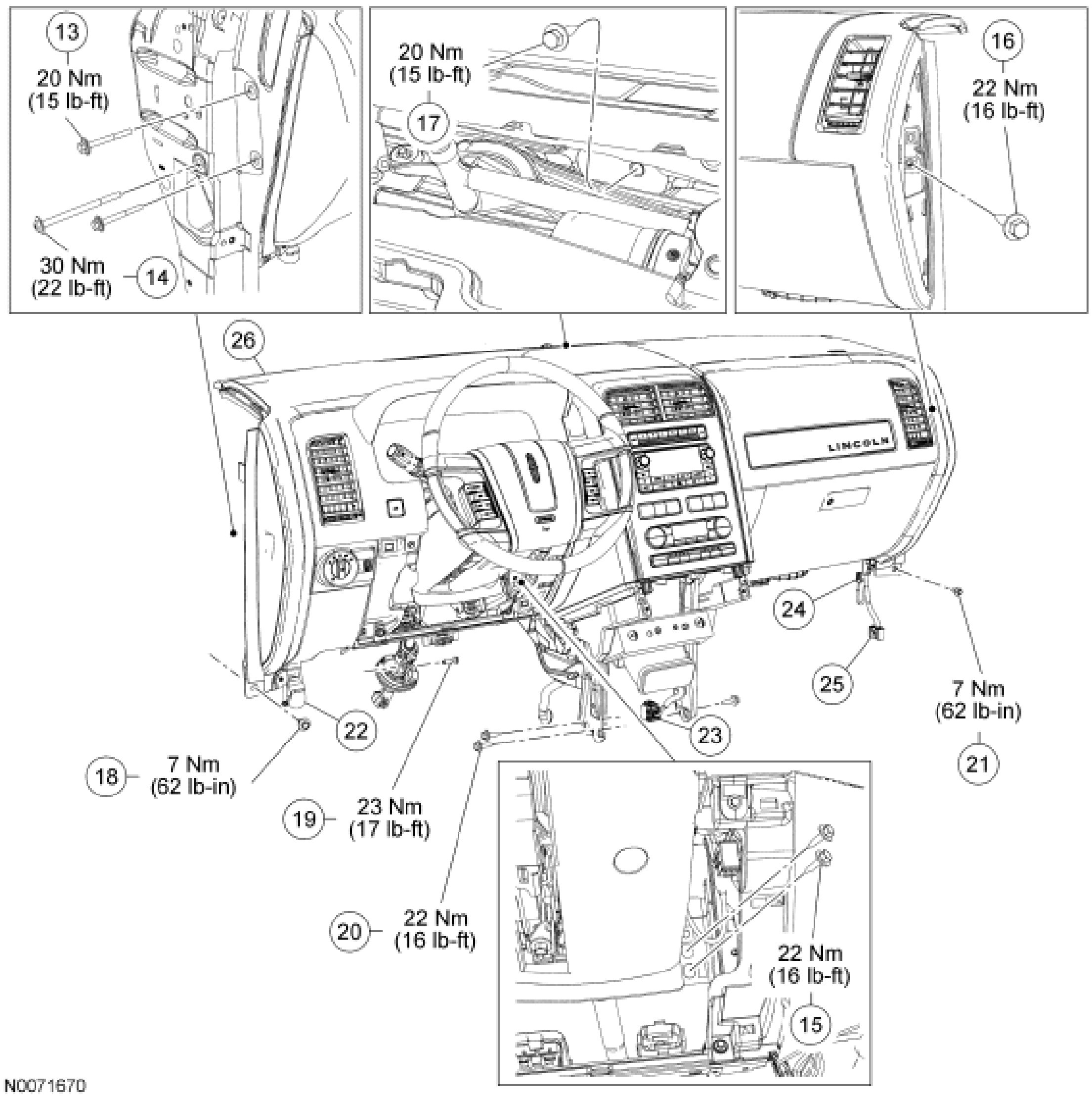


Fig. 4: Identifying MKX Instrument Panel (2 Of 2) With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
13	W712386	LH instrument panel bolt (2 required)
14	W712387	Torx head bolt
15	W711648	Instrument panel-to-steering column bracket bolt (2 required)
16	W706246	RH instrument panel bolt
17	W712403	Instrument panel-to-front of dash bolt
18	W703845	LH instrument panel-to-body bolt
19	3RA27	Steering column pinch bolt
20	W706246	Instrument panel-to-floor bolt (3 required)

21	W703845	RH instrument panel-to-body bolt
22	14401	LH instrument panel electrical connectors
23	14401	Restraints control module (RCM) electrical connector
24	-	Antenna lead-in
25	14401	RH instrument panel electrical connector
26	04320	Instrument panel

1. For additional information, refer to the appropriate procedure.

INSTRUMENT PANEL CENTER FINISH PANEL

REMOVAL AND INSTALLATION

All vehicles

1. Place the vehicle in NEUTRAL.

   MKX only

2. Remove the floor console trim ring.

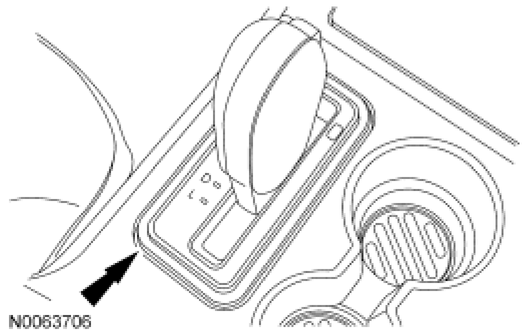


Fig. 5: Identifying Floor Console Trim Ring
Courtesy of FORD MOTOR CO.

All vehicles

3. Remove the floor console finish panel.
   - Open the storage compartment door.
   - Remove the console finish panel.

   MKX only

4. Remove the storage bin.

- Remove the 2 scrivets.
- Disconnect the power point electrical connector.

NOTE: The upper and lower center instrument panel finish panels are removed as one assembly.

5. Using a suitable tool, gently pry out the upper instrument panel center finish panel to disengage the clips.
    - Disconnect the electrical connectors.
6. Using a suitable tool, gently pry out the lower instrument panel center finish panel to disengage the clips.
    - Disconnect the electrical connectors.
7. Separate the upper instrument panel finish panel from the lower instrument panel finish panel.

    Edge only

    NOTE: The upper and lower instrument panel center finish panels are removed separately.

8. Using a suitable tool, gently pry out the upper instrument panel center finish panel to disengage the clips and remove the panel.
    - Disconnect the electrical connectors.
9. Using a suitable tool, gently pry out the lower instrument panel center finish panel to disengage the clips and remove the panel.
    - Disconnect the electrical connectors.

    All vehicles

10. To install, reverse the removal procedure.

INSTRUMENT CLUSTER FINISH PANEL

Edge only

1. Remove the upper instrument panel center finish panel.
    - Using a suitable tool, gently pry out the upper center finish panel to disengage the clips.
    - Remove the upper instrument panel center finish panel.
    - Disconnect the electrical connectors.

    All vehicles

2. Lower the steering column to the full down position.
3. Remove the steering column opening cover.
    - Remove the 2 steering column opening cover screws.

- Disengage the steering column opening cover from the retainers.
- Disconnect the electrical connector and tube, if equipped.

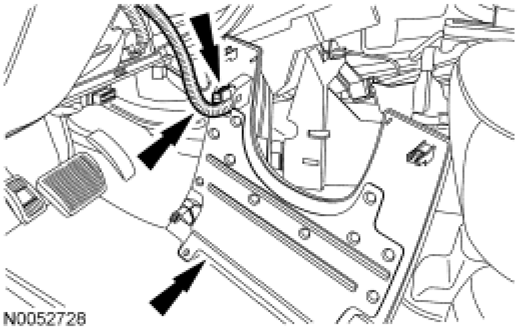


Fig. 6: Locating Electrical Connector, Tube & Steering Column Opening Cover
Courtesy of FORD MOTOR CO.

4. Remove the 2 cluster finish panel screws.

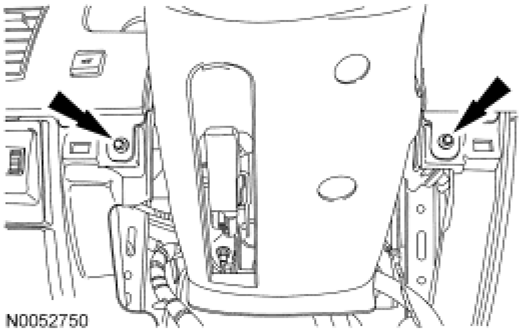


Fig. 7: Locating Cluster Finish Panel Screws
Courtesy of FORD MOTOR CO.

5. Disengage the instrument cluster finish panel from the retaining clips and remove the panel.
   - Disconnect the electrical connectors, if equipped.
6. To install, reverse the removal procedure.

INSTRUMENT PANEL

1. Remove the floor console. For additional information, refer to **Console - Floor**.
2. Depower the supplemental restraint system (SRS). For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** .
3. Remove the weatherstripping from the front door openings near the instrument panel.
4. Remove the LH and RH instrument panel end trim panels.
5. Remove the LH and RH A-pillar trim panels. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** .
6. Remove the LH and RH cowl panels.

7. Remove the steering column opening cover.
    - Remove the 2 steering column opening cover screws.
    - Disengage the steering column opening cover from the retaining clips.
    - Disconnect the electrical connector and hose, if equipped.

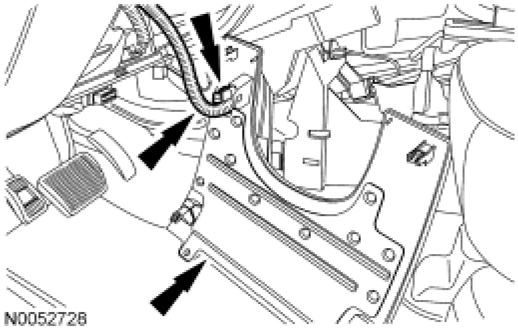


Fig. 8: Locating Electrical Connector, Tube & Steering Column Opening Cover
Courtesy of FORD MOTOR CO.

8. Remove the bolt and the hood opening handle.
    - Position the handle aside.

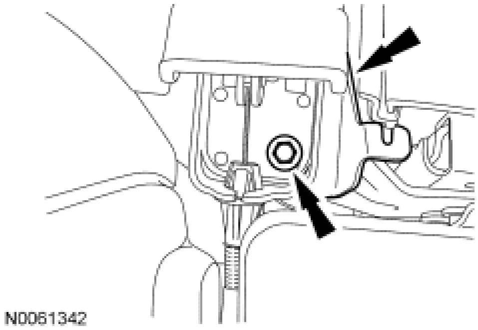


Fig. 9: Identifying Hood Opening Handle & Bolt
Courtesy of FORD MOTOR CO.

9. Disconnect the LH bulkhead electrical connector from under the steering column.

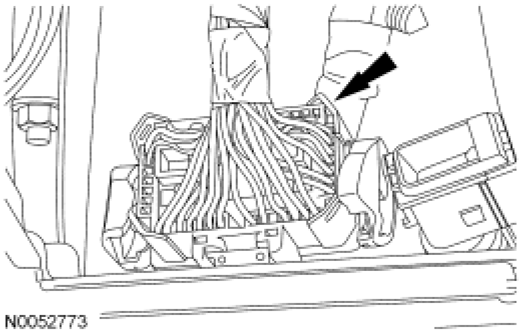


Fig. 10: Identifying LH Bulkhead Electrical Connector
Courtesy of FORD MOTOR CO.

10. Disconnect the RH bulkhead electrical connector from under the steering column.

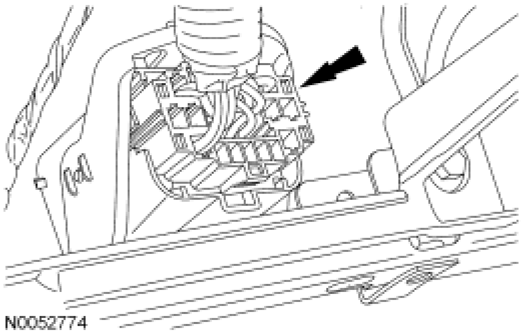


Fig. 11: Identifying RH Bulkhead Electrical Connector
Courtesy of FORD MOTOR CO.

11. Disconnect the 2 electrical connectors from the left cowl panel side.

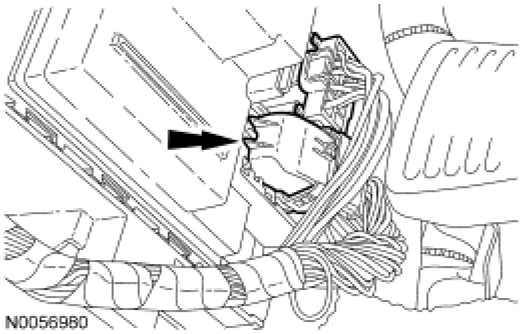


Fig. 12: Locating Electrical Connectors From Left Cowl Panel Side
Courtesy of FORD MOTOR CO.

12. Disconnect the electrical connectors and the antenna lead-in cable from the right cowl panel side.
    - Remove the harness from the retainers.

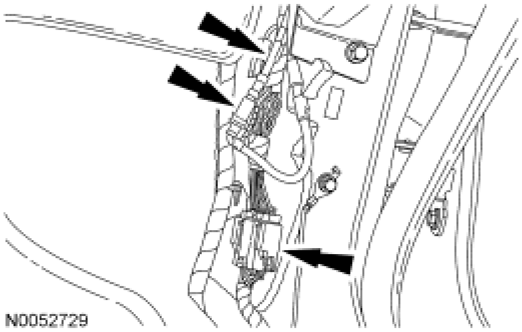


Fig. 13: Locating Electrical Connectors & Antenna Lead-In Cable From Right Cowl Panel Side

Courtesy of FORD MOTOR CO.

13. Disconnect the 2 A/C electrical connectors from inside the glove compartment.

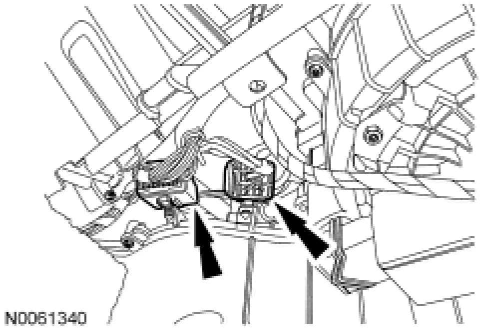


Fig. 14: Locating A/C Electrical Connectors From Inside Glove Compartment
Courtesy of FORD MOTOR CO.

14. Disconnect the electrical connector from the top of the heater core and evaporator core housing.

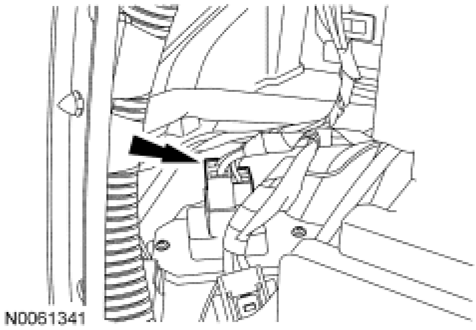


Fig. 15: Locating Blower Motor Resistor Or Blower Motor Speed Control Electrical Connector
Courtesy of FORD MOTOR CO.

15. Disconnect the selector lever cable from the ball stud on the selector lever.

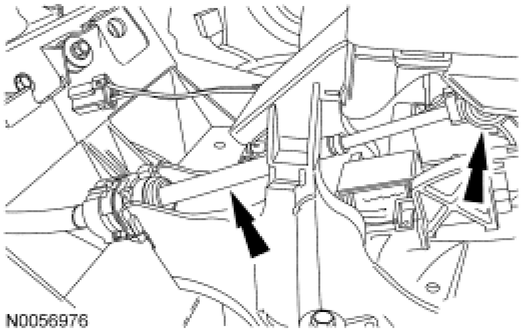


Fig. 16: Locating Shift Cable From Ball Stud On Shifter
Courtesy of FORD MOTOR CO.

16. Remove the selector lever cable from the retaining clips.

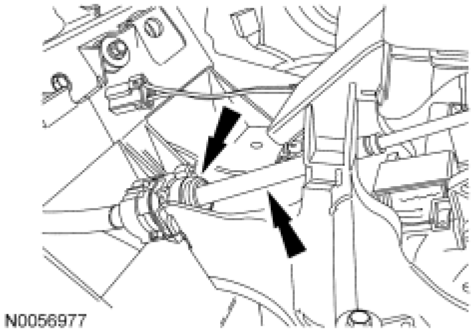


Fig. 17: Locating Shift Cable From Retaining Clips
Courtesy of FORD MOTOR CO.

17. Remove the 4 screws (2 each side) from the inner floor console support.

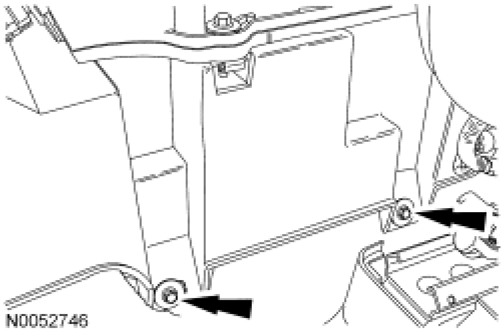


Fig. 18: Locating Screws From Inner Floor Console Support
Courtesy of FORD MOTOR CO.

18. Remove the screws from the front inner floor console support-to-instrument panel.

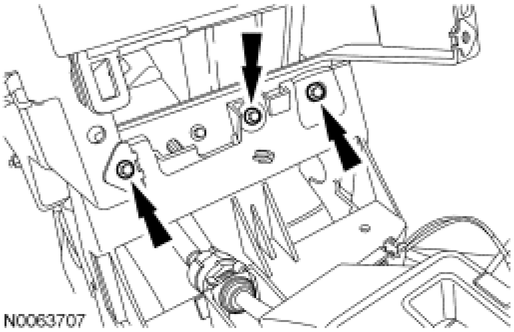


Fig. 19: Locating Screws From Front Inner Floor Console Support-To-Instrument Panel
Courtesy of FORD MOTOR CO.

19. Disconnect the electrical connectors from the front inner floor console.

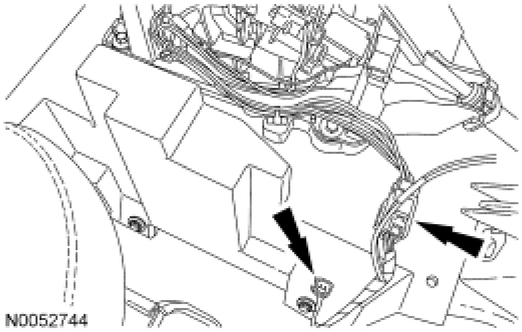


Fig. 20: Locating Electrical Connectors From Front Inner Floor Console
Courtesy of FORD MOTOR CO.

20. Remove the inner floor console support.
21. Disconnect the small restraints control module (RCM) electrical connector.

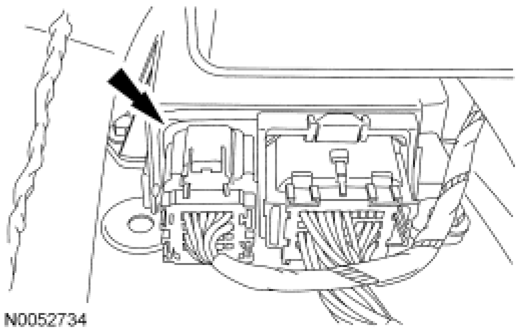


Fig. 21: Locating Restraints Control Module (RCM) Small Electrical Connector
Courtesy of FORD MOTOR CO.

22. Remove the LH pushpin retainer and position the carpet aside.

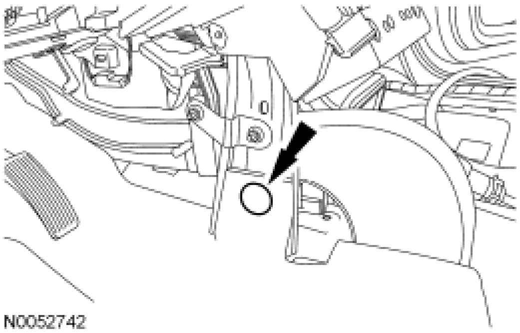


Fig. 22: Locating LH Push Pin Retainer & Position Carpet Aside
Courtesy of FORD MOTOR CO.

23. Remove the LH pushpin retainer from the instrument panel-to-A/C duct.

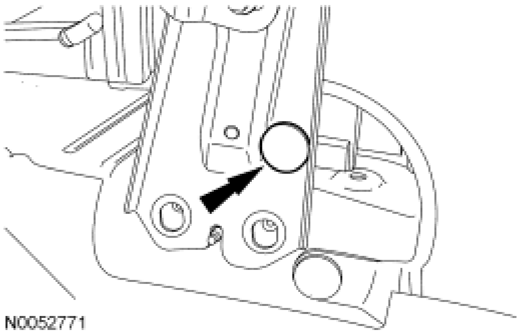


Fig. 23: Locating LH Push Pin Retainer From Instrument Panel-To-A/C Duct
Courtesy of FORD MOTOR CO.

24. Remove the 2 LH instrument panel-to-floor bolts.
    - To install, tighten to 22 N.m (16 lb-ft).
25. Remove the RH pushpin retainer and position the carpet aside.

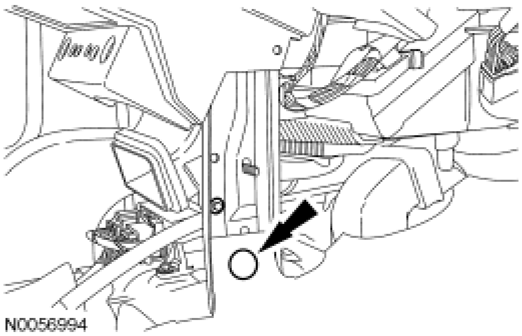


Fig. 24: Locating LH Instrument Panel-To-Floor Bolts
Courtesy of FORD MOTOR CO.

26. Remove the screw from the RH instrument panel brace-to-A/C duct.

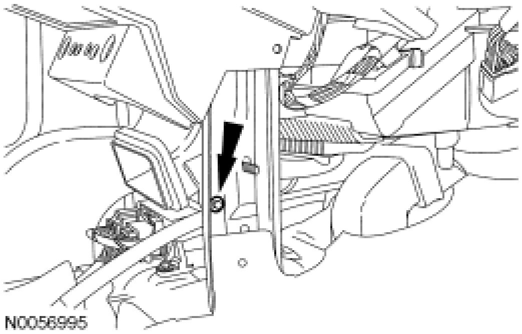


Fig. 25: Locating Screw From RH Instrument Panel Brace-To-A/C Duct
Courtesy of FORD MOTOR CO.

27. Remove the RH instrument panel-to-floor bolt.

- To install, tighten to 22 N.m (16 lb-ft).

28. Remove the 2 nuts and the LH instrument panel brace-to-A/C duct.

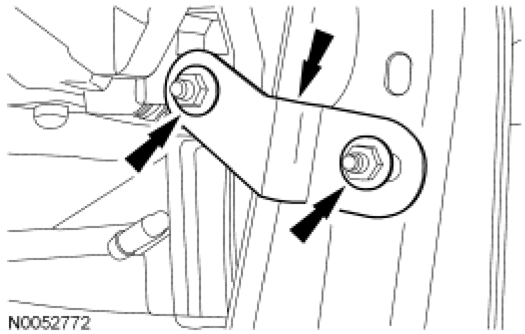


Fig. 26: Locating LH Instrument Panel Brace-To-A/C Duct Nuts
Courtesy of FORD MOTOR CO.

29. Remove and discard the steering column pinch bolt.
    - To install, use a new steering column pinch bolt and tighten to 23 Nm (17 lb-ft).
30. Rotate the steering wheel until the front wheels are in the straight-ahead position.
    - Remove the ignition key.

CAUTION: Do not allow the steering column shaft to rotate while the intermediate shaft is disconnected or damage to the clockspring may result. If there is evidence that the shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to SUPPLEMENTAL RESTRAINT SYSTEM .

31. Detach the steering column shaft from the intermediate shaft.
32. Remove the upper cowl panel grille. For additional information, refer to **FRONT END BODY PANELS** .
33. Remove the bolt from the front of dash.
    - To install, tighten to 20 N.m (15 lb-ft).

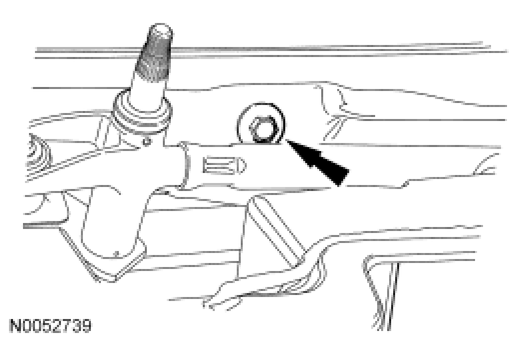


Fig. 27: Locating Bolt From Front Of Dash
Courtesy of FORD MOTOR CO.

34. Remove the driver seat. For additional information, refer to **SEATING** .

NOTE: The Torx head bolt is not completely removed. The bolt is pulled outward far enough to allow for clearance when removing the instrument panel.

35. Remove the Torx head bolt from inside the LH door.
    - To install, tighten to 30 N.m (22 lb-ft).

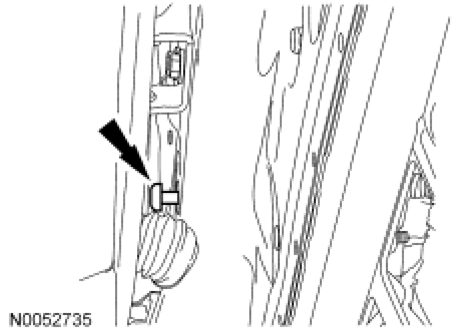


Fig. 28: Locating Torx(R) Head Bolt From Inside LH Door
Courtesy of FORD MOTOR CO.

36. Remove the 2 LH instrument panel bolts from inside the LH door.
    - To install, tighten to 20 N.m (15 lb-ft).

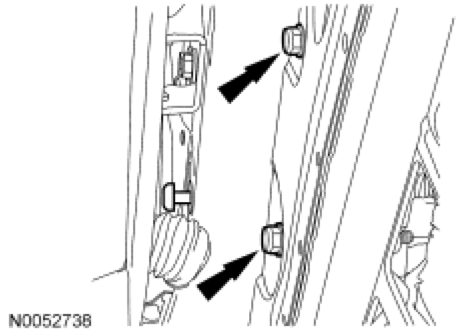


Fig. 29: Locating Bolts From Inside LH Door
Courtesy of FORD MOTOR CO.

37. Remove the 2 instrument panel-to-steering column bracket bolts from the bracket under the steering column.
    - To install, tighten to 22 N.m (16 lb-ft).

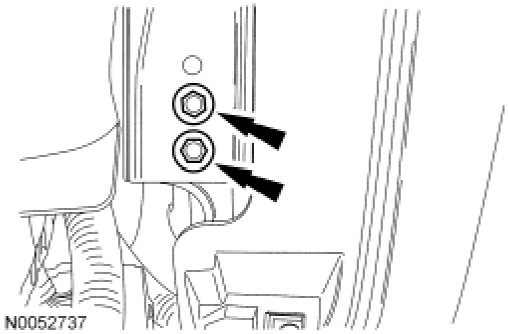


Fig. 30: Identifying Bolts From Bracket Under Steering Column
Courtesy of FORD MOTOR CO.

38. Remove the LH instrument panel-to-body bolt.
    - To install, tighten to 7 N.m (62 lb-in).

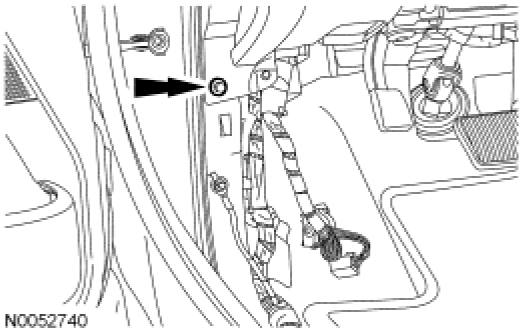


Fig. 31: Identifying LH Instrument Panel-To-Body Bolt
Courtesy of FORD MOTOR CO.

39. Remove the bolt from the RH instrument panel.
    - To install, tighten to 22 N.m (16 lb-ft).

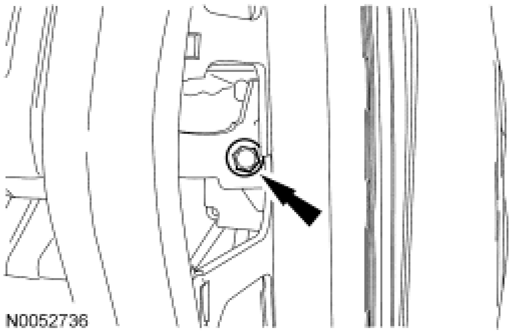


Fig. 32: Locating Bolt From RH Instrument Panel Cowl Side Panel
Courtesy of FORD MOTOR CO.

40. Remove the RH instrument panel-to-body bolt.

- To install, tighten to 7 N.m (62 lb-in).

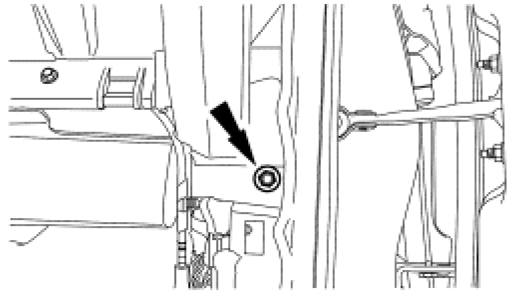


Fig. 33: Identifying RH Instrument Panel-To-Body Bolt
Courtesy of FORD MOTOR CO.

41. Remove the bolt and the hood opening handle.
    - Position the handle aside.

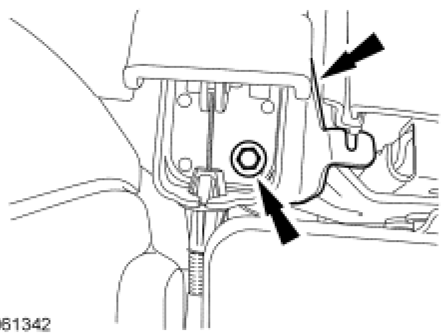


Fig. 34: Identifying Hood Opening Handle & Bolt
Courtesy of FORD MOTOR CO.

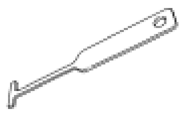
CAUTION: To avoid damage to the instrument panel, this next step requires the help of an assistant.

42. Remove the instrument panel.
43. To install, reverse the removal procedure.

POWER POINT

Special Tools

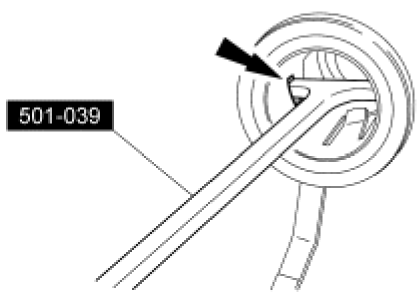
Illustration	Tool Name	Tool Number
	Remover, Power Point Socket	501-039 or equivalent

 ST3024-A		

REMOVAL

NOTE: Power point cover may differ depending on location.

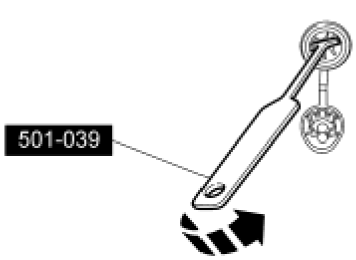
1. Open the power point cover.
2. Install the Power Point Socket Remover in one of the power point socket slots.



N0061767

Fig. 35: Installing Special Tool In Power Point Socket Slot
Courtesy of FORD MOTOR CO.

3. Position the Power Point Socket Remover so that it engages in the adjacent slot.



N0061768

Fig. 36: Positioning Special Tool To Engage In Adjacent Slot
Courtesy of FORD MOTOR CO.

4. Using the Power Point Socket Remover, pull the power point socket out of the retainer.

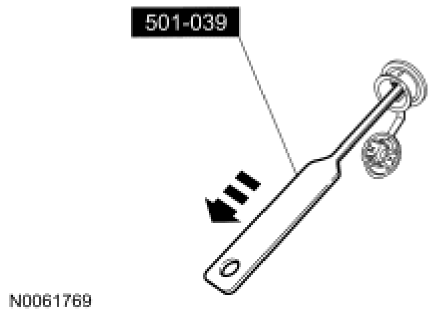


Fig. 37: Pulling Power Point Socket Out Of Retainer
Courtesy of FORD MOTOR CO.

5. Disconnect the electrical connector.

INSTALLATION

1. Connect the electrical connector.
2. Slide the power point socket into the retainer.

CONSOLE - FLOOR

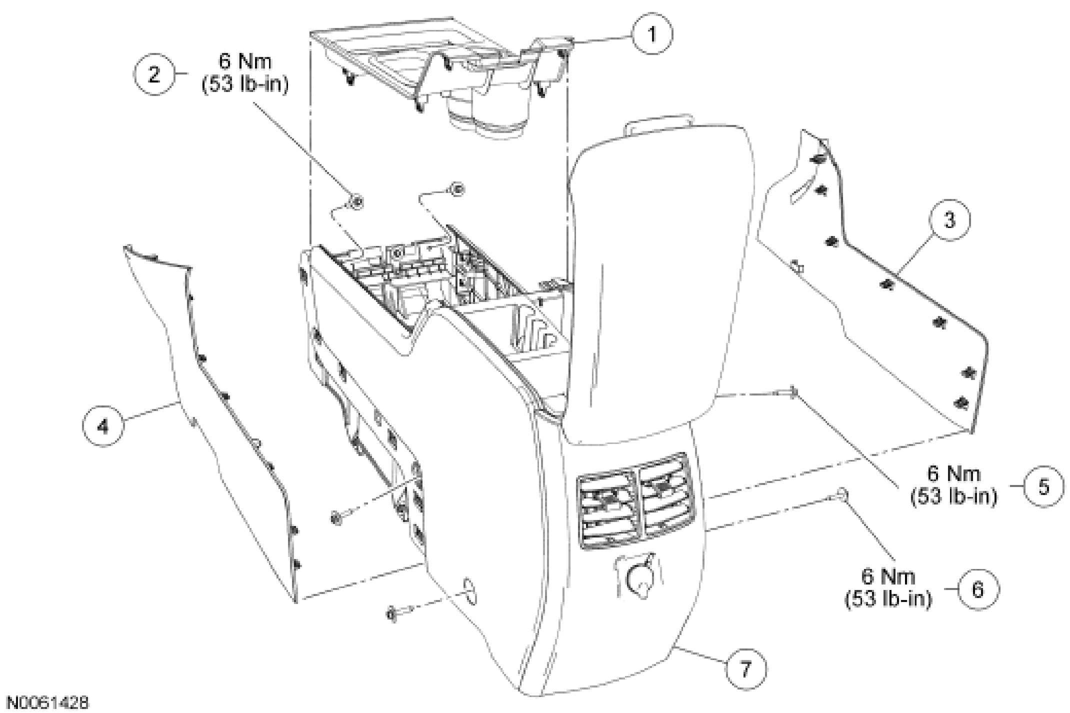


Fig. 38: Identifying Edge Floor Console With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description

1	045A76	Floor console finish panel
2	W706862	Floor console-to-instrument panel bolt (2 required)
3	04608	Floor console RH side panel
4	04609	Floor console LH side panel
5	W706862	Floor console center bolt (2 required)
6	W706862	Floor console rear bolt (2 required)
7	045A36	Floor console

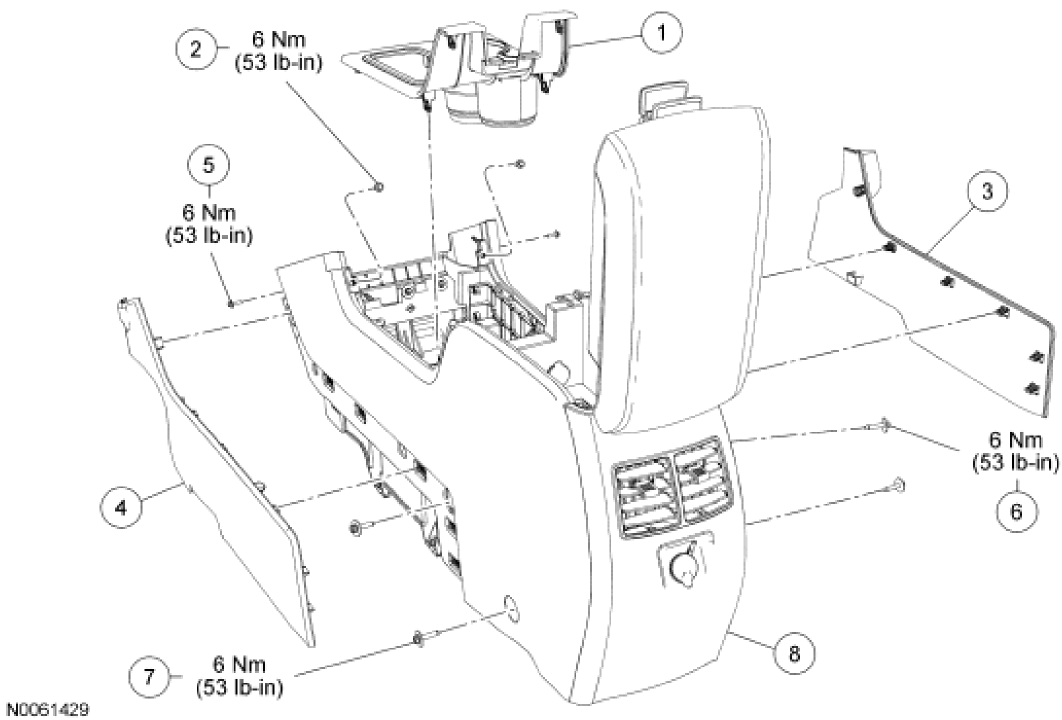


Fig. 39: Identifying MKX Floor Console With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	045A76	Floor console finish panel
2	W706862	Floor console-to-instrument panel bolt (2 required)
3	04608	Floor console RH side panel
4	04609	Floor console LH side panel
5	W707628	Floor console front side bolt (2 required)
6	W706862	Floor console center bolt (2 required)
7	W706862	Floor console rear bolt (2 required)
8	045A36	Floor console

All vehicles

1. Position the selector lever to NEUTRAL.

NOTE: The seats must be in the full raised position to access the bolts.

2. Position the seats forward and remove the 2 floor console rear bolts.
   - To install, tighten to 6 N.m (53 lb-in).
3. Remove the 2 floor console side panels.

NOTE: The seats must be in the full raised position to access the bolts.

4. Position the seats rearward and remove the 2 floor console side panels and 2 floor console center bolts.
   - To install, tighten to 6 N.m (53 lb-in).
5. Remove the floor console finish panel.

MKX only

6. Remove the storage bin.
   - Remove the 2 scrivets.
   - Disconnect the power point electrical connector.
7. Remove the 2 floor console front side bolts.
   - To install, tighten to 6 N.m (53 lb-in).

All vehicles

8. Remove the 2 floor console-to-instrument panel bolts.
   - To install, tighten to 6 N.m (53 lb-in).
9. Disconnect the floor console electrical connector from the lower right front wiring harness.
10. Remove the floor console.
11. To install, reverse the removal procedure.

CONSOLE - OVERHEAD

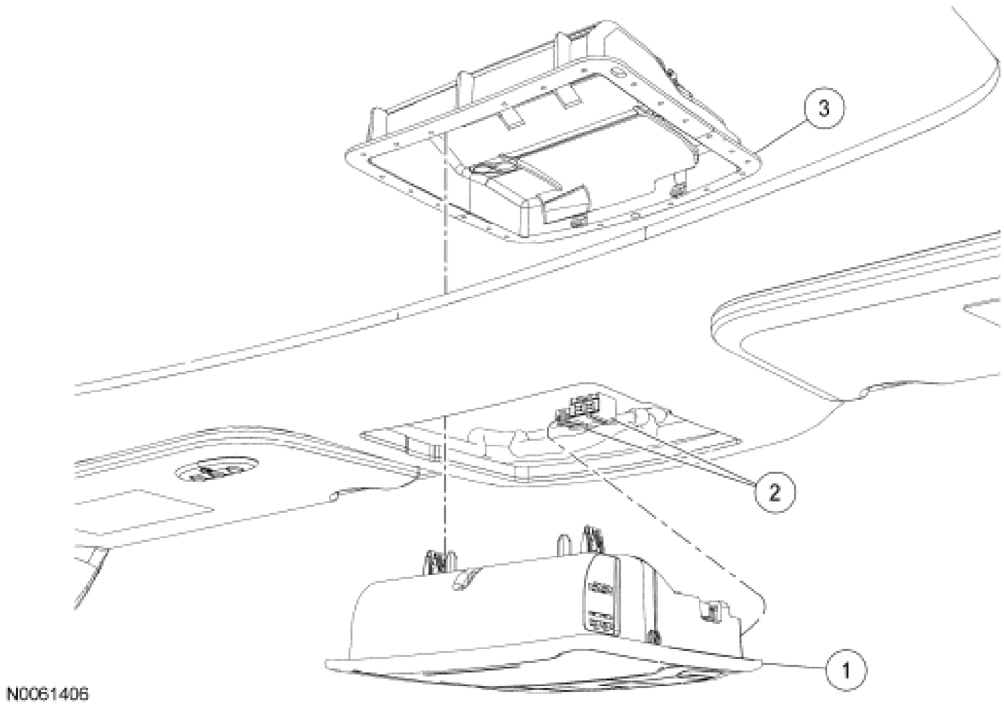


Fig. 40: Exploded View Of Overhead Console
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	519A70	Overhead console
2	-	Overhead console electrical connectors
3	519K22	Overhead console bracket

1. Remove the overhead console.
    - Pull downward on the overhead console.
    - Disconnect the electrical connectors.
2. To install, reverse the removal procedure.

2008 ENGINE PERFORMANCE

Intake Air Distribution and Filtering - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Air cleaner bolt	9	80
Air cleaner outlet pipe-to-air cleaner cover clamp	5	44
Air cleaner outlet pipe-to-throttle body (TB) clamp	5	44

DESCRIPTION AND OPERATION

INTAKE AIR DISTRIBUTION AND FILTERING

The air intake system consists of the:

- air cleaner inlet.
- air cleaner element.
- mass air flow (MAF) sensor.
- air cleaner outlet pipe.

The air intake system:

- cleans intake air with a replaceable, dry-type air cleaner element.
- measures airflow and air temperature with the MAF sensor.

DIAGNOSTIC TESTS

INTAKE AIR DISTRIBUTION AND FILTERING

Refer to the **Introduction - Gasoline Engines** article.

REMOVAL AND INSTALLATION

INTAKE AIR SYSTEM COMPONENTS - EXPLODED VIEW

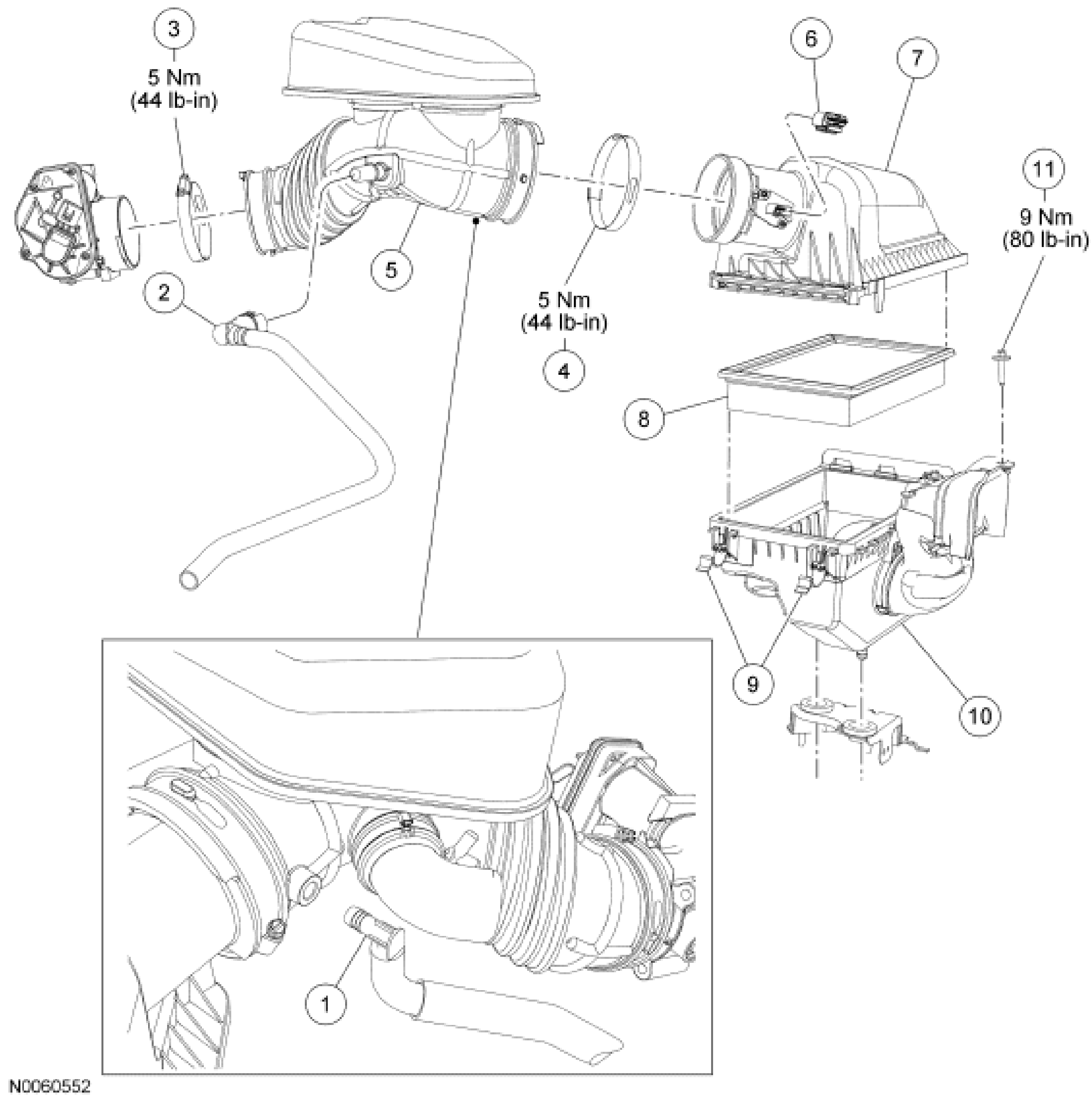


Fig. 1: Exploded View Of Intake Air System Components With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	9Y432	Vacuum tube
2	6758	Crankcase vent tube
3	9C632	Air cleaner outlet pipe-to-throttle body (TB) clamp
4	9C632	Air cleaner outlet pipe-to-air cleaner cover clamp
5	9F805	Air cleaner outlet pipe
6	14A464	Mass air flow (MAF) sensor electrical connector
7	9661	Air cleaner cover

8	9601	Air cleaner element
9	9628	Air cleaner tray assembly-to-air cleaner cover clamps
10	9A600	Air cleaner tray assembly
11	N606678	Air cleaner bolt

1. For additional information, refer to the procedures in this article.

AIR CLEANER

REMOVAL AND INSTALLATION

1. Disconnect the mass air flow (MAF) sensor electrical connector.
2. Loosen the clamp and disconnect the air cleaner outlet pipe from the air cleaner.
   - To install, tighten to 5 Nm (44 lb-in).
3. Remove the air cleaner bolt.
   - To install, tighten to 9 Nm (80 lb-in).

NOTE: No tools are needed to remove the air cleaner assembly. Removal should be carried out using hands only.

4. Separate the 2 air cleaner feet from the rubber grommets and remove the air cleaner assembly.

NOTE: Make sure that the 2 air cleaner feet are seated into the rubber grommets under the air cleaner assembly.

NOTE: The air cleaner outlet pipe should be securely sealed to prevent unmetered air from entering the engine.

5. To install, reverse the removal procedure.

AIR CLEANER OUTLET PIPE

REMOVAL AND INSTALLATION

1. Disconnect the crankcase vent tube and vacuum tube from the air cleaner outlet pipe.
2. Loosen the air cleaner outlet pipe-to-air cleaner cover clamp.
   - To install, tighten to 5 Nm (44 lb-in).
3. Loosen the air cleaner outlet pipe-to-throttle body clamp.
   - Remove the air cleaner outlet pipe.
   - To install, tighten to 5 Nm (44 lb-in).

NOTE: **The air cleaner outlet pipe should be securely sealed to prevent unmetered air from entering the engine.**

4. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Interior Lighting - Edge & MKX

DESCRIPTION AND OPERATION

INTERIOR LIGHTING

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The interior lighting system consists of the following components:

- SJB
- Liftgate/trunk module (LTM) (if equipped)
- Dimmer control switch
- Interior/map lamps
- Puddle lamps
- Cargo lamp
- Vanity mirror lamps
- Door ajar switches

The interior lighting system consists of 2 subsystems:

- Courtesy lamps
- Demand lamps

The courtesy lamps are controlled by the SJB. The SJB supplies voltage to the courtesy lamps. The courtesy lamp subsystem consists of the interior dome lamps, the overhead console lamps, the cargo lamp, and the puddle lamps (if equipped).

The SJB supplies voltage to the demand lamps. The demand lamps subsystem consists of the front map lamps, and the left and right vanity mirror lamps.

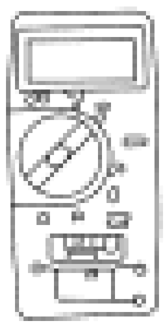
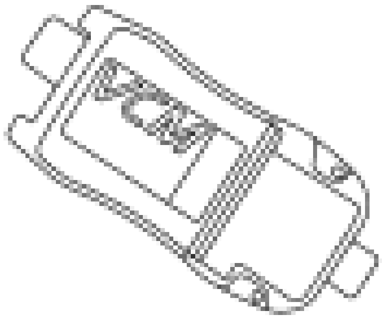
The SJB supplies power to the interior lighting system. The SJB and the LTM (if equipped) set DTCs if certain circuit failures exist with the interior lighting system.

DIAGNOSTIC TESTS

INTERIOR LIGHTING

SPECIAL TOOLS

Illustration	Tool Name	Tool Number

 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	-
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The SJB supplies voltage to the interior lighting system. The interior lighting system illuminates the courtesy lamps to enhance visibility of the interior while a vehicle door is open or ajar, and the vehicle speed is less than 15 km/h (9 mph) or 5 km/h (3 mph) for puddle lamps. The SJB controls all interior lighting functions and timing by monitoring inputs from the door ajar switches, instrument panel dimmer switch and vehicle speed.

Interior Lighting Delay

The interior lighting delay feature provides temporary illumination of the courtesy lamps after the doors are opened and then closed. The interior lighting delay feature keeps the courtesy lamps on for a period of 25 seconds after all the doors are closed. If during the 25-second delay time, the SJB detects that the ignition has been turned out of OFF, or if the vehicle is locked using the remote keyless entry (RKE) transmitter or the keypad, the courtesy lamp illumination is discontinued.

Illuminated Entry

The illuminated entry requests the courtesy lamps to be illuminated (when the ignition is off) and either the RKE transmitter UNLOCK button is pressed, or the vehicle is unlocked using the keypad. The illuminated entry requests the courtesy lamps off after 25 seconds have elapsed, the ignition is switched out of off, the RKE transmitter LOCK button is pressed, or the vehicle is locked using the keypad or door lock cylinder.

Illuminated Exit

The illuminated exit requests the courtesy lamps to be illuminated for 25 seconds when all doors are closed and the ignition key is removed from the ignition lock cylinder. The illuminated exit requests the courtesy lamps to be deactivated when the ignition key is inserted into the ignition lock cylinder, 25 seconds have elapsed or a door or liftgate is opened.

Theater Lighting

The theater lighting option ramps-up the courtesy lamps over 0.7 second when courtesy lamp activation is requested. The theater lighting feature ramps-down the courtesy lamps over 1.7 seconds when interior lighting deactivation is requested by any feature other than the panic alarm or battery saver.

Interior Lamp Arbitrator

The SJB chooses between the interior lighting, interior mode, interior lighting delay, illuminated entry, illuminated exit and battery saver to determine which feature has precedence of activating and deactivating the interior lamps.

The features are prioritized as follows:

- Perimeter alarm/panic alarm
- Demand lighting
- Battery saver
- Interior lighting
- Interior light delay
- Illuminated entry
- Illuminated exit

Battery Saver

The SJB provides automatic shut-off of the demand lamps (cargo lamp, vanity lamps, map lamps and cargo lamp) and courtesy lamps after a time-out period in order to save battery voltage. A timer in the SJB is started when the ignition is turned to the OFF position, and all the doors, the liftgate and the liftgate glass are closed. When the time-out period for the lamps has elapsed, the voltage is automatically shut off to the lamps by the SJB. While the SJB has voltage disabled, if the ignition is turned to any position other than OFF, any door becomes ajar, or the UNLOCK button of the RKE transmitter is pressed, a valid keypad code is entered, an unlock request from the cylinder is received, or the dome lamp switch is turned on, the SJB restores voltage and starts the timer again.

NOTE: Time-out is 1 minute if the vehicle has less than 80 km (50 miles).

The battery saver time-outs are as follows:

- Courtesy lamps = 10 minutes
- Demand lamps = 10 minutes

Field-Effect Transistor (FET) Protection

The SJB utilizes a FET protective circuit strategy for many of its outputs (for example, the headlamp output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault is detected. A continuous DTC is stored at that time of the fault. The circuit then resets after an ignition cycle or customer demand of the function (switching the component on, 30-minute battery saver being energized). When an excessive circuit load occurs several times, the module shuts down the output until a repair procedure is carried out. At the same time, the continuous DTC that was stored on the first failure cannot be cleared by a command to clear the continuous DTCs. The module does not allow this code to be cleared or the circuit restored to normal until a successful on-demand self-test proves that the fault has been repaired. After the on-demand self-test has successfully completed (no on-demand DTCs present), the continuous DTC clears and the circuit function returns.

Each circuit has 3 predefined levels of short circuit tolerance established in the module based on each circuits' capability. When the first or second level is reached, the continuous DTC associated with the circuit sets along with DTC B106E. These DTCs may be cleared using the Clear DTC operation on the scan tool as long as the fault itself has been corrected. If any of the circuits are shorted past the third level, then DTCs B106F and B1342 set along with the associated continuous DTC. This DTC cannot be cleared and a new module must be installed.

The SJB FET protected output circuits for the interior lighting system are for the puddle lamps and courtesy lamp output circuits.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical

- Courtesy lamps - Map lamps - Cargo lamp - Vanity lamps	- Smart junction box (SJB) fuse(s): 9 (15A) 10 (15A) 25 (10A) - Wiring, terminals or connectors - Ajar switch(es) (integral to latch) - Courtesy lamp(s) - Map lamp(s) - Puddle lamp(s) - Cargo lamp - Vanity lamp(s) - Overhead console - Instrument panel dimmer switch - SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool release software.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.

- If the scan tool responds with no communication with the SJB, refer to **MODULE COMMUNICATIONS NETWORK** article.
- If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB and the liftgate/trunk module (LTM) (if equipped).
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **SYMPTOM CHART**.

DTC Charts

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1320	Driver Door Ajar Circuit Open	Go to **Pinpoint Test C** .
B1328	Passenger Door Ajar Circuit Open	Go to **Pinpoint Test C** .
B1336	Door Ajar RR Circuit Open	Go to **Pinpoint Test C** .
B1572	Door Ajar LR Circuit Open	Go to **Pinpoint Test C** .
B1688	Lamp Dome Input Circuit Short to Ground	Go to **Pinpoint Test C** .
B2077	Liftgate Ajar Sw Circuit Failure	Go to **Pinpoint Test C** .
B2A35	Interior Lighting Output Circuit Open	If the courtesy lamps are inoperative, go to **Pinpoint Test A** . If the courtesy lamps stay on continuously, go to **Pinpoint Test C** .
B2A36	Interior Lighting Output Circuit Short to Ground	Go to **Pinpoint Test A** .
B2A39	Puddle Lamp Output Circuit Open	If the puddle lamps are inoperative, go to **Pinpoint Test I** . If the puddle lamps are always on, go to **Pinpoint Test J** .
B2A3A	Puddle Lamp Output Circuit Short to Ground	Go to **Pinpoint Test I** .
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

LIFTGATE/TRUNK MODULE (LTM) DTC CHART

DTC	Description	Action
B2718	Liftgate/Decklid Ajar Output Short to Battery	Go to **Pinpoint Test C** .
B2721	Liftgate/Decklid Ajar Output Short to	If interior lamps are inoperative, go to **Pinpoint Test L** .

	Ground or Open	If interior lamps are always on, go to **Pinpoint Test C** .
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

SYMPTOM CHART

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• No communication with the liftgate/trunk module (LTM)	• Wiring, terminals or connectors • LTM	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The courtesy lamps flash on and off	• The SJB is not configured correctly.	• CONFIGURE the SJB. REFER to **MODULE CONFIGURATION** article. TEST the system for normal operation.
• The courtesy lamps are inoperative	• Fuse • Wiring, terminals or connectors • SJB	• Go to **Pinpoint Test A** .
• An individual courtesy lamp is inoperative	• Wiring, terminals or connectors • Interior lamp	• Go to **Pinpoint Test B** .
• The courtesy lamps stay on continuously	• Wiring, terminals or connectors • Door ajar switch • Liftgate ajar switch • Instrument panel dimmer switch • LTM • SJB	• Go to **Pinpoint Test C** .
• The courtesy lamps do not turn on with one door open	• Wiring, terminals or connectors • Door ajar switch • SJB	• Go to **Pinpoint Test D** .
• The demand lamps are	• Fuse • Wiring, terminals	

inoperative	or connectors • SJB	• Go to **Pinpoint Test E** .
• An individual demand lamp is inoperative	• Wiring, terminals or connectors • Interior lamp	• Go to **Pinpoint Test F** .
• The illuminated entry is inoperative when using the remote keyless entry (RKE) transmitter	• RKE system • SJB	• Go to **Pinpoint Test G** .
• The battery saver does not deactivate after time-out	• Wiring, terminals or connectors • SJB	• Go to **Pinpoint Test H** .
• The puddle lamp(s) are inoperative	• Fuse • Wiring, terminals or connectors • Exterior mirror • SJB	• Go to **Pinpoint Test I** .
• The puddle lamps stay on continuously	• Wiring, terminals or connectors • SJB	• Go to **Pinpoint Test J** .
• The courtesy lamps are inoperative - from the instrument panel dimmer switch	• Wiring, terminals or connectors • Instrument panel dimmer switch • SJB	• Go to **Pinpoint Test K** .
• The courtesy lamps do not turn on with the liftgate open	• Wiring, terminals or connectors • Liftgate ajar switch • LTM • SJB	• Go to **Pinpoint Test L** .

Pinpoint Tests

Pinpoint Test A: The Courtesy Lamps Are Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Interior Lamps schematic and connector information.

Normal Operation

Power is supplied to the courtesy lamps through the smart junction box (SJB) fuse 9 (15A), and SJB fuse 25

(10A) for the demand lamps. When any door is opened, the ajar switch opens, signaling the SJB. The SJB monitors the ajar circuits, and based on the ajar status, the SJB supplies voltage to the courtesy lamps on circuit VLN33 (GY/VT). Ground is supplied through circuit GD133 (BK) for the courtesy lamps, and circuit GD126 (BK/WH) for the cargo lamp.

- DTC B2A35 (Interior Lighting Output Circuit Open) - is an on-demand DTC that sets when the SJB detects an open from the interior lighting circuit.
- DTC B2A36 (Interior Lighting Output Circuit Short to Ground) - is a continuous and on-demand DTC that sets when the SJB detects a short to ground from the interior lighting circuit.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- SJB

PINPOINT TEST A: THE COURTESY LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

A1 CHECK THE SJB DTCs FROM BOTH THE CONTINUOUS AND THE ON-DEMAND SELF-TESTS

- Use the recorded results from the SJB continuous and on-demand self-test.
- **Are any SJB DTCs recorded?**

  YES : For DTC B2A35 or B2A36, go to A2 .

  For all other DTCs, REFER to DTC Charts in this service information.

  NO : Go to A3.

A2 CHECK CIRCUIT VLN33 (GY/VT) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280a

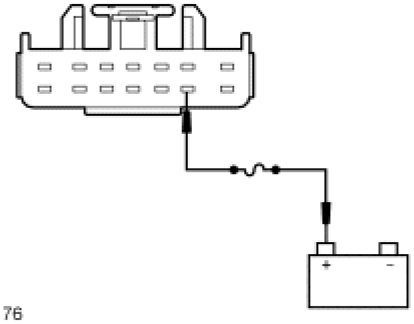


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Fig. 1: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

NOTE: If the jumper wire fails, repair circuit VLN33 for a short to ground.

- Connect a fused (10A) jumper wire between the SJB C2280a-9, circuit VLN33 (GY/VT), harness side and battery positive.
- **Do the courtesy lamps illuminate?**

  YES : VERIFY the SJB fuse 9 (15A) is OK. If OK, go to A3 .

  NO : REPAIR the circuit. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.

A3 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: An Individual Courtesy Lamp Is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Interior Lamps schematic and connector information.

Normal Operation

The smart junction box (SJB) provides voltage to the courtesy lamps on circuit VLN33 (GY/VT). The courtesy lamps are grounded through circuit GD133 (BK). The cargo lamp is also on the courtesy lamp circuit. Circuit VLN33 (GY/VT) provides voltage to the cargo lamp, and is grounded through circuit GD126 (BK/WH).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Interior lamp

PINPOINT TEST B: AN INDIVIDUAL COURTESY LAMP IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

B1 CHECK THE INTERIOR LAMP

- Key in OFF position.
- Disconnect: Suspect Interior Lamp
- Open the driver door.
- Measure the voltage between the suspect interior lamp connector, harness side as follows:

Location	Connector-Pin/ Circuit	Connector-Pin/ Circuit
Overhead console	C930-2 VLN33 (GY/VT)	C930-1 GD133 (BK)
Rear interior lamp	C923-1 VLN33 (GY/VT)	C923-2 GD133 (BK)
Cargo lamp	C926-1 VLN33 (GY/VT)	C926-2 GD126 (BK/WH)

- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new interior lamp for the lamp in question. REFER to **Interior Lamp**. TEST the system for normal operation.

  NO : Go to B2.

B2 CHECK CIRCUIT VLN33 (GY/VT) FOR VOLTAGE

- Measure the voltage between the suspect interior lamp, harness side and ground as follows:

Location	Connector-Pin	Circuit
Overhead console	C930-2	VLN33 (GY/VT)
Rear interior lamp	C923-1	VLN33 (GY/VT)
Cargo lamp	C926-2	VLN33 (GY/VT)

- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new interior lamp for the lamp in question. REFER to **Interior Lamp**. TEST the system for normal operation.

NO : REPAIR circuit VLN33 (GY/VT) for the lamp in question. TEST the system for normal operation.

Pinpoint Test C: The Courtesy Lamps Stay On Continuously

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Interior Lamps schematic and connector information.

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Power Liftgate schematic and connector information.

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Remote Keyless Entry and Alarm schematic and connector information.

Normal Operation

When any door or the liftgate is opened, the ajar switch (or the liftgate/trunk module [LTM], if equipped) opens the circuit to the smart junction box (SJB). The SJB monitors the ajar circuits, and based on the ajar status, supplies voltage to the courtesy lamps on circuit VLN33 (GY/VT).

DTC Description	Fault Trigger Conditions
B1320 - Driver Door Ajar Circuit Open	An on-demand DTC that sets when the SJB detects an open from the LH front door ajar circuit.
B1328 - Passenger Door Ajar Circuit Open	An on-demand DTC that sets when the SJB detects an open from the RH front door ajar circuit.
B1336 - Door Ajar RR Circuit Open	An on-demand DTC that sets when the SJB detects an open from the RH rear door ajar circuit.
B1572 - Door Ajar LR Circuit Open	An on-demand DTC that sets when the SJB detects an open from the LH rear door ajar circuit.
B1688 - Lamp Dome Input Circuit Short To Ground	An on-demand DTC that sets when the SJB detects a short to ground from the instrument panel dimmer switch circuit.
B2077 - Liftgate Ajar Sw Circuit Failure	An on-demand DTC that sets when the SJB detects an open from the liftgate ajar circuit.
B2A35 - Interior Lighting Output Circuit Open	An on-demand DTC that sets when the SJB detects a short to voltage from the courtesy lamp output circuit.
B2718 - Liftgate/Decklid Ajar Output Short to Battery	An continuous and on-demand DTC that sets when the LTM detects a short to voltage from the liftgate ajar input circuit

	to the SJB.
B2721 - Liftgate/Decklid Ajar Output Short to Ground or Open	An continuous and on-demand DTC that sets when the LTM detects an open from the liftgate ajar input circuit to the SJB.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door ajar switch
- Liftgate ajar switch
- Instrument panel dimmer switch
- LTM
- SJB

PINPOINT TEST C: THE COURTESY LAMPS STAY ON CONTINUOUSLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

C1 CHECK THE SJB DTCs FROM BOTH THE CONTINUOUS AND THE ON-DEMAND SELF-TESTS

- Use the recorded results from the SJB continuous and the on-demand self-test.
- **Are any SJB DTCs recorded?**

  YES : For DTC B1320, B1328, B1336, or B1572, go to C2.

  For DTC B1688, go to C5.

  For DTC B2A35, go to C7.

  For DTC B2077 (manual liftgate), go to C8.

  For DTC B2077 (power liftgate), go to C12.

  NO : If equipped with a power liftgate, go to C11.

  If equipped with a manual liftgate, go to C14.

C2 CHECK THE DOOR AJAR GROUND CIRCUITS FOR AN OPEN

- Key in OFF position.
- Disconnect: Suspect Ajar Switch

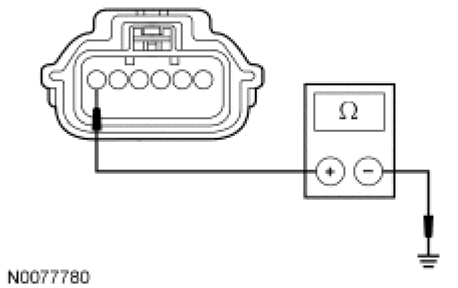

Fig. 2: Measuring Resistance Between Suspect Door Ajar Switch And Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the suspect ajar switch connector, harness side and ground as follows:

Location	Connector-Pin	Circuit
LF	C525-6	GD133 (BK)
RF	C603-6	GD140 (BK/GN)
LR	C704-6	GD126 (BK/WH)
RR	C804-6	GD145 (BK/BU)

- **Is the resistance less than 5 ohms?**

  YES : Go to C3.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C3 CHECK THE DOOR AJAR SWITCH OPERATION

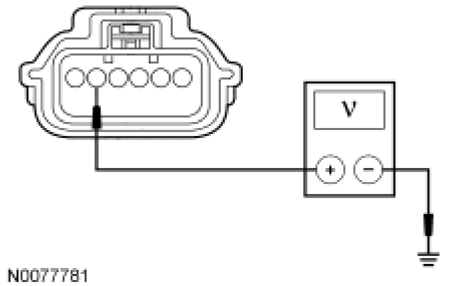

Fig. 3: Measuring Voltage Between Suspect Door Ajar Switch And Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the suspect door ajar switch, harness side and ground as follows:

Location	Connector-Pin	Circuit
LF	C525-5	CPL26 (GN/VT)
RF	C603-5	CPL31 (WH)
LR	C704-5	CPL36 (GN)
RR	C804-5	CPL39 (YE)

- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new door latch for the switch in question. REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to C4.

C4 CHECK THE DOOR AJAR SWITCH CIRCUIT FOR AN OPEN

- Disconnect: SJB C2280c
- Measure the resistance between the suspect door ajar switch, harness side and the SJB, harness side as follows:

Location	SJB Connector-Pin	Suspect Door Ajar Switch Connector-Pin	Circuit
LF	C2280c-14	C525-5	CPL26 (GN/VT)
RF	C2280c-2	C603-5	CPL31 (WH)
LR	C2280c-3	C704-5	CPL36 (GN)
RR	C2280c-15	C804-5	CPL39 (YE)

- **Is the resistance less than 5 ohms?**

  YES : Go to C14.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C5 CHECK THE INSTRUMENT PANEL DIMMER SWITCH

- Key in OFF position.
- Disconnect: Instrument Panel Dimmer Switch C2298
- **Are the courtesy lamps still illuminated?**

  YES : Go to C6.

NO : INSTALL a new instrument panel dimmer switch. REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** article. CLEAR the DTCs. REPEAT the self-test.

C6 CHECK CIRCUIT CLN28 (GN/BU) FOR A SHORT TO GROUND

- Disconnect: SJB C2280b

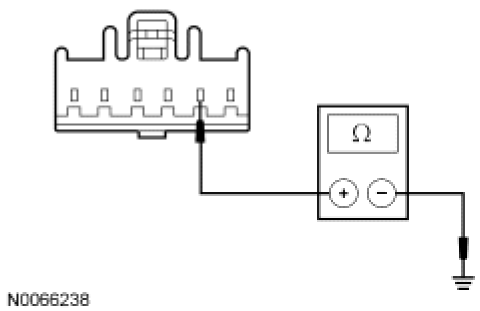

Fig. 4: Measuring Resistance Between Dimmer Switch C2298-2 Circuit CLN28 (GN/BU) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument panel dimmer switch C2298-2 circuit CLN28 (GN/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to C14.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C7 CHECK CIRCUIT VLN33 (GY/VT) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280a
- Key in ON position.
- Observe the courtesy lamps.
- **Are the courtesy lamps still illuminated?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to C14.

C8 CHECK CIRCUIT GD149 (BK/GY) FOR AN OPEN (MANUAL LIFTGATE)

- Key in OFF position.
- Disconnect: Liftgate Latch C479

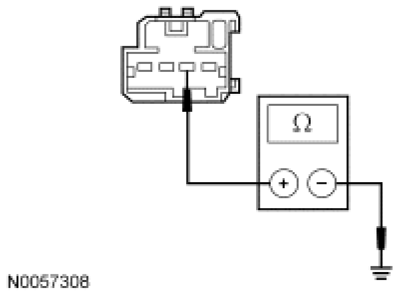

Fig. 5: Measuring Resistance Between Liftgate Latch C479-3, Circuit GD149 (BK/GY) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the liftgate latch C479-3, circuit GD149 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to C9.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C9 CHECK THE LIFTGATE AJAR SWITCH OPERATION (MANUAL LIFTGATE)

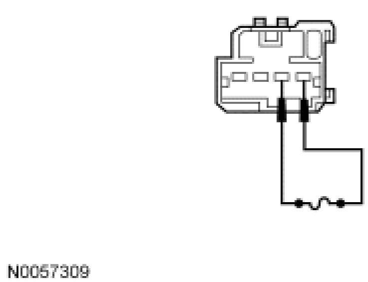

Fig. 6: Connecting Fused Jumper Wire
Courtesy of FORD MOTOR CO.

- Connect a (5A) jumper wire between the liftgate latch C479-4, circuit CPL60 (BN/YE), harness side and the liftgate latch C479-3, circuit GD149 (BK/GY), harness side.
- **Do the courtesy lamps turn off?**

  YES : REMOVE the jumper wire. INSTALL a new manual liftgate latch. REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article. CLEAR the DTCs. REPEAT the self-test.

  NO : LEAVE the jumper wire connected. Go to C10.

C10 CHECK CIRCUIT CPL60 (BN/YE) FOR AN OPEN (MANUAL LIFTGATE)

- Disconnect: SJB C2280c

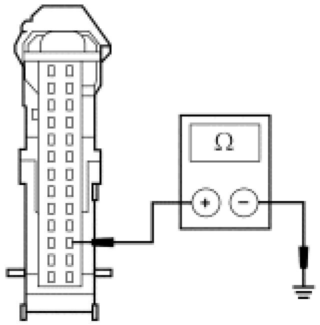

Fig. 7: Measuring Resistance Between SJB C2280C-16, Circuit CPL60 (BN/YE), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280c-16, circuit CPL60 (BN/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : REMOVE the jumper wire. Go to C14.

  NO : REMOVE the jumper wire. REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C11 CHECK THE LTM DTCs FROM BOTH THE CONTINUOUS AND THE ON-DEMAND SELF-TESTS

- Use the recorded results from the LTM continuous and the on-demand self-test.
- **Are any LTM DTCs recorded?**

  YES : For DTCs B2718 or B2721, go to C12.

  For all other DTCs, REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

  NO : Go to C14.

C12 CHECK THE LTM

- Key in OFF position.
- Disconnect: LTM C4174b

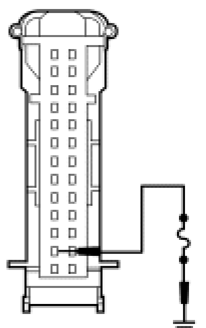

Fig. 8: Connecting Fused Jumper Wire
Courtesy of FORD MOTOR CO.

NOTE: If the fuse fails, repair the circuit for a short to voltage.

- Connect a fused (5A) jumper wire between the LTM C4174b-2, circuit CPL60 (BN/YE), harness side and ground.
- **Do the courtesy lamps turn off?**

  YES : REMOVE the jumper wire. Go to C15.

  NO : LEAVE the jumper wire connected. Go to C13.

C13 CHECK CIRCUIT CPL60 (BN/YE) FOR AN OPEN

- Disconnect: SJB C2280c

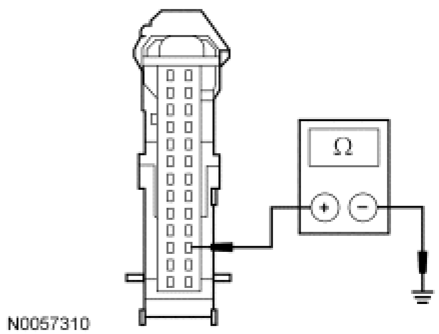

Fig. 9: Measuring Resistance Between SJB C2280C-16, Circuit CPL60 (BN/YE), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280c-16, circuit CPL60 (BN/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : REMOVE the jumper wire. Go to C14.

  NO : REMOVE the jumper wire. REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C14 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

C15 CHECK FOR CORRECT LTM OPERATION

- Disconnect all the LTM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the LTM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new LTM. REFER to **BODY CLOSURES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: The Courtesy Lamps Do Not Turn On With One Door Open

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Remote Keyless Entry and Alarm schematic and connector information.

Normal Operation

When any door is opened, the ajar switch opens the circuit to the smart junction box (SJB). The SJB monitors the ajar circuits, and based on the ajar status, supplies voltage to the courtesy lamps on circuit VLN33 (GY/VT).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door ajar switch
- SJB

PINPOINT TEST D: THE COURTESY LAMPS DO NOT TURN ON WITH ONE DOOR OPEN

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

D1 CHECK THE DOOR AJAR PIDs

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Check the SJB door ajar switch PIDs (D_DR_SW, P_DR_SW, LRDR_SW, and RRDR_SW) while opening and closing all the doors.
- **Do all the door ajar switch PID values agree with the door positions?**

YES : Go to D4.

NO : Go to D2.

D2 CHECK THE AJAR SWITCH OPERATION

- Disconnect: Suspect Ajar Switch
- **Do the courtesy lamps illuminate?**

YES : INSTALL a new door latch for the ajar switch in question. REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article. TEST the system for normal operation.

NO : Go to D3.

D3 CHECK THE AJAR SWITCH CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280c

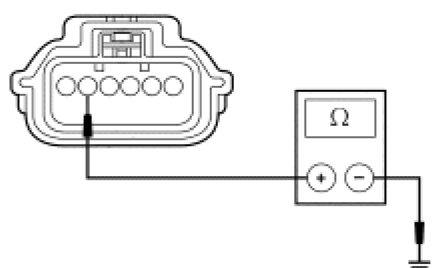

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Fig. 10: Measuring Resistance Between Suspect Door Ajar Switch And Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the suspect ajar switch, harness side and ground as follows:

Location	Connector-Pin	Circuit
LF	C525-5	CPL26 (GN/VT)
RF	C603-5	CPL31 (WH)
LR	C704-5	CPL36 (GN)
RR	C804-5	CPL39 (YE)

- **Is the resistance greater than 10,000 ohms?**

YES : Go to D4.

NO : REPAIR the circuit in question. TEST the system for normal operation.

D4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors

- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test E: The Demand Lamps Are Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Interior Lamps schematic and connector information.

Normal Operation

The smart junction box (SJB) supplies voltage to the demand lamps on circuit CLN09 (YE/GN). The demand lamps are grounded through circuit GD133 (BK).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- SJB

PINPOINT TEST E: THE DEMAND LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

E1 CHECK THE OPERATION OF THE COURTESY LAMPS

- Open the driver door.
- **Do the courtesy lamps illuminate?**

  YES : Go to E2.

  NO : Go to **Pinpoint Test A** .

E2 CHECK CIRCUIT CLN09 (YE/GN) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280d

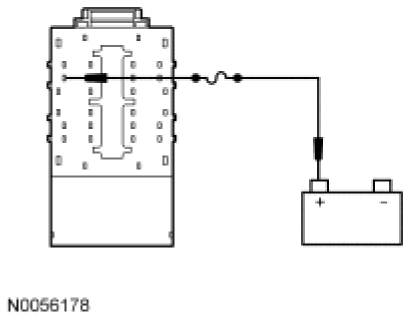


Fig. 11: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

NOTE: If the fuse fails, repair circuit CLN09 (YE/GN) for a short to ground.

- Connect a fused (10A) jumper wire between the SJB C2280d-21, circuit CLN09 (YE/GN), harness side and battery positive.
- **Do the demand lamps illuminate when switched on?**

  YES : VERIFY the SJB fuse 25 (10A) is OK. If OK, go to E3.

  NO : REPAIR the circuit. TEST the system for normal operation.

E3 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test F: An Individual Demand Lamp Is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Interior Lamps schematic and connector information.

Normal Operation

The smart junction box (SJB) supplies voltage to the demand lamps on circuit CLN09 (YE/GN). The demand lamps are grounded through circuit GD133 (BK).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Interior lamp

PINPOINT TEST F: AN INDIVIDUAL DEMAND LAMP IS INOPERATIVE

> **CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

F1 CHECK CIRCUIT CLN09 (YE/GN) FOR AN OPEN

- Key in OFF position.
- Disconnect: Suspect Demand Lamp
- Key in ON position.
- Measure the voltage between the suspect demand lamp, harness side and ground as follows:

Location	Connector-Pin	Circuit
RH vanity mirror lamp	C906-1	CLN09 (YE/GN)
LH vanity mirror lamp	C907-1	CLN09 (YE/GN)
Overhead console	C930-3	CLN09 (YE/GN)
Rear interior lamp	C923-3	CLN09 (YE/GN)

- **Is the voltage greater than 10 volts?**

  YES : Go to F2.

  NO : REPAIR the circuit. TEST the system for normal operation.

F2 CHECK THE GROUND CIRCUIT FOR AN OPEN

- Measure the resistance between the suspect demand lamp, harness side and ground as follows:

Location	Connector-Pin	Circuit
RH vanity mirror	C906-2	GD133 (BK)

lamp		
LH vanity mirror lamp	C907-2	GD133 (BK)
Overhead console	C930-1	GD133 (BK)
Rear interior lamp	C923-2	GD133 (BK)

- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new interior lamp for the lamp in question. REFER to **Interior Lamp**. TEST the system for normal operation.

  NO : REPAIR circuit GD133 (BK). TEST the system for normal operation.

Pinpoint Test G: The Illuminated Entry Is Inoperative When Using The Remote Keyless Entry (RKE) Transmitter

Normal Operation

The illuminated entry provides interior lighting whenever the smart junction box (SJB) receives a doors unlock request from the remote keyless entry (RKE) transmitter. The SJB provides voltage on circuit VLN33 (GY/VT) for the courtesy lamps.

This pinpoint test is intended to diagnose the following:

- RKE system
- SJB

PINPOINT TEST G: THE ILLUMINATED ENTRY IS INOPERATIVE WHEN USING THE REMOTE KEYLESS ENTRY (RKE) TRANSMITTER

G1 CHECK FOR CORRECT RKE OPERATION

- Using the RKE transmitter, lock and unlock the doors.
- **Do the doors lock and unlock?**

  YES : Go to G2.

  NO : REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article to continue diagnosis of the RKE system.

G2 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion

    - damaged pins
    - pushed-out pins
  - Connect all the SJB connectors and make sure they seat correctly.
  - Operate the system and verify the concern is still present.
  - **Is the concern still present?**

    YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

    NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test H: The Battery Saver Does Not Deactivate After Time-Out

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Interior Lamps schematic and connector information.

Normal Operation

The smart junction box (SJB) provides a battery saver function. The battery saver function provides automatic shutoff of the interior lamps (courtesy lamps and demand lamps) after a predetermined time has elapsed in order to save battery power.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- SJB

PINPOINT TEST H: THE BATTERY SAVER DOES NOT DEACTIVATE AFTER TIME-OUT

H1 CHECK THE SJB IGNITION SWITCH PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB ignition switch PIDs (IGN_A_ECU, IGN_O_ECU, IGN_R_ECU and IGN_S_ECU) while rotating the ignition switch through all positions.
- **Do the ignition switch PIDs agree with the ignition switch positions?**

  YES : Go to H2.

  NO : REFER to **STEERING COLUMN SWITCHES** article.

H2 CHECK CIRCUIT CLN09 (YE/GN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280d
- Key in ON position.
- Operate the demand lamps.
- **Do the demand lamps illuminate?**

YES : REPAIR the circuit. TEST the system for normal operation.

NO : Go to H3.

H3 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test I: The Puddle Lamp(s) are Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Interior Lamps schematic and connector information.

Normal Operation

The smart junction box (SJB) provides voltage to the puddle lamps through circuit CLN25 (VT). The puddle lamps have separate ground circuits. The LH exterior mirror is grounded through circuit GD133 (BK) and the RH exterior mirror is grounded through circuit GD140 (BK/GN).

- DTC B2A39 (Puddle Lamp Output Circuit Open) - is an on-demand DTC that sets when the SJB detects an open on the puddle lamp output circuit.
- DTC B2A3A (Puddle Lamp Output Circuit Short to Ground) - is a continuous and on-demand DTC that sets when the SJB detects a short to ground on the puddle lamp output circuit. This DTC also sets as a result when the SJB fuse 10 (15A) has failed or is removed.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Exterior mirror
- SJB

PINPOINT TEST I: THE PUDDLE LAMP(S) ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

I1 CHECK THE PUDDLE LAMP OPERATION

- Open any door and observe the puddle lamps.
- **Are both the puddle lamps inoperative?**

  YES : Go to I2.

  NO : Go to I3.

I2 CHECK CIRCUIT CLN25 (VT) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280c

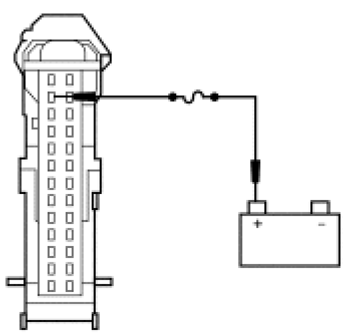


Fig. 12: Connecting Fused (10A) Jumper Wire Between SJB C2280C-12, Circuit CLN25 (VT) & Battery Positive
Courtesy of FORD MOTOR CO.

NOTE: If the fuse fails, repair circuit CLN25 (VT) for a short to ground.

- Connect a fused (10A) jumper wire between the SJB C2280c-12, circuit CLN25 (VT), harness side and battery positive.
- **Do the puddle lamps illuminate?**

  YES : REMOVE the jumper wire. Go to I5.

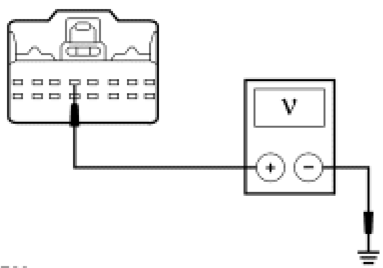
  NO : REMOVE the jumper wire. REPAIR the circuit. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.

I3 CHECK CIRCUIT CLN25 (VT) FOR AN OPEN

- Disconnect: Suspect Exterior Mirror

NOTE: The courtesy lamps must be active during this test.

- Open any door.



N0077783

Fig. 13: Measuring Voltage Between Suspect Exterior Mirror Connector, Harness Side And Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the suspect exterior mirror connector, harness side and ground as follows:

Location	Connector-Pin	Circuit
RH exterior mirror	C622-5	CLN25 (VT)
LH exterior mirror	C516-5	CLN25 (VT)

- **Is the voltage greater than 10 volts?**

  YES : Go to I4.

  NO : REPAIR the circuit. TEST the system for normal operation.

I4 CHECK THE GROUND CIRCUIT FOR AN OPEN

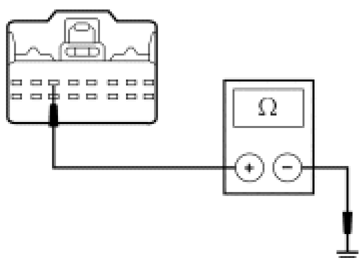


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Fig. 14: Measuring Resistance Between Suspect Exterior Mirror Connector, Harness Side And Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the suspect exterior mirror connector, harness side and ground as follows:

Location	Connector-Pin	Circuit
RH exterior mirror	C622-6	GD140 (BK/GN)
LH exterior mirror	C516-6	GD133 (BK)

- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new exterior mirror in question. REFER to **REAR VIEW MIRRORS** article. TEST the system for normal operation.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

I5 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.

Pinpoint Test J: The Puddle Lamps Stay On Continuously

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Interior Lamps schematic and connector information.

Normal Operation

The smart junction box (SJB) provides voltage to the puddle lamps through circuit CLN25 (VT). The puddle lamps have separate ground circuits. The LH exterior mirror is grounded through circuit GD133 (BK) and the RH exterior mirror is grounded through circuit GD140 (BK/GN).

- DTC B2A39 (Puddle Lamp Output Circuit Open) - is an on-demand DTC that sets when the SJB detects a short to voltage on the puddle lamp output circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- SJB

PINPOINT TEST J: THE PUDDLE LAMPS STAY ON CONTINUOUSLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

J1 CHECK CIRCUIT CLN25 (VT) FOR A SHORT TO VOLTAGE

- Disconnect: SJB C2280c
- **Do the puddle lamps continue to illuminate?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to J2.

J2 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test K: The Courtesy Lamps Are Inoperative From The Instrument Panel Dimmer Switch

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Interior Lamps schematic and connector information.

Normal Operation

The smart junction box (SJB) monitors the instrument panel dimmer switch status on circuit CLN28 (GN/BU) to determine if the courtesy lamps are requested. Based on the instrument panel dimmer switch status, the SJB supplies voltage to the courtesy lamps through circuit VLN33 (GY/VT).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Instrument panel dimmer switch
- SJB

PINPOINT TEST K: THE COURTESY LAMPS ARE INOPERATIVE FROM THE INSTRUMENT PANEL DIMMER SWITCH

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

K1 CHECK THE DIMMABLE BACKLIGHTING DTCs

- Key in ON position.
- Use the recorded results from the SJB continuous and on-demand self-test.
- **Are any DTCs recorded?**

  YES : REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

  NO : Go to K2.

K2 CHECK THE INSTRUMENT PANEL DIMMER SWITCH

- Key in OFF position.
- Disconnect: Instrument Panel Dimmer Switch C2298

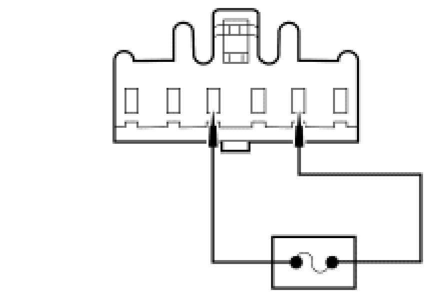

Fig. 15: Checking Dimmer Control Switch
Courtesy of FORD MOTOR CO.

- Connect a fused (5A) jumper wire between the instrument panel dimmer switch C2298-2, circuit CLN28 (GN/BU), harness side and the instrument panel dimmer switch C2298-4, circuit CLN27 (WH/BN), harness side.
- **Do the courtesy lamps illuminate?**

  YES : REMOVE the jumper wire. INSTALL a new instrument panel dimmer switch. REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** article. TEST the system for normal operation.

  NO : REMOVE the jumper wire. Go to K3.

K3 CHECK CIRCUIT CLN28 (GN/BU) FOR AN OPEN

- Disconnect: SJB C2280b

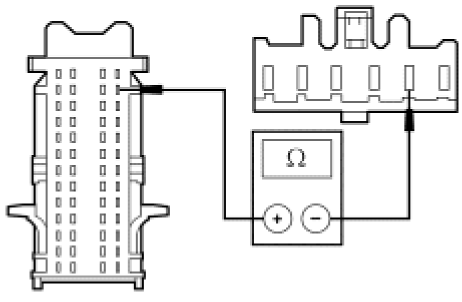

Fig. 16: Measuring Resistance Between SJB C2280B-51, Circuit CLN28 (GN/BU) & Dimmer Switch C2298-2
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280b-51, circuit CLN28 (GN/BU), harness side and the instrument panel dimmer switch C2298-2, circuit CLN28 (GN/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to K4.

  NO : REPAIR the circuit. TEST the system for normal operation.

K4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test L: The Courtesy Lamps Do Not Turn On With the Liftgate Open

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Power Liftgate schematic and connector information.

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Remote Keyless Entry and Alarm schematic and connector information.

Normal Operation

When the liftgate is opened, the ajar switch (or liftgate/trunk module (LTM), if equipped) opens the circuit to the smart junction box (SJB). The SJB monitors the ajar circuit, and based on the ajar status, supplies voltage to the courtesy lamps on circuit VLN33 (GY/VT).

- DTC B2721 (Liftgate/Decklid Ajar Output Short to Ground or Open) - is a continuous and on-demand DTC that sets when the LTM detects a short to ground from the SJB, or liftgate ajar circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Liftgate ajar switch
- LTM
- SJB

PINPOINT TEST L: THE COURTESY LAMPS DO NOT TURN ON WITH THE LIFTGATE OPEN

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

L1 CHECK THE LTM OR THE LIFTGATE LATCH

- Key in OFF position.
- Disconnect: LTM C4174b or Liftgate Latch C479
- **Do the courtesy lamps illuminate?**

  YES : If equipped with a power liftgate, go to L4.

  If equipped with a manual liftgate, INSTALL a new manual liftgate latch. REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article. TEST the system for normal operation.

  NO : Go to L2.

L2 CHECK CIRCUIT CPL60 (BN/YE) FOR A SHORT TO GROUND

- Disconnect: SJB C2280c

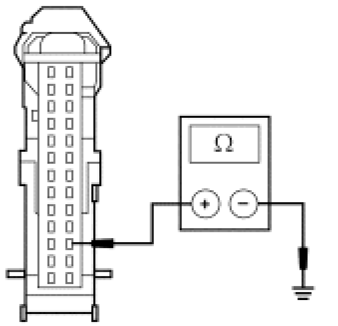

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Fig. 17: Measuring Resistance Between SJB C2280C-16, Circuit CPL60 (BN/YE), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280c-16, circuit CPL60 (BN/YE), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to L3.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

L3 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

L4 CHECK FOR CORRECT LTM OPERATION

- Disconnect all the LTM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the LTM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new LTM. REFER to **BODY CLOSURES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

REMOVAL AND INSTALLATION

INTERIOR LAMP

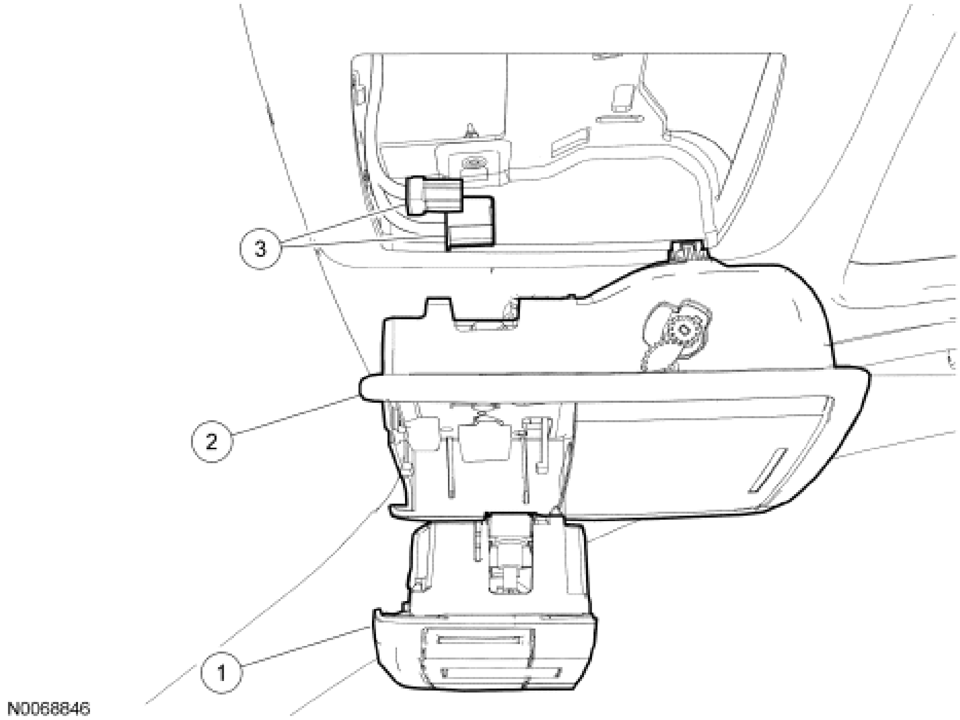


Fig. 18: Identifying Front Interior Lamp With Overhead Console
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	13776	Lamp assembly
2	54519A70	Overhead console
3	-	Overhead console electrical connectors (part of 17K745)

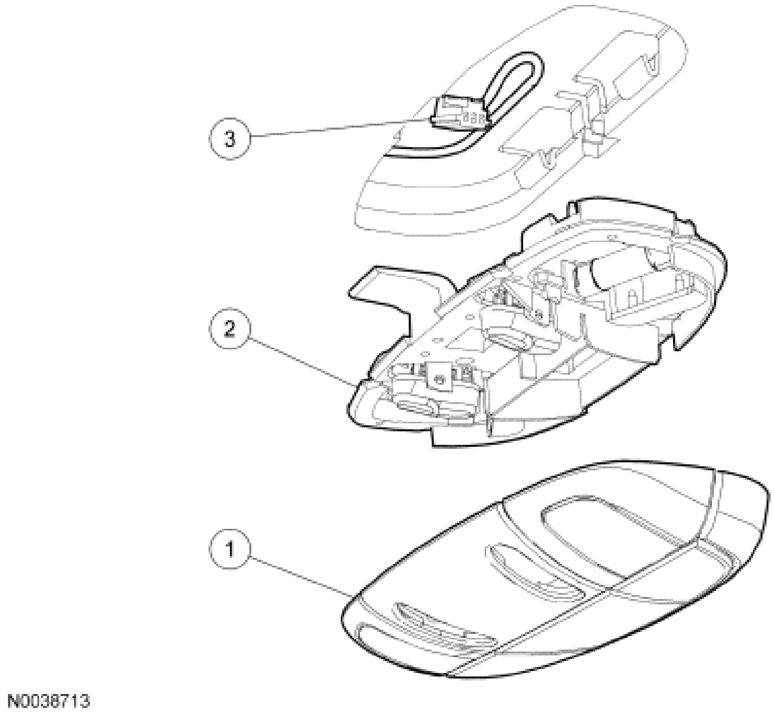


Fig. 19: Exploded View Of Rear Interior Lamp
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	13783	Interior lamp lens
2	13776	Interior lamp
3	-	Interior lamp electrical connector (part of 14334)

REMOVAL AND INSTALLATION

Front

NOTE: Do not pull down on the front of the overhead console.

1. Pull down on the rear of the overhead console to remove the overhead console from the retaining clips.
   - Disconnect the electrical connectors.
2. Release the 4 retaining clips and remove the lamp assembly from the overhead console.

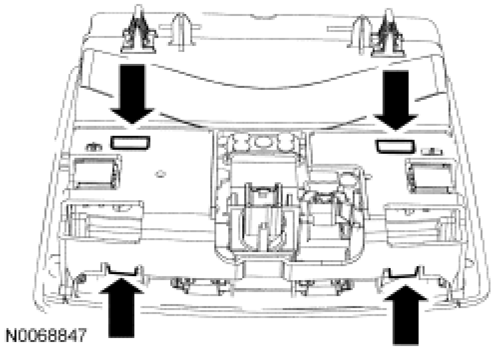


Fig. 20: Locating Retaining Clips On Lamp Assembly From Overhead Console
Courtesy of FORD MOTOR CO.

3. Release the 6 retaining clips and remove the lens from the lamp assembly.

NOTE: The bulbs can be pushed out from the backside of the lamp assembly.

- Replace the bulb(s) as necessary.

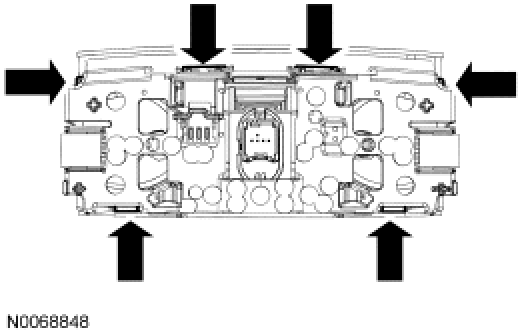


Fig. 21: Locating Retaining Clips On Lens From Lamp Assembly
Courtesy of FORD MOTOR CO.

REAR

4. Remove the interior lamp lens.

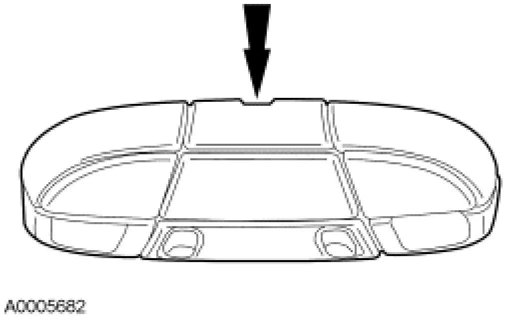


Fig. 22: Identifying Rear Interior Lamp Lens
Courtesy of FORD MOTOR CO.

5. Release the 2 retaining clips (through the access holes) and remove the interior lamp.
   - Disconnect the electrical connector.

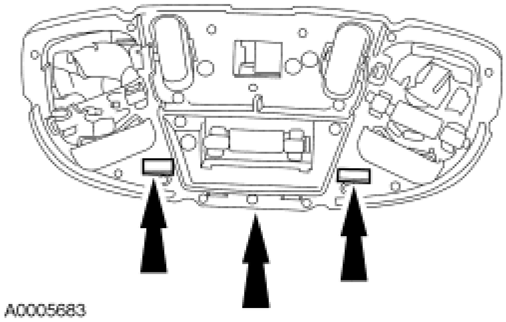


Fig. 23: Locating Electrical Connector Retaining Clips
Courtesy of FORD MOTOR CO.

Any interior lamps

6. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Interior Trim & Ornamentation - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Assist handle bolts	9	-	80
B-pillar upper trim panel screw	9	-	80
C-pillar trim panel screw	9	-	80
D-ring safety belt bolt	54	40	-
Liftgate rod nut	11	8	-
Safety belt anchor bolt	54	40	-

REMOVAL AND INSTALLATION

INTERIOR TRIM - EXPLODED VIEW

NOTE: Edge shown, MKX similar.

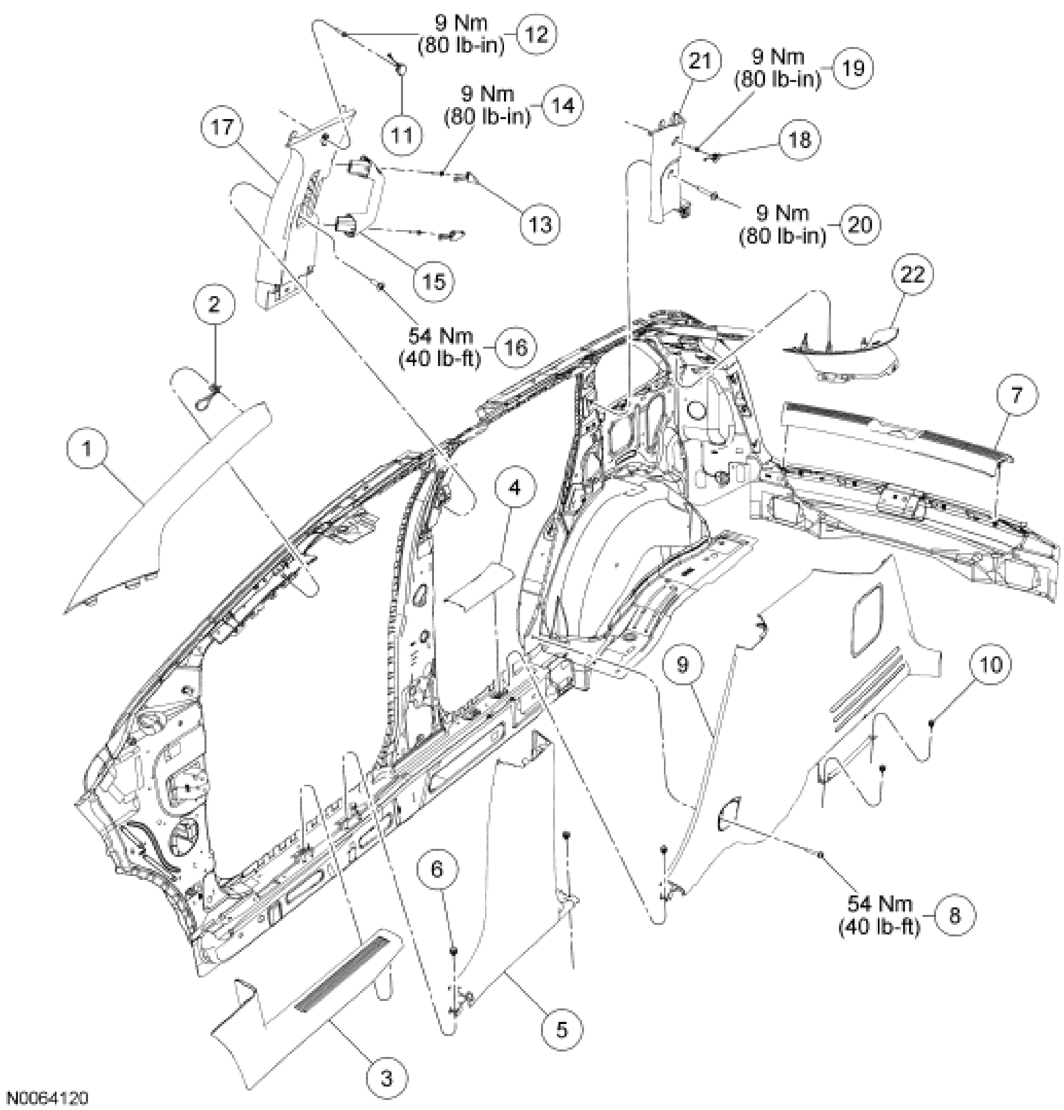


Fig. 1: Exploded View Of Interior Trim With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	03598 RH/ 03599 LH	A-pillar trim panel
2	-	A-pillar trim panel tether (part of 03598 RH/ 03599 LH)
3	13208 RH/ 13209 LH	Front door scuff plate
4	13244 RH/ 13245 LH	Rear door scuff plate
5	24346 RH/ 24347 LH	B-pillar lower trim panel
6	-	B-pillar lower trim panel pushpin retainer (2 required)
7	42624	Liftgate scuff plate
8	-	Quarter trim panel safety belt anchor bolt

9	31012 RH/ 31013 LH	Quarter trim panel
10	-	Quarter trim panel pushpin retainer (3 required)
11	-	B-pillar upper trim panel screw cover
12	W712518	B-pillar upper trim panel screw
13	31458 Upper/ 31459 Lower	B-pillar assist handle bolt cover (2 required)
14	W712518	B-pillar assist handle bolt (2 required)
15	31406 RH/ 31407 LH	B-pillar assist handle
16	-	B-pillar trim panel safety belt D-ring bolt
17	24346 RH/ 24347 LH	B-pillar upper trim panel
18	-	C-pillar trim panel screw cover
19	W712518	C-pillar trim panel screw
20	-	C-pillar trim panel safety belt D-ring bolt
21	31004 RH/ 31005 LH	C-pillar trim panel
22	31010 RH/ 31011 LH	D-pillar trim panel

1. For additional information, refer to the appropriate procedure.

A-PILLAR TRIM PANEL

REMOVAL

1. Position the door opening weatherstrip aside.

CAUTION: The LH and RH A-pillar trim panels are attached to the A-pillar with a safety tether. During a side air curtain deployment, the A-pillar trim panel tether helps prevent the trim panel from striking the occupant. The tether must be detached from the A-pillar trim panel before the A-pillar trim panel can be removed. Failure to detach the tether will result in damage to the tether or the A-pillar trim panel.

2. Gently pull the upper A-pillar trim panel toward the center of the vehicle to release the A-pillar trim panel retaining clips.

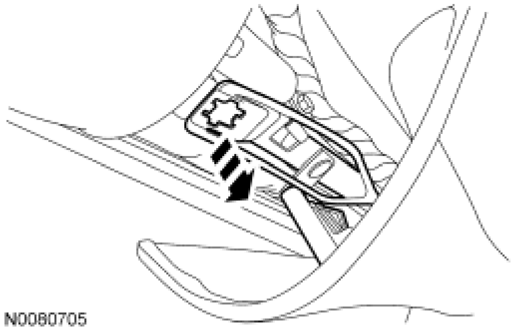


Fig. 2: Pulling A-pillar Trim Panel
Courtesy of FORD MOTOR CO.

NOTE: The A-pillar trim panel tether is removed from the A-pillar for clarity.

3. Remove the A-pillar trim panel tether from the A-pillar trim panel.
   - Carefully route the A-pillar trim panel tether end through the hole in the A-pillar trim panel.

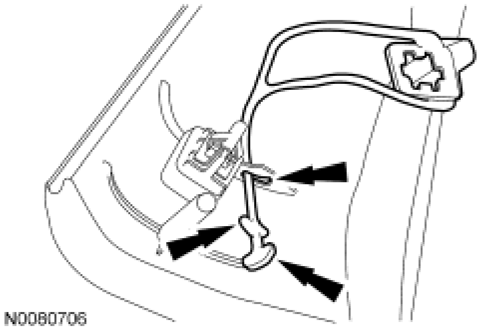


Fig. 3: Identifying A-pillar Trim Panel Tether
Courtesy of FORD MOTOR CO.

4. Remove the A-pillar trim panel.

INSTALLATION

1. Install the lower A-pillar trim panel in the instrument panel.

WARNING: A new A-pillar trim panel tether must be installed if the tether is damaged or does not fasten correctly. During a side air curtain deployment the A-pillar trim panel tether helps prevent the trim from striking the occupant. Failure to follow this instruction may result in serious injury to vehicle occupant(s).

2. Carefully route the A-pillar trim panel tether end through the hole in the A-pillar trim panel.
3. Install the A-pillar trim panel onto the A-pillar.
4. Install the door opening weatherstrip.

B-PILLAR TRIM PANEL

REMOVAL AND INSTALLATION

1. Position the front seats in the full forward position.

NOTE: Inspect the safety belt D-ring cover for damage. If the safety belt D-ring cover does not remain in place, install a new cover.

2. Remove the safety belt D-ring cover and remove the safety belt bolt.
    - To install, tighten to 54 N.m (40 lb-ft).

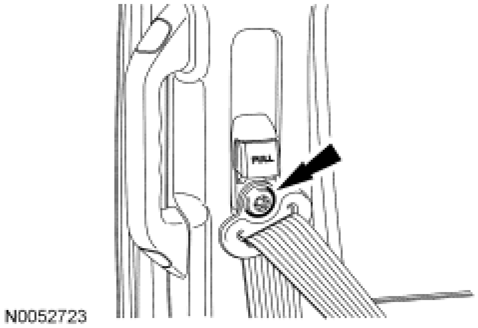


Fig. 4: Locating Safety Belt Bolt
Courtesy of FORD MOTOR CO.

3. Remove the front door scuff plate trim panel.
4. Remove the rear door scuff plate trim panel.
5. Remove the lower B-pillar trim panel.
6. Position the front and rear door weatherstrips aside.
7. Remove the upper B-pillar trim panel assist handle, if equipped.
    - Remove the bolt covers.
    - Remove the bolts.
        - To install, tighten to 9 N.m (80 lb-in).

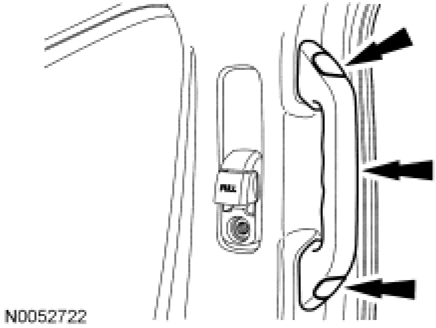


Fig. 5: Identifying Upper B-Pillar Trim Panel Assist Handle & Bolt Covers
Courtesy of FORD MOTOR CO.

8. Remove the B-pillar trim panel.
    - Remove the screw cover.
    - Remove the screw.
        - To install, tighten to 9 N.m (80 lb-in).
9. To install, reverse the removal procedure.

C-PILLAR TRIM PANEL

REMOVAL AND INSTALLATION

NOTE: Inspect the safety belt D-ring cover for damage. If the safety belt D-ring cover does not remain in place, install a new cover.

1. Remove the safety belt D-ring cover and remove the safety belt bolt.
   - To install, tighten to 54 N.m (40 lb-ft).
2. Remove the screw cover.
3. Remove the screw.
   - To install, tighten to 9 N.m (80 lb-in).
4. Position the quarter trim panel aside to allow C-pillar trim panel removal.
5. Remove the C-pillar trim panel.
   - Pull outward and downward to remove the panel.
6. To install, reverse the removal procedure.

D-PILLAR TRIM PANEL

1. Remove the quarter trim panel. For additional information, refer to **Quarter Trim Panel**.
2. Remove the D-pillar trim panel.
   - Disengage the trim panel from the retainers.
   - Disconnect the speaker wire connector from the trim panel, if equipped.

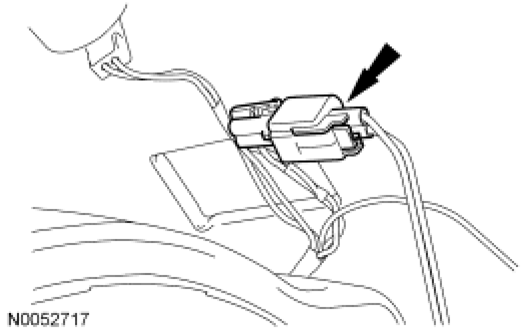


Fig. 6: Identifying Speaker Wire Connector
Courtesy of FORD MOTOR CO.

3. To install, reverse the removal procedure.

QUARTER TRIM PANEL

LH side with power liftgate

1. Remove the cover and the switch from the LH quarter trim panel.

- Disconnect the electrical connector.

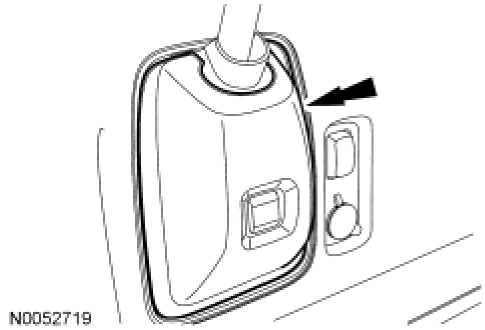


Fig. 7: Identifying LH Quarter Trim Panel
Courtesy of FORD MOTOR CO.

2. Remove the power liftgate rod-to-liftgate cover and nut.
   - To install, tighten to 11 N.m (8 lb-ft).

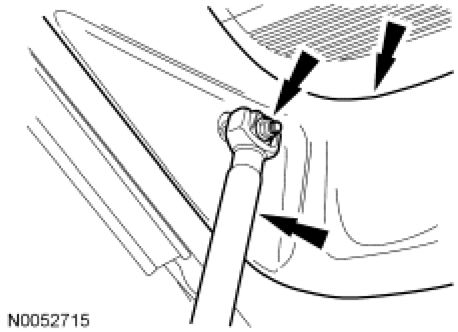


Fig. 8: Identifying Strut From Liftgate
Courtesy of FORD MOTOR CO.

All vehicles

3. Remove the rear cargo load area.
   - Remove the foam blocks from the spare tire well.

NOTE: Inspect the safety belt lower anchor bolt cover for damage. If the safety belt lower anchor bolt cover does not remain in place, install a new cover.

4. Remove the safety belt lower anchor bolt cover and remove the safety belt lower anchor bolt.
   - To install, tighten to 54 N.m (40 lb-ft).

NOTE: Make sure the pushpin retainers are removed with the quarter trim panel.

5. Remove the RH or LH quarter trim panel.

- Disconnect the electrical connectors, if equipped.

6. To install, reverse the removal procedure.

DOOR TRIM PANEL - FRONT

NOTE: **MKX shown, Edge similar.**

NOTE: **RH door shown, LH door similar.**

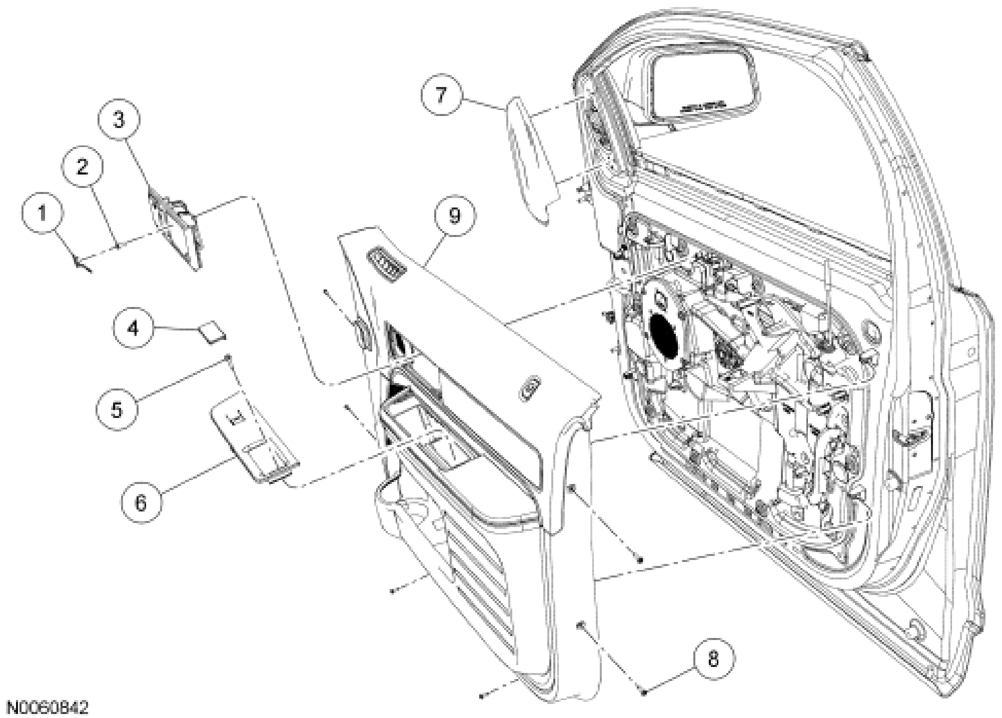


Fig. 9: Exploded View Of Front Door Trim Panel
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Front door handle bezel screw cover
2	W712934	Front door handle bezel screw
3	22620 RH/ 22621 LH	Front door handle bezel
4	22670	Front door window control switch bezel screw cover (MKX only)
5	W503904	Front door window control switch bezel screw
6	14524 RH/ 14525 LH	Front door window control switch bezel
7	17D720 RH/ 17D721 LH	Front door trim sail panel
8	W708412	Front door trim panel screw (6 required)

9	23942 RH/ 23943 LH	Front door trim panel

REMOVAL AND INSTALLATION

All vehicles

1. Remove the front door handle bezel.
   - Remove the screw cover.
   - Remove the screw.
   - Remove the front door handle bezel.
     - Disconnect the electrical connectors, if equipped.

   MKX only

2. Remove the screw cover.

   All vehicles

3. Remove the screw.
4. Remove the 6 front door trim panel screws.
5. Disengage the bottom of the door trim panel from the door.
   - Pull outward to disengage the push nuts from the retainers.
6. Lift the top of the door trim panel edge upward and out of the beltline molding.
7. Pull the lock rod through the lock rod grommet.
8. Remove the front door trim panel.
   - Disconnect the electrical connectors.
9. To install, reverse the removal procedure.

DOOR TRIM PANEL - REAR

NOTE: MKX shown, Edge similar.

NOTE: RH door shown, LH door similar.

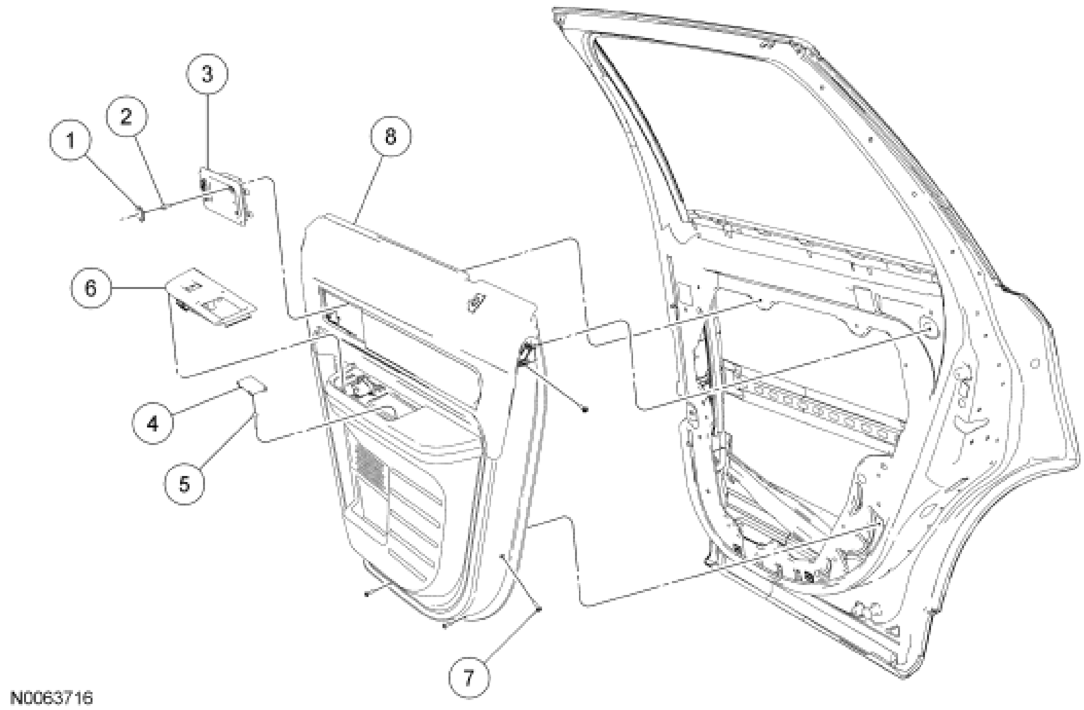


Fig. 10: Exploded View Of Rear Door Trim Panel
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Rear door handle bezel screw cover
2	W712934	Rear door handle bezel screw
3	22620 RH/ 22621 LH	Rear door handle bezel
4	22670	Rear door trim pull handle cup screw cover (MKX only)
5	W503904	Rear door trim pull handle cup screw
6	14524 RH/ 14525 LH	Rear door trim window control switch bezel
7	W708412	Rear door trim panel screw (6 required)
8	27406 RH/ 27407 LH	Rear door trim panel

REMOVAL AND INSTALLATION

All vehicles

1. Remove the rear door handle bezel.
    - Remove the screw cover.
    - Remove the screw.
    - Remove the rear door handle bezel.
        - Disconnect the electrical connector, if equipped.

MKX only

2. Remove the screw cover.

All vehicles

3. Remove the screw.
4. Remove the 6 trim panel screws.
5. Disengage the bottom of the door trim panel from the door.
    - Pull outward to disengage the push nuts from the retainers.
6. Lift the top of the door trim panel edge upward and out of the beltline molding.
7. Pull the lock rod through the lock rod grommet.
8. Remove the rear door trim panel.
    - Disconnect the electrical connectors.
9. To install, reverse the removal procedure.

LIFTGATE TRIM PANEL

NOTE: **Non-powered liftgate shown, powered liftgate similar.**

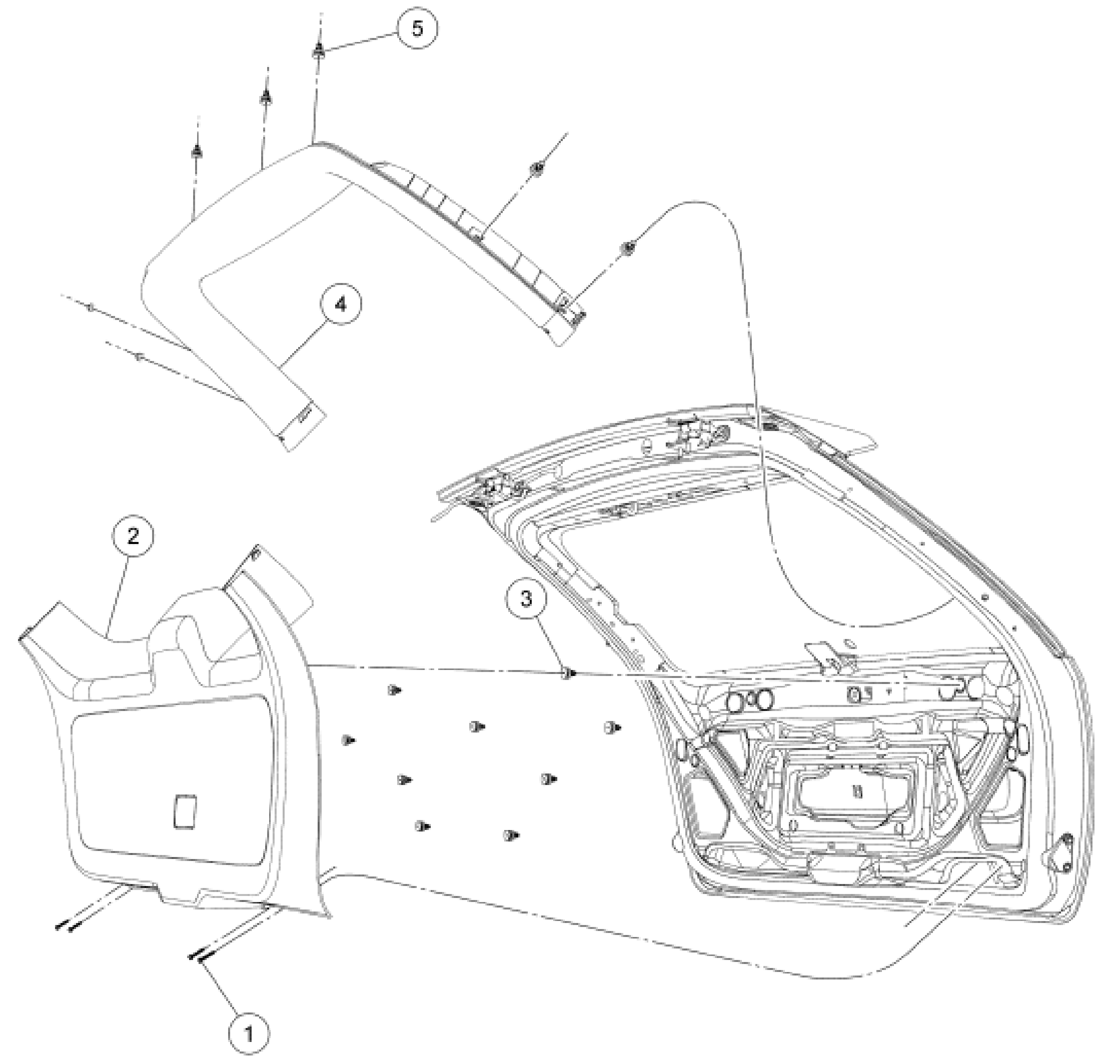


Fig. 11: Identifying Liftgate Trim Panel
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W711043	Liftgate lower trim panel screw (4 required)
2	46404	Liftgate lower trim panel
3	W711043	Liftgate lower trim panel retainer (11 required)
4	42410	Liftgate upper trim panel
5	W711043	Liftgate upper trim panel retainer (7 required)

1. Remove the power liftgate rod-to-liftgate cover and nut, if equipped.

- To install, tighten to 11 N.m (8 lb-ft).

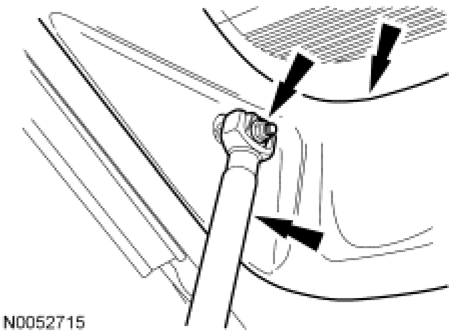


Fig. 12: Identifying Strut From Liftgate
Courtesy of FORD MOTOR CO.

NOTE: The back of the liftgate trim panel is shown indicating the location of the liftgate trim panel retainers.

2. Remove the liftgate lower trim panel.
    - Remove the 4 liftgate lower trim panel screws.
    - Pull outward on the liftgate lower trim panel to release the liftgate lower trim panel retainers.

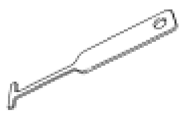
Fig. 13: Identifying Liftgate Lower Trim Panel Retainers
Courtesy of FORD MOTOR CO.

3. Remove the liftgate upper trim panel.
4. To install, reverse the removal procedure.

POWER POINT

Special Tools

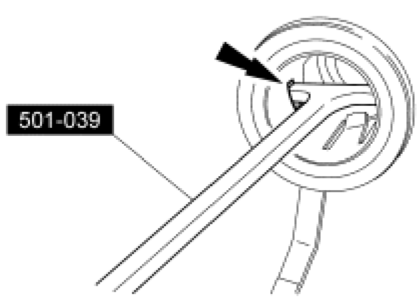
Illustration	Tool Name	Tool Number
	Remover, Power Point Socket	501-039 or equivalent

 ST3024-A		

REMOVAL

NOTE: Power point cover may differ depending on location.

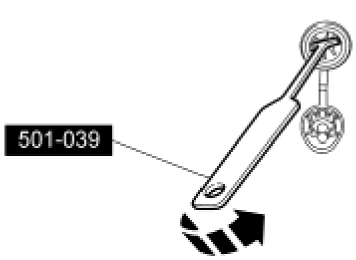
1. Open the power point cover.
2. Install the Power Point Socket Remover in one of the power point socket slots.



N0061767

Fig. 14: Installing Special Tool In Power Point Socket Slot
Courtesy of FORD MOTOR CO.

3. Position the Power Point Socket Remover so that it engages in the adjacent slot.



N0061768

Fig. 15: Positioning Special Tool To Engage In Adjacent Slot
Courtesy of FORD MOTOR CO.

4. Using the Power Point Socket Remover, pull the power point socket out of the retainer.

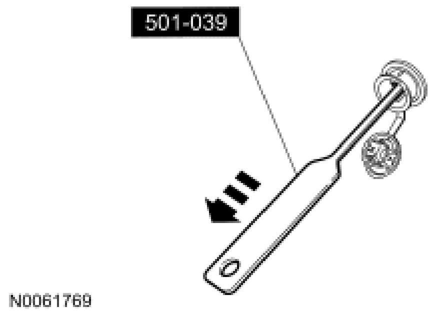


Fig. 16: Pulling Power Point Socket Out Of Retainer
Courtesy of FORD MOTOR CO.

5. Disconnect the electrical connector.

INSTALLATION

1. Connect the electrical connector.
2. Slide the power point socket into the retainer.

HEADLINER

NOTE: **Headliner with roof opening panel shown, headliner without roof opening panel similar.**

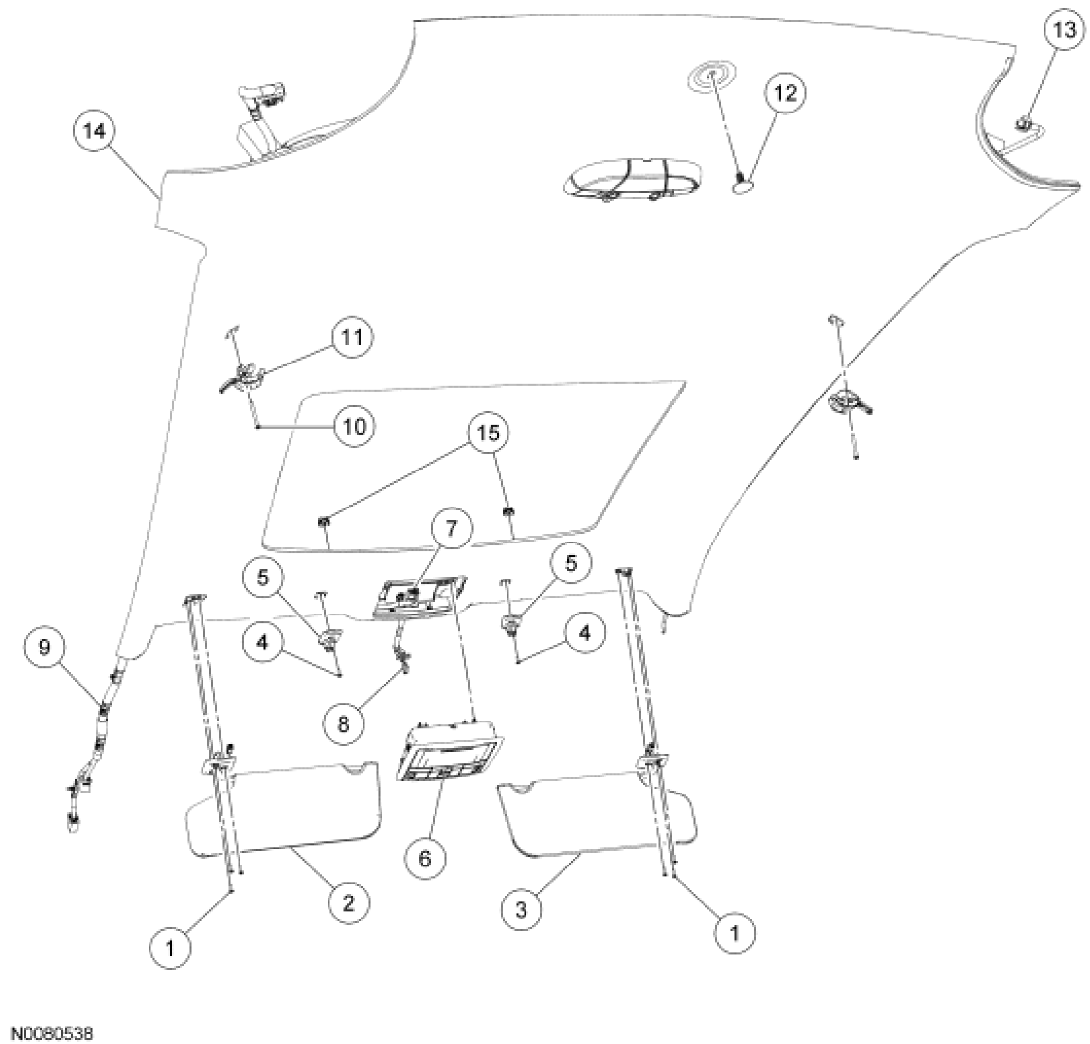


Fig. 17: Identifying Headliner With Roof Opening Panel
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W504242	Sun visor screws (6 required)
2	04101	LH sun visor
3	04100	RH sun visor
4	W504242	Sun visor arm clip screws (2 required)
5	04132	Sun visor arm clips
6	519A58	Overhead console
7	-	Overhead console electrical connector
8	-	Rear view mirror electrical connector
9	14334	Headliner wiring harness
10	W504349	Garment hanger screw

11	29024	Garment hanger
12	W708761	Headliner pushpin retainer
13	17409	Headliner washer fluid hose
14	51944	Headliner
15	-	Headliner magnets

REMOVAL

1. If equipped, remove the rear entertainment module (RETM). For additional information, refer to **INFORMATION & ENTERTAINMENT SYSTEMS** article.
2. Remove the LH and RH A-pillar trim panels. For additional information, refer to **A-Pillar Trim Panel**.
3. Remove the LH and RH B-pillar trim panels. For additional information, refer to **B-Pillar Trim Panel**.
4. Remove the LH and RH C-pillar trim panels. For additional information, refer to **C-Pillar Trim Panel**.
5. Remove the LH and RH D-pillar trim panels. For additional information, refer to **D-Pillar Trim Panel**.
6. Remove the LH and RH quarter trim panels. For additional information, refer to **Quarter Trim Panel**.
7. If equipped, remove the power liftgate rod from the power liftgate motor assembly.
   - Squeeze the clip as shown to release and pull the power liftgate rod assembly upward.

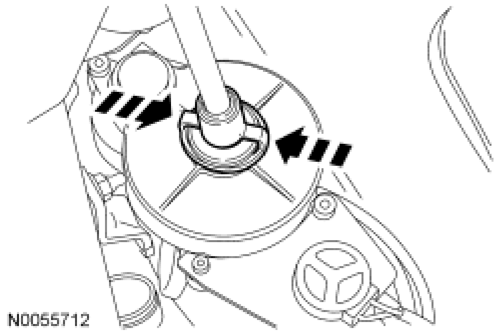


Fig. 18: Squeezing Clip To Release & Position Rod Assembly Upward
Courtesy of FORD MOTOR CO.

8. If equipped, disconnect the electrical connectors from the interior rear view mirror and compass.
9. Disconnect the electrical connectors from the wiring harness on the LH A-pillar and remove the harness from the A-pillar.

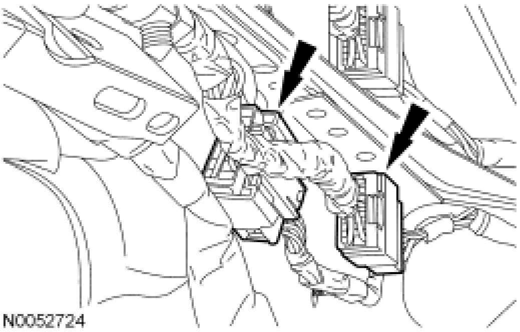


Fig. 19: Identifying Electrical Connectors From Wiring Harness On LH A-Pillar
Courtesy of FORD MOTOR CO.

10. Remove the overhead console, if equipped. For additional information, refer to **INSTRUMENT PANEL & CONSOLE** article.
11. Position the front and rear door weatherstrips aside.
12. Remove the LH and RH sun visors.
    - Remove the LH and RH sun visor screws.
    - If equipped, disconnect the electrical connector.
13. Disconnect the rear washer fluid hose connector on the RH A-pillar.

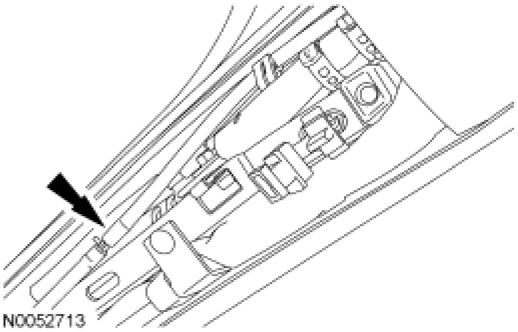


Fig. 20: Locating Rear Washer Fluid Hose Connector On RH A-Pillar
Courtesy of FORD MOTOR CO.

14. Remove the LH and RH garment hangers.
    - Remove the LH and RH garment hanger screws.
15. Position the liftgate weatherstrip aside.
16. Disconnect the rear washer fluid hose connector on the RH D-pillar.

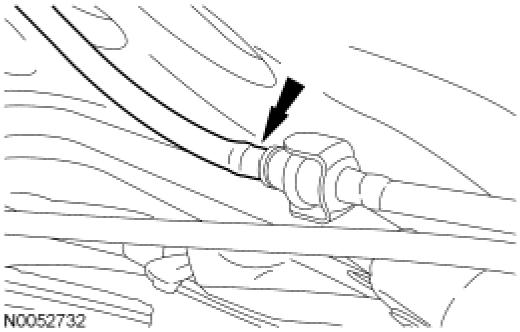


Fig. 21: Locating Rear Washer Fluid Hose Routing
Courtesy of FORD MOTOR CO.

17. Remove the headliner rear pushpin.
18. Lower the headliner and disconnect the electrical connectors on the LH D-pillar.

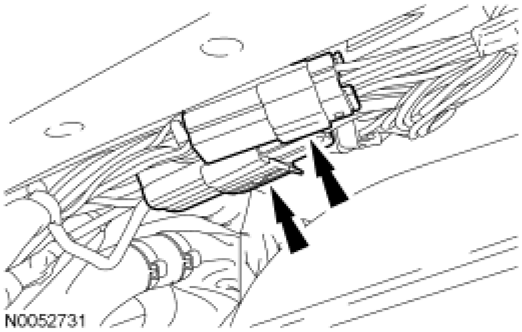


Fig. 22: Identifying Electrical Connectors On LH D-Pillar
Courtesy of FORD MOTOR CO.

CAUTION: To avoid damaging the headliner, an assistant is required for this step.

19. Remove the headliner through the liftgate opening.

INSTALLATION

Installing a new headliner

1. Using a suitable marking tool, mark the new headliner with the routing and exit points of the wire harness from the original headliner.
2. Carefully remove the wire harness from the original headliner.

CAUTION: Make sure not to damage the wire harness when cutting the excess adhesive from the wire harness.

3. Cut and remove any excessive adhesive from the wire harness.

CAUTION: Make sure to provide enough length to the wire harness connector ends when positioning the wire harness onto the headliner. Otherwise, the wire harness connector ends will not be able to be connected when the headliner is installed into the vehicle.

NOTE: Headliner with RETM opening shown, all other headliners similar.

4. Position the wire harness onto the new headliner and apply tape to temporarily attach the wire harness onto the headliner.

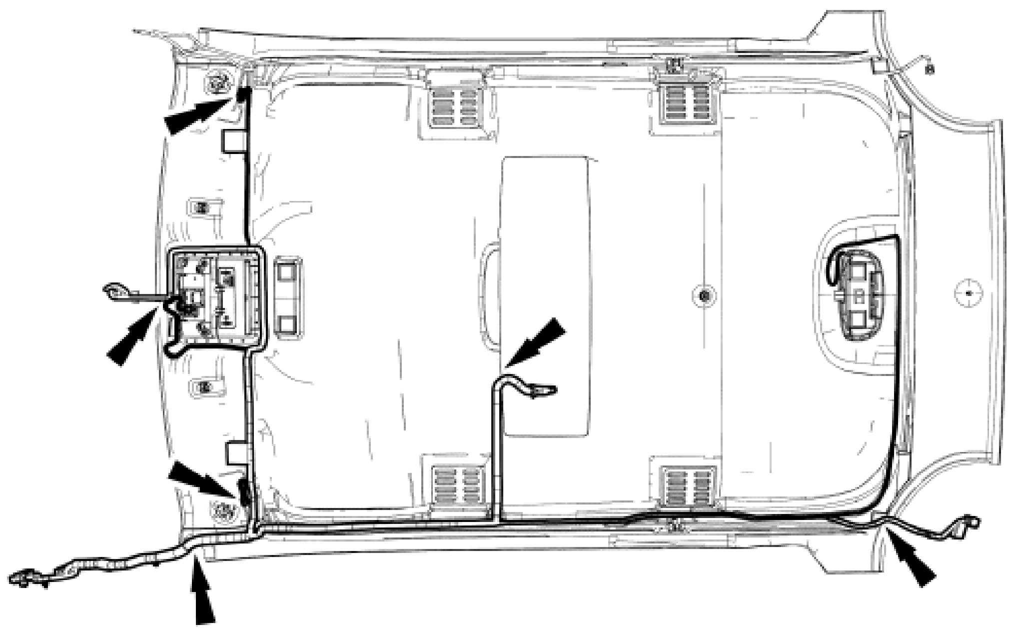


Fig. 23: Identifying Wire Harness
Courtesy of FORD MOTOR CO.

NOTE: The 3M Duramix 4747 Super Fast Adhesive will set in 22 seconds. Continually make sure that the wire harness is routed correctly when applying the adhesive.

NOTE: Apply adhesive to the entire length of the wire harness when fastening the wire harness to the headliner. Otherwise, the wire harness can loosen from the headliner and a vibration or rattle can occur.

5. Obtain 3M Duramix 4747 Super Fast Adhesive commercially and apply onto the headliner and wire harness.

6. Transfer parts as needed.

All headliners

CAUTION: To avoid damaging the headliner, an assistant is required for this step.

7. Install the headliner through the liftgate opening.
8. Connect the electrical connectors on the LH D-pillar.

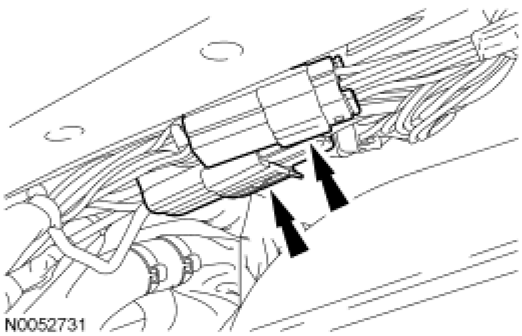


Fig. 24: Identifying Electrical Connectors On LH D-Pillar
Courtesy of FORD MOTOR CO.

9. Install the headliner rear pushpin.
10. Connect the rear washer fluid hose connector on the RH D-pillar.

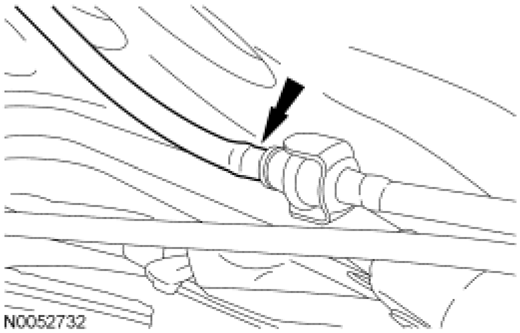


Fig. 25: Locating Rear Washer Fluid Hose Routing
Courtesy of FORD MOTOR CO.

11. Install the liftgate weatherstrip.
12. Install the LH and RH garment hangers.
    - Install and tighten the LH and RH garment hanger screws.
13. Connect the rear washer fluid hose connector on the RH A-pillar.

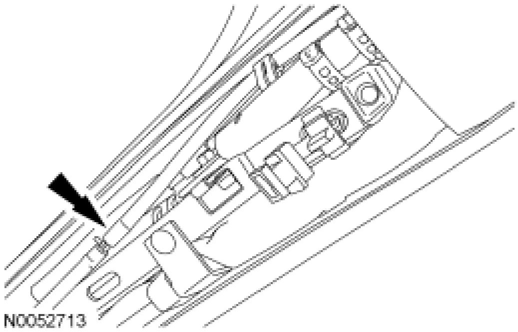


Fig. 26: Locating Rear Washer Fluid Hose Connector On RH A-Pillar
Courtesy of FORD MOTOR CO.

14. Install the LH and RH sun visors in the following sequence.
    1. If equipped, connect the electrical connector.
    2. Install and tighten the LH and RH sun visor screws.
15. Install the front and rear door weatherstrips.
16. If equipped, install the overhead console. For additional information, refer to **INSTRUMENT PANEL & CONSOLE** article.
17. Connect the electrical connectors on the LH A-pillar and attach the wire harness onto the A-pillar.

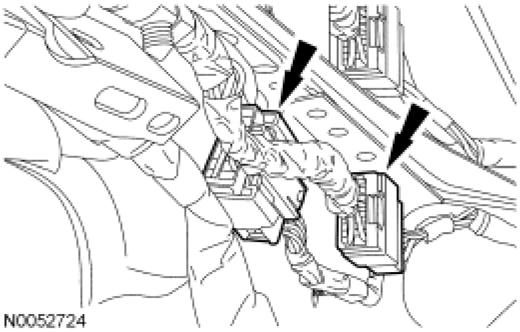


Fig. 27: Identifying Electrical Connectors From Wiring Harness On LH A-Pillar
Courtesy of FORD MOTOR CO.

18. If equipped, connect the electrical connectors to the interior rear view mirror and compass.
19. If equipped, install the power liftgate rod.
20. Install the LH and RH quarter trim panels. For additional information, refer to **Quarter Trim Panel**.
21. Install the LH and RH D-pillar trim panels. For additional information, refer to **D-Pillar Trim Panel**.
22. Install the LH and RH C-pillar trim panels. For additional information, refer to **C-Pillar Trim Panel**.
23. Install the LH and RH B-pillar trim panels. For additional information, refer to **B-Pillar Trim Panel**.
24. Install the LH and RH A-pillar trim panels. For additional information, refer to **A-Pillar Trim Panel**.
25. If equipped, install the RETM. For additional information, refer to **INFORMATION & ENTERTAINMENT SYSTEMS** article.

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CALIFORNIA Proposition 65 Warning

WARNING: Engine exhaust, some of its constituents, and certain vehicle components contain or emit chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. In addition, certain fluids contained in vehicles and certain products of component wear contain or emit chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

PERCHLORATE MATERIAL

Certain components of this vehicle such as airbag modules, seat belt pretensioners, and button cell batteries may contain Perchlorate Material – Special handling may apply for service or vehicle end of life disposal. See www.dtsc.ca.gov/hazardouswaste/perchlorate.

CONGRATULATIONS

Congratulations on acquiring your new Lincoln. Please take the time to get well acquainted with your vehicle by reading this handbook. The more you know and understand about your vehicle, the greater the safety and pleasure you will derive from driving it.

For more information on Ford Motor Company and its products visit the following website:

- In the United States: www.ford.com
- In Canada: www.ford.ca
- In Mexico: www.ford.com.mx
- In Australia: www.ford.com.au

Additional owner information is given in separate publications.

This *Owner's Guide* describes every option and model variant available and therefore some of the items covered may not apply to your particular vehicle. Furthermore, due to printing cycles it may describe options before they are generally available.

Remember to pass on the *Owner's Guide* when reselling the vehicle. It is an integral part of the vehicle.

Fuel pump shut-off switch: In the event of an accident the safety switch will automatically cut off the fuel supply to the engine. The switch can also be activated through sudden vibration (e.g. collision when parking). To reset the switch, refer to the *Fuel pump shut-off switch* in the *Roadside Emergencies* chapter.

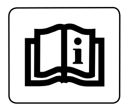
SAFETY AND ENVIRONMENT PROTECTION

Warning symbols in this guide

How can you reduce the risk of personal injury to yourself or others? In this guide, answers to such questions are contained in comments highlighted by the warning triangle symbol. These comments should be read and observed.

Warning symbols on your vehicle

When you see this symbol, it is imperative that you consult the relevant section of this guide before touching or attempting adjustment of any kind.



Protecting the environment

We must all play our part in protecting the environment. Correct vehicle usage and the authorized disposal of waste, cleaning and lubrication materials are significant steps towards this aim. Information in this respect is highlighted in this guide with the tree symbol.

BREAKING-IN YOUR VEHICLE

Your vehicle does not need an extensive break-in. Try not to drive continuously at the same speed for the first 1,000 miles (1,600 km) of new vehicle operation. Vary your speed frequently in order to give the moving parts a chance to break in.

Drive your new vehicle at least 1,000 miles (1,600 km) before towing a trailer. For more detailed information about towing a trailer, refer to *Trailer towing* in the *Tires, Wheels and Loading* chapter.

Do not add friction modifier compounds or special break-in oils since these additives may prevent piston ring seating. See *Engine oil* in the *Maintenance and Specifications* chapter for more information on oil usage.

SPECIAL NOTICES

New Vehicle Limited Warranty

For a detailed description of what is covered and what is not covered by your vehicle's New Vehicle Limited Warranty, refer to the *Warranty Guide* that is provided to you along with your *Owner's Guide.*

Special instructions

For your added safety, your vehicle is fitted with sophisticated electronic controls.

> ⚠ Please read the section *Airbag supplemental restraint system (SRS)* in the *Seating and Safety Restraints* chapter. Failure to follow the specific warnings and instructions could result in personal injury.

> ⚠ Front seat mounted rear-facing child or infant seats should **NEVER** be placed in front of an active passenger airbag.

Service Data Recording

Service data recorders in your vehicle are capable of collecting and storing diagnostic information about your vehicle. This potentially includes information about the performance or status of various systems and modules in the vehicle, such as engine, throttle, steering or brake systems. In order to properly diagnose and service your vehicle, Ford Motor Company, Ford of Canada, and service and repair facilities may access vehicle diagnostic information through a direct connection to your vehicle when diagnosing or servicing your vehicle.

Event Data Recording

Other modules in your vehicle — event data recorders — are capable of collecting and storing data during a crash or near crash event. The recorded information may assist in the investigation of such an event. The modules may record information about both the vehicle and the occupants, potentially including information such as:

- how various systems in your vehicle were operating;
- whether or not the driver and passenger seatbelts were buckled;
- how far (if at all) the driver was depressing the accelerator and/or the brake pedal;
- how fast the vehicle was traveling; and
- where the driver was positioning the steering wheel.

To access this information, special equipment must be directly connected to the recording modules. Ford Motor Company and Ford of Canada do not access event data recorder information without obtaining consent, unless pursuant to court order or where required by law enforcement, other government authorities or other third parties acting with lawful authority. Other parties may seek to access the information independently of Ford Motor Company and Ford of Canada.

Cell phone use

The use of Mobile Communications Equipment has become increasingly important in the conduct of business and personal affairs. However, drivers must not compromise their own or others' safety when using such equipment. Mobile Communications can enhance personal safety and security when appropriately used, particularly in emergency situations. Safety must be paramount when using mobile communications equipment to avoid negating these benefits.

Mobile Communication Equipment includes, but is not limited to cellular phones, pagers, portable email devices, in-vehicle communications systems, telematics devices and portable two-way radios.

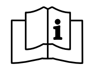
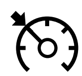
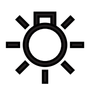
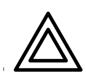
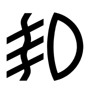
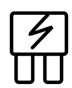
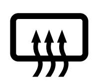
Driving while distracted can result in loss of vehicle control, accident and injury. Ford strongly recommends that drivers use extreme caution when using any device that may take their focus off the road. The drivers primary responsibility is the safe operation of their vehicle. Only use cell phones and other devices not essential to the driving task when it is safe to do so.

Export unique (Non–United States/Canada) vehicle specific information

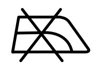
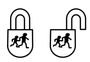
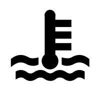
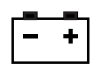
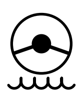
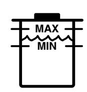
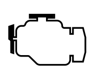
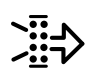
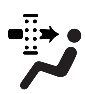
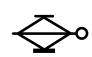
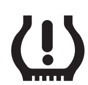
For your particular global region, your vehicle may be equipped with features and options that are different from the ones that are described in this *Owner's Guide.* A market unique supplement may be supplied that complements this book. By referring to the market unique supplement, if provided, you can properly identify those features, recommendations and specifications that are unique to your vehicle. This *Owner's Guide* is written primarily for the U.S. and Canadian Markets. Features or equipment listed as standard may be different on units built for Export. **Refer to this Owner's Guide for all other required information and warnings.**

These are some of the symbols you may see on your vehicle.

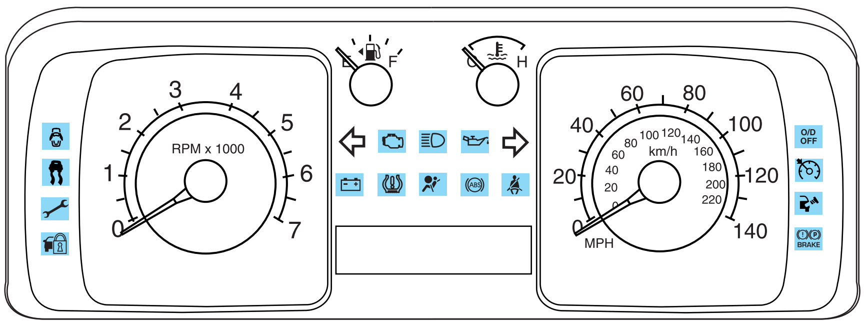
Vehicle Symbol Glossary

Safety Alert		See Owner's Guide	
Fasten Safety Belt		Airbag - Front	
Airbag - Side		Child Seat Lower Anchor	
Child Seat Tether Anchor		Brake System	
Anti-Lock Brake System		Parking Brake System	
Brake Fluid - Non-Petroleum Based		Parking Aid System	
Stability Control System		Speed Control	
Master Lighting Switch		Hazard Warning Flasher	
Fog Lamps-Front		Fuse Compartment	
Fuel Pump Reset		Windshield Wash/Wipe	
Windshield Defrost/Demist		Rear Window Defrost/Demist	

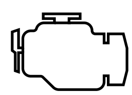
Vehicle Symbol Glossary

Power Windows Front/Rear		Power Window Lockout	
Child Safety Door Lock/Unlock		Interior Luggage Compartment Release	
Panic Alarm		Engine Oil	
Engine Coolant		Engine Coolant Temperature	
Do Not Open When Hot		Battery	
Avoid Smoking, Flames, or Sparks		Battery Acid	
Explosive Gas		Fan Warning	
Power Steering Fluid		Maintain Correct Fluid Level	
Service Engine Soon		Engine Air Filter	
Passenger Compartment Air Filter		Jack	
Check Fuel Cap		Low Tire Pressure Warning	

WARNING LIGHTS AND CHIMES



Warning lights and gauges can alert you to a vehicle condition that may become serious enough to cause extensive repairs. A warning light may illuminate when a problem exists with one of your vehicle's functions. Many lights will illuminate when you start your vehicle to make sure the bulbs work. If any light remains on after starting the vehicle, refer to the respective system warning light for additional information.

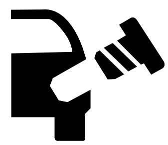


Service engine soon: The *Service engine soon* indicator light illuminates when the ignition is first turned to the ON position to check the bulb and to indicate whether the vehicle is ready for Inspection/Maintenance (I/M) testing. Normally, the ″Service engine soon″ light will stay on until the engine is cranked, then turn itself off if no malfunctions are present. However, if after 15 seconds the ″Service engine soon″ light blinks eight times, it means that the vehicle is not ready for I/M testing. See the *Readiness for Inspection/Maintenance (I/M) testing* in the *Maintenance and Specifications* chapter.

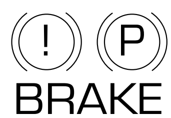
Solid illumination after the engine is started indicates the On Board Diagnostics System (OBD-II) has detected a malfunction. Refer to *On board diagnostics (OBD-II)* in the *Maintenance and Specifications* chapter. If the light is blinking, engine misfire is occurring which could damage your catalytic converter. Drive in a moderate fashion (avoid heavy acceleration and deceleration) and have your vehicle serviced immediately by your authorized dealer.

Under engine misfire conditions, excessive exhaust temperatures could damage the catalytic converter, the fuel system, interior floor coverings or other vehicle components, possibly causing a fire.

Powertrain malfunction/reduced power: Illuminates when a powertrain or a AWD fault has been detected. Contact your authorized dealer as soon as possible.

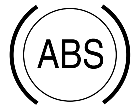


Check fuel cap: Illuminates when the fuel cap may not be properly installed. Continued driving with this light on may cause the Service engine soon warning light to come on, refer to *Fuel filler cap* in the *Maintenance and Specification* chapter.



Brake system warning light: To confirm the brake system warning light is functional, it will momentarily illuminate when the ignition is turned to the ON position when the engine is not running, or in a position between ON and START, or by applying the parking brake when the ignition is turned to the ON position. If the brake system warning light does not illuminate at this time, seek service immediately from your authorized dealer. Illumination after releasing the parking brake indicates low brake fluid level or a brake system malfunction and the brake system should be inspected immediately by your authorized dealer.

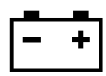
Driving a vehicle with the brake system warning light on is dangerous. A significant decrease in braking performance may occur. It will take you longer to stop the vehicle. Have the vehicle checked by your authorized dealer. Driving extended distances with the parking brake engaged can cause brake failure and the risk of personal injury.



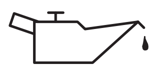
Anti-lock brake system: If the ABS light stays illuminated or continues to flash, a malfunction has been detected, have the system serviced immediately by your authorized dealer. Normal braking is still functional unless the brake warning light also is illuminated.

Airbag readiness: If this light fails to illuminate when the ignition is turned to ON, continues to flash or remains on, have the system serviced immediately by your authorized dealer. A chime will also sound when a malfunction in the supplemental restraint system has been detected.

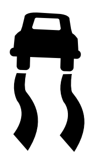
Safety belt: Reminds you to fasten your safety belt. A Belt-Minder® chime will also sound to remind you to fasten your safety belt. Refer to the *Seating and Safety Restraints* chapter to activate/deactivate the Belt-Minder® chime feature.



Charging system: Illuminates when the battery is not charging properly.

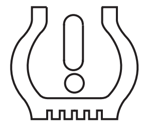


Engine oil pressure: Illuminates when the oil pressure falls below the normal range, refer to *Engine oil* in the *Maintenance and Specifications* chapter.

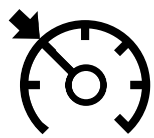


Traction Control™/AdvanceTrac® active: Illuminates when the Traction Control™ is active. If the light remains on, have the system serviced immediately, refer to the *Driving* chapter for more information.

Low tire pressure warning: Illuminates when your tire pressure is low. If the light remains ON at start up or while driving, the tire pressure should be checked. Refer to *Inflating your tires* in the *Tires, Wheels and Loading* chapter. When the ignition is first turned to ON, the light will illuminate for 3 seconds to ensure the bulb is working. If the light does not turn ON or begins to flash, have the system inspected by your authorized dealer. For more information on this system, refer to *Tire pressure monitoring system* in the *Tires, Wheels and Loading* chapter.



Speed control: Illuminates when the speed control is engaged. Turns off when the speed control system is disengaged.

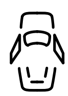


O/D off: Illuminates when the overdrive function of the transmission has been turned OFF, refer to the *Driving* chapter. If the light flashes steadily or does not illuminate, have the transmission serviced soon, or damage may occur.

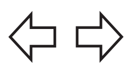
O/D
OFF

Anti-theft system: Flashes when the SecuriLock™ Passive Anti-theft System has been activated.

Door ajar: Illuminates when the ignition is in the ON position and any door is open.



Turn signal: Illuminates when the left or right turn signal or the hazard lights are turned on. If the indicators flash faster, check for a burned out bulb.



High beams: Illuminates when the high beam headlamps are turned on.

Key-in-ignition warning chime: Sounds when the key is left in the ignition in the OFF/LOCK or ACCESSORY position and the driver's door is opened.

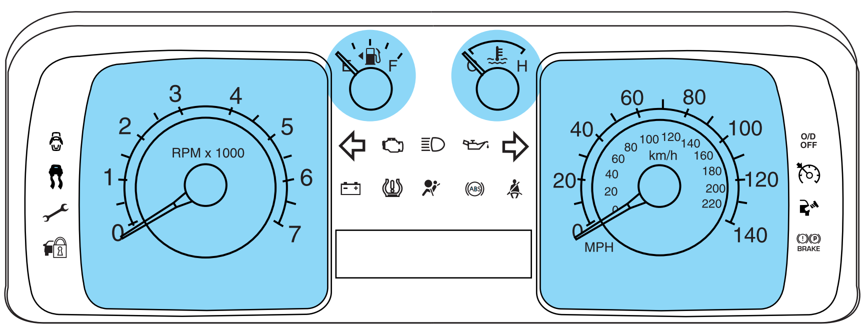
Headlamps on warning chime: Sounds when the headlamps or parking lamps are on, the ignition is off (the key is not in the ignition) and the driver's door is opened.

Parking brake ON chime: Sounds when the parking brake is left ON and the vehicle is driven. If the warning stays on after the park brake is off, contact your authorized dealer as soon as possible.

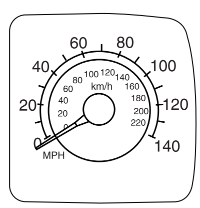
Message center activation chime: Sounds when some warning messages appear in the message center display for the first time.

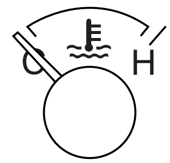
Overspeed chime (if equipped): Sounds when the vehicle speed reaches 75 mph (120 km/h) or higher.

GAUGES



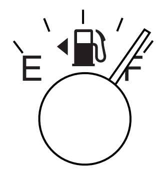
Speedometer: Indicates the current vehicle speed.





Engine coolant temperature gauge: Indicates engine coolant temperature. At normal operating temperature, the needle will be in the normal range (between "H" and "C"). **If it enters the red section, the engine is overheating. Stop the vehicle as soon as safely possible, switch off the engine and let the engine cool.**

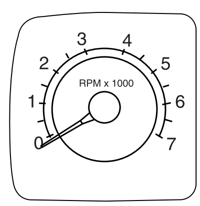
Never remove the coolant reservoir cap while the engine is running or hot.



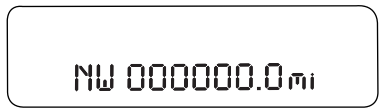
Fuel gauge: Indicates approximately how much fuel is left in the fuel tank (when the ignition is in the ON position). The fuel gauge may vary slightly when the vehicle is in motion or on a grade.

The FUEL icon and arrow indicates which side of the vehicle the fuel filler door is located.

Refer to *Filling the tank* in the *Maintenance and Specifications* chapter for more information.

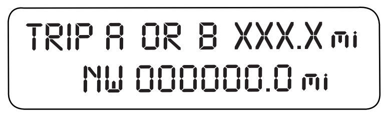


Tachometer: Indicates the engine speed in revolutions per minute. Driving with your tachometer pointer continuously at the top of the scale may damage the engine.



Odometer: Registers the total miles (kilometers) of the vehicle.

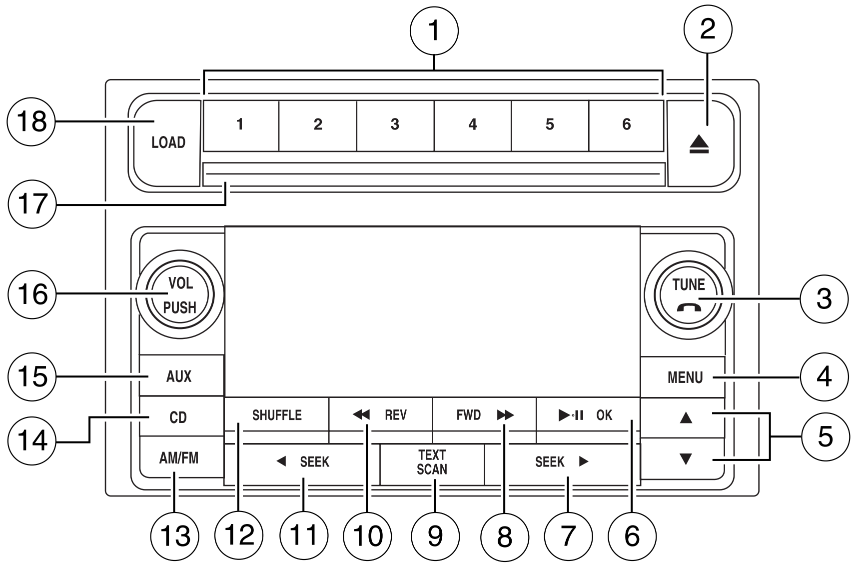
Refer to *Message center* in the *Driver Controls* chapter on how to switch the display from Metric to English.



Trip odometer: Registers the miles (kilometers) of individual journeys. Press and release the message center INFO button until “TRIP” appears in the display (this represents the trip mode). Press the control again to select Trip A and Trip B features. Press and hold the RESET button for two seconds to reset.

AUDIO SYSTEMS

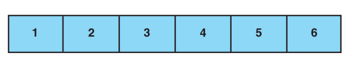
AM/FM In-dash six CD/MP3 satellite compatible sound system



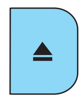
Accessory delay: Your vehicle is equipped with accessory delay. With this feature, the window controls, radio and moon roof (if equipped) may be used for up to ten minutes after the ignition is turned off or until either front door is opened.

THX: Your vehicle may be equipped with the THX® II certified premium audio system. This system creates optimal acoustic quality for all seating positions and road conditions. The system offers an advanced speaker system, amplifier, subwoofer and equalization.

1. **Memory presets:** To set a station: Select frequency band AM/FM1/FM2; tune to a station, press and hold a preset button until sound returns. PRESET SAVED will appear in the display. You may store up to 18 stations, six presets in AM, FM1 and FM2.



In satellite Radio mode (if equipped), there are 18 available presets, six each for SAT1, SAT2 and SAT3. To save satellite channels in your memory presets, tune to the desired channel then press and hold a preset control until sound returns.
Satellite radio is available only with a valid SIRIUS subscription. Check with your authorized dealer for availability.



2. ⏏ **(Eject):** Press to eject the current CD/MP3. To eject a specific CD/MP3, press ⏏ and the corresponding memory preset. Press and hold ⏏ to auto eject all discs in the system.

3. **TUNE / : In radio mode,** turn to go up/down the frequency band in individual increments.
In MP3 mode, with folder mode active, turn to advance to the next/previous MP3 folder.

In satellite radio mode (if equipped), press ◀ SEEK, SEEK ▶ to tune to the next/previous channel.
In CATEGORY MODE, press ▲ / ▼ to scroll through the list of available SIRIUS channel categories (Pop, Rock, News, etc.). Refer to *Category Mode* under *Menu* for further information.
Satellite radio is available only with a valid SIRIUS subscription. Check with your authorized dealer for availability.

(Phone): Your vehicle may be equipped with SYNC which has special phone features. Refer to the *SYNC supplement* for further information. If your vehicle is not equipped with SYNC, the display will read NO PHONE.

4. **MENU:** Press MENU repeatedly to scroll through the following modes:

Setting the clock: Press MENU until SET HOURS, SET MINUTES and SET AM/SET PM is displayed. Use ▲ /▼ to manually adjust. Press MENU again to disengage clock mode.

SATELLITE RADIO MENU (if equipped): Press MENU when satellite radio mode is active to access. Press OK to enter into the satellite radio menu. Press ▲ /▼ to cycle through the following options:

- **CATEGORY:** Press OK to enter category mode. Press ▲/▼ to scroll through the list of available SIRIUS channel Categories (Pop, Rock, News, etc.) Press OK when the desired category appears in the display. After a category is selected, press SEEK to search for that specific category of channels only (i.e. ROCK). You may also select CATEGORY ALL to seek all available SIRIUS categories and channels. Press OK to close and return to the main menu.
- **SAVE SONG:** Press OK to save the currently playing song in the system's memory. (If you try to save something other than a song, CANT SAVE will appear in the display.) When the chosen song is playing on any satellite radio channel, the system will alert you with an audible prompt. Press OK while SONG ALERT is in the display and the system will take you to the channel playing the desired song. You can save up to 20 songs. If you attempt to save a song when the system is full, the display will read REPLACE SONG? Press OK to access the saved songs and press ▲/▼ to cycle through the saved songs. When the song appears in the display that you would like to replace, press OK. SONG REPLACED will appear in the display.
- **DELETE SONG:** Press OK to delete a song from the system's memory. Press ▲/▼ to cycle through the saved songs. When the song appears in the display that you would like to delete, press OK. The song will appear in the display for confirmation. Press OK again and the display will read SONG DELETED. If you do not want to delete the currently listed song, press ▲/▼ to select either RETURN or CANCEL.
  Note: If there are no songs presently saved, the display will read NO SONGS.
- **DELETE ALL SONGS:** Press OK to delete all song's from the system's memory. The display will read ARE YOU SURE ? Press OK to confirm deletion of all saved songs and the display will read ALL DELETED.
  Note: If there are no songs presently saved, the display will read NO SONGS.
- **ENABLE ALERTS / DISABLE ALERTS:** Press OK to enable/disable the satellite alert status which alerts you when your selected songs are playing on a satellite radio channel. (The system default is disabled.) SONG ALERTS ENABLED/DISABLED will appear in the display. The menu listing will display the opposite state. For example, if you have chosen to enable the song alerts, the menu listing will read DISABLE as the alerts are currently on, so your other option is to turn them off.

Satellite radio is available only with a valid SIRIUS radio subscription. Check with your authorized dealer for availability.

RBDS ON/OFF: Press ▲/▼ to turn RBDS ON or OFF.

Program Type: If RBDS is ON, press ▲/▼ to find the desired program type, then use ◀ SEEK ▶ or SCAN to search for FM radio stations broadcasting the desired program type.

RBDS (Radio Broadcast Data System): Available in FM mode only. Allows you to search RBDS-equipped stations for certain categories of music or announcements. With RBDS ON, you may select from: Info (Information), Alert, Test, Religious, R&B, Classical, Jazz, Oldies, Country, Top 40, Soft and Rock as described under *Program Type* above. When the desired category appears in the display, press ◀ SEEK, SEEK ▶ to initiate the search. The system will cycle through the FM frequency band searching for stations broadcasting the selected category type. If the desired program type is not found after searching the frequency band three times, the search will stop. The announcement categories are as follows:

- **Alert**: Searches for RBDS stations actively broadcasting important messages relating to weather or government emergencies.
- **Test**: Searches for RBDS stations actively broadcasting a test message.

Autoset: Allows you to set the strongest local radio stations without losing your original manually set preset stations for AM/FM1/FM2. Use ▲/▼ to turn on/off.

When the six strongest stations are filled, the station stored in preset 1 will begin playing. If there are less than six strong stations, the system will store the last one in the remaining presets.

Bass: Press ▲/▼ to adjust the bass setting.

Treble: Press ▲/▼ to adjust the treble setting.

Balance: Press ▲/▼ to adjust the audio between the right and left speakers.

Fade: Press ▲/▼ to adjust the audio between the front and rear speakers.

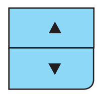
Speed sensitive volume: Radio volume automatically changes slightly with vehicle speed to compensate for road and wind noise. Use ▲/▼ to adjust. Recommended level is 1–3. Level 7 is the maximum setting.

Occupancy mode (if equipped): Use ▲/▼ to select and optimize sound for ALL SEATS, DRIVERS SEAT or REAR SEATS.

Compression: Available in CD mode, this feature brings soft and loud CD passages together for a more consistent listening level. Press MENU until compression status is displayed. Press ▲/▼ to turn the feature on/off.

SINGLE PLAY/DUAL PLAY (if equipped): If SINGLE PLAY is ON, press ▲/▼ for DUAL PLAY. For further information on Single Play/Dual Play, please refer to the *Family Entertainment DVD system* later in this chapter.

5. **Select:** These controls are used in Menu mode to select various settings/options.



6. **Play/Pause: In CD/MP3 mode,** press to pause the playing media. CDX PAUSE will appear in the display. Press again to return to the playing media.

OK: Use in various menu selections. Your vehicle may be equipped with SYNC which has special phone and media features. For further information, refer to the *SYNC supplement.*

7. **SEEK ▶ : In radio or CD/MP3 mode,** press to access the next strong station or track.

In satellite radio mode (if equipped), press SEEK ▶ to seek to the next channel. If a specific category is selected, (Jazz, Rock, News, etc.), press SEEK ▶ to seek to the next channel in the selected category. Press and hold SEEK ▶ to fast seek through the next channels.

In TEXT MODE, press SEEK ▶ to view the additional display text when “>” is active in the display.

In CATEGORY MODE, press ▲/▼ to select a category.

Satellite radio is available only with a valid SIRIUS subscription. Check with your authorized dealer for availability.

8. **FWD (Fast Forward):** Press FWD to manually advance in a CD/MP3 track.

9. **TEXT/SCAN: In radio mode,** when listening to a RBDS-equipped station, press and hold for a brief sampling of radio stations.

In CD/MP3 mode, press and release to view the track title, artist name or disc title. Press and hold for a brief sampling of all tracks on the current disc.

In satellite radio mode (if equipped), press and release to enter TEXT MODE and toggle between channel name/channel category and the current song title/artist.

In TEXT MODE, sometimes the display requires additional text to be displayed. When the “>” indicator is active, press SEEK ▶ to view the additional display text. When the “<” indicator is active, press ◀ SEEK to view the previous display text.

10. **REV (Reverse):** Press REV to manually reverse in a CD track.

11. ◀ **SEEK: In radio and CD/MP3 mode,** press to access the previous strong station or track.

In satellite radio mode (if equipped), press ◀ SEEK to seek to the previous channel. If a specific category is selected, (Jazz, Rock, News, etc.), press ◀ SEEK to seek to the previous channel in the selected category. Press and hold ◀ SEEK to fast seek through the previous channels.

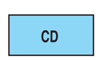
In TEXT MODE press ◀ SEEK to view the previous display text when “<” is active in the display.

Satellite radio is available only with a valid SIRIUS subscription. Check with your authorized dealer for availability.

12. **SHUFFLE:** Press to play all tracks on the current disc in random order.

13. **AM/FM:** Press to select AM/FM1/FM2 frequency band.

14. **CD:** Press to enter CD mode. If a CD is already loaded into the system, CD play will begin where it ended last. If no CD is loaded, NO DISC will appear in the display.



CD units are designed to play commercially pressed 4.75 in (12 cm) audio compact discs only. Due to technical incompatibility, certain recordable and re-recordable compact discs may not function correctly when used in CD players. Dirty, warped or damaged CDs, irregular shaped CDs, CDs with a scratch protection film attached, and CDs with homemade paper (adhesive) labels should not be inserted into the CD player. The label may peel and cause the CD to become jammed. It is recommended that homemade CDs be identified with permanent felt tip marker rather than adhesive labels. Ballpoint pens may damage CDs. Please contact your authorized dealer for further information.

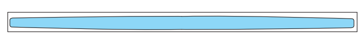
15. **AUX:** Press repeatedly to cycle through FES/DVD (if equipped), LINE IN (auxiliary audio mode), SAT1, SAT2 and SAT3 modes (satellite radio, if equipped) and SYNC (if equipped).

For location and further information on auxiliary audio mode, refer to *Auxiliary input jack* later in this chapter.
For further information on SYNC, refer to the *SYNC supplement.*
Satellite radio is available only with a valid SIRIUS radio subscription. Check with your authorized dealer for availability.

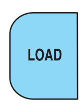
16. **ON/OFF/Volume:** Press to turn ON/OFF. Turn to increase/decrease volume.

If the volume is set above a certain level and the ignition is turned off, the volume will come back on at a “nominal” listening level when the ignition switch is turned back on.

17. **CD slot:** Insert a CD/MP3 label side up.

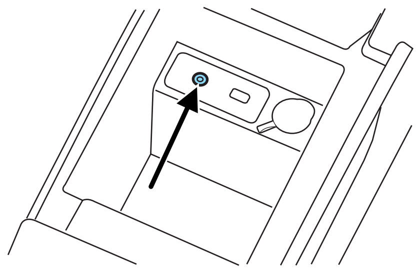


18. **LOAD:** Press to load a CD/MP3. Press LOAD and a memory preset to load to a specific slot. Press and hold to autoload up to six CD/MP3s.



Auxiliary input jack (Line in)

Driving while distracted can result in loss of vehicle control, accident and injury. Ford strongly recommends that drivers use extreme caution when using any device that may take their focus off the road. The drivers primary responsibility is the safe operation of their vehicle. Only use cell phones and other devices not essential to the driving task when it is safe to do so.



Your vehicle is equipped with an Auxiliary Input Jack (AIJ). The Auxiliary Input Jack provides a way to connect your portable music player to the in-vehicle audio system. This allows the audio from a portable music player to be played through the vehicle speakers with high fidelity. To achieve optimal performance, please observe the following instructions when attaching your portable music device to the audio system.

Required equipment:

1. Any portable music player designed to be used with headphones
2. An audio extension cable with stereo male 1/8 in. (3.5 mm) connectors at each end

To play your portable music player using the auxiliary input jack:

1. Begin with the vehicle parked and the radio turned off.
2. Ensure that the battery in your portable music player is new or fully charged and that the device is turned off.
3. Attach one end of the audio extension cable to the headphone output of your player and the other end of the audio extension cable to the AIJ in your vehicle.
4. Turn the radio on, using either a tuned FM station or a CD loaded into the system. Adjust the volume to a comfortable listening level.
5. Turn the portable music player on and adjust the volume to 1/2 the volume.
6. Press AUX on the vehicle radio repeatedly until LINE IN appears in the display.

You should hear audio from your portable music player although it may be low.

7. Adjust the sound on your portable music player until it reaches the level of the FM station or CD by switching back and forth between the AUX and FM or CD controls.

Troubleshooting:

1. Do not connect the audio input jack to a line level output. Line level outputs are intended for connection to a home stereo and are not compatible with the AIJ. The AIJ will only work correctly with devices that have a headphone output with a volume control.

2. Do not set the portable music player's volume level higher than is necessary to match the volume of the CD or FM radio in your audio system as this will cause distortion and will reduce sound quality. Many portable music players have different output levels, so not all players should be set at the same levels. Some players will sound best at full volume and others will need to be set at a lower volume.

3. If the music sounds distorted at lower listening levels, turn the portable music player volume down. If the problems persists, replace or recharge the batteries in the portable music player.

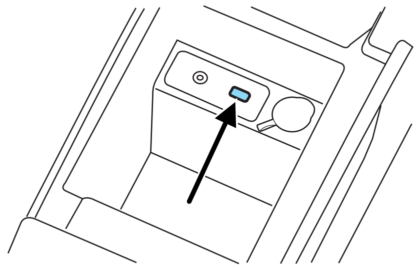
4. The portable music player must be controlled in the same way manner when it is used with headphones as the AIJ does not provide control (play, pause, etc.) over the attached portable music player.

5. For safety reasons, connecting or adjusting the settings on your portable music player should not be attempted while the vehicle is moving. Also, the portable music player should be stored in a secure location, such as the center console or the glove box, when the vehicle is in motion. The audio extension cable must be long enough to allow the portable music player to be safely stored while the vehicle is in motion.

USB port (if equipped)

Driving while distracted can result in loss of vehicle control, accident and injury. Ford strongly recommends that drivers use extreme caution when using any device that may take their focus off the road. The drivers primary responsibility is the safe operation of their vehicle. Only use cell phones and other devices not essential to the driving task when it is safe to do so.

Your vehicle may be equipped with a USB port inside your center console. This feature allows you to plug in media playing devices, memory sticks, and also to charge devices. For further information on this feature, refer to *Using your USB port* in the *SYNC supplement*.



GENERAL AUDIO INFORMATION

Radio frequencies:

AM and FM frequencies are established by the Federal Communications Commission (FCC) and the Canadian Radio and Telecommunications Commission (CRTC). Those frequencies are:

AM: 530, 540–1700, 1710 kHz

FM: 87.7, 87.9–107.7, 107.9 MHz

Radio reception factors:

There are three factors that can affect radio reception:

- Distance/strength: The further you travel from an FM station, the weaker the signal and the weaker the reception.
- Terrain: Hills, mountains, tall buildings, power lines, electric fences, traffic lights and thunderstorms can interfere with your reception.
- Station overload: When you pass a broadcast tower, a stronger signal may overtake a weaker one and play while the weak station frequency is displayed.

CD/CD player care

Do:

- Handle discs by their edges only. (Never touch the playing surface).
- Inspect discs before playing.
- Clean only with an approved CD cleaner.

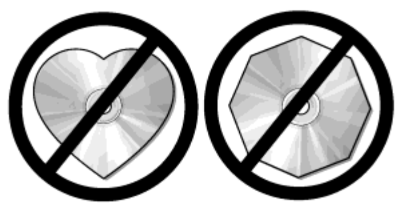
- Wipe discs from the center out.

Don't:

- Expose discs to direct sunlight or heat sources for extended periods of time.
- Clean using a circular motion.

CD units are designed to play commercially pressed 4.75 in (12 cm) audio compact discs only. Due to technical incompatibility, certain recordable and re-recordable compact discs may not function correctly when used in Ford CD players.

Do not use any irregular shaped CDs or discs with a scratch protection film attached.



CDs with homemade paper (adhesive) labels should not be inserted into the CD player as the label may peel and cause the CD to become jammed. It is recommended that homemade CDs be identified with permanent felt tip marker rather than adhesive labels. Ballpoint pens may damage CDs. Please contact your authorized dealer for further information.

Audio system warranty and service

Refer to the *Warranty Guide* for audio system warranty information. If service is necessary, see your dealer or qualified technician.

Satellite radio information (if equipped)

Satellite radio channels: SIRIUS broadcasts a variety of music, news, sports, weather, traffic and entertainment satellite radio channels. For more information and a complete list of SIRIUS satellite radio channels, visit www.sirius.com in the United States, www.sirius-canada.ca in Canada, or call SIRIUS at 1–888–539–7474.

Satellite radio reception factors: To receive the satellite signal, your vehicle has been equipped with a satellite radio antenna located on the roof of your vehicle. The vehicle roof provides the best location for an unobstructed, open view of the sky, a requirement of a satellite radio system. Like AM/FM, there are several factors that can affect satellite radio reception performance:

- Antenna obstructions: For optimal reception performance, keep the antenna clear of snow and ice build-up and keep luggage and other material as far away from the antenna as possible.
- Terrain: Hills, mountains, tall buildings, bridges, tunnels, freeway overpasses, parking garages, dense tree foliage and thunderstorms can interfere with your reception.
- Station overload: When you pass a ground based broadcast repeating tower, a stronger signal may overtake a weaker one and result in an audio mute.

Unlike AM/FM audible static, you will hear an audio mute when there is a satellite radio signal interference. Your radio display may display NO SIGNAL to indicate the interference.

SIRIUS satellite radio service: SIRIUS Satellite Radio is a subscription based satellite radio service that broadcasts music, sports, news and entertainment programming. A service fee is required in order to receive SIRIUS service. Vehicles that are equipped with a factory installed SIRIUS Satellite Radio system include:

- Hardware and limited subscription term, which begins on the date of sale or lease of the vehicle.
- Online media player providing access to all 65 SIRIUS music channels over the internet (U.S. customers only).

For information on extended subscription terms, contact SIRIUS at 1–888–539–7474.

Note: SIRIUS reserves the unrestricted right to change, rearrange, add or delete programming including canceling, moving or adding particular channels, and its prices, at any time, with or without notice to you. Ford Motor Company shall not be responsible for any such programming changes.

Satellite Radio Electronic Serial Number (ESN): This 12–digit Satellite Serial Number is needed to activate, modify or track your satellite radio account. You will need this number when communicating with SIRIUS. While in Satellite Radio mode, you can view this number on the radio display by pressing AUX and Preset 1 control simultaneously.

Radio Display	Condition	Action Required
ACQUIRING	Radio requires more than two seconds to produce audio for the selected channel.	No action required. This message should disappear shortly.
SAT FAULT	Internal module or system failure present.	If this message does not clear within a short period of time, or with an ignition key cycle, your receiver may have a fault. See your authorized dealer for service.
INVALID CHNL	Channel no longer available.	This previously available channel is no longer available. Tune to another channel. If the channel was one of your presets, you may choose another channel for that preset button.
UNSUBSCRIBED	Subscription not available for this channel.	Contact SIRIUS at 1–888–539–7474 to subscribe to the channel or tune to another channel.
NO TEXT	Artist information not available.	Artist information not available at this time on this channel. The system is working properly.

Radio Display	Condition	Action Required
NO TEXT	Song title information not available.	Song title information not available at this time on this channel. The system is working properly.
NO TEXT	Category information not available.	Category information not available at this time on this channel. The system is working properly.
NO SIGNAL	Loss of signal from the SIRIUS satellite or SIRIUS tower to the vehicle antenna.	You are in a location that is blocking the SIRIUS signal (i.e., tunnel, under an overpass, dense foliage, etc). The system is working properly. When you move into an open area, the signal should return.
UPDATING	Update of channel programming in progress.	No action required. The process may take up to three minutes.
CALL SIRIUS 1–888–539–7474	Satellite service has been deactivated by SIRIUS Satellite Radio.	Call SIRIUS at 1–888–539–7474 to re-activate or resolve subscription issues.

FAMILY ENTERTAINMENT DVD SYSTEM (IF EQUIPPED)

Driving while distracted can result in loss of vehicle control, accident and injury. Ford strongly recommends that drivers use extreme caution when using any device that may take their focus off the road. The drivers primary responsibility is the safe operation of their vehicle. Only use cell phones and other devices not essential to the driving task when it is safe to do so.

Your vehicle may be equipped with a Family Entertainment System (FES) which allows you to listen to audio CDs, MP3 discs, watch DVDs and to plug in and play a variety of standard video game systems. The DVD player is capable of playing standard DVDs, CDs, MP3s and is compatible with CD-R/W, CD-R and certain CD-ROM media.

Please review this material to become familiar with the FES features and controls as well as the very important safety information.

Quick start

Your Family Entertainment System includes a DVD system, two sets of wireless infrared (IR) headphones and a wireless infrared (IR) remote control.

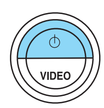
To play a DVD in the DVD system:

The DVD system can play DVD-Video, DVD-R, DVD-R/W discs as well as audio CDs and video CDs. To ensure proper disc operation, check the disc for finger prints, scratches and cleanliness. Clean with a soft cloth, wiping from center to edge.

1. Ensure that the vehicle ignition is in the RUN or ACCESSORY position.

2. Insert a DVD into the system, label-side up to turn on the system. It will load automatically.

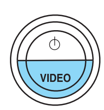
3. Press the power button on the DVD player, then press Play () to begin to play the disc.



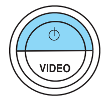
If a DVD is already loaded into the system, press PLAY on the DVD player.

Note: If sound can be heard, but no video is present, press VIDEO to select the video source (DVD or aux-inputs).

Press VIDEO to change the source displayed on the screen. Press repeatedly to cycle through: DVD-DISC, DVD-AUX, NON-DVD, OFF.



Press the power button to turn the system OFF. The indicator light will turn off indicating the system is off.



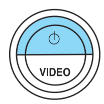
Note: The audio from the DVD system will play over all vehicle speakers and can be adjusted by the radio volume control.

To play a CD in the DVD system:

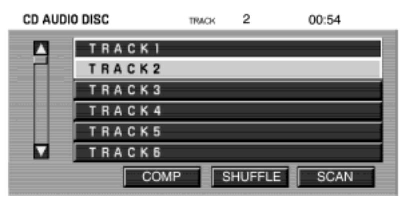
The DVD system can play audio CDs, CD-R and CD-R/W, CD-ROM and video CDs. To ensure proper disc operation, check the disc for finger prints and scratches. Clean the disc with a soft cloth, wiping from the center to the edge.

1. Ensure that the vehicle ignition is in the RUN or ACCESSORY position.

2. Insert a CD into the system, label-side up to turn on the DVD system. It will load and automatically begin to play. If there is already a CD in the system, press PLAY on the DVD player.



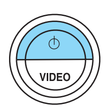
3. The disc will begin to play and the ’CD Audio Disc’ screen will display. From this screen, you can also select from COMPRESSION, SHUFFLE and SCAN features.



To play an MP3 disc in the DVD system:

1. Ensure that the vehicle ignition is in the RUN or ACCESSORY position.

2. Insert an MP3 disc into the system, label-side up to turn on the DVD system. It will load and automatically begin to play. If there is already a disc in the system, press PLAY on the DVD player.



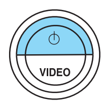
3. The disc will begin to play and the 'MP3 Audio Disc' screen will display and allow you to access the COMPRESSION, SHUFFLE, SCAN and FOLDER MODE features.

To play an auxiliary source through the DVD system

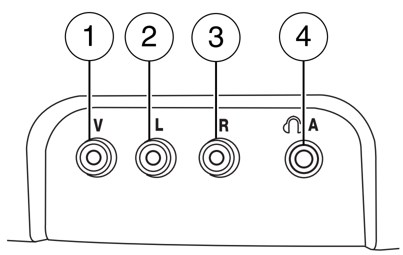
The DVD system can be used to connect and play auxiliary electronic devices such as game systems, personal camcorders, video cassette recorders, etc.

1. Ensure that the vehicle ignition is in the RUN or ACCESSORY position.

2. Press the power button to turn the DVD system on. The indicator light next to the power button will illuminate.



3. Connect an auxiliary audio/video source by connecting RCA cords (not included) to the RCA jacks on the left hand side of the system.



- Yellow (1) — video input
- White (2) — left channel audio input
- Red (3) — right channel audio input

4. Press MEDIA on the DVD system to change the media source to AUX.

5. Press VIDEO on the DVD system to change the video source to DVD-AUX. If your source is properly plugged in, it will appear on the LCD (Liquid Crystal Display) screen. If your auxiliary source does not have a video signal, or if the DVD system does not detect a video signal from the auxiliary source, the screen will remain black. If the video source is set to DVD-AUX, the display will automatically turn on if a video signal is detected.

To listen to audio over the headphones (Dual play mode):

1. You may listen to channels A and B over wired or wireless headphones. Refer to *Using the infrared wireless headphones* and *Using wired headphones* for further information.

- Black (4) — wired headphone output (wired headphones not included)

2. Press the headphone/speaker button on the DVD player or press the 2 and 4 memory presets on the audio system at the same time.

A green light will illuminate next to either the A or B Headphone Control Button to indicate which channel is active (able to be controlled).

3. Press MEDIA to change the audio source of the active channel (A or B). The audio source will be shown on the display. You may change the active channel by pressing the A or B headphone control button.

Note: Channel A can access any possible media source (AM, FM1, FM2, SAT (if equipped), CD, DVD, AUX). Channel B can only access DVD and AUX sources.

Note: Refer to *Single play/Dual play* for more information.

Using the infrared (IR) wireless headphones:

1. Press the power control on the earpiece to turn the headphones ON.

2. Select Channel A or B for each set of wireless headphones by using the A/B control on the ear piece.

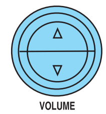
3. Adjust the headphone volume using the rotary dial on the earpiece.

Using wired headphones (not included):

Do not leave children unattended in the vehicle and do not let children operate the system while unsupervised. If wired headphones or auxiliary systems are used, children may become entangled in the cords and seriously injure themselves.

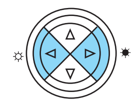
1. Connect the wired headphones in to the headphone jacks on either side of the DVD system. Each side is labeled A or B. Headphones plugged into jack A will listen to Channel A and headphones plugged into jack B will listen to Channel B.

2. Adjust the volume levels using the volume controls on the DVD system.

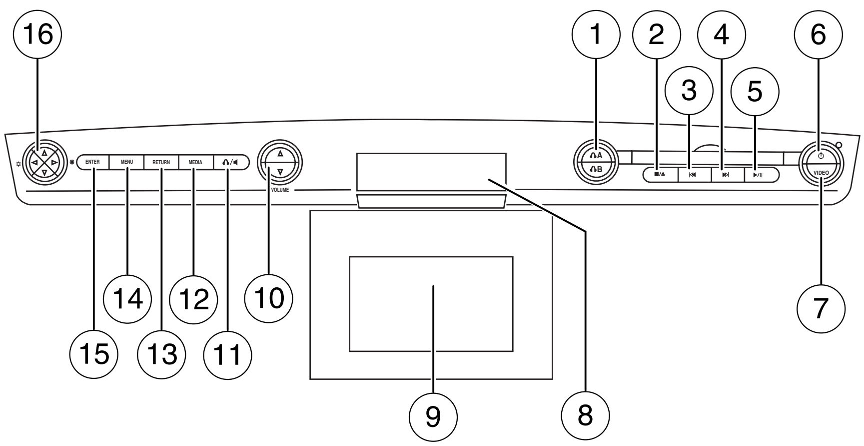


To adjust display brightness:

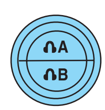
To decrease/increase the brightness level on the display screen, press the brightness control on the DVD system. A display will appear at the bottom of the screen indicating the brightness level. The brightness display will only appear when the menu is not displayed.



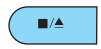
DVD player controls



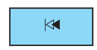
1. **Headphone control A/B:** Press to select either the A or B headphone source. Then press MEDIA to select the desired playing media for that headset. When a headphone channel has been selected (A or B), selections will affect the source on that channel only.



Note: Headphone A can access any possible media (AM, FM1, FM2, SAT (if equipped), CD, DVD, DVD-AUX). Headphone B can only access DVD and DVD-AUX.
For further information, refer to *Single play/Dual play* later in this section.



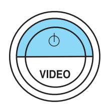
2. ■ / ⏏ (Stop/Eject): Press once to stop and press a second time to eject a disc from the DVD system.



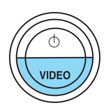
3. ⏮ (Reverse): Press and release for the previous chapter or track. Press and hold to reverse search a DVD, Video CD, or FES CD in DVD/CD mode.

4. ⏭ (Fast forward): Press and release for the next chapter or track. Press and hold to forward search a DVD, Video CD, or FES CD in DVD/CD mode.

5. ▶ / ❚❚ (Play/Pause): Press (Play) to select DVD mode (and to turn the DVD system on if it is off). If a disc is present, it will resume or begin to play. Press (Pause) while playing a disc to pause a DVD or CD.



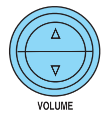
6. **On/Off:** Press to turn the DVD system On/Off.



7. **VIDEO:** Press repeatedly to cycle through the following video state options which will be indicated on the bottom right hand corner of the display: DVD DISC, DVD-AUX, NON-DVD and Off (no indicator). If you select the DVD-AUX video source, the display will turn off if there is no video signal detected. When a video signal is detected on the auxiliary video input, and the display is in the DVD-AUX video mode, the display will automatically turn on.

8. **Infrared (IR) Receiver & Transmitter:** System sensor which reads the signals from the remote control and sends audio signals to the infrared (IR) wireless headphones.

9. **LCD screen:** The eight inch diagonal screen rotates down to view and up into housing to store when not in use. Ensure that the screen is latched into the housing when being stored.



10. **Volume:** When in Single Play, press to increase (▲) or decrease (▼) the volume over all speakers. When in Dual Play, press to increase (▲) or decrease (▼) the volume for the wired headphones. (Wireless headphone volume is controlled with the rotary dial on the right ear piece.)

11. / (Headphones/Speakers): Press once for Dual Play (Headphone mode- the rear speakers are muted) and press again for Single Play (same media playing through all speakers). You can also press the 2 and 4 memory preset buttons on the audio system at the same time to perform the same function. For further interaction information, refer to *Single Play/Dual play.*

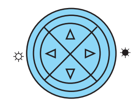
12. **MEDIA:** Press repeatedly to select from the various possible playing media sources (AM, FM1, FM2, SAT (if equipped), CD, DVD, DVD-AUX). The media will show in the status display on the top of the screen when in Dual Play mode. When in Single Play mode, the media source will be displayed on the radio.
Note: Channel A can access any possible media source (AM, FM1, FM2, SAT (if equipped), CD, DVD, DVD-AUX). Channel B can only access DVD and DVD-AUX sources.

13. **RETURN:** Press to return to the playing media or to resume playback.

14. **MENU:** When playing a DVD, press MENU once to enter the DVD disc menu (if available) and press twice to enter the system set-up menu. From the set-up menu, you may select from Angle, Aspect Ratio, Language, Subtitles, Disc resume, Compression, Restore Defaults and Back. For more detailed information, refer to *Menu mode.*

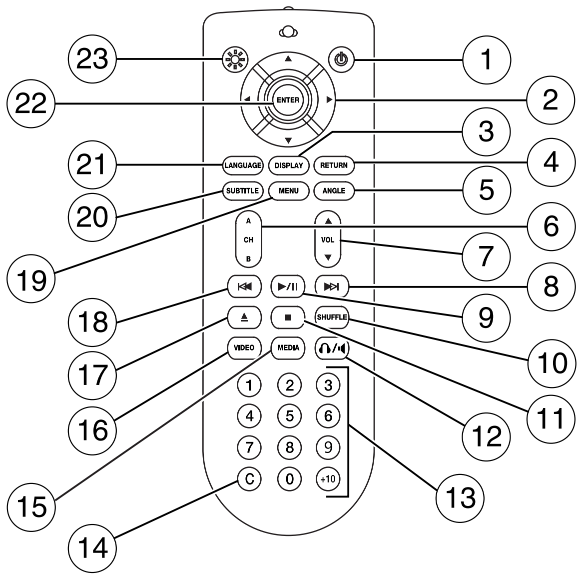
15. **ENTER:** Press to select/confirm the current selection.

16. **Cursor /Brightness controls:** Use the cursor controls to make various selections when in any menu. When not in a menu, and in DVD mode, press ◀ / ▶ to adjust the brightness. A display bar will appear at the bottom of the screen indicating the brightness levels.



Remote control

Unless otherwise stated, all operations can be carried out with the remote control. Always point the remote control directly at the player. Ensure that there are no obstructions between the remote and player.



1. **Power control:** Press to turn the FES (Family Entertainment System) ON/OFF.

2. **Cursor controls:** Use in various active menus to advance the cursor up/down/left/right. When not in a Menu, the left and right cursor controls decrease and increase the display brightness.

3. **DISPLAY:** Press to access the on-screen display of the FES functions and adjustments.

4. **RETURN:** Press to return to the previous menu screen.

5. **ANGLE** (DVD dependent): Press to select the angle to view the scene.

6. **Channel A/B:** Press to select either A or B headphones and then use the MEDIA control to select the desired playing media for the headphones.

7. **VOL (Volume):** When in Single Play, press to increase (▲) or decrease (▼) the volume over all speakers. When in Dual Play, press to increase (▲) or decrease (▼) the volume for the wired headphones. (Wireless headphone volume is controlled with the rotary dial on the right ear piece.)

8. **Fast Forward/Next:** In DVD mode, press and hold for a quick advance within the DVD. Press and release to advance to the next chapter. In CD/MP3 mode, press to access the next track.

9. **Play/Pause:** Press to play or pause a DVD.

10. **SHUFFLE:** Press to play all tracks on the current CD/MP3 disc in random order.

11. **STOP:** Press to stop the current DVD or CD/MP3.

12. / **Speaker/Headphone** (Single/Dual Play): Press to toggle between Single Play (same media playing through all speakers) and Dual Play (headphone mode — the rear speakers are muted). You can also press the 2 and 4 memory presets on the audio system at the same time to perform the same function.

13. **Keypad:** Use the numeric controls to enter in a specific CD/MP3 track or DVD chapter to be played.

14. **C (Cancel):** Press to cancel/clear the numeric input (i.e. chapter number).

15. **MEDIA:** Press to cycle through the possible media sources: AM, FM1, FM2, SAT (if equipped), CD, DVD, LINE IN (if equipped), DVD-AUX.
Channel B can only access DVD and AUX sources.

16. **VIDEO:** Press to cycle through video states: DVD-DISC, DVD-AUX, NON-DVD, Off.

17. **EJECT:** Press to eject a disc from the FES.

18. **Fast reverse/Previous:** When a DVD is playing, press and hold for a quick reverse within the DVD. Press and release for the previous chapter. Press PLAY to resume normal playback speed and volume.
In CD/MP3 mode, press to access the previous track.

19. **MENU:** Press to access the DVD disc menu for selections. Press MENU again when in the DVD disc menu to access the system set-up menu.

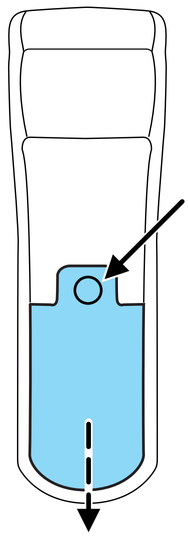
20. **SUBTITLE** (DVD dependent): Press to turn the subtitle feature ON or OFF.

21. **LANGUAGE** (DVD dependent): Press to select the desired language.

22. **ENTER:** Press to select the highlighted menu option.

23. **ILLUMINATION**: Press to illuminate the remote control and backlight all of the buttons.

Battery replacement



Batteries are supplied with the remote control unit. Since all batteries have a limited shelf life, replace them when the unit fails to control the DVD player.

Remove the screw and unlatch the battery cover to access the batteries.

The remote control unit uses two AAA batteries which are supplied with the unit.

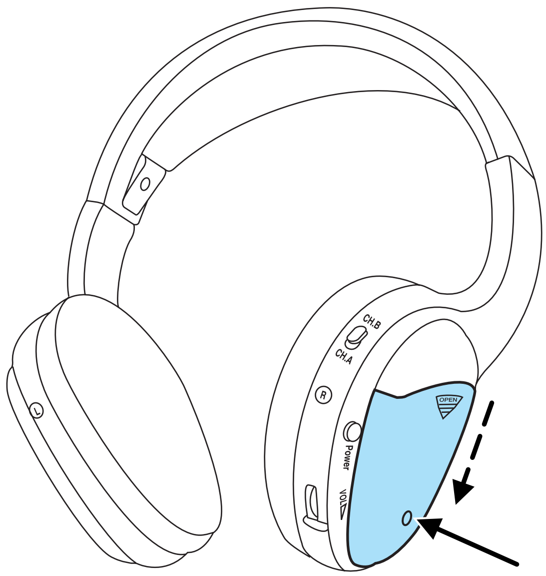
Headphones

Wireless headphones

The driver should never use the headphones while driving the vehicle. Using headphones may prevent the driver from hearing audible warnings such as horns or emergency sirens, which could result in a crash causing serious injury. Give your full attention to driving and to the road.

Your FES system is equipped with two sets of battery powered, infrared wireless headphones. Two AAA batteries are needed to operate the headphones. (Batteries are included.)

Additional infrared wireless headphones may be purchased for use with the system. Also, wired headphones may be purchased and plugged in where indicated on the left and right hand sides of the system. Refer to *Wired Headphones* below.



To install the batteries, remove the screw at the bottom of the cover. Then, lightly press down on top and slide the cover off.

When replacing the batteries, use two new batteries (alkaline recommended) and install them with the correct orientation as indicated in the battery housing.

To operate the headphones:

- Press POWER on the ear piece to turn on the headphones. A red indicator light will illuminate indicating the headphones are ON. Press POWER again to turn the headphones off.
- Adjust the headphones to comfortably fit your head using the headband adjustment.
- Select the desired audio source (Channel A or B) for each set of wireless headphones by using the A/B selection switch on the ear piece.
- Adjust the volume control to the desired listening level.

Ensure that the headphones are turned off when not in use. After approximately one minute of not being in use (no infrared signal is received), the wireless headphones will automatically turn off. They will also turn off after two hours of continuous use as a power save feature. If this happens, simply turn the headphones on again and continue use.

Wired headphones

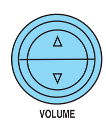
Do not leave children unattended in the vehicle and do not let children operate the system while unsupervised. If wired headphones or auxiliary systems are used, children may become entangled in the cords and seriously injure themselves.

The driver should never use the headphones while driving the vehicle. Using headphones may prevent the driver from hearing audible warnings such as horns or emergency sirens, which could result in a crash causing serious injury. Give your full attention to driving and to the road.

You may purchase wired headphones for your FES (Family Entertainment System). Plug them into the 3.5 mm headphone jack(s) located on the left and right sides of the system. (Channel A is located on the left side and Channel B is located on the right side.) These headphones will be active when in Dual Play mode.

To listen to the audio on wired headphones (not included), connect the wired headphones into the headphone jacks on the sides of the DVD system. The wired headphone jack for Channel A is located on the left side of the FES and is labeled A. Headphones plugged into this headphone jack will hear audio from the audio source selected to be the Channel A source. The wired headphone jack for Channel B is located on the right side of the FES and is labeled B. Headphones plugged into this headphone jack will hear audio from the audio source selected to be the Channel B source.

Adjust the headphone volume using the volume control on the DVD system.



Operation

Single play/Dual play

Your DVD and audio system work together with the infrared headphones and wired headphones (not included) to allow the rear seat passengers to listen to the radio (and other media sources) over the headphones. This enables the front and rear seat passengers to listen to a variety of sources a variety of ways.

Single Play: Single play consists of all occupants in the vehicle listening to the same playing media over the front and rear speakers. When the DVD system is on, and the same source is playing through the front and rear speakers, SINGLE PLAY will appear in the front radio display.

Dual Play: Dual play is when the rear seat passengers choose to listen to a different playing media than the front seat passengers. With the DVD and Rear Seat Controls turned ON, the rear seat passengers may choose to listen to the radio, CD, MP3, DVD, or DVD-AUX media sources over headphones while the front speakers play the chosen selection for the front audio system, they may listen to another over the headphones. DUAL PLAY will appear in the radio display.

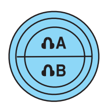
When both the front seat passengers and the rear seat passengers listen to the same audio source, SHARED MODE will appear on the radio.

Note: If the front seat passengers are listening to the radio, the rear seat passengers can also listen to the radio, however they will be limited to listening to the same radio channel.

Press / on the DVD player to listen to audio over the headphones.

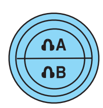
The headphone control will now be active and a green light next to the A or B headphone control buttons will illuminate. The system can output two different audio sources over the headphones. These are called Channel A and Channel B. Both Channel A and Channel B can be listened to on the wired headphones (not included) or on the infrared (IR) wireless headphones.

Press the Headphone Control button A to change the audio source for Channel A.



Press MEDIA to change the audio source for Channel A. This information will display on the DVD system screen.

Press the Headphone Control button B to change the audio source for Channel B.



Press MEDIA to change the audio source for Channel B. This information will display on the DVD system screen. Channel B can listen to either the DVD media or the DVD system auxiliary inputs (DVD-AUX).

Operation with an aftermarket audio system (Headphone only mode)

When the Family Entertainment System (FES) detects that the original radio supplied by Ford Motor Company has been removed from the vehicle, the Family Entertainment System will work in a state referred to as “Headphone Only Mode”.

While operating in Headphone Only Mode, the system will have limited functionality.

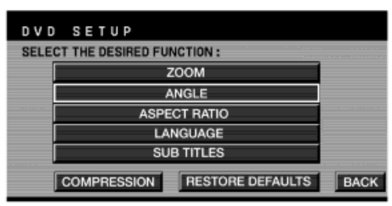
- The system will only output audio to the headphones. It will not be capable of providing audio to the speakers.
- The available sources in FES Headphone Only Mode are DVD-DISC and DVD-AUX, regardless of headphone channel (A or B).
- When a disc is inserted into the FES while in Headphone Only Mode, both headphone channels (A&B) will be connected to FES-DISC.

Menu mode

Press MENU once on the DVD system to access the DVD disc menu if available.

Press MENU twice to access the DVD set-up menu and the following features:

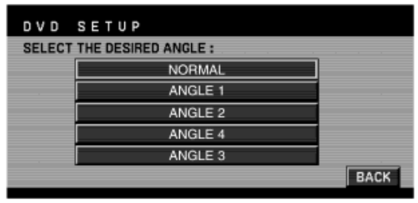
1. ZOOM
2. ANGLE
3. ASPECT RATIO
4. LANGUAGE
5. SUB TITLES



Angle mode

Select ANGLE to select various angles of view for the DVD.

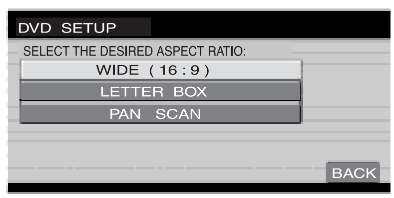
This is disc dependent — some DVD discs may have more viewing angles to select from. Once you have made your selection, press ENTER to confirm. The system default is Angle 1.



Aspect ratio

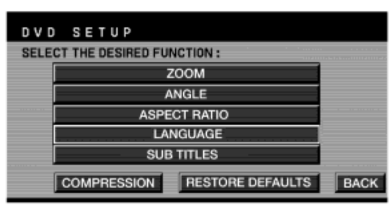
Select ASPECT RATIO to select the viewing size and shape of the video displayed on the LCD screen. This is disc dependent.

You can select from: WIDE, LETTER BOX or PAN SCAN. Once you have made your selection, press ENTER to confirm. The LCD screen display will immediately change to your selection after the system resumes playback of the DVD. The system default is WIDE (16:9).



Language

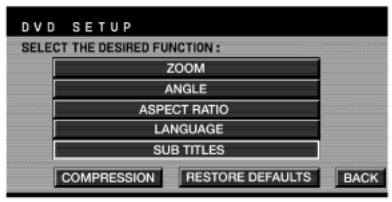
Select LANGUAGE to select the language you would like to use for audio output (English, Spanish, French). This is disc dependent.



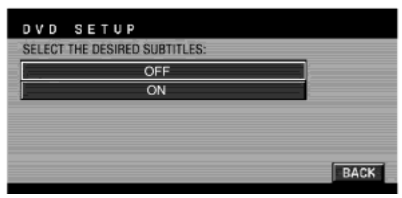
Once you have made your selection, press ENTER to confirm. The system default is English.

Subtitles

Select SUBTITLES to turn the subtitle option on or off. The system default is OFF.



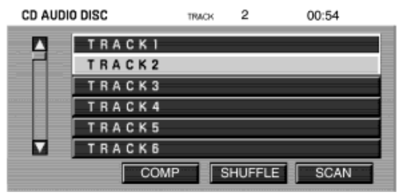
Once you have made your selection, press ENTER to confirm. This is disc dependent.



Audio CDs

To play audio CDs on your DVD system:

1. Ensure that the vehicle ignition is in the RUN or ACCESSORY position.
2. Ensure that the DVD system is ON.
3. Insert an audio CD into the DVD system, label side up.



4. The track and elapsed time will appear in the status bar. Use the DVD cursor controls on the bezel to highlight which track you would like to play. You can also use the cursor controls to highlight COMPRESSION, SHUFFLE or SCAN. Once you have highlighted the desired track or function, press ENTER on the DVD bezel to confirm your selection.

COMP (Compression): Compression brings soft and loud CD passages together for a more consistent listening level when in CD mode. Press to turn the feature ON/OFF

SHUFFLE: Press to hear all tracks on the current CD in random order. Press again to stop.

SCAN: Press for a brief sampling of all tracks on the current CD. Press again to stop.

Playing MP3 discs

To play an MP3 disc on your DVD system:

1. Ensure that the vehicle ignition is in the RUN or ACCESSORY position.

2. Ensure that the DVD system is ON.

3. Insert the MP3 disc into the DVD system, label side up.

4. The folder, track and elapsed time will appear in the status bar. The screen will list the Artist, Title, Album and File Name.

COMP (Compression): Compression brings soft and loud CD/MP3 passages together for a more consistent listening level when in CD mode. Press to turn the feature ON/OFF

SHUFFLE: Press to hear all tracks on the current MP3 folder in random order. Press again to stop.

SCAN: Press for a brief sampling of all tracks on the current MP3 folder. Press again to stop.

FOLDER LIST: Press access folder mode and to go to the previous/next folder in the MP3 disc.

MP3 disc quality factors

Several factors can effect disc playback quality:

- Disc capacity — Each disc contains about 650 MB of storage capacity. We do not recommend using high capacity discs containing 700MB of storage.
- Disc type — Some CD-RW discs may operate inconsistently and may cause an error message to appear. We recommend burning MP3 files onto CD-R discs.
- Disc finalization — The disc may be left open for the purpose of adding sessions to it at a later time, but be sure to close each session or the disc will not play.
- Bit rate — The player supports bit rates from 32–320 kbps, as well as variable bit rate MP3 files, but lower bit rates will have a noticeable effect on sound quality and are recommended only for speech or low fidelity music material. We recommend that you encode MP3 files using a high quality encoder.
- PC configuration — Encoding MP3 files requires intensive use of your computer's resources. Follow the PC configuration recommendations of the encoder software vendor. We recommend that you avoid running other software applications on your PC during MP3 encoding to avoid undesirable noise and distortion.

CD, MP3 and CD player care

- Handle discs by their edges only. Never touch the playing surface.
- Do not expose discs to direct sunlight or heat sources for extended periods of time.
- Do not insert more than one disc into the slot of the CD player (if equipped).
- Always store discs out of direct sunlight. Excessive heat may damage or warp discs.
- Use care when handling and playing CD-R and CD-RW discs, which are more susceptible to damage from heat, light and stress than are regular CDs.
- Always insert and remove a disc by holding the disc flat, with the playing surface facing down, in order to prevent damage to the disc or the player.
- Never insert any object other than a compact disc (CD) or digital versatile disc (DVD) into the player, as doing so may damage the player and may cause injury to you.

- Do not disassemble the player. The laser used in disc playback is extremely harmful to the eyes.

The FES DVD system is designed to play commercially pressed 12 cm (4.75 in) audio compact discs and digital versatile discs (DVD) only. Due to technical incompatibility, certain recordable and re-recordable compact discs may not function correctly when used in Ford CD and DVD players. Irregular shaped CDs or DVDs, CDs or DVDs with a scratch protection film attached, and CDs with homemade paper (adhesive) labels should not be inserted into the FES DVD system. The label may peel and cause the CD or DVD to become jammed. It is recommended that homemade CDs or DVDs be identified with permanent felt tip marker rather than adhesive labels. Ball point pens may damage CDs or DVDs. Please contact your authorized dealer for further information.

Playing a DVD

1. Ensure that the vehicle ignition is in the RUN or ACCESSORY position.

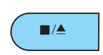
2. Ensure that the navigation system is on.

3. Insert a DVD label-side up into the system.

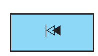
4. Use the DVD bezel controls to:

Press to play or pause a DVD.

Press to stop or eject a DVD.

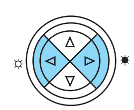


Press and release to go to the previous chapter. Press and hold for a fast reverse search.

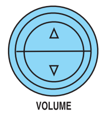


Press and release to go to the next chapter. Press and hold for a fast forward search.

Press when not in menu mode to adjust brightness, or when in menu mode to navigate through the menu selections.



Press to adjust volume levels.



Slow play

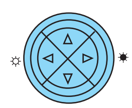
1. With a DVD playing, press pause.

2. Press and hold the reverse or advance button to enter into slow play mode. Once in slow play mode, press and release the reverse or advance button repeatedly to cycle through 1/4 and 1/2. These will display on the status bar on top of the screen as the screens cycle through at this rate.

Frame by frame

1. With a DVD playing, press pause.

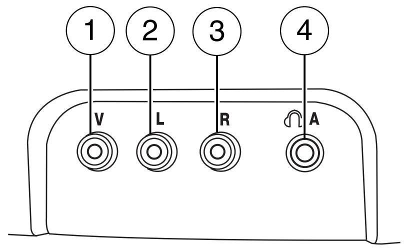
2. Press the right cursor button. The DVD will advance one frame. Each press of the right cursor button will advance the DVD video by one frame.



Headphone/auxiliary jacks

There are wired headphones (not included) and auxiliary jacks on the left and right side of your DVD system. They can be used to plug in wired headphones or to connect and play auxiliary electronic devices such as game systems, personal camcorders, video cassette recorders, etc.

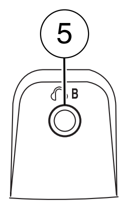
On the left side of the system is the Headphone A input jack. This headphone will listen to the media selected on the Channel A source. When you need to make any adjustments to the media, volume, etc, ensure that the Channel A source is highlighted. For more information, refer to *Headphone adjustments*.



Also located here are the various auxiliary jacks which can be used to plug in a VCR, camcorder, video games, etc. The specific jacks are as follows:

1. Yellow: video input
2. White: left channel audio input
3. Red: right channel audio input
4. Black: wired headphone jack (not included)

The B headphone jack (5) is located on the right side of the DVD system. Plug in wired headphones (not included) here.



Note: The B headphones can only access DVD and AUX modes. They cannot access radio sources.

Audio displays

Your DVD system interacts closely with the front audio system. Status messages will appear in the radio display showing the DVD status. Some possible radio display messages:

- SINGLE PLAY or DUAL PLAY
- DVD LOAD
- DVD MENU
- DVD STOP

Audio interaction

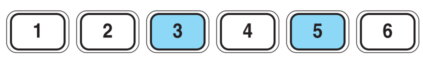
You can then also use the front audio controls to advance, reverse, play and pause a DVD. While a DVD is playing you may use the following controls on the front radio:

- SEEK: Press to advance to the previous (◀) or next (▶) DVD chapters.
- ▶ ❙❙ : Press to play a DVD or to pause the DVD.

When the radio displays “DVD MENU”, press PLAY on the radio (memory preset #6), to play the disc.

Parental control for the DVD system

Your Family Entertainment System (FES) allows you to have control over the rear seat controls in a few different ways. The DVD system is automatically activated when the vehicle ignition is ON, which allows the rear seat passengers to use the DVD system.

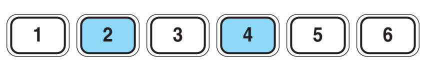


There are three levels of control of the FES buttons. The states are FULL (enabled), LOCAL or LOCKED (disabled). To change the level of control, press the memory preset controls 3 and 5 simultaneously on the front audio controls. The control level will cycle each time the buttons are pressed simultaneously. The three states are described as:

FULL (enabled): The FES has control over the primary (speaker) and secondary (headphone) audio sources.

LOCAL: The FES has control over the secondary source (headphones) only. The radio will ignore button presses that affect the primary (speaker) audio source.

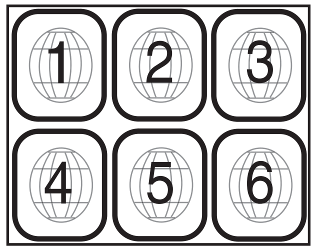
LOCKED (disabled): The FES buttons are locked and all FES button presses are ignored by the radio and the FES except for load and eject.



When the DVD system is ON, you can then press the memory preset controls 2 and 4 simultaneously to toggle between Single Play and Dual Play. In Single Play mode, all speakers listen to the same media. In Dual Play mode, rear seat passengers can use the infrared wireless, or wired (not included) headphones to listen to a different playing media than the front seat passengers.

General information

Note: DVDs are formatted by regions. US and Canada systems can only play region 1 DVDs and Mexico systems can only play region 4 DVDs. Systems sold in vehicles targeted for other parts of the world would have different regions. If a playback problem is encountered, please ensure that you are using a disc designed for your vehicle. The region coding can be found stamped on the disc or on the box, and can say 'region-1' or 'region 4', etc. They may also be marked by a numerical symbol.



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Safety information

Driving while distracted can result in loss of vehicle control, accident and injury. Ford strongly recommends that drivers use extreme caution when using any device that may take their focus off the road. The drivers primary responsibility is the safe operation of their vehicle. Only use cell phones and other devices not essential to the driving task when it is safe to do so.

Read all of the safety and operating instructions before operating the system and retain for future reference.

Do not attempt to service, repair or modify the Family Entertainment System (FES). See your dealer.

Do not insert foreign objects into the DVD compartment.

Do not leave children unattended in the vehicle and do not let children operate the system while unsupervised. If wired headphones or auxiliary systems are used, children may become entangled in the cords and seriously injure themselves.

The front glass on the liquid crystal display (LCD) flip-down screen may break when hit with a hard surface. If the glass breaks, do not touch the liquid crystalline material. In case of contact with skin, wash immediately with soap and water.

The driver should not attempt to operate any function of the DVD system while the vehicle is in motion. Give full attention to driving and to the road. Pull off the road in a safe place before inserting or extracting DVDs from the system. A remote control is included in the system to allow the rear seat occupants to operate the FES functions without distracting the driver.

Do not expose the liquid crystal display (LCD) flip-down screen to direct sunlight or intensive ultraviolet rays for extensive periods of time. Ultraviolet rays deteriorate the liquid crystal.

Be sure to review User Manuals for video games and video game equipment when used as auxiliary inputs for your Family Entertainment System (FES).

Do not operate video games or video equipment if the power cords and/or cables are broken, split or damaged. Carefully place cords and/or cables where they will not be stepped on or interfere with the operation of seats and/or compartments.

Disconnect video games and video equipment power cords and/or cables when not in use.

Avoid touching auxiliary input jacks with your fingers. Do not blow on them or allow them to get wet or dirty.

Do not clean any part of the DVD player with benzene, paint thinner or any other solvent.

Federal Communication Commission (FCC) Compliance

Changes or modifications not approved by Ford Lincoln-Mercury could void user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference and radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to consult the dealer or an experienced radio/TV technician for help.

Care and service of the DVD player

Environmental extremes

DVD players which are subjected to harsh environmental conditions may be damaged or perform at less than maximum capability. To avoid these outcomes, whenever possible avoid exposing your DVD player to:

- extremely hot or cold temperatures.
- direct sunlight.
- high humidity.
- a dusty environment.
- locations where strong magnetic fields are generated.

Temperature extremes

When the vehicle is parked under direct sunlight or in an extremely cold place for a long period of time, wait until the cabin temperature of the vehicle is at normal temperature before operating the system.

Humidity and moisture condensation

Moisture in the air will condense in the DVD player under extremely humid conditions or when moving from a cold place to a warm one. Moisture condensation may cause damage to the DVD and/or player. If moisture condensation occurs, do not insert a CD or DVD into the player. If one is already in the player, remove it. Turn the DVD player ON to dry the moisture before inserting a DVD. This could take an hour or more.

Foreign substances

Exercise care to prevent dirt and foreign objects from entering the DVD player compartment. Be especially careful not to spill liquids of any kind onto the media controls or into the system. If liquid is accidentally spilled onto the system, immediately turn the system OFF and consult a qualified service technician.

Cleaning the liquid crystal display (LCD) flip-down screen

Clean the display screen by applying a small amount of water or any ammonia-based household glass cleaner directly to a soft cloth. Rub the screen gently until the dust, dirt or fingerprints are removed. Do not spray the screen directly with water or glass cleaning solvents. Overspray from these fluids could drip down into the internal electronics of the screen and cause damage. Do not apply excessive pressure while cleaning the screen.

Cleaning DVD and CD discs

Inspect all discs for contamination before playing. If necessary, clean discs only with an approved DVD and CD cleaner and wipe from the center out to the edge. Do not use circular motion.

Compatibility with aftermarket audio systems (headphone only mode)

When the Family Entertainment System (FES) detects that the original radio supplied by Ford Motor Company has been removed from the vehicle, the FES will work in a state referred to as “Headphone Only Mode.” This mode allows the FES to operate as a standalone system, without interface to the radio.

While operating in Headphone Only Mode, the system will have limited functionality.

- The system will only output audio to the headphones. It will not be capable of providing audio to the speakers.
- The available sources in FES Headphone Only Mode are DVD-DISC and DVD-AUX, regardless of headphone channel (A or B).
- When a disc is inserted into the FES while in Headphone Only Mode, both headphone channels (A and B) will be connected to FES-DISC.

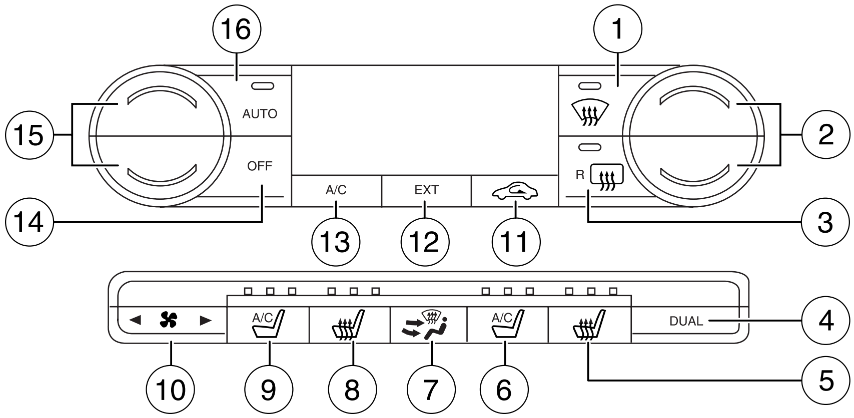
NAVIGATION SYSTEM (IF EQUIPPED)

Your vehicle may be equipped with a Navigation System. Refer to the *Navigation supplement* for further information.

SYNC (LATE AVAILABILITY — IF EQUIPPED)

Your vehicle may be equipped with SYNC, a hands-free communications and entertainment system with special phone and media features. For more information, please refer to the *SYNC supplement* or to the *SYNC* chapter in the *Navigation supplement* (if equipped).

DUAL AUTOMATIC TEMPERATURE CONTROL (DATC) SYSTEM WITH HEATED AND COOLED SEATS (IF EQUIPPED)



Temperature conversion: To switch between Fahrenheit and Celsius, refer to *Message center* in the *Driver Controls* chapter.

MAX A/C setting: In order to achieve maximum cooling performance, press , A/C, , and set the temperature to 60°F (16°C) and the highest blower setting.

1. **Defrost:** Distributes outside air through the windshield defroster vents and demister vents. Can be used to clear the windshield of fog and thin ice. The system will automatically provide outside air to reduce window fogging. To exit defrost, select another distribution mode.

2. **Passenger side temperature control:** Press to increase/decrease the temperature on the passenger side of the vehicle. Allows the passenger to choose and control a different temperature than the driver, if desired.

3. R **Rear defroster:** Press to activate/deactivate the rear window defroster. Refer to the *Rear window defroster* section in this chapter for more information.

4. **DUAL** zone selector: Press to engage/disengage separate passenger side temperature control.

5. **Passenger heated seat:** Press to control the passenger heated seat. Refer to *Heated and cooled seats* in the *Seating and Safety Restraints* chapter for more information.

6. **Passenger cooled seat:** Press to control the passenger cooled seat. Refer to *Heated and cooled seats* in the *Seating and Safety Restraints* chapter for more information.

7. **Manual override controls:** Allows you to manually select where airflow is distributed. Press to toggle through the air distribution modes listed below. The selected mode will illuminate in the display. To return to full automatic control, press AUTO.

: Distributes air through the windshield defroster vents, demister vents, floor vents and rear seat floor vents. The system will automatically provide outside air to reduce window fogging.

: Distributes air through the floor vents and rear seat floor vents. The system will automatically provide outside air to reduce window fogging. **Note:** You may notice a small amount of air flowing from the demister and defroster vents.

: Distributes air through the instrument panel vents, center console vents, floor vents and rear seat floor vents.

: Distributes air through the instrument panel vents and center console vents.

8. **Driver heated seat:** Press to control the driver heated seat. Refer to *Heated and cooled seats* in the *Seating and Safety Restraints* chapter for more information.

9. **Driver cooled seat:** Press to control the driver cooled seat. Refer to *Heated and cooled seats* in the *Seating and Safety Restraints* chapter for more information.

10. **Fan Speed:** Press to manually increase or decrease the fan speed. To return to automatic fan operation, press AUTO.

11. **Recirculated air:** Press to activate/deactivate air recirculation in the vehicle. Recirculated air may reduce the amount of time need to cool down the interior of the vehicle and may also help reduce undesired odors from reaching the interior of the vehicle. Recirculation can be engaged manually in any airflow selection except defrost. Recirculation may turn off automatically in some airflow modes to reduce fog potential.

12. **EXT:** Press to display outside temperature. Press again to display cabin temperature settings. **Note:** Exterior readings are more accurate when the vehicle is moving.

13. **A/C:** Press to activate/deactivate air conditioning. Use with recirculated air to improve cooling performance and efficiency. Engages automatically in AUTO, (defrost) and (floor/defrost).

14. **OFF:** Outside air is shut out and the fan will not operate.

15. **Driver side temperature control:** Press to increase/decrease the temperature on the driver side of the vehicle in dual zone or the temperature of both the driver and passenger sides in single zone.

16. **AUTO:** To engage automatic temperature control, press AUTO and select the desired temperature using the temperature control. The system will automatically determine fan speed, airflow distribution, A/C on or off, and outside or recirculated air, to heat or cool the vehicle to reach the desired temperature.

Operating tips

- To reduce fog build up on the windshield during humid weather, select (defrost) or (floor/defrost).
- To reduce humidity build up inside the vehicle, do not drive with the system OFF or with (recirculated air) engaged and A/C off.
- Do not put objects under the front seats that will interfere with the airflow to the back seats.
- Remove any snow, ice or leaves from the air intake area at the base of the windshield.
- To improve the A/C cool down, drive with the windows slightly open for 2-3 minutes after start up or until the vehicle has been “aired out.”

For maximum cooling performance in MAX A/C mode:

- **Automatic operation:**

1. Press AUTO for full automatic operation.
2. Do not override A/C or (recirculated air).
3. Set the temperature to 60°F (16°C).

- **Manual operation:**

1. Select or .
2. Select A/C and (recirculated air). Use (recirculated air) with A/C to provide colder airflow.
3. Set the temperature to 60°F (16°C).
4. Set highest fan setting initially, then adjust to maintain comfort.

To aid in side window defogging/demisting in cold weather:

1. Select .
2. Select A/C.
3. Adjust the temperature control to maintain comfort.

4. Set the fan speed to the highest setting.
5. Direct the outer instrument panel vents towards the side windows.

Do not place objects on top of the instrument panel as these objects may become projectiles in a collision or sudden stop.

REAR WINDOW DEFROSTER

The rear defroster control is located on the climate control panel and works to clear the rear window of fog and thin ice.

The ignition must be in the 3 (RUN) position to operate the rear window defroster.

Press the control to turn the rear window defroster on. An indicator light on the button will illuminate when active. The rear window defroster turns off automatically after 10 minutes or when the ignition is turned to the 1 (LOCK) or 2 (ACC) position. To manually turn off the rear window defroster at any time, press the control again.

If your vehicle is equipped with both rear defroster and heated mirrors, the same button will activate both.

Do not use razor blades or other sharp objects to clean the inside of the rear window or to remove decals from the inside of the rear window. This may cause damage to the heated grid lines and will not be covered by your warranty.

CABIN AIR FILTER

The cabin air filter element is designed to reduce the concentration of airborne particles such as dust, spores and pollen in the air being supplied to the interior of the vehicle. The presence of a particulate filter element provides the following benefits:

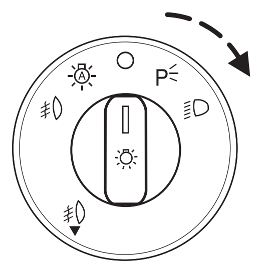
- Improves your driving comfort by reducing particle concentration.
- Improves the interior compartment cleanliness.
- Protects the climate control components from particle deposits.

Note: A cabin air filter must be installed at all times to prevent foreign objects from entering the system. Running the system without a filter in place could result in degradation or damage to the system.

The access door for the filter is located behind the glove box. For replacement intervals regarding the cabin air filter, see the *scheduled maintenance information*. For more information regarding your filter, see your authorized dealer.

HEADLAMP CONTROL

Rotate the headlamp control to the first position to turn on the parking lamps. Rotate to the second position to turn on the headlamps.



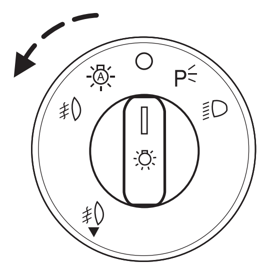
Adaptive headlamps (if equipped)

The headlamp beams move in the same direction as the steering wheel which provides more visability when driving around curves.

Note: The system has a power-up movement check feature. When the vehicle is started, the lamps track left to right, then back to center to alert the driver that the system is working properly.

Autolamp control

The autolamp system provides light sensitive automatic on-off control of the exterior lights normally controlled by the headlamp control.



The autolamp system also keeps the lights on for approximately 20 seconds or, if equipped with a message center, you can select a delay from 0–180 seconds, after the ignition switch is turned to OFF. See *Message Center (if equipped)* in the *Driver Controls* chapter.

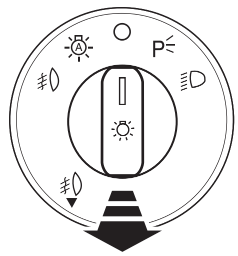
- To turn autolamps on, rotate the control counterclockwise.
- To turn autolamps off, rotate the control clockwise to OFF.

Note: Some vehicles may be equipped with a *headlamps on with windshield wipers feature.* If the windshield wipers are turned on (for a fixed period of time) the exterior lamps will turn on with headlamp control in the Autolamp position.

Fog lamp control

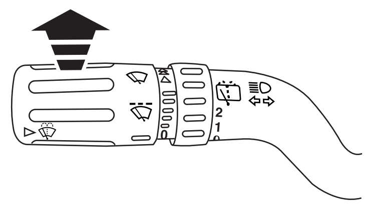
The headlamp control also operates the fog lamps. The fog lamps can be turned on when the headlamp control is in the , or positions and the high beams are not turned on.

Pull headlamp control towards you to turn fog lamps on. The fog lamp indicator light will illuminate.



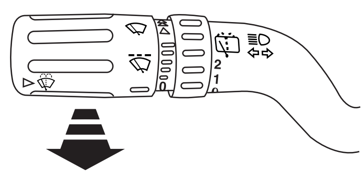
High beams

Push the lever toward the instrument panel to activate. Pull the lever towards you to deactivate.



Flash to pass

Pull toward you slightly to activate and release to deactivate.



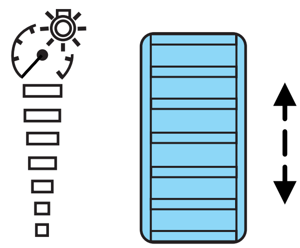
Daytime running lamps (DRL) (if equipped)

Turns the headlamps on at reduced intensity output. To activate:

- the ignition must be in the ON position and
- the headlamp control must be in the OFF or Parking lamps position.

Always remember to turn on your headlamps at dusk or during inclement weather. The Daytime Running Lamp (DRL) system does not activate the tail lamps and generally may not provide adequate lighting during these conditions. Failure to activate your headlamps under these conditions may result in a collision.

PANEL DIMMER CONTROL



Use to adjust the brightness of the instrument panel and all applicable switches in the vehicle during headlamp and parking lamp operation.

Move the control to the full upright position, past detent, to turn on the interior lamps.

Certain displays like the message center and the climate control unit do not change with the dimmer control till the dash-mounted sensor senses full night conditions.

Note: If the battery is disconnected, discharged, or a new battery is installed, the dimmer switch requires re-calibration. Rotate the dimmer switch from the full dim position to the full Dome/ON position to reset. This will ensure that your displays are visible under all lighting conditions.

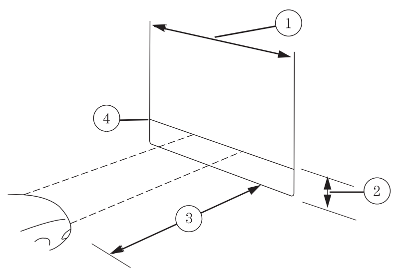
AIMING THE HEADLAMPS

The headlamps on your vehicle are properly aimed at the assembly plant.

If your vehicle has been in an accident the alignment of your headlamps should be checked by your authorized dealer.

Vertical aim adjustment

1. Park the vehicle directly in front of a wall or screen on a level surface, approximately 25 feet (7.6 meters) away.



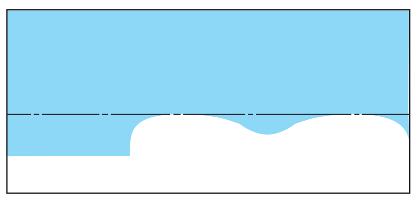
- (1) 8 feet (2.4 meters)
- (2) Center height of lamp to ground
- (3) 25 feet (7.6 meters)
- (4) Horizontal reference line

2. Measure the height of the headlamp bulb center from the ground and mark an 8 foot (2.5 meter) horizontal reference line on the vertical wall or screen at this height (a piece of masking tape works well).

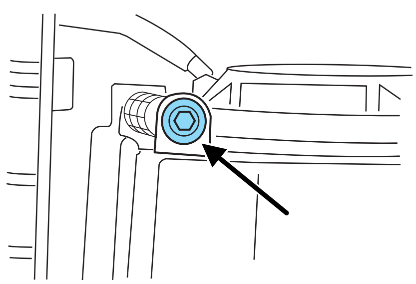
3. Turn on the low beam headlamps to illuminate the wall or screen and open the hood.

To see a clearer light pattern for adjusting, you may want to block the light from one headlamp while adjusting the other.

4. On the wall or screen you will observe an area of high intensity light. The top of the high intensity area should touch the horizontal reference line, if not, the beam will need to be adjusted using the next step.



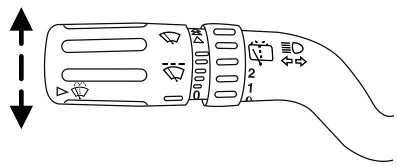
5. Locate the vertical adjuster on each headlamp. Using a Phillips #2 screwdriver, turn the adjuster either clockwise (to adjust down) or counterclockwise (to adjust up). The horizontal edge of the brighter light should touch the horizontal reference line.



6. Close the hood and turn off the lamps.

HORIZONTAL AIM IS NOT REQUIRED FOR THIS VEHICLE AND IS NON-ADJUSTABLE.

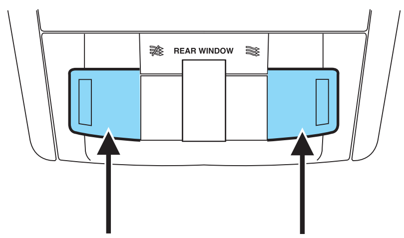
TURN SIGNAL CONTROL ⇦⇨



- Push down to activate the left turn signal.
- Push up to activate the right turn signal.

INTERIOR LAMPS

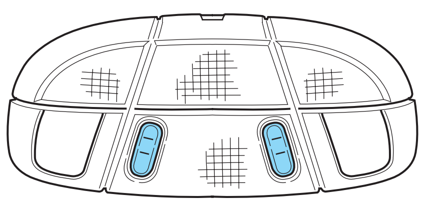
Front row map lamps (if equipped)



To turn on the map lamps, press the outer edge of the clear lens. The front row map lamp lights when:

- any door is opened.
- the instrument panel dimmer switch is rotated until the courtesy lamps come on.
- the remote entry controls are pressed and the ignition is OFF.

Map/dome lamp (if equipped)

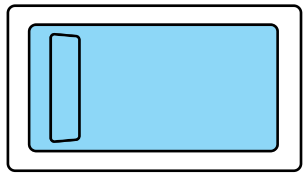


The dome lamp lights when:

- any door is opened,
- the instrument panel dimmer switch is rotated up until the courtesy lamps come on, and
- any of the remote entry controls are pressed and the ignition is OFF.

The map lamps are activated by pressing the controls on either side of the lens.

Rear courtesy lamp



Located in the rear cargo area, the courtesy lamp lights when:

- any door is opened.
- any of the remote entry controls are pressed and the ignition is OFF.

BULB REPLACEMENT

Headlamp Condensation

The headlamps are vented to equalize pressure. When moist air enters the headlamp(s) through the vents, there is a possibility that condensation can occur. This condensation is normal and will clear within 45 minutes of headlamp operation.

Using the right bulbs

Replacement bulbs are specified in the chart below. Headlamp bulbs must be marked with an authorized “D.O.T.” for North America and an “E” for Europe to ensure lamp performance, light brightness and pattern and safe visibility. The correct bulbs will not damage the lamp assembly or void the lamp assembly warranty and will provide quality bulb burn time.

Function	Number of bulbs	Trade number
Headlamp high beam	2	9005
Headlamp low beam	2	H11
Front sidemarker lamp	2	168
Front park/turn signal lamp	2	3157NAK (amber)
Rear sidemarker lamp	2	194
Stop/tail/turn lamp	2	4157 K
* Backup lamp	N/A	LED
License plate lamp	2	C5W
* High-mount brake lamp	N/A	LED

Function	Number of bulbs	Trade number
Fog lamp (if equipped)	2	H11
Front row map lamp	2	1600XB
Second row dome/reading lamp	3	1600XB
Rear courtesy lamp	1	1600XB
Visor vanity lamp - Slide on Rail system (SOR) (if equipped)	2	37
All replacement bulbs are clear in color except where noted.		
To replace all instrument panel lights - see your authorized dealer.		
* To replace these lamps - see your authorized dealer.		

Replacing the interior bulbs

Check the operation of all bulbs frequently.

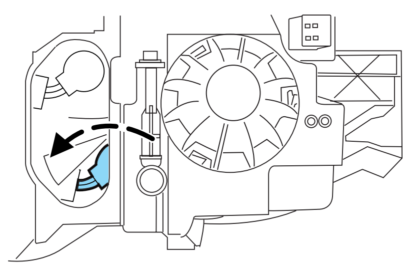
Replacing exterior bulbs

Check the operation of all the bulbs frequently.

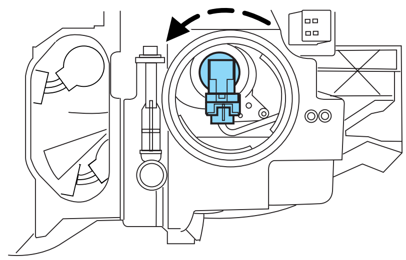
Replacing headlamp bulbs

1. Make sure that the headlamp control is in the OFF position.
2. Open the hood.
3. Reach over the front bolster.

Highbeam bulb



Lowbeam bulb

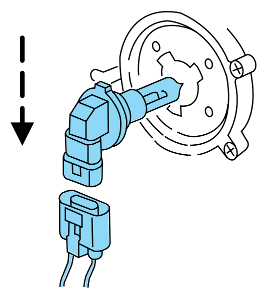


4. Remove the bulb cover. Note: The left side has a side access bulb cover instead of a back access bulb cover

5. Remove the bulb by turning it counterclockwise and then pulling it straight out.

6. Disconnect the electrical connector from the bulb.

7. Connect the electrical connector on the new bulb.



Handle a halogen headlamp bulb carefully and keep out of children's reach. Grasp the bulb only by its plastic base and do not touch the glass. The oil from your hand could cause the bulb to break the next time the headlamps are operated.

8. Insert the glass end of the new bulb into the headlamp assembly. When the grooves in the plastic base are aligned, turn the new bulb clockwise to install.

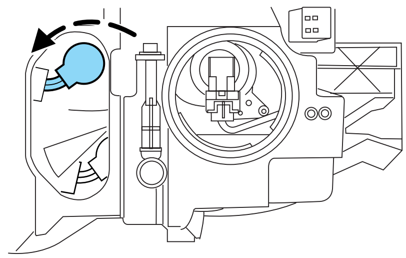
9. Install the bulb cover.

Replacing front parking lamp/turn signal bulbs

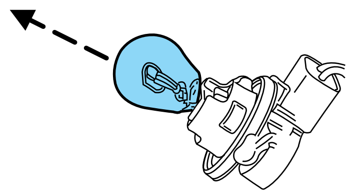
1. Make sure that the headlamp control is in the OFF position.

2. Open the hood.

3. Reach over the front bolster.

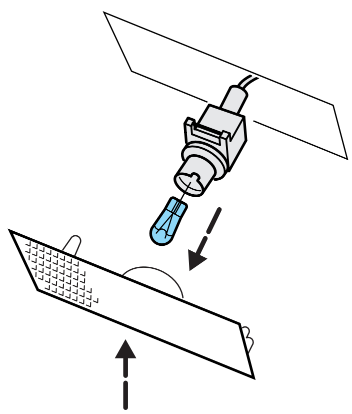


4. Remove the bulb cover.
5. Rotate the bulb socket counterclockwise and remove from the lamp assembly.



6. Carefully pull the bulb out of the socket and push in the new bulb.
7. Install the bulb socket into the lamp assembly and rotate clockwise.
8. Install the bulb cover.

Replacing front side marker bulbs



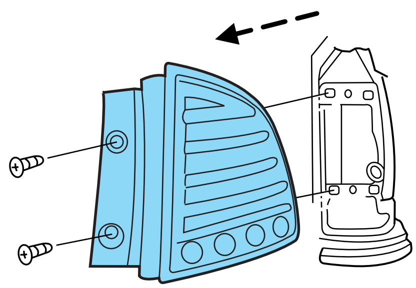
1. Make sure the headlamp control is in the OFF position.
2. Pry the lamp away from the vehicle at the rear of lamp at the wheel opening. (Rotate lamp from the wheel opening away from the vehicle), as the lamp separates from the vehicle, slide the lamp towards the wheel opening to disengage lamp
3. Rotate the lamp clockwise while holding the electrical connector in place with your other hand. After rotating the lamp 90 degrees clockwise, pull and disengage the wire harness and bulb from the lamp.
4. With the bulb exposed, carefully remove the bulb from the socket by grasping the bulb and pulling it away from the wire harness.

Replace with a new bulb, and reverse the removal steps to complete the process.

Replacing tail/stop/turn/sidemarker/backup lamp bulbs

The tail/stop/turn/sidemarker/backup lamp bulbs are located in the same portion of the tail lamp assembly, one just below the other. Follow the same steps to replace either bulb.

Note: Your vehicle is equipped with a backup lamp assembly containing integral multiple light emitting diodes (LED). See your authorized dealer for the replacement LED module.



1. Make sure the headlamp switch is in the OFF position and then open the liftgate to expose the lamp assembly bolts.

2. Remove the two bolts from the lamp assembly.

3. Carefully remove the lamp assembly away from the vehicle by pulling the assembly straight out to expose the bulb socket. DO NOT TIP THE LAMP ASSEMBLY SIDEWAYS.

4. Rotate the bulb socket counterclockwise and remove from lamp assembly.

5. Pull bulb straight out of socket and snap in the new bulb.

6. Install the bulb socket into the lamp assembly and rotate clockwise.

7. Carefully install the tail lamp assembly on the vehicle by securing the lamp assembly with two bolts.

Replacing supplemental liftgate lamp assembly

Your vehicle is equipped with a liftgate lamp assembly containing integral multiple light emitting diodes (LED). If one or more LEDs burn out, the complete lamp module has to be replaced. See your authorized dealer for the replacement LED module.

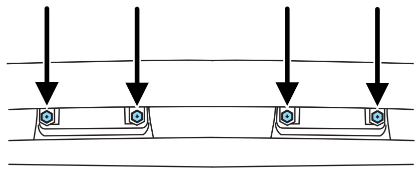
Replacing high-mount brake lamp bulbs

Your vehicle is equipped with an LED center high-mount stop lamp. It is designed to last the life of the vehicle. If replacement is required, see your authorized dealer.

Replacing license plate lamp bulbs

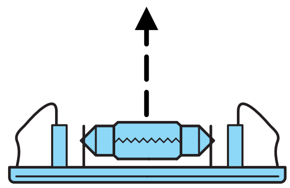
1. Make sure the headlamp switch is in the OFF position.

2. Remove the two screws and the license plate lamp assembly from the liftgate.



3. Carefully pull the bulb straight out from the lamp assembly.

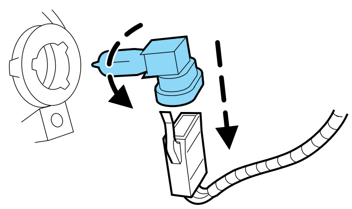
Install new bulb(s) in reverse order.



Replacing fog lamp bulbs

1. Make sure the fog lamp switch is in the OFF position.

2. From underneath the vehicle, remove the splash shield and rotate the harness/bulb assembly counterclockwise, to remove from the fog lamp.

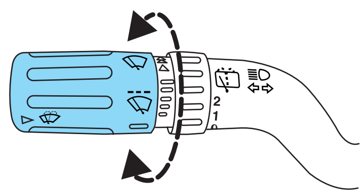


3. Carefully disconnect the bulb from the harness assembly via the two snap clips.

Install the new bulb in reverse order.

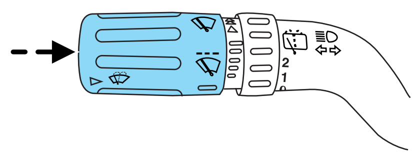
MULTI-FUNCTION LEVER

Windshield wiper: Rotate the end of the control away from you to increase the speed of the wipers; rotate towards you to decrease the speed of the wipers.



Speed dependent wipers: When the wiper control is on, the speed of the wipers will automatically adjust with the vehicle speed. The faster your vehicle is travelling the faster the wipers will go.

Windshield washer: Push the end of the stalk:



- briefly: causes a single swipe of the wipers without washer fluid.
- a quick push and hold: the wipers will swipe three times with washer fluid.
- a long push and hold: the wipers and washer fluid will be activated for up to ten seconds.

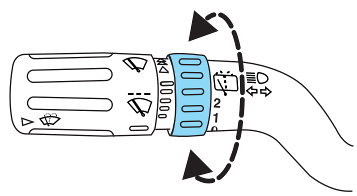
Courtesy wipe feature: One extra wipe will happen a few seconds after washing the front window to clear any water that is dripping down from the top of the windshield caused by the washing.

Note: Do not operate the washer when the washer reservoir is empty. This may cause the washer pump to overheat. Check the washer fluid level frequently. Do not operate the wipers when the windshield is dry. This may scratch the glass, damage the wiper blades and cause the wiper motor to burn out. Before operating the wiper on a dry windshield, always use the windshield washer. In freezing weather, be sure the wiper blades are not frozen to the windshield before operating the wipers.

Windshield wiper features (if equipped with Autolamp feature)

The exterior lamps will turn on with the ignition on, headlamp control in the Autolamp position and the windshield wipers are turned on (for a fixed period of time).

Rear window wiper/washer controls



For rear wiper operation, rotate the rear window wiper and washer control to the desired position. Select:

2 — Normal speed operation of rear wiper.

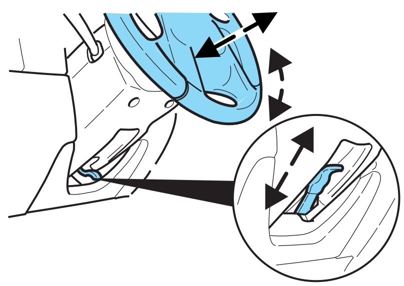
1 — Intermittent operation of rear wiper.

OFF — Rear wiper and washer off.

For rear wash cycle, rotate (and hold as desired) the rear wiper/washer control to either position.

From either position, the control will automatically return to the INT 2 or OFF position.

TILT/TELESCOPE STEERING WHEEL



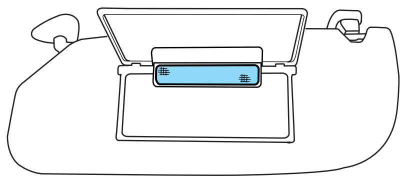
To adjust the steering wheel:

1. Pull the lever down to unlock the steering column.
2. While the lever is in the down position, move the steering wheel up or down and in or out until you find the desired position.
3. While holding the steering wheel in place, pull the lever up to its original position to lock the steering column.

Never adjust the steering wheel when the vehicle is moving.

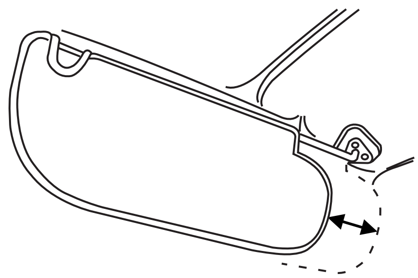
ILLUMINATED VISOR MIRROR

Lift the mirror cover to turn on the visor mirror lamp.



Slide on rod feature

The visor will slide back and forth on the rod for increased sunlight coverage. Rotate the visor towards the side window and extend it rearward for additional sunlight coverage.



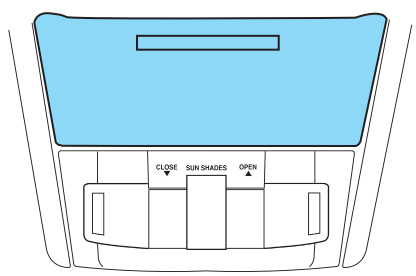
Note: To stow the visor back into the headliner, visor must be retracted before moving it back towards the windshield.

OVERHEAD CONSOLE

The appearance of your vehicle's overhead console will vary according to your option package.

Forward storage bin (if equipped)

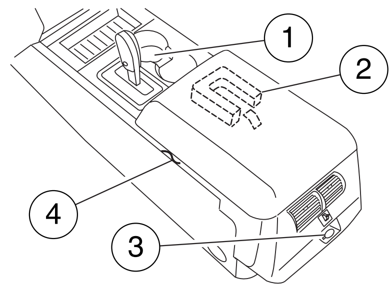
The storage compartment may be used to store a pair of sunglasses. Press the release area on the rear edge of the bin door to open the storage compartment. The door will open to full open position.



CENTER CONSOLE

Your vehicle may be equipped with a variety of console features. These include:

1. Cupholders
2. Tissue box holder (if equipped) (located on underside of console lid)
3. Rear power point
4. Utility compartment with a Secondary storage bin with coin holder slots (on hinges inside utility compartment), power point, AIJ (Audio Input Jack), and a Multi Position Bin Divider (2 positions vertical / 1 position horizontal)

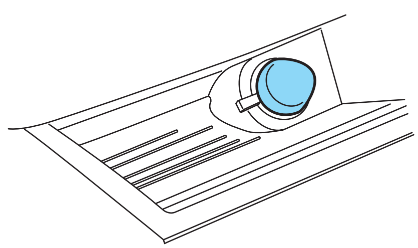


Use only soft cups in the cupholder. Hard objects can injure you in a collision.

AUXILIARY POWER POINT (12VDC)

Power outlets are designed for accessory plugs only. Do not insert any other object in the power outlet as this will damage the outlet and blow the fuse. Do not hang any type of accessory or accessory bracket from the plug. Improper use of the power outlet can cause damage not covered by your warranty.

The auxiliary power point is located on the instrument panel.



A second auxiliary power point is located in the center console utility compartment.

Do not use the power point for operating the cigarette lighter element (if equipped).

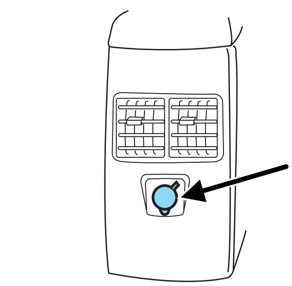
To prevent the fuse from being blown, do not use the power point(s) over the vehicle capacity of 12 VDC/180W. If the power point or cigar lighter socket is not working, a fuse may have blown. Refer to *Fuses and relays* in the *Roadside Emergencies* chapter for information on checking and replacing fuses.

To have full capacity usage of your power point, the engine is required to be running to avoid unintentional discharge of the battery. To prevent the battery from being discharged:

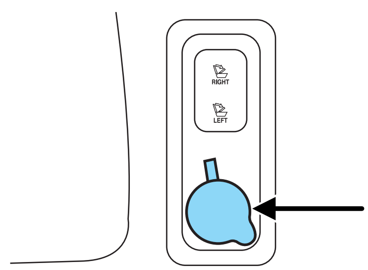
- do not use the power point longer than necessary when the engine is not running,
- do not leave battery chargers, video game adapters, computers and other devices plugged in overnight or when the vehicle is parked for extended periods.

Always keep the power point caps closed when not being used.

A third auxiliary power point is located on the rear side of the center console. The power point is accessible from the rear seats.



The rear auxiliary power point is located on the left rear quarter panel. The power point is accessible from the liftgate or behind the rear seat.



Cigar/Cigarette lighter (if equipped)

Do not plug optional electrical accessories into the cigarette lighter socket.

Do not hold the lighter in with your hand while it is heating, this will damage the lighter element and socket. The lighter will be released from its heating position when it is ready to be used.

Improper use of the lighter can cause damage not covered by your warranty.

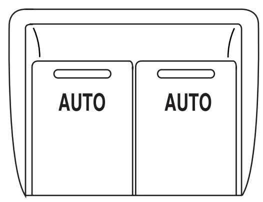
POWER WINDOWS

Do not leave children unattended in the vehicle and do not let children play with the power windows. They may seriously injure themselves.

When closing the power windows, you should verify they are free of obstructions and ensure that children and/or pets are not in the proximity of the window openings.

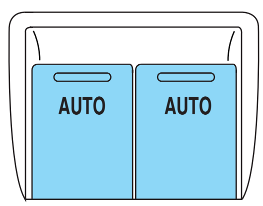
Press and pull the switches to open and close windows.

- Push down (to the first detent) and hold the switch to open.
- Pull up (to the first detent) and hold the switch to close.



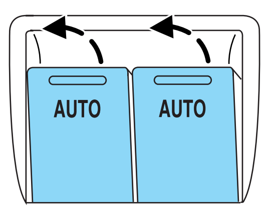
Express down (One Touch Down, Front windows only)

Allows the driver and passenger's window to open fully without holding the control down. Push the switch completely down to the second detent and release quickly. The window will open fully. Momentarily press the switch to any position to stop the window operation.



Express Up (One Touch Up, Front windows only)

Allows the driver and passenger's window to close fully without holding the control up. Pull the switch completely up to the second detent and release quickly. The window will close fully. Momentarily press the switch to any position to stop the window operation.



Note: Refer to the *Locks and Security* chapter for the *Opening front windows and panoramic roof* feature.

Bounce-Back

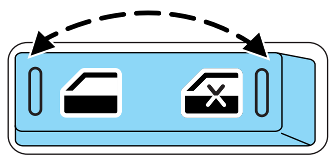
When the window is moving upward and an obstacle or a rough road condition interferes with the window’s movement, the window will automatically reverse direction and move down. This is known as “bounce-back”. If the ignition is turned OFF (without accessory delay being active) during bounce-back, the window will move down until the bounce back position is reached.

Security Override

If during a bounce-back condition, the switch is released to the neutral position, then held in the one touch up position within two seconds after the window reaches the bounce-back position, **the window will travel up with no bounce-back protection.** If the switch is released before the window reaches fully closed or the ignition is turned OFF (without accessory delay being active), the window will stop. Security override can be used if the window movement is restricted in some way, for example, if there is ice on the window or seals.

Window lock

The window lock feature allows only the driver and front passenger to operate the power windows.



To lock out all the window controls (except for the driver and front passenger) press the right side of the control. Press the left side to restore the window controls.

Accessory delay

With accessory delay, the audio system, power windows, and moon roof (if equipped) operate for up to ten minutes after the ignition switch is turned from the ON to the OFF position or until either front door is opened.

INTERIOR MIRROR

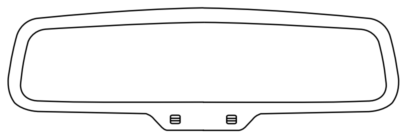
The interior rear view mirror has two pivot points on the support arm which lets you adjust the mirror UP or DOWN and from SIDE to SIDE.

Do not adjust the mirror while the vehicle is in motion.

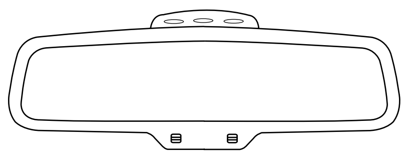
Automatic dimming interior rear view mirror

Your vehicle is equipped with an interior rear view mirror which has an auto-dimming function. The electronic day/night mirror will change from the normal (high reflective) state to the non-glare (darkened) state when bright lights (glare) reach the mirror. When the mirror detects bright light from behind the vehicle, it will automatically adjust (darken) to minimize glare.

Without voice activated Navigation System or SYNC



With voice activated Navigation System or SYNC



The mirror will automatically return to the normal state whenever the vehicle is placed in R (Reverse) to ensure a bright clear view when backing up.

Do not block the sensors on the front and back of the interior rear view mirror since this may impair proper mirror performance.

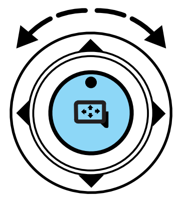
Do not clean the housing or glass of any mirror with harsh abrasives, fuel or other petroleum-based cleaning products.

EXTERIOR MIRRORS

Power side view mirrors 

Do not adjust the mirror while the vehicle is in motion.

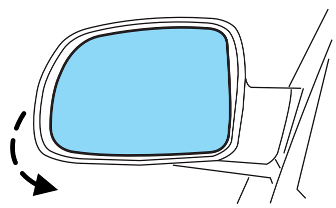
To adjust your mirrors:



1. Rotate the control clockwise to adjust the right mirror and rotate the control counterclockwise to adjust the left mirror.
2. Move the control in the direction you wish to tilt the mirror.
3. Return to the center position to lock mirrors in place.

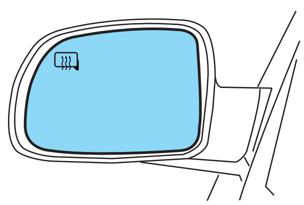
Fold-away mirrors

Pull the side mirrors in carefully when driving through a narrow space, like an automatic car wash.



Heated outside mirrors (if equipped)

Both mirrors are heated automatically to remove ice, mist and fog when the rear window defrost is activated.



Do not remove ice from the mirrors with a scraper or attempt to readjust the mirror glass if it is frozen in place. These actions could cause damage to the glass and mirrors.

SPEED CONTROL

With speed control set, you can maintain a set speed without keeping your foot on the accelerator pedal.

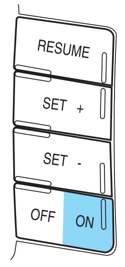
Do not use the speed control in heavy traffic or on roads that are winding, slippery or unpaved.

Setting speed control

The controls for using your speed control are located on the steering wheel for your convenience.

1. Press the ON control and release it.

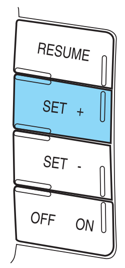
2. Accelerate to the desired speed.



3. Press the SET + control and release it.

4. Take your foot off the accelerator pedal.

5. The indicator light on the instrument cluster will turn on.



Note:

- Vehicle speed may vary momentarily when driving up and down a steep hill.
- If the vehicle speed increases above the set speed on a downhill, you may want to apply the brakes to reduce the speed.
- If the vehicle speed decreases more than 10 mph (16 km/h) below your set speed on an uphill, your speed control will disengage.

Disengaging speed control

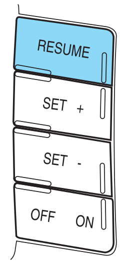
To disengage the speed control:

- Depress the brake pedal.

Disengaging the speed control will not erase previous set speed.

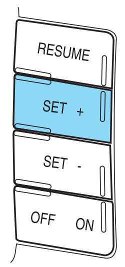
Resuming a set speed

Press the RESUME control and release it. This will automatically return the vehicle to the previously set speed.



Increasing speed while using speed control

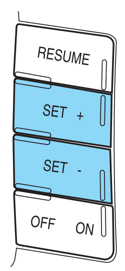
There are two ways to set a higher speed:



- Press and hold the SET + control until you get to the desired speed, then release the control. You can also use the SET + control to operate the Tap-Up function. Press and release this control to increase the vehicle set speed in small amounts by 1 mph (1.6 km/h).
- Use the accelerator pedal to get to the desired speed. When the vehicle reaches that speed press and release the SET + control.

Reducing speed while using speed control

There are two ways to reduce a set speed:



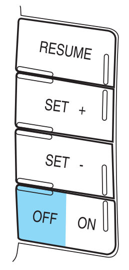
- Press and hold the SET - control until you get to the desired speed, then release the control. You can also use the SET - control to operate the Tap-Down function. Press and release this control to decrease the vehicle set speed in small amounts by 1 mph (1.6 km/h).
- Depress the brake pedal until the desired vehicle speed is reached and press the SET + control.

Turning off speed control

There are two ways to turn off the speed control:

- Depress the brake pedal. This will not erase your vehicle's previously set speed.
- Press the speed control OFF control.

Note: When you turn off the speed control or the ignition, your speed control set speed memory is erased.



STEERING WHEEL CONTROLS

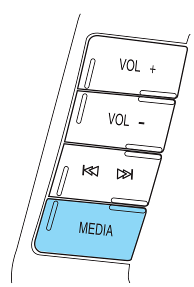
Driving while distracted can result in loss of vehicle control, accident and injury. Ford strongly recommends that drivers use extreme caution when using any device that may take their focus off the road. The drivers primary responsibility is the safe operation of their vehicle. Only use steering wheel controls and other devices not essential to the driving task when it is safe to do so.

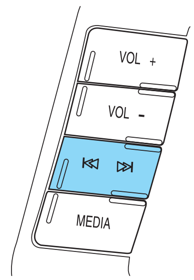
These controls allow you to operate some radio control features.

Radio control features

Press MEDIA to select:

- AM, FM1, FM2, or CD
- DVD/FES (if equipped)
- SAT1, SAT2 or SAT3 (Satellite Radio mode if equipped).
- LINE IN (Auxiliary input jack)





In Radio mode:

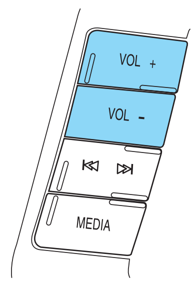
- Press ⏮ ⏭ to access the next/previous preset station.

In CD mode:

- Press ⏮ ⏭ to listen to the next track on the disc.

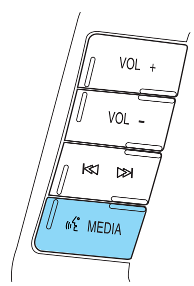
In Satellite radio mode (if equipped):

- Press ⏮ ⏭ to advance through preset channels.



In any mode:

- Press VOL + or - to adjust the volume.



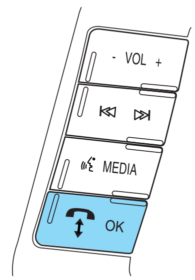
Navigation system hands free control features (if equipped)

Press and hold control briefly until the voice icon appears on the Navigation display to use the voice command feature.

Press to complete a voice command.

For further information on the Navigation system, refer to the *Navigation supplement.*

SYNC system hands free control feature (if equipped)



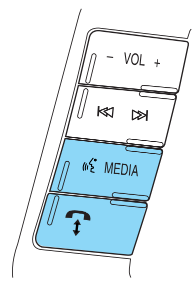
Press briefly to use the voice command feature. You will hear a tone and LISTENING will appear in the radio display. Press and hold to exit voice command.

Press to activate phone mode or answer a phone call. Press and hold to end call or exit phone mode.

Press OK to confirm your selection.

For further information on the SYNC system, refer to the *SYNC supplement*.

Navigation system/SYNC hands free control features (if equipped)



Press the control briefly until the voice icon appears on the Navigation display to use the voice command feature.

Press to activate phone mode or answer a phone call. Press and hold to exit phone mode or end call.

For further information on the Navigation system/SYNC system, refer to the *Navigation and SYNC supplements*.

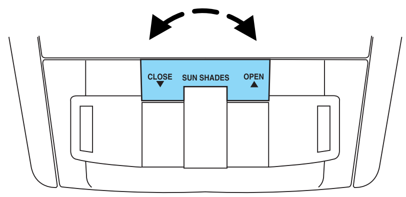
PANORAMIC VISTA ROOF™ AND POWER SUNSHADES (IF EQUIPPED)

The panoramic Vista Roof™ and power sunshade controls are located on the overhead console.

> Do not let children play with the panoramic Vista Roof™ and power sunshade or leave children unattended in the vehicle. They may seriously hurt themselves.

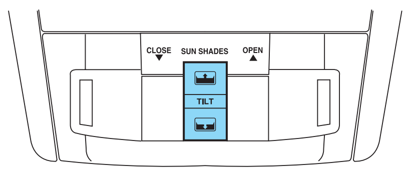
> When closing the panoramic Vista Roof™ and power sunshade, you should verify that it is free of obstructions and ensure that children and/or pets are not in the proximity of the panoramic Vista Roof™ and power sunshade opening.

Note: Do not attempt to move the panoramic power sunshades manually or sunshade damage or malfunction may occur. The sunshade track clips are designed to release the sunshade crossbar in order to prevent damage to the system. If this occurs the sunshade crossbar ends may just need to be slid back into position to regain proper function. See your authorized dealer for proper panoramic Vista Roof™ or sunshade operating, diagnostic or repair instructions.



To operate power sunshades: Press the OPEN portion of the control to open the sunshade. The front and rear sunshades open simultaneously. Press the CLOSE portion of the control until the sunshades stop at the "Express close" position. Firmly press and hold the control again to fully close the front and rear sunshades.

Note: Closing the sunshade will also close the panoramic Vista Roof™, if open.



To open the panoramic Vista Roof™: Press and hold to open manually. The panoramic Vista Roof™ is equipped with a one-touch open feature. Firmly press and release the rear control. The panoramic Vista Roof™ will open to the "comfort" position. Firmly press and release the control again to fully open. To stop the one-touch open feature press any control again.

Note: Opening the panoramic Vista Roof™ will also open the sunshades, if closed.

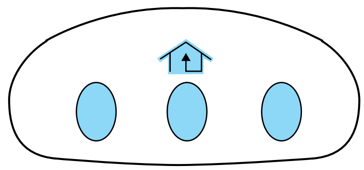
Note: The panoramic Vista Roof™ will open to the **"comfort"** position first before opening all the way. The "comfort" position helps to alleviate rumbling wind noise which may happen in the vehicle with the roof fully opened.

To close the panoramic Vista Roof™: Press and release the front control until the glass panel stops at the "Express close" position. Firmly press and hold the control again to fully close.

To vent the panoramic Vista Roof™: From the closed position, press and release the TILT control. To vent the panoramic Vista Roof™ from any position, press and hold the TILT control. To close, press and hold the front control.

Note: If the panoramic Vista Roof™ is excessively operated, the glass and shade motors will automatically go into a fail-safe jog mode (manual intermittent operation) to prevent overheating and/or damage to the motor. The motors will revert back to normal operation after a period of idle time.

HOMELINK® WIRELESS CONTROL SYSTEM (IF EQUIPPED)



The HomeLink® Wireless Control System, located on the driver's visor, provides a convenient way to replace up to three hand-held transmitters with a single built-in device. This feature will learn the radio frequency codes of most transmitters to operate garage doors, entry gate operators, security systems, entry door locks, and home or office lighting.

When programming your HomeLink® Wireless Control System to a garage door or gate, be sure that people and objects are out of the way to prevent potential injury or damage.

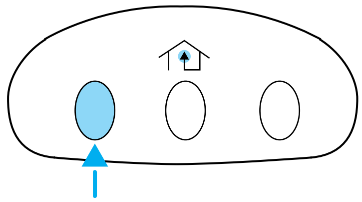
Do not use the HomeLink® Wireless Control System with any garage door opener that lacks safety stop and reverse features as required by U.S. federal safety standards (this includes any garage door opener model manufactured before April 1, 1982). A garage door which cannot detect an object, signaling the door to stop and reverse, does not meet current U.S. federal safety standards. For more information, contact HomeLink® at: **www.homelink.com** or **1–800–355–3515.**

Retain the original transmitter for use in other vehicles as well as for future programming procedures (i.e. new HomeLink® equipped vehicle purchase). It is also suggested that upon the sale of the vehicle, the programmed Homelink® buttons be erased for security purposes, refer to *Programming* in this section.

Programming

Do not program HomeLink® with the vehicle parked in the garage.

Note: Your vehicle may require the ignition switch to be turned to the ACC position for programming and/or operation of the HomeLink®. It is also recommended that a new battery be placed in the hand-held transmitter of the device being programmed to HomeLink® for quicker training and accurate transmission of the radio-frequency signal.



1. Position the end of your hand-held transmitter 1–3 inches (2–8 cm) away from the HomeLink® button you wish to program (located on your visor) while keeping the indicator light in view.

2. Simultaneously press and hold both the chosen HomeLink® and hand-held transmitter buttons until the HomeLink® indicator light changes from a slow to a rapidly blinking light. Now you may release both the HomeLink® and hand-held transmitter buttons.

Note: Some entry gates and garage door openers may require you to replace Step 2 with procedures noted in the "Gate Operator and Canadian Programming" in this section for Canadian residents.

3. Firmly **press, hold for five seconds and release** the programmed HomeLink® button up to two separate times to activate the door. If the door does not activate, press and hold the just-trained HomeLink® button and observe the indicator light.

- If the indicator light **stays on constantly, programming is complete** and your device should activate when the HomeLink® button is pressed and released.
- If the indicator light blinks **rapidly for two seconds and then turns to a constant light continue with "Programming" Steps 4 through 6** to complete programming of a rolling code equipped device (most commonly a garage door opener).

4. At the garage door opener receiver (motor-head unit) in the garage, locate the "learn" or "smart" button (usually near where the hanging antenna wire is attached to the unit).

5. Firmly press and release the "learn" or "smart" button. (The name and color of the button may vary by manufacturer.)

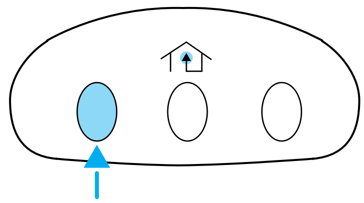
Note: There are 30 seconds in which to initiate Step 6.

6. Return to the vehicle and firmly **press, hold for two seconds and release** the programmed HomeLink® button. Repeat the **press/hold/release** sequence again and, depending on the brand of the garage door opener (or other rolling code equipped device), repeat this sequence a third time to complete the programming.

HomeLink® should now activate your rolling code equipped device. To program additional HomeLink® buttons begin with Step 1 in the "Programming" section. For questions or comments, please contact HomeLink® at **www.homelink.com** or **1–800–355–3515.**

Gate Operator & Canadian Programming

During programming, your hand-held transmitter may automatically stop transmitting — not allowing enough time for HomeLink® to accept the signal from the hand-held transmitter.



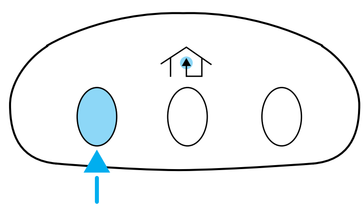
After completing Step 1 outlined in the *"Programming"* section, replace Step 2 with the following:

Note: If programming a garage door opener or gate operator, it is advised to unplug the device during the "cycling" process to prevent overheating.

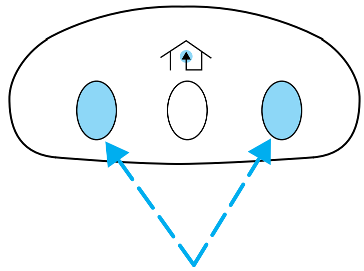
- Continue to press and hold the HomeLink® button (note Step 2 in the "Programming" section) while you press and release — **every two seconds** ("cycle") your hand-held transmitter until the frequency signal has been accepted by the HomeLink®. The indicator light will flash slowly and then rapidly after HomeLink® accepts the radio frequency signal.
- Proceed with Step 3 in the "Programming" section.

Operating the HomeLink® Wireless Control System

To operate, simply press and release the appropriate HomeLink® button. Activation will now occur for the trained product (garage door, gate operator, security system, entry door lock, or home or office lighting etc.). For convenience, the hand-held transmitter of the device may also be used at any time. In the event that there are still programming difficulties, contact HomeLink® at **www.homelink.com** or **1–800–355–3515.**



Erasing HomeLink® buttons



To erase the three programmed buttons (individual buttons cannot be erased):

- Press and hold the two outer HomeLink® buttons until the indicator light begins to flash-after 20 seconds. Release both buttons. Do not hold for longer that 30 seconds.

HomeLink® is now in the train (or learning) mode and can be programmed at any time beginning with Step 1 in the *"Programming"* section.

Reprogramming a single HomeLink® button

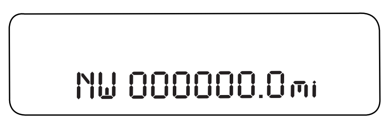
To program a device to HomeLink® using a HomeLink® button previously trained, follow these steps:

1. Press and hold the desired HomeLink® button. **Do NOT** release the button.

2. The indicator light will begin to flash after 20 seconds. Without releasing the HomeLink® button, follow Step 1 in the "Programming" section.

For questions or comments, contact HomeLink® at **www.homelink.com** or **1–800–355–3515.**

MESSAGE CENTER

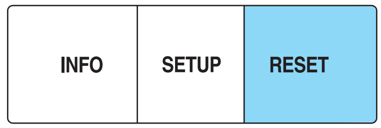


With the ignition in the RUN position, the message center, located on your instrument cluster, displays important vehicle information **through a constant monitor of vehicle systems.** You may select display features on the message center for a display of status. The system will also notify you of potential vehicle problems with a display of system warnings followed by a long indicator chime.

Selectable features

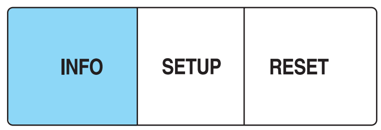
Reset

Press this control to select and reset functions shown in the INFO menu and SETUP menu.



Info menu

This control displays the following control displays:



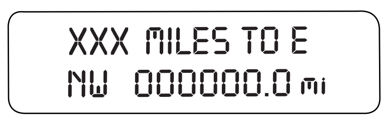
- Odometer
- Trip Odometer A or B
- Distance to Empty
- Average Fuel Economy
- Average Speed
- Compass
- Trip Elapsed Drive Time 1 or 2

Odometer/Trip odometer

Refer to *Gauges* in the *Instrument Cluster* chapter.

Distance to empty (DTE)

Selecting this function from the INFO menu estimates approximately how far you can drive with the fuel remaining in your tank under normal driving conditions.



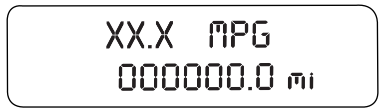
Remember to turn the ignition OFF when refueling to allow this feature to correctly detect the added fuel.

The DTE function will display LOW FUEL LEVEL when you have approximately 50 miles (80 km) to empty. If you RESET this warning message, this display will return within 10 minutes.

DTE is calculated using a running average fuel economy, which is based on your recent driving history of 500 miles (800 km). This value is not the same as the average fuel economy display. The running average fuel economy is reinitialized to a factory default value if the battery is disconnected.

Average fuel economy (AFE)

Select this function from the INFO menu to display your average fuel economy in miles/gallon or liters/100 km.



If you calculate your average fuel economy by dividing 100 miles traveled by gallons of fuel used (kilometers traveled by liters used), your figure may be different than displayed for the following reasons:

- Your vehicle was not perfectly level during fill-up
- Differences in the automatic shut-off points on the fuel pumps at service stations
- Variations in top-off procedure from one fill-up to another
- Rounding of the displayed values to the nearest 0.1 gallon (liter)

1. Drive the vehicle at least 5 miles (8 km) with the speed control system engaged to display a stabilized average.

2. Record the highway fuel economy for future reference.

It is important to press the RESET control (press and hold RESET for 2 seconds in order to reset the function) after setting the speed control to get accurate highway fuel economy readings.

For more information refer to *Fuel Information* in the *Maintenance and Specifications* chapter.

Average Speed

Select this function from the INFO menu to display AVERAGE SPEED and press the RESET control (press and hold RESET for 2 seconds in order to reset the function). Your average speed from that point will be displayed until RESET is pressed and held for two seconds again.

Compass display

The compass reading may be affected when you drive near large buildings, bridges, power lines and powerful broadcast antenna. Magnetic or metallic objects placed in, on or near the vehicle may also affect compass accuracy.

Usually, when something affects the compass readings, the compass will correct itself after a few days of operating your vehicle in normal conditions. If the compass still appears to be inaccurate, a manual calibration may be necessary. Refer to *Compass zone/calibration adjustment.*

Most geographic areas (zones) have a magnetic north compass point that varies slightly from the northerly direction on maps. This variation is four degrees between adjacent zones and will become noticeable as the vehicle crosses multiple zones. A correct zone setting will eliminate this error. Refer to *Compass zone/calibration adjustment*.

Compass zone/calibration adjustment

Perform this adjustment in an open area free from steel structures and high voltage lines.

For optimum calibration, turn off all electrical accessories (heater/air conditioning, wipers, etc.) and make sure all vehicle doors are shut.

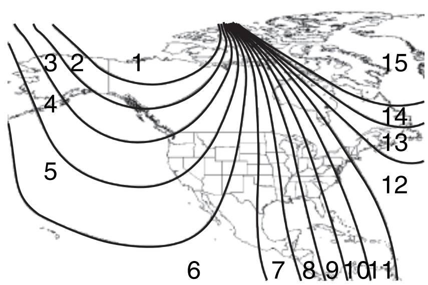
1. Turn ignition to the RUN position.

2. Start the engine.

3. Press the INFO button repeatedly until the Compass and Odometer are displayed. (Do not select Trip, DTE, or AFE. The top of the message center must be blank).

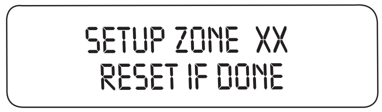
Note: If the compass displays ″CAL 000000.0 mi″ instead of heading information, the compass will need to be calibrated. Slowly drive the vehicle in a circle (less than 3 mph [5 km/h]) until the ″CAL″ indicator changes to display compass heading. This may take up to 3 circles to complete calibration.

4. Determine your magnetic zone by referring to the zone map.



5. Press and hold the RESET until the message center display changes to show the current zone setting.

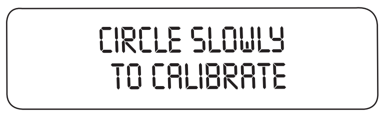
6. Release the RESET control, then slowly press RESET down again.



7. Press the SETUP control repeatedly until the correct zone setting for your geographic location is displayed on the message center. To exit the zone setting mode press and release the RESET control.

8. Press the RESET control to start the compass calibration function.

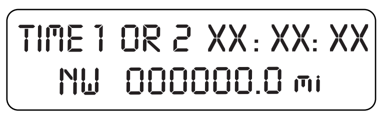
9. Slowly drive the vehicle in a circle (less than 3 mph [5 km/h]) until the CIRCLE SLOWLY TO CALIBRATE indicator changes to CALIBRATION COMPLETED. This will take up to three circles to complete calibration.



10. The compass is now calibrated.

Trip elapsed drive time

Select this function from the INFO menu to display a timer.

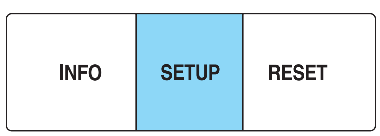


To operate the Trip Elapsed Drive Time perform the following:

1. Press and release RESET in order to start the timer.
2. Press and release RESET to pause the timer.
3. Press and hold RESET for 2 seconds in order to reset the timer.

Setup menu

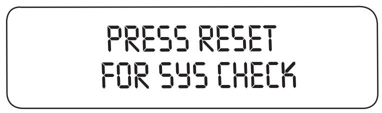
Press this control for the following displays:



- System Check
- Units (English/Metric)
- Autolamp
- Autolock
- Autounlock

- Power Liftgate (if equipped)
- Easy entry/exit seat (if equipped)
- Reverse sensing system (Park Assist) (if equipped)
- Language

System check



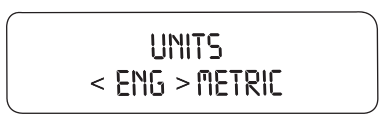
Selecting this function from the SETUP menu causes the message center to cycle through each of the systems being monitored. For each of the monitored systems, the message center will indicate either an OK message or a warning message for two to four seconds.

Pressing the RESET control cycles the message center through each of the systems being monitored.

The sequence of the system check report is as follows:

1. DOORS CLOSED
2. ENGINE TEMPERATURE
3. OIL PRESSURE
4. BRAKE FLUID LEVEL
5. WASHER FLUID LEVEL
6. FUEL LEVEL
7. DISTANCE TO EMPTY

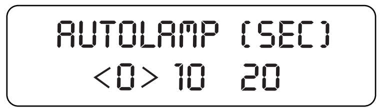
Units (English/Metric)



1. Select this function from the SETUP menu for the current units to be displayed.
2. Press the RESET control to change from English to Metric.

Autolamp delay

This feature keeps your headlights on for up to three minutes after the ignition is switched off.

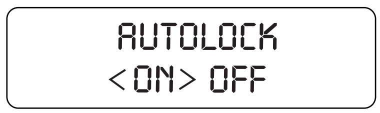


1. To disable/enable the autolamp delay feature, select this function from the SETUP control for the current display mode.

2. Press the RESET control to select the new Autolamp delay values of 0, 10, 20, 30, 60, 90, 120 or 180 seconds.

Autolock

This feature automatically locks all vehicle doors when the vehicle is shifted into any gear, putting the vehicle in motion.

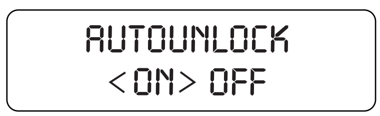


1. To disable/enable the autolock feature, select this function from the SETUP control for the current display mode.

2. Press the RESET control to turn the autolock ON or OFF.

Autounlock

This feature automatically unlocks all vehicle doors when the driver's door is opened within 10 minutes of the ignition being turned off.



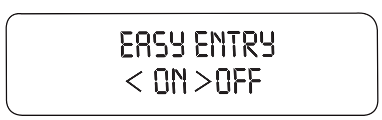
1. To disable/enable the autounlock feature, select this function from the SETUP MENU.

2. Press and hold the RESET control switch to turn the autounlock ON or OFF.

3. Press the RESET control switch for the next SETUP MENU item or wait for more than 4 seconds to return to the INFO MENU.

Easy entry/exit (if equipped)

This feature automatically moves the drivers seat backwards for easy exit from the vehicle.



1. To disable/enable the easy entry/exit seat feature, select this function from the SETUP control for the current display mode.

2. Press the RESET control to turn the easy entry/exit seat ON or OFF.

Power Liftgate (if equipped)

This feature allows users to open/close the rear liftgate at the touch of a button.

1. To disable/enable the power liftgate feature, select this function from the SETUP control for the current display mode.

POWER LIFTGATE
ON <OFF>

2. Press the RESET control to turn the power liftgate ON or OFF.

Reverse Sensing System (Park aid) (if equipped)

This feature sounds a warning tone to warn the driver of obstacles near the rear bumper, and functions only when R (Reverse) gear is selected.

1. To disable/enable the reverse sensing system feature, select this function from the SETUP menu or put the vehicle in R (Reverse).

REAR PARK AID
< ON > OFF

2. Press the RESET control to turn the rear park aid OFF or ON.

Language

1. Select this function from the SETUP menu for the current language to be displayed.

ENGLISH
RESET FOR NEW

2. Pressing the RESET control cycles the message center through each of the language choices.

FOR ENGLISH
HOLD RESET

Selectable languages are English, Spanish and French.

3. Press and hold the RESET control for 2 seconds to set the language choice.

SET TO
ENGLISH

System warnings

System warnings alert you to possible problems or malfunctions in your vehicle's operating systems.

In the event of a multiple warning situation, the message center will cycle the display to show all warnings by displaying each one for several seconds.

The message center will display the last selected feature if there are no more warning messages. This allows you to use the full functionality of the message center after you acknowledge the warning by pressing the RESET control and clearing the warning message.

Warning messages that have been reset are divided into three categories:

- They will not disappear until a condition is changed.
- They will reappear on the display ten minutes from the reset.
- They will not reappear until an ignition LOCK/OFF-ON cycle has been completed.

This acts as a reminder that these warning conditions still exist within the vehicle.

Warnings	Status
Driver door ajar	Warning cannot be reset (PLEASE CLOSE DOOR) will be displayed
Passenger door ajar	
Rear left door ajar	
Rear right door ajar	
Park brake engaged	RELEASE PARK BRAKE will be displayed
Low fuel level	Warning returns after 10 minutes
Check brake system	
Low brake fluid level	Warning returns after the ignition key is turned from LOCK/OFF to RUN
Liftgate ajar	
Low tire pressure	
Tire pressure monitor fault	
Tire pressure sensor fault	
Compass data error	
Integrated key programming status	Maximum number of Integrated Keys exceeded

DRIVER DOOR AJAR. Displayed when the driver's door is not completely closed.

PASSENGER DOOR AJAR. Displayed when the passenger side door is not completely closed.

REAR LEFT DOOR AJAR. Displayed when the rear left door is not completely closed.

REAR RIGHT DOOR AJAR. Displayed when the rear right door is not completely closed.

PARK BRAKE ENGAGED. Displayed when the manual park brake is set, the engine is running and the vehicle is driven more than 3 mph (5 km). If the warning stays on after the park brake is released, contact your authorized dealer as soon as possible.

LOW FUEL LEVEL. Displayed as an early reminder of a low fuel condition.

CHECK BRAKE SYSTEM. Displayed when the brake system needs servicing. If the warning stays on or continues to come on, contact your authorized dealer as soon as possible.

LOW BRAKE FLUID LEVEL. Indicates the brake fluid level is low and the brake system should be inspected immediately. Refer to *Brake fluid reservoir* in the *Maintenance and Specifications* chapter.

LIFTGATE AJAR. Displayed when the liftgate is not completely closed.

LOW TIRE PRESSURE. Displayed when one or more tires on your vehicle have low tire pressure. Refer to *Inflating your tires* in the *Tires, Wheels and Loading* chapter.

TIRE PRESSURE MONITOR FAULT. Displayed when the Tire Pressure Monitoring System is malfunctioning. If the warning stays on or continues to come on, have the system inspected by your authorized dealer.

TIRE PRESSURE SENSOR FAULT. Displayed when a tire pressure sensor is malfunctioning, or your spare tire is in use. For more information on how the system operates under these conditions, refer to *Tire pressure monitoring system* in the *Tires, Wheels and Loading* chapter. If the warning stays on or continues to come on, have the system inspected by your authorized dealer.

COMPASS DATA ERROR. Displayed when the compass is not operating properly. If the warning stays on or continues to come on, contact your authorized dealer as soon as possible.

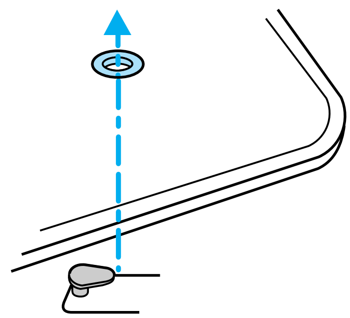
INTEGRATED KEY PROGRAMMING STATUS. Displayed when an attempt is made to program a fifth Integrated Key to the Remote Key Entry System. For more information on Integrated Key, refer to *Locks and Security* chapter in this manual.

POSITIVE RETENTION FLOOR MAT (IF EQUIPPED)

Do not install additional floor mats on top of the factory installed floor mats as they may interfere with the accelerator or the brake pedals.

To install floor mats that have a retention post:

Position the floor mat so that the eyelet is over the pointed end of the retention post and rotate forward to lock in. Make sure that the mat does not interfere with the operation of the accelerator or the brake pedal. To remove the floor mat, reverse the installation procedure.

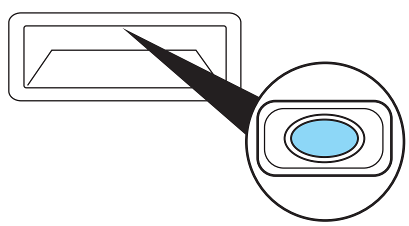


MANUAL LIFTGATE (IF EQUIPPED)

The liftgate cargo area is only intended for cargo, not for passengers. You can open and close the liftgate from outside the vehicle. It cannot be opened from inside the cargo area.

Note: In the event of a power failure, the latch can be accessed and released through the access panel in the liftgate trim.

To open, push the control button located above the liftgate outside handle to unlatch the liftgate, then pull on the outside handle to access the cargo area.



- Exercise care when opening or closing the liftgate in a garage or other enclosed area. The liftgate could be damaged against a garage door, low ceiling or wall.
- Do not hang anything (bike rack, etc.) from the spoiler/glass or liftgate. Doing so could cause serious damage to the liftgate and its components.
- Do not leave the liftgate open while driving. Doing so could cause serious damage to the liftgate and its components as well as allowing carbon monoxide to enter the vehicle.

Make sure that the liftgate is closed to prevent exhaust fumes from being drawn into the vehicle. This will also prevent passengers and cargo from falling out. If you must drive with the liftgate door open, keep the vehicle well ventilated so outside air comes into the vehicle.

Liftgate ajar signal

If the liftgate is not fully latched, you will receive a "LIFTGATE AJAR" message on the instrument panel. If you see this message, check the liftgate door to ensure it is fully latched.

POWER LIFTGATE (PLG) (IF EQUIPPED)

You can power open or close the liftgate with the following controls.

- instrument panel control button
- integrated keyhead transmitter button
- outside liftgate control button
- control button in the rear cargo area

Opening and Closing the power liftgate:

WARNING: Make sure all persons are clear of the power liftgate area before using the power liftgate control.

Keep keys out of reach of children. Do not allow children to play near an open or moving power liftgate.

The liftgate will only operate with the vehicle in P (Park).

When the liftgate is being power closed, a chime will sound three times as the liftgate begins to power close. A single chime indicates a problem with the close request, caused by:

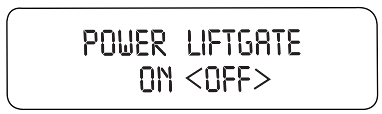
- the ignition is in Run and the transmission is not in Park
- or the Battery Voltage is below the minimum operating voltage
- or the vehicle speed is at or above 3 mph (5 kph)

A fast continuous chime during power closing indicates there is an excessive load on the liftgate (snow, bike rack, etc.) or a possible strut malfunction. If any excessive load is removed and you still have a faster chime, have the system serviced immediately by your authorized dealer.

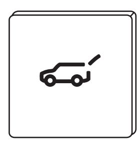
Do not attempt to manually force the liftgate to travel faster than the power system will permit. This will activate the obstacle detection feature.

Exercise care, when power opening or closing the liftgate in a garage or other enclosed area with a low ceiling or close to a wall/garage door. The liftgate could be damaged from the contact. Disable the power feature and operate the liftgate manually if necessary.

When power operating the liftgate at temperatures below 32° F (0° C), the liftgate may stop about 5 inches (12.7 cm) from the full open position. The liftgate can be fully opened by pushing it upward to the maximum open position.

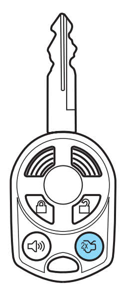


The Power Liftgate feature can be enabled or disabled using the Message Center. With the control in the OFF position, power operation is disabled from the liftgate handle button and from the rear cargo area button. The integrated keyhead transmitter and instrument panel switch will operate the liftgate regardless of the position state of the Message Center. Refer to the *Message Center* section in this chapter.



To power open or close the liftgate from the Instrument panel:

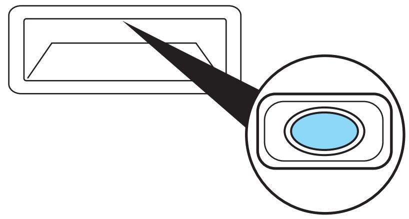
Press the button, located to the left of the steering column, once to power open or close the liftgate.



To power open or close the liftgate with the integrated keyhead transmitter:

Press 2x twice within 3 seconds to power open or close the liftgate. Refer to *Remote entry system* in the *Locks and Security* chapter.

To power open the liftgate with outside liftgate control button:

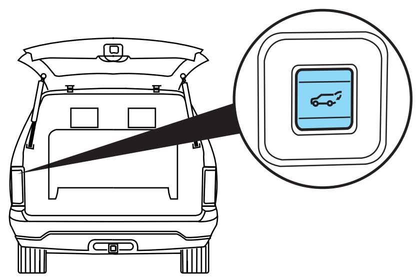


1. To open, unlock the liftgate with the integrated keyhead transmitter or power door unlock control.

2. Push the control button located above the liftgate outside handle to unlatch and power open the liftgate.

Note: For the best performance allow the power system to open the liftgate after pushing the control. Manually pushing or pulling the liftgate may activate the system's obstacle detection feature and stop the power system.

To power close the liftgate with the rear cargo area control button:



Press and release the control on the left rear quarter panel to close the liftgate.

Note: The rear cargo area control button is disabled when the liftgate is latched.

Warning, keep clear of the liftgate when activating the rear switch.

Note: The liftgate movement direction can be reversed with a second press of the instrument panel, or the rear cargo area control button, or a second double press of the integrated keyhead transmitter button.

To manually operate the liftgate:

1. Disable the liftgate power function. Refer to the *Message Center* in this chapter.

2. Open and close the liftgate as you would a standard liftgate. Refer to the *Manual liftgate* in this chapter.

Note: In case of operation in extreme cold -40° F (-40° C), or on extreme inclines, manual operation of the liftgate is suggested.

Obstacle detection:

The power liftgate system is equipped with an obstacle detection feature.

If the power liftgate is closing, the system will reverse to full open when it detects an obstacle. A chime will sound 3 times when an obstacle is detected as the liftgate begins to reopen. Once the obstacle is removed, the liftgate can be closed under power.

If the power liftgate is opening, the system will stop and a chime will sound 3 times when an obstacle is detected. Once the obstacle is removed, the liftgate can again be operated normally.

Resetting the power liftgate:

The power liftgate may not operate properly and may need to be reset if any of these conditions occur:

- a low voltage or dead battery or disconnected battery
- the liftgate has been left open or unlatched for more than six (6) hours

To reset the power liftgate:

1. Ensure the battery is properly connected and charged.

2. Manually close and fully latch the liftgate.

3. Power open the liftgate by using the integrated keyhead transmitter, or the instrument panel control button. The outside liftgate control button can also be used if the power liftgate is enabled in the Message Center.

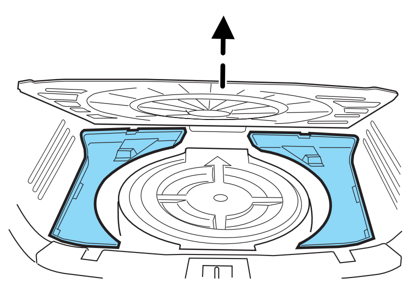
Note: If the battery is disconnected, discharged, or a new battery is installed, the power liftgate needs to be power opened to the full open position to reset the power liftgate positions.

CARGO MANAGEMENT SYSTEM (IF EQUIPPED)

The cargo management system consists of storage compartments located in the floor of the rear cargo area.

1. To open, lift the release handle and the lid.

2. To close, lower the lid.



LUGGAGE RACK (IF EQUIPPED)

The load **must be** placed directly on the luggage rack. The vehicle's roof panel **is not** designed to carry a load.

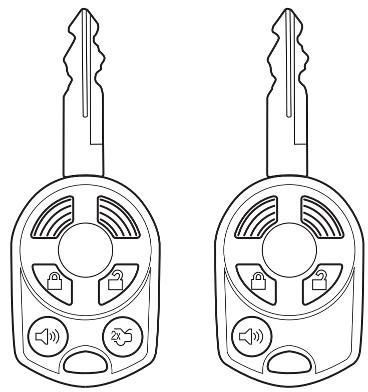
When loading the luggage rack, it is recommended to evenly distribute the load, as well as maintain a low center of gravity. Ensure that the load is securely fastened. The maximum load for the roof rack is 100 lb (44 kg).

Your fuel economy will decrease when you drive with items on the luggage rack. When the rack is loaded, check the tightness of the load before driving and at each refueling stop.

Loaded vehicles, with a higher center of gravity, may handle differently than unloaded vehicles. Extra precautions, such as slower speeds and increased stopping distance, should be taken when driving a heavily loaded vehicle.

KEYS

Your vehicle is equipped with two Integrated Keyhead Transmitters (IKTs). The IKT functions as both a programmed ignition key that operates all the locks and starts the vehicle, and a remote keyless entry transmitter. Vehicles with a power liftgate will have a four-button IKT while vehicles without a power liftgate will have a three-button IKT.



Your IKTs are programmed to your vehicle; using a non-programmed key will not permit your vehicle to start. If you lose your authorized dealer supplied IKTs, replacement IKTs are available through your authorized dealer. Standard SecuriLock™ keys without remote entry transmitter functionality can also be purchased from your authorized dealer if desired.

Always carry a spare key with you in case of an emergency.

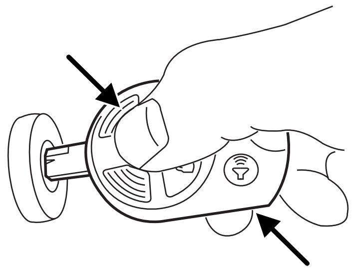
For more information regarding programming replacement IKTs, refer to the *SecuriLock™ passive anti-theft system* section later in this chapter.

Note: Your vehicle’s IKTs were issued with an adhesive security label on them that provides important vehicle key cut information. It is recommended that you maintain the label in a safe place for future reference, such as the inside front cover of this *Owner’s Guide*.

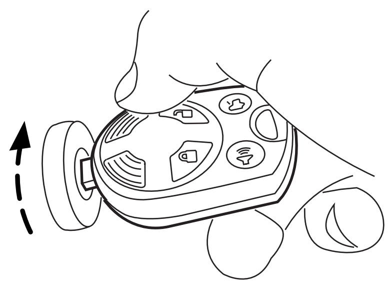
Recommended handling of the Integrated Keyhead Transmitter (IKT)

To avoid inadvertently activating the remote entry functions of your vehicle, it is recommended that the Integrated Keyhead Transmitter (IKT) be handled properly when starting and turning off your vehicle.

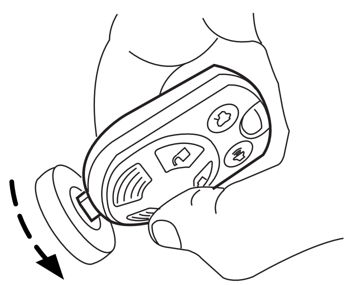
When inserting the IKT into the ignition cylinder, place your thumb on the center thumb rest of the IKT and forefinger on the logo badge on the opposite side.



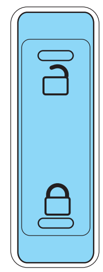
To gain more leverage when rotating the IKT in the ignition lock cylinder, you can readjust the location of your thumb to grasp the IKT on the outer edge next to the unlock control.



Likewise, when rotating the IKT to the 1 (LOCK) position in the ignition lock cylinder, the bottom edge of the IKT adjacent to the lock control can be utilized.



POWER DOOR LOCKS



- Press the control to unlock all doors.
- Press the control to lock all doors.

Smart locks

This feature helps to prevent you from locking yourself out of the vehicle if your key is still in the ignition.

When you open one of the front doors or the liftgate and you lock the vehicle with the power door lock control (on the driver or passenger door trim panel), all the doors will lock, then all doors will automatically unlock reminding you that your key is still in the ignition.

The vehicle can still be locked, with the key in the ignition, by locking the driver's door with a key, using the lock control on the remote entry transmitter portion of your Integrated Keyhead Transmitter, or locking the vehicle with the keyless entry keypad.

If both front doors and the liftgate are closed, the vehicle can be locked from any method, regardless of whether the key is in the ignition or not.

Autolock feature

The autolock feature will lock all the doors when:

- all the doors are closed,
- the ignition is in the 3 (RUN) position,
- you shift into any gear putting the vehicle in motion, and
- the vehicle attains a speed greater than 12 mph (20 km/h) for greater than 2 seconds.

The autolock feature repeats when:

- any door is opened then closed while the ignition is in the 3 (RUN) position and the vehicle speed is 9 mph (15 km/h) or lower, and
- the vehicle then attains a speed greater than 12 mph (20 km/h) for greater than 2 seconds.

Deactivating/activating autolock feature

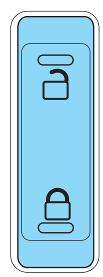
Your vehicle comes with the autolock features activated; there are four methods to enable/disable this feature:

- Through your authorized dealer,
- by using a power door unlock/lock procedure,
- using a keypad procedure (if equipped), or
- or by using the instrument cluster message center (if equipped). Refer to *Message center* in the *Driver Controls* chapter.

Note: The autolock feature can be activated/deactivated independently of the autounlock feature.

Power door lock switch autolock enable/disable procedure

Before starting, ensure the ignition is in the 1 (LOCK) position and all vehicle doors are closed. You must complete Steps 1–5 within 30 seconds or the procedure will have to be repeated. If the procedure needs to be repeated, wait a minimum of 30 seconds before beginning again.



1. Place the key in the ignition and turn the ignition to the 3 (RUN) position.

2. Press the power door unlock control on the door panel three times.

3. Turn the ignition from the 3 (RUN) position to the 1 (LOCK) position.

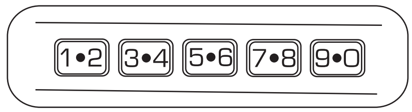
4. Press the power door unlock control on the door panel three times.

5. Turn the ignition back to the 3 (RUN) position. The horn will chirp one time to confirm programming mode has been entered and is active.

6. To enable/disable the autolock feature, press the unlock control, then press the lock control. The horn will chirp once if autolock was deactivated or twice (one short and one long chirp) if autolock was activated.

7. Turn the ignition to the 1 (LOCK) position. The horn will chirp once to confirm the procedure is complete.

Keyless entry key pad autolock enable/disable procedure



1. Turn the ignition to the 1 (LOCK) position.
2. Close all the doors.
3. Enter factory–set 5–digit entry code.
4. Press and hold the 3 • 4. While holding the 3 • 4 press the 7 • 8.
5. Release the 7 • 8.
6. Release the 3 • 4.

The user should receive a **horn chirp** to indicate the system has been disabled or a chirp followed by a honk to indicate the system has been enabled.

Autounlock feature

The autounlock feature will unlock all the doors when:

- the ignition is in the 3 (RUN) position, all the doors are closed, and the vehicle has been in motion at a speed greater than 12 mph (20 km/h);
- the vehicle has then come to a stop and the ignition is turned to the 1 (LOCK) or 2 (ACC) position; and
- the driver door is opened within 10 minutes of the ignition being transitioned to the 1 (LOCK) or 2 (ACC) position.

Note: The doors will not autounlock if the vehicle has been electronically locked before the driver door is opened.

Deactivating/activating autounlock feature

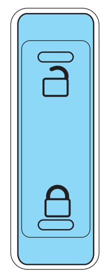
Your vehicle comes with the autounlock features activated; there are four methods to enable/disable this feature:

- Through your authorized dealer,
- by using a power door unlock/lock sequence,
- using a keypad procedure (if equipped), or
- or by using the instrument cluster message center (if equipped). Refer to *Message center* in the *Driver Controls* chapter.

Note: The autounlock feature can be activated/deactivated independently of the autolock feature.

Power door lock switch autounlock enable/disable procedure

Before starting, ensure the ignition is in the 1 (LOCK) position and all vehicle doors are closed. You must complete Steps 1–5 within 30 seconds or the procedure will have to be repeated. If the procedure needs to be repeated, wait a minimum of 30 seconds before beginning again.



1. Place the key in the ignition and turn the ignition to the 3 (RUN) position.

2. Press the power door unlock control on the door panel three times.

3. Turn the ignition from the 3 (RUN) position to the 1 (LOCK) position.

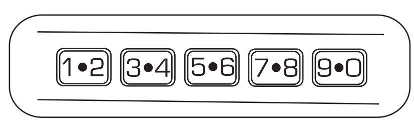
4. Press the power door unlock control on the door panel three times.

5. Turn the ignition back to the 3 (RUN) position. The horn will chirp one time to confirm programming mode has been entered and is active.

6. To enable/disable the autounlock feature, press the lock control, then press the unlock control. The horn will chirp once if autounlock was deactivated or twice (one short and one long chirp) if autounlock was activated.

7. Turn the ignition to the 1 (LOCK) position. The horn will chirp once to confirm the procedure is complete.

Keyless entry key pad autounlock enable/disable procedure



1. Turn the ignition to the 1 (LOCK) position.

2. Close all the doors.

3. Enter factory–set 5–digit entry code.

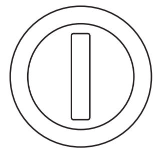
4. Press and hold the 3 • 4. While holding the 3 • 4, press and release the 7 • 8. While still holding the 3 • 4, press and release the 7 • 8 a second time.

5. Release the 3 • 4.

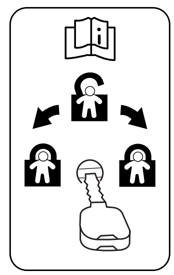
The user should receive a **horn chirp** to indicate the system has been disabled or a chirp followed by a honk to indicate the system has been enabled.

CHILDPROOF DOOR LOCKS

- When these locks are set, the rear doors cannot be opened from the inside.
- The rear doors can be opened from the outside when the doors are unlocked.



The childproof locks are located on rear edge of each rear door and must be set separately for each door. Setting the lock for one door will not automatically set the lock for both doors.



- Insert the key and turn to the lock position (key horizontal) to engage the childproof locks.
- Insert the key and turn to the unlock position (key vertical) to disengage the childproof locks.

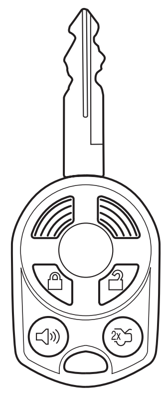
REMOTE ENTRY SYSTEM

The Integrated Keyhead Transmitter (IKT) complies with part 15 of the FCC rules and with RSS-210 of Industry Canada. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

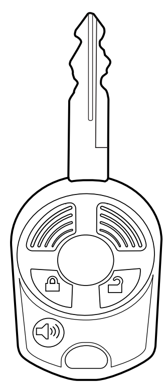
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

There are 2 possible types of IKTs:

- Vehicles equipped with a power liftgate



- Vehicles not equipped with a power liftgate



The typical operating range for your IKT is approximately 33 feet (10 meters). A decrease in operating range could be caused by:

- weather conditions,
- nearby radio towers,
- structures around the vehicle, or
- other vehicles parked next to your vehicle.

The IKT allows you to:

- remotely unlock the vehicle doors.
- remotely lock all the vehicle doors.
- remotely open the power liftgate (if equipped).
- activate the personal alarm.
- arm and disarm the perimeter anti-theft system.
- operate the illuminated entry feature.

The remote entry lock/unlock feature operates in any ignition position except while the key is held in the 4 (START) position. The panic feature operates with the key in the 1 (LOCK) position.

If there are problems with the remote entry system, make sure to take **ALL Integrated Keyhead Transmitters** with you to the authorized dealer in order to aid in troubleshooting the problem.

Unlocking the doors/two stage unlock

1. Press and release to unlock the driver's door. **Note:** The interior lamps will illuminate.

2. Press and release again within three seconds to unlock all the doors.

The remote entry system activates the illuminated entry feature; this feature turns on the lamps for 25 seconds or until the ignition is turned to the 3 (RUN) position.

The inside lights will not turn off if:

- they have been turned on using the dimmer control or
- any door is open.

The battery saver feature will turn off the interior lamps 10 minutes after the ignition is turned to the 1 (LOCK) position.

Two stage unlocking may be disabled or re-enabled by simultaneously pressing the and controls on the IKT for four seconds (disabling two stage unlock allows all vehicle doors to unlock simultaneously). The turn lamps will flash twice to indicate that two-stage unlock was enabled or disabled.

Opening front windows and panoramic roof (if equipped)

Press and hold for more than two seconds in order to begin opening the two front windows and venting the panoramic roof (if equipped).

- The control can then be released and the windows and panoramic roof will complete the opening operation.
- If any other remote entry transmitter control is pressed during the opening operation, both windows and panoramic roof movement will stop.

Note: The ignition must be in the 1 (LOCK) position and the accessory delay feature must be not activated in order for this feature to operate.

Locking the doors

1. Press and release to lock all the doors. The turn lamps will flash.

2. Press and release again within three seconds to confirm that all the doors are closed. **Note:** The doors will lock again, the horn will chirp and the turn lamps will flash once if all the doors and liftgate are closed.

Note: If any door or the liftgate is not closed, or if the hood is not closed in vehicles equipped with the perimeter alarm feature, the horn will chirp twice and the lamps will not flash.

Opening the power liftgate (if equipped)

Press twice within 3 seconds to fully unlatch and open the liftgate.

> Make sure all persons are clear of the liftgate area before using power liftgate control.

In order to fully lower and latch the liftgate, press the control twice.

If the liftgate stops mid travel, it may have detected an obstacle, Check to ensure the liftgate swing zone is free from obstruction and reset the power assist by manually closing the liftgate. Normal operation can then be resumed.

> Make sure the liftgate is closed to prevent exhaust fumes from being drawn into the vehicle. This will also prevent passengers and cargo from falling out. If you must drive with the liftgate open, keep the vents open so outside air comes into the vehicle.

Car finder

Press twice within three seconds. The horn will chirp and the turn lamps will flash. It is recommended that this method be used to locate your vehicle, rather than using the panic alarm.

Sounding a panic alarm

Press to activate the alarm. The horn will sound and the turn lamps will flash for a maximum of 3 minutes. Press again or turn the ignition to the 3 (RUN) position to deactivate, or wait for the alarm to timeout in 3 minutes.

Note: The panic alarm will only operate when the ignition is in the 1 (LOCK) position.

Memory feature

The Integrated Keyhead Transmitter allows you to recall the memory seat/mirror feature.

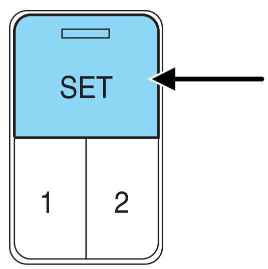
Press to automatically move the seat/mirrors to the desired memory position. **Note:** The seat will not travel to its final position if the key is not in the ignition and the easy entry feature is enabled.

Activating the memory feature

To activate this feature:

1. Position the seat and mirrors to the desired positions.

2. Press the SET control on the driver's door panel.



3. Within 5 five seconds, press the lock or unlock control on the Integrated keyhead Transmitter and then press the 1 or 2 control on the driver's door panel which you would like to associate with the seat and Driver 1 or Driver 2 positions.

4. Repeat this procedure for another Integrated Keyhead Transmitter if desired.

Deactivating the memory feature

To deactivate this feature:

1. Press the SET control on the driver's door panel.

2. Within five seconds, press the lock or unlock control on the Integrated Keyhead Transmitter which you would like to deactivate and then press the SET control on the driver's door panel again.

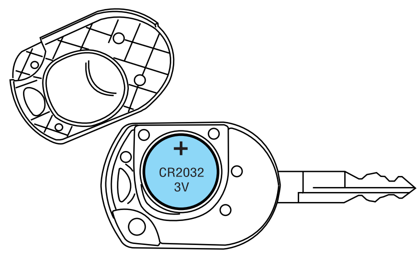
3. Repeat this procedure for another Integrated Keyhead Transmitter if desired.

Replacing the battery

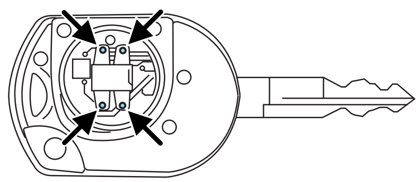
The Integrated Keyhead Transmitter uses one coin type three-volt lithium battery CR2032 or equivalent.

To replace the battery:

1. Twist a thin coin in the slot of the IKT near the key ring in order to remove the battery cover.



2. Do not wipe off any grease on the battery terminals on the back surface of the circuit board.



3. Remove the old battery. **Note:** Please refer to local regulations when disposing of transmitter batteries.

4. Insert the new battery. Refer to the instructions inside the IKT for the correct orientation of the battery. Press the battery down to ensure that the battery is fully seated in the battery housing cavity.

5. Snap the battery cover back onto the key.

Note: Replacement of the battery will **not** cause the IKT to become deprogrammed from your vehicle. The IKT should operate normally after battery replacement.

Replacing lost Integrated Keyhead Transmitters (IKTs)

If you would like to have your Integrated Keyhead Transmitters reprogrammed because you lost one, or would like to buy additional IKTs, you can either reprogram them yourself, or take **all IKTs** to your authorized dealer for reprogramming.

How to reprogram your Integrated Keyhead Transmitters (IKTs)

To program a new Integrated Keyhead Transmitter yourself, refer to *Programming spare keys* in the *SecuriLock™ passive anti-theft* section of this chapter. **Note:** At least two IKTs are required to perform this procedure yourself.

Illuminated entry

The interior lamps and puddle lamps (if equipped) illuminate when the Integrated Keyhead Transmitter or the keyless entry system keypad is used to unlock the door(s).

The illuminated entry system will turn off the interior lights if:

- the ignition is turned to the 3 (RUN) position, or
- the Integrated Keyhead Transmitter lock control is pressed, or
- the vehicle is locked using the keyless entry keypad, or
- after 25 seconds of illumination.

The inside lights will not turn off if:

- they have been turned on with the dimmer control, or
- any door is open.

Perimeter lamps illuminated entry

With the Integrated Keyhead Transmitter system, the following items will illuminate when the (unlock) control on the transmitter is pressed:

- Head lamps
- Park lamps
- Tail lamps

The lamps will automatically turn off:

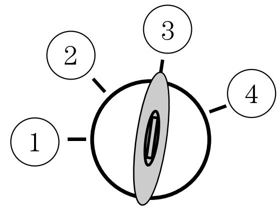
- if the ignition switch is turned to the 3 (RUN) position, or
- the Integrated Keyhead Transmitter lock control is pressed, or
- the vehicle is locked using the keyless entry keypad, or
- after 25 seconds of illumination.

Note: On some vehicles, the perimeter lamps illuminated entry feature will not activate in daylight conditions.

Deactivating/activating perimeter lamps illuminated entry

You may enable/disable this feature by having your vehicle serviced by your authorized dealer.

You may also perform the following power door lock sequence to enable/disable the perimeter lamps feature. **Note:** Before starting, ensure the ignition is in the 1 (LOCK) position and all vehicle doors are closed. You must complete Steps 1–5 within 30 seconds or the procedure will have to be repeated. If the procedure needs to be repeated, wait a minimum of 30 seconds before beginning again.



1. Place the key in the ignition and turn the ignition to the 3 (RUN) position.

2. Press the power door unlock control on the door panel three times.

3. Turn the ignition from the 3 (RUN) position to the 1 (LOCK) position.

4. Press the power door unlock control on the door panel three times.

5. Turn the ignition back to the 3 (RUN) position. The horn will chirp one time to confirm programming mode has been entered and is active.

6. Press the power door unlock control twice within 5 seconds. **Note:** The horn will chirp once to indicate the perimeter lighting feature has been deactivated. The horn will chirp once and honk once (one short and one long) to indicate the perimeter lighting feature has been activated.

7. Turn the ignition to the 1 (LOCK) position to exit the procedure. **Note:** The horn will chirp once to confirm the procedure is complete.

Illuminated exit

- When all vehicle doors are closed and the key is removed from the ignition, the interior dome lamps (and the exterior mirror puddle lamps, if equipped) will illuminate.

The lights will turn off if all the doors remain closed and

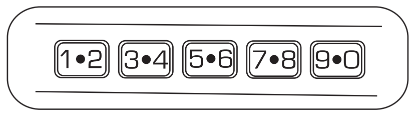
- 25 seconds elapse, or
- the key is inserted in the ignition.

Battery saver

The battery saver will shut off the interior lamps 10 minutes after the ignition has been turned to the 1 (LOCK) position.

- If the dome lamps were turned on using the panel dimmer control, the battery saver will shut them off 10 minutes after the ignition has been turned to the 1 (LOCK) position.
- If the courtesy lamps were turned on because one of the vehicle doors or the trunk was opened, the battery saver will shut off them off 10 minutes after the ignition has been turned to the 1 (LOCK) position.
- The battery saver will shut off the headlamps 10 minutes after the ignition has been turned to the 1 (LOCK) position.

KEYLESS ENTRY SYSTEM



You can use the keyless entry keypad to:

- lock or unlock the doors without using a key.
- recall memory seat/power mirrors positions.

The keypad can be operated with the factory set 5–digit entry code; this code is located on the owner's wallet card in the glove box and is available from your authorized dealer. You can also create up to three of your own 5–digit personal entry codes.

When pressing the controls on the keypad, press the middle of the controls to ensure a good activation.

Programming a personal entry code and keypad association to memory seats and mirrors

To create your own personal entry code:

1. Enter the factory set code.
2. Within five seconds press the 1 • 2 on the keypad.
3. Enter your personal 5-digit code. Each number must be entered within five seconds of each other.
4. To associate the entry code with a memory setting, enter a sixth digit to indicate which driver should be set in a memory recalled by the personal entry code:

- Pressing 1 • 2 recalls Driver 1 settings.
- Pressing 3 • 4 recalls Driver 2 settings.
- Pressing other keypad buttons or not pressing a keypad button as a sixth digit does not set a driver position and will not recall a memory setting. **Note:** The factory-set code cannot be associated with a memory setting.

5. The doors will lock then unlock to confirm that your personal keycode has been programmed to the module.

Tips:

- Do not set a code that uses five of the same number.
- Do not use five numbers in sequential order.
- The factory set code will work even if you have set your own personal code.

Erasing personal code

1. Enter the factory set 5–digit code.

2. Within five seconds, press the 1 • 2 on the keypad and release.

3. Press and hold the 1 • 2 for two seconds. This must be done within five seconds of completing Step 2.

All personal codes are now erased and only the factory set 5–digit code will work.

Anti-scan feature

If the wrong code has been entered 7 times (35 consecutive button presses), the keypad will go into an anti-scan mode. This mode disables the keypad for one minute and the keypad lamp will flash.

The anti-scan feature will turn off after:

- one minute of keypad inactivity.
- pressing the UNLOCK control on the remote entry transmitter portion of your Integrated Keyhead Transmitter.
- the ignition is turned to the 3 (RUN) position.

Unlocking and locking the doors using keyless entry

To unlock the driver's door, enter the factory set 5-digit code or your personal code. Each number must be pressed within five seconds of each other. The interior lamps will illuminate. **Note:** If the two-stage unlocking feature is disabled, all doors will unlock; for more information regarding two-stage unlocking, refer to the *Two stage unlocking* section earlier in this chapter.

To unlock all doors, enter the factory set code or your personal code, then press the 3 • 4 control within five seconds.

To lock all doors, press the 7 • 8 and the 9 • 0 at the same time (with the driver's door closed). You **do not** need to enter the keypad code first.

SECURILOCK™ PASSIVE ANTI-THEFT SYSTEM

SecuriLock™ passive anti-theft system is an engine immobilization system. This system is designed to help prevent the engine from being started unless a **coded Integrated Keyhead Transmitter (IKT) programmed to your vehicle** is used. The use of the wrong type of coded key may lead to a “no-start” condition.

Your vehicle comes with two coded Integrated Keyhead Transmitters; additional coded IKTs may be purchased from your authorized dealer. Standard SecuriLock™ keys without remote entry transmitter functionality can also be purchased from your authorized dealer if desired. The authorized dealer can program your spare IKTs to your vehicle or you can program the IKTs yourself. Refer to *Programming spare Integrated Keyhead Transmitters* for instructions on how to program the coded key.

Note: The SecuriLock™ passive anti-theft system is not compatible with non-Ford aftermarket remote start systems. Use of these systems may result in vehicle starting problems and a loss of security protection.

Note: Large metallic objects, electronic devices that are used to purchase gasoline or similar items, or a second coded key on the same key chain may cause vehicle starting issues. You need to prevent these objects from touching the coded IKT while starting the engine. These objects will not cause damage to the coded IKT, but may cause a momentary issue if they are too close to the IKT when starting the engine. If a problem occurs, turn the ignition off, remove all objects on the key chain away from the coded IKT and restart the engine.

Anti-theft indicator

The anti-theft indicator is located in the instrument panel cluster.

- When the ignition is in the 1 (LOCK) position, the indicator will flash once every 2 seconds to indicate the SecuriLock™ system is functioning as a theft deterrent.

- When the ignition is in the 3 (RUN) position, the indicator will glow for 3 seconds to indicate normal system functionality.

If a problem occurs with the SecuriLock™ system, the indicator will flash rapidly or glow steadily when the ignition is in the 3 (RUN) position. If this occurs, the vehicle will not start and should be taken to an authorized dealer for service.

Automatic arming

The vehicle is armed immediately after switching the ignition to the 1 (LOCK) position.

The theft indicator will flash every two seconds to act as a theft deterrent when the vehicle is armed.

Automatic disarming

The vehicle is disarmed immediately after the ignition is turned to the 3 (RUN) position.

The theft indicator will illuminate for three seconds and then go out. If the theft indicator stays on for an extended period of time or flashes rapidly, have the system serviced by your authorized dealer.

Replacement Integrated Keyless Transmitters (IKT) and coded keys

Note: Your vehicle comes equipped with two Integrated Keyhead Transmitters (IKTs). The IKT functions as both a programmed ignition key that operates all the locks and starts the vehicle, as well as a remote keyless entry transmitter. A maximum of eight coded keys can be programmed to your vehicle; only four of these eight keys can be IKTs with remote entry functionality.

If your IKTs or standard SecuriLock™ coded keys are lost or stolen and you don't have an extra coded key, you will need to have your vehicle towed to an authorized dealer. The key codes need to be erased from your vehicle and new coded keys will need to be programmed.

Replacing coded keys can be very costly. Store an extra programmed key away from the vehicle in a safe place to help prevent any inconveniences. Please visit an authorized dealer to purchase additional spare or replacement keys.

Programming spare keys

You can program your own Integrated Keyhead Transmitters or standard SecuriLock™ coded keys to your vehicle. This procedure will program both the engine immobilizer keycode and the remote entry transmitter portion of the IKT to your vehicle. **Note**: A maximum of eight coded keys can be programmed to your vehicle; only four of these eight can be IKTs with remote entry functionality.

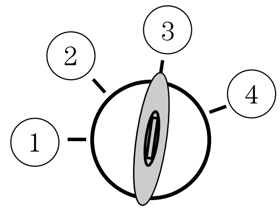
Tips:

- Only use Integrated Keyhead Transmitters (IKTs) or standard SecuriLock™ keys.
- You must have two previously programmed coded keys (keys that already operate your vehicle's engine) and the new unprogrammed key(s) readily accessible.

- If two previously programmed coded keys are not available, you must take your vehicle to your authorized dealer to have the spare key(s) programmed.

Please read and understand the entire procedure before you begin.

1. Insert the first previously programmed **coded key** into the ignition.



2. Turn the ignition from the 1 (LOCK) position to the 3 (RUN) position. Keep the ignition in the 3 (RUN) position for at least three seconds, but no more than 10 seconds.

3. Turn the ignition to the 1 (LOCK) position and remove the first **coded key** from the ignition.

4. Within ten seconds of turning the ignition to the 1 (LOCK) position, insert the second previously **coded key** into the ignition.

5. Turn the ignition from the 1 (LOCK) position to the 3 (RUN) position. Keep the ignition in the 3 (RUN) position for at least three seconds, but no more than 10 seconds.

6. Turn the ignition to the 1 (LOCK) position and remove the second previously programmed **coded key** from the ignition.

7. Within twenty seconds of turning the ignition to the 1 (LOCK) position and removing the previously programmed **coded key,** insert the new unprogrammed key (new key/valet key) into the ignition.

8. Turn the ignition from the 1 (LOCK) position to the 3 (RUN) position. Keep the ignition in the 3 (RUN) position for at least six seconds.

9. Remove the newly programmed **coded key** from the ignition.

If the key has been successfully programmed it will start the vehicle's engine and will operate the remote entry system (if the new key is an Integrated Keyhead Transmitter). The theft indicator light will illuminate for three seconds and then go out to indicate successful programming.

If the key was not successfully programmed, it will not start your vehicle's engine and/or will not operate the remote entry features. The theft indicator light may flash on and off. Wait 20 seconds and you may repeat Steps 1 through 8. If failure repeats, bring your vehicle to your authorized dealer to have the new key(s) programmed.

To program additional new unprogrammed key(s), wait twenty seconds and then repeat this procedure from Step 1.

PERIMETER ALARM SYSTEM

The perimeter anti-theft system will help protect your vehicle from unauthorized entry.

If there is any potential perimeter anti-theft problem with your vehicle, ensure **ALL Integrated Keyhead Transmitters** are brought to the authorized dealer to aid in troubleshooting.

Arming the system

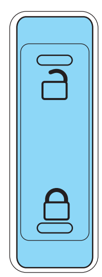
When armed, this system will respond if unauthorized entry is attempted. When unauthorized entry occurs, the system will flash the turn signal lamps and will sound the horn.

The system is ready to arm whenever the key is in the 1(LOCK) position, or is removed from the ignition. Either of the following actions will prearm the alarm system:

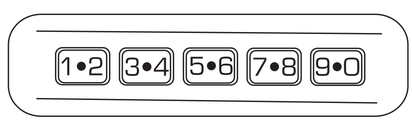
- Press the  control on the remote entry transmitter portion of your Integrated Keyhead Transmitter.

  When you press the lock control twice within three seconds on the remote entry transmitter portion of your IKT, the horn will chirp once to let you know that all doors, the hood and the liftgate are closed. If any of these are not closed, the horn will chirp twice to warn you that a door, the hood or the liftgate is still open.

- Press the driver or passenger interior door lock control while the door is open, then close the door.



- Press the 7 • 8 and 9 • 0 controls on the keyless entry pad (if equipped) at the same time to lock the doors (driver's door must be closed).



There is a 20 second countdown when any of the above actions occur before the vehicle becomes armed.

Each door, the hood, and the liftgate is armed individually, and if any are open, they must be closed before the open entry point (door, hood, or liftgate) can enter the 20 second countdown.

The turn signal lamps will flash once when all doors, the hood and the liftgate are closed indicating the vehicle is locked and entering the 20 second countdown.

Disarming the system

You can disarm the system by any of the following actions:

- Unlock the doors by using the remote entry transmitter portion of your Integrated Keyhead Transmitter.
- Unlock the doors by using your keyless entry pad (if equipped).
- Unlock the driver's door with a key. Turn the key full rearward (toward the rear of the vehicle) to ensure the alarm disarms.
- Turn ignition to the 3 (ON) position with a valid SecuriLock™ key or Integrated Keyhead Transmitter (IKT).
- Press the panic control on the remote entry transmitter portion of your IKT. This will only shut off the horn and turn lamps when the alarm is sounding. The alarm system will still be armed.

Pressing the power door UNLOCK control within the 20 second prearmed mode will return the vehicle to a disarmed state.

Triggering the anti-theft system

The armed system will be triggered if:

- Any door, the hood or the liftgate is opened without using the door key, keypad or the remote entry transmitter portion of your IKT.
- The ignition is turned to the 3 (ON) position with an invalid SecuriLock™ key or IKT.

SEATING

Notes:

Reclining the seatback can cause an occupant to slide under the seat's safety belt, resulting in severe personal injuries in the event of a collision.

Do not pile cargo higher than the seatbacks to reduce the risk of injury in a collision or sudden stop.

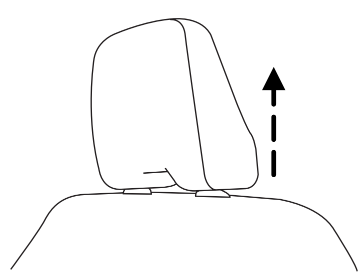
Before returning the seatback to its original position, make sure that cargo or any objects are not trapped behind the seatback. After returning the seatback to its original position, pull on the seatback to ensure that it has fully latched. An unlatched seat may become dangerous in the event of a sudden stop or collision.

Adjustable head restraints

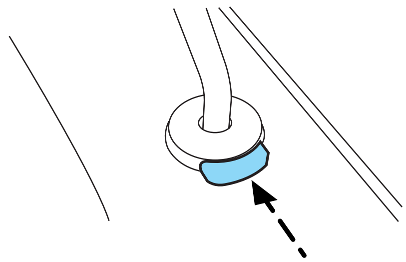
To minimize the risk of neck injury in the event of a crash, the driver and passenger occupants should not sit in and/or operate the vehicle, until the head restraint is placed in its proper position. The driver should never adjust the head restraint while the vehicle is in motion.

Head restraints help to limit head motion in the event of a rear collision. Adjust your head restraint so that it is located directly or as close as possible behind your head.

The head restraints can be moved up by pulling up on the head restraint.



Push release button to lower head restraint.



Adjusting the front power seat

Never adjust the driver's seat or seatback when the vehicle is moving.

Do not pile cargo higher than the seatbacks to reduce the risk of injury in a collision or sudden stop.

Always drive and ride with your seatback upright and the lap belt snug and low across the hips.

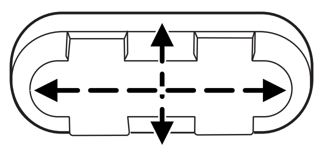
Reclining the seatback can cause an occupant to slide under the seat's safety belt, resulting in severe personal injuries in the event of a collision.

Sitting improperly out of position or with the seat back reclined too far can take off weight from the seat cushion and affect the decision of the front passenger sensing system, resulting in serious injury or death in a crash. Always sit upright against your seatback, with your feet on the floor.

To reduce the risk of possible serious injury: Do not hang objects off seat back or stow objects in the seatback map pocket (if equipped) when a child is in the front passenger seat. Do not place objects underneath the front passenger seat or between the seat and the center console (if equipped). Check the “passenger airbag off” or “pass airbag off” indicator lamp for proper airbag status. Refer to *Front passenger sensing system* section for additional details. Failure to follow these instructions may interfere with the front passenger seat sensing system.

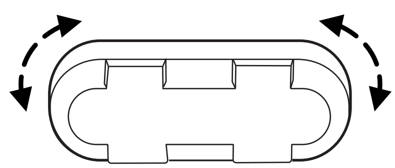
The control is located on the outboard side of the seat cushion.

Press the switch in the direction of the arrows to move the seat forward, backward, up or down.



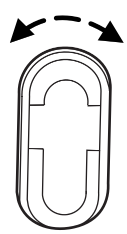
Tilt Function

Move the switch in the direction of the arrows to tilt the seat forward or backward.



Power recline (if equipped)

Press the control to recline the seatback forward or rearward.

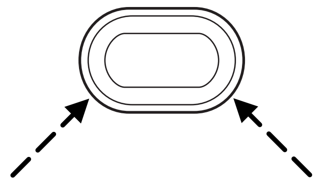


Using the power lumbar support

The power lumbar control is located on the outboard side of the seat.

Press one side of the control to adjust firmness.

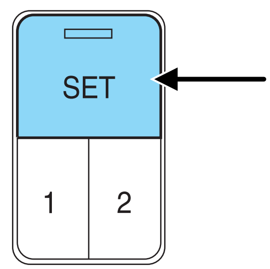
Press the other side of the control to adjust softness.



Memory seat and mirrors

This system allows automatic positioning of the driver seat and outside rearview mirrors, to two programmable positions.

The memory seat control is located on the driver door.



- To program position one, move the driver seat and exterior mirrors to the desired positions using the associated controls. Press the SET control. The SET control light will briefly illuminate. While the light is illuminated, press control 1.
- To program position two, repeat the previous procedure using control 2.

A position can only be recalled when the transmission gearshift is in Park (automatic transmission). A memory seat position may be programmed at any time.

The memory seat positions are also recalled when you press your remote entry transmitter UNLOCK control and the transmitter is programmed to a memory seat position or when you enter a valid customer code 1 or 2 on the keypad.

To program the memory seat to remote entry transmitter, refer to *Remote entry system* in the *Locks and Security chapter.*.

Note: The seat will not travel to its final position if the key is not in the ignition and the easy entry feature is enabled.

Easy-entry/easy-exit feature

This feature automatically moves the driver's seat rearward 2 inches (5 cm) when:

- the transmission is in N (Neutral) or P (Park)
- the key is removed from the ignition cylinder

The seat will move forward (to the original position) when:

- the transmission is in N (Neutral) or P (Park)
- the key is placed in the ignition cylinder

Heated and cooled seats

Heated seats

Persons who are unable to feel pain to the skin because of advanced age, chronic illness, diabetes, spinal cord injury, medication, alcohol use, exhaustion, or other physical conditions, must exercise care when using the seat heater. The seat heater may cause burns even at low temperatures, especially if used for long periods of time. Do not place anything on the seat that insulates against heat, such as a blanket or cushion, because this may cause the seat heater to overheat. Do not puncture the seat with pins, needles, or other pointed objects because this may damage the heating element which may cause the seat heater to overheat. An overheated seat may cause serious personal injury.

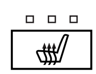
Note: Do not do the following:

- Place heavy objects on the seat
- Operate the seat heater if water or any other liquid is spilled on the seat. Allow the seat to dry thoroughly.

The heated seats will only function when the engine is running.

To operate the heated seats:

Press once to activate the high heat setting (3 indicator lights). Continue pressing to scroll through the other settings; medium heat (2 indicator lights), low heat (1 indicator light) or off.



The heated seats will turn off after 15 minutes.

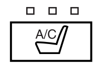
If the vehicle falls below 350 RPMs while the heated seats are on, the feature will turn itself off and will need to be reactivated.

Cooled seats

The cooled seats will only function when the engine is running.

To operate the cooled seats:

Press once to activate the high cool setting (3 indicator lights). Continue pressing to scroll through the other settings; medium cool (2 indicator lights), low cool (1 indicator light) or off.



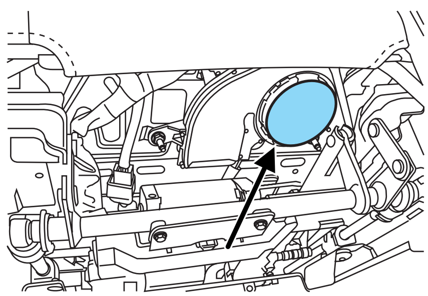
The cooled seats will turn off after 30 minutes.

If the vehicle falls below 350 RPMs while the cooled seats are on, the feature will turn itself off and will need to be reactivated.

Climate controlled seats air filter replacement

The climate controlled seat system includes air filters that must be replaced periodically. Refer to the *Scheduled Maintenance Guide* for more information.

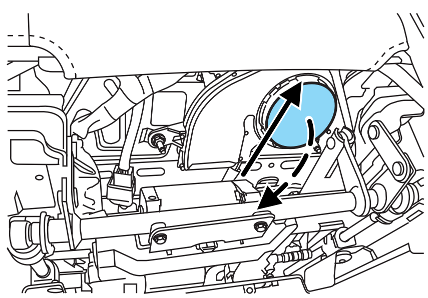
- There is a filter located under each front seat.



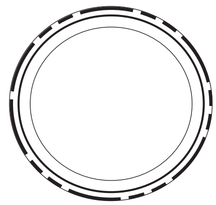
- The filter can be accessed from the first row seat. Move the front seats all the way back and up to ease access.

To remove an air filter:

- Remove key from ignition.
- Push up on the outside rigid edge of the filter until the tabs are released, then rotate the air filter toward the front of the vehicle.

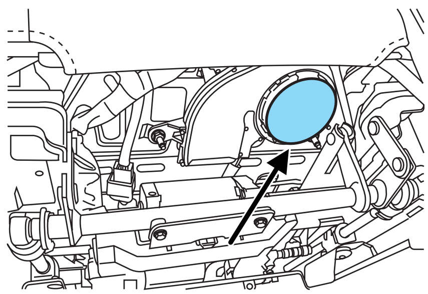


• Remove filter.



To install a filter:

• First, position the filter in it's housing making sure that the far forward end is all the way up in the housing. Then push in on the center of the outside edge of the filter and rotate up into the housing until it clips into position.

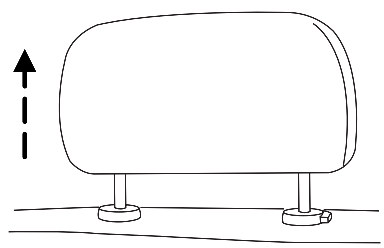


REAR SEATS

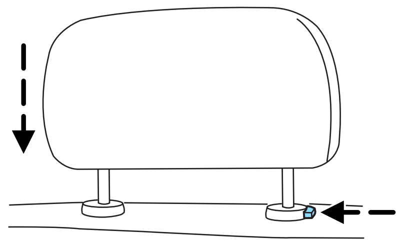
Head restraints

Lift the head restraint so that it is located directly or as close as possible behind your head.

The head restraints can be moved up by pulling up on the head restraint.



Push release button to lower head restraint.



Folding down the 60/40 rear seats

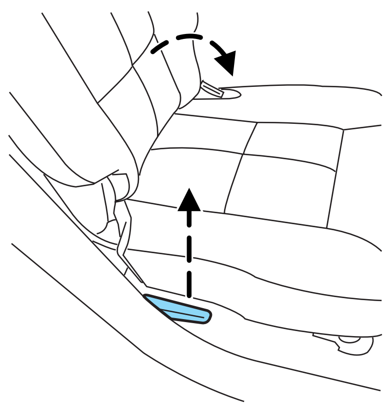
Note: The head restraints should be placed in the full down position before folding the seatback down.

Note: Ensure that no objects such as books, purses, or briefcases are on the floor in front of, on or under the second row seat cushion before actuating the release lever to cycle the seats to the load-floor position.

To prevent possible damage to the seat or safety belts, ensure that the safety belts are not buckled when moving the seat to the load floor position.

2nd row manual folding seat

To fold down the rear seat, pull up on the lever on the outboard side of the seat cushion and let the seatback rotate downward into the load floor position.



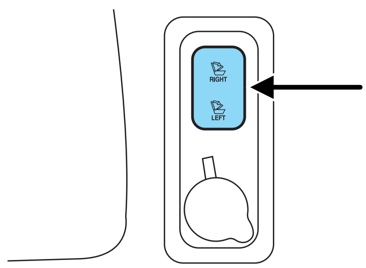
2nd row EasyFold™ seatback release

Ensure that the seat is unoccupied when folding it down. Folding the seat while occupied could result in damage to the seat or injury.

Note: The power feature is operational when the vehicle is in park and the lifgate has been open for less than 10 minutes.

The control buttons are located on the left-hand rear quarter trim panel (accessible from the liftgate area).

Press and hold the control mechanism to lower the seatback. The top portion lowers the right (40%) seatback, and the bottom portion lowers the left (60%) seatback.



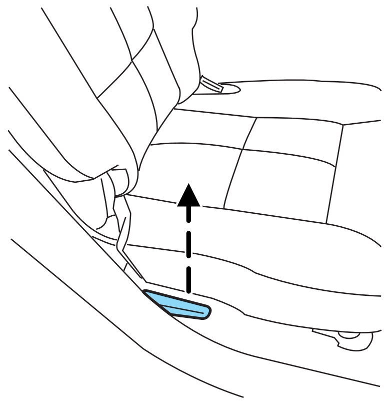
Returning the 2nd row seatback to the upright position

Before returning the seatback to its original position, make sure that cargo or any objects are not trapped behind the seatback. After returning the seatback to its original position, pull on the seatback to ensure that the latches are engaged. An unlatched seat may become dangerous in the event of a sudden stop or collision.

Rotate the seatback upward until the seatback latches in the upright position. The seatback will click when it is locked into position.

Adjusting the second row seatback

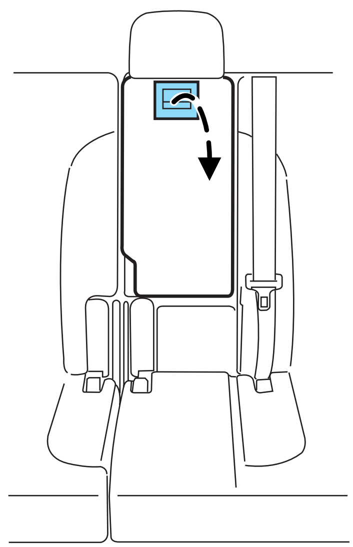
Reclining the seatback can cause an occupant to slide under the seat's safety belt, resulting in severe personal injuries in the event of a collision.



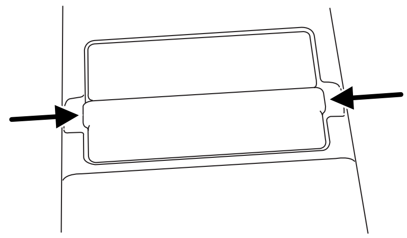
The second row seat reclines for additional comfort. To adjust the second row seatback to the desired position, while seated, pull the release lever up and push the seatback rearward.

Seat mounted armrest and cupholders

Your vehicle is equipped with a rear seat armrest. To fold the armrest down, release the latch located on the seatback by pressing down and pulling forward.



To access the cup holders, lift up one of the slotted areas on the cover.



Use only soft cups in the cupholder. Hard objects can injure you in a collision.

Returning the 2nd row armrest to the upright position

Close the cover on the cup holders. Rotate the armrest rearward until the armrest is in the latched position. The armrest will click when it is latched into position.

Rear heated seats (if equipped)

Persons who are unable to feel pain to the skin because of advanced age, chronic illness, diabetes, spinal cord injury, medication, alcohol use, exhaustion, or other physical conditions, must exercise care when using the seat heater. The seat heater may cause burns even at low temperatures, especially if used for long periods of time. Do not place anything on the seat that insulates against heat, such as a blanket or cushion, because this may cause the seat heater to overheat. Do not puncture the seat with pins, needles, or other pointed objects because this may damage the heating element which may cause the seat heater to overheat. An overheated seat may cause serious personal injury.

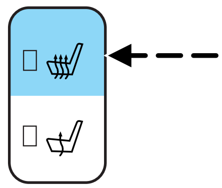
Note: Do not do the following:

- Place heavy objects on the seat
- Operate the seat heater if water or any other liquid is spilled on the seat. Allow the seat to dry thoroughly.

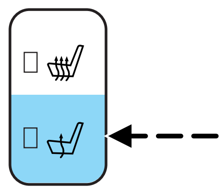
The rear seat heat controls are located on the rear door panels.

To operate the heated seats:

- Push the indicated side of the control for maximum heat.
- Push again to deactivate.



- Push the indicated side of the control for minimum heat.
- Push again to deactivate.



The heated seat module resets at every ignition run cycle. While the ignition is in the ON position, activating the high or low heated seat switch enables heating mode. When activated, they will turn off automatically when the engine is turned off.

The indicator light will illuminate when the heated seats have been activated.

SAFETY RESTRAINTS

Personal Safety System™

The Personal Safety System™ provides an improved overall level of frontal crash protection to front seat occupants and is designed to help further reduce the risk of airbag-related injuries. The system is able to analyze different occupant conditions and crash severity before activating the appropriate safety devices to help better protect a range of occupants in a variety of frontal crash situations.

Your vehicle's Personal Safety System™ consists of:

- Driver and passenger dual-stage airbag supplemental restraints.
- Front outboard safety belts with pretensioners, energy management retractors (first row only), and safety belt usage sensors.
- Driver's seat position sensor.
- Front passenger sensing system
- "Passenger airbag off" or "pass airbag off" indicator lamp

- Front crash severity sensors.
- Restraints Control Module (RCM) with impact and safing sensors.
- Restraint system warning light and back-up tone.
- The electrical wiring for the airbags, crash sensor(s), safety belt pretensioners, front safety belt usage sensors, driver seat position sensor, front passenger sensing system, and indicator lights.

How does the Personal Safety System™ work?

The Personal Safety System™ can adapt the deployment strategy of your vehicle's safety devices according to crash severity and occupant conditions. A collection of crash and occupant sensors provides information to the Restraints Control Module (RCM). During a crash, the RCM may activate the safety belt pretensioners and/or either one or both stages of the dual-stage airbag supplemental restraints based on crash severity and occupant conditions.

The fact that the pretensioners or airbags did not activate for both front seat occupants in a collision does not mean that something is wrong with the system. Rather, it means the Personal Safety System™ determined the accident conditions (crash severity, belt usage, etc.) were not appropriate to activate these safety devices. Front airbags are designed to activate only in frontal and near-frontal collisions (not rollovers, side impacts or rear impacts) unless the collision causes sufficient longitudinal deceleration. The pretensioners are designed to activate in frontal and near-frontal collisions, and in rollovers and side collisions when the Safety Canopy is activated.

Driver and passenger dual-stage airbag supplemental restraints

The dual-stage airbags offer the capability to tailor the level of airbag inflation energy. A lower, less forceful energy level is provided for more common, moderate-severity impacts. A higher energy level is used for the most severe impacts. Refer to *Airbag supplemental restraints* section in this chapter.

Front crash severity sensor

The front crash severity sensor enhances the ability to detect the severity of an impact. Positioned up front, it provides valuable information early in the crash event on the severity of the impact. This allows your Personal Safety System™ to distinguish between different levels of crash severity and modify the deployment strategy of the dual-stage airbags and safety belt pretensioners.

Driver's seat position sensor

The driver's seat position sensor allows your Personal Safety System™ to tailor the deployment level of the driver dual-stage airbag based on seat position. The system is designed to help protect smaller drivers sitting close to the driver airbag by providing a lower airbag output level.

Front passenger sensing system

For airbags to do their job they must inflate with great force, and this force can pose a potentially deadly risk to occupants that are very close to the airbag when it begins to inflate. For some occupants, this occurs because they are initially sitting very close to the airbag. For other occupants, this occurs when the occupant is not properly restrained by safety belts or child safety seats and they move forward during pre-crash braking. The most effective way to reduce the risk of unnecessary injuries is to make sure all occupants are properly restrained. Accident statistics suggest that children are much safer when properly restrained in the rear seating positions than in the front.

Air bags can kill or injure a child in a child seat. **NEVER** place a rear-facing child seat in front of an active air bag. If you must use a forward-facing child seat in the front seat, move the seat all the way back.

Always transport children 12 years old and under in the back seat and always properly use appropriate child restraints.

The front passenger sensing system can automatically turn off the front passenger airbag and passenger seat-mounted side airbag. The system is designed to help protect small (child size) occupants from frontal airbag deployments when they are seated or restrained in the front passenger seat contrary to proper child-seating or restraint usage recommendations. Even with this technology, parents are **STRONGLY** encouraged to always properly restrain children in the rear seat. The sensor also turns off the passenger front airbag and passenger seat-mounted side airbag (if equipped) when the passenger seat is empty and the safety belt is unbuckled.

Front safety belt usage sensors

The front safety belt usage sensors detect whether or not the driver and front outboard passenger safety belts are fastened. This information allows your Personal Safety System™ to tailor the airbag deployment and safety belt pretensioner activation depending upon safety belt usage. Refer to *Safety belt* section in this chapter.

Front safety belt pretensioners

The safety belt pretensioners at the front outboard seating positions are designed to tighten the safety belts firmly against the occupant's body during frontal collisions, and in rollover and side collisions when the Safety Canopy is activated. This helps increase the effectiveness of the safety belts. In frontal collisions, the safety belt pretensioners can be activated alone or, if the collision is of sufficient severity, together with the front airbags.

Front safety belt energy management retractors

The front outboard safety belt energy management retractors allow webbing to be pulled out of the retractor in a gradual and controlled manner in response to the occupant's forward momentum. This helps reduce the risk of force-related injuries to the occupant's chest by limiting the load on the occupant. Refer to *Energy management feature* section in this chapter.

Determining if the Personal Safety System™ is operational

The Personal Safety System™ uses a warning light in the instrument cluster or a back-up tone to indicate the condition of the system. Refer to the *Warning light* section in the *Instrument Cluster* chapter. Routine maintenance of the Personal Safety System™ is not required.

The Restraints Control Module (RCM) monitors its own internal circuits and the circuits for the airbag supplemental restraints, crash sensor(s), safety belt pretensioners, front safety belt buckle sensors, driver seat position sensor, and front passenger sensing system. In addition, the RCM also monitors the restraints warning light in the instrument cluster. A difficulty with the system is indicated by one or more of the following.

- The warning light will either flash or stay lit.
- The warning light will not illuminate immediately after ignition is turned on.
- A series of five beeps will be heard. The tone pattern will repeat periodically until the problem and warning light are repaired.

If any of these things happen, even intermittently, have the Personal Safety System™ serviced at an authorized dealer immediately. Unless serviced, the system may not function properly in the event of a collision.

Safety belt precautions

Always drive and ride with your seatback upright and the lap belt snug and low across the hips.

To reduce the risk of injury, make sure children sit where they can be properly restrained.

Never let a passenger hold a child on his or her lap while the vehicle is moving. The passenger cannot protect the child from injury in a collision.

All occupants of the vehicle, including the driver, should always properly wear their safety belts, even when an air bag supplemental restraint system (SRS) is provided.

It is extremely dangerous to ride in a cargo area, inside or outside of a vehicle. In a collision, people riding in these areas are more likely to be seriously injured or killed. Do not allow people to ride in any area of your vehicle that is not equipped with seats and safety belts. Be sure everyone in your vehicle is in a seat and using a safety belt properly.

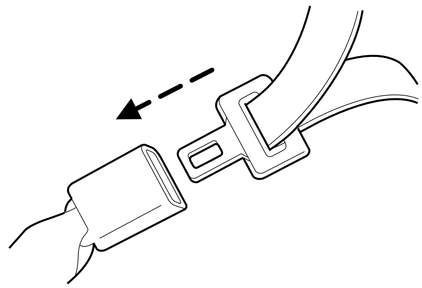
In a rollover crash, an unbelted person is significantly more likely to die than a person wearing a seat belt.

Each seating position in your vehicle has a specific safety belt assembly which is made up of one buckle and one tongue that are designed to be used as a pair. 1) Use the shoulder belt on the outside shoulder only. Never wear the shoulder belt under the arm. 2) Never swing the safety belt around your neck over the inside shoulder. 3) Never use a single belt for more than one person.

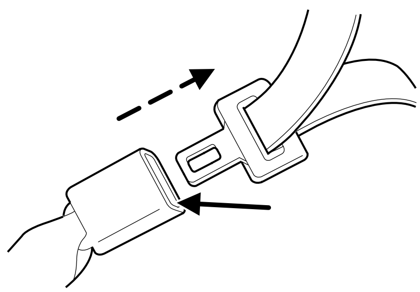
Always transport children 12 years old and under in the back seat and always properly use appropriate child restraints.

Combination lap and shoulder belts

1. Insert the belt tongue into the proper buckle (the buckle closest to the direction the tongue is coming from) until you hear a snap and feel it latch. Make sure the tongue is securely fastened in the buckle.



2. To unfasten, push the release button and remove the tongue from the buckle.



All restraints in the vehicle are combination lap and shoulder belts.

While you are fastened in the safety belt, the combination lap/shoulder belt adjusts to your movement. However, if you brake hard, turn hard, or if your vehicle receives an impact of 5 mph (8 km/h) or more, the safety belt will become locked and help reduce your forward movement.

Energy Management Feature — Front Outboard

- This vehicle has a safety belt system with an energy management feature at the front seats to help further reduce the risk of injury in the event of a head-on collision.
- The energy management feature has a retractor assembly that is designed to extend the safety belt webbing in a controlled manner. This helps reduce the belt force acting on the user's chest.

Failure to inspect and replace if necessary the Belt and Retractor assembly after an accident could increase the risk of injury in a collision.

All safety restraints in the vehicle are combination lap and shoulder belts. All of the passenger combination lap and shoulder belts have two types of locking modes described below:

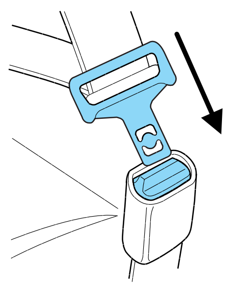
Vehicle sensitive mode

This is the normal retractor mode, which allows free shoulder belt length adjustment to your movements and locking in response to vehicle movement. For example, if the driver brakes suddenly or turns a corner sharply, or the vehicle receives an impact of approximately 5 mph (8 km/h) or more, the combination safety belts will lock to help reduce forward movement of the driver and passengers.

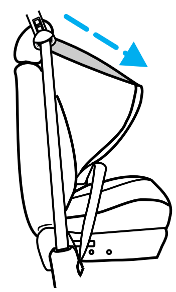
Automatic locking mode

How to use the automatic locking mode

- Buckle the combination lap and shoulder belt.



- Grasp the shoulder portion and pull downward until the entire belt is pulled out.



- Allow the belt to retract. As the belt retracts, you will hear a clicking sound. This indicates the safety belt is now in the automatic locking mode.

When to use the automatic locking mode

In this mode, the shoulder belt is automatically pre-locked. The belt will still retract to remove any slack in the shoulder belt. The automatic locking mode is not available on the driver safety belt.

This mode should be used **any time** a child safety seat, except a booster, is installed in passenger front or rear seating positions. Children 12 years old and under should be properly restrained in the rear seat whenever possible. Refer to *Safety restraints for children* or *Safety seats for children* later in this chapter.

How to disengage the automatic locking mode

Ford Motor Company recommends that all passenger safety belt assemblies and attaching hardware should be inspected by an authorized dealer after any collision to verify that the ″automatic locking retractor″ feature for child seats is still working properly. Safety belt assemblies should be inspected by an authorized dealer and must be replaced if either damage or improper operation is noted. Failure to replace the belt and retractor assembly could increase the risk of injury in a collision.

Unbuckle the combination lap/shoulder belt and allow it to retract completely to disengage the automatic locking mode and activate the vehicle sensitive (emergency) locking mode.

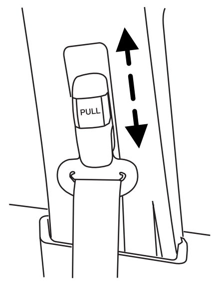
Safety belt pretensioner

Your vehicle is equipped with safety belt pretensioners at the driver and front outboard passenger seating positions.

The safety belt pretensioner tightens the safety belts firmly against the occupant's body at the start of the crash.

The driver and front passenger safety belt system (including retractors, buckles and height adjusters) must be replaced if the vehicle is involved in a collision that results in deployment of front airbags, seat-mounted side airbags and Safety Canopy™, and safety belt pretensioners.

Safety belt height adjustment

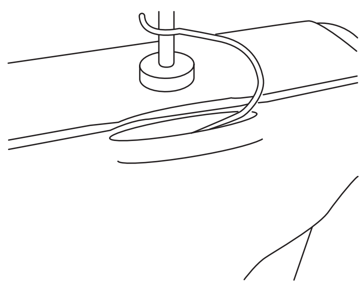


Your vehicle has safety belt height adjustments at the front outboard seating positions. Adjust the height of the shoulder belt so the belt rests across the middle of your shoulder.

To adjust the shoulder belt height, pull on the center button and slide the height adjuster up or down. Release the button and pull down on the height adjuster to make sure it is locked in place.

Position the safety belt height adjusters so that the belt rests across the middle of your shoulder. Failure to adjust the safety belt properly could reduce the effectiveness of the safety belt and increase the risk of injury in a collision.

Second row comfort guide

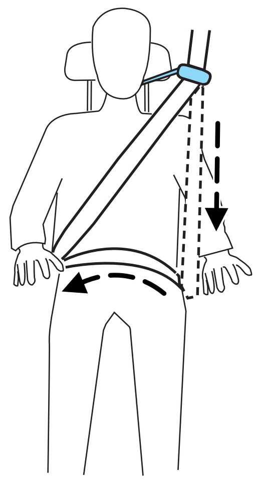


The second row outboard lap/shoulder belt is equipped with a belt comfort guide. This guide is attached to the head restraint and is stored in a pocket in the seatback. It is used to adjust the comfort of the shoulder belt for smaller occupants in the outboard second row seats.

To adjust the comfort guide:

1. Slip the shoulder belt into the belt guide.

2. Slide the guide up or down along the webbing so that the belt is centered on the occupant's shoulder.



Position the safety belt comfort guide so that the belt rests across the middle of your shoulder. Failure to adjust the safety belt properly could reduce the effectiveness of the safety belt and increase the risk of injury in a collision.

Safety belt extension assembly

If the safety belt is too short when fully extended, there is a 8 inch (20 cm) safety belt extension assembly that can be added (part number 611C22). This assembly can be obtained from an authorized dealer.

Use only extensions manufactured by the same supplier as the safety belt. Manufacturer identification is located at the end of the webbing on the label. Also, use the safety belt extension only if the safety belt is too short for you when fully extended.

Do not use extensions to change the fit of the shoulder belt across the torso.

Safety belt maintenance

Inspect the safety belt systems periodically to make sure they work properly and are not damaged. Inspect the safety belts to make sure there are no nicks, tears or cuts. Replace if necessary. All safety belt assemblies, including retractors, buckles, front safety belt buckle assemblies, buckle support assemblies (slide bar-if equipped), shoulder belt height adjusters (if equipped), shoulder belt guide on seatback (if equipped), child safety seat LATCH and tether anchors, and attaching hardware, should be inspected after a collision. Ford Motor Company recommends that all safety belt assemblies in use in vehicles involved in a collision be replaced. However, if the collision was minor and an authorized dealer finds that the belts do not show damage and continue to operate properly, they do not need to be replaced. Safety belt assemblies not in use during a collision should also be inspected and replaced if either damage or improper operation is noted.

Failure to inspect and if necessary replace the safety belt assembly under the above conditions could result in severe personal injuries in the event of a collision.

For proper care of soiled safety belts, refer to *Interior* in the *Cleaning* chapter.

Safety belt warning light and indicator chime

The safety belt warning light illuminates in the instrument cluster and a chime sounds to remind the occupants to fasten their safety belts.

Conditions of operation

If...	Then...
The driver's safety belt is not buckled before the ignition switch is turned to the ON position...	The safety belt warning light illuminates 1-2 minutes and the warning chime sounds 4-8 seconds.
The driver's safety belt is buckled while the indicator light is illuminated and the warning chime is sounding...	The safety belt warning light and warning chime turn off.
The driver's safety belt is buckled before the ignition switch is turned to the ON position...	The safety belt warning light and indicator chime remain off.

Belt-Minder®

The Belt-Minder® feature is a supplemental warning to the safety belt warning function. This feature provides additional reminders by intermittently sounding a chime and illuminating the safety belt warning light in the instrument cluster when the driver's and front passenger's safety belt is unbuckled.

The Belt-Minder® feature uses information from the front passenger sensing system to determine if a front seat passenger is present and therefore potentially in need of a warning. To avoid activating the Belt-Minder® feature for objects placed in the front passenger seat, warnings will only be given to large front seat occupants as determined by the front passenger sensing system.

Both the driver's and passenger's safety belt usages are monitored and either may activate the Belt-Minder® feature. The warnings are the same for the driver and the front passenger. If the Belt-Minder® warnings have expired (warnings for approximately 5 minutes) for one occupant (driver or front passenger), the other occupant can still activate the Belt-Minder® feature.

If...	Then...
The driver's and front passenger's safety belts are buckled before the ignition switch is turned to the ON position or less than 1-2 minutes have elapsed since the ignition switch has been turned ON...	The Belt-Minder® feature will not activate.
The driver's or front passenger's safety belt is not buckled when the vehicle has reached at least 3 mph (5 km/h) and 1-2 minutes have elapsed since the ignition switch has been turned to ON...	The Belt-Minder® feature is activated - the safety belt warning light illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until the safety belts are buckled.
The driver's or front passenger's safety belt becomes unbuckled for approximately 1 minute while the vehicle is traveling at least 3 mph (5 km/h) and more than 1-2 minutes have elapsed since the ignition switch has been turned to ON...	The Belt-Minder® feature is activated - the safety belt warning light illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until the safety belts are buckled.

The following are reasons most often given for not wearing safety belts (All statistics based on U.S. data):

Reasons given...	**Consider...**
"Crashes are rare events"	**36700 crashes occur every day.** The more we drive, the more we are exposed to "rare" events, even for good drivers. *1 in 4 of us will be seriously injured in a crash during our lifetime.*
"I'm not going far"	**3 of 4** fatal crashes occur within **25** miles (40 km) of home.
"Belts are uncomfortable"	We design our safety belts to enhance comfort. If you are uncomfortable - try different positions for the safety belt upper anchorage and seatback which should be as upright as possible; this can improve comfort.
"I was in a hurry"	**Prime time for an accident.** Belt-Minder® reminds us to take a few seconds to buckle up.
"Safety belts don't work"	**Safety belts,** when used properly, **reduce risk of death** to front seat occupants by **45% in cars,** and by **60% in light trucks.**
"Traffic is light"	**Nearly 1 of 2 deaths occur in single-vehicle crashes,** many when no other vehicles are around.
"Belts wrinkle my clothes"	Possibly, but a serious crash can do much more than wrinkle your clothes, particularly if you are unbelted.
"The people I'm with don't wear belts"	Set the example, teen deaths occur 4 times more often in vehicles with TWO or MORE people. Children and younger brothers/sisters imitate behavior they see.

Reasons given...	Consider...
"I have an airbag"	Airbags offer greater protection when used with safety belts. Frontal airbags are not designed to inflate in rear and side crashes or rollovers.
"I'd rather be thrown clear"	Not a good idea. **People** who are **ejected are 40 times more likely to DIE.** Safety belts help prevent ejection, WE CAN'T "PICK OUR CRASH".

Do not sit on top of a buckled safety belt or insert a latchplate into the buckle to avoid the Belt-Minder® chime. To do so may adversely affect the performance of the vehicle's air bag system.

One time disable

If at any time the driver/front passenger quickly buckles then unbuckles the safety belt for that seating position, the Belt-Minder® is disabled for the current ignition cycle. The Belt-Minder® feature will enable during the same ignition cycle if the occupant buckles and remains buckled for approximately 30 seconds. Confirmation is not given for the one time disable.

Deactivating/activating the Belt-Minder® feature

The driver and front passenger Belt-Minder® are deactivated/activated independently. When deactivating/activating one seating position, do not buckle the other position as this will terminate the process.

Read Steps 1 - 4 thoroughly before proceeding with the deactivation/activation programming procedure.

Note: The driver and front passenger Belt-Minder® features must be disabled/enabled separately. Both cannot be disable/enabled during the same key cycle.

The driver and front passenger Belt-Minder® features can be deactivated/activated by performing the following procedure:

Before following the procedure, make sure that:

- The parking brake is set
- The gearshift is in N (Neutral) (manual transmission)
- The gearshift is in P (Park) (automatic transmission)
- The ignition switch is in the OFF position
- The driver and front passenger safety belts are unbuckled

While the design allows you to deactivate your Belt-Minder®, this system is designed to improve your chances of being safely belted and surviving an accident. We recommend you leave the Belt-Minder® system activated for yourself and others who may use the vehicle. To reduce the risk of injury, do not deactivate/activate the Belt-Minder® feature while driving the vehicle.

1. Turn the ignition switch to the RUN (or ON) position. DO NOT START THE ENGINE.

2. Wait until the safety belt warning light turns off (Approximately 1–2 minutes).

- Step 3 must be completed within 50 seconds after the safety belt warning light turns off.

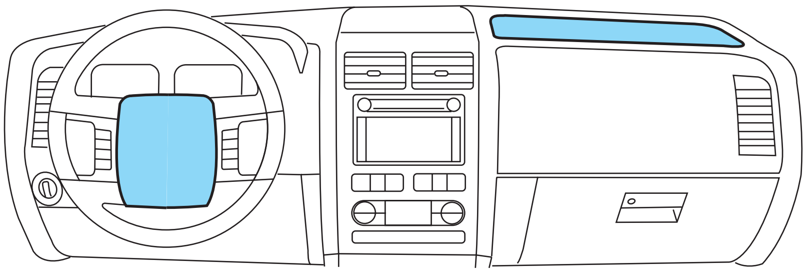
3. For the seating position being disabled, at a moderate speed, buckle then unbuckle the safety belt nine times, ending in the unbuckled state. Step 3 must be completed within 50 seconds after the safety belt warning light turns off.

- After Step 3, the safety belt warning light will be turned on for three seconds.

4. Within approximately seven seconds of the light turning off, buckle then unbuckle the safety belt.

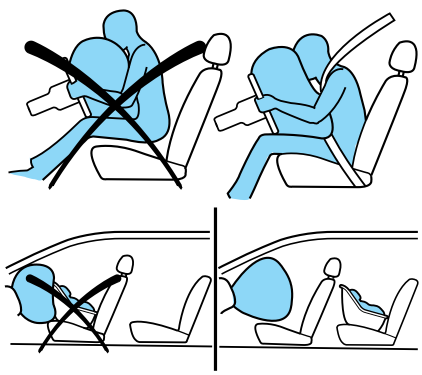
- This will disable the Belt-Minder® feature for that seating position if it is currently enabled. As confirmation, the safety belt warning light will flash four times per second for three seconds.
- This will enable the Belt-Minder® feature for that seating position if it is currently disabled. As confirmation, the safety belt warning light will flash four times per second for three seconds, followed by three seconds with the light off, then followed by the safety belt warning light flashing four times per second for three seconds again.

AIRBAG SUPPLEMENTAL RESTRAINT SYSTEM (SRS)



Important supplemental restraint system precautions

Airbags DO NOT inflate slowly or gently and the risk of injury from a deploying airbag is greatest close to the trim covering the airbag module.



> ⚠ All occupants of the vehicle, including the driver, should always properly wear their safety belts, even when an air bag supplemental restraint system (SRS) is provided.

> ⚠ Always transport children 12 years old and under in the back seat and always properly use appropriate child restraints.

> ⚠ National Highway Traffic Safety Administration (NHTSA) recommends a minimum distance of at least 10 inches (25 cm) between an occupant's chest and the driver airbag module.

Never place your arm over the airbag module as a deploying airbag can result in serious arm fractures or other injuries.

Steps you can take to properly position yourself away from the airbag:

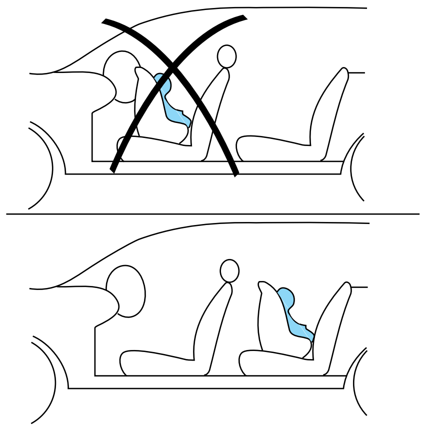
- Move your seat to the rear as far as you can while still reaching the pedals comfortably.
- Recline the seat slightly (one or two degrees) from the upright position.

Do not put anything on or over the airbag module. Placing objects on or over the airbag inflation area may cause those objects to be propelled by the airbag into your face and torso causing serious injury.

Do not attempt to service, repair, or modify the airbag supplemental restraint system (SRS) or its fuses. See your authorized dealer.

Modifying or adding equipment to the front end of the vehicle (including frame, bumper, front end body structure and tow hooks) may affect the performance of the airbag system, increasing the risk of injury. Do not modify the front end of the vehicle.

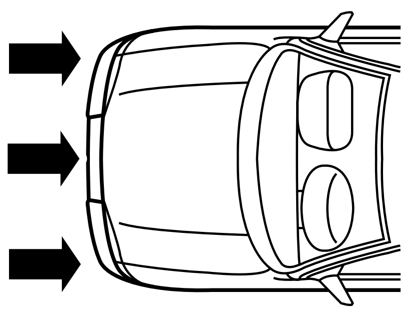
Children and airbags



Children must always be properly restrained. Accident statistics suggest that children are safer when properly restrained in the rear seating positions than in the front seating position. Failure to follow these instructions may increase the risk of injury in a collision.

> ⚠ Airbags can kill or injure a child in a child seat. **NEVER** place a rear-facing child seat in front of an active airbag. If you must use a forward-facing child seat in the front seat, move the seat all the way back.

How does the safety belt pretensioner and airbag supplemental restraint system work?



The safety belt pretensioner and airbag SRS are designed to activate when the vehicle sustains longitudinal deceleration sufficient to cause the sensors to close an electrical circuit that initiates pretensioner activation and airbag inflation.

The fact that the airbags did not activate in a collision does not mean that something is wrong with the system. Rather, it means the forces were not of the type sufficient to cause activation. Front airbags are designed to activate in frontal and near-frontal collisions, not rollover, side-impact, or rear-impacts unless the collision causes sufficient longitudinal deceleration.

The airbags inflate and deflate rapidly upon activation. After airbag deployment, it is normal to notice a smoke-like, powdery residue or smell the burnt propellant. This may consist of cornstarch, talcum powder (to lubricate the bag) or sodium compounds (e.g., baking soda) that result from the combustion process that inflates the airbag. Small amounts of sodium hydroxide may be present which may irritate the skin and eyes, but none of the residue is toxic.

While the system is designed to help reduce serious injuries, contact with a deploying airbag may also cause abrasions, swelling or temporary hearing loss. Because airbags must inflate rapidly and with considerable force, there is the risk of death or serious injuries such as fractures, facial and eye injuries or internal injuries, particularly to occupants who are not properly restrained or are otherwise out of position at the time of airbag deployment. Thus, it is extremely important that occupants be properly restrained as far away from the airbag module as possible while maintaining vehicle control.

Several air bag system components get hot after inflation. Do not touch them after inflation.

If the air bag has deployed, **the air bag will not function again and must be replaced immediately.** If the air bag is not replaced, the unrepaired area will increase the risk of injury in a collision.

The SRS consists of:

- driver and passenger airbag modules (which include the inflators and airbags)
- seat-mounted side airbags . Refer to *Seat-mounted side airbag system* later in this chapter
- safety belt pretensioners
- one or more impact and safing sensors

- a readiness light and tone
- and the electrical wiring which connects the components
- Side curtain airbag system. Refer to *Safety Canopy™ system* later in this chapter.
- Front passenger sensing system. Refer to *Front passenger sensing system.* later in this chapter.
- “Passenger airbag off” or “pass airbag off” indicator lamp. Refer to *Front passenger sensing system.* later in this chapter.

The diagnostic module monitors its own internal circuits and the supplemental airbag electrical system wiring (including the impact sensors), the system wiring, the airbag system readiness light, the airbag back up power, the airbag ignitors and safety belt pretensioners.

Front passenger sensing system

The front passenger sensing system is designed to meet the regulatory requirements of Federal Motor Vehicle Safety Standard (FMVSS) 208 and is designed to disable (will not inflate) the front passenger’s frontal airbag under certain conditions.

The front passenger sensing system works with sensors that are part of the front passenger’s seat and safety belt. The sensors are designed to detect the presence of a properly seated occupant and determine if the front passenger’s frontal airbag should be enabled (may inflate) or disabled (will not inflate).

The front passenger sensing system will disable (will not inflate) the front passenger’s frontal airbag if:

- the front passenger seat is unoccupied, or has small/medium objects in the front seat.
- the system determines that an infant is present in a rear-facing infant seat that is installed according to the manufacturer’s instructions.
- the system determines that a small child is present in a forward-facing child restraint that is installed according to the manufacturer’s instructions.
- the system determines that a small child is present in a booster seat.
- a front passenger takes his/her weight off of the seat for a period of time.

The front passenger sensing system uses a ″passenger airbag off″ or ″pass airbag off″ indicator which will illuminate and stay lit to remind you that the front passenger frontal airbag is disabled. The indicator lamp is located in the center stack of the instrument panel above the climate controls.

PASS AIRBAG OFF

Note: The indicator lamp will illuminate for a short period of time when the ignition is turned to the ON position to confirm it is functional.

When the front passenger seat is not occupied (empty seat) or in the event that the front passenger frontal airbag is enabled (may inflate), the indicator lamp will be unlit.

The front passenger sensing system is designed to disable (will not inflate) the front passenger's frontal airbag when a rear facing infant seat, a forward-facing child restraint, or a booster seat is detected.

- When the front passenger sensing system disables (will not inflate) the front passenger frontal airbag, the indicator lamp will illuminate and stay lit to remind you that the front passenger frontal airbag is disabled.
- If the child restraint has been installed and the indicator lamp is not lit, then turn the vehicle off, remove the child restraint from the vehicle and reinstall the restraint following the child restraint manufacturer's instructions.

The front passenger sensing system is designed to enable (may inflate) the front passenger's frontal airbag anytime the system senses that a person of adult size is sitting properly in the front passenger seat.

- When the front passenger sensing system enables the front passenger frontal airbag (may inflate), the indicator lamp will be unlit and stay unlit.

If a person of adult size is sitting in the front passenger's seat, but the ″passenger airbag off″ or ″pass airbag off″ indicator lamp is lit, it is possible that the person isn't sitting properly in the seat. If this happens:

- Turn the vehicle off and ask the person to place the seatback in the full upright position.
- Have the person sit upright in the seat, centered on the seat cushion, with the person's legs comfortably extended.
- Restart the vehicle and have the person remain in this position for about two minutes. This will allow the system to detect that person and enable the passenger's frontal airbag.

- If the indicator lamp remains lit even after this, the person should be advised to ride in the rear seat.

Occupant	**Pass Airbag Off Indicator Lamp**	**Passenger Airbag**
Empty seat	Unlit	Disabled
Small child in child safety seat or booster	Lit	Disabled
Small child with safety belt buckled or unbuckled	Lit	Disabled
Adult	Unlit	Enabled

Even with Advanced Restraints Systems, children 12 and under should be properly restrained in the back seat.

After all occupants have adjusted their seats and put on safety belts, it's very important that they continue to sit properly. A properly seated occupant sits upright, leaning against the seat back, and centered on the seat cushion, with their feet comfortably extended on the floor. Sitting improperly can increase the chance of injury in a crash event. For example, if an occupant slouches, lies down, turns sideways, sits forward, leans forward or sideways, or puts one or both feet up, the chance of injury during a crash is greatly increased.

Sitting improperly out of position or with the seat back reclined too far can take off weight from the seat cushion and affect the decision of the front passenger sensing system, resulting in serious injury or death in a crash.
Always sit upright against your seatback, with your feet on the floor.

The front passenger sensing system may detect small or medium objects placed on the seat cushion. For most objects that are in the front passenger seat, the passenger airbag will be disabled. Even though the passenger airbag is disabled, the ″pass airbag off″ lamp may or may not be illuminated according to the table below.

Objects	Pass Airbag Off Indicator Lamp	Passenger Airbag
Small (i.e. 3 ring binder, small purse, bottled water)	Unlit	Disabled
Medium (i.e. heavy briefcase, fully packed luggage)	Lit	Disabled
Empty seat, or small to medium object with safety belt buckled	Lit	Disabled

If you think that the status of the passenger airbag off indicator lamp is incorrect, check for the following:

- Objects lodged underneath the seat
- Objects between the seat cushion and the center console (if equipped)
- Objects hanging off the seat back
- Objects stowed in the seatback map pocket (if equipped)
- Objects placed on the occupant's lap
- Cargo interference with the seat
- Other passengers pushing or pulling on the seat
- Rear passenger feet and knees resting or pushing on the seat

The conditions listed above may cause the weight of a properly seated occupant to be incorrectly interpreted by the front passenger sensing system. The person in the front passenger seat may appear heavier or lighter due to the conditions described in the list above.

To reduce the risk of possible serious injury:
Do not stow objects in seat back map pocket (if equipped) or hang objects off seat back if a child is in the front passenger seat.
Do not place objects underneath the front passenger seat or between the seat and the center console (if equipped).
Check the "passenger airbag off" or "pass airbag off" indicator lamp for proper airbag status.
Failure to follow these instructions may interfere with the front passenger seat sensing system.

In case there is a problem with the front passenger sensing system, the airbag readiness light in the instrument cluster will stay lit.

If the airbag readiness light is lit, do the following:

The driver and/or adult passengers should check for any objects that may be lodged underneath the front passenger seat or cargo interfering with the seat.

If objects are lodged and/or cargo is interfering with the seat; please take the following steps to remove the obstruction:

- Pull the vehicle over.
- Turn the vehicle off.
- Driver and/or adult passengers should check for any objects lodged underneath the front passenger seat or cargo interfering with the seat.
- Remove the obstruction(s) (if found).
- Restart the vehicle.
- Wait at least 2 minutes and verify that the airbag readiness light is no longer illuminated
- If the airbag readiness light remains illuminated, this may or may/not be a problem due to the front passenger sensing system.

DO NOT attempt to repair or service the system; take your vehicle immediately to an authorized dealer.

If it is necessary to modify an advanced front airbag system to accommodate a person with disabilities, contact the Ford Customer Relationship Center at the phone number shown in the *Customer Assistance* section of this *Owner's Guide*.

> ⚠ Any alteration/modification to the front passenger seat may affect the performance of the front passenger sensing system.

Determining if the system is operational

The supplemental restraint system uses a warning indicator light in the instrument cluster or a back-up tone to indicate the condition of the system. Refer to the *Warning lights and chimes* section in the *Instrument Cluster* chapter. Routine maintenance of the airbag is not required.

A difficulty with the system is indicated by one or more of the following:

- The readiness light (same light for front and side airbag system) will either flash or stay lit.
- The readiness light will not illuminate immediately after ignition is turned on.
- A series of five beeps will be heard. The tone pattern will repeat periodically until the problem and/or light are repaired.

If any of these things happen, even intermittently, have the supplemental restraint system serviced at an authorized dealer immediately. Unless serviced, the system may not function properly in the event of a collision.

Seat-mounted side airbag system

Do not place objects or mount equipment on or near the airbag cover on the side of the seatbacks of the front seats or in front seat areas that may come into contact with a deploying airbag. Failure to follow these instructions may increase the risk of personal injury in the event of a collision.

Do not use accessory seat covers. The use of accessory seat covers may prevent the deployment of the side airbags and increase the risk of injury in an accident.

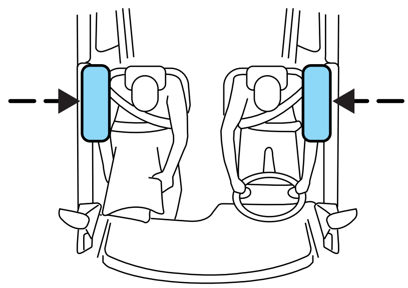
Do not lean your head on the door. The side airbag could injure you as it deploys from the side of the seatback.

Do not attempt to service, repair, or modify the airbag SRS, its fuses or the seat cover on a seat containing an airbag. See your authorized dealer.

All occupants of the vehicle should always wear their safety belts even when an airbag SRS is provided.

How does the side airbag system work?

The design and development of the side airbag system included recommended testing procedures that were developed by a group of automotive safety experts known as the Side Airbag Technical Working Group. These recommended testing procedures help reduce the risk of injuries related to the deployment of side airbags.



The side airbag system consists of the following:

- An inflatable nylon bag (airbag) with a gas generator concealed behind the outboard bolster of the driver and front passenger seatbacks.
- The same warning light, electronic control and diagnostic unit as used for the front airbags.
- Two crash sensors mounted on the B pillar (one on each side of the vehicle).
- Two crash sensors located at the C pillar behind the rear doors (one on each side of the vehicle).

Side airbags, in combination with safety belts, can help reduce the risk of severe injuries in the event of a significant side impact collision.

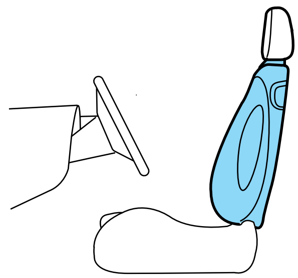
The side airbags are fitted on the outboard side of the seatbacks of the front seats. In certain lateral collisions, the airbag on the side affected by the collision will be inflated. If the front passenger sensing system detects an empty seat, the front passenger seat-mounted side airbag will be deactivated. The airbag was designed to inflate between the door panel and occupant to further enhance the protection provided occupants in side impact collisions.

The airbag SRS is designed to activate when the vehicle sustains lateral deceleration sufficient to cause the sensors to close an electrical circuit that initiates airbag inflation.

The fact that the airbags did not inflate in a collision does not mean that something is wrong with the system. Rather, it means the forces were not of the type sufficient to cause activation. Side airbags are designed to inflate in side-impact collisions, not roll-over, rear-impact, frontal or near-frontal collisions, unless the collision causes sufficient lateral deceleration.

Several air bag system components get hot after inflation. Do not touch them after inflation.

If the side airbag has deployed, **the airbag will not function again. The side airbag system (including the seat) must be inspected and serviced by an authorized dealer.** If the airbag is not replaced, the unrepaired area will increase the risk of injury in a collision.



Determining if the system is operational

The SRS uses a readiness light in the instrument cluster or a tone to indicate the condition of the system. Refer to the *Airbag readiness* section in the *Instrument cluster* chapter. Routine maintenance of the airbag is not required.

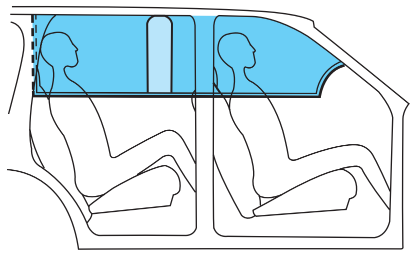
Any difficulty with the system is indicated by one or more of the following:

- The readiness light (same light as used for front airbag system) will either flash or stay lit.
- The readiness light will not illuminate immediately after ignition is turned to the RUN position.
- A series of five beeps will be heard. The tone pattern will repeat periodically until the problem and light are repaired.

If any of these things happen, even intermittently, have the SRS serviced at an authorized dealer immediately. Unless serviced, the system may not function properly in the event of a collision.

Safety Canopy™ system

Do not place objects or mount equipment on or near the headliner at the siderail that may come into contact with a deploying Safety Canopy™. Failure to follow these instructions may increase the risk of personal injury in the event of a collision.



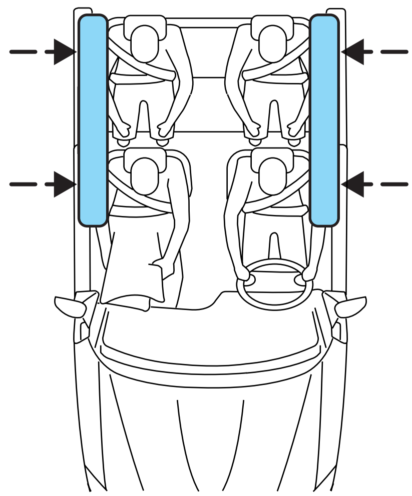
Do not lean your head on the door. The Safety Canopy™ could injure you as it deploys from the headliner.

Do not attempt to service, repair, or modify the Safety Canopy™ system, its fuses, the A, B, C or D pillar trim, or the headliner on a vehicle containing a Safety Canopy™. See your authorized dealer.

All occupants of the vehicle including the driver should always wear their safety belts even when an airbag SRS and Safety Canopy™ system is provided.

To reduce risk of injury, do not obstruct or place objects in the deployment path of the inflatable Safety Canopy™.

How does the Safety Canopy™ system work?



The design and development of the Safety Canopy™ system included recommended testing procedures that were developed by a group of automotive safety experts known as the Side Airbag Technical Working Group. These recommended testing procedures help reduce the risk of injuries related to the deployment of side airbags (including the Safety Canopy™).

The Safety Canopy™ system consists of the following:

- An inflatable nylon curtain with a gas generator concealed behind the headliner and above the doors (one on each side of vehicle).
- A headliner designed to flex open above the side doors to allow Safety Canopy™ deployment.
- The same readiness airbag light, electronic control and diagnostic unit as used for the front airbags.
- Two crash sensors mounted on the B pillar (one on each side of the vehicle).
- Two crash sensors located at the C pillar behind the rear doors (one on each side of the vehicle).
- Rollover sensor in the restraints control module (RCM).

The Safety Canopy™ system, in combination with safety belts, can help reduce the risk of severe injuries in the event of a significant side impact collision or rollover event.

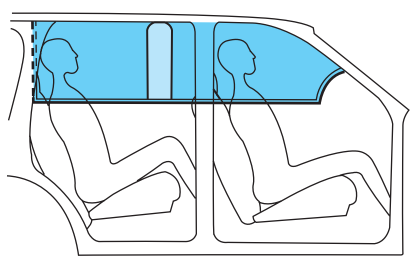
Children 12 years old and under should always be properly restrained in the second or third row seats. The Safety Canopy™ will not interfere with children restrained using a properly installed child or booster seat because it is designed to inflate downward from the headliner above the doors along the side window opening.

The Safety Canopy™ system is designed to activate when the vehicle sustains lateral deceleration sufficient to cause the side crash sensor to close an electrical circuit that initiates Safety Canopy™ inflation or when a certain likelihood of a rollover event is detected by the rollover sensor.

The Safety Canopy™ is mounted to roof side-rail sheet metal, behind the headliner, along the entire side of the vehicle. In certain lateral collisions or rollover events, the Safety Canopy™ system will be activated, regardless of which seats are occupied. The Safety Canopy™ is designed to inflate between the side window area and occupants to further enhance protection provided in side impact collisions and rollover events.

The fact that the Safety Canopy™ did not activate in a collision does not mean that something is wrong with the system. Rather, it means the forces were not of the type sufficient to cause activation. The Safety Canopy™ is designed to inflate in certain side impact collisions or rollover events, not in rear impact, frontal or near-frontal collisions, unless the collision causes sufficient lateral deceleration or rollover.

If the Safety Canopy™ system has deployed, **the Safety Canopy™ will not function again unless replaced. The Safety Canopy™ system (including the A, B, C, and D pillar trim and headliner) must be inspected and serviced by an authorized dealer.** If the Safety Canopy™ is not replaced, the unrepaired area will increase the risk of injury in a collision.



Determining if the system is operational

The SRS uses a readiness light in the instrument cluster or a tone to indicate the condition of the system. Refer to the *Airbag readiness* section in the *Instrument Cluster* chapter. Routine maintenance of the airbag is not required.

Any difficulty with the system is indicated by one or more of the following:

- The readiness airbag light (same light as for front airbag system) will either flash or stay lit.
- The readiness light will not illuminate immediately after ignition is turned on.
- A series of five beeps will be heard. The tone pattern will repeat periodically until the problem and light are repaired.

If any of these things happen, even intermittently, have the SRS serviced at your an authorized dealer immediately. Unless serviced, the system may not function properly in the event of a collision or rollover event.

Disposal of airbags and airbag equipped vehicles (including pretensioners)

See your authorized dealer. Airbags MUST BE disposed of by qualified personnel.

SAFETY RESTRAINTS FOR CHILDREN

See the following sections for directions on how to properly use safety restraints for children. Also see *Airbag supplemental restraint system (SRS)* in this chapter for special instructions about using airbags.

Important child restraint precautions

You are required by law to use safety restraints for children in the U.S. and Canada. If small children (generally children who are four years old or younger and who weigh 40 lb. [18 kg] or less) ride in your vehicle, you must put them in safety seats made especially for children. Many states require that children use approved booster seats until they are eight years old. Check your local and state or provincial laws for specific requirements regarding the safety of children in your vehicle. When possible, always place children under age 12 in the rear seat of your vehicle. Accident statistics suggest that children are safer when properly restrained in the rear seating positions than in the front seating position.

Never let a passenger hold a child on his or her lap while the vehicle is moving. The passenger cannot protect the child from injury in a collision.

Always follow the instructions and warnings that come with any infant or child restraint you might use.

Children and safety belts

If the child is the proper size, restrain the child in a safety seat. Children who are too large for child safety seats (as specified by your child safety seat manufacturer) should always wear safety belts.

Follow all the important safety restraint and airbag precautions that apply to adult passengers in your vehicle.

If the shoulder belt portion of a combination lap and shoulder belt can be positioned so it does not cross or rest in front of the child's face or neck, the child should wear the lap and shoulder belt. Moving the child closer to the center of the vehicle may help provide a good shoulder belt fit.

Do not leave children, unreliable adults, or pets unattended in your vehicle.

Child booster seats

Children outgrow a typical convertible or toddler seat when they weigh 40 lb. (18 kg) and are around 4 years of age. Although the lap/shoulder belt will provide some protection, these children are still too small for lap/shoulder belts to fit properly, which could increase the risk of serious injury in a crash.

To improve the fit of both the lap and shoulder belt on children who have outgrown child safety seats, Ford Motor Company recommends use of a belt-positioning booster.

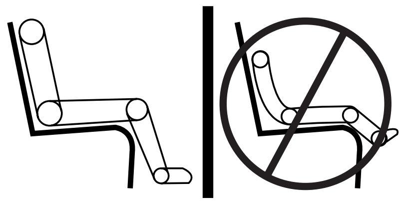
Booster seats position a child so that safety belts fit better. They lift the child up so that the lap belt rests low across the hips and the knees bend comfortably. Booster seats may also make the shoulder belt fit better and more comfortably. Try to keep the belt near the middle of the shoulder.

When children should use booster seats

Children need to use booster seats from the time they outgrow the toddler seat until they are big enough for the vehicle seat and lap/shoulder belt to fit properly. Generally this is when they weigh about 80 lb. (36 kg) (about 8 to 12 years old).

Booster seats should be used until you can answer YES to ALL of these questions:

- Can the child sit all the way back against the vehicle seat back with knees bent comfortably at the edge of the seat without slouching?



- Does the lap belt rest low across the hips?
- Is the shoulder belt centered on the shoulder and chest?
- Can the child stay seated like this for the whole trip?

Types of booster seats

There are two types of belt-positioning booster seats:

- Those that are backless.

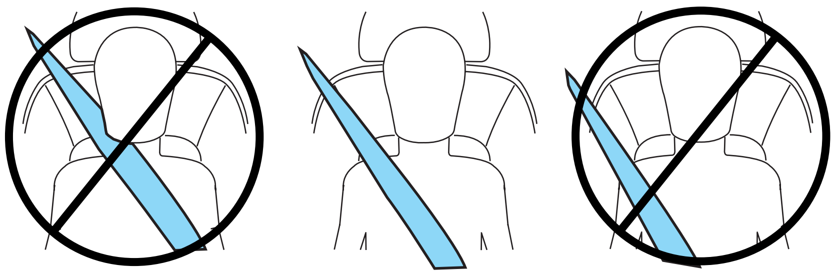
  If your backless booster seat has a removable shield, remove the shield and use the lap/shoulder belt. If a seating position has a low seat back and no head restraint, a backless booster seat may place your child's head (top of ear level) above the top of the seat. In this case, move the backless booster to another seating position with a higher seat back and lap/shoulder belts.

- Those with a high back.

  If, with a backless booster seat, you cannot find a seating position that adequately supports your child's head, a high back booster seat would be a better choice.

Either type can be used at any seating position equipped with lap/shoulder belts if your child is over 40 lb. (18 kg).

Children and booster seats vary widely in size and shape. Choose a booster that keeps the lap belt low and snug across the hips, never up across the stomach, and lets you adjust the shoulder belt to cross the chest and rest snugly near the center of the shoulder. The drawings below compare the ideal fit (center) to a shoulder belt uncomfortably close to the neck and a shoulder belt that could slip off the shoulder.



If the booster seat slides on the vehicle seat, placing a rubberized mesh sold as shelf or carpet liner under the booster seat may improve this condition.

The importance of shoulder belts

Using a booster without a shoulder belt increases the risk of a child's head hitting a hard surface in a collision. For this reason, you should never use a booster seat with a lap belt only. It is best to use a booster seat with lap/shoulder belts in the back seat- the safest place for children to ride.

Move a child to a different seating location if the shoulder belt does not stay positioned on the shoulder during use.

Follow all instructions provided by the manufacturer of the booster seat.

Never put the shoulder belt under a child's arm or behind the back because it eliminates the protection for the upper part of the body and may increase the risk of injury or death in a collision.

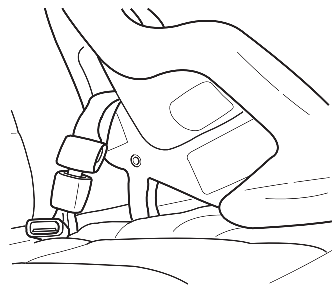
Never use pillows, books, or towels to boost a child. They can slide around and increase the likelihood of injury or death in a collision.

SAFETY SEATS FOR CHILDREN

Child and infant or child safety seats

Use a safety seat that is recommended for the size and weight of the child. Carefully follow all of the manufacturer's instructions with the safety seat you put in your vehicle. If you do not install and use the safety seat properly, the child may be injured in a sudden stop or collision.

When installing a child safety seat:



- Review and follow the information presented in the *Airbag Supplemental Restraint System* section in this chapter.
- Use the correct safety belt buckle for that seating position.
- Insert the belt tongue into the proper buckle until you hear a snap and feel it latch. Make sure the tongue is securely fastened in the buckle.
- Keep the buckle release button pointing up and away from the safety seat, with the tongue between the child seat and the release button, to prevent accidental unbuckling.
- Place seat back in upright position.
- Put the safety belt in the automatic locking mode. Refer to *Automatic locking mode.*
- LATCH lower anchors are recommended for use by children up to 48 lb (22 kg) in a child restraint. Top tether anchors can be used for children up to 60 lb (27 kg) in a child restraint, and to provide upper torso restraint for children up to 80 lb (36 kg) using an upper torso harness and a belt-positioning booster.

Ford Motor Company recommends the use of a child safety seat having a top tether strap. Install the child safety seat in a seating position with LATCH and tether anchors. For more information on top tether straps and anchors, refer to *Attaching safety seats with tether straps* in this chapter. For more information of LATCH anchors refer to *Attaching safety seats with LATCH (Lower Anchors and Tethers for Children) attachments* in this chapter.

Carefully follow all of the manufacturer's instructions included with the safety seat you put in your vehicle. If you do not install and use the safety seat properly, the child may be injured in a sudden stop or collision.

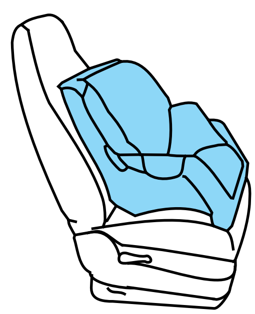
Rear-facing child seats or infant carriers should never be placed in front of an active passenger airbag.

Installing child safety seats with combination lap and shoulder belts

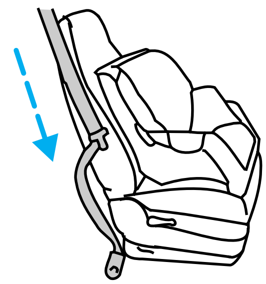
Airbags can kill or injure a child in a child seat. **NEVER** place a rear-facing child seat in front of an active airbag. If you must use a forward-facing child seat in the front seat, move the seat all the way back.

Children 12 and under should be properly restrained in the rear seat whenever possible.

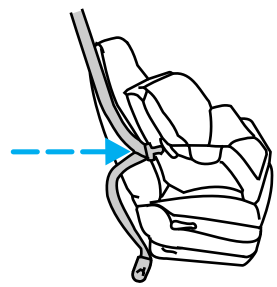
1. Position the child safety seat in a seat with a combination lap and shoulder belt.



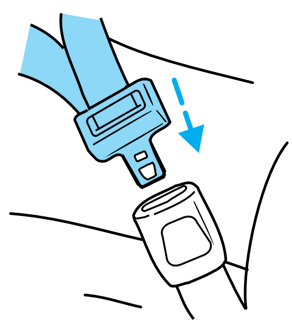
2. Pull down on the shoulder belt and then grasp the shoulder belt and lap belt together.



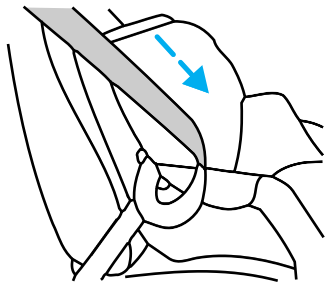
3. While holding the shoulder and lap belt portions together, route the tongue through the child seat according to the child seat manufacturer's instructions. Be sure the belt webbing is not twisted.



4. Insert the belt tongue into the proper buckle (the buckle closest to the direction the tongue is coming from) for that seating position until you hear a snap and feel the latch engage. Make sure the tongue is latched securely by pulling on it.

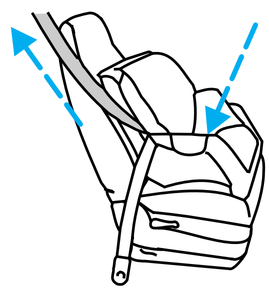


5. To put the retractor in the automatic locking mode, grasp the shoulder portion of the belt and pull downward until all of the belt is pulled out and a click is heard.



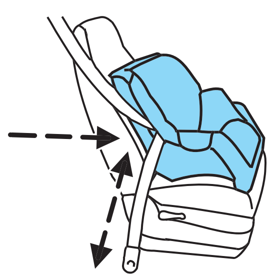
6. Allow the belt to retract. The belt will click as it retracts to indicate it is in the automatic locking mode.

7. Pull the lap belt portion across the child seat toward the buckle and pull up on the shoulder belt while pushing down with your knee on the child seat.



8. Allow the safety belt to retract to remove any slack in the belt.

9. Before placing the child in the seat, forcibly move the seat forward and back to make sure the seat is securely held in place. To check this, grab the seat at the belt path and attempt to move it side to side and forward. There should be no more than one inch of movement for proper installation.



10. Try to pull the belt out of the retractor to make sure the retractor is in the automatic locking mode (you should not be able to pull more belt out). If the retractor is not locked, unbuckle the belt and repeat Steps 2 through 9.

Check to make sure the child seat is properly secured before each use.

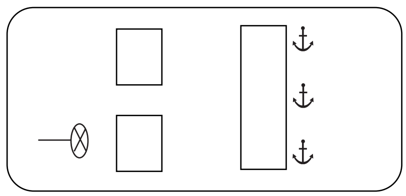
Attaching child safety seats with tether straps

Most new forward-facing child safety seats include a tether strap which goes over the back of the seat and hooks to an anchoring point. Tether straps are available as an accessory for many older safety seats. Contact the manufacturer of your child seat for information about ordering a tether strap.

The rear seats of your vehicle are equipped with built-in tether strap anchors located behind the seats as described below.

The tether anchors in your vehicle are located under the second row seat gap cover marked with tether anchor symbols (shown with title).

The tether strap anchors in your vehicle are in the following positions (shown from top view):



Attach the tether strap only to the appropriate tether anchor as shown. The tether strap may not work properly if attached somewhere other than the correct tether anchor.

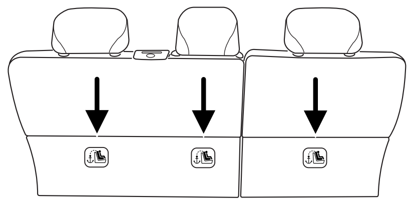
Do not use seat anchors as cargo tie downs.

1. Position the child safety seat on the seat cushion.

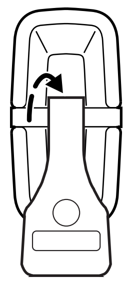
2. Route the child safety seat tether strap over the back of the seat.

For vehicles with adjustable head restraints, route the tether strap under the head restraint and between the head restraint posts. For seating positions with non-adjustable (fixed) head restraints, route the tether strap over the top of the head restraint.

3. Locate the correct anchor behind the gap cover for the selected seating position.



4. Clip the tether strap to the anchor as shown.



If the tether strap is clipped incorrectly, the child safety seat may not be retained properly in the event of a collision.

5. Install the child safety seat tightly using the LATCH anchors or safety belts. Follow the instructions in this chapter.

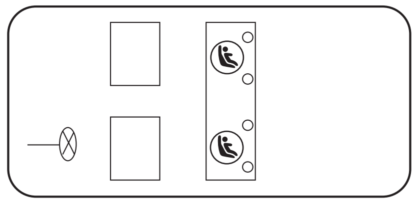
6. Tighten the child safety seat tether strap according to the manufacturer's instructions.

If the safety seat is not anchored properly, the risk of a child being injured in a collision greatly increases.

Attaching safety seats with LATCH (Lower Anchors and Tethers for Children) attachments for child seat anchors

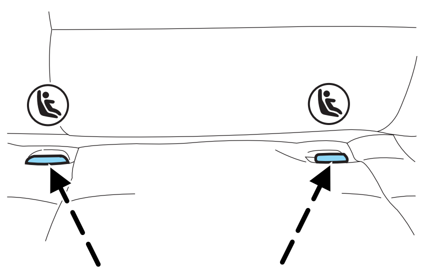
Some child safety seats have two rigid or webbing mounted attachments that connect to two anchors at certain seating positions in your vehicle. This type of child seat eliminates the need to use safety belts to attach the child seat. For forward-facing child seats, the tether strap must also be attached to the proper tether anchor. See *Attaching safety seats with tether straps* in this chapter.

Your vehicle has LATCH anchors for child seat installation at the seating positions marked with the child seat symbol.



The anchors at the center of the rear seat are further apart than the sets of lower anchors for child seat installation at other seating positions. A child seat with rigid LATCH attachments cannot be installed at this seating position. LATCH compatible child seats (with attachments on belt webbing) can be used at this seating position only if the child seat instructions state that the child seat can be installed to anchors that are spaced up to 20 inches (500 mm) apart. Do not attach a child seat to any lower anchor if an adjacent child seat is attached to that anchor.

Never attach two LATCH child safety seats to the same anchor. In a crash, one anchor may not be strong enough to hold two child safety seat attachments and may break, causing serious injury or death.



The lower anchors for child seat installation are located at the rear section of the rear seat between the cushion and seat back. The LATCH anchors are below the locator symbols on the seat back.

Follow the child seat manufacturer's instructions to properly install a child seat with LATCH attachments.

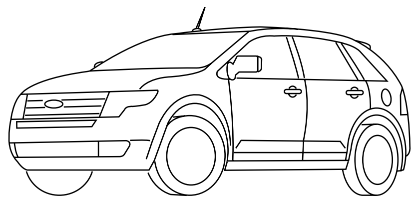
Attach LATCH lower attachments of the child seat only to the anchors shown.

If you install a child seat with rigid LATCH attachments, do not tighten the tether strap enough to lift the child seat off the vehicle seat cushion when the child is seated in it. Keep the tether strap just snug without lifting the front of the child seat. Keeping the child seat just touching the vehicle seat gives the best protection in a severe crash.

Each time you use the safety seat, check that the seat is properly attached to the lower anchors and tether anchor. Try to tilt the child seat from side to side. Also try to tug the seat forward. Check to see if the anchors hold the seat in place.

If the safety seat is not anchored properly, the risk of a child being injured in a crash greatly increases.

NOTICE TO CROSSOVER VEHICLE OWNERS



Crossover vehicles handle differently than passenger cars in the various driving conditions that are encountered on streets, highways and off-road. Crossover vehicles are not designed for cornering at speeds as high as passenger cars any more than low-slung sports cars are designed to perform satisfactorily under off-road conditions.

Crossover vehicles have a significantly higher rollover rate than other types of vehicles. To reduce the risk of serious injury or death from a rollover or other crash you must:

- Avoid sharp turns and abrupt maneuvers;
- Drive at safe speeds for the conditions;
- Keep tires properly inflated;
- Never overload or improperly load your vehicle; and
- Make sure every passenger is properly restrained.

In a rollover crash, an unbelted person is significantly more likely to die than a person wearing a seat belt. All occupants must wear seat belts and children/infants must use appropriate restraints to minimize the risk of injury or ejection.

Study your *Owner's Guide* for specific information about equipment features, instructions for safe driving and additional precautions to reduce the risk of an accident or serious injury.

VEHICLE CHARACTERISTICS

All Wheel Drive (AWD) System (if equipped)

Your vehicle may be equipped with a full-time All Wheel Drive (AWD) system. With the AWD option, power will be delivered to the front wheels and distributed to the rear wheels as needed. This increases traction which may enable you to safely drive over terrain and road conditions that a conventional two-wheel drive vehicle cannot. The AWD system is active all the time and requires no input from the operator.

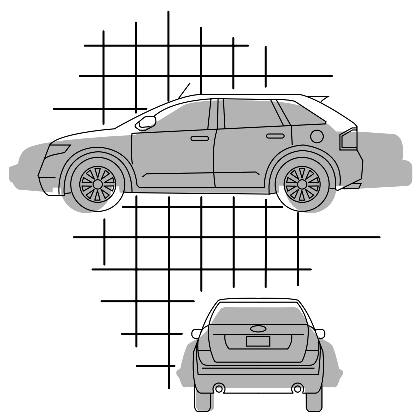
Note: Your AWD vehicle is not intended for off-road use. The AWD feature gives your vehicle some limited off-road capabilities in which driving surfaces are relatively level, obstruction-free and otherwise similar to normal on-road driving conditions. Operating your vehicle under other than those conditions could subject the vehicle to excessive stress which might result in damage which is not covered under your warranty.

For AWD vehicles, a spare tire of a different size other that the tire provided should never be used. A dissimilar spare tire size (other than the spare tire provided) or major dissimilar tire sized between the front and rear axles could cause the AWD system to stop functioning and default to front wheel drive.

Do not become overconfident in the ability of AWD vehicles. Although a AWD vehicle may accelerate better than two-wheel drive vehicle in low traction situations, it won’t stop any faster than two-wheel drive vehicles. Always drive at a safe speed.

How your vehicle differs from other vehicles

Crossover vehicles can differ from some other vehicles in a few noticeable ways. Your vehicle may be:



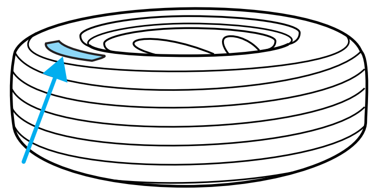
- Higher – to allow higher load carrying capacity.
- Shorter – to give it the capability to approach inclines. All other things held equal, a shorter wheelbase may make your vehicle quicker to respond to steering inputs than a vehicle with a longer wheelbase.
- Narrower — to provide greater maneuverability in tight spaces.

As a result of the above dimensional differences, crossover vehicles often will have a higher center of gravity and a greater difference in center of gravity between the loaded and unloaded condition.

These differences that make your vehicle so versatile also make it handle differently than an ordinary passenger car.

INFORMATION ABOUT UNIFORM TIRE QUALITY GRADING

Tire Quality Grades apply to new pneumatic passenger car tires. The Quality grades can be found where applicable on the tire sidewall between tread shoulder and maximum section width. For example:



- **Treadwear 200 Traction AA Temperature A**

These Tire Quality Grades are determined by standards that the United States Department of Transportation has set.

Tire Quality Grades apply to new pneumatic passenger car tires. They do not apply to deep tread, winter-type snow tires, space-saver or temporary use spare tires, light truck or "LT" type tires, tires with nominal rim diameters of 10 to 12 inches or limited production tires as defined in Title 49 Code of Federal Regulations Part 575.104(c)(2).

U.S. Department of Transportation-Tire quality grades: The U.S. Department of Transportation requires Ford Motor Company to give you the following information about tire grades exactly as the government has written it.

Treadwear

The treadwear grade is a comparative rating based on the wear rate of the tire when tested under controlled conditions on a specified government test course. For example, a tire graded 150 would wear one and one-half (1 1/2) times as well on the government course as a tire graded 100. The relative performance of tires depends upon the actual conditions of their use, however, and may depart significantly from the norm due to variations in driving habits, service practices, and differences in road characteristics and climate.

Traction AA A B C

The traction grades, from highest to lowest are AA, A, B, and C. The grades represent the tire's ability to stop on wet pavement as measured under controlled conditions on specified government test surfaces of asphalt and concrete. A tire marked C may have poor traction performance.

The traction grade assigned to this tire is based on straight-ahead braking traction tests, and does not include acceleration, cornering, hydroplaning or peak traction characteristics.

Temperature A B C

The temperature grades are A (the highest), B and C, representing the tire's resistance to the generation of heat and its ability to dissipate heat when tested under controlled conditions on a specified indoor laboratory test wheel. Sustained high temperature can cause the material of the tire to degenerate and reduce tire life, and excessive temperature can lead to sudden tire failure. The grade C corresponds to a level of performance which all passenger car tires must meet under the Federal Motor Vehicle Safety Standard No. 139. Grades B and A represent higher levels of performance on the laboratory test wheel than the minimum required by law.

The temperature grade for this tire is established for a tire that is properly inflated and not overloaded. Excessive speed, underinflation, or excessive loading, either separately or in combination, can cause heat buildup and possible tire failure.

TIRES

Tires are designed to give many thousands of miles of service, but they must be maintained in order to get the maximum benefit from them.

Glossary of tire terminology

- **Tire label:** A label showing the OE (Original Equipment) tire sizes, recommended inflation pressure and the maximum weight the vehicle can carry.
- **Tire Identification Number (TIN):** A number on the sidewall of each tire providing information about the tire brand and manufacturing plant, tire size and date of manufacture. Also referred to as DOT code.
- **Inflation pressure:** A measure of the amount of air in a tire.
- **Standard load:** A class of P-metric or Metric tires designed to carry a maximum load at 35 psi [37 psi (2.5 bar) for Metric tires]. Increasing the inflation pressure beyond this pressure will not increase the tire's load carrying capability.
- **Extra load:** A class of P-metric or Metric tires designed to carry a heavier maximum load at 41 psi [43 psi (2.9 bar) for Metric tires].

Increasing the inflation pressure beyond this pressure will not increase the tire's load carrying capability.

- **kPa:** Kilopascal, a metric unit of air pressure.
- **PSI:** Pounds per square inch, a standard unit of air pressure.
- **Cold inflation pressure:** The tire pressure when the vehicle has been stationary and out of direct sunlight for an hour or more and prior to the vehicle being driven for 1 mile (1.6 km).
- **Recommended inflation pressure:** The cold inflation pressure found on the Safety Compliance Certification Label or Tire Label located on the B-Pillar or the edge of the driver's door.
- **B-pillar:** The structural member at the side of the vehicle behind the front door.
- **Bead area of the tire:** Area of the tire next to the rim.
- **Sidewall of the tire:** Area between the bead area and the tread.
- **Tread area of the tire:** Area of the perimeter of the tire that contacts the road when mounted on the vehicle.
- **Rim:** The metal support (wheel) for a tire or a tire and tube assembly upon which the tire beads are seated.

INFLATING YOUR TIRES

Safe operation of your vehicle requires that your tires are properly inflated. Remember that a tire can lose up to half of its air pressure without appearing flat.

Every day before you drive, check your tires. If one looks lower than the others, use a tire gauge to check pressure of all tires and adjust if required.

At least once a month and before long trips, inspect each tire and check the tire pressure with a tire gauge (including spare, if equipped). Inflate all tires to the inflation pressure recommended by Ford Motor Company.

Use a tire gauge to check the tire inflation pressure, including the spare (if equipped), at least monthly and before long trips. You are strongly urged to buy a reliable tire pressure gauge, as automatic service station gauges may be inaccurate. Ford recommends the use of a digital or dial-type tire pressure gauge rather than a stick-type tire pressure gauge.

Use the recommended cold inflation pressure for optimum tire performance and wear. Under-inflation or over-inflation may cause uneven treadwear patterns.

Under-inflation is the most common cause of tire failures and may result in severe tire cracking, tread separation or "blowout", with unexpected loss of vehicle control and increased risk of injury. Under-inflation increases sidewall flexing and rolling resistance, resulting in heat buildup and internal damage to the tire. It also may result in unnecessary tire stress, irregular wear, loss of vehicle control and accidents. A tire can lose up to half of its air pressure and not appear to be flat!

Always inflate your tires to the Ford recommended inflation pressure even if it is less than the maximum inflation pressure information found on the tire. The Ford recommended tire inflation pressure is found on the Safety Compliance Certification Label or Tire Label which is located on the B-Pillar or the edge of the driver's door. Failure to follow the tire pressure recommendations can cause uneven treadwear patterns and adversely affect the way your vehicle handles.

Maximum Permissible Inflation Pressure is the tire manufacturer's maximum permissible pressure and/or the pressure at which the maximum load can be carried by the tire. This pressure is normally higher than the manufacturer's recommended cold inflation pressure which can be found on the Safety Compliance Certification Label or Tire Label which is located on the B-Pillar or the edge of the driver's door. The cold inflation pressure should never be set lower than the recommended pressure on the Safety Compliance Certification Label or Tire Label.

When weather temperature changes occur, tire inflation pressures also change. A 10°F (6°C) temperature drop can cause a corresponding drop of 1 psi (7 kPa) in inflation pressure. Check your tire pressures frequently and adjust them to the proper pressure which can be found on the Safety Compliance Certification Label or Tire Label.

To check the pressure in your tire(s):

1. Make sure the tires are cool, meaning they are not hot from driving even a mile.

If you are checking tire pressure when the tire is hot, (i.e. driven more than 1 mile [1.6 km]), never "bleed" or reduce air pressure. The tires are hot from driving and it is normal for pressures to increase above recommended cold pressures. A hot tire at or below recommended cold inflation pressure could be significantly under-inflated.

Note: If you have to drive a distance to get air for your tire(s), check and record the tire pressure first and add the appropriate air pressure when you get to the pump. It is normal for tires to heat up and the air pressure inside to go up as you drive.

2. Remove the cap from the valve on one tire, then firmly press the tire gauge onto the valve and measure the pressure.

3. Add enough air to reach the recommended air pressure.

Note: If you overfill the tire, release air by pushing on the metal stem in the center of the valve. Then recheck the pressure with your tire gauge.

4. Replace the valve cap.

5. Repeat this procedure for each tire, including the spare.

Note: Some spare tires operate at a higher inflation pressure than the other tires. For T-type/mini-spare tires (see *Dissimilar Spare Tire/Wheel Information* section for description): Store and maintain at 60 psi (4.15 bar). For Full Size and Dissimilar spare tires (see *Dissimilar Spare Tire/Wheel Information* section for description): Store and maintain at the higher of the front and rear inflation pressure as shown on the Tire Label.

6. Visually inspect the tires to make sure there are no nails or other objects embedded that could poke a hole in the tire and cause an air leak.

7. Check the sidewalls to make sure there are no gouges, cuts or bulges.

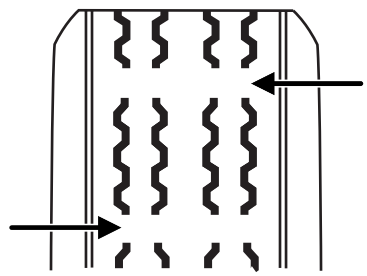
TIRE CARE

Inspecting your tires

Periodically inspect the tire treads for uneven or excessive wear and remove objects such as stones, nails or glass that may be wedged in the tread grooves. Check for holes or cuts that may permit air leakage from the tire and make necessary repairs. Also inspect the tire sidewalls for cracking, cuts, bruises and other signs of damage or excessive wear. If internal damage to the tire is suspected, have the tire demounted and inspected in case it needs to be repaired or replaced. For your safety, tires that are damaged or show signs of excessive wear should not be used because they are more likely to blow out or fail.

Improper or inadequate vehicle maintenance can cause tires to wear abnormally. Inspect all your tires, including the spare, frequently, and replace them if one or more of the following conditions exist:

Tire wear



When the tread is worn down to 1/16th of an inch (2 mm), tires must be replaced to help prevent your vehicle from skidding and hydroplaning. Built-in treadwear indicators, or "wear bars", which look like narrow strips of smooth rubber across the tread will appear on the tire when the tread is worn down to 1/16th of an inch (2 mm). When the tire tread wears down to the same height as these "wear bars", the tire is worn out and must be replaced.

Damage

Periodically inspect the tire treads and sidewalls for damage (such as bulges in the tread or sidewalls, cracks in the tread groove and separation in the tread or sidewall). If damage is observed or suspected have the tire inspected by a tire professional. Tires can be damaged during off-road use, so inspection after off-road use is also recommended.

Age

Tires degrade over time depending on many factors such as weather, storage conditions, and conditions of use (load, speed, inflation pressure, etc.) the tires experience throughout their lives.

In general, tires should be replaced after six years regardless of tread wear. However, heat caused by hot climates or frequent high loading conditions can accelerate the aging process and may require tires to be replaced more frequently.

You should replace your spare tire when you replace the road tires or after six years due to aging even if it has not been used.

U.S. DOT Tire Identification Number (TIN)

Both U.S. and Canada Federal regulations require tire manufacturers to place standardized information on the sidewall of all tires. This information identifies and describes the fundamental characteristics of the tire and also provides a U.S. DOT Tire Identification Number for safety standard certification and in case of a recall.

This begins with the letters "DOT" and indicates that the tire meets all federal standards. The next two numbers or letters are the plant code designating where it was manufactured, the next two are the tire size code and the last four numbers represent the week and year the tire was built. For example, the numbers 317 mean the 31st week of 1997. After 2000 the numbers go to four digits. For example, 2501 means the 25th week of 2001. The numbers in between are identification codes used for traceability. This information is used to contact customers if a tire defect requires a recall.

Tire replacement requirements

Your vehicle is equipped with tires designed to provide a safe ride and handling capability.

Only use replacement tires and wheels that are the same size, load index, speed rating and type (such as P-metric versus LT-metric or all-season versus all-terrain) as those originally provided by Ford. The recommended tire and wheel size may be found on either the Safety Compliance Certification Label or the Tire Label which is located on the B-Pillar or edge of the driver's door. If this information is not found on these labels then you should consult your Ford dealer. Use of any tire or wheel not recommended by Ford can affect the safety and performance of your vehicle, which could result in an increased risk of loss of vehicle control, vehicle rollover, personal injury and death. Additionally the use of non-recommended tires and wheels could cause steering, suspension, axle or transfer case/power transfer unit failure. If you have questions regarding tire replacement, see an authorized dealer.

When mounting replacement tires and wheels, you should not exceed the maximum pressure indicated on the sidewall of the tire to set the beads without additional precautions listed below. If the beads do not seat at the maximum pressure indicated, re-lubricate and try again.
When inflating the tire for mounting pressures up to 20 psi (1.38 bar) greater than the maximum pressure on the tire sidewall, the following precautions must be taken to protect the person mounting the tire:

1. Make sure that you have the correct tire and wheel size.
2. Lubricate the tire bead and wheel bead seat area again.
3. Stand at a minimum of 12 ft. (366 cm) away from the tire wheel assembly.
4. Use both eye and ear protection.

For a mounting pressure more than 20 psi (1.38 bar) greater than the maximum pressure, a Ford Dealer or other tire service professional should do the mounting.
Always inflate steel carcass tires with a remote air fill with the person inflating standing at a minimum of 12 ft. (366 cm) away from the tire wheel assembly.

Important: Remember to replace the wheel valve stems when the road tires are replaced on your vehicle.

It is recommended that the two front tires or two rear tires generally be replaced as a pair.

The tire pressure sensors mounted in the wheels (originally installed on your vehicle) are not designed to be used in aftermarket wheels.

The use of wheels or tires not recommended by Ford Motor Company may affect the operation of your Tire Pressure Monitoring System.

If the TPMS indicator is flashing, your TPMS is malfunctioning. Your replacement tire might be incompatible with your TPMS, or some component of the TPMS may be damaged.

Safety practices

Driving habits have a great deal to do with your tire mileage and safety.

- Observe posted speed limits
- Avoid fast starts, stops and turns
- Avoid potholes and objects on the road

- Do not run over curbs or hit the tire against a curb when parking

If your vehicle is stuck in snow, mud, sand, etc., **do not** rapidly spin the tires; spinning the tires can tear the tire and cause an explosion. A tire can explode in as little as three to five seconds.

Do not spin the wheels at over 35 mph (56 km/h). The tires may fail and injure a passenger or bystander.

Highway hazards

No matter how carefully you drive there's always the possibility that you may eventually have a flat tire on the highway. Drive slowly to the closest safe area out of traffic. This may further damage the flat tire, but your safety is more important.

If you feel a sudden vibration or ride disturbance while driving, or you suspect your tire or vehicle has been damaged, immediately reduce your speed. Drive with caution until you can safely pull off the road. Stop and inspect the tires for damage. If a tire is under-inflated or damaged, deflate it, remove wheel and replace it with your spare tire and wheel. If you cannot detect a cause, have the vehicle towed to the nearest repair facility or tire dealer to have the vehicle inspected.

Tire and wheel alignment

A bad jolt from hitting a curb or pothole can cause the front end of your vehicle to become misaligned or cause damage to your tires. If your vehicle seems to pull to one side when you're driving, the wheels may be out of alignment. Have an authorized dealer check the wheel alignment periodically.

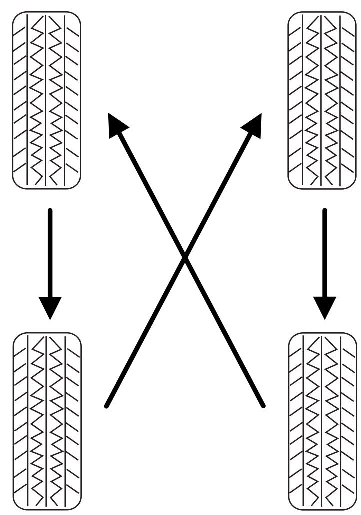
Wheel misalignment in the front or the rear can cause uneven and rapid treadwear of your tires and should be corrected by an authorized dealer. Front wheel drive (FWD) vehicles and those with an independent rear suspension (if equipped) may require alignment of all four wheels.

The tires should also be balanced periodically. An unbalanced tire and wheel assembly may result in irregular tire wear.

Tire rotation

Rotating your tires at the recommended interval (as indicated in the *scheduled maintenance information* that comes with your vehicle) will help your tires wear more evenly, providing better tire performance and longer tire life.

- Front Wheel Drive (FWD)/ All Wheel Drive vehicles (front tires at top of diagram)



Sometimes irregular tire wear can be corrected by rotating the tires.

Note: If your tires show uneven wear ask an authorized dealer to check for and correct any wheel misalignment, tire imbalance or mechanical problem involved before tire rotation.

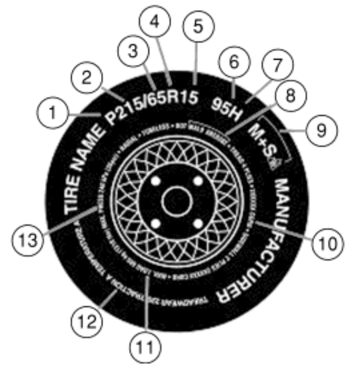
Note: Your vehicle may be equipped with a dissimilar spare tire/wheel. A dissimilar spare tire/wheel is defined as a spare tire and/or wheel that is different in brand, size or appearance from the road tires and wheels. If you have a dissimilar spare tire/wheel it is intended for temporary use only and should not be used in a tire rotation.

Note: After having your tires rotated, inflation pressure must be checked and adjusted to the vehicle requirements.

INFORMATION CONTAINED ON THE TIRE SIDEWALL

Both U.S. and Canada Federal regulations require tire manufacturers to place standardized information on the sidewall of all tires. This information identifies and describes the fundamental characteristics of the tire and also provides a U.S. DOT Tire Identification Number for safety standard certification and in case of a recall.

Information on "P" type tires



P215/65R15 95H is an example of a tire size, load index and speed rating. The definitions of these items are listed below. (Note that the tire size, load index and speed rating for your vehicle may be different from this example.)

1. **P:** Indicates a tire, designated by the Tire and Rim Association (T&RA), that may be used for service on cars, SUVs, minivans and light trucks.

Note: If your tire size does not begin with a letter this may mean it is designated by either ETRTO (European Tire and Rim Technical Organization) or JATMA (Japan Tire Manufacturing Association).

2. **215:** Indicates the nominal width of the tire in millimeters from sidewall edge to sidewall edge. In general, the larger the number, the wider the tire.

3. **65:** Indicates the aspect ratio which gives the tire's ratio of height to width.

4. **R:** Indicates a "radial" type tire.

5. **15:** Indicates the wheel or rim diameter in inches. If you change your wheel size, you will have to purchase new tires to match the new wheel diameter.

6. **95:** Indicates the tire's load index. It is an index that relates to how much weight a tire can carry. You may find this information in your *Owner's Guide*. If not, contact a local tire dealer.

Note: You may not find this information on all tires because it is not required by federal law.

7. **H:** Indicates the tire's speed rating. The speed rating denotes the speed at which a tire is designed to be driven for extended periods of time under a standard condition of load and inflation pressure. The tires on your vehicle may operate at different conditions for load and inflation pressure. These speed ratings may need to be adjusted for the difference in conditions. The ratings range from 81 mph (130 km/h) to 186 mph (299 km/h). These ratings are listed in the following chart.

Note: You may not find this information on all tires because it is not required by federal law.

Letter rating	Speed rating - mph (km/h)
M	81 mph (130 km/h)
N	87 mph (140 km/h)
Q	99 mph (159 km/h)
R	106 mph (171 km/h)
S	112 mph (180 km/h)
T	118 mph (190 km/h)
U	124 mph (200 km/h)
H	130 mph (210 km/h)
V	149 mph (240 km/h)
W	168 mph (270 km/h)
Y	186 mph (299 km/h)
Note: For tires with a maximum speed capability over 149 mph (240 km/h), tire manufacturers sometimes use the letters ZR. For those with a maximum speed capability over 186 mph (299 km/h), tire manufacturers always use the letters ZR.	

8. **U.S. DOT Tire Identification Number (TIN):** This begins with the letters "DOT" and indicates that the tire meets all federal standards. The next two numbers or letters are the plant code designating where it was manufactured, the next two are the tire size code and the last four numbers represent the week and year the tire was built. For example, the numbers 317 mean the 31st week of 1997. After 2000 the numbers go to four digits. For example, 2501 means the 25th week of 2001. The numbers in between are identification codes used for traceability. This information is used to contact customers if a tire defect requires a recall.

9. **M+S or M/S:** Mud and Snow, or
AT: All Terrain, or
AS: All Season.

10. **Tire Ply Composition and Material Used:** Indicates the number of plies or the number of layers of rubber-coated fabric in the tire tread and sidewall. Tire manufacturers also must indicate the ply materials in the tire and the sidewall, which include steel, nylon, polyester, and others.

11. **Maximum Load:** Indicates the maximum load in kilograms and pounds that can be carried by the tire. Refer to the Safety Compliance Certification Label, which is located on the B-Pillar or the edge of the driver's door, for the correct tire pressure for your vehicle.

12. **Treadwear, Traction and Temperature Grades**

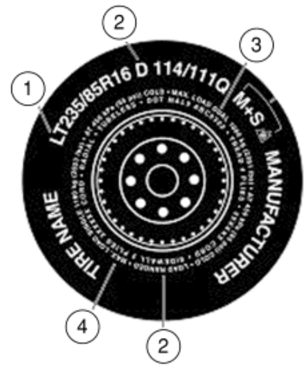
- **Treadwear:** The treadwear grade is a comparative rating based on the wear rate of the tire when tested under controlled conditions on a specified government test course. For example, a tire graded 150 would wear one and one-half (1½) times as well on the government course as a tire graded 100.
- **Traction:** The traction grades, from highest to lowest are AA, A, B, and C. The grades represent the tire's ability to stop on wet pavement as measured under controlled conditions on specified government test surfaces of asphalt and concrete. A tire marked C may have poor traction performance.
- **Temperature:** The temperature grades are A (the highest), B and C, representing the tire's resistance to the generation of heat and its ability to dissipate heat when tested under controlled conditions on a specified indoor laboratory test wheel.

13. **Maximum Permissible Inflation Pressure:** Indicates the tire manufacturers' maximum permissible pressure and/or the pressure at which the maximum load can be carried by the tire. This pressure is normally higher than the manufacturer's recommended cold inflation pressure which can be found on the Safety Compliance Certification Label or Tire Label which is located on the B-Pillar or the edge of the driver's door. The cold inflation pressure should never be set lower than the recommended pressure on the vehicle label.

The tire suppliers may have additional markings, notes or warnings such as standard load, radial tubeless, etc.

Additional information contained on the tire sidewall for "LT" type tires

"LT" type tires have some additional information beyond those of "P" type tires; these differences are described below.



Note: Tire Quality Grades do not apply to this type of tire.

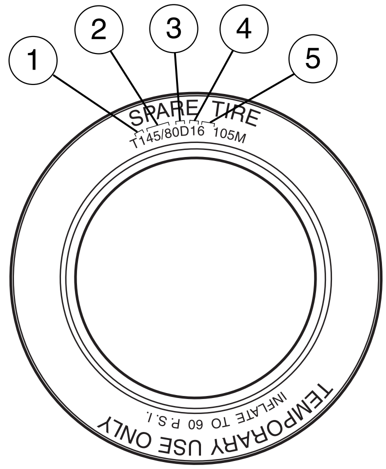
1. **LT:** Indicates a tire, designated by the Tire and Rim Association (T&RA), that is intended for service on light trucks.

2. **Load Range/Load Inflation Limits:** Indicates the tire's load-carrying capabilities and its inflation limits.

3. **Maximum Load Dual lb. (kg) at psi (kPa) cold:** Indicates the maximum load and tire pressure when the tire is used as a dual; defined as four tires on the rear axle (a total of six or more tires on the vehicle).

4. **Maximum Load Single lb. (kg) at psi (kPa) cold:** Indicates the maximum load and tire pressure when the tire is used as a single; defined as two tires (total) on the rear axle.

Information on "T" type tires



"T" type tires have some additional information beyond those of "P" type tires; these differences are described below:

T145/80D16 is an example of a tire size.

Note: The temporary tire size for your vehicle may be different from this example. Tire Quality Grades do not apply to this type of tire.

1. **T:** Indicates a type of tire, designated by the Tire and Rim Association (T&RA), that is intended for temporary service on cars, SUVs, minivans and light trucks.

2. **145:** Indicates the nominal width of the tire in millimeters from sidewall edge to sidewall edge. In general, the larger the number, the wider the tire.

3. **80:** Indicates the aspect ratio which gives the tire's ratio of height to width. Numbers of 70 or lower indicate a short sidewall.

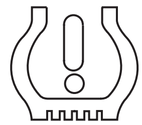
4. **D:** Indicates a "diagonal" type tire.
R: Indicates a "radial" type tire.

5. **16:** Indicates the wheel or rim diameter in inches. If you change your wheel size, you will have to purchase new tires to match the new wheel diameter.

Location of the tire label

You will find a Tire Label containing tire inflation pressure by tire size and other important information located on the B-Pillar or the edge of the driver's door. Refer to the payload description and graphic in the *Vehicle loading — with and without a trailer* section.

TIRE PRESSURE MONITORING SYSTEM (TPMS)



Each tire, including the spare (if provided), should be checked monthly when cold and inflated to the inflation pressure recommended by the vehicle manufacturer on the vehicle placard or tire inflation pressure label. (If your vehicle has tires of a different size than the size indicated on the vehicle placard or tire inflation pressure label, you should determine the proper tire inflation pressure for those tires.)

As an added safety feature, your vehicle has been equipped with a tire pressure monitoring system (TPMS) that illuminates a low tire pressure telltale when one or more of your tires is significantly under-inflated. Accordingly, when the low tire pressure telltale illuminates, you should stop and check your tires as soon as possible, and inflate them to the proper pressure. Driving on a significantly under-inflated tire causes the tire to overheat and can lead to tire failure. Under-inflation also reduces fuel efficiency and tire tread life, and may affect the vehicle's handling and stopping ability.

Please note that the TPMS is not a substitute for proper tire maintenance, and it is the driver's responsibility to maintain correct tire pressure, even if under-inflation has not reached the level to trigger illumination of the TPMS low tire pressure telltale.

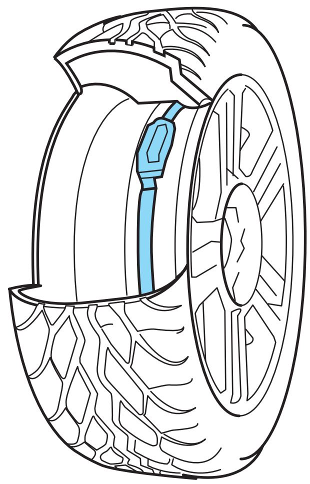
Your vehicle has also been equipped with a TPMS malfunction indicator to indicate when the system is not operating properly. The TPMS malfunction indicator is combined with the low tire pressure telltale. When the system detects a malfunction, the telltale will flash for approximately one minute and then remain continuously illuminated. This sequence will continue upon subsequent vehicle start-ups as long as the malfunction exists.

When the malfunction indicator is illuminated, the system may not be able to detect or signal low tire pressure as intended. TPMS malfunctions may occur for a variety of reasons, including the installation of replacement or alternate tires or wheels on the vehicle that prevent the TPMS from functioning properly. Always check the TPMS malfunction telltale after replacing one or more tires or wheels on your vehicle to ensure that the replacement or alternate tires and wheels allow the TPMS to continue to function properly.

The Tire Pressure Monitoring System complies with part 15 of the FCC rules and with RSS-210 of Industry Canada. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

The Tire Pressure Monitoring System is NOT a substitute for manually checking tire pressure. The tire pressure should be checked periodically (at least monthly) using a tire gauge, see *Inflating your tires* in this chapter. Failure to properly maintain your tire pressure could increase the risk of tire failure, loss of control, vehicle rollover and personal injury.

Changing tires with TPMS



Each road tire is equipped with a tire pressure sensor fastened to the inside rim of the wheel. The pressure sensor is covered by the tire and is not visible unless the tire is removed. The pressure sensor is located opposite (180 degrees) from the valve stem. Care must be taken when changing the tire to avoid damaging the sensor. It is recommended that you always have your tires serviced by an authorized dealer.

The tire pressure should be checked periodically (at least monthly) using an accurate tire gauge, refer to *Inflating your tires* in this chapter.

Understanding your Tire Pressure Monitoring System (TPMS)

The Tire Pressure Monitoring System measures pressure in your four road tires and sends the tire pressure readings to your vehicle. The Low Tire Pressure Warning Lamp will turn ON if the tire pressure is significantly low. Once the light is illuminated, your tires are under inflated and need to be inflated to the manufacturer's recommended tire pressure. Even if the light turns ON and a short time later turns OFF, your tire pressure still needs to be checked. Visit www.checkmytires.org for additional information.

When your temporary spare tire is installed

When one of your road tires needs to be replaced with the temporary spare, the TPMS system will continue to identify an issue to remind you that the damaged road wheel/tire needs to be repaired and put back on your vehicle.

To restore the full functionality of the Tire Pressure Monitoring System, have the damaged road wheel/tire repaired and remounted on your vehicle. For additional information, refer to *Changing tires with TPMS* in this section.

When you believe your system is not operating properly

The main function of the Tire Pressure Monitoring System is to warn you when your tires need air. It can also warn you in the event the system is no longer capable of functioning as intended. Please refer to the following chart for information concerning your Tire Pressure Monitoring System:

Low Tire Pressure Warning Light	Possible cause	Customer Action Required
Solid Warning Light	Tire(s) under-inflated	1. Check your tire pressure to ensure tires are properly inflated; refer to *Inflating your tires* in this chapter. 2. After inflating your tires to the manufacturer's recommended inflation pressure as shown on the Tire Label (located on the edge of driver's door or the B-Pillar), the vehicle must be driven for at least two minutes over 20 mph (32 km/h) before the light will turn OFF.
	Spare tire in use	Your temporary spare tire is in use. Repair the damaged road wheel/tire and reinstall it on the vehicle to restore system functionality. For a description on how the system functions, refer to *When your temporary spare tire is installed* in this section.
	TPMS malfunction	If your tires are properly inflated and your spare tire is not in use and the light remains ON, have the system inspected by your authorized dealer.

Low Tire Pressure Warning Light	Possible cause	Customer Action Required
Flashing Warning Light	Spare tire in use	Your temporary spare tire is in use. Repair the damaged road wheel and re-mount it on the vehicle to restore system functionality. For a description of how the system functions under these conditions, refer to *When your temporary spare tire is installed* in this section.
	TPMS malfunction	If your tires are properly inflated and your spare tire is not in use and the TPMS warning light still flashes, have the system inspected by your authorized dealer.

When inflating your tires

When putting air into your tires (such as at a gas station or in your garage), the Tire Pressure Monitoring System may not respond immediately to the air added to your tires.

It may take up to two minutes of driving over 20 mph (32 km/h) for the light to turn OFF after you have filled your tires to the recommended inflation pressure.

How temperature affects your tire pressure

The Tire Pressure Monitoring System (TPMS) monitors tire pressure in each pneumatic tire. While driving in a normal manner, a typical passenger tire inflation pressure may increase approximately 2 to 4 psi (14 to 28 kPa) from a cold start situation. If the vehicle is stationary over night with the outside temperature significantly lower than the daytime temperature, the tire pressure may decrease approximately 3 psi (20.7 kPa) for a drop of 30° F (16.6°C) in ambient temperature. This lower pressure value may be detected by the TPMS as being significantly lower than the recommended inflation pressure and activate the TPMS warning for low tire pressure. If the low tire pressure warning light is ON, visually check each tire to verify that no tire is flat. (If one or more tires are flat, repair as necessary.) Check air pressure in the road tires. If any tire is under-inflated, carefully drive the vehicle to the nearest location where air can be added to the tires. Inflate all the tires to the recommended inflation pressure.

SNOW TIRES AND CHAINS

Snow tires must be the same size, load index, speed rating as those originally provided by Ford. Use of any tire or wheel not recommended by Ford can affect the safety and performance of your vehicle, which could result in an increased risk of loss of vehicle control, vehicle rollover, personal injury and death. Additionally, the use of non-recommended tires and wheels could cause steering, suspension, axle or transfer case/power transfer unit failure.

The tires on your vehicle have all weather treads to provide traction in rain and snow. However, in some climates, you may need to use snow tires and chains. If you need to use chains, it is recommended that only cable chains are used with steel wheels (of the same size and specifications) as chains may chip aluminum wheels.

Follow these guidelines when using snow tires and chains:

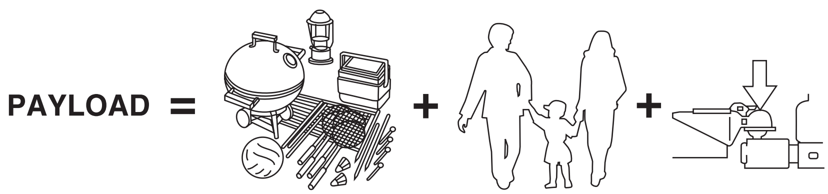
- Install cable chains only on the front wheels.
- Use only cable chains on 18 inch wheels with P245/60R18 tires.
- Do not use tire chains, cables or optional traction devices on 20 inch wheels and tires.
- Drive cautiously. If you hear the cable chains rub or bang against your vehicle, stop and re-tighten the cable chains. If this does not work, remove the cable chains to prevent damage to your vehicle.
- If possible, avoid fully loading your vehicle.
- Remove the tire cable chains when they are no longer needed. Do not use tire cable chains on dry roads.
- The suspension insulation and bumpers will help prevent vehicle damage. Do not remove these components from your vehicle when using snow tires and cable chains.

VEHICLE LOADING – WITH AND WITHOUT A TRAILER

This section will guide you in the proper loading of your vehicle and/or trailer, to keep your loaded vehicle weight within its design rating capability, with or without a trailer. Properly loading your vehicle will provide maximum return of vehicle design performance. Before loading your vehicle, familiarize yourself with the following terms for determining your vehicle's weight ratings, with or without a trailer, from the vehicle's Tire Label or Safety Compliance Certification Label:

Base Curb Weight – is the weight of the vehicle including a full tank of fuel and all standard equipment. It does not include passengers, cargo, or optional equipment.

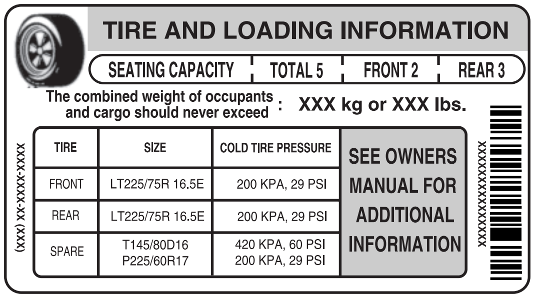
Vehicle Curb Weight – is the weight of your new vehicle when you picked it up from your authorized dealer plus any aftermarket equipment.

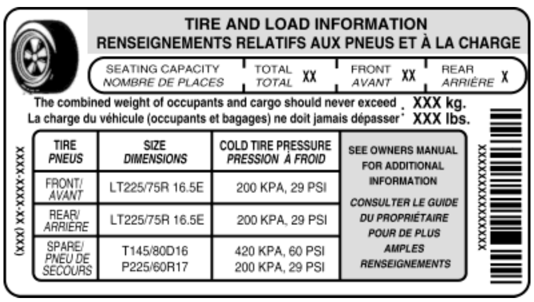


Payload – is the combined weight of cargo and passengers that the vehicle is carrying. The maximum payload for your vehicle can be found on the Tire Label on the B-Pillar or the edge of the driver's door (vehicles exported outside the US and Canada may not have a Tire Label). Look for **"THE COMBINED WEIGHT OF OCCUPANTS AND CARGO SHOULD NEVER EXCEED XXX kg OR XXX lb."** for maximum payload. The payload listed on the Tire Label is the maximum payload for the vehicle as built by the assembly plant. If any aftermarket or authorized-dealer installed equipment has been installed on the vehicle, the weight of the equipment must be subtracted from the payload listed on the Tire Label in order to determine the new payload.

The appropriate loading capacity of your vehicle can be limited either by volume capacity (how much space is available) or by payload capacity (how much weight the vehicle should carry). Once you have reached the maximum payload of your vehicle, do not add more cargo, even if there is space available. Overloading or improperly loading your vehicle can contribute to loss of vehicle control and vehicle rollover.

Example only:



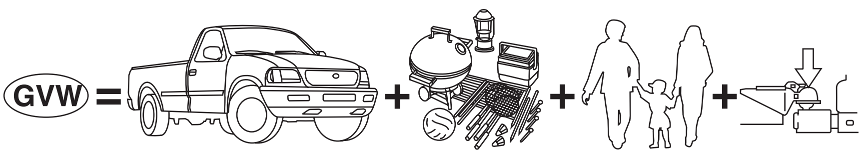


Cargo Weight – includes all weight added to the Base Curb Weight, including cargo and optional equipment. When towing, trailer tongue load weight is also part of cargo weight.

GAW (Gross Axle Weight) – is the total weight placed on each axle (front and rear) – including vehicle curb weight and all payload.

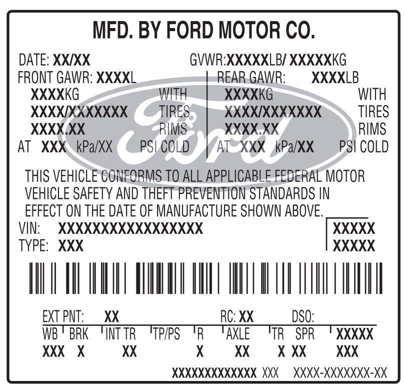
GAWR (Gross Axle Weight Rating) – is the maximum allowable weight that can be carried by a single axle (front or rear). **These numbers are shown on the Safety Compliance Certification Label located on the B-Pillar or the edge of the driver's door. The total load on each axle must never exceed its GAWR.**

Note: For trailer towing information refer to *Trailer towing* found in this chapter or the *RV and Trailer Towing Guide* provided by your authorized dealer.

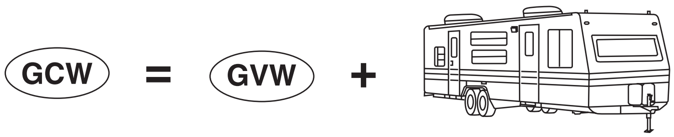


GVW (Gross Vehicle Weight) – is the Vehicle Curb Weight + cargo + passengers.

GVWR (Gross Vehicle Weight Rating) – is the maximum allowable weight of the fully loaded vehicle (including all options, equipment, passengers and cargo). **The GVWR is shown on the Safety Compliance Certification Label located on the B-Pillar or the edge of the driver's door. The GVW must never exceed the GVWR.**



Exceeding the Safety Compliance Certification Label vehicle weight rating limits could result in substandard vehicle handling or performance, engine, transmission and/or structural damage, serious damage to the vehicle, loss of control and personal injury.



GCW (Gross Combined Weight) – is the weight of the loaded vehicle (GVW) plus the weight of the fully loaded trailer.

GCWR (Gross Combined Weight Rating) – is the maximum allowable weight of the vehicle and the loaded trailer – including all cargo and passengers – that the vehicle can handle without risking damage. (Important: The towing vehicles' braking system is rated for operation at GVWR, not at GCWR. Separate functional brakes should be used for safe control of towed vehicles and for trailers where the GCW of the towing vehicle plus the trailer exceed the GVWR of the towing vehicle. **The GCW must never exceed the GCWR.**

Maximum Loaded Trailer Weight – is the highest possible weight of a fully loaded trailer the vehicle can tow. It assumes a vehicle with only mandatory options, no cargo (internal or external), a tongue load of 10–15% (conventional trailer), and driver only (150 lb. [68 kg]). **Consult your authorized dealer (or the** *RV and Trailer Towing Guide* **provided by your authorized dealer) for more detailed information.**

Do not exceed the GVWR or the GAWR specified on the Safety Compliance Certification Label.

Do not use replacement tires with lower load carrying capacities than the original tires because they may lower the vehicle's GVWR and GAWR limitations. Replacement tires with a higher limit than the original tires do not increase the GVWR and GAWR limitations.

Exceeding any vehicle weight rating limitation could result in serious damage to the vehicle and/or personal injury.

Steps for determining the correct load limit:

1. Locate the statement "The combined weight of occupants and cargo should never exceed XXX kg or XXX lbs." on your vehicle's placard.

2. Determine the combined weight of the driver and passengers that will be riding in your vehicle.

3. Subtract the combined weight of the driver and passengers from XXX kg or XXX lbs.

4. The resulting figure equals the available amount of cargo and luggage load capacity. For example, if the "XXX" amount equals 1,400 lbs. and there will be five 150 lb. passengers in your vehicle, the amount of available cargo and luggage load capacity is 650 lbs. (1400–750 (5 x 150) = 650 lb.). In metric units (635–340 (5 x 68) = 295 kg.)

5. Determine the combined weight of luggage and cargo being loaded on the vehicle. That weight may not safely exceed the available cargo and luggage load capacity calculated in Step 4.

6. If your vehicle will be towing a trailer, load from your trailer will be transferred to your vehicle. Consult this manual to determine how this reduces the available cargo and luggage load capacity of your vehicle.

The following gives you a few examples on how to calculate the available amount of cargo and luggage load capacity:

- Another example for your vehicle with 1,400 lb. (635 kg) of cargo and luggage capacity. You decide to go golfing. Is there enough load capacity to carry you, 4 of your friends and all the golf bags? You and four friends average 220 lb. (99 kg) each and the golf bags weigh approximately 30 lb. (13.5 kg) each. The calculation would be: 1,400 - (5 x 220) - (5 x 30) = 1,400 - 1,100 - 150 = 150 lb. Yes, you have enough load capacity in your vehicle to transport four friends and your golf bags. In metric units, the calculation would be: 635 kg - (5 x 99 kg) - (5 x 13.5 kg) = 635 - 495 - 67.5 = 72.5 kg.
- A final example for your vehicle with 1,400 lb. (635 kg) of cargo and luggage capacity. You and one of your friends decide to pick up cement from the local home improvement store to finish that patio you have been planning for the past 2 years. Measuring the inside of the vehicle with the rear seat folded down, you have room for 12-100 lb. (45 kg) bags of cement. Do you have enough load capacity to transport the cement to your home? If you and your friend each weigh 220 lb. (99 kg), the calculation would be: 1,400 - (2 x 220) - (12 x 100) = 1,400 - 440 - 1,200 = - 240 lb. No, you do not have enough cargo capacity to carry that much weight. In metric units, the calculation would be: 635 kg - (2 x 99 kg) - (12 x 45 kg) = 635 - 198 - 540 = -103 kg. You will need to reduce the load weight by at least 240 lb. (104 kg). If you remove 3-100 lb. (45 kg) cement bags, then the load calculation would be:

1,400 - (2 x 220) - (9 x 100) = 1,400 - 440 - 900 = 60 lb. Now you have the load capacity to transport the cement and your friend home. In metric units, the calculation would be: 635 kg - (2 x 99 kg) - (9 x 45 kg) = 635 - 198 - 405 = 32 kg.

The above calculations also assume that the loads are positioned in your vehicle in a manner that does not overload the Front or the Rear Gross Axle Weight Rating specified for your vehicle on the Safety Compliance Certification Label found on the edge of the driver's door.

TRAILER TOWING

Trailer towing with your vehicle may require the use of a trailer tow option package.

Trailer towing puts additional loads on your vehicle's engine, transmission, axle, brakes, tires, and suspension. For your safety and to maximize vehicle performance, be sure to use the proper equipment while towing.

When towing maximum loads under high outside temperatures and on steep grades, the A/C system may cycle on and off to protect the engine from overheating. This may result in a temporary increase of interior temperatures.

Follow these guidelines to ensure safe towing procedure:

- Stay within your vehicle's load limits.
- Thoroughly prepare your vehicle for towing. Refer to *Preparing to tow* in this chapter.
- Use extra caution when driving while trailer towing. Refer to *Driving while you tow* in this chapter.
- Service your vehicle more frequently if you tow a trailer. Refer to the severe duty schedule in the scheduled maintenance guide.
- Do not tow a trailer until your vehicle has been driven at least 1,000 miles (1600 km).
- Refer to the instructions included with towing accessories for the proper installation and adjustment specifications.

Do not exceed the maximum loads listed on the Safety Compliance Certification label. For load specification terms found on the label, refer to *Vehicle loading* in this chapter. Remember to figure in the tongue load of your loaded vehicle when figuring the total weight.

FWD			
GCWR (Gross Combined Weight Rating)/Trailer Weight			
Engine	**Maximum GCWR-lb. (kg)**	**Trailer weight range-lb. (kg) (0-Maximum)**	**Tongue load-lb. (kg) (0-Maximum)**
3.5L Class I towing (standard)	7350 (3334)	0–2000 (0-907)	0–200 (0–91)
3.5L Class II towing (optional)	8500 (3855)	0–3500 (0–1588)	0–350 (0–159)

AWD			
GCWR (Gross Combined Weight Rating)/Trailer Weight			
Engine	**Maximum GCWR-lb. (kg)**	**Trailer weight range-lb. (kg) (0-Maximum)**	**Tongue load-lb. (kg) (0-Maximum)**
3.5L Class I towing (standard)	7550 (3425)	0–2000 (0-907)	0–200 (0–91)
3.5L Class II towing (optional)	8720 (3955)	0–3500 (0–1588)	0–350 (0–159)

Do not exceed the GVWR or the GAWR specified on the certification label.

Towing trailers beyond the maximum recommended gross trailer weight exceeds the limit of the vehicle and could result in engine damage, transmission damage, structural damage, loss of vehicle control, vehicle rollover and personal injury.

Preparing to tow

Use the proper equipment for towing a trailer and make sure it is properly attached to your vehicle. See your authorized dealer or a reliable trailer dealer if you require assistance.

Hitches

Do not use hitches that clamp onto the vehicle's bumper or attach to the axle. You must distribute the load in your trailer so that 10%–15% of the total weight of the trailer is on the tongue.

Safety chains

Always connect the trailer's safety chains to the hook retainers on the hitch. To connect the trailer's safety chains, cross the chains under the trailer tongue and allow slack for turning corners.

If you use a rental trailer, follow the instructions that the rental agency gives to you.

Do not attach safety chains to the bumper.

Trailer brakes

Be sure your trailer conforms to all applicable local and Federal Regulations regarding trailer braking. If your trailer is equipped with electronically controlled brakes you will need to have an electronic brake controller with associated wiring installed to your vehicle by an authorized dealer.

Do not connect a trailer's hydraulic brake system directly to your vehicle's brake system. Your vehicle may not have enough braking power and your chances of having a collision greatly increase.

The braking system of the tow vehicle is rated for operation at the GVWR not GCWR.

Trailer lamps

Trailer lamps are required on most towed vehicles. Make sure all running lights, brake lights, turn signals and hazard lights are working.

Do not splice into the vehicle lamp wiring for trailer lamps. Your vehicle uses an advanced electronic module to control and monitor your vehicle lamps. Splicing into the wiring or attaching wiring to the vehicle bulb. may DISABLE the rear vehicle lamps or cause them not to function properly. Your lamp outage feature may also be disabled or provide incorrect information.

See your authorized dealer or trailer rental agency for proper instructions and equipment for hooking up trailer lamps.

Trailer tow connector (equipped on vehicles with a Class II trailer tow/prep package)

The trailer tow connector is located under the rear bumper, on the driver's side of the vehicle.

Refer to the following chart for information regarding the factory-equipped trailer tow connector:

Trailer tow connector	
Color	**Function**
1. Dark Green	Right hand turn signal/brake/hazard flasher
2. Yellow	Left hand turn signal/brake/hazard flasher
3. Brown	Tail lamps/parking lamps
4. White	Ground

Driving while you tow

When towing a trailer:

- To ensure proper "break-in" of powertrain components, do not trailer tow during the first 1,000 miles (1600 km) of a new vehicle.
- To ensure proper "break-in" of powertrain components during the first 500 miles (800 km) of trailer towing, drive no faster than 70 mph (112 km/h) with no full throttle starts.
- Turn off the speed control. The speed control may shut off automatically when you are towing on long, steep grades.
- Consult your local motor vehicle speed regulations for towing a trailer.
- To eliminate excessive shifting, use a lower gear. This will also assist in transmission cooling. (For additional information, refer to the *Understanding the positions of the 6–speed automatic transmission* section in this chapter.
- Anticipate stops and brake gradually.
- Do not exceed the GCWR rating or transmission damage may occur.

Servicing after towing

If you tow a trailer for long distances, your vehicle will require more frequent service intervals. Refer to your *Scheduled Maintenance Guide* for more information.

Trailer towing tips

- Practice turning, stopping and backing up before starting on a trip to get the feel of the vehicle trailer combination. When turning, make wider turns so the trailer wheels will clear curbs and other obstacles.
- Allow more distance for stopping with a trailer attached.
- If you are driving down a long or steep hill, shift to a lower gear. Do not apply the brakes continuously, as they may overheat and become less effective.
- The trailer tongue weight should be 10–15% of the loaded trailer weight.
- If you will be towing a trailer frequently in hot weather, hilly conditions, at GCWR, or any combination of these factors, consider refilling your rear axle with synthetic gear lube if not already so equipped. Refer to the *Maintenance and Specifications* chapter for the lubricant specification. Remember that regardless of the rear axle lube used, do not tow a trailer for the first 1,000 miles (1600 km) of a new vehicle, and that the first 500 miles (800 km) of towing be done at no faster than 70 mph (112 km/h) with no full throttle starts.
- After you have traveled 50 miles (80 km), thoroughly check your hitch, electrical connections and trailer wheel lug nuts.
- To aid in engine/transmission cooling and A/C efficiency during hot weather while stopped in traffic, place the gearshift lever in P (Park).
- Vehicles with trailers should not be parked on a grade. If you must park on a grade, place wheel chocks under the trailer's wheels.

RECREATIONAL TOWING

Follow these guidelines for your specific powertrain combination to tow your vehicle for personal travel (such as behind a motor home or a truck).

In case of roadside emergency with a disabled vehicle, please refer to *Wrecker towing* in the *Roadside Emergencies* chapter.

These guidelines are designed to prevent damage to your vehicle.

Front Wheel Drive (FWD) vehicles:

Tow your Front Wheel Drive vehicle with all four wheels on the ground or with the front wheels off the ground by using a tow dolly. If you are using a tow dolly follow the instructions specified by the equipment provider.

All Wheel Drive (AWD) vehicles:

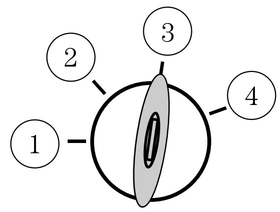
Tow your All Wheel Drive vehicle with all four wheels on the ground or with all four wheels off the ground using a vehicle transport trailer. **Do not tow your All Wheel Drive vehicle with the front wheels off the ground (by using a tow dolly) and the rear wheels on the ground.** This will cause damage to your AWD system. If you are using a vehicle transport trailer, follow the instruction specified by the equipment provider.

Note: If you tow your vehicle with all four wheels on the ground, follow these instructions:

- Tow only in the forward direction
- Release the parking brake
- Place the transmission shift lever in Neutral (N)
- Turn the key in the ignition to the ACC position (refer to *Starting* in the *Driving* chapter). The ACC position also unlocks the steering wheel.
- Do not exceed 65 mph (105 km/h)
- Start the engine and allow it to run for five minutes at the beginning of each day and at each fuel stop.

STARTING

Positions of the ignition



1. LOCK, locks the automatic transaxle gearshift lever and allows key removal. This position also shuts the engine and all electrical accessories off without locking the steering wheel. To lock the steering wheel, remove the key then turn the steering wheel.

2. ACC, allows the electrical accessories such as the radio to operate while the engine is not running. This position also unlocks the steering wheel.

3. RUN, all electrical circuits operational. Warning lights illuminated. Key position when driving.

4. START, cranks the engine. Release the key as soon as the engine starts.

Preparing to start your vehicle

Engine starting is controlled by the powertrain control system. This system meets all Canadian Interference-Causing Equipment standard requirements regulating the impulse electrical field strength of radio noise.

When starting a fuel-injected engine, avoid pressing the accelerator before or during starting. Only use the accelerator when you have difficulty starting the engine. For more information on starting the vehicle, refer to *Starting the engine* in this chapter.

Extended idling at high engine speeds can produce very high temperatures in the engine and exhaust system, creating the risk of fire or other damage.

Do not park, idle, or drive your vehicle in dry grass or other dry ground cover. The emission system heats up the engine compartment and exhaust system, which can start a fire.

WARNING: Do not start your vehicle in a closed garage or in other enclosed areas. Exhaust fumes can be toxic. Always open the garage door before you start the engine. See *Guarding against exhaust fumes* in this chapter for more instructions.

WARNING: If you smell exhaust fumes inside your vehicle, have your dealer inspect your vehicle immediately. Do not drive if you smell exhaust fumes.

Important safety precautions

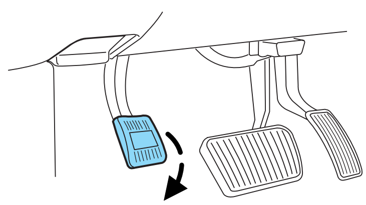
When the engine starts, the idle RPM runs faster to warm the engine. If the engine idle speed does not slow down automatically, have the vehicle checked.

Before starting the vehicle:

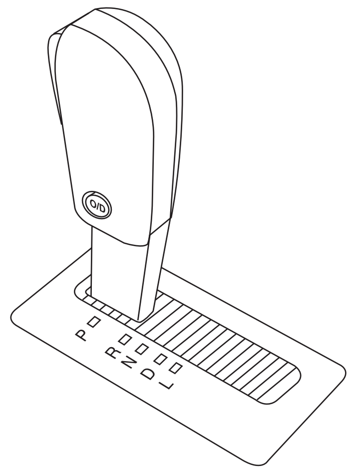
1. Make sure all vehicle occupants buckle their safety belts. For more information on safety belts and their proper usage, refer to the *Seating and Safety Restraints* chapter.

2. Make sure the headlamps and electrical accessories are off.

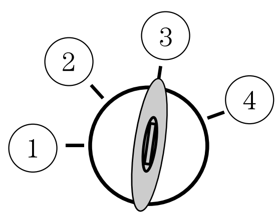
- Make sure the parking brake is set.



- Make sure the gearshift is in P (Park).



3. Turn the key to 3 (RUN) without turning the key to 4 (START).

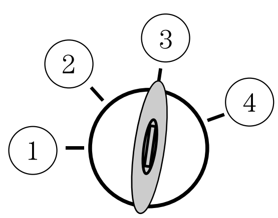


Some warning lights will briefly illuminate. See *Warning lights and chimes* in the *Instrument Cluster* chapter for more information regarding the warning lights.

Starting the engine

1. Turn the key to 3 (RUN) without turning the key to 4 (START).

2. Turn the key to 4 (START), then release the key as soon as the engine starts. Excessive cranking could damage the starter.



Note: If the engine does not start on the first try, turn the key to LOCK, wait 10 seconds and try again. If the engine still fails to start, press the accelerator to the floor and try again; this will allow the engine to crank with the fuel shut off in case the engine is flooded with fuel.

This vehicle has a computer assisted cranking system which assists in starting the engine. If the ignition key is turned to 4 (START) and then released when the engine begins cranking, the engine may continue cranking for up to 10 seconds or until the vehicle starts.

Guarding against exhaust fumes

Carbon monoxide is present in exhaust fumes. Take precautions to avoid its dangerous effects.

If you smell exhaust fumes inside your vehicle, have your dealer inspect your vehicle immediately. Do not drive if you smell exhaust fumes.

Important ventilating information

If the engine is idling while the vehicle is stopped for a long period of time, open the windows at least one inch (2.5 cm) or adjust the heating or air conditioning to bring in fresh air.

ENGINE BLOCK HEATER (IF EQUIPPED)

An engine block heater warms the engine coolant which aids in starting and allows the heater/defroster system to respond quickly. If your vehicle is equipped with this system, your equipment includes a heater element which is installed in your engine block and a wire harness which allows the user to connect the system to a grounded 120 volt a/c electrical source. The block heater system is most effective when outdoor temperatures reach below 0°F (-17°C).

Failure to follow engine block heater instructions could result in property damage or physical injury.

To reduce the risk of electrical shock, do not use your heater with ungrounded electrical systems or two-pronged (cheater) adapters.

Prior to using the engine block heater, follow these recommendations for proper and safe operation:

- For your safety, use an outdoor extension cord that is product certified by Underwriter's laboratory (UL) or Canadian Standards Association (CSA). Use only an extension cord that can be used outdoors, in cold temperatures, and is clearly marked ″Suitable for Use with Outdoor Appliances.″ Never use an indoor extension cord outdoors; it could result in an electric shock or fire hazard.
- Use a 16 gauge outdoor extension cord, minimum.
- Use as short an extension cord as possible.
- Do not use multiple extension cords. Instead, use one extension cord which is long enough to reach from the engine block heater cord to the outlet without stretching.
- Make certain that the extension cord is in excellent condition (not patched or spliced). Store your extension cord indoors at temperatures above 32°F (0°C). Outdoor conditions can deteriorate extension cords over a period of time.
- To reduce the risk of electrical shock, do not use your heater with ungrounded electrical systems or two pronged (cheater) adapters. Also ensure that the block heater, especially the cord, is in good condition before use.
- Make sure that when in operation, the extension cord plug /engine block heater cord plug connection is free and clear of water in order to prevent possible shock or fire.
- Be sure that areas where the vehicle is parked are clean and clear of all combustibles such as petroleum products, dust, rags, paper and similar items.
- Be sure that the engine block heater, heater cord and extension cord are solidly connected. A poor connection can cause the cord to become very hot and may result in an electrical shock or fire. Be sure to check for heat anywhere in the electrical hookup once the system has been operating for approximately a half hour.
- Finally, have the engine block heater system checked during your fall tune-up to be sure it's in good working order.

How to use the engine block heater

Ensure the receptacle terminals are clean and dry prior to use. To clean them, use a dry cloth.

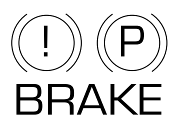
Depending on the type of factory installed equipment, your engine block heater system may consume anywhere between 400 watts or 1000 watts of energy per hour. Your factory installed block heater system does not have a thermostat; however, maximum temperature is attained after approximately 3 hours of operation. Block heater operation longer than 3 hours will not improve system performance and will unnecessarily use additional electricity.

Make sure system is unplugged and properly stowed before driving the vehicle. While not in use, make sure the protective cover seals the prongs of the engine block heater cord plug.

BRAKES

Occasional brake noise is normal. If a metal-to-metal, continuous grinding or continuous squeal sound is present, the brake linings may be worn-out and should be inspected by an authorized dealer. If the vehicle has continuous vibration or shudder in the steering wheel while braking, the vehicle should be inspected by an authorized dealer.

Refer to *Brake system warning light* in the *Instrument Cluster* chapter for information on the brake system warning light.



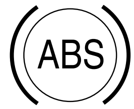
Four-wheel anti-lock brake system (ABS)

Your vehicle is equipped with an Anti-lock Braking System (ABS). This system helps you maintain steering control during emergency stops by keeping the brakes from locking. Noise from the ABS pump motor and brake pedal pulsation may be observed during ABS braking and the brake pedal may suddenly travel a little farther as soon as ABS braking is done and normal brake operation resumes. These are normal characteristics of the ABS and should be no reason for concern.

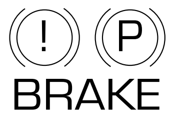
Using ABS

When hard braking is required, apply continuous force on the brake pedal; do not pump the brake pedal since this will reduce the effectiveness of the ABS and will increase your vehicle's stopping distance. The ABS will be activated immediately, allowing you to retain steering control during hard braking and on slippery surfaces. However, the ABS does not decrease stopping distance.

ABS warning lamp

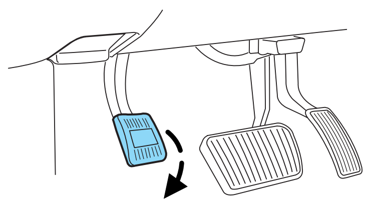


The ABS lamp in the instrument cluster momentarily illuminates when the ignition is turned on. If the light does not illuminate during start up, remains on or flashes, the ABS may be disabled and may need to be serviced.

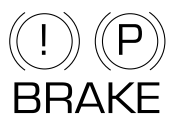


Even when the ABS is disabled, normal braking is still effective. If your BRAKE warning lamp illuminates with the parking brake released, have your brake system serviced immediately by an authorized dealer.

Parking brake



Apply the parking brake whenever the vehicle is parked. To set the parking brake, press the parking brake pedal down until the pedal stops.

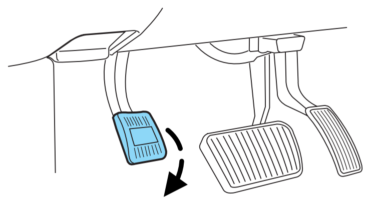


The BRAKE warning lamp in the instrument cluster illuminates and remains illuminated (when the ignition is turned ON) until the parking brake is released.

> Always set the parking brake fully and make sure that the gearshift is securely latched in P (Park).

The parking brake is not recommended to stop a moving vehicle. However, if the normal brakes fail, the parking brake can be used to stop your vehicle in an emergency. Since the parking brake applies only the rear brakes, the vehicle's stopping distance will increase greatly and the handling of your vehicle will be adversely affected.

Push the parking brake pedal downward again to release the parking brake. Driving with the parking brake on will cause the brakes to wear out quickly and reduce fuel economy.



Note: If the vehicle is driven with the parking brake applied, a chime will sound.

ADVANCETRAC® WITH ROLL STABILITY CONTROL™ (RSC) STABILITY ENHANCEMENT SYSTEM

The AdvanceTrac® with RSC system provides stability enhancement features such as Roll Stability Control™ (RSC), Electronic Stability Control (ESC) and Traction Control (TCS) for certain driving situations. The system includes an AdvanceTrac® with RSC on/off button, and a “sliding car” icon in the instrument cluster.

The Anti-lock Braking System (ABS) will work with the regular brakes in order to prevent wheel lock during a braking event. This feature will also help provide better steerability during braking.

During AdvanceTrac® with RSC operation you may experience the following:

- A rumble, grunting, or grinding noise after startup and when driving off
- A slight deceleration of the vehicle
- The AdvanceTrac® with RSC indicator light will flash when the system is activated.
- If your foot is on the brake pedal, you will feel a vibration in the pedal.

Traction Control

Traction Control helps your vehicle maintain traction, when driving on slippery and/or hilly road surfaces, by detecting and controlling wheel spin. Excessive wheel spin is controlled by momentarily reducing engine power and/or applying the anti-lock brakes.

If your vehicle should become stuck in deep snow or mud, try switching the AdvanceTrac® with RSC system off by pressing the AdvanceTrac® with RSC button momentarily. This will allow your wheels to spin and your tires to “dig” for traction. If your vehicle seems to lose engine power while driving in deep sand or very deep snow, switching off the

AdvanceTrac with RSC stability enhancement feature will restore full engine power and torque to each wheel.

If the AdvanceTrac® with RSC system is activated excessively in a short period of time, the brake portion of the system will disable to allow the brakes to cool down. In this situation, Traction Control will use only engine power reduction to help control the wheels from over-spinning. When the brakes have cooled down, the system will again function normally. Anti-lock braking, RSC and ESC are not affected by this condition and will function normally during the cool-down period.

During Traction Control events the “sliding car” icon in the instrument cluster will flash momentarily.

Electronic Stability Control (ESC)

The Electronic Stability Control (ESC) with RSC system may enhance your vehicle’s stability during adverse maneuvers.

The AdvanceTrac® with RSC system helps the driver maintain steering control. AdvanceTrac® with RSC will attempt to correct the vehicle motion by applying brake force at individual tires and, if necessary, by reducing engine power.

During Electronic Stability Control events the “sliding car” icon in the instrument cluster will flash momentarily.

Driving maneuvers which may activate AdvanceTrac® with RSC system include:

- Taking a turn too fast.
- Maneuvering quickly to avoid an accident, pedestrian or obstacle.
- Driving over a patch of ice.
- Changing lanes on a snow-rutted road.
- Entering a snow-free road from a snow-covered side street, or vice versa.
- Entering a paved road from a gravel road, or vice versa.
- Driving on slick surfaces.
- Cornering while towing a heavily loaded trailer (refer to *Trailer towing* in the *Tires, Wheels and Loading* chapter.)

Roll Stability Control™ (RSC)

The RSC system works in conjunction with the AdvanceTrac® system to help maintain roll stability of the vehicle during aggressive maneuvers by applying brake force to one or more wheels.

During Roll Stability Control™ (RSC) events the “sliding car” icon in the instrument cluster will flash momentarily.

Driving conditions that may activate AdvanceTrac® with RSC include:

- Emergency lane-change
- Taking a turn too fast
- Quick maneuvering to avoid an accident, pedestrian or obstacle

AdvanceTrac® with RSC button and icon functionality

The AdvanceTrac® with RSC system automatically turns on each time the engine is started, even if it was turned off when the engine was last shut down. The “sliding car” icon which is located with the warning lights in the instrument cluster will illuminate during bulb check at initial start-up and then go off. This tells you that the system is normal and active. All functions of the AdvanceTrac® with RSC system (RSC, ESC, Engine Traction Control, and Brake Traction Control) will be tested at start up. When the system is left active, the “sliding car” icon will flash only when any of the components of the system are affecting the vehicle’s performance, otherwise the light will remain off. Consequently, the “sliding car” icon will not be illuminated during most of your normal driving.

The AdvanceTrac® with RSC button, located on the center stack of the instrument panel, allows the driver to control certain features of the AdvanceTrac® with RSC system below 45 mph (70 km/h). If the vehicle is below 45 mph (70 km/h), pressing the AdvanceTrac® with RSC button will disable RSC, ESC and Engine Traction Control and steadily illuminate the “sliding car” icon. The AdvanceTrac® with RSC system will remain enabled when the vehicle speed is above 45 mph (70 km/h) even if the button has been pressed.

In R (Reverse), ABS and the Traction Control feature will continue to function, however ESC and RSC are disabled.

All these conditions are normal during AdvanceTrac® with RSC operation.

Do not alter or modify your vehicle’s suspension or steering; the resulting changes to the vehicle’s handling can adversely affect the AdvanceTrac® with RSC system.

Aggressive driving in any road conditions can cause you to lose control of your vehicle increasing the risk of severe personal injury or property damage. The occurrence of a AdvanceTrac® with RSC event is an indication that at least some of the tires have exceeded their ability to grip the road; this may lead to an increased risk of loss of vehicle control, vehicle rollover, personal injury and death. If you experience a severe road event, SLOW DOWN.

If a failure is detected in the AdvanceTrac® with RSC system, and the AdvanceTrac® with RSC button has not been pushed, the warning indicator light in the instrument cluster will stay on. If the warning indicator light in the instrument cluster remains on while the engine is running, have the system serviced by an authorized dealer immediately.

STEERING

To help prevent damage to the power steering system:

- Never hold the steering wheel at its furthest turning points (until it stops) for more than a few seconds when the engine is running.
- Do not operate the vehicle with a low power steering fluid level (below the MIN mark on the reservoir).
- Some noise is normal during operation. If the noise is excessive, check for a low power steering fluid level before seeking service by your authorized dealer.
- Heavy or uneven steering efforts may be caused by a low power steering fluid level. Check for a low power steering fluid level before seeking service by your authorized dealer.
- Do not fill the power steering fluid reservoir above the MAX mark on the reservoir.

If the power steering system breaks down (or if the engine is turned off), you can steer the vehicle manually, but it takes more effort.

If the steering wanders or pulls, check for:

- an improperly inflated tire
- uneven tire wear
- loose or worn suspension components
- loose or worn steering components
- improper steering alignment

A high crown in the road or high crosswinds may also make the steering seem to wander/pull.

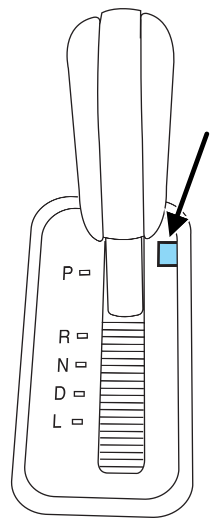
AUTOMATIC TRANSMISSION OPERATION

Brake-shift interlock

This vehicle is equipped with a brake-shift interlock feature that prevents the gearshift lever from being moved from P (Park) when the ignition is in the RUN position unless brake pedal is depressed.

If you cannot move the gearshift lever out of P (Park) with ignition in the RUN position and the brake pedal depressed:

1. Apply the parking brake, turn ignition key to LOCK, then remove the key.
2. Using a screwdriver (or similar tool), remove the protective cover to the interlock release access hole on the console.
3. Insert the screwdriver (or similar tool) into the access hole and press downward while pulling the gearshift lever out of the P (Park) position and into the N (Neutral) position.
4. Remove the tool and reinstall the protective cover.
5. Start the vehicle and release the parking brake.



If it is necessary to use the above procedure to move the gearshift lever, it is possible that a fuse has blown or the vehicle's brakelamps are not operating properly. Refer to *Fuses and relays* in the *Roadside Emergencies* chapter.

Do not drive your vehicle until you verify that the brakelamps are working.

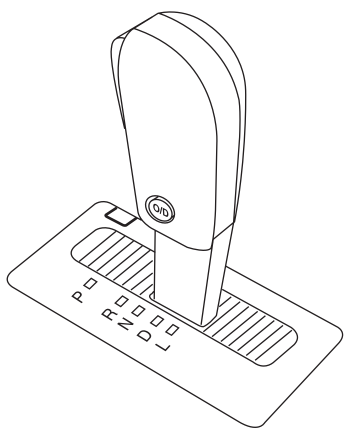
Always set the parking brake fully and make sure the gearshift is latched in P (Park). Turn the ignition to the LOCK position and remove the key whenever you leave your vehicle.

If the parking brake is fully released, but the brake warning lamp remains illuminated, the brakes may not be working properly. See your authorized dealer as soon as possible.

Automatic Transaxle Adaptive Learning

Your transaxle is equipped with an adaptive learning strategy found in the vehicle computer. This feature is designed to increase durability and provide consistent shift feel over the life of the vehicle. A new vehicle or transaxle may have firm and/or soft shifts. This operation is considered normal and will not affect function or durability of the transaxle. Over time, the adaptive learning process will fully update transaxle operation. Additionally, whenever the battery is disconnected or a new battery installed, the strategy must be relearned.

Understanding the gearshift positions of the 6–speed automatic transaxle



P (Park)

This position locks the transaxle and prevents the front wheels from turning.

To put your vehicle in gear:

- Depress the brake pedal

- Move the gearshift lever into the desired gear

To put your vehicle in P (Park):

- Come to a complete stop
- Move the gearshift lever and securely latch it in P (Park)

Always set the parking brake fully and make sure the gearshift is latched in P (Park). Turn the ignition to the LOCK position and remove the key whenever you leave your vehicle.

R (Reverse)

With the gearshift lever in R (Reverse), the vehicle will move backward. Always come to a complete stop before shifting into and out of R (Reverse).

N (Neutral)

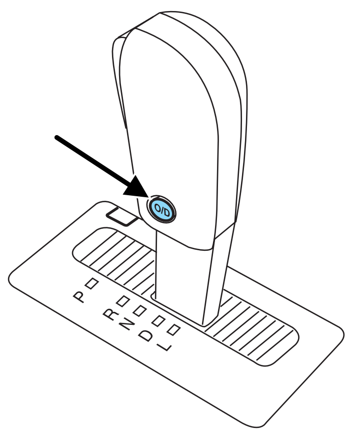
With the gearshift lever in N (Neutral), the vehicle can be started and is free to roll. Hold the brake pedal down while in this position.

D (Drive) with Overdrive

The normal driving position for the best fuel economy. Transaxle operates in gears one through six.

D (Drive) with Grade Assist

Overdrive can be deactivated by pressing the transmission control switch on the side of the gearshift lever. This will also activate Grade Assist.



- Transaxle operates in gears one through five.
- Provides engine braking. Depending on conditions the transaxle will automatically downshift to increase the level of engine braking while descending grades.
- Use when driving conditions cause excessive shifting from O/D to other gears. Examples: hilly terrain, mountainous areas and when engine braking is required.

- O/D OFF lamp in the instrument cluster is illuminated.

O/D
OFF

- To return to O/D (overdrive mode), press the transmission control switch. The O/D OFF lamp in the instrument cluster will not be illuminated.
- O/D (overdrive) is automatically returned each time the key is turned off.

L (Low)

- Provides maximum engine braking.
- Will downshift to the lowest available gear for the current vehicle speed; allows for first gear when vehicle reaches slower speeds.

If your vehicle gets stuck in mud or snow

If your vehicle gets stuck in mud or snow, it may be rocked out by shifting between forward and reverse gears, stopping between shifts in a steady pattern. Press lightly on the accelerator in each gear.

Do not rock the vehicle if the engine is not at normal operating temperature or damage to the transmission may occur.

Do not rock the vehicle for more than a minute or damage to the transmission and tires may occur, or the engine may overheat.

It may be beneficial to turn the AdvanceTrac® with RSC system off so the wheels are allowed to spin.

REVERSE SENSING SYSTEM (IF EQUIPPED)

The Reverse Sensing System (RSS) sounds a tone to warn the driver of obstacles near the rear bumper when the R (Reverse) is selected and the vehicle is moving at speeds less than 3 mph (5 km/h). The system is not effective at speeds above 3 mph (5 km/h) and may not detect certain angular or moving objects.

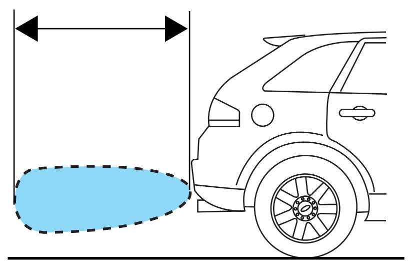
To help avoid personal injury, please read and understand the limitations of the reverse sensing system as contained in this section. Reverse sensing is only an aid for some (generally large and fixed) objects when moving in reverse on a flat surface at "parking speeds". Inclement weather may also affect the function of the RSS; this may include reduced performance or a false activation.

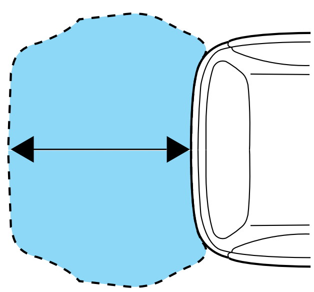
To help avoid personal injury, always use caution when in R (Reverse) and when using the RSS.

This system is not designed to prevent contact with small or moving objects. The system is designed to provide a warning to assist the driver in detecting large stationary objects to avoid damaging the vehicle. The system may not detect smaller objects, particularly those close to the ground.

Certain add-on devices such as large trailer hitches, bike or surfboard racks and any device that may block the normal detection zone of the RSS system may create false beeps.

The RSS detects obstacles up to six feet (two meters) from the rear bumper with a decreased coverage area at the outer corners of the bumper, (refer to the figures for approximate zone coverage areas). As you move closer to the obstacle, the rate of the tone increases. When the obstacle is less than 10 inches (25.0 cm) away, the tone will sound continuously. If the RSS detects a stationary or receding object further than 10 inches (25.0 cm) from the side of the vehicle, the tone will sound for only three seconds. Once the system detects an object approaching, the tone will sound again.





While receiving a warning the radio volume will be reduced to a predetermined level. After the warning goes away, the radio will return to the previous value.

The RSS automatically turns on when the gear selector is placed in R (Reverse) and the ignition is ON. A control in the message center allows the driver to disable the system only when the ignition is ON and the gear selector is in R (Reverse). Refer to *Message center* in the *Driver Controls* chapter for more information.

Keep the RSS sensors (located on the rear bumper/fascia) free from snow, ice and large accumulations of dirt (do not clean the sensors with sharp objects). If the sensors are covered, it will affect the accuracy of the RSS.

If your vehicle sustains damage to the rear bumper/fascia, leaving it misaligned or bent, the sensing zone may be altered causing inaccurate measurement of obstacles or false alarms.

ALL WHEEL DRIVE (AWD) SYSTEM (IF EQUIPPED)

Your vehicle may be equipped with a full-time All Wheel Drive (AWD) system. With the AWD option, power will be delivered to the front wheels and distributed to the rear wheels as needed. The AWD system is active all the time and requires no input from the operator.

All components of the AWD system are sealed for life and require no maintenance.

If your vehicle is equipped with AWD, a spare tire of a different size other than the tire provided should never be used. A dissimilar spare tire size (other than the spare tire provided) or major dissimilar tire sizes between the front and rear axles could cause the AWD system to stop functioning and default to front wheel drive and could damage the system.

Note: Your AWD vehicle is not intended for severe off-road use. The AWD feature gives your vehicle some limited off-road capabilities in which driving surfaces are relatively level, obstruction-free and otherwise similar to normal on-road driving conditions. Operating your vehicle under other than those conditions could subject the vehicle to excessive stress which might result in damage which is not covered under your warranty.

Driving off-highway with AWD vehicles

AWD vehicles are equipped for driving on sand, snow, mud and rough roads and have operating characteristics that are somewhat different from conventional vehicles, both on and off the highway.

When driving at slow speeds off-highway under high outside temperatures, use L (Low) gear when possible. L (Low) gear operation will maximize the engine and transmission cooling capability.

Under severe operating conditions, the A/C may cycle on and off to protect overheating of the engine.

Basic operating principles

- Drive slower in strong crosswinds which can affect the normal steering characteristics of your vehicle.
- Be extremely careful when driving on pavement made slippery by loose sand, water, gravel, snow or ice.

If your vehicle goes off the edge of the pavement

- If your vehicle goes off the edge of the pavement, slow down, but avoid severe brake application, ease the vehicle back onto the pavement only after reducing your speed. Do not turn the steering wheel too sharply while returning to the road surface.
- It may be safer to stay on the apron or shoulder of the road and slow down gradually before returning to the pavement. You may lose control if you do not slow down or if you turn the steering wheel too sharply or abruptly.
- It often may be less risky to strike small objects, such as highway reflectors, with minor damage to your vehicle rather than attempt a sudden return to the pavement which could cause the vehicle to slide sideways out of control or rollover. Remember, your safety and the safety of others should be your primary concern.

If your vehicle gets stuck

If your vehicle gets stuck in mud or snow it may be rocked out by shifting between forward and reverse gears, stopping between shifts, in a steady pattern. Press lightly on the accelerator in each gear.

If your vehicle is equipped with AdvanceTrac® with Roll Stability Control™, it may be beneficial to disengage the AdvanceTrac® with Roll Stability Control™ system while attempting to rock the vehicle.

Do not rock the vehicle if the engine is not at normal operating temperature or damage to the transmission may occur.

Do not rock the vehicle for more than a few minutes or damage to the transmission and tires may occur or the engine may overheat.

Always set the parking brake fully and make sure the gearshift is latched in P (Park). Turn the ignition to the LOCK position and remove the key whenever you leave your vehicle.

If the parking brake is fully released, but the brake warning lamp remains illuminated, the brakes may not be working properly. See your authorized dealer.

Do not spin the wheels at over 35 mph (56 km/h). The tires may fail and injure a passenger or bystander.

Emergency maneuvers

- In an unavoidable emergency situation where a sudden sharp turn must be made, remember to avoid “over-driving” your vehicle (i.e., turn the steering wheel only as rapidly and as far as required to avoid the emergency). Excessive steering will result in less vehicle control, not more. Additionally, smooth variations of the accelerator and/or brake pedal pressure should be utilized if changes in vehicle speed are called for. Avoid abrupt steering, acceleration or braking which could result in an increased risk of loss of vehicle control, vehicle rollover and/or personal injury. Use all available road surface to return the vehicle to a safe direction of travel.
- In the event of an emergency stop, avoid skidding the tires and do not attempt any sharp steering wheel movements.
- If the vehicle goes from one type of surface to another (i.e., from concrete to gravel) there will be a change in the way the vehicle responds to a maneuver (steering, acceleration or braking). Again, avoid these abrupt inputs.

AWD Systems (if equipped)

With AWD, the vehicle uses all four wheels to power the vehicle. This increases traction, enabling you to drive over terrain and road conditions that a conventional two-wheel drive vehicle cannot.

Sand

When driving over sand, try to keep all four wheels on the most solid area of the trail. Avoid reducing the tire pressures but shift to a lower gear and drive steadily through the terrain. Apply the accelerator slowly and avoid spinning the wheels.

Do not drive your AWD vehicle in deep sand for an extended period of time. This will cause the AWD system to overheat. If the rear tires stop spinning while the front tires spin in deep sand, turn off the vehicle and allow the AWD system to cool down for a minimum of 15 minutes. After the system has cooled down, normal AWD function will return. When driving at slow speeds in deep sand under high outside temperatures, use L (Low) gear when possible. L (Low) gear operation will maximize the engine and transmission cooling capability.

Under severe operating conditions, the A/C may cycle on and off to protect overheating of the engine.

Avoid excessive speed because vehicle momentum can work against you and cause the vehicle to become stuck to the point that assistance may be required from another vehicle. Remember, you may be able to back out the way you came if you proceed with caution.

Mud and water

If you must drive through high water, drive slowly. Traction or brake capability may be limited.

When driving through water, determine the depth; avoid water higher than the bottom of the wheel rims (for cars) or the bottom of the hubs (for trucks) (if possible) and proceed slowly. If the ignition system gets wet, the vehicle may stall.

Once through water, always try the brakes. Wet brakes do not stop the vehicle as effectively as dry brakes. Drying can be improved by moving your vehicle slowly while applying light pressure on the brake pedal.

Be cautious of sudden changes in vehicle speed or direction when you are driving in mud. Even AWD vehicles can lose traction in slick mud. As when you are driving over sand, apply the accelerator slowly and avoid spinning your wheels. If the vehicle does slide, steer in the direction of the slide until you regain control of the vehicle.

After driving through mud, clean off residue stuck to rotating driveshafts and tires. Excess mud stuck on tires and rotating driveshafts causes an imbalance that could damage drive components.

Driving through deep water may damage the transmission.

If the front or rear axle is submerged in water, the axle lubricant and PTU (Power Transfer Unit) lubricant should be checked and changed if necessary.

"Tread Lightly" is an educational program designed to increase public awareness of land-use regulations and responsibilities in our nations wilderness areas. Ford Motor Company joins the U.S. Forest Service and the Bureau of Land Management in encouraging you to help preserve our national forest and other public and private lands by "treading lightly."

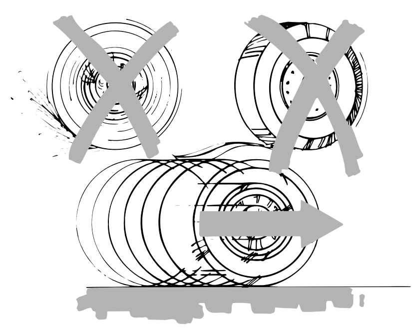
Driving on hilly or sloping terrain

Although natural obstacles may make it necessary to travel diagonally up or down a hill or steep incline, you should always try to drive straight up or straight down. **Avoid driving crosswise or turning on steep slopes or hills.** A danger lies in losing traction, slipping sideways and possibly rolling over. Whenever driving on a hill, determine beforehand the route you will use. Do not drive over the crest of a hill without seeing what conditions are on the other side. Do not drive in reverse over a hill without the aid of an observer.

When climbing a steep slope or hill, start in a lower gear rather than downshifting to a lower gear from a higher gear once the ascent has started. This reduces strain on the engine and the possibility of stalling.

If you do stall out, do not try to turnaround because you might roll over. It is better to back down to a safe location.

Apply just enough power to the wheels to climb the hill. Too much power will cause the tires to slip, spin or lose traction, resulting in loss of vehicle control.



Descend a hill in the same gear you would use to climb up the hill to avoid excessive brake application and brake overheating. Do not descend in neutral; instead, disengage overdrive or manually shift to a lower gear. When descending a steep hill, avoid sudden hard braking as you could lose control. The front wheels have to be turning in order to steer the vehicle.

Your vehicle has anti-lock brakes, therefore apply the brakes steadily. Do not "pump" the brakes.

Driving on snow and ice

Note: Excessive tire slippage can cause transaxle damage.

AWD vehicles have advantages over 2WD vehicles in snow and ice but can skid like any other vehicle.

Should you start to slide while driving on snowy or icy roads, turn the steering wheel in the direction of the slide until you regain control.

Avoid sudden applications of power and quick changes of direction on snow and ice. Apply the accelerator slowly and steadily when starting from a full stop.

Avoid sudden braking as well. Although an AWD vehicle may accelerate better than a two-wheel drive vehicle in snow and ice, it won't stop any faster, because as in other vehicles, braking occurs at all four wheels. Do not become overconfident as to road conditions.

Make sure you allow sufficient distance between you and other vehicles for stopping. Drive slower than usual and consider using one of the lower gears. In emergency stopping situations, apply the brake steadily. Since your vehicle is equipped with a four wheel anti-lock brake system (ABS), do not "pump" the brakes. Refer to the *Brakes* section of this chapter for additional information on the operation of the anti-lock brake system.

Maintenance and Modifications

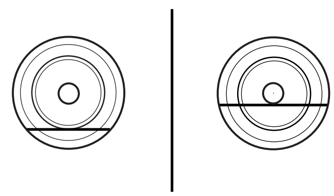
The suspension and steering systems on your vehicle have been designed and tested to provide predictable performance whether loaded or empty and durable load carrying capability. For this reason, Ford Motor Company strongly recommends that you do not make modifications such as adding or removing parts (such as lift kits or stabilizer bars) or by using replacement parts not equivalent to the original factory equipment.

Any modifications to a vehicle that raise the center of gravity can make it more likely the vehicle will rollover as a result of a loss of control. Ford Motor Company recommends that caution be used with any vehicle equipped with a high load or device (such as ladder or luggage racks).

Failure to maintain your vehicle properly may void the warranty, increase your repair cost, reduce vehicle performance and operational capabilities and adversely affect driver and passenger safety. Frequent inspection of vehicle chassis components is recommended if the vehicle is subjected to off-highway usage.

DRIVING THROUGH WATER

If driving through deep or standing water is unavoidable, proceed very slowly especially when the depth is not known. Never drive through water that is higher than the bottom of the wheel rims (for cars) or the bottom of the hubs (for trucks).



When driving through water, traction or brake capability may be limited. Also, water may enter your engine's air intake and severely damage your engine or your vehicle may stall. **Driving through deep water where the transmission vent tube is submerged may allow water into the transmission and cause internal transmission damage.**

Once through the water, always dry the brakes by moving your vehicle slowly while applying light pressure on the brake pedal. Wet brakes do not stop the vehicle as quickly as dry brakes.

ROADSIDE ASSISTANCE

Getting roadside assistance

To fully assist you should you have a vehicle concern, Ford Motor Company offers a complimentary roadside assistance program. This program is separate from the New Vehicle Limited Warranty. The service is available:

- 24–hours, seven days a week
- for the coverage period listed on the Roadside Assistance Card included in your Owner Guide portfolio.

Roadside assistance will cover:

- a flat tire change with a good spare (except vehicles that have been supplied with a tire inflation kit)
- battery jump start
- lock-out assistance (key replacement cost is the customer's responsibility)
- fuel delivery – Independent Service Contractors, if not prohibited by state, local or municipal law shall deliver up to 2.0 gallons (7.5L) of gasoline or 5 gallons (18.9L) of diesel fuel to a disabled vehicle. Fuel delivery service is limited to two no-charge occurrences within a 12-month period.
- winch out – available within 100 feet (30.5 meters) of a paved or county maintained road, no recoveries.
- towing – Ford/Mercury/Lincoln eligible vehicle towed to an authorized dealer within 35 miles (56.3 km) of the disablement location or to the nearest authorized dealer. If a member requests to be towed to an authorized dealer more than 35 miles (56.3 km) from the disablement location, the member shall be responsible for any mileage costs in excess of 35 miles (56.3 km).

Trailers shall be covered up to $200 if the disabled eligible vehicle requires service at the nearest authorized dealer. If the trailer is disabled, but the towing vehicle is operational, the trailer does not qualify for any roadside services.

Canadian customers refer to your Customer Information Guide for information on:

- coverage period
- exact fuel amounts
- towing of your disabled vehicle
- emergency travel expense reimbursement
- travel planning benefits

Using roadside assistance

Complete the roadside assistance identification card and place it in your wallet for quick reference. In the United States, this card is found in the Owner Guide portfolio in the glove compartment. In Canada, the card is found in the *Customer Information Guide* in the glove compartment.

U.S. Ford or Mercury vehicle customers who require roadside assistance, call 1–800–241–3673; Lincoln vehicle customers call 1–800–521–4140.

Canadian customers who require roadside assistance, call 1–800–665–2006.

If you need to arrange roadside assistance for yourself, Ford Motor Company will reimburse a reasonable amount for towing to the nearest dealership within 35 miles. To obtain reimbursement information, U.S. Ford or Mercury vehicle customers call 1–800–241–3673; Lincoln vehicle customers call 1–800–521–4140. Customers will be asked to submit their original receipts.

Canadian customers who need to obtain reimbursement information, call 1–800–665–2006.

Roadside coverage beyond basic warranty

In the United States, you may purchase additional roadside assistance coverage beyond this period through the Ford Auto Club by contacting your authorized dealer or by calling 1–800–FORD–CLUB.

Similarly in Canada, for uninterrupted Roadside Assistance coverage, you may purchase extended coverage prior to your Basic Warranty's Roadside Assistance expiring. For more information and enrollment, contact 1–877–294–2582 or visit our website at www.ford.ca.

HAZARD FLASHER CONTROL

The hazard flasher is located on the instrument panel by the radio. The hazard flashers will operate when the ignition is in any position or if the key is not in the ignition.

Push in the flasher control and all front and rear direction signals will flash. Press the flasher control again to turn them off. Use it when your vehicle is disabled and is creating a safety hazard for other motorists.

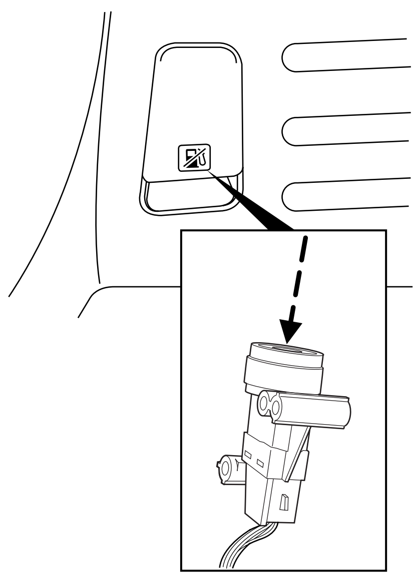
Note: With extended use, the flasher may run down your battery.

FUEL PUMP SHUT-OFF SWITCH

This device stops the electric fuel pump from sending fuel to the engine when your vehicle has had a substantial jolt.

After an accident, if the engine cranks but does not start, this switch may have been activated.

This switch is located behind a panel on the left side of the cargo area.



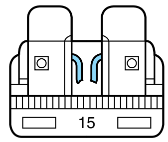
To reset the switch:

1. Turn the ignition OFF.
2. Check the fuel system for leaks.
3. If no leaks are apparent, reset the switch by pushing in on the reset button.
4. Turn the ignition ON.
5. Wait a few seconds and return the key to OFF.
6. Make another check for leaks.

FUSES AND RELAYS

Fuses

If electrical components in the vehicle are not working, a fuse may have blown. Blown fuses are identified by a broken wire within the fuse. Check the appropriate fuses before replacing any electrical components.



Note: Always replace a fuse with one that has the specified amperage rating. Using a fuse with a higher amperage rating can cause severe wire damage and could start a fire.

Standard fuse amperage rating and color

COLOR					
Fuse rating	**Mini fuses**	**Standard fuses**	**Maxi fuses**	**Cartridge maxi fuses**	**Fuse link cartridge**
2A	Grey	Grey	—	—	—
3A	Violet	Violet	—	—	—
4A	Pink	Pink	—	—	—
5A	Tan	Tan	—	—	—
7.5A	Brown	Brown	—	—	—
10A	Red	Red	—	—	—
15A	Blue	Blue	—	—	—
20A	Yellow	Yellow	Yellow	Blue	Blue
25A	Natural	Natural	—	—	—
30A	Green	Green	Green	Pink	Pink
40A	—	—	Orange	Green	Green
50A	—	—	Red	Red	Red
60A	—	—	Blue	Yellow	Yellow
70A	—	—	Tan	—	Brown
80A	—	—	Natural	Black	Black

Passenger compartment fuse panel

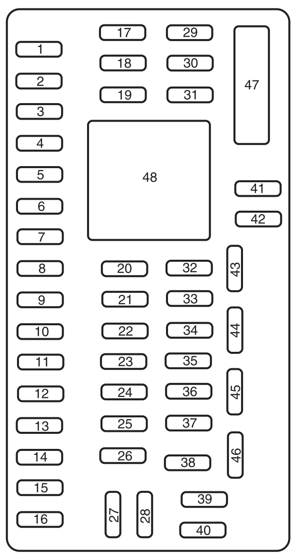
The fuse panel is located behind a trim panel on the left side of the driver’s footwell near the parking brake. To remove the trim panel, slide the release lever to the right then pull the trim panel out.

To remove the fuse panel cover, press in the tabs on both sides of the cover, then pull the cover off.

To reinstall the fuse panel cover, place the top part of the cover on the fuse panel, then push the bottom part of the cover until it clicks into place. Gently pull on the cover to make sure it is secure.

To reinstall the trim panel, align the tabs on the bottom of the panel with the grooves, push the panel shut and slide the release lever to the left to secure the panel.

To remove a fuse, use the fuse puller tool provided on the fuse panel cover.



The fuses are coded as follows.

Fuse/Relay Location	Fuse Amp Rating	Passenger Compartment Fuse Panel Description
1	30A	Passenger front smart window
2	15A	Not used (Spare)
3	15A	Family entertainment system (FES)/Rear seat control, SYNC
4	30A	Driver front smart window
5	10A	Keypad illumination, 2nd row seat, Tire Pressure Monitoring System (TPMS), Brake Shift Interlock (BSI)
6	20A	Turn signals
7	10A	Low beam headlamps (left)
8	10A	Low beam headlamps (right)
9	15A	Interior lights, Cargo lamps
10	15A	Backlighting, Puddle lamps
11	10A	All wheel drive
12	7.5A	Power mirror switch, Driver side power seat memory, Driver seat module – Keep alive power (KA)
13	5A	Not used
14	10A	Power liftgate module
15	10A	Climate control
16	15A	Not used (Spare)
17	20A	All power lock motor feeds, Liftgate release, Moon roof
18	20A	THX system
19	25A	Rear wiper
20	15A	Datalink
21	15A	Fog lamps
22	15A	Park lamps
23	15A	High beam headlamps
24	20A	Horn relay

Fuse/Relay Location	Fuse Amp Rating	Passenger Compartment Fuse Panel Description
25	10A	Demand lamps/Interior lamps
26	10A	Instrument panel cluster
27	20A	Ignition switch
28	5A	Radio
29	5A	Instrument panel cluster
30	5A	Overdrive cancel switch
31	10A	Automatic dimming rear view mirror
32	10A	Not used (Spare)
33	10A	Not used (Spare)
34	5A	Steering angle sensor
35	10A	Rear park assist, AWD, Heated seat module
36	5A	PATS transceiver
37	10A	Climate control
38	20A	THX System
39	20A	Radio
40	20A	Not used (Spare)
41	15A	Delayed accessory function for radio and lock switch illumination
42	10A	Not used (Spare)
43	10A	Rear wiper logic
44	10A	Customer accessory feed
45	5A	Front wiper logic, Climate control relay feed
46	7.5A	Occupant Classification Sensor (OCS), Passenger Airbag Deactivation Indicator (PADI)
47	30A Circuit Breaker	Power windows
48	—	Delayed accessory relay

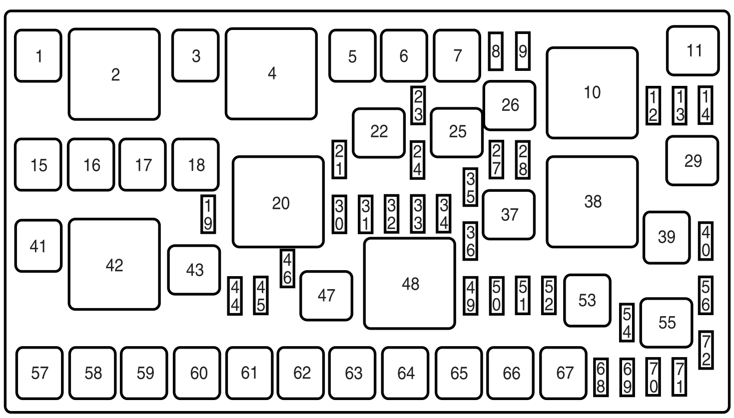
Power distribution box

The power distribution box is located in the engine compartment. The power distribution box contains high-current fuses that protect your vehicle's main electrical systems from overloads.

Always disconnect the battery before servicing high current fuses.

To reduce risk of electrical shock, always replace the cover to the Power Distribution Box before reconnecting the battery or refilling fluid reservoirs.

If the battery has been disconnected and reconnected, refer to the *Battery* section of the *Maintenance and Specifications* chapter.



The high-current fuses are coded as follows:

Fuse/Relay Location	Fuse Amp Rating	Power Distribution Box Description
1	—	Not used
2	—	Blower motor relay
3	—	Not used
4	—	Not used

Fuse/Relay Location	Fuse Amp Rating	Power Distribution Box Description
5	40A**	Cooling fan (vehicles with trailer tow)
	60A**	Cooling fan (vehicles without trailer tow)
6	40A**	Cooling fan (trailer tow only)
7	30A**	Rear heated seats
8	10A*	Alternator
9	20A*	Trailer tow parking lamps
10	—	Not used
11	—	Trailer tow parking lamp relay
12	—	Not used
13	—	Not used
14	—	Not used
15	40A**	ABS pump motor
16	30A**	Front heated seats
17	20A**	Cigar lighter/Power point
18	20A**	Panorama moon roof
19	—	Fuel pump diode
20	—	PCM relay
21	7.5A*	PCM – Keep alive power (KA)
22	—	Trailer tow left stop/turn lamp relay
23	—	Not used
24	10A*	Trailer tow left stop/turn lamp
25	—	Rear seat release relay
26	—	Fuel pump relay
27	10A*	Rear seat release
28	15A*	Heated mirror
29	—	Heated mirror relay
30	15A*	VPWR 1 – PCM
31	10A*	VPWR 3 – PCM

Fuse/Relay Location	Fuse Amp Rating	Power Distribution Box Description
32	10A*	VPWR 2 – PCM
33	15A*	VPWR 4 – PCM
34	—	Not used
35	10A*	A/C clutch
36	—	Not used
37	—	A/C clutch relay
38	—	Rear window defroster relay
39	40A**	Rear window defroster
40	—	Not used
41	30A**	Starter
42	—	Starter relay
43	—	Backup lamp relay
44	10A*	Backup lamps
45	—	Not used
46	10A*	Trailer tow right stop/turn lamp
47	—	Trailer tow right stop/turn lamp relay
48	—	Run/Start relay
49	10A*	PCM ISPR
50	10A*	ABS Run/Start
51	5A*	Adaptive lighting
52	5A*	Fuel pump relay coil
53	30A**	SPDJB Run/Start
54	—	Not used
55	—	Not used
56	—	A/C clutch diode
57	40A**	ABS valves
58	30A**	Front wipers
59	30A**	Power liftgate
60	30A**	Driver power seat
61	30A**	Passenger power seat

Fuse/Relay Location	Fuse Amp Rating	Power Distribution Box Description
62	—	Not used
63	40A**	Blower motor
64	20A**	Cigar lighter/Power point
65	20A**	Cigar lighter/Power point
66	20A**	Cigar lighter/Power point
67	—	Not used
68	15A*	Fuel pump
69	—	Not used
70	—	Not used
71	10A*	Stop lamps
72	—	Not used
* Mini Fuses ** Cartridge Fuses		

CHANGING THE TIRES

If you get a flat tire while driving, do not apply the brake heavily. Instead, gradually decrease your speed. Hold the steering wheel firmly and slowly move to a safe place on the side of the road.

Note: The tire pressure monitoring system (TPMS) indicator light will illuminate when the spare tire is in use. To restore the full functionality of the monitoring system, all road wheels equipped with tire pressure monitoring sensors must be mounted on the vehicle.

Have a flat serviced by an authorized dealer in order to prevent damage to the TPMS sensors, refer to *Tire Pressure Monitoring System (TPMS)* in the *Tires, Wheels and Loading* chapter. Replace the spare tire with a road tire as soon as possible.

⚠ The use of tire sealants may damage your Tire Pressure Monitoring System and should not be used.

⚠ Refer to *Tire Pressure Monitoring System (TPMS)* in the *Tires, Wheels and Loading* chapter for important information. If the tire pressure monitor sensor becomes damaged, it will no longer function.

Dissimilar spare tire/wheel information

Failure to follow these guidelines could result in an increased risk of loss of vehicle control, injury or death.

If you have a dissimilar spare tire/wheel, then it is intended for temporary use only. This means that if you need to use it, you should replace it as soon as possible with a road tire/wheel that is the same size and type as the road tires and wheels that were originally provided by Ford. If the dissimilar spare tire or wheel is damaged, it should be replaced rather than repaired.

A dissimilar spare tire/wheel is defined as a spare tire and/or wheel that is different in brand, size or appearance from the road tires and wheels and can be one of three types:

1. **T-type mini-spare:** This spare tire begins with the letter “T” for tire size and may have “Temporary Use Only” molded in the sidewall

2. **Full-size dissimilar spare with label on wheel:** This spare tire has a label on the wheel that states: “THIS TIRE AND WHEEL FOR TEMPORARY USE ONLY”

When driving with one of the dissimilar spare tires listed above, **do not:**

- Exceed 50 mph (80 km/h)
- Load the vehicle beyond maximum vehicle load rating listed on the Safety Compliance Label
- Tow a trailer
- Use snow chains on the end of the vehicle with the dissimilar spare tire
- Use more than one dissimilar spare tire at a time
- Use commercial car washing equipment
- Try to repair the dissimilar spare tire

Use of one of the dissimilar spare tires listed above at any one wheel location can lead to impairment of the following:

- Handling, stability and braking performance
- Comfort and noise
- Ground clearance and parking at curbs
- Winter weather driving capability
- Wet weather driving capability

3. **Full-size dissimilar spare without label on wheel**

When driving with the full-size dissimilar spare tire/wheel, **do not:**

- Exceed 70 mph (113 km/h)
- Use more than one dissimilar spare tire/wheel at a time
- Use commercial car washing equipment
- Use snow chains on the end of the vehicle with the dissimilar spare tire/wheel

The usage of a full-size dissimilar spare tire/wheel can lead to impairment of the following:

- Handling, stability and braking performance
- Comfort and noise
- Ground clearance and parking at curbs
- Winter weather driving capability
- Wet weather driving capability
- All-Wheel driving capability (if applicable)
- Load leveling adjustment (if applicable)

When driving with the full-size dissimilar spare tire/wheel additional caution should be given to:

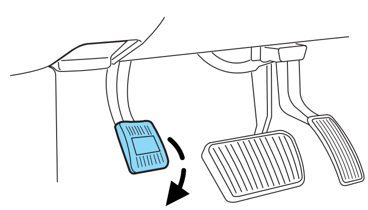
- Towing a trailer
- Driving vehicles equipped with a camper body
- Driving vehicles with a load on the cargo rack

Drive cautiously when using a full-size dissimilar spare tire/wheel and seek service as soon as possible.

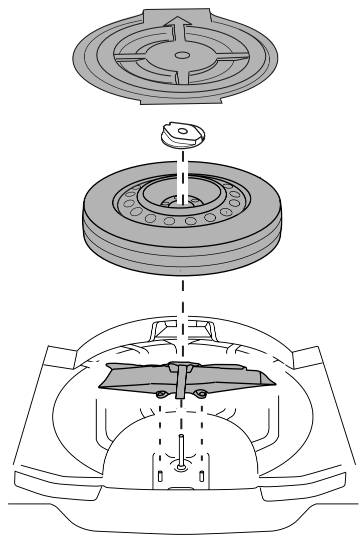
Stopping and securing the vehicle

1. Park on a level surface, activate hazard flashers and set the parking brake.

2. Place the gearshift lever in P (Park) and turn the engine OFF.



Removing the spare tire and jack



1. Lift the carpeted load floor panel located in the rear of the vehicle.

2. Remove the spare tire cover (if equipped).

3. Remove the wing nut securing the spare tire by turning it counterclockwise.

4. Lift and remove the temporary spare tire from the cargo area.

5. Remove the jack assembly from the vehicle. Loosen the bag tabs and remove the jack and lug wrench from the bag.

6. Fold down the wrench socket used to loosen the lug nuts and operate the jack.

Tire change procedure

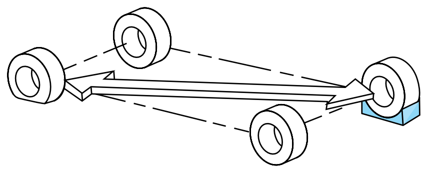
When one of the front wheels is off the ground, the transaxle alone will not prevent the vehicle from moving or slipping off the jack, even if the vehicle is in P (Park).

To help prevent the vehicle from moving when you change a tire, be sure to place the transaxle in P (Park), set the parking brake and block (in both directions) the wheel that is diagonally opposite (other side and end of the vehicle) to the tire being changed.

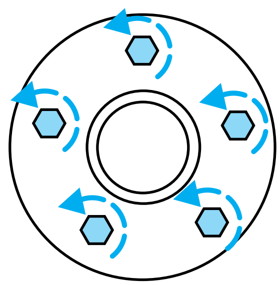
If the vehicle slips off the jack, you or someone else could be seriously injured.

Do not attempt to change a tire on the side of the vehicle close to moving traffic. Pull far enough off the road to avoid the danger of being hit when operating the jack or changing the wheel.

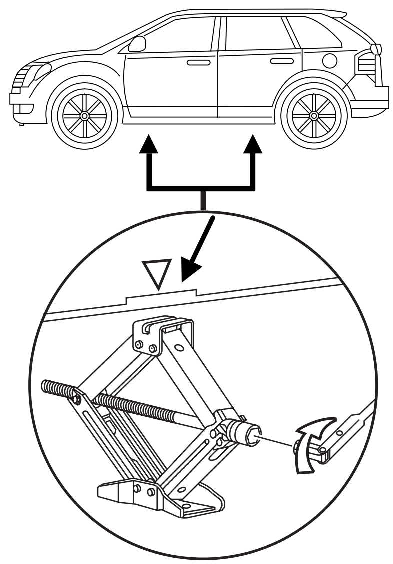
1. Block the diagonally opposite wheel.



2. Remove wheel cover (if equipped) with the lug wrench tip and loosen each wheel lug nut one-half turn counterclockwise but do not remove them until the wheel is raised off the ground.



3. Align the slot on top of the jack with the sheet metal flange indicated by the jack locator triangle next to the tire you are changing. Turn the jack handle clockwise until the wheel is completely off the ground.



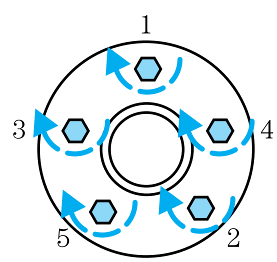
To lessen the risk of personal injury, do not put any part of your body under the vehicle while changing a tire. Do not start the engine when your vehicle is on the jack. The jack is only meant for changing the tire.

4. Remove the lug nuts with the lug wrench.

5. Replace the flat tire with the spare tire, making sure the valve stem is facing outward. Reinstall the lug nuts until the wheel is snug against the hub. Do not fully tighten the lug nuts until the wheel has been lowered.

6. Lower the wheel by turning the jack handle counterclockwise.

7. Remove the jack and fully tighten the lug nuts in the order shown. Refer to *Wheel lug nut torque specifications* later in this chapter for the proper lug nut torque specification.



Stowing the flat/spare tire and jack

1. Fully collapse the jack, fold the wrench socket into the handle and place them both into the bag making sure to secure the tabs.

2. Place the jack assembly in the spare tire well aligning it with the two vertical studs.

3. Place the tire in the spare tire well over the jack assembly.

If you are stowing a flat tire, place the tire in the spare tire well with the valve stem facing down. Rotate the tire until the jack assembly is able to protrude through a wheel opening.

If you are stowing the spare tire, place the spare in the spare tire well in its original position.

4. Secure the wheel by replacing the wing nut and turning clockwise.

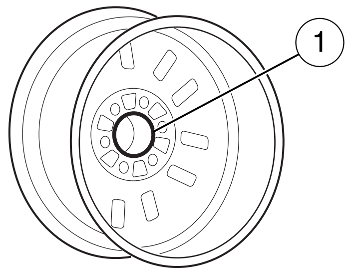
WHEEL LUG NUT TORQUE SPECIFICATIONS

Retighten the lug nuts to the specified torque within 100 miles (160 km) after any wheel disturbance (rotation, flat tire, wheel removal, etc.).

<table>
<tr><th rowspan="2">Lug nut socket size/Bolt size</th><th colspan="2">Wheel lug nut torque*</th></tr>
<tr><th>lb.ft.</th><th>N•m</th></tr>
<tr><td>Lug nut socket size: ¾ inch (19 mm) hex
Bolt size: ½ x 20</td><td>100</td><td>135</td></tr>
<tr><td colspan="3">* Torque specifications are for nut and bolt threads free of dirt and rust. Use only Ford recommended replacement fasteners.</td></tr>
</table>

When a wheel is installed, always remove any corrosion, dirt or foreign materials present on the mounting surfaces of the wheel or the surface of the wheel hub, brake drum or brake disc that contacts the wheel. Ensure that any fasteners that attach the rotor to the hub are secured so they do not interfere with the mounting surfaces of the wheel. Installing wheels without correct metal-to-metal contact at the wheel mounting surfaces can cause the wheel nuts to loosen and the wheel to come off while the vehicle is in motion, resulting in loss of control.

Note: Inspect the wheel pilot hole prior to installation. If there is visible corrosion in wheel pilot hole, remove loose particles by wiping with clean rag and apply grease. Apply grease only to the wheel pilot hole surface by smearing a "dime" (1 square cm) sized glob of grease around the wheel pilot surface (1) with end of finger. DO NOT apply grease to lugnut/stud holes or wheel-to-brake surfaces.



JUMP STARTING

⚠ The gases around the battery can explode if exposed to flames, sparks, or lit cigarettes. An explosion could result in injury or vehicle damage.

⚠ Batteries contain sulfuric acid which can burn skin, eyes and clothing, if contacted.

Do not attempt to push-start your automatic transmission vehicle. Automatic transmissions do not have push-start capability. Attempting to push-start a vehicle with an automatic transmission may cause transmission damage.

Preparing your vehicle

When the battery is disconnected or a new battery is installed, the automatic transmission must relearn its shift strategy. As a result, the transmission may have firm and/or soft shifts. This operation is considered normal and will not affect function or durability of the transmission. Over time, the adaptive learning process will fully update transmission operation.

1. **Use only a 12–volt supply to start your vehicle.**

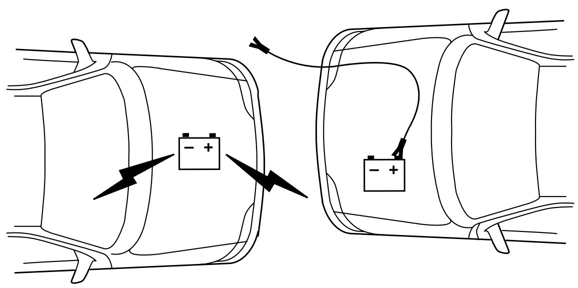
2. Do not disconnect the battery of the disabled vehicle as this could damage the vehicle's electrical system.

3. Park the booster vehicle close to the hood of the disabled vehicle making sure the two vehicles **do not** touch. Set the parking brake on both vehicles and stay clear of the engine cooling fan and other moving parts.

4. Check all battery terminals and remove any excessive corrosion before you attach the battery cables. Ensure that vent caps are tight and level.

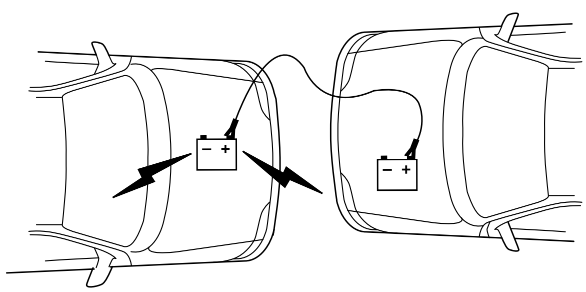
5. Turn the heater fan on in both vehicles to protect from any electrical surges. Turn all other accessories off.

Connecting the jumper cables

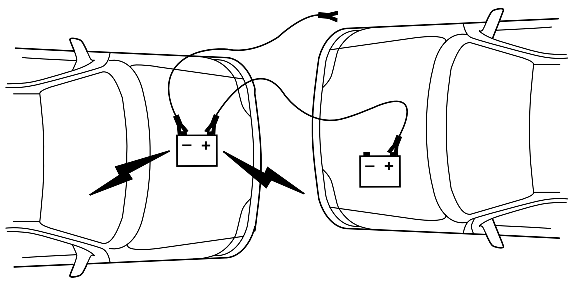


1. Connect the positive (+) jumper cable to the positive (+) terminal of the discharged battery.

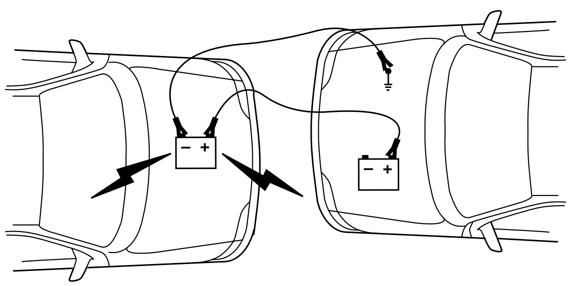
Note: In the illustrations, *lightning bolts* are used to designate the assisting (boosting) battery.



2. Connect the other end of the positive (+) cable to the positive (+) terminal of the assisting battery.



3. Connect the negative (-) cable to the negative (-) terminal of the assisting battery.



4. Make the final connection of the negative (-) cable to an exposed metal part of the stalled vehicle's engine, away from the battery and the carburetor/fuel injection system. **Do not** use fuel lines, engine rocker covers or the intake manifold as *grounding* points.

Do not connect the end of the second cable to the negative (-) terminal of the battery to be jumped. A spark may cause an explosion of the gases that surround the battery.

5. Ensure that the cables are clear of fan blades, belts, moving parts of both engines, or any fuel delivery system parts.

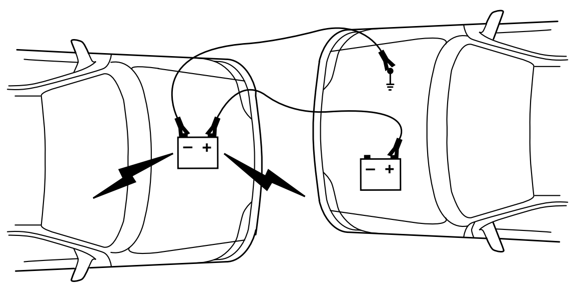
Jump starting

1. Start the engine of the booster vehicle and run the engine at moderately increased speed.

2. Start the engine of the disabled vehicle.

3. Once the disabled vehicle has been started, run both engines for an additional three minutes before disconnecting the jumper cables.

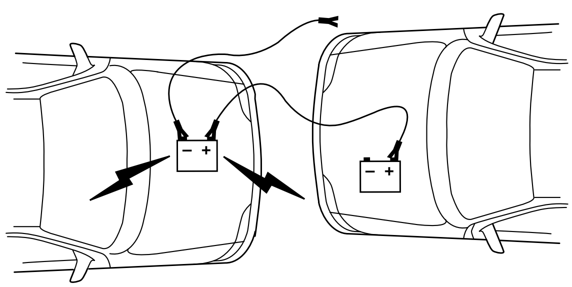
Removing the jumper cables



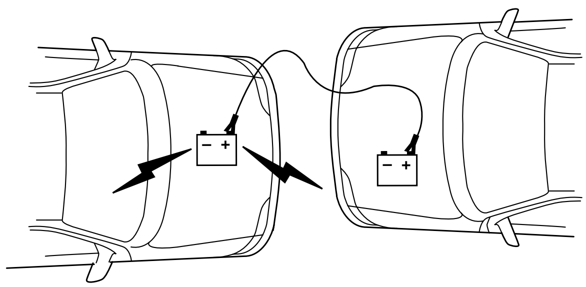
Remove the jumper cables in the reverse order that they were connected.

1. Remove the jumper cable from the *ground* metal surface.

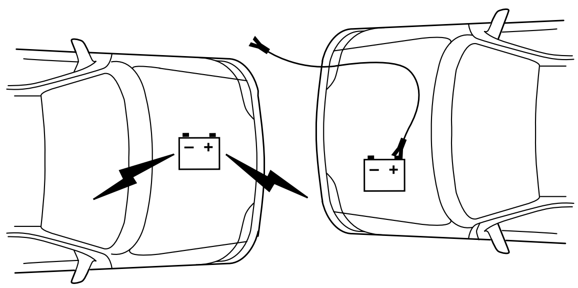
Note: In the illustrations, *lightning bolts* are used to designate the assisting (boosting) battery.



2. Remove the jumper cable on the negative (-) connection of the booster vehicle's battery.



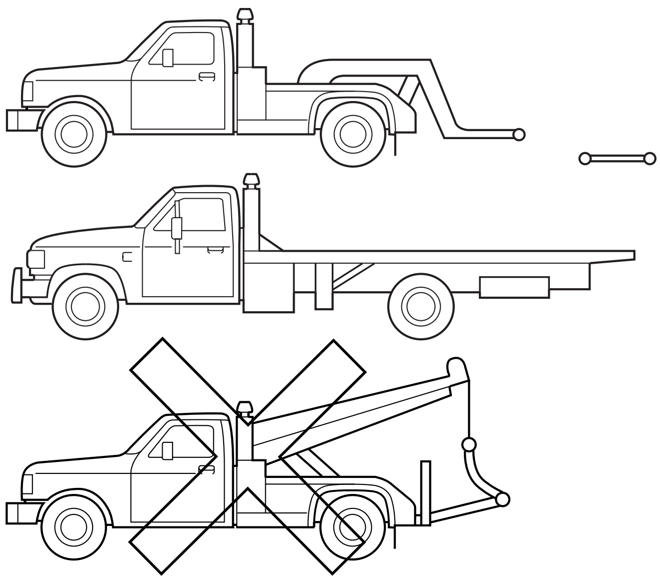
3. Remove the jumper cable from the positive (+) terminal of the booster vehicle's battery.



4. Remove the jumper cable from the positive (+) terminal of the disabled vehicle's battery.

After the disabled vehicle has been started and the jumper cables removed, allow it to idle for several minutes so the engine computer can *relearn* its idle conditions.

WRECKER TOWING



If you need to have your vehicle towed, contact a professional towing service or, if you are a member of a roadside assistance program, your roadside assistance service provider.

It is recommended that your vehicle be towed with a wheel lift and dollies or flatbed equipment. Do not tow with a slingbelt. Ford Motor Company has not approved a slingbelt towing procedure.

On FWD vehicles, if your vehicle is to be towed from the front, ensure proper wheel lift equipment is used to raise the front wheels off the ground. The rear wheels can be left on the ground when towed in this fashion.

If your vehicle is to be towed from the rear using wheel lift equipment, it is recommended that the front wheels (drive wheels) be placed on a dolly to prevent damage to the automatic transaxle.

On AWD vehicles, it is **required** that your vehicle be towed with a wheel lift and dollies or flatbed equipment with all the wheels off the ground to prevent damage to the automatic transaxle, AWD system or vehicle.

If the vehicle is towed by other means or incorrectly, vehicle damage may occur.

In case of a roadside emergency with a disabled vehicle (without access to wheel dollies, car hauling trailer, or flatbed transport vehicle) your vehicle (regardless of transmission powertrain configuration) can be flat towed (all wheels on the ground) under the following conditions:

- Place the transmission in N (Neutral).
- Maximum distance is 50 miles (80 km).
- Maximum speed is not to exceed 35 mph (56 km/h).

Ford Motor Company produces a towing manual for all authorized tow truck operators. Have your tow truck operator refer to this manual for proper hook-up and towing procedures for your vehicle.

GETTING THE SERVICES YOU NEED

At home

You must take your Lincoln or Mercury vehicle to an authorized dealer for warranty repairs. While any authorized dealer handling your vehicle line will provide warranty service, we recommend you return to your selling authorized dealer who wants to ensure your continued satisfaction. Please note that certain warranty repairs require special training and/or equipment, so not all authorized dealers are authorized to perform all warranty repairs. This means that, depending on the warranty repair needed, you may have to take your vehicle to another authorized dealer. A reasonable time must be allowed to perform a repair after taking your vehicle to the authorized dealer. Repairs will be made using Ford or Motorcraft parts, or remanufactured or other parts that are authorized by Ford.

If you have questions or concerns, or are unsatisfied with the service you are receiving, follow these steps:

1. Contact your Sales Representative or Service Advisor at your selling/servicing authorized dealer.

2. If your inquiry or concern remains unresolved, contact the Sales Manager, Service Manager or Customer Relations Manager.

3. If you require assistance or clarification on Ford Motor Company policies or procedures, please contact the Lincoln Mercury Customer Relationship Center at 1-800-521-4140.

Away from home

If you own a Ford or Mercury vehicle and are away from home when your vehicle needs service, or if you need more help than the authorized dealer could provide, after following the steps described above, contact the Ford Customer Relationship Center to find an authorized dealer to help you.

In the United States:

Ford Motor Company
Customer Relationship Center
P.O. Box 6248
Dearborn, MI 48121
1-800-392-3673 (FORD)
(TDD for the hearing impaired: 1-800-232-5952)
www.customersaskford.com

In Canada:
Customer Relationship Centre
Ford Motor Company of Canada, Limited
P.O. Box 2000
Oakville, Ontario L6J 5E4
1-800-565-3673 (FORD)
www.ford.ca

If you own a Lincoln vehicle and are away from home when your vehicle needs service, or if you need more help than the authorized dealer could provide, after following the steps described above, contact the Ford Customer Relationship Center to find an authorized dealer to help you.

In the United States:
Ford Motor Company
Customer Relationship Center
P.O. Box 6248
Dearborn, MI 48121
1-800-521-4140
(TDD for the hearing impaired: 1-800-232-5952)
www.customersaskford.com

In Canada:
Lincoln Centre
Ford Motor Company of Canada, Limited
P.O. Box 2000
Oakville, Ontario L6J 5E4
1-800-387-9333
www.lincolncanada.com

In order to help you service your Lincoln vehicle, please have the following information available when contacting the Lincoln Centre:

- Your telephone number (home and business)
- The name of the authorized dealer and the city where the authorized dealer is located
- The year and make of your vehicle
- The date of vehicle purchase
- The current odometer reading
- The vehicle identification number (VIN)

Additional Assistance

If you still have a complaint involving a warranty dispute, you may wish to contact the Better Business Bureau (BBB) AUTO LINE program (U.S. only).

In some states (in the U.S.) you must directly notify Ford in writing before pursuing remedies under your state's warranty laws. Ford is also allowed a final repair attempt in some states.

In the United States, a warranty dispute must be submitted to the BBB AUTO LINE before taking action under the Magnuson-Moss Warranty Act, or to the extent allowed by state law, before pursuing replacement or repurchase remedies provided by certain state laws. This dispute handling procedure is not required prior to enforcing state created rights or other rights which are independent of the Magnuson-Moss Warranty Act or state replacement or repurchase laws.

IN CALIFORNIA (U.S. ONLY)

California Civil Code Section 1793.2(d) requires that, if a manufacturer or its representative is unable to repair a motor vehicle to conform to the vehicle's applicable express warranty after a reasonable number of attempts, the manufacturer shall be required to either replace the vehicle with one substantially identical or repurchase the vehicle and reimburse the buyer in an amount equal to the actual price paid or payable by the consumer (less a reasonable allowance for consumer use). The consumer has the right to choose whether to receive a refund or replacement vehicle.

California Civil Code Section 1793.22(b) presumes that the manufacturer has had a reasonable number of attempts to conform the vehicle to its applicable express warranties if, within the first 18 months of ownership of a new vehicle or the first 18,000 miles (29,000 km), whichever occurs first:

1. Two or more repair attempts are made on the same non-conformity likely to cause death or serious bodily injury OR

2. Four or more repair attempts are made on the same nonconformity (a defect or condition that substantially impairs the use, value or safety of the vehicle) OR

3. The vehicle is out of service for repair of nonconformities for a total of more than 30 calendar days (not necessarily all at one time)

In the case of 1 or 2 above, the consumer must also notify the manufacturer of the need for the repair of the nonconformity at the following address:

Ford Motor Company
16800 Executive Plaza Drive
Mail Drop 3NE-B
Dearborn, MI 48126

THE BETTER BUSINESS BUREAU (BBB) AUTO LINE PROGRAM (U.S. ONLY)

Your satisfaction is important to Ford Motor Company and to your dealer. Experience has shown that our customers have been very successful in achieving satisfaction by following the three-step procedure outlined on the front page of the Warranty Guide. However, if your warranty concern has not been resolved using the three-step procedure, you may be eligible to participate in the BBB AUTO LINE program.

The BBB AUTO LINE program consists of two parts – mediation and arbitration. Initially, the BBB will try to resolve your question or concern through mediation. Mediation is a process through which a representative of the BBB will contact the parties and explore options for settlement of your claim. If mediation is not successful, customers with eligible claims may participate in the BBB AUTO LINE arbitration process. An arbitration hearing will be scheduled so that you can present your case in an informal setting before an impartial person. The arbitrator will consider the testimony provided and make a decision after the hearing. You are not bound by the decision but may choose to accept it. If you choose to accept the BBB AUTO LINE decision then Ford must abide by the accepted decision as well. If the arbitrator has decided in your favor and you accept the decision, the BBB AUTO LINE program will contact you to ensure that Ford has complied with the decision in a timely manner. Disputes submitted to the BBB AUTO LINE program are usually decided within forty days after you file your claim with the BBB.

To initiate a claim with the BBB AUTO LINE, you will be asked for your name and address, general information about your new vehicle, information about your warranty concerns and any steps you have already taken to try to resolve them. You will then be mailed a Customer Claim Form that you will need to complete, provide proof of vehicle ownership, sign and return the Customer Claim Form to the BBB. Upon receipt, the BBB will review the claim for eligibility under the Program Summary Guidelines.

You can get more information by calling BBB AUTO LINE at 1–800–955–5100, or writing to:

BBB AUTO LINE
4200 Wilson Boulevard, Suite 800
Arlington, Virginia 22203–1833

Note: Ford Motor Company reserves the right to change eligibility limitations, modify procedures, or to discontinue this process at any time without notice and without obligation.

UTILIZING THE MEDIATION/ARBITRATION PROGRAM (CANADA ONLY)

For vehicles delivered to authorized Canadian dealers. In those cases where you continue to feel that the efforts by Ford of Canada and the authorized dealer to resolve a factory-related vehicle service concern have been unsatisfactory, Ford of Canada participates in an impartial third party mediation/arbitration program administered by the Canadian Motor Vehicle Arbitration Plan (CAMVAP).

The CAMVAP program is a straight-forward and relatively speedy alternative to resolve a disagreement when all other efforts to produce a settlement have failed. This procedure is without cost to you and is designed to eliminate the need for lengthy and expensive legal proceedings.

In the CAMVAP program, impartial third-party arbitrators conduct hearings at mutually convenient times and places in an informal environment. These impartial arbitrators review the positions of the parties, make decisions and, when appropriate, render awards to resolve disputes. CAMVAP decisions are fast, fair, and final as the arbitrator's award is binding both to you and Ford of Canada.

CAMVAP services are available in all territories and provinces. For more information, without charge or obligation, call your CAMVAP Provincial Administrator directly at 1-800-207-0685.

FORD EXTENDED SERVICE PLAN

You can get more protection for your new car or light truck by purchasing Ford Extended Service Plan (Ford ESP) coverage. It provides the following:

- Benefits during the warranty period depending on the plan you purchase (such as: reimbursement for rentals; coverage for certain maintenance and wear items).
- Protection against covered repair costs after your Bumper-to-Bumper Warranty expires.

You may purchase Ford ESP from any participating authorized dealer. There are several plans available in various time, distance and deductible combinations which can be tailored to fit your own driving needs. Ford ESP also offers reimbursement benefits for towing and rental coverage.

When you buy Ford ESP, you receive Peace-of-Mind protection throughout the United States and Canada, provided by a network of more than 4,600 participating authorized dealers.

If you did not take advantage of the Ford Extended Service Plan at the time of purchasing your vehicle, you may still be eligible. Since this information is subject to change, please ask your authorized dealer for complete details about Ford Extended Service Plan coverage options, or visit the Ford ESP website at www.ford-esp.com.

GETTING ASSISTANCE OUTSIDE THE U.S. AND CANADA

Before exporting your vehicle to a foreign country, contact the appropriate foreign embassy or consulate. These officials can inform you of local vehicle registration regulations and where to find unleaded fuel.

If you cannot find unleaded fuel or can only get fuel with an anti-knock index lower than is recommended for your vehicle, contact a regional office or owner relations/customer relationship office.

The use of leaded fuel in your vehicle without proper conversion may damage the effectiveness of your emission control system and may cause engine knocking or serious engine damage. Ford Motor Company/Ford of Canada is not responsible for any damage caused by use of improper fuel. Using leaded fuel may also result in difficulty importing your vehicle back into the U.S.

If your vehicle must be serviced while you are traveling or living in Central America, the Caribbean, or the Middle East, contact the nearest authorized dealer. If the authorized dealer cannot help you, write or call:

FORD MOTOR COMPANY
FORD EXPORT OPERATIONS
1555 Fairlane Drive
Fairlane Business Park #3
Allen Park, Michigan 48101
U.S.A.
Telephone: (313) 594-4857
FAX: (313) 390-0804

If you are in another foreign country, contact the nearest authorized dealer. If the authorized dealer employees cannot help you, they can direct you to the nearest Ford affiliate office.

If you buy your vehicle in North America and then relocate outside of the U.S. or Canada, register your vehicle identification number (VIN) and new address with Ford Motor Company Export Operations.

Customers in the U.S. should call 1–800–392–3673.

ORDERING ADDITIONAL OWNER'S LITERATURE

To order the publications in this portfolio, contact Helm, Incorporated at:

HELM, INCORPORATED
P.O. Box 07150
Detroit, Michigan 48207

Or call:

For a free publication catalog, order toll free: 1-800-782-4356

Monday-Friday 8:00 a.m. - 6:00 p.m. EST

Helm, Incorporated can also be reached by their website:
www.helminc.com.

(Items in this catalog may be purchased by credit card, check or money order.)

Obtaining a French owner's guide

French Owner's Guides can be obtained from your authorized dealer or by writing to:
Ford Motor Company of Canada, Limited
Service Publications CHQ202
The Canadian Road
P.O. Box 2000
Oakville, ON, Canada
L6J 5E4

REPORTING SAFETY DEFECTS (U.S. ONLY)

If you believe that your vehicle has a defect which could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying Ford Motor Company.

If NHTSA receives similar complaints, it may open an investigation, and if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in individual problems between you, your dealer, or Ford Motor Company.

To contact NHTSA, you may call the Vehicle Safety Hotline toll-free at 1–888–327–4236 (TTY: 1–800–424–9153); go to *http://www.safercar.gov;* or write to:

Administrator
1200 New Jersey Avenue, Southeast
Washington, D.C. 20590

You can also obtain other information about motor vehicle safety from *http://www.safercar.gov.*

REPORTING SAFETY DEFECTS (CANADA ONLY)

If you believe that your vehicle has a defect which could cause a crash or could cause injury or death, you should immediately inform Transport Canada, using their toll-free number: 1–800–333–0510.

WASHING THE EXTERIOR

Wash your vehicle regularly with cool or lukewarm water and a neutral pH shampoo, such as Motorcraft Detail Wash (ZC-3-A), which is available from your authorized dealer.

- Never use strong household detergents or soap, such as dish washing or laundry liquid. These products can discolor and spot painted surfaces.
- Never wash a vehicle that is “hot to the touch” or during exposure to strong, direct sunlight.
- Always use a clean sponge or car wash mitt with plenty of water for best results.
- Dry the vehicle with a chamois or soft terry cloth towel in order to eliminate water spotting.
- It is especially important to wash the vehicle regularly during the winter months, as dirt and road salt are difficult to remove and cause damage to the vehicle.
- Immediately remove items such as gasoline, diesel fuel, bird droppings and insect deposits because they can cause damage to the vehicle’s paintwork and trim over time. Use Bug and Tar Remover (ZC-42) which is available from your authorized dealer.
- Remove any exterior accessories, such as antennas, before entering a car wash.
- **Suntan lotions and insect repellents can damage any painted surface; if these substances come in contact with your vehicle, wash off as soon as possible.**

Exterior chrome

- Wash the vehicle first, using cool or lukewarm water and a neutral pH shampoo, such as Motorcraft Detail Wash (ZC-3-A).
- Use Custom Bright Metal Cleaner (ZC-15), available from your authorized dealer. Apply the product as you would a wax to clean bumpers and other chrome parts; allow the cleaner to dry for a few minutes, then wipe off the haze with a clean, dry rag.
- **Never use abrasive materials such as steel wool or plastic pads as they can scratch the chrome surface.**
- After polishing chrome bumpers, apply a coating of Motorcraft Premium Liquid Wax (ZC-53-A), available from your authorized dealer, or an equivalent quality product to help protect from environmental effects.

WAXING

- Wash the vehicle first.
- Do not use waxes that contain abrasives; use Motorcraft Premium Liquid Wax (ZC-53-A), which is available from your authorized dealer, or an equivalent quality product.
- Do not allow paint sealant to come in contact with any non-body (low-gloss black) colored trim, such as grained door handles, roof racks, bumpers, side moldings, mirror housings or the windshield cowl area. The paint sealant will "gray" or stain the parts over time.

PAINT CHIPS

Your authorized dealer has touch-up paint to match your vehicle's color. Take your color code (printed on a sticker in the driver's door jamb) to your authorized dealer to ensure you get the correct color.

- Remove particles such as bird droppings, tree sap, insect deposits, tar spots, road salt and industrial fallout before repairing paint chips.
- Always read the instructions before using the products.

ALUMINUM WHEELS AND WHEEL COVERS

Aluminum wheels and wheel covers are coated with a clearcoat paint finish. In order to maintain their shine:

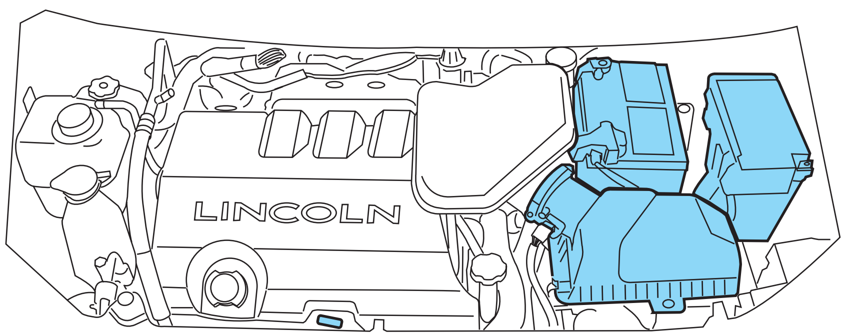
- Clean weekly with Motorcraft Wheel and Tire Cleaner (ZC-37-A), which is available from your authorized dealer. Heavy dirt and brake dust accumulation may require agitation with a sponge. Rinse thoroughly with a strong stream of water.
- Never apply any cleaning chemical to hot or warm wheel rims or covers.
- Some automatic car washes may cause damage to the finish on your wheel rims or covers. Chemical-strength cleaners, or cleaning chemicals, in combination with brush agitation to remove brake dust and dirt, could wear away the clearcoat finish over time.
- Do not use hydrofluoric acid-based or high caustic-based wheel cleaners, steel wool, fuels or strong household detergent.
- To remove tar and grease, use Motorcraft Bug and Tar Remover (ZC-42), available from your authorized dealer.

ENGINE

Engines are more efficient when they are clean because grease and dirt buildup keep the engine warmer than normal. When washing:

- Take care when using a power washer to clean the engine. The high-pressure fluid could penetrate the sealed parts and cause damage.
- Do not spray a hot engine with cold water to avoid cracking the engine block or other engine components.
- Spray Motorcraft Engine Shampoo and Degreaser (ZC-20) on all parts that require cleaning and pressure rinse clean. In Canada use Motorcraft Engine Shampoo (CXC-66-A).
- Cover the highlighted areas to prevent water damage when cleaning the engine.

3.5L ENGINE



- Never wash or rinse the engine while it is running; water in the running engine may cause internal damage.

PLASTIC (NON-PAINTED) EXTERIOR PARTS

Use only approved products to clean plastic parts. These products are available from your authorized dealer.

- For routine cleaning, use Motorcraft Detail Wash (ZC-3-A).
- If tar or grease spots are present, use Motorcraft Bug and Tar Remover (ZC-42).
- For plastic headlamp lenses, use Motorcraft Ultra Clear Spray Glass Cleaner (ZC-23).

WINDOWS AND WIPER BLADES

The windshield, rear and side windows and the wiper blades should be cleaned regularly. If the wipers do not wipe properly, substances on the vehicle's glass or the wiper blades may be the cause. These may include hot wax treatments used by commercial car washes, water repellent coatings, tree sap, or other organic contamination; these contaminants may cause squeaking or chatter noise from the blades, and streaking and smearing of the windshield. To clean these items, follow these tips:

- The windshield, rear windows and side windows may be cleaned with a non-abrasive cleaner such as Motorcraft Ultra-Clear Spray Glass Cleaner (ZC-23), available from your authorized dealer.
- The wiper blades can be cleaned with isopropyl (rubbing) alcohol or Motorcraft Premium Windshield Washer Concentrate (ZC-32-A), available from your authorized dealer. This washer fluid contains special solution in addition to alcohol which helps to remove the hot wax deposited on the wiper blade and windshield from automated car wash facilities. Be sure to replace wiper blades when they appear worn or do not function properly.
- Do not use abrasives, as they may cause scratches.
- Do not use fuel, kerosene, or paint thinner to clean any parts.

If you cannot remove those streaks after cleaning with the glass cleaner or if the wipers chatter and move in a jerky motion, clean the outer surface of the windshield and the wiper blades using a sponge or soft cloth with a neutral detergent or mild-abrasive cleaning solution. After cleaning, rinse the windshield and wiper blades with clean water. The windshield is clean if beads do not form when you rinse the windshield with water.

Do not use sharp objects, such as a razor blade, to clean the inside of the rear window or to remove decals, as it may cause damage to the rear window defroster's heated grid lines.

PANORAMIC ROOF DEFLECTOR (IF EQUIPPED)

Vacuum the wind deflector cloth to remove insects & loose dirt. Clean with Motorcraft Professional Strength Carpet & Upholstery Cleaner (ZC-54).

INSTRUMENT PANEL/INTERIOR TRIM AND CLUSTER LENS

Clean the instrument panel, interior trim areas and cluster lens with a clean and damp white cotton cloth, then with a clean and dry white cotton cloth; you may also use Motorcraft Dash & Vinyl Cleaner (ZC-38-A) on the instrument panel and interior trim areas.

- Avoid cleaners or polishes that increase the gloss of the upper portion of the instrument panel. The dull finish in this area helps protect the driver from undesirable windshield reflection.
- Be certain to wash or wipe your hands clean if you have been in contact with certain products such as insect repellent and suntan lotion in order to avoid possible damage to the interior painted surfaces.
- Do not use household or glass cleaners as these may damage the finish of the instrument panel, interior trim and cluster lens.

Do not use chemical solvents or strong detergents when cleaning the steering wheel or instrument panel to avoid contamination of the airbag system.

If a staining liquid like coffee/juice has been spilled on the instrument panel or on interior trim surfaces, clean as follows:

1. Wipe up spilled liquid using a clean, white, cotton cloth.
2. Apply Motorcraft Deluxe Leather and Vinyl Cleaner (ZC-11-A) [In Canada use Motorcraft Multi-Purpose Cleaner (CXC-101)] to the wiped area and spread around evenly.
3. Apply more Motorcraft cleaner to a clean, white, cotton cloth and press the cloth onto the soiled area–allow this to set at room temperature for 30 minutes.
4. Remove the soaked cloth, and if it is not soiled badly, use this cloth to clean the area by using a rubbing motion for 60 seconds.
5. Following this, wipe area dry with a clean, white, cotton cloth.

INTERIOR

For fabric, carpets, cloth seats and safety belts:

- Remove dust and loose dirt with a vacuum cleaner.
- Remove light stains and soil with Motorcraft Professional Strength Carpet & Upholstery Cleaner (ZC-54).
- If grease or tar is present on the material, spot-clean the area first with Motorcraft Spot and Stain Remover (ZC-14). In Canada, use Motorcraft Multi-Purpose Cleaner (CXC-101).

- If a ring forms on the fabric after spot cleaning, clean the entire area immediately (but do not oversaturate) or the ring will set.
- Do not use household cleaning products or glass cleaners, which can stain and discolor the fabric and affect the flame retardant abilities of the seat materials.

Do not use cleaning solvents, bleach or dye on the vehicle's seatbelts, as these actions may weaken the belt webbing.

LEATHER SEATS

Your leather seating surfaces have a clear, protective coating over the leather.

- To clean, use a soft cloth with Motorcraft Deluxe Leather and Vinyl Cleaner (ZC-11-A). In Canada, use Motorcraft Vinyl Cleaner (CXC-93). Dry the area with a soft cloth.
- To help maintain its resiliency and color, use the Motorcraft Deluxe Leather Care Kit (ZC-11-D), available from your authorized dealer. In Canada, use Motorcraft Vinyl Cleaner (CXC-93) or an equivalent high–quality leather care product.
- Do not use household cleaning products, alcohol solutions, solvents or cleaners intended for rubber, vinyl and plastics, or oil/petroleum-based leather conditioners. These products may cause premature wearing of the clear, protective coating.

Note: In some instances, color or dye transfer can occur when wet clothing comes in contact with leather upholstery. If this occurs, the leather should be cleaned immediately to avoid permanent staining.

CLEANING THE CLIMATE CONTROLLED SEATS (IF EQUIPPED)

Remove dust and loose dirt with a whisk broom or a vacuum cleaner. Remove fresh spots immediately. Clean the seat with a damp cloth, using a mild soap and water solution, if necessary.

UNDERBODY

Flush the complete underside of your vehicle frequently. Keep body and door drain holes free from packed dirt.

FORD AND LINCOLN MERCURY CAR CARE PRODUCTS

Your Ford or Lincoln Mercury authorized dealer has many quality products available to clean your vehicle and protect its finishes. These quality products have been specifically engineered to fulfill your automotive needs; they are custom designed to complement the style and appearance of your vehicle. Each product is made from high quality materials that meet or exceed rigid specifications. For best results, use the following products or products of equivalent quality:

Motorcraft Bug and Tar Remover (ZC-42)

Motorcraft Car Wash (Canada only) (CXC-21)

Motorcraft Custom Bright Metal Cleaner (ZC-15)

Motorcraft Custom Clear Coat Polish (ZC-8-A)

Motorcraft Custom Vinyl Protectant (ZC-40-A)

Motorcraft Dash and Vinyl Cleaner (ZC-38-A)

Motorcraft Deluxe Leather and Vinyl Cleaner (U.S. only) (ZC-11-A)

Motorcraft Leather Care Kit (U.S. only) (ZC-11-D)

Motorcraft Detail Wash (ZC-3-A)

Motorcraft Dusting Cloth (ZC-24)

Motorcraft Engine Shampoo and Degreaser (U.S. only) (ZC-20)

Motorcraft Engine Shampoo (Canada only) (CXC-66-A)

Motorcraft Multi-Purpose Cleaner (Canada only) (CXC-101)

Motorcraft Premium Glass Cleaner (Canada only) (CXC-100)

Motorcraft Premium Liquid Wax (ZC-53-A)

Motorcraft Premium Windshield Washer Concentrate (U.S. only) (ZC-32-A)

Motorcraft Professional Strength Carpet & Upholstery Cleaner (ZC-54)

Motorcraft Spot and Stain Remover (U.S. only) (ZC-14)

Motorcraft Tire Clean and Shine (ZC-28)

Motorcraft Triple Clean (U.S. only) (ZC-13)

Motorcraft Ultra-Clear Spray Glass Cleaner (ZC-23)

Motorcraft Vinyl Cleaner (Canada only) (CXC-93)

Motorcraft Wash and Wax (Canada only) (CXC-95)

Motorcraft Wheel and Tire Cleaner (ZC-37-A)

SERVICE RECOMMENDATIONS

To help you service your vehicle, we provide *scheduled maintenance information* which makes tracking routine service easy.

If your vehicle requires professional service, your authorized dealer can provide the necessary parts and service. Check your *Warranty Guide* to find out which parts and services are covered.

Use only recommended fuels, lubricants, fluids and service parts conforming to specifications. Motorcraft parts are designed and built to provide the best performance in your vehicle.

PRECAUTIONS WHEN SERVICING YOUR VEHICLE

- Do not work on a hot engine.
- Make sure that nothing gets caught in moving parts.
- Do not work on a vehicle with the engine running in an enclosed space, unless you are sure you have enough ventilation.
- Keep all open flames and other burning (cigarettes) material away from the battery and all fuel related parts.

Working with the engine off

1. Set the parking brake and ensure the gearshift is securely latched in P (Park).
2. Turn off the engine and remove the key.
3. Block the wheels to prevent the vehicle from moving unexpectedly.

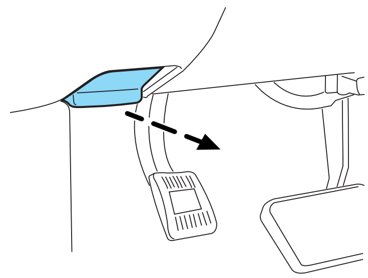
Working with the engine on

1. Set the parking brake and shift to P (Park).
2. Block the wheels.

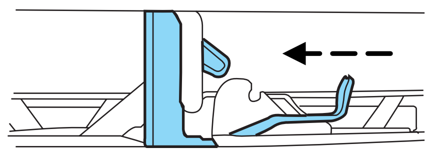
To reduce the risk of vehicle damage and/or personal burn injuries, do not start your engine with the air cleaner removed and do not remove it while the engine is running.

OPENING THE HOOD

1. Inside the vehicle, pull the hood release handle located under the bottom of the instrument panel near the steering column.



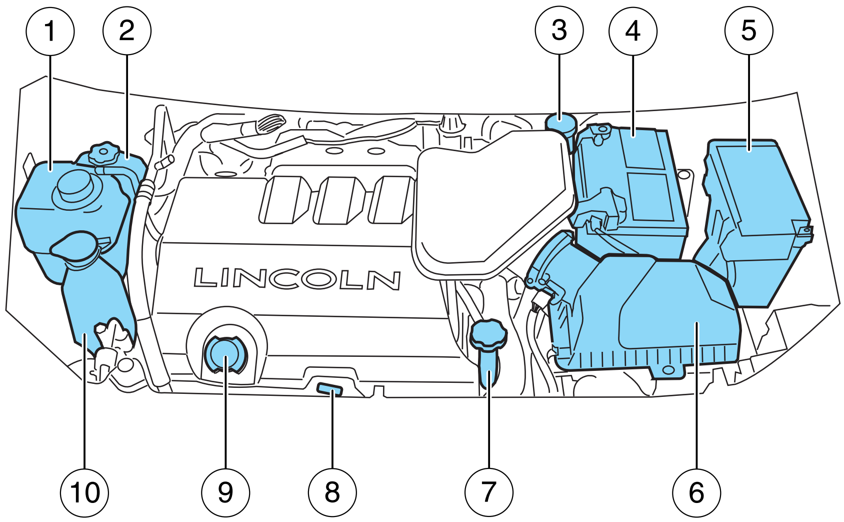
2. Go to the front of the vehicle and release the secondary hood latch that is located under the front center of the hood.



3. Lift the hood and support it with the prop rod.

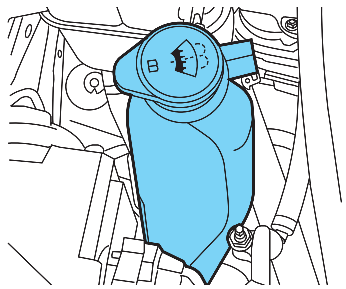
IDENTIFYING COMPONENTS IN THE ENGINE COMPARTMENT

3.5L V6 engine



1. Engine coolant reservoir
2. Power steering fluid reservoir
3. Brake fluid reservoir
4. Battery
5. Power distribution box
6. Air filter assembly
7. Transaxle fluid dipstick
8. Engine oil dipstick
9. Engine oil filler cap
10. Windshield washer fluid reservoir

WINDSHIELD WASHER FLUID



Add fluid to fill the reservoir if the level is low. In very cold weather, do not fill the reservoir completely.

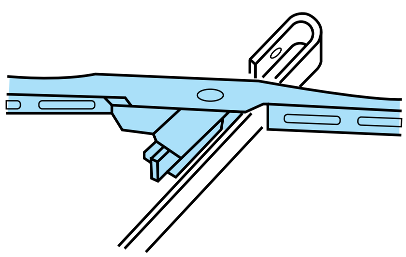
Only use a washer fluid that meets Ford specification WSB-M8B16-A2. Do not use any special washer fluid such as windshield water repellent type fluid or bug wash. They may cause squeaking, chatter noise, streaking and smearing. Refer to the *Maintenance product specifications and capacities* section in this chapter.

State or local regulations on volatile organic compounds may restrict the use of methanol, a common windshield washer antifreeze additive. Washer fluids containing non-methanol antifreeze agents should be used only if they provide cold weather protection without damaging the vehicle's paint finish, wiper blades or washer system.

If you operate your vehicle in temperatures below 40° F (4.5°C), use washer fluid with antifreeze protection. Failure to use washer fluid with antifreeze protection in cold weather could result in impaired windshield vision and increase the risk of injury or accident.

Note: Do not put washer fluid in the engine coolant reservoir. Washer fluid placed in the cooling system may harm engine and cooling system components.

CHANGING THE WIPER BLADES



1. Pull the wiper arm away from the vehicle. Turn the blade at an angle from the wiper arm. Push the lock pin manually to release the blade and pull the wiper blade down toward the windshield to remove it from the arm.
2. Attach the new wiper to the wiper arm and press it into place until a click is heard.

Replace wiper blades at least once per year for optimum performance.

Poor wiper quality can be improved by cleaning the wiper blades and the windshield, refer to *Windows and wiper blades* in the *Cleaning* chapter.

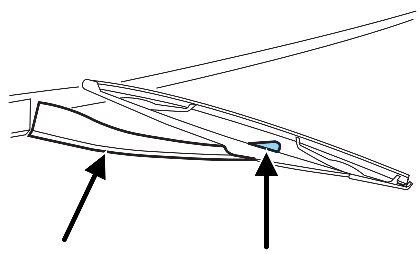
To prolong the life of the wiper blades, it is highly recommended to scrape off the ice on the windshield before turning on the wipers. The layer of ice has many sharp edges and can damage the micro edge of the wiper rubber element.

Changing rear window wiper blade

The rear wiper arm is designed without a service position. This reduces the risk of damage to the blade in an automatic car wash.

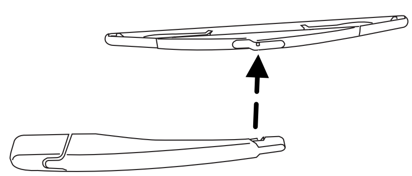
To replace the wiper blade:

1. Grab the wiper arm just below the blade attachment and pull it as far away from the glass as possible. Do not use excessive force because it can break the wiper arm at the heel. Hold it there until the next step.



2. Grab the wiper blade with your other hand and use your fingers to push the wiper arm tip through the wiper blade center to separate the blade from the arm.

3. Attach the new wiper to the wiper arm and press it into place until a click is heard.



If you find this procedure too difficult, please see your dealer.

ENGINE OIL

Checking the engine oil

Refer to the *scheduled maintenance information* for the appropriate intervals for checking the engine oil.

1. Make sure the vehicle is on level ground.

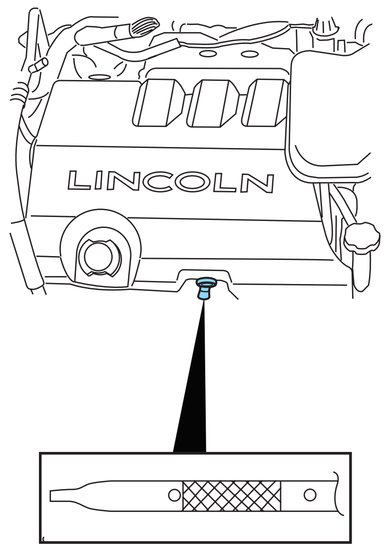
2. Turn the engine off and wait a few minutes for the oil to drain into the oil pan.

3. Set the parking brake and ensure the gearshift is securely latched in P (Park).

4. Open the hood. Protect yourself from engine heat.

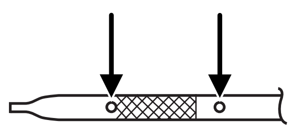
5. Locate and carefully remove the engine oil level dipstick.

- 3.5L V6 engine

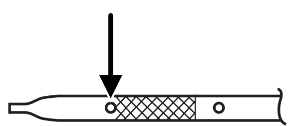


6. Wipe the dipstick clean. Insert the dipstick fully, then remove it again.

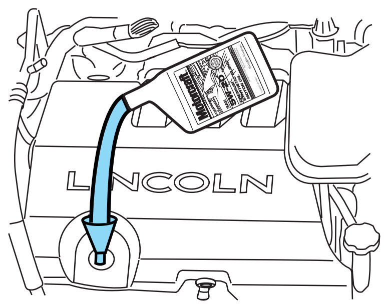
- If the oil level is **within this range,** the oil level is acceptable. **DO NOT ADD OIL.**



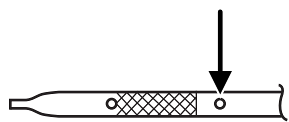
- If the oil level is **below this mark,** engine **oil must be added** to raise the level within the normal operating range.



• 3.5L V6 engine



• If required, add engine oil to the engine. Refer to *Adding engine oil* in this chapter.
• **Do not overfill the engine with oil. Oil levels above this mark may cause engine damage.** If the engine is overfilled, some oil must be removed from the engine by an authorized dealer.



7. Put the dipstick back in and ensure it is fully seated.

Adding engine oil

1. Check the engine oil. For instructions, refer to *Checking the engine oil* in this chapter.

2. If the engine oil level is not within the normal operating range, add only certified engine oil of the recommended viscosity. Remove the engine oil filler cap and use a funnel to pour the engine oil into the opening.

3. Recheck the engine oil level. Make sure the oil level is not above the normal operating range on the engine oil level dipstick.

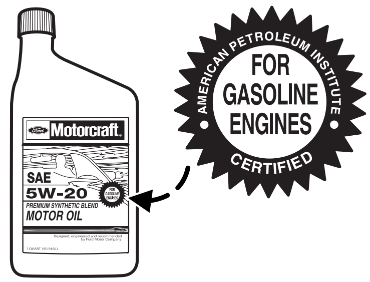
4. Install the dipstick and ensure it is fully seated.

5. Fully install the engine oil filler cap by turning the filler cap clockwise until it stops.

To avoid possible oil loss, DO NOT operate the vehicle with the engine oil level dipstick and/or the engine oil filler cap removed.

Engine oil and filter recommendations

Look for this certification trademark.



Use SAE 5W-20 engine oil

Only use oils "Certified For Gasoline Engines" by the American Petroleum Institute (API). An oil with this trademark symbol conforms to the current engine and emission system protection standards and fuel economy requirements of the International Lubricant Standardization and Approval Committee (ILSAC), comprised of U.S. and Japanese automobile manufacturers.

To protect your engine's warranty use Motorcraft SAE 5W-20 or an equivalent SAE 5W-20 oil meeting Ford specification WSS-M2C930-A. **SAE 5W-20 oil provides optimum fuel economy and durability performance meeting all requirements for your vehicle's engine.**

Do not use supplemental engine oil additives, cleaners or other engine treatments. They are unnecessary and could lead to engine damage that is not covered by Ford warranty.

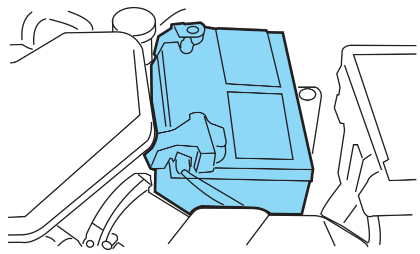
Change your engine oil and filter according to the appropriate schedule listed in *scheduled maintenance information.*

Ford production and aftermarket (Motorcraft) oil filters are designed for added engine protection and long life. If a replacement oil filter is used that does not meet Ford material and design specifications, start-up engine noises or knock may be experienced.

It is recommended you use the appropriate Motorcraft oil filter or another with equivalent performance for your engine application.

BATTERY

Your vehicle is equipped with a Motorcraft maintenance-free battery which normally does not require additional water during its life of service.



If your battery has a cover/shield, make sure it is reinstalled after the battery has been cleaned or replaced.

For longer, trouble-free operation, keep the top of the battery clean and dry. Also, make certain the battery cables are always tightly fastened to the battery terminals.

If you see any corrosion on the battery or terminals, remove the cables from the terminals and clean with a wire brush. You can neutralize the acid with a solution of baking soda and water.

It is recommended that the negative battery cable terminal be disconnected from the battery if you plan to store your vehicle for an extended period of time. This will minimize the discharge of your battery during storage.

Note: Electrical or electronic accessories or components added to the vehicle by the dealer or the owner may adversely affect battery performance and durability.

Batteries normally produce explosive gases which can cause personal injury. Therefore, do not allow flames, sparks or lighted substances to come near the battery. When working near the battery, always shield your face and protect your eyes. Always provide proper ventilation.

When lifting a plastic-cased battery, excessive pressure on the end walls could cause acid to flow through the vent caps, resulting in personal injury and/or damage to the vehicle or battery. Lift the battery with a battery carrier or with your hands on opposite corners.

Keep batteries out of reach of children. Batteries contain sulfuric acid. Avoid contact with skin, eyes or clothing. Shield your eyes when working near the battery to protect against possible splashing of acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If acid is swallowed, call a physician immediately.

Battery posts, terminals and related accessories contain lead and lead compounds. **Wash hands after handling.**

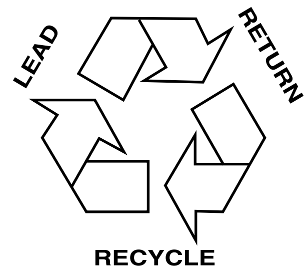
Because your vehicle's engine is electronically controlled by a computer, some control conditions are maintained by power from the battery. When the battery is disconnected or a new battery is installed, the engine must relearn its idle and fuel trim strategy for optimum driveability and performance. To begin this process:

1. With the vehicle at a complete stop, set the parking brake.
2. Put the gearshift in P (Park), turn off all accessories and start the engine.
3. Run the engine until it reaches normal operating temperature.
4. Allow the engine to idle for at least one minute.
5. Turn the A/C on and allow the engine to idle for at least one minute.
6. Release the parking brake. With your foot on the brake pedal and with the A/C on, put the vehicle in D (Drive) and allow the engine to idle for at least one minute.
7. Drive the vehicle to complete the relearning process.

- The vehicle may need to be driven 10 miles (16 km) or more to relearn the idle and fuel trim strategy.
- **If you do not allow the engine to relearn its idle trim, the idle quality of your vehicle may be adversely affected until the idle trim is eventually relearned.**

If the battery has been disconnected or a new battery has been installed, the clock and radio settings must be reset once the battery is reconnected.

- Always dispose of automotive batteries in a responsible manner. Follow your local authorized standards for disposal. Call your local authorized recycling center to find out more about recycling automotive batteries.



ENGINE COOLANT

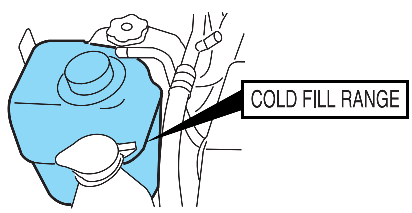
Checking engine coolant

The concentration and level of engine coolant should be checked at the intervals listed in *scheduled maintenance information.* The coolant concentration should be maintained at 50/50 coolant and distilled water, which equates to a freeze point of -34°F (-36°C). Coolant concentration testing is possible with a hydrometer or antifreeze tester (such as the Rotunda Battery and Antifreeze Tester, 014–R1060). The level of coolant should be maintained at the “FULL COLD” level or within the “COLD FILL RANGE” in the coolant reservoir. If the level falls below, add coolant per the instructions in the *Adding engine coolant* section.

Your vehicle was factory-filled with a 50/50 engine coolant and water concentration. If the concentration of coolant falls below 40% or above 60%, the engine parts could become damaged or not work properly. **A 50–50 mixture of coolant and water provides the following:**

- **Freeze protection down to -34°F (-36°C).**
- **Boiling protection up to 265°F (129°C).**
- **Protection against rust and other forms of corrosion.**
- **Enables calibrated gauges to work properly.**

When the engine is cold, check the level of the engine coolant in the reservoir.



- The engine coolant should be at the “FULL COLD” level or within the “COLD FILL RANGE” as listed on the engine coolant reservoir (depending upon application).

- Refer to *scheduled maintenance information* for service interval schedules.
- Be sure to read and understand *Precautions when servicing your vehicle* in this chapter.

If the engine coolant has not been checked at the recommended interval, the engine coolant reservoir may become low or empty. If the reservoir is low or empty, add engine coolant to the reservoir. Refer to *Adding engine coolant* in this chapter.

Note: Automotive fluids are not interchangeable; do not use engine coolant, antifreeze or windshield washer fluid outside of its specified function and vehicle location.

Adding engine coolant

When adding coolant, make sure it is a 50/50 mixture of engine coolant and distilled water. Add the mixture to the coolant reservoir, **when the engine is cool,** until the appropriate fill level is obtained.

Do not add engine coolant when the engine is hot. Steam and scalding liquids released from a hot cooling system can burn you badly. Also, you can be burned if you spill coolant on hot engine parts.

Do not put engine coolant in the windshield washer fluid container. If sprayed on the windshield, engine coolant could make it difficult to see through the windshield.

- **Add Motorcraft Premium Gold Engine Coolant or equivalent meeting Ford specification WSS-M97B51-A1.** Refer to *Maintenance product specifications and capacities* in this chapter.

Note: Do not use stop leak pellets or cooling system sealants/additives as they can cause damage to the engine cooling and/or heating systems. This damage would not be covered under your vehicle's warranty.

- **Do not add/mix an orange-colored, extended life coolant such as Motorcraft Specialty Orange Engine Coolant, meeting Ford specification WSS-M97B44-D, or DEX-COOL® brand with the factory-filled coolant.** Mixing Motorcraft Specialty Orange Engine Coolant or any orange-colored extended life product such as DEX-COOL® brand with your factory filled coolant can result in degraded corrosion protection.

- A large amount of water without engine coolant may be added, in case of emergency, to reach a vehicle service location. In this instance, the cooling system must be drained and refilled with a 50/50 mixture of engine coolant and distilled water as soon as possible. Water alone (without engine coolant) can cause engine damage from corrosion, overheating or freezing.
- **Do not use alcohol, methanol, brine or any engine coolants mixed with alcohol or methanol antifreeze (coolant).** Alcohol and other liquids can cause engine damage from overheating or freezing.
- **Do not add extra inhibitors or additives to the coolant.** These can be harmful and compromise the corrosion protection of the engine coolant.

For vehicles with overflow coolant systems with a non-pressurized cap on the coolant recovery system, add coolant to the coolant recovery reservoir when the engine is cool. Add the proper mixture of coolant and water to the "FULL COLD" level. For all other vehicles which have a coolant degas system with a pressurized cap, or if it is necessary to remove the coolant pressure relief cap on the radiator of a vehicle with an overflow system, follow these steps to add engine coolant.

To reduce the risk of personal injury, make sure the engine is cool before unscrewing the coolant pressure relief cap. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly.

Add the proper mixture of coolant and water to the cooling system by following these steps:

1. Before you begin, turn the engine off and let it cool.

2. When the engine is cool, wrap a thick cloth around the coolant pressure relief cap on the coolant reservoir (a translucent plastic bottle). Slowly turn cap counterclockwise (left) until pressure begins to release.

3. Step back while the pressure releases.

4. When you are sure that all the pressure has been released, use the cloth to turn it counterclockwise and remove the cap.

5. Fill the coolant reservoir slowly with the proper coolant mixture, to within the "COLD FILL RANGE" or the "FULL COLD" level on the reservoir. If you removed the radiator cap in an overflow system, fill the radiator until the coolant is visible and radiator is almost full.

6. Replace the cap. Turn until tightly installed. Cap must be tightly installed to prevent coolant loss.

After any coolant has been added, check the coolant concentration (refer to *Checking engine coolant*). If the concentration is not 50/50 (protection to –34° F/–36° C), drain some coolant and adjust the concentration. It may take several drains and additions to obtain a 50/50 coolant concentration.

Whenever coolant has been added, the coolant level in the coolant reservoir should be checked the next few times you drive the vehicle. If necessary, add enough 50/50 concentration of engine coolant and distilled water to bring the liquid level to the proper level.

If you have to add more than 1.0 quart (1.0 liter) of engine coolant per month, have your authorized dealer check the engine cooling system. Your cooling system may have a leak. Operating an engine with a low level of coolant can result in engine overheating and possible engine damage.

Recycled engine coolant

Ford Motor Company does NOT recommend the use of recycled engine coolant in vehicles originally equipped with Motorcraft Premium Gold Engine Coolant since a Ford-approved recycling process is not yet available.

Used engine coolant should be disposed of in an appropriate manner. Follow your community's regulations and standards for recycling and disposing of automotive fluids.

Coolant refill capacity

To find out how much fluid your vehicle's cooling system can hold, refer to *Maintenance product specifications and capacities* in this chapter.

Fill your engine coolant reservoir as outlined in *Adding engine coolant* in this section.

Severe climates

If you drive in extremely cold climates (less than –34°F [–36°C]):

- **It may be necessary to increase the coolant concentration above 50%.**
- **NEVER increase the coolant concentration above 60%.**
- **Increased engine coolant concentrations above 60% will decrease the overheat protection characteristics of the engine coolant and may cause engine damage.**

- **Refer to the chart on the coolant container to ensure the coolant concentration in your vehicle will provide adequate freeze protection at the temperatures in which you drive in the winter months.**

If you drive in extremely hot climates:

- **It is still necessary to maintain the coolant concentration above 40%.**
- **NEVER decrease the coolant concentration below 40%.**
- **Decreased engine coolant concentrations below 40% will decrease the corrosion protection characteristics of the engine coolant and may cause engine damage.**
- **Decreased engine coolant concentrations below 40% will decrease the freeze protection characteristics of the engine coolant and may cause engine damage.**
- **Refer to the chart on the coolant container to ensure the coolant concentration in your vehicle will provide adequate protection at the temperatures in which you drive.**

Vehicles driven year-round in non-extreme climates should use a 50/50 mixture of engine coolant and distilled water for optimum cooling system and engine protection.

What you should know about fail-safe cooling

If the engine coolant supply is depleted, this feature allows the vehicle to be driven temporarily before incremental component damage is incurred. The “fail-safe” distance depends on ambient temperatures, vehicle load and terrain.

How fail-safe cooling works

If the engine begins to overheat:

- The engine coolant temperature gauge will move to the red (hot) area.
- The  symbol will illuminate.

If the engine reaches a preset over-temperature condition, the engine will automatically switch to alternating cylinder operation. Each disabled cylinder acts as an air pump and cools the engine.

When this occurs the vehicle will still operate. However:

- The engine power will be limited.
- The air conditioning system will be disabled.

Continued operation will increase the engine temperature:

- The engine will completely shut down.
- Steering and braking effort will increase.

Once the engine temperature cools, the engine can be re-started. Take your vehicle to an authorized dealer as soon as possible to minimize engine damage.

When fail-safe mode is activated

You have limited engine power when in the fail-safe mode, so drive the vehicle with caution. The vehicle will not be able to maintain high speed operation and the engine will run rough. Remember that the engine is capable of completely shutting down automatically to prevent engine damage, therefore:

1. Pull off the road as soon as safely possible and turn off the engine.
2. Arrange for the vehicle to be taken to an authorized dealer.
3. If this is not possible, wait a short period for the engine to cool.
4. Check the coolant level and replenish if low.

> ⚠ Never remove the coolant reservoir cap while the engine is running or hot.

5. Restart the engine and take your vehicle to an authorized dealer.

Driving the vehicle without repairing the engine problem increases the chance of engine damage. Take your vehicle to an authorized dealer as soon as possible.

FUEL FILTER

Your vehicle is equipped with a lifetime fuel filter that is integrated with the fuel tank. Regular maintenance or replacement is not needed.

WHAT YOU SHOULD KNOW ABOUT AUTOMOTIVE FUELS

Important safety precautions

> ⚠ Do not overfill the fuel tank. The pressure in an overfilled tank may cause leakage and lead to fuel spray and fire.

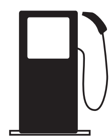
The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise, fuel may spray out and injure you or others.

If you do not use the proper fuel filler cap, excessive vacuum in the fuel tank may damage the fuel system or cause the fuel cap to disengage in a collision, which may result in serious personal injury.

Automotive fuels can cause serious injury or death if misused or mishandled.

Gasoline may contain benzene, which is a cancer-causing agent.

Observe the following guidelines when handling automotive fuel:



- Extinguish all smoking materials and any open flames before refueling your vehicle.
- Always turn off the vehicle before refueling.
- Automotive fuels can be harmful or fatal if swallowed. Fuel such as gasoline is highly toxic and if swallowed can cause death or permanent injury. If fuel is swallowed, call a physician immediately, even if no symptoms are immediately apparent. The toxic effects of fuel may not be visible for hours.
- Avoid inhaling fuel vapors. Inhaling too much fuel vapor of any kind can lead to eye and respiratory tract irritation. In severe cases, excessive or prolonged breathing of fuel vapor can cause serious illness and permanent injury.
- Avoid getting fuel liquid in your eyes. If fuel is splashed in the eyes, remove contact lenses (if worn), flush with water for 15 minutes and seek medical attention. Failure to seek proper medical attention could lead to permanent injury.
- Fuels can also be harmful if absorbed through the skin. If fuel is splashed on the skin and/or clothing, promptly remove contaminated clothing and wash skin thoroughly with soap and water. Repeated or prolonged skin contact with fuel liquid or vapor causes skin irritation.

- Be particularly careful if you are taking “Antabuse” or other forms of disulfiram for the treatment of alcoholism. Breathing gasoline vapors, or skin contact could cause an adverse reaction. In sensitive individuals, serious personal injury or sickness may result. If fuel is splashed on the skin, promptly wash skin thoroughly with soap and water. Consult a physician immediately if you experience an adverse reaction.

When refueling always shut the engine off and never allow sparks or open flames near the filler neck. Never smoke while refueling. Fuel vapor is extremely hazardous under certain conditions. Care should be taken to avoid inhaling excess fumes.

The flow of fuel through a fuel pump nozzle can produce static electricity, which can cause a fire if fuel is pumped into an ungrounded fuel container.

Refueling

Fuel vapor burns violently and a fuel fire can cause severe injuries. To help avoid injuries to you and others:

- Read and follow all the instructions on the pump island;
- Turn off your engine when you are refueling;
- Do not smoke if you are near fuel or refueling your vehicle;
- Keep sparks, flames and smoking materials away from fuel;
- Stay outside your vehicle and do not leave the fuel pump unattended when refueling your vehicle — this is against the law in some places;
- Keep children away from the fuel pump; never let children pump fuel.

Use the following guidelines to avoid electrostatic charge build-up when filling an ungrounded fuel container:
- Place approved fuel container on the ground.
- DO NOT fill a fuel container while it is in the vehicle (including the cargo area).
- Keep the fuel pump nozzle in contact with the fuel container while filling.
- DO NOT use a device that would hold the fuel pump handle in the fill position.

Fuel Filler Cap

Your fuel tank filler cap has an indexed design with a 1/4 turn on/off feature.

When fueling your vehicle:

1. Turn the engine off.
2. Carefully turn the filler cap counterclockwise 1/4 turn until it stops.
3. Pull to remove the cap from the fuel filler pipe.
4. To install the cap, align the tabs on the cap with the notches on the filler pipe.
5. Turn the filler cap clockwise 1/4 of a turn until at least a few clicks are heard.

If the check fuel cap light or a “check fuel cap” message comes on, the fuel filler cap may not be properly installed. The light or message can come on after several driving events after you’ve refueled your vehicle.

At the next opportunity, safely pull off of the road, remove the fuel filler cap, align the cap properly and reinstall it. The check fuel cap light or “check fuel cap” message may not reset immediately; it may take several driving cycles for the check fuel cap light or “check fuel cap” message to turn off. A driving cycle consists of an engine start-up (after four or more hours with the engine off) followed by city and highway driving.

Continuing to drive with the check fuel cap light or “check fuel cap” message on may cause the light to turn on as well.

If you must replace the fuel filler cap, replace it with a fuel filler cap that is designed for your vehicle. The customer warranty may be void for any damage to the fuel tank or fuel system if the correct genuine Ford, Motorcraft or other certified fuel filler cap is not used.

The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise, fuel may spray out and injure you or others.

If you do not use the proper fuel filler cap, excessive vacuum in the fuel tank may damage the fuel system or cause the fuel cap to disengage in a collision, which may result in personal injury.

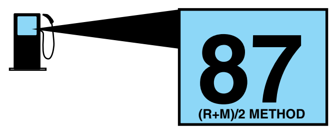
Choosing the right fuel

Use only UNLEADED fuel or UNLEADED fuel blended with a maximum of 10% ethanol. Your vehicle was not designed to run on E85 fuels that are blended with a maximum of 85% ethanol. The use of leaded fuel is prohibited by law and could damage your vehicle. Do not use fuel containing methanol. It can damage critical fuel system components.

Your vehicle was not designed to use fuel or fuel additives with metallic compounds, including manganese-based additives. Studies indicate that these additives can cause your vehicle's emission control system to deteriorate more rapidly.

Repairs to correct the effects of using a fuel for which your vehicle was not designed may not be covered by your warranty.

Octane recommendations



Your vehicle is designed to use "Regular" unleaded gasoline with pump (R+M)/2 octane rating of 87. We do not recommend the use of gasolines labeled as "Regular" that are sold with octane ratings of 86 or lower in high altitude areas.

Do not be concerned if your engine sometimes knocks lightly. However, if it knocks heavily under most driving conditions while you are using fuel with the recommended octane rating, see your authorized dealer to prevent any engine damage.

Fuel quality

If you are experiencing starting, rough idle or hesitation driveability problems, try a different brand of unleaded gasoline. "Premium" unleaded gasoline is not recommended for vehicles designed to use "Regular" unleaded gasoline because it may cause these problems to become more pronounced. If the problems persist, see your authorized dealer.

Do not add aftermarket fuel additive products to your fuel tank. It should not be necessary to add any aftermarket products to your fuel tank if you continue to use high quality fuel of the recommended octane rating. These products have not been approved for your engine and could cause damage to the fuel system. Repairs to correct the effects of using an aftermarket product in your fuel may not be covered by your warranty.

Many of the world's automakers approved the World-Wide Fuel Charter that recommends gasoline specifications to provide improved performance and emission control system protection for your vehicle. Gasolines that meet the World-Wide Fuel Charter should be used when available. Ask your fuel supplier about gasolines that meet the World-Wide Fuel Charter.

Cleaner air

Ford endorses the use of reformulated "cleaner-burning" gasolines to improve air quality, per the recommendations in the *Choosing the Right Fuel* section.

Running out of fuel

Avoid running out of fuel because this situation may have an adverse effect on powertrain components.

If you have run out of fuel:

- You may need to cycle the ignition from OFF to ON several times after refueling to allow the fuel system to pump the fuel from the tank to the engine. On restarting, cranking time will take a few seconds longer than normal.
- Normally, adding 1 gallon (3.8L) of fuel is enough to restart the engine. If the vehicle is out of fuel and on a steep grade, more than 1 gallon (3.8L) may be required.
- The *Service engine soon* indicator may come on. For more information on the *Service engine soon* indicator, refer to *Warning lights and chimes* in the *Instrument Cluster* chapter.

ESSENTIALS OF GOOD FUEL ECONOMY

Measuring techniques

Your best source of information about actual fuel economy is you, the driver. You must gather information as accurately and consistently as possible. Fuel expense, frequency of fill-ups or fuel gauge readings are NOT accurate as a measure of fuel economy. We do not recommend taking fuel economy measurements during the first 1,000 miles (1,600 km) of driving (engine break-in period). You will get a more accurate measurement after 2,000 miles–3,000 miles (3,000 km–5,000 km).

Filling the tank

The advertised fuel capacity of the fuel tank on your vehicle is equal to the rated refill capacity of the fuel tank as listed in the *Maintenance product specifications and capacities* section of this chapter.

The advertised capacity is the amount of the indicated capacity and the empty reserve combined. Indicated capacity is the difference in the amount of fuel in a full tank and a tank when the fuel gauge indicates empty. Empty reserve is the small amount of fuel remaining in the fuel tank after the fuel gauge indicates empty.

The amount of usable fuel in the empty reserve varies and should not be relied upon to increase driving range. When refueling your vehicle after the fuel gauge indicates empty, you might not be able to refuel the full amount of the advertised capacity of the fuel tank due to the empty reserve still present in the tank.

For consistent results when filling the fuel tank:

- Turn the engine/ignition switch to the off position prior to refueling, an error in the reading will result if the engine is left running.
- Use the same filling rate setting (low — medium — high) each time the tank is filled.
- Allow no more than two automatic click-offs when filling.
- Always use fuel with the recommended octane rating.
- Use a known quality gasoline, preferably a national brand.
- Use the same side of the same pump and have the vehicle facing the same direction each time you fill up.
- Have the vehicle loading and distribution the same every time.

Your results will be most accurate if your filling method is consistent.

Calculating fuel economy

1. Fill the fuel tank completely and record the initial odometer reading (in miles or kilometers).

2. Each time you fill the tank, record the amount of fuel added (in gallons or liters).

3. After at least three to five tank fill-ups, fill the fuel tank and record the current odometer reading.

4. Subtract your initial odometer reading from the current odometer reading.

5. Follow one of the simple calculations in order to determine fuel economy:

Calculation 1: **Divide total miles traveled by total gallons used.**

Calculation 2: **Multiply liters used by 100, then divide by total kilometers traveled.**

Keep a record for at least one month and record the type of driving (city or highway). This will provide an accurate estimate of the vehicle's fuel economy under current driving conditions. Additionally, keeping records during summer and winter will show how temperature impacts fuel economy. In general, lower temperatures give lower fuel economy.

Driving style — good driving and fuel economy habits

Give consideration to the lists that follow and you may be able to change a number of variables and improve your fuel economy.

Habits

- Smooth, moderate operation can yield up to 10% savings in fuel.
- Steady speeds without stopping will usually give the best fuel economy.
- Idling for long periods of time (greater than one minute) may waste fuel.
- Anticipate stopping; slowing down may eliminate the need to stop.
- Sudden or hard accelerations may reduce fuel economy.
- Slow down gradually.
- Driving at reasonable speeds (traveling at 55 mph [88 km/h] uses 15% less fuel than traveling at 65 mph [105 km/h]).
- Revving the engine before turning it off may reduce fuel economy.
- Using the air conditioner or defroster may reduce fuel economy.
- You may want to turn off the speed control in hilly terrain if unnecessary shifting between the top gears occurs. Unnecessary shifting of this type could result in reduced fuel economy.
- Warming up a vehicle on cold mornings is not required and may reduce fuel economy.
- Resting your foot on the brake pedal while driving may reduce fuel economy.
- Combine errands and minimize stop-and-go driving.

Maintenance

- Keep tires properly inflated and use only recommended size.
- Operating a vehicle with the wheels out of alignment will reduce fuel economy.
- Use recommended engine oil. Refer to *Maintenance product specifications and capacities* in this chapter.

- Perform all regularly scheduled maintenance items. Follow the recommended maintenance schedule and owner maintenance checks found in *scheduled maintenance information*.

Conditions

- Heavily loading a vehicle may reduce fuel economy at any speed.
- Carrying unnecessary weight may reduce fuel economy (approximately 1 mpg [0.4 km/L] is lost for every 400 lb [180 kg] of weight carried).
- Adding certain accessories to your vehicle (for example; bug deflectors, rollbars/light bars, running boards, ski/luggage racks) may reduce fuel economy.
- Using fuel blended with alcohol may lower fuel economy.
- Fuel economy may decrease with lower temperatures during the first 8–10 miles (12–16 km) of driving.
- Driving on flat terrain offers improved fuel economy as compared to driving on hilly terrain.
- Transmissions give their best fuel economy when operated in the top cruise gear and with steady pressure on the gas pedal.
- Close windows for high speed driving.

EPA window sticker

Every new vehicle should have the EPA window sticker. Contact your authorized dealer if the window sticker is not supplied with your vehicle. The EPA window sticker should be your guide for the fuel economy comparisons with other vehicles.

It is important to note the box in the lower left corner of the window sticker. These numbers represent the Range of MPG (L/100 km) expected on the vehicle under optimum conditions. Your fuel economy may vary depending upon the method of operation and conditions.

EMISSION CONTROL SYSTEM

Your vehicle is equipped with various emission control components and a catalytic converter which will enable your vehicle to comply with applicable exhaust emission standards. To make sure that the catalytic converter and other emission control components continue to work properly:

- Use only the specified fuel listed.
- Avoid running out of fuel.

- Do not turn off the ignition while your vehicle is moving, especially at high speeds.
- Have the items listed in *scheduled maintenance information* performed according to the specified schedule.

The scheduled maintenance items listed in *scheduled maintenance information* are essential to the life and performance of your vehicle and to its emissions system.

If other than Ford, Motorcraft or Ford-authorized parts are used for maintenance replacements or for service of components affecting emission control, such non-Ford parts should be equivalent to genuine Ford Motor Company parts in performance and durability.

WARNING: Do not park, idle, or drive your vehicle in dry grass or other dry ground cover. The emission system heats up the engine compartment and exhaust system, which can start a fire.

Illumination of the *Service engine soon* indicator, charging system warning light or the temperature warning light, fluid leaks, strange odors, smoke or loss of engine power could indicate that the emission control system is not working properly.

An improperly operating or damaged exhaust system may allow exhaust to enter the vehicle. Have a damaged or improperly operating exhaust system inspected and repaired immediately.

WARNING: Exhaust leaks may result in entry of harmful and potentially lethal fumes into the passenger compartment.

Do not make any unauthorized changes to your vehicle or engine. By law, vehicle owners and anyone who manufactures, repairs, services, sells, leases, trades vehicles, or supervises a fleet of vehicles are not permitted to intentionally remove an emission control device or prevent it from working. Information about your vehicle's emission system is on the Vehicle Emission Control Information Decal located on or near the engine. This decal also lists engine displacement.

Please consult your *Warranty Guide* for complete emission warranty information.

On board diagnostics (OBD-II)

Your vehicle is equipped with a computer that monitors the engine's emission control system. This system is commonly known as the On Board Diagnostics System (OBD-II). The OBD-II system protects the environment by ensuring that your vehicle continues to meet government emission standards. The OBD-II system also assists your authorized dealer in properly servicing your vehicle. When the *Service engine soon* indicator illuminates, the OBD-II system has detected a malfunction. Temporary malfunctions may cause the *Service engine soon* indicator to illuminate. Examples are:

1. The vehicle has run out of fuel—the engine may misfire or run poorly.

2. Poor fuel quality or water in the fuel—the engine may misfire or run poorly.

3. The fuel cap may not have been securely tightened. See *Fuel filler cap* in this chapter.

4. Driving through deep water—the electrical system may be wet.

These temporary malfunctions can be corrected by filling the fuel tank with good quality fuel, properly tightening the fuel cap or letting the electrical system dry out. After three driving cycles without these or any other temporary malfunctions present, the *Service engine soon* indicator should stay off the next time the engine is started. A driving cycle consists of a cold engine startup followed by mixed city/highway driving. No additional vehicle service is required.

If the *Service engine soon* indicator remains on, have your vehicle serviced at the first available opportunity. Although some malfunctions detected by the OBD-II may not have symptoms that are apparent, continued driving with the *Service engine soon* indicator on can result in increased emissions, lower fuel economy, reduced engine and transmission smoothness, and lead to more costly repairs.

Readiness for Inspection/Maintenance (I/M) testing

Some state/provincial and local governments may have Inspection/Maintenance (I/M) programs to inspect the emission control equipment on your vehicle. Failure to pass this inspection could prevent you from getting a vehicle registration. Your vehicle may not pass the I/M test if the *Service engine soon* indicator is on or not working properly (bulb is burned out), or if the OBD-II system has determined that some of the emission control systems have not been properly checked. In this case, the vehicle is considered not ready for I/M testing.

If the *Service engine soon* indicator is on or the bulb does not work, the vehicle may need to be serviced. Refer to the On board diagnostics (OBD-II) description in this chapter.

If the vehicle's engine or transmission has just been serviced, or the battery has recently run down or been replaced, the OBD-II system may indicate that the vehicle is not ready for I/M testing. To determine if the vehicle is ready for I/M testing, turn the ignition key to the ON position for 15 seconds without cranking the engine. If the *Service engine soon* indicator blinks eight times, it means that the vehicle is not ready for I/M testing; if the *Service engine soon* indicator stays on solid, it means that the vehicle is ready for I/M testing.

The OBD-II system is designed to check the emission control system during normal driving. A complete check may take several days. If the vehicle is not ready for I/M testing, the following driving cycle consisting of mixed city and highway driving may be performed:

15 minutes of steady driving on an expressway/highway followed by 20 minutes of stop-and-go driving with at least four 30-second idle periods.

Allow the vehicle to sit for at least eight hours without starting the engine. Then, start the engine and complete the above driving cycle. The engine must warm up to its normal operating temperature. Once started, do not turn off the engine until the above driving cycle is complete. If the vehicle is still not ready for I/M testing, the above driving cycle will have to be repeated.

POWER STEERING FLUID

Check the power steering fluid. Refer to the *scheduled maintenance information* for the service interval schedules.

1. Start the engine and let it run until it reaches normal operating temperature (the engine coolant temperature gauge indicator will be near the center of the normal area between H and C).

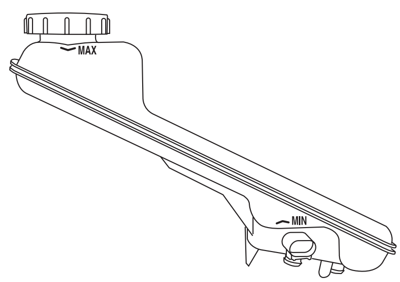
2. While the engine idles, turn the steering wheel left and right several times.

3. Turn the engine off.

4. Check the fluid level in the reservoir. It should be between the MIN and MAX lines. Do not add fluid if the level is in this range.

5. If the fluid is low, add fluid in small amounts, continuously checking the level until it reaches the range between the MIN and MAX lines. Be sure to put the cap back on the reservoir. Refer to *Maintenance product specifications and capacities* in this chapter for the proper fluid type.

BRAKE FLUID



The fluid level will drop slowly as the brakes wear, and will rise when the brake components are replaced. Fluid levels between the “MIN” and “MAX” lines are within the normal operating range; there is no need to add fluid. If the fluid levels are outside of the normal operating range the performance of the system could be compromised; seek service from your authorized dealer immediately.

TRANSAXLE FLUID

Checking automatic transaxle fluid

Refer to your *scheduled maintenance information* for scheduled intervals for fluid checks and changes.Your transaxle does not consume fluid. However, the fluid level should be checked if the transaxle is not working properly, i.e., if the transaxle slips or shifts slowly or if you notice some sign of fluid leakage.

Automatic transmission fluid expands when warmed. To obtain an accurate fluid check, drive the vehicle until it is warmed up (approximately 20 miles [30 km]). If your vehicle has been operated for an extended period at high speeds, in city traffic during hot weather or pulling a trailer, the vehicle should be turned off for about 30 minutes to allow fluid to cool before checking.

1. Drive the vehicle 20 miles (30 km) or until it reaches normal operating temperature.

2. Park the vehicle on a level surface and engage the parking brake.

3. With the parking brake engaged and your foot on the brake pedal, start the engine and move the gearshift lever through all of the gear ranges. Allow sufficient time for each gear to engage.

4. Latch the gearshift lever in P (Park) and leave the engine running.

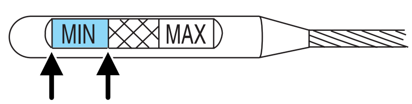
5. Remove the dipstick, wiping it clean with a clean, dry lint free rag. If necessary, refer to *Identifying components in the engine compartment* in this chapter for the location of the dipstick.

6. Install the dipstick making sure it is fully seated in the filler tube.

7. Remove the dipstick and inspect the fluid level. The fluid should be in the designated areas for normal operating temperature.

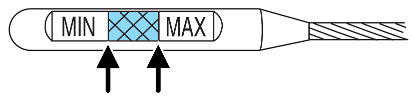
Low fluid level

Do not drive the vehicle if the fluid level is in the add range or does not show at all on the dipstick.



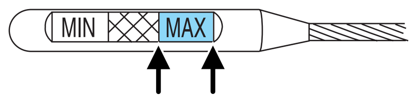
Correct fluid level

The transmission fluid should be checked at normal operating temperature 149°F (65°C) on a level surface. The normal operating temperature can be reached after approximately 20 miles (30 km) of driving.



The transmission fluid should be within the cross-hatch area if at normal operating temperature 149°F (65°C).

High fluid level



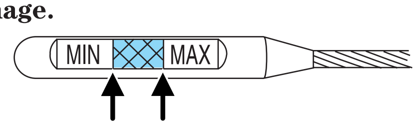
Fluid levels above the safe range may result in transaxle failure. An overfill condition of transmission fluid may cause shift and/or engagement concerns and/or possible damage.

High fluid levels can be caused by an overheating condition.

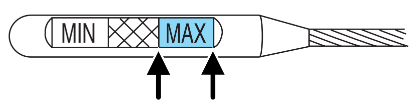
Adjusting automatic transmission fluid levels

Before adding any fluid, make sure the correct type is used. The type of fluid used is normally indicated on the dipstick and also in the *Maintenance product specifications and capacities* section in this chapter.

Use of a non-approved automatic transmission fluid may cause internal transaxle component damage.



If necessary, add fluid in 1/2 pint (250 mL) increments through the filler tube until the level is correct.



If an overfill occurs, excess fluid should be removed by an authorized dealer.

An overfill condition of transmission fluid may cause shift and/or engagement concerns and/or possible damage.

Do not use supplemental transmission fluid additives, treatments or cleaning agents. The use of these materials may affect transmission operation and result in damage to internal transaxle components.

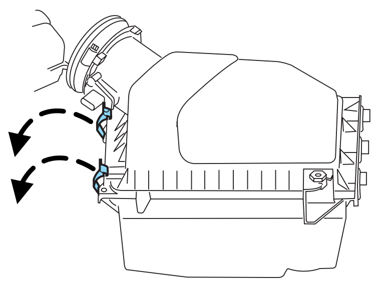
AIR FILTER

Refer to *scheduled maintenance information* for the appropriate intervals for changing the air filter element.

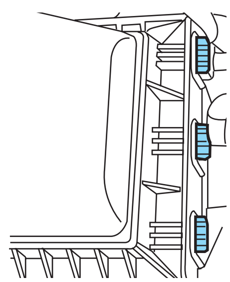
When changing the air filter element, use only the Motorcraft air filter element listed. Refer to *Motorcraft part numbers* in this chapter.

To reduce the risk of vehicle damage and/or personal burn injuries do not start your engine with the air cleaner removed and do not remove it while the engine is running.

Changing the air filter element



1. Release the clamps that secure the air filter housing cover.
2. Carefully separate the two halves of the air filter housing.
3. Remove the air filter element from the air filter housing.
4. Wipe the air filter housing and cover clean to remove any dirt or debris and to ensure good sealing.
5. Install a new air filter element. Be careful not to crimp the filter element edges between the air filter housing and cover. This could cause filter damage and allow unfiltered air to enter the engine if not properly seated.



6. Replace the air filter housing cover and secure the clamps. Be sure that the air cleaner cover tabs are engaged into the slots of the air cleaner housing.

Note: Failure to use the correct air filter element may result in severe engine damage. The customer warranty may be void for any damage to the engine if the correct air filter element is not used.

MOTORCRAFT PART NUMBERS

Component	3.5L V6 Engine
Engine air filter element	FA-1884
Battery	BXT-36R
Oil filter	FL-400-SB12
PCV valve	[1]
Spark plugs	[2]

[1]The PCV valve is a critical emission component. It is one of the items listed in *scheduled maintenance information* and is essential to the life and performance of your vehicle and to its emissions system.

For PCV valve replacement, see your authorized dealer. Refer to *scheduled maintenance information* for the appropriate intervals for changing the PCV valve.

Replace the PCV valve with one that meets Ford material and design specifications for your vehicle, such as a Motorcraft or equivalent replacement part. The customer warranty may be void for any damage to the emissions system if such a PCV valve is not used.

[2]For spark plug replacement, see your authorized dealer. Refer to *scheduled maintenance information* for the appropriate intervals for changing the spark plugs.

Replace the spark plugs with ones that meet Ford material and design specifications for your vehicle, such as Motorcraft or equivalent replacement parts. The customer warranty may be void for any damage to the engine if such spark plugs are not used.

MAINTENANCE PRODUCT SPECIFICATIONS AND CAPACITIES

Item	Capacity	Ford part name	Ford part number / Ford specification
Brake fluid	Between MIN and MAX on reservoir	Motorcraft High Performance DOT 3 Motor Vehicle Brake Fluid	PM-1-C / WSS-M6C62-A
Door weatherstrips	—	Silicone Spray Lubricant	XL-6 / ESR-M13P4-A
Door latch, hood latch, auxiliary hood latch, door hinges, striker plates, seat tracks and fuel filler door hinge	—	Multi-Purpose Grease	XG-4 or XL-5 / ESB-M1C93-B
Lock cylinders	—	Motorcraft Penetrating and Lock Lubricant	XL-1 / None
Engine oil[1]	5.5 quarts (5.2L)	Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil (US) Motorcraft SAE 5W-20 Super Premium Motor Oil (Canada)	XO-5W20-QSP (US) CXO-5W20–LSP12 (Canada) / WSS-M2C930-A with API Certification Mark
Engine coolant	11.7 quarts (11.09L)	Motorcraft Premium Gold Engine Coolant with bittering agent (yellow-colored)[2]	VC-7-B / WSS-M97B51-A1
Engine coolant–with trailer tow package	12.83 quarts (12.14L)		
Power steering fluid	Between MIN and MAX on reservoir	Motorcraft MERCON® V ATF	XT-5-QM / MERCON® V

Item	Capacity	Ford part name	Ford part number / Ford specification
Automatic transmission fluid	10.0 quarts (9.5L)[3]	Motorcraft MERCON® V ATF[4]	XT-5-QM / MERCON® V
Rear differential (AWD) fluid	2.4 pints (1.15L)	Motorcraft SAE 80W-90 Premium Rear Axle Lubricant	XY-80W90-QL / WSP-M2C197-A
Power Transfer Unit (PTU) fluid (AWD)[5]	12 ounces (0.35L)	Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant	XY-75W140-QL / WSL-M2C192-A
Windshield washer fluid	4.75 quarts (4.5L)	Motorcraft Premium Windshield Washer Concentrate	ZC-32-A / WSB-M8B16-A2
Fuel tank (front-wheel drive)	19.2 gallons (72.7L)	—	—
Fuel tank (all-wheel drive)	20.8 gallons (78.7L)	—	—

[1]Use of synthetic or synthetic blend motor oil is not mandatory. Engine oil need only meet the requirements of Ford specification WSS-M2C930-A and the API Certification mark.

[2]Add the coolant type originally equipped in your vehicle.

[3]Indicates only approximate dry-fill capacity. Some applications may vary based on cooler size and if equipped with an in-tank cooler. The amount of transmission fluid and fluid level should be set by the indication on the dipstick's normal operating range.

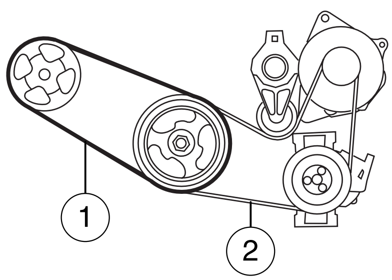
[4]Automatic transmissions that require MERCON® V should only use MERCON® V fluid or fluid that is specified dual usage MERCON®/MERCON® V. Refer to *scheduled maintenance information* to determine the correct service interval. Use of any fluid other than the recommended fluid may cause transmission damage.

[5]See your authorized dealer for fluid level checking or filling.

ENGINE DATA

Engine	3.5L-DOHC V6 engine
Displacement	3.5L
Required fuel	87 octane
Firing order	1–4–2–5–3–6
Spark plug gap	(0.052–0.056 inch) 1.32–1.42 mm
Ignition system	Coil on plug
Compression ratio	10.3:1

Engine drivebelt routing



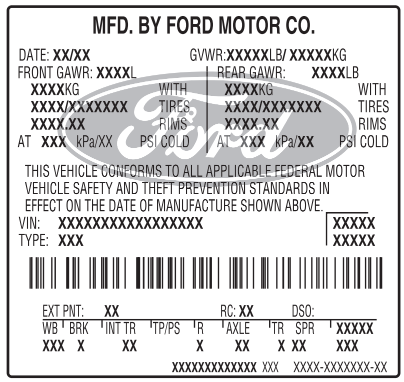
- 3.5L V6 Engine

1. Short drivebelt is on first pulley groove closest to engine.
2. Long drivebelt is on second pulley groove farthest from engine.

IDENTIFYING YOUR VEHICLE

Safety Compliance Certification Label

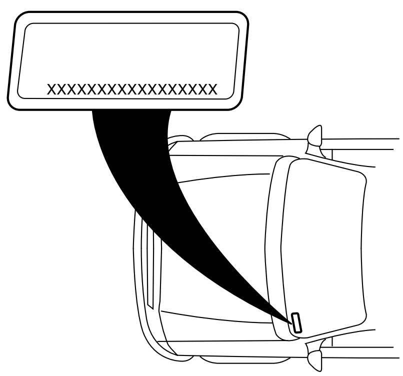
The National Highway Traffic Safety Administration Regulations require that a Safety Compliance Certification Label be affixed to a vehicle and prescribe where the Safety Compliance Certification Label may be located. The Safety Compliance Certification Label is located on the structure (B-Pillar) by the trailing edge of the driver's door or the edge of the driver's door.



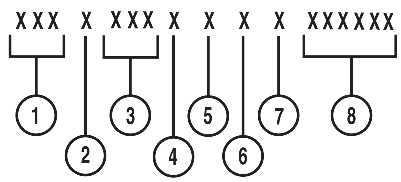
Vehicle identification number (VIN)

The vehicle identification number is located on the driver side instrument panel.

Please note that in the graphic, XXXX is representative of your vehicle identification number.



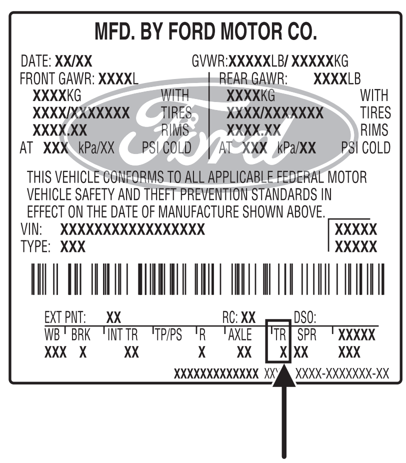
The Vehicle Identification Number (VIN) contains the following information:



1. World manufacturer identifier
2. Brake system / Gross Vehicle Weight Rating (GVWR) / Restraint System
3. Vehicle line, series, body type
4. Engine type
5. Check digit
6. Model year
7. Assembly plant
8. Production sequence number

TRANSMISSION/TRANSAXLE CODE DESIGNATIONS

You can find a transmission/transaxle code on the Safety Compliance Certification Label. The following table tells you which transmission or transaxle each code represents.



Description	Code
6F50 6–Speed Automatic Transaxle	J

GENUINE LINCOLN ACCESSORIES FOR YOUR VEHICLE

A wide selection of Genuine Lincoln Accessories are available for your vehicle through your local Lincoln or Ford of Canada dealer. These quality accessories have been specifically engineered to fulfill your automotive needs; they are custom designed to complement the style and aerodynamic appearance of your vehicle. In addition, each accessory is made from high quality materials and meets or exceeds Lincoln's rigorous engineering and safety specifications. Ford Motor Company will repair or replace any properly dealer-installed Genuine Lincoln Accessories found to be defective in factory-supplied materials or workmanship during the warranty period, as well as any component damaged by the defective accessories. The accessories will be warranted for whichever provides you the greatest benefit:

- 12 months or 12,000 miles (20,000 km) (whichever occurs first), or
- the remainder of your new vehicle limited warranty.

Contact your dealer for details and a copy of the warranty.

Following is a list of several Genuine Lincoln Accessories. Not all accessories are available for all models. To find out what accessories are available for your vehicle, please contact your dealer or visit our online store at: www.lincolnaccessories.com.

Exterior style

Bug shields

Deflectors

Splash guards

Interior style

Electrochromatic compass/temperature interior mirrors

Floor mats

Lifestyle

Ash cup / coin holder

Cargo organization and management

Cross bars

Trailer hitches, wiring harnesses and accessories

Peace of mind

Mobile-Ease™ hands-free communication system

TripTunes™ advanced portable audio solution

Remote start

Vehicle security systems

Wheel locks

For maximum vehicle performance, keep the following information in mind when adding accessories or equipment to your vehicle:

- When adding accessories, equipment, passengers and luggage to your vehicle, do not exceed the total weight capacity of the vehicle or of the front or rear axle (GVWR or GAWR as indicated on the Safety Compliance Certification label). Consult your authorized dealer for specific weight information.
- The Federal Communications Commission (FCC) and Canadian Radio Telecommunications Commission (CRTC) regulate the use of mobile communications systems — such as two-way radios, telephones and theft alarms - that are equipped with radio transmitters. Any such equipment installed in your vehicle should comply with FCC or CRTC regulations and should be installed only by a qualified service technician.
- Mobile communications systems may harm the operation of your vehicle, particularly if they are not properly designed for automotive use.
- To avoid interference with other vehicle functions, such as anti-lock braking systems, amateur radio users who install radios and antennas onto their vehicle should not locate the Amateur Radio Antennas in the area of the driver's side hood.
- Electrical or electronic accessories or components that are added to the vehicle by the authorized dealer or the owner may adversely affect battery performance and durability.

2008 ACCESSORIES & BODY, CAB

Rear View Mirrors - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Exterior mirror nuts	9	80

DESCRIPTION AND OPERATION

REAR VIEW MIRRORS

The main components of the rear view mirrors are:

- Exterior mirror control switch
- Exterior mirror cover
- Exterior mirror glass
- Exterior mirror glass adjustment motors
- Exterior mirror plastic housing
- Heated exterior mirror glass (optional)
- Interior auto-dimming rear view mirror
- LH exterior auto-dimming mirror glass (optional)
- Memory exterior mirrors (optional)
- Puddle lamps (optional)

For information on the puddle lamps, refer to **EXTERIOR LIGHTING** article.

Power Exterior Mirrors - Power mirrors allow the driver or passenger mirror glass to be positioned electronically. The position of the power mirror glass is controlled by the exterior rear view mirror control switch, which is located on the LH front door trim panel. Adjusting the exterior rear view mirror control switch to the LH or RH position determines which power mirror glass will be controlled.

Heated Exterior Mirrors - The power exterior rear view mirrors are available with a heated mirror glass option, which heats the mirror glass to remove frost, snow, ice and condensation. The rear window defrost switch controls the operation of the heated exterior rear view mirrors. The heated exterior rear view mirrors only operate when the rear window defrost system is on.

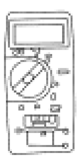
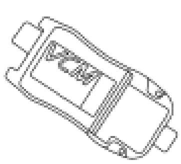
Memory Exterior Mirrors - The memory mirror function recalls the preferred positioning of the LH and RH exterior mirror glass that is retained in the driver seat module (DSM) memory. The memory mirror function is activated by the door mounted switches or the remote keyless entry (RKE) transmitter. When a memory position is recalled by the operator, the LH and RH exterior mirror glass will automatically adjust to the preferred position. The DSM is capable of setting a DTC for the memory mirror system when a system concern exists. For information on the DSM and Memory Position Programming, refer to **SEATING** article.

Auto-Dimming Rear View Mirror(s) - The interior rear view mirror and LH exterior mirror may be equipped with an auto-dimming feature. This feature automatically reduces the glare caused by headlamps reflecting in the mirror. The auto-dimming feature is activated when the ignition is in the RUN or ACC position. The interior rear view mirror adjusts the reflectance level of the interior rear view mirror and LH exterior mirror to eliminate unwanted glare. The reflectance level of the mirror glass is variable and depends on the amount of rear glare in relation to ambient light conditions in front of the interior rear view mirror. To provide increased visibility when backing up, the interior rear view mirror will automatically return to a high reflectance mode whenever the vehicle is in REVERSE.

DIAGNOSTIC TESTS

REAR VIEW MIRRORS

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Principles of Operation

Power Exterior Mirrors

Adjusting the exterior rear view mirror control switch to the LH or RH position determines which power mirror glass will be controlled.

The exterior mirrors use a jumper harness between the vehicle wire harness connector and the exterior mirror motor. The exterior mirror jumper harness is integral to the exterior mirror. If a concern with the exterior mirror jumper harness exists and cannot be repaired, a new exterior mirror must be installed.

Memory Exterior Mirror

The memory exterior mirror feature is controlled by the driver seat module (DSM). The power driver seat positions are also stored and recalled with the memory exterior mirror positions. The memory exterior mirror function recalls the preferred positioning of the LH and RH exterior mirror motors when the transmission is in the PARK or NEUTRAL position and the door mounted switches or the remote keyless entry (RKE) transmitter are activated. The DSM constantly tracks the position of the LH and RH exterior mirror motors by using the potentiometers in the LH and RH exterior mirror motors. The position of the LH and RH exterior mirror motors are stored in the DSM memory as long as the DSM retains power. When a memory position is recalled by the operator, the DSM powers the LH and RH exterior mirror motors simultaneously and monitors the LH and RH potentiometer circuits. When the stored memory position is reached, the DSM removes the voltage from the LH and RH exterior mirror motors. If the exterior mirror control switch is operated during a memory recall, the DSM stops the recall and responds to the exterior mirror control switch command. The DSM is capable of setting a DTC for the memory mirror system when a system concern exists.

For information on the DSM and memory position programming, refer to **SEATING** article.

Heated Exterior Mirror

The heated exterior rear view mirrors only operate when the heated rear window is ON. The heated rear window switch controls the operation of the heated exterior rear view mirrors. The heated rear window switch is an integral part of the HVAC module and cannot be replaced separately. The heated exterior rear view mirror power is supplied by the heated mirror relay.

Auto-Dimming Mirrors

The interior rear view and LH exterior mirror may be equipped with an auto-dimming feature. This feature automatically reduces the glare caused by headlamps reflecting in the mirror. The auto-dimming feature is disabled when the vehicle is in REVERSE. Power is supplied to the auto-dimming interior mirror when the ignition is in the RUN or ACC position.

The interior auto-dimming rear view mirror has 2 photoelectric sensors that detect forward and rearward light conditions. Based on those inputs, the interior rear view mirror adjusts the reflectance level of the interior rear view mirror and LH exterior mirror to eliminate unwanted glare. The reflectance level of the mirror glass is variable and depends on the amount of rear glare in relation to ambient light conditions in front of the interior rear view mirror.

When the forward sensor detects daytime conditions, the rearward sensor is inactive and the mirror stays in a high reflectance mode. When the forward sensor detects nighttime conditions, the rearward sensor is active and detects glare from the headlights of vehicles approaching from the rear, or other glare producing light sources. To provide increased visibility when backing up, the interior rear view and LH exterior mirror will automatically return to a high reflectance mode whenever the vehicle is in REVERSE.

If the forward or rearward sensors are blocked, the interior auto-dimming rear view and LH exterior mirror might not work correctly.

Inspection and Verification

1. Verify the customer concern.
2. Inspect the components of the exterior mirror system to determine if any of the following mechanical or electrical concerns apply:

VISUAL INSPECTION CHART

Mechanical	Electrical
- Exterior mirror - Exterior mirror control switch - Exterior mirror glass - Interior rear view mirror	- Smart junction box (SJB) fuse(s): 12 (7.5A) 31 (10A) - Battery junction box (BJB) fuse 28 (15A) - DSM - Heated mirror relay - Exterior mirror control switch - Exterior mirror motor - Exterior mirror - Exterior mirror glass - Interior rear view mirror - Driver seat module (DSM) - Loose or corroded connections - Wiring harness

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the

DSM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the DSM.
9. If the DTCs retrieved are related to the concern, go to **DRIVER SEAT MODULE (DSM) DTC CHART**t. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart - Rear View Mirrors** or Go to **Symptom Chart - Noise, Vibration and Harshness (NVH)**.

DRIVER SEAT MODULE (DSM) DTC CHART

DTC	Description	Action
B1667	Mirror Driver Up/Down Motor Stalled	Go to **Pinpoint Test D** .
B1668	Mirror Driver Right/Left Motor Stalled	Go to **Pinpoint Test D** .
B1669	Mirror Passenger Up/Down Motor Stalled	Go to **Pinpoint Test D** .
B1670	Mirror Passenger Right/Left Motor Stalled	Go to **Pinpoint Test D** .
B1733	Mirror Driver Vertical Switch Circuit Failure	Go to **Pinpoint Test D** .
B1737	Mirror Driver Horizontal Switch Circuit Failure	Go to **Pinpoint Test D** .
B1741	Mirror Passenger Vertical Switch Circuit Failure	Go to **Pinpoint Test D** .
B1745	Mirror Passenger Horizontal Switch Circuit Failure	Go to **Pinpoint Test D** .
B2223	Mirror Driver Drive Circuit Failure	Go to **Pinpoint Test D** .
B2224	Mirror Passenger Drive Circuit Failure	Go to **Pinpoint Test D** .
B2312	Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	Go to **Pinpoint Test D** .
B2314	Mirror Passenger Horizontal Feedback Potentiometer Circuit Short to Battery	Go to **Pinpoint Test D** .
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	Go to **Pinpoint Test D** .
	Mirror Passenger Vertical	

B2318	Feedback Potentiometer Circuit Short to Battery	Go to **Pinpoint Test D** .
B2320	Mirror Driver Horizontal Feedback Potentiometer Circuit Failure	Go to **Pinpoint Test D** .
B2322	Mirror Driver Horizontal Feedback Potentiometer Circuit Short to Battery	Go to **Pinpoint Test D** .
B2324	Mirror Driver Vertical Feedback Potentiometer Circuit Failure	Go to **Pinpoint Test D** .
B2326	Mirror Driver Vertical Feedback Potentiometer Circuit Short to Battery	Go to **Pinpoint Test D** .
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart - Rear View Mirrors

Symptom Chart - Rear View Mirrors

Condition	Possible Sources	Action
• The mirrors are inoperative - puddle/approach lamp	• Fuse • Circuitry • Exterior mirrors	• REFER to **INTERIOR LIGHTING** article.
• The mirrors are inoperative - non-memory mirrors	• Fuse • Circuitry • Exterior mirror control switch	• Go to **Pinpoint Test A** .
• A single mirror is inoperative - non-memory mirrors	• Circuitry • Exterior mirror control switch • Exterior mirror motor • Exterior mirror motor	• Go to **Pinpoint Test B** .
• A single mirror does not function with switch logic - non-memory mirrors	• Circuitry • Exterior mirror motor • Exterior mirror control switch • Exterior mirror	• Go to **Pinpoint Test C** .
• The memory mirror is	• Fuse • Driver seat module (DSM) • Circuitry	

<table>
<tr><td>inoperative</td><td>Exterior mirror motor
Exterior mirror control switch
Exterior mirror</td><td>Go to Pinpoint Test D .</td></tr>
<tr><td>The heated exterior mirror is inoperative - both heated exterior mirrors</td><td>Fuse(s)
Heated mirror relay
Circuitry
HVAC module</td><td>Go to Pinpoint Test E .</td></tr>
<tr><td>The heated exterior mirror is inoperative - LH heated exterior mirror</td><td>Left heated exterior mirror glass
Circuitry</td><td>Go to Pinpoint Test F .</td></tr>
<tr><td>The heated exterior mirror is inoperative - RH heated exterior mirror</td><td>Right heated exterior mirror glass
Circuitry</td><td>Go to Pinpoint Test G .</td></tr>
<tr><td rowspan="4">The auto-dimming mirror does not operate correctly</td><td>Obstructed rearward-facing sensor:
stickers, window decals, tags
non-OEM window tinting
Obstructed forward-facing sensor:
stickers, window decals, tags
non-OEM window tinting</td><td>If possible, REMOVE the obstruction. If the obstruction cannot be removed, go to Pinpoint Test H to test the auto-dimming mirror for correct function.</td></tr>
<tr><td>Light source near or inside of vehicle</td><td>None. Any light source the rearward-facing sensor is exposed to can be considered glare.</td></tr>
<tr><td>Vehicle inside garage or tunnel</td><td>None. Ambient light conditions are similar to nighttime.</td></tr>
<tr><td>Fuse
Circuitry
Auto-dimming interior mirror
LH exterior rear view mirror</td><td>Go to Pinpoint Test H .</td></tr>
</table>

Symptom Chart - Noise, Vibration and Harshness (NVH)

NOTE: Noise, vibration and harshness (NVH) symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.

Symptom Chart - Noise, Vibration and Harshness (NVH)

Condition	Possible Sources	Action
• Mirror vibrates/loose	• Mirror glass adjustment motor screws loose • Exterior mirror mounting nuts loose **NOTE: Compare the LH and RH exterior mirror glass to verify that the exterior mirror glass is loose.** • Mirror glass loose • Aftermarket air deflector/stone shields	• REMOVE mirror glass and TIGHTEN mirror glass adjustment motor screws. • TIGHTEN nuts to 9 N.m (80 lb-in). • PRESS the center of the exterior mirror glass up, down, left and right to make sure that the exterior mirror glass is seated correctly. If the exterior mirror glass is still loose, REMOVE the exterior mirror glass and INSPECT the exterior mirror backing plate for damage. If the exterior mirror backing plate is damaged, INSTALL a new exterior mirror glass. REFER to **Exterior Mirror Glass**. • If possible, REMOVE aftermarket air deflector/stone shield, then ROAD TEST the vehicle. If concern is no longer present, ADVISE customer that aftermarket components were causing undesired vibration.
• Wind noise	• Foam gasket between the exterior mirror and door is	• VERIFY gasket is present and in good condition. REPOSITION gasket

	missing or damaged • Exterior mirror is not correctly fitted to the door	between exterior mirror and door frame if necessary. • VERIFY that there are no gaps between the exterior mirror and the door. If necessary, LOOSEN the exterior mirror nuts and REPOSITION the exterior mirror.

Pinpoint Tests

Pinpoint Test A: The Mirrors are Inoperative - Non-Memory Mirrors

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Mirrors for schematic and connector information.

Normal Operation

Under normal operation, the exterior mirror control switch receives power through circuit SBP12 (GN/RD) and ground through circuit GD133 (BK). The exterior mirror control switch uses circuit CPM23 (GY) as the common circuit for both exterior mirror up/down and right/left movement.

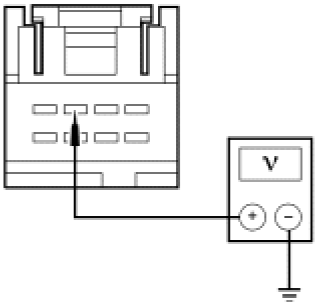
This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Exterior mirror control switch

PINPOINT TEST A: THE MIRRORS ARE INOPERATIVE - NON-MEMORY MIRRORS

A1 CHECK THE VOLTAGE TO THE EXTERIOR MIRROR CONTROL SWITCH - CIRCUIT SBP12 (GN/RD)

- Disconnect: Exterior Mirror Control Switch C527
- Key in ON position.



N0006111

Fig. 1: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

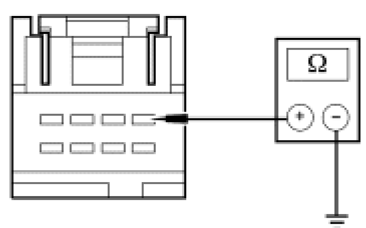
- Measure the voltage between exterior mirror control switch C527-3, circuit SBP12 (GN/RD) harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to A2.

  NO : VERIFY smart junction box (SJB) fuse 12 (7.5A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation

A2 CHECK CIRCUIT GD133 (BK) FOR AN OPEN

- Key in OFF position.



N0006112

Fig. 2: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

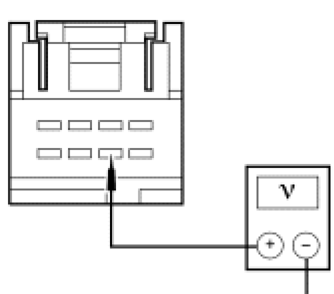
- Measure the resistance between exterior mirror control switch C527-1, circuit GD133 (BK) harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to A3.

  NO : REPAIR the circuit. TEST the system for normal operation.

A3 CHECK CIRCUIT CPM23 (GY) FOR A SHORT TO VOLTAGE

- Key in ON position.



A0073142

Fig. 3: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between exterior mirror control switch C527-6, circuit CPM23 (GY) harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to A4.

A4 CHECK CIRCUIT CPM23 (GY) FOR A SHORT TO GROUND

- Key in OFF position.

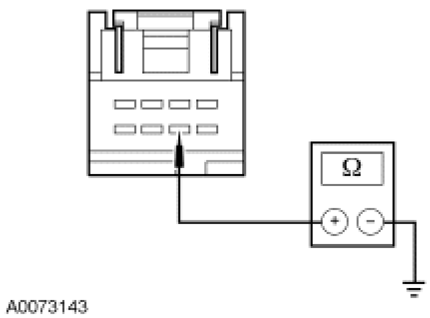


Fig. 4: Checking Circuit For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between exterior mirror control switch C527-6, circuit CPM23 (GY) harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to A5.

  NO : REPAIR the circuit. TEST the system for normal operation.

A5 CHECK CIRCUIT CPM23 (GY) FOR AN OPEN

- Disconnect: LH Exterior Mirror C516

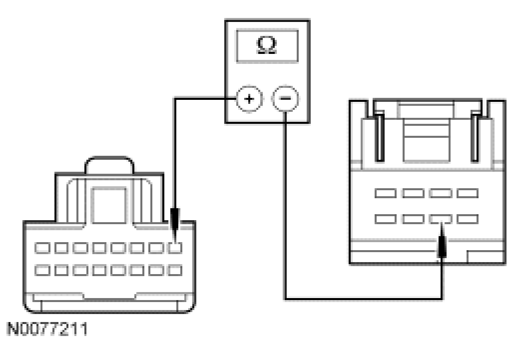


Fig. 5: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH exterior mirror C516-1, circuit CPM23 (GY) harness side and exterior mirror control switch C527-6, circuit CPM23 (GY) harness side.

- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new exterior mirror control switch. REFER to **Exterior Mirror Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST system for normal operation.

Pinpoint Test B: A Single Mirror is Inoperative - Non-Memory Mirror

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Mirrors for schematic and connector information.

Normal Operation

Under normal operation, the exterior mirror control switch uses circuit CPM23 (GY) as the common circuit for both exterior mirror down/up and left/right movement.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Exterior mirror control switch
- Exterior mirror motor
- Exterior mirror

PINPOINT TEST B: A SINGLE MIRROR IS INOPERATIVE - NON-MEMORY MIRRORS

B1 CHECK THE LH EXTERIOR MIRROR

- Set the exterior mirror control switch to the LH mirror position.
- Use the exterior mirror control switch to operate the LH exterior mirror.
- **Does the LH exterior mirror operate?**

  YES : Go to B2.

  NO : Go to B4.

B2 CHECK THE EXTERIOR MIRROR CONTROL SWITCH

- Key in OFF position.
- Disconnect: Exterior Mirror Control Switch C527
- Carry out the Exterior Mirror Control Switch Component Test. Refer to COMPONENT TESTING.
- **Did the exterior mirror control switch pass the component test?**

  YES : Go to B3.

  NO : INSTALL a new exterior mirror control switch. REFER to **Exterior Mirror Control Switch**. TEST the system for normal operation.

B3 CHECK CIRCUIT CPM23 (GY) FOR AN OPEN

- Disconnect: RH Exterior Mirror C622

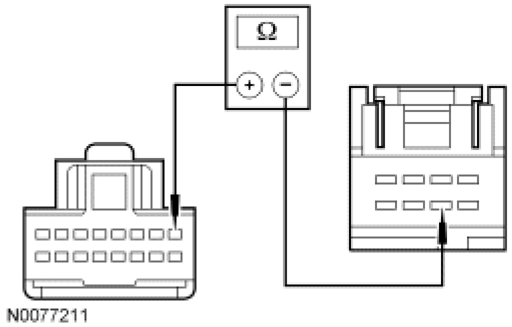


Fig. 6: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RH exterior mirror C622-1, circuit CPM23 (GY) harness side and exterior mirror control switch C527-6, circuit CPM23 (GY) harness side.
- **Is the resistance less than 5 ohms?**

  YES : CHECK the RH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new exterior mirror motor. REFER to **Exterior Mirror Motor**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

B4 CHECK THE EXTERIOR MIRROR CONTROL SWITCH

- Key in OFF position.
- Disconnect: Exterior Mirror Control Switch C527
- Carry out the Exterior Mirror Control Switch Component Test. Refer to COMPONENT TESTING.
- **Did the exterior mirror control switch pass the component test?**

  YES : Go to B5.

  NO : INSTALL a new exterior mirror control switch. REFER to **Exterior Mirror Control Switch**. TEST the system for normal operation.

B5 CHECK CIRCUIT CPM23 (GY) FOR AN OPEN

- Disconnect: LH Exterior Mirror C516

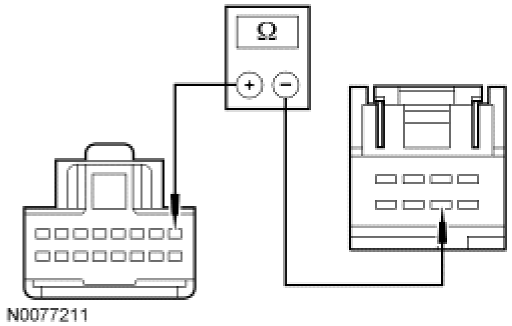


Fig. 7: Measuring Resistance

Courtesy of FORD MOTOR CO.

- Measure the resistance between LH exterior mirror C516-1, circuit CPM23 (GY) harness side and exterior mirror control switch C527-6, circuit CPM23 (GY) harness side.
- **Is the resistance less than 5 ohms?**

  YES : CHECK the LH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new exterior mirror motor. REFER to **Exterior Mirror Motor**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test C: A Single Mirror Does Not Function with Switch Logic - Non-Memory Mirrors

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Mirrors for schematic and connector information.

Normal Operation

The exterior mirror switch controls the LH exterior mirror movement by switching voltage and ground to circuits CPM16 (BN/BU), CPM17 (BU/GN) and CPM23 (GY). The exterior mirror switch controls the RH exterior mirror movement by switching voltage and ground to circuits CPM20 (BN/WH), CPM21 (YE/VT) and CPM23 (GY).

- When the LH/RH exterior mirror motor receives power through circuit CPM16 (BN/BU) or CPM20 (BN/WH) and ground through circuit CPM23 (GY), the LH or RH exterior mirror motor will operate right.
- When LH/RH exterior mirror motor receives ground through circuit CPM16 (BN/BU) or CPM20 (BN/WH) and power through circuit CPM23 (GY), the LH or RH exterior mirror motor will operate left.
- When the LH/RH exterior mirror motor receives power through circuit CPM17 (BU/GN) or CPM21 (YE/VT) and ground through circuit CPM23 (GY), the LH or RH exterior mirror motor will operate upward.
- When LH/RH exterior mirror motor receives ground through circuit CPM17 (BU/GN) or CPM21 (YE/VT) and power through circuit CPM23 (GY), the LH or RH exterior mirror motor will operate downward.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Exterior mirror control switch
- Exterior mirror motor
- Exterior mirror

PINPOINT TEST C: A SINGLE MIRROR DOES NOT FUNCTION WITH SWITCH LOGIC - NON-MEMORY MIRRORS

C1 CHECK MIRROR MOVEMENT (LEFT/RIGHT)

- Operate the LH and RH exterior mirrors in the left and right direction.
- **Do the exterior mirrors move left and right?**

  YES : Go to C2.

  NO : Go to C3.

C2 CHECK MIRROR MOVEMENT (UP/DOWN)

- Operate the LH and RH exterior mirrors in the up and down direction.
- **Do the exterior mirrors move up and down?**

  YES : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

  NO : Go to C4.

C3 CHECK THE VOLTAGE TO THE INOPERATIVE MIRROR

- Key in OFF position.
- Disconnect: Inoperative Exterior Mirror C516 (LH) or C622 (RH)

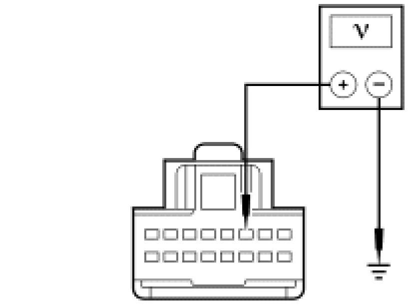


Fig. 8: Measuring Voltage
Courtesy of FORD MOTOR CO.

NOTE: **Position the exterior mirror control switch to the LH or RH mirror position.**

- While operating the exterior mirror control switch in the RIGHT position, measure the voltage between ground and exterior mirror:
  - **(LH)** C516-3, circuit CPM16 (BN/BU) harness side.
  - **(RH)** C622-3, circuit CPM20 (BN/WH) harness side.
- **Is the voltage greater than 10 volts?**

  YES : CHECK the LH or RH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open or shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new exterior mirror motor. REFER to **Exterior Mirror Motor**. TEST the system for normal operation.

NO : Go to C5.

C4 CHECK THE VOLTAGE TO THE INOPERATIVE MIRROR

- Disconnect: Inoperative Exterior Mirror C516 (LH) or C622 (RH)

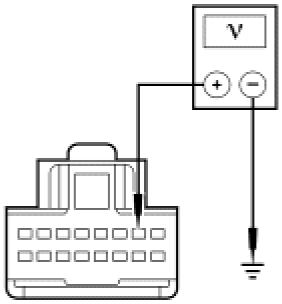


Fig. 9: Measuring Voltage
Courtesy of FORD MOTOR CO.

NOTE:	**Position the exterior mirror control switch to the LH or RH mirror position.**

- While operating the exterior mirror control switch in the UP position, measure the voltage between ground and exterior mirror:
  - **(LH)** C516-2, circuit CPM17 (BU/GN) harness side.
  - **(RH)** C622-2, circuit CPM21 (YE/VT) harness side.
- **Is the voltage greater than 10 volts?**

  YES : CHECK the LH or RH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open or shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new exterior mirror motor. REFER to **Exterior Mirror Motor**. TEST the system for normal operation.

  NO : Go to C6.

C5 CHECK CIRCUIT CPM16 (BN/BU) OR CIRCUIT CPM20 (BN/WH) FOR AN OPEN

- Disconnect: Exterior Mirror Control Switch C527

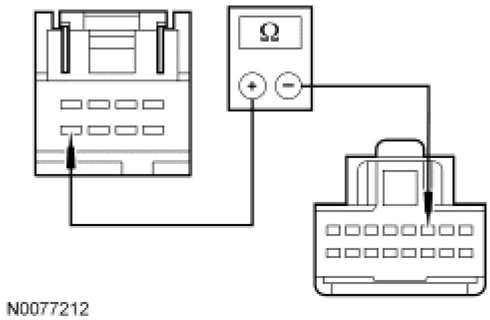


Fig. 10: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **Inoperative LH mirror:** Measure the resistance between exterior mirror control switch C527-8, circuit CPM16 (BN/BU) harness side and LH exterior mirror C516-3, circuit CPM16 (BN/BU) harness side.

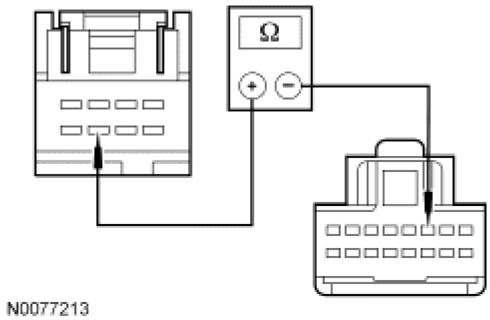


Fig. 11: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **Inoperative RH mirror:** Measure the resistance between exterior mirror control switch C527-7, circuit CPM20 (BN/WH) harness side and RH exterior mirror C622-3, circuit CPM20 (BN/WH) harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new exterior mirror control switch. REFER to **Exterior Mirror Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

C6 CHECK CIRCUIT CPM17 (BU/GN) OR CIRCUIT CPM21 (YE/VT) FOR AN OPEN

- Disconnect: Exterior Mirror Control Switch C527

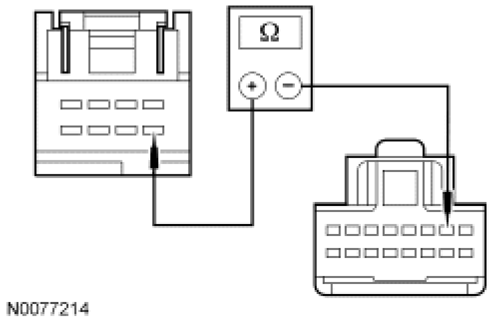


Fig. 12: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **Inoperative LH mirror:** Measure the resistance between exterior mirror control switch C527-5, circuit CPM17 (BU/GN) harness side and LH exterior mirror C516-2, circuit CPM17 (BU/GN) harness side.

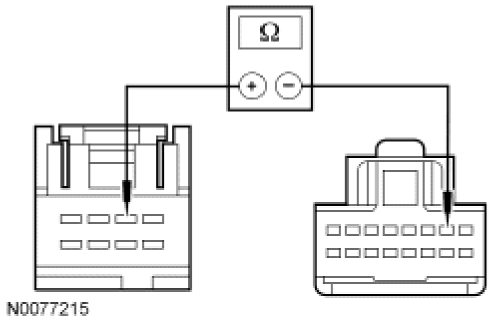


Fig. 13: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **Inoperative RH mirror:** Measure the resistance between exterior mirror control switch C527-2, circuit CPM21 (YE/VT) harness side and RH exterior mirror C622-2, circuit CPM21 (YE/VT) harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new exterior mirror control switch. REFER to **Exterior Mirror Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test D: The Memory Mirror is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Mirrors for schematic and connector information.

Normal Operation

Under normal operation, the exterior mirror control switch receives power from circuit SBP12 (GN/RD) and ground from circuit GD133 (BK). The exterior mirror control switch sends input to the driver seat module (DSM) for the LH exterior mirror by switching power and ground to circuits CPM16 (BU/BN), CPM17 (BU/GN) and CPM23 (GY), and for the RH exterior mirror by switching power and ground to circuits CPM20 (BN/WH), CPM21 (YE/VT) and CPM23 (GY). The DSM controls the vertical movement of the exterior mirror motors by supplying power and ground signals to the exterior mirror motor up/down circuits CPM26 (WH), CPM29 (GN), CPM31 (YE/GY) and CPM34 (WH/BN). The DSM controls the horizontal movement of the LH and RH exterior mirror motors by supplying power and ground signals to the exterior mirror motor left/right circuits CPM26 (WH), CPM28 (BU/BN), CPM31 (YE/GY) and CPM33 (WH/VT).

The DSM supplies the LH and RH exterior mirror feedback potentiometer reference voltage through circuit LPM30 (GY/VT) and ground through circuit RPM30 (YE). The DSM receives feedback from the LH exterior mirror feedback potentiometer through circuit (left/right) VPM35 (YE/BU) and circuit (up/down) VPM36 (BN/YE). The DSM receives feedback from the RH exterior mirror feedback potentiometer through circuit (left/right) VPM37 (BU/OG) and circuit (up/down) VPM38 (BN/GN).

DTC Description	Fault Trigger Conditions
B1667 - Mirror Driver Up/Down Motor Stalled	Open or incorrect mirror motor position reported to the DSM during On-Demand Self Test.
B1668 - Mirror Driver Right/Left Motor Stalled	Open or incorrect mirror motor position reported to the DSM during On-Demand Self Test.
B1669 - Mirror Passenger Up/Down Motor Stalled	Open or incorrect mirror motor position reported to the DSM during On-Demand Self Test.
B1670 - Mirror Passenger Right/Left Motor Stalled	Open or incorrect mirror motor position reported to the DSM during On-Demand Self Test.
B1733 - Mirror Driver Vertical Switch Circuit Failure	Short to ground or battery detected by the DSM.
B1737 - Mirror Driver Horizontal Switch Circuit Failure	Short to ground or battery detected by the DSM.
B1741 - Mirror Passenger Vertical Switch Circuit Failure	Short to ground or battery detected by the DSM.
B1745 - Mirror Passenger Horizontal Switch Circuit Failure	Short to ground or battery detected by the DSM.
B2223 - Mirror Driver Drive Circuit Failure	Short to ground or battery detected by the DSM.
B2224 - Mirror Passenger Drive Circuit Failure	Short to ground or battery detected by the DSM.
B2312 - Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	Open or short to ground detected by the DSM.
B2314 - Mirror Passenger Horizontal Feedback Potentiometer Circuit Short to Battery	Short to battery detected by the DSM.
B2316 - Mirror Passenger Vertical Feedback	Open or short to ground detected by the DSM.

Potentiometer Circuit Failure	
B2318 - Mirror Passenger Vertical Feedback Potentiometer Circuit Short to Battery	Short to battery detected by the DSM.
B2320 - Mirror Driver Horizontal Feedback Potentiometer Circuit Failure	Open or short to ground detected by the DSM.
B2322 - Mirror Driver Horizontal Feedback Potentiometer Circuit Short to Battery	Short to battery detected by the DSM.
B2324 - Mirror Driver Vertical Feedback Potentiometer Circuit Failure	Open or short to ground detected by the DSM.
B2326 - Mirror Driver Vertical Feedback Potentiometer Circuit Short to Battery	Short to battery detected by the DSM.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Exterior mirror control switch
- Exterior mirror motor
- Exterior mirror
- DSM

PINPOINT TEST D: THE MEMORY MIRROR IS INOPERATIVE

D1 RETRIEVE THE DTCs FROM THE DSM

- Use the recorded DSM DTCs from the continuous and on-demand self tests.
- **Are any DTCs retrieved?**

  YES : If DTC B1667 or B1668 - If other DTCs are present, DIAGNOSE them first. If no other DTCs are present, INSPECT the LH exterior mirror motor for foreign material, damage or a binding condition. If no condition is found, Go to D12.

  If DTC B1669 or B1670 - If other DTCs are present, DIAGNOSE them first. If no other DTCs are present, INSPECT the RH exterior mirror motor for foreign material, damage or a binding condition. If no condition is found, Go to D14.

  If DTC B1733, B1737, B1741 or B1745 - CARRY OUT the exterior mirror control switch component test. Refer to COMPONENT TESTING. If the switch tests OK, go to D16.

  If DTC B2223, go to D18.

  If DTC B2224, go to D21.

  If DTC B2312, B2316, B2320 or B2324, go to D24.

  If DTC B2314, B2318, B2322 or B2326, go to D28.

  NO : Go to D2.

D2 CHECK OPERATION OF THE MIRRORS FROM THE EXTERIOR MIRROR CONTROL SWITCH

- Operate the mirrors using the exterior mirror control switch.

- **Do the mirrors operate from the exterior mirror control switch?**

  YES : Go to D9.

  NO : Go to D3.

D3 CHECK THE EXTERIOR MIRROR CONTROL SWITCH

- Key in OFF position.
- Disconnect: Exterior Mirror Control Switch C527
- Carry out the Exterior Mirror Control Switch Component Test. Refer to COMPONENT TESTING.
- **Did the exterior mirror control switch pass the component test?**

  YES : Go to D4.

  NO : INSTALL a new exterior mirror control switch. REFER to **Exterior Mirror Control Switch**. TEST the system for normal operation.

D4 CHECK CIRCUIT SBP12 (GN/RD) FOR VOLTAGE

- Key in ON position.

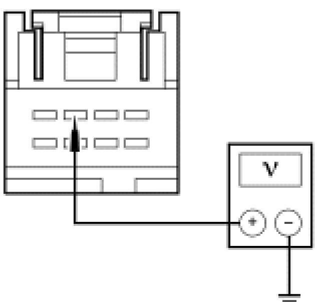


Fig. 14: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

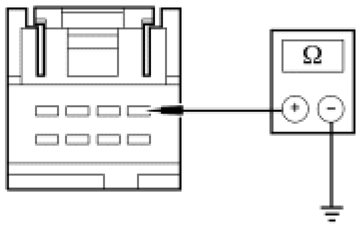
- Measure the voltage between ground and exterior mirror control switch C527-3, circuit SBP12 (GN/RD) harness side.
- **Is the voltage greater than 10 volts?**

  YES : Go to D5.

  NO : VERIFY smart junction box (SJB) fuse 12 (7.5A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

D5 CHECK CIRCUIT GD133 (BK) FOR AN OPEN

- Key in OFF position.



N0006112

Fig. 15: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

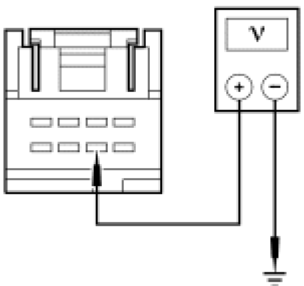
- Measure the resistance between ground and exterior mirror control switch C527-1, circuit GD133 (BK) harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to D6.

  NO : REPAIR the circuit. TEST the system for normal operation.

D6 CHECK CIRCUIT CPM23 (GY) FOR A SHORT TO VOLTAGE

- Key in ON position.
- Disconnect: DSM C3299D



N0077231

Fig. 16: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between exterior mirror control switch C527-6, circuit CPM23 (GY) harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to D7.

  NO : REPAIR the circuit. TEST the system for normal operation.

D7 CHECK CIRCUIT CPM23 (GY) FOR A SHORT TO GROUND

- Key in OFF position.

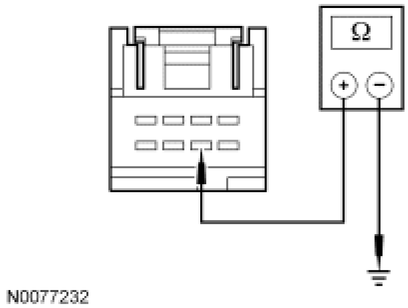


Fig. 17: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between exterior mirror control switch C527-6, circuit CPM23 (GY) harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to D8.

  NO : REPAIR the circuit. TEST the system for normal operation.

D8 CHECK CIRCUITS CPM16 (BU/BN), CPM17 (BU/GN), CPM20 (BN/WH), CPM21 (YE/VT) AND CPM23 (GY) FOR AN OPEN

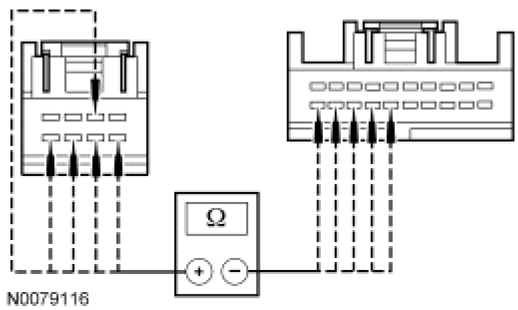


Fig. 18: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between exterior mirror control switch:
  - C527-2, circuit CPM21 (YE/VT) harness side and DSM C3299D-17, circuit CPM21 (YE/VT) harness side.
  - C527-5, circuit CPM17 (BU/GN) harness side and DSM C3299D-19, circuit CPM17 (BU/GN) harness side.
  - C527-6, circuit CPM23 (GY) harness side and DSM C3299D-16, circuit CPM23 (GY) harness side.
  - C527-7, circuit CPM20 (BN/WH) harness side and DSM C3299D-18, circuit CPM20 (BN/WH) harness side.
  - C527-8, circuit CPM16 (BU/BN) harness side and DSM C3299D-20, circuit CPM16 (BU/BN) harness side.

- **Are the resistances less than 5 ohms?**

  YES : Go to D30.

  NO : REPAIR the circuit(s). TEST the system for normal operation.

D9 CHECK CIRCUIT RPM30 (YE) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DSM C3299D
- Key in ON position.

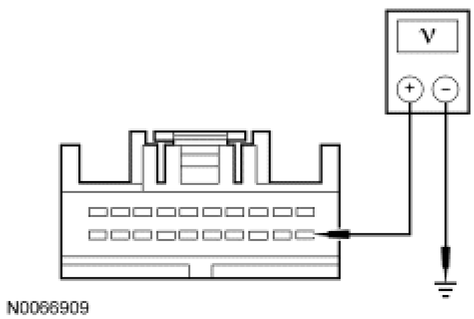


Fig. 19: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DSM C3299D-11, circuit RPM30 (YE) harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to D10.

D10 CHECK CIRCUIT LPM30 (GY/VT) FOR SHORT TO GROUND

- Key in OFF position.
- Disconnect: Exterior Mirror C516 and C622

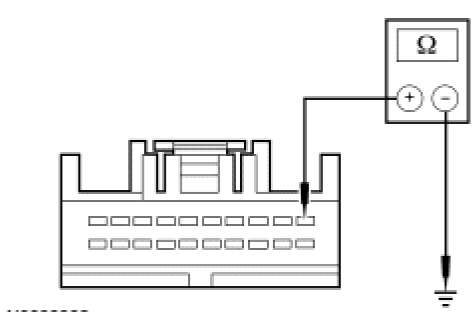


Fig. 20: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299D-1, circuit LPM30 (GY/VT) harness side and ground.

- **Is the resistance greater than 10,000 ohms?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to D11.

D11 CHECK CIRCUITS RPM30 (YE) AND LPM30 (GY/VT) FOR AN OPEN

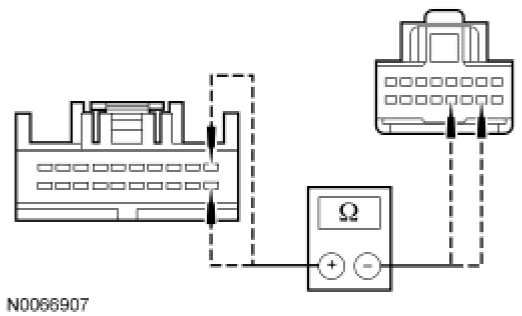


Fig. 21: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM:
  - C3299D-1, circuit LPM30 (GY/VT) harness side and LH exterior mirror C516-10, circuit LPM30 (GY/VT) harness side.
  - C3299D-11, circuit RPM30 (YE) harness side and RH exterior mirror C516-12, circuit RPM30 (YE) harness side.
  - C3299D-1, circuit LPM30 (GY/VT) harness side and LH exterior mirror C622-10, circuit LPM30 (GY/VT) harness side.
  - C3299D-11, circuit RPM30 (YE) harness side and RH exterior mirror C622-12, circuit RPM30 (YE) harness side.
- **Are the resistances less than 5 ohms?**

  YES : CHECK the LH or RH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open or shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new LH or RH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new LH or RH exterior mirror motor. REFER to **Exterior Mirror Motor**. CLEAR the DTCs. TEST the system for normal operation.

  NO : REPAIR the circuit(s). TEST the system for normal operation.

D12 CHECK THE EXTERIOR MIRROR FOR VOLTAGE FROM THE DSM

- Key in OFF position.
- Disconnect: LH Exterior Mirror C516
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DDM DataLogger

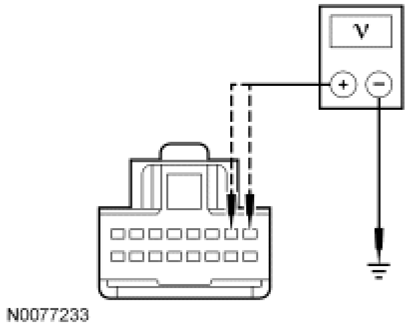


Fig. 22: Measuring Voltage
Courtesy of FORD MOTOR CO.

- **DTC B1667:** Measure the voltage between LH exterior mirror C516-1, circuit CPM29 (GN) harness side and ground while toggling the LH exterior mirror DSM PID DR_UP to ON; and between LH exterior mirror C516-2, circuit CPM26 (WH) harness side and ground while toggling the LH exterior mirror DSM PID DR_DOWN to ON.

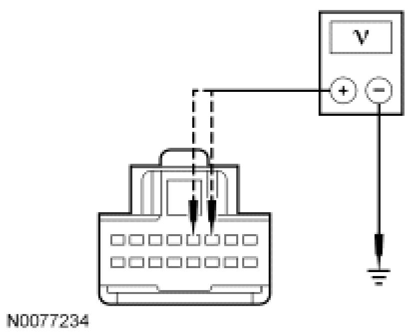


Fig. 23: Measuring Voltage
Courtesy of FORD MOTOR CO.

- **DTC B1668:** Measure the voltage between LH exterior mirror C516-3, circuit CPM26 (WH) harness side and ground while toggling the LH exterior mirror DSM PID DR_LEFT to ON; and between LH exterior mirror C516-4, circuit CPM28 (BU/BN) harness side and ground while toggling the LH exterior mirror DSM PID DR_RIGHT to ON.
- **Do the voltages momentarily change from 0 volt to greater than 10 volts when the active command is toggled ON?**

  YES : CHECK the LH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for shorted and open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new LH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new LH exterior mirror motor. REFER to **Exterior Mirror Motor**. CLEAR the DTCs. TEST the system for normal operation.

  NO : Go to D13.

D13 CHECK CIRCUITS CPM26 (WH), CPM28 (BU/BN) AND CPM29 (GN) FOR AN OPEN

- Key in OFF position.

- Disconnect: DSM C3299D

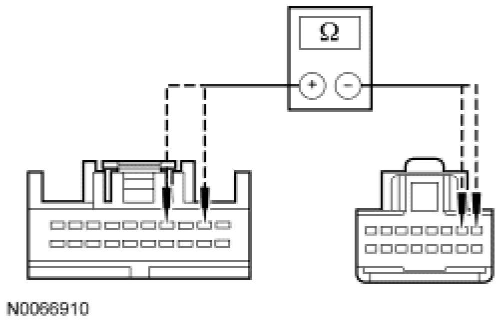


Fig. 24: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **DTC B1667:** Measure the resistance between DSM:
  - C3299D-2, circuit CPM26 (WH) harness side and LH exterior mirror C516-2, circuit CPM26 (WH) harness side.
  - C3299D-4, circuit CPM29 (GN) harness side and LH exterior mirror C516-1, circuit CPM29 (GN) harness side.

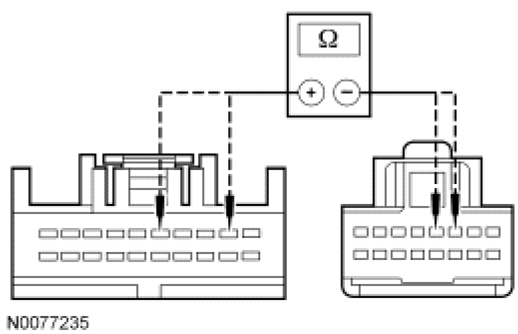


Fig. 25: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **DTC B1668:** Measure the resistance between DDM:
  - C3299D-2, circuit CPM26 (WH) harness side and LH exterior mirror C516-3, circuit CPM26 (WH) harness side.
  - C3299D-5, circuit CPM28 (BU/BN) harness side and LH exterior mirror C516-4, circuit CPM28 (BU/BN) harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to D30.

  NO : REPAIR the circuit(s). CLEAR the DTCs. TEST the system for normal operation.

D14 CHECK THE EXTERIOR MIRROR FOR VOLTAGE FROM THE DSM

- Key in OFF position.

- Disconnect: RH Exterior Mirror C622
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DSM DataLogger

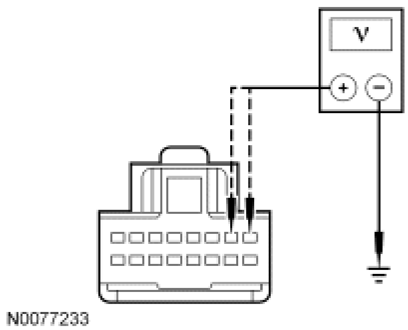


Fig. 26: Measuring Voltage
Courtesy of FORD MOTOR CO.

- **DTC B1669:** Measure the voltage between RH exterior mirror C622-1, circuit CPM34 (WH/BN) harness side and ground while toggling the RH exterior mirror DSM PID PR_UP to ON; and between RH exterior mirror C622-2, circuit CPM31 (YE/GY) harness side and ground while toggling the RH exterior mirror DSM PID PR_DOWN to ON.

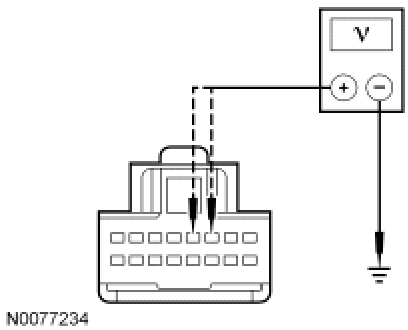


Fig. 27: Measuring Voltage
Courtesy of FORD MOTOR CO.

- **DTC B1670:** Measure the voltage between RH exterior mirror C622-3, circuit CPM31 (YE/GY) harness side and ground while toggling the RH exterior mirror DSM PID PR_LEFT to ON; and between RH exterior mirror C622-4, circuit CPM33 (WH/VT) harness side and ground while toggling the RH exterior mirror DSM PID PR_RIGHT to ON.
- **Do the voltages momentarily change from 0 volt to greater than 10 volts when the active command is toggled ON?**

  YES : CHECK the RH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for shorted and open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new RH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new RH exterior mirror motor. REFER to **Exterior Mirror Motor**. CLEAR the DTCs. TEST the system for normal operation.

NO : Go to D15.

D15 CHECK CIRCUITS CPM31 (YE/GY), CPM33 (WH/VT) AND CPM34 (WH/BN) FOR AN OPEN

- Key in OFF position.
- Disconnect: DSM C3299D

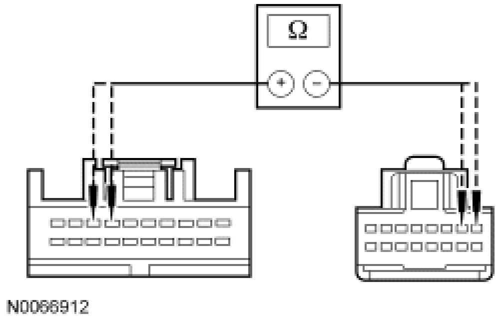


Fig. 28: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **DTC B1669:** Measure the resistance between DSM:
  - C3299D-7, circuit CPM34 (WH/BN) harness side and RH exterior mirror C622-1, circuit CPM34 (WH/BN) harness side.
  - C3299D-8, circuit CPM31 (YE/GY) harness side and RH exterior mirror C622-2, circuit CPM31 (YE/GY) harness side.

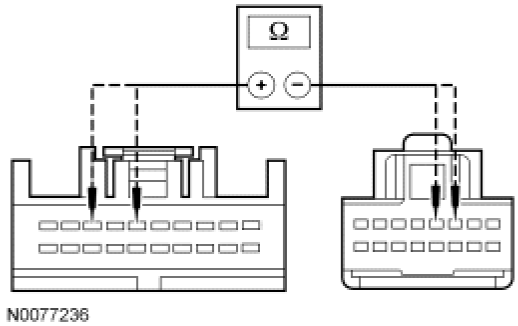


Fig. 29: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **DTC B1670:** Measure the resistance between DSM:
  - C3299D-6, circuit CPM33 (WH/VT) harness side and RH exterior mirror C622-4, circuit CPM33 (WH/VT) harness side.
  - C3299D-8, circuit CPM31 (YE/GY) harness side and RH exterior mirror C622-3, circuit CPM31 (YE/GY) harness side.
- **Are the resistances less than 5 ohms?**

YES : Go to D30.

NO : REPAIR the circuit(s). CLEAR the DTCs. TEST the system for normal operation.

D16 CHECK CIRCUITS CPM16 (BU/BN), CPM17 (BU/GN), CPM20 (BN/WH) OR CPM21 (YE/VT) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Exterior Mirror Control Switch C527
- Disconnect: DSM C3299D
- Key in ON position.

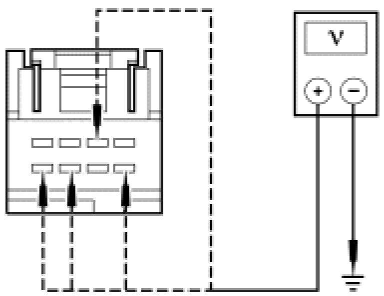


Fig. 30: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and exterior mirror control switch:
  - **DTC B1733:** C527-5, circuit CPM17 (BU/GN) harness side.
  - **DTC B1737:** C527-8, circuit CPM16 (BN/BU) harness side.
  - **DTC B1741:** C527-2, circuit CPM21 (YE/VT) harness side.
  - **DTC B1745:** C527-7, circuit CPM20 (BN/WH) harness side.
- **Is any voltage present?**

YES : REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.

NO : Go to D17.

D17 CHECK CIRCUITS CPM16 (BU/BN), CPM17 (BU/GN), CPM20 (BN/WH) OR CPM21 (YE/VT) FOR A SHORT TO GROUND

- Key in OFF position.

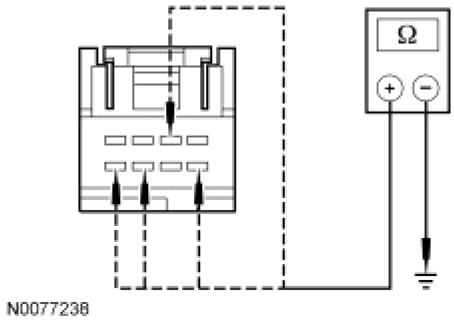


Fig. 31: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and exterior mirror control switch:
  - **DTC B1733:** C527-5, circuit CPM17 (BU/GN) harness side.
  - **DTC B1737:** C527-8, circuit CPM16 (BN/BU) harness side.
  - **DTC B1741:** C527-2, circuit CPM21 (YE/VT) harness side.
  - **DTC B1745:** C527-7, circuit CPM20 (BN/WH) harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.

  NO : Go to D30.

D18 CHECK CIRCUITS CPM26 (WH), CPM28 (BU/BN) AND CPM29 (GN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DSM C3299D
- Key in ON position.

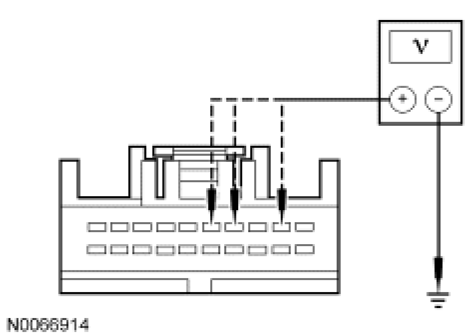


Fig. 32: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and DSM:
  - C3299D-2, circuit CPM26 (WH) harness side.
  - C3299D-4, circuit CPM29 (GN) harness side.
  - C3299D-5, circuit CPM28 (BU/BN) harness side.

- **Is any voltage present?**

  YES : REPAIR the circuit(s). CLEAR the DTCs. TEST the system for normal operation.

  NO : Go to D19.

D19 CHECK CIRCUITS CPM26 (WH), CPM28 (BU/BN) AND CPM29 (GN) FOR A SHORT TO GROUND

- Key in OFF position.

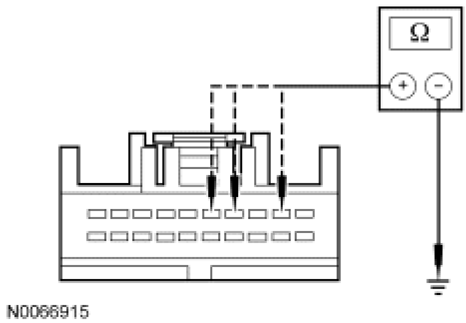


Fig. 33: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and DSM:
  - C3299D-2, circuit CPM26 (WH) harness side.
  - C3299D-4, circuit CPM29 (GN) harness side.
  - C3299D-5, circuit CPM28 (BU/BN) harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to D30.

  NO : Go to D20.

D20 CHECK THE LH EXTERIOR MIRROR FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: LH Exterior Mirror C516

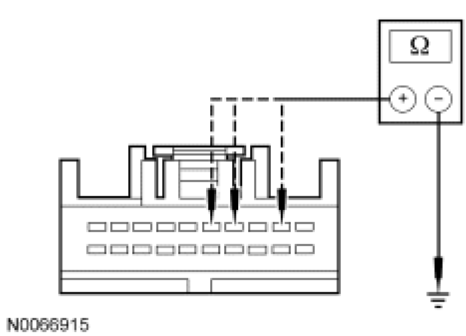


Fig. 34: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and DSM:
  - C3299D-2, circuit CPM26 (WH) harness side.
  - C3299D-4, circuit CPM29 (GN) harness side.
  - C3299D-5, circuit CPM28 (BU/BN) harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : CHECK the LH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new LH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new LH exterior mirror motor. REFER to **Exterior Mirror Motor**. CLEAR the DTCs. TEST the system for normal operation.

  NO : REPAIR the circuit(s). CLEAR the DTCs. TEST the system for normal operation.

D21 CHECK CIRCUITS CPM31 (YE/GY), CPM33 (WH/VT) AND CPM34 (WH/BN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DSM C3299D
- Key in ON position.

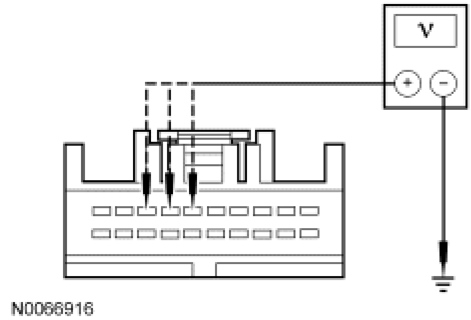


Fig. 35: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and DSM:
  - C3299D-6, circuit CPM33 (WH/VT) harness side.
  - C3299D-7, circuit CPM34 (WH/BN) harness side.
  - C3299D-8, circuit CPM31 (YE/GY) harness side.
- **Is any voltage present?**

  YES : REPAIR the circuit(s). CLEAR the DTCs. TEST the system for normal operation.

  NO : Go to D22.

D22 CHECK CIRCUITS CPM31 (YE/GY), CPM33 (WH/VT) AND CPM34 (WH/BN) FOR A SHORT TO GROUND

- Key in OFF position.

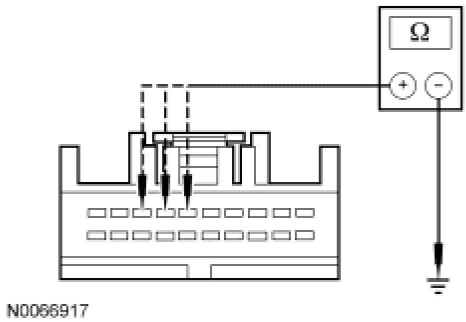


Fig. 36: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and DSM:
  - C3299D-6, circuit CPM33 (WH/VT) harness side.
  - C3299D-7, circuit CPM34 (WH/BN) harness side.
  - C3299D-8, circuit CPM31 (YE/GY) harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to D30.

  NO : Go to D23.

D23 CHECK THE RH EXTERIOR MIRROR FOR A SHORT TO GROUND

- Disconnect: RH Exterior Mirror C622

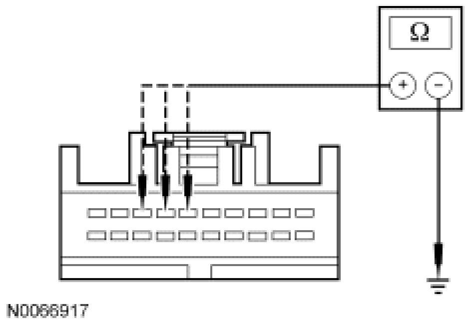


Fig. 37: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and DSM:
  - C3299D-6, circuit CPM33 (WH/VT) harness side.
  - C3299D-7, circuit CPM34 (WH/BN) harness side.
  - C3299D-8, circuit CPM31 (YE/GY) harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : CHECK the RH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new RH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new RH exterior mirror motor. REFER to **Exterior Mirror Motor**. CLEAR the DTCs. TEST the system for normal operation.

NO : REPAIR the circuit(s). CLEAR the DTCs. TEST the system for normal operation.

D24 CHECK THE LH AND RH EXTERIOR MIRRORS

- Key in OFF position.
- Disconnect: DSM C3299D

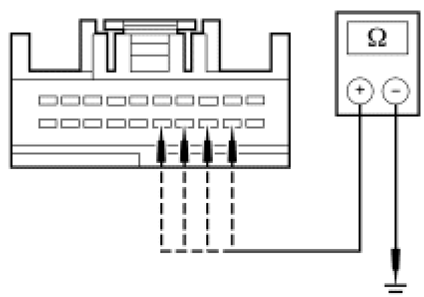


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Fig. 38: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and DSM:
  - **DTC B2312:** C3299D-15, circuit VPM37 (BU/OG) harness side.
  - **DTC B2316:** C3299D-14, circuit VPM38 (BN/GN) harness side.
  - **DTC B2320:** C3299D-13, circuit VPM35 (YE/BU) harness side.
  - **DTC B2324:** C3299D-12, circuit VPM36 (BN/YE) harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to D26.

  NO : Go to D25.

D25 CHECK CIRCUITS VPM35 (YE/BU), VPM36 (BN/YE), VPM37 (BU/OG) AND VPM38 (BN/GN) FOR A SHORT TO GROUND

- Disconnect: **DTC B2312 or B2316:** RH Exterior Mirror C622
- Disconnect: **DTC B2320 or B2324:** LH Exterior Mirror C516

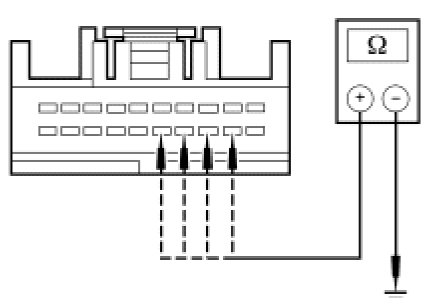

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Fig. 39: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and DSM:
  - **DTC B2312:** C3299D-15, circuit VPM37 (BU/OG) harness side.
  - **DTC B2316:** C3299D-14, circuit VPM38 (BN/GN) harness side.
  - **DTC B2320:** C3299D-13, circuit VPM35 (YE/BU) harness side.
  - **DTC B2324:** C3299D-12, circuit VPM36 (BN/YE) harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : CHECK the LH or RH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new LH or RH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new LH or RH exterior mirror motor. REFER to **Exterior Mirror Motor**. CLEAR the DTCs. TEST the system for normal operation.

  NO : REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.

D26 CHECK THE LH OR RH MIRRORS FOR AN INTERNAL OPEN

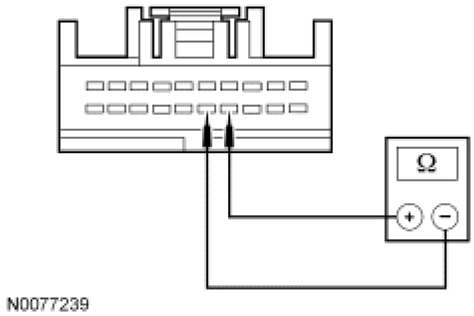

Fig. 40: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **DTC B2312 or B2316:** Measure the resistance between DSM C3299D-15, circuit VPM37 (BU/OG) harness side and DSM C3299D-14, circuit VPM38 (BN/GN) harness side.

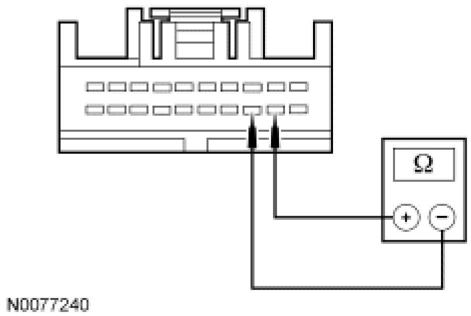

Fig. 41: Measuring Resistance

Courtesy of FORD MOTOR CO.

- **DTC B2320 or B2324:** Measure the resistance between DSM C3299D-12, circuit VPM36 (BN/YE) harness side and DSM C3299D-13, circuit VPM35 (YE/BU) harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to D30.

  NO : Go to D27.

D27 CHECK CIRCUITS VPM35 (YE/BU), VPM36 (BN/YE), VPM37 (BU/OG) AND VPM38 (BN/GN) FOR AN OPEN

- Disconnect: **DTC B2312 or B2316:** RH Exterior Mirror C622
- Disconnect: **DTC B2320 or B2324:** LH Exterior Mirror C516

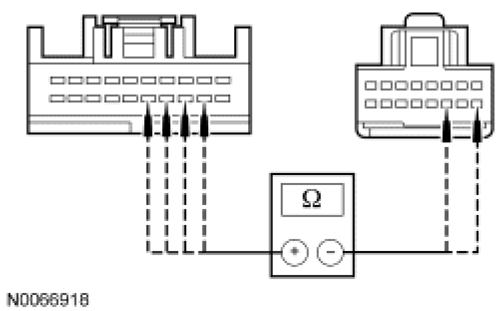

Fig. 42: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM:
  - **DTC B2312:** C3299D-15, circuit VPM37 (BU/OG) harness side and RH exterior mirror C622-11, circuit VPM37 (BU/OG) harness side.
  - **DTC B2316:** C3299D-14, circuit VPM38 (BN/GN) harness side and RH exterior mirror C622-9, circuit VPM38 (BN/GN) harness side.
  - **DTC B2320:** C3299D-13, circuit VPM35 (YE/BU) harness side and LH exterior mirror C516-11, circuit VPM35 (YE/BU) harness side.
  - **DTC B2324:** C3299D-12, circuit VPM36 (BN/YE) harness side and LH exterior mirror C516-9, circuit VPM36 (BN/YE) harness side.
- **Are the resistances less than 5 ohms?**

  YES : CHECK the LH or RH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new LH or RH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new LH or RH exterior mirror motor. REFER to **Exterior Mirror Motor**. CLEAR the DTCs. TEST the system for normal operation.

  NO : REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.

D28 CHECK THE LH AND RH EXTERIOR MIRRORS

- Key in OFF position.
- Disconnect: DSM C3299D
- Key in ON position.

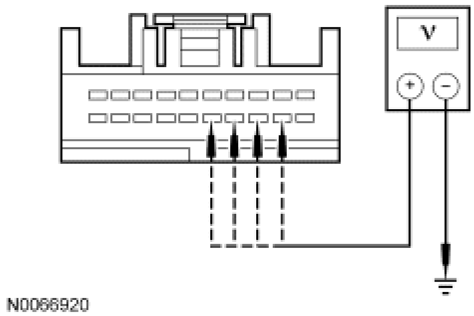

Fig. 43: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and DSM:
  - **DTC B2314:** C3299D-15, circuit VPM37 (BU/OG) harness side.
  - **DTC B2318:** C3299D-14, circuit VPM38 (BN/GN) harness side.
  - **DTC B2322:** C3299D-13, circuit VPM35 (YE/BU) harness side.
  - **DTC B2326:** C3299D-12, circuit VPM36 (BN/YE) harness side.
- **Is any voltage present?**

  YES : Go to D29.

  NO : Go to D30.

D29 CHECK CIRCUITS VPM35 (YE/BU), VPM36 (BN/YE), VPM37 (BU/OG) AND VPM38 (BN/GN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: **DTC B2314 or B2318:** RH Exterior Mirror C622
- Disconnect: **DTC B2322 or B2326:** LH Exterior Mirror C516
- Key in ON position.

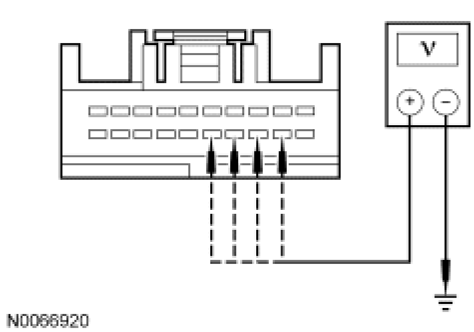

Fig. 44: Measuring Voltage

Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and DSM:
  - **DTC B2314:** C3299D-15, circuit VPM37 (BU/OG) harness side.
  - **DTC B2318:** C3299D-14, circuit VPM38 (BN/GN) harness side.
  - **DTC B2322:** C3299D-13, circuit VPM35 (YE/BU) harness side.
  - **DTC B2326:** C3299D-12, circuit VPM36 (BN/YE) harness side.
- **Is any voltage present?**

  YES : REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.

  NO : CHECK the LH or RH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new LH or RH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new LH or RH exterior mirror motor. REFER to **Exterior Mirror Motor**. CLEAR the DTCs. TEST the system for normal operation.

D30 CHECK THE DSM FOR CORRECT OPERATION

- Disconnect all DSM connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all DSM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DSM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: The Heated Exterior Mirror is Inoperative - Both Heated Exterior Mirrors

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Heated Windows for schematic and connector information.

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Mirrors for schematic and connector information.

Normal Operation

When the rear window defrost switch is depressed on the HVAC module, the HVAC module grounds circuit CH122 (WH/OG) and the heated mirror relay closes. When the heated mirror relay is closed, power is supplied to the LH and RH exterior mirrors through circuit CRD13 (GN/VT). The LH exterior mirror receives ground through circuit GD133 (BK). The RH exterior mirror receives ground through circuit GD140 (BK/GN).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Heated mirror relay
- HVAC module

PINPOINT TEST E: THE HEATED EXTERIOR MIRROR IS INOPERATIVE - BOTH HEATED EXTERIOR MIRRORS

E1 CHECK THE POWER TO THE HEATED MIRROR RELAY

- Key in OFF position.
- Disconnect: Heated Mirror Relay
- Key in ON position.

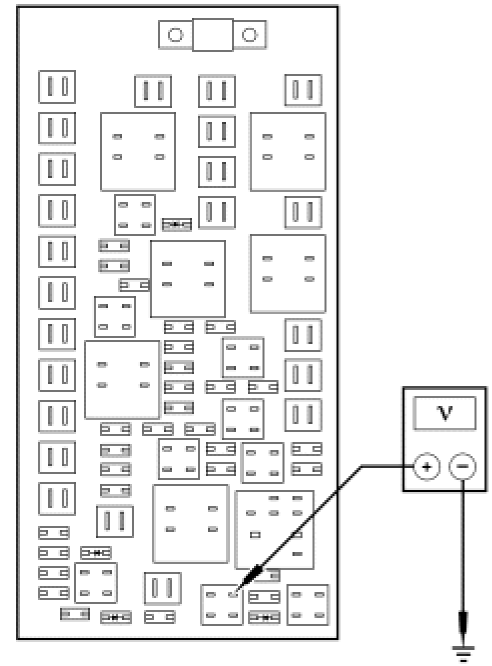

Fig. 45: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated mirror relay pin 5, harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to E2.

  NO : VERIFY that battery junction box (BJB) fuses 28 (15A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

E2 CHECK THE HVAC MODULE OUTPUT

- With the engine running, depress the rear window defrost switch to the ON position.

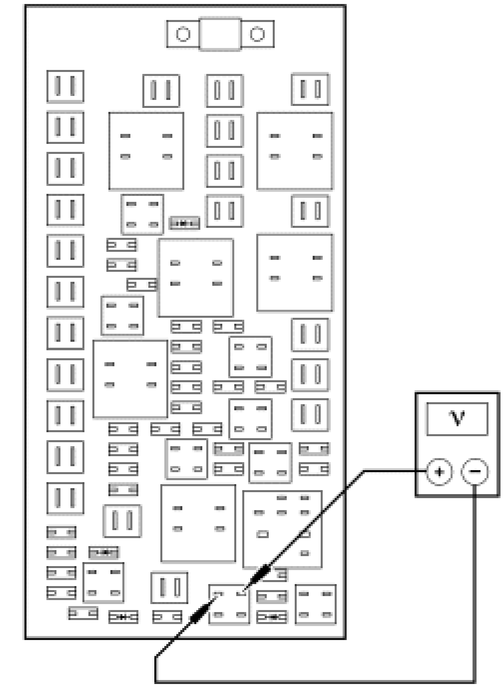

Fig. 46: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated mirror relay pin 5 harness side and heated mirror relay pin 2 harness side.
- **Is the voltage greater than 10 volts?**

  YES : Go to E3.

  NO : Go to E4.

E3 CHECK THE HEATED MIRROR RELAY

- Carry out the Heated Mirror Relay Component Test. Refer to COMPONENT TESTING.
- **Did the heated mirror relay pass the component test?**

  YES : Go to E5.

  NO : INSTALL a new heated mirror relay. TEST the system for normal operation.

E4 CHECK CIRCUIT CH122 (WH/OG) FOR AN OPEN

- Key in OFF position.
- Disconnect: HVAC Module C228B

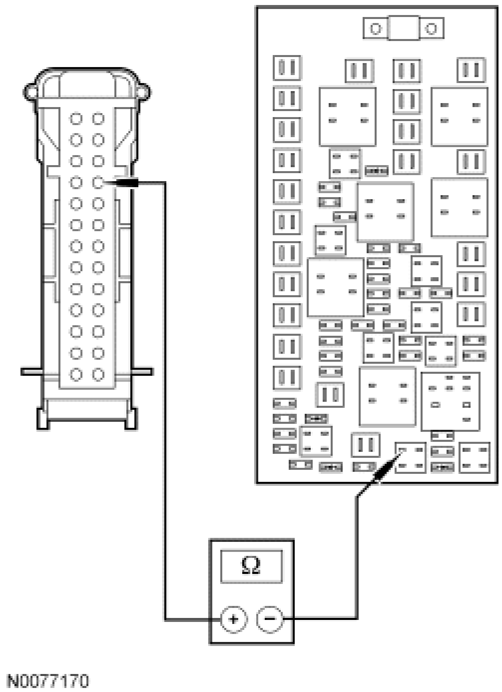

Fig. 47: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module C228B-23, circuit CH122 (WH/OG) and heated mirror relay pin 2 harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to E6.

  NO : REPAIR the circuit. TEST the system for normal operation.

E5 CHECK CIRCUIT CRD13 (GN/VT) FOR AN OPEN

- Key in OFF position.
- Disconnect: LH Exterior Mirror C516

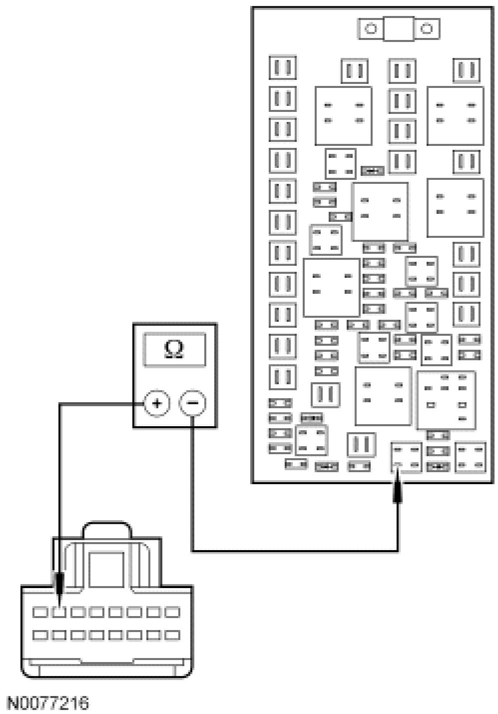

Fig. 48: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH exterior mirror C521-7, circuit CRD13 (GN/VT) harness side and heated mirror relay pin 3 harness side.
- **Is the resistance less than 5 ohms?**

  YES : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

E6 CHECK THE HVAC MODULE FOR CORRECT OPERATION

- Disconnect all HVAC module connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all HVAC module connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test F: The Heated Exterior Mirror is Inoperative - LH Heated Exterior Mirror

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Mirrors for schematic and connector information.

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Heated Window for schematic and connector information.

Normal Operation

Under normal operation, when the rear window defrost switch is depressed on the HVAC module, the LH exterior mirror receives power through circuit CRD13 (GN/VT). The LH exterior mirror receives ground through circuit GD133 (BK).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- LH exterior mirror glass
- LH exterior mirror

PINPOINT TEST F: THE HEATED EXTERIOR MIRROR IS INOPERATIVE - LH HEATED EXTERIOR MIRROR

F1 CHECK CIRCUIT CRD13 (GN/VT) FOR VOLTAGE

- Key in OFF position.
- Disconnect: LH Exterior Mirror C516
- Key in ON position.
- With the engine running, depress the rear window defrost switch to the ON position.

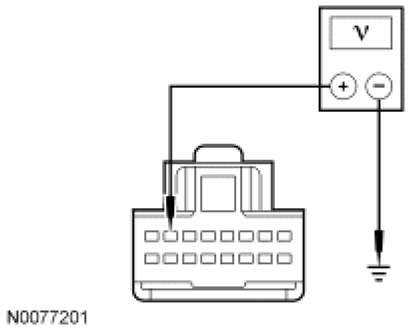

Fig. 49: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between LH exterior mirror C516-7, circuit CRD13 (GN/VT) harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to F2.

  NO : REPAIR the circuit. TEST the system for normal operation.

F2 CHECK CIRCUIT GD133 (BK) FOR AN OPEN

- Key in OFF position.

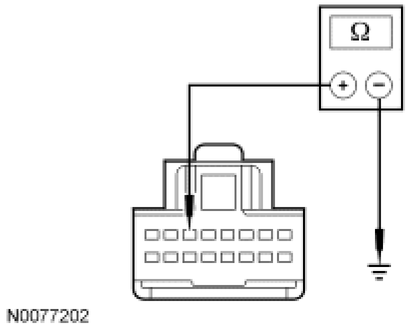

Fig. 50: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH exterior mirror C516-6, circuit GD133 (BK) harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : CHECK the LH exterior mirror jumper harness between the vehicle harness and the exterior mirror glass for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new exterior mirror glass. REFER to **Exterior Mirror Glass**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test G: The Heated Exterior Mirror is Inoperative - RH Heated Exterior Mirror

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Mirrors for schematic and connector information.

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Heated Window for schematic and connector information.

Normal Operation

Under normal operation, when the rear window defrost switch is depressed on the HVAC module, the RH exterior mirror receives power through circuit CRD13 (GN/VT). The RH exterior mirror receives ground through circuit GD140 (BK/GN).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- RH exterior mirror glass
- RH exterior mirror

PINPOINT TEST G: THE HEATED EXTERIOR MIRROR IS INOPERATIVE - RH HEATED EXTERIOR MIRROR

G1 CHECK CIRCUIT CRD13 (GN/VT) FOR VOLTAGE

- Key in OFF position.
- Disconnect: RH Exterior Mirror C622
- Key in ON position.
- With the engine running, depress the rear window defrost switch to the ON position.

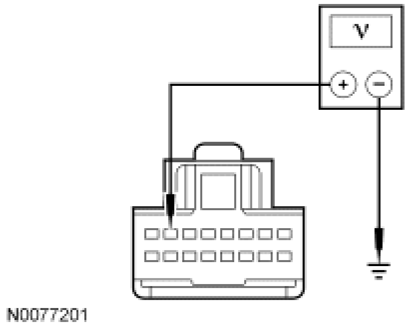

Fig. 51: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between RH exterior mirror C622-7, circuit CRD13 (GN/VT) harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to G2.

  NO : REPAIR the circuit. TEST the system for normal operation.

G2 CHECK CIRCUIT GD140 (BK/GN) FOR AN OPEN

- Key in OFF position.

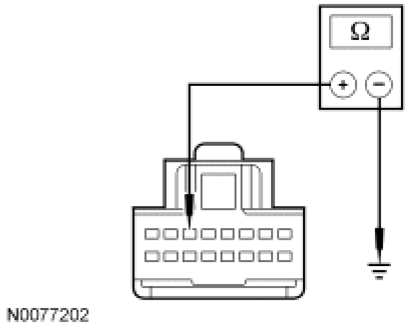

Fig. 52: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RH exterior mirror C622-6, circuit GD140 (BK/GN) harness side and ground.

- **Is the resistance less than 5 ohms?**

  YES : CHECK the RH exterior mirror jumper harness between the vehicle harness and the exterior mirror glass for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new exterior mirror glass. REFER to **Exterior Mirror Glass**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test H: The Auto-Dimming Mirror Does Not Operate Correctly

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Mirrors for schematic and connector information.

Normal Operation

The interior auto-dimming mirror receives power from circuit CBP31 (BU/OG) and ground from circuit GD133 (BK). When the vehicle is placed in REVERSE, voltage is sent to circuit CLS10 (GN/BN) and the interior auto-dimming mirror will turn the dimming feature off. There are 2 photoelectric sensors: one in the front of the interior rear view mirror and one mounted on the glass side of the mirror. If the sensors are blocked, the interior auto-dimming mirror might not work correctly. Always verify both sensors are not physically blocked before attempting to diagnose auto-dimming mirror concerns.

If equipped with a LH exterior auto-dimming mirror, and the auto-dimming feature is activated, voltage is sent from the interior mirror to the LH exterior mirror though circuit LRD12 (BU/GY). Ground for the LH exterior mirror is provided by the interior mirror through circuit RRD12 (BN).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Interior auto-dimming mirror
- LH exterior mirror glass
- LH exterior mirror

PINPOINT TEST H: THE AUTO-DIMMING MIRROR DOES NOT OPERATE CORRECTLY

NOTE: **If the transmission range (TR) sensor is malfunctioning and the backup lamps are on all the time or do not turn on, the auto-dimming interior mirror will not darken or return to normal view.**

H1 CHECK THE OPERATION OF THE BACKUP LAMPS

- Key in ON position.
- Move the selector lever through the entire range.
- **Do the backup lamps illuminate only in REVERSE?**

YES : If the LH exterior mirror only is always dim, REPAIR circuit LRD12 (BU/GY) for a short to voltage. TEST the system for normal operation.

If the LH exterior mirror only does not dim correctly, go to H10 .

If the interior mirror only does not dim correctly and the LH exterior mirror does dim correctly, INSTALL a new interior auto-dimming mirror, REFER to **Auto-Dimming Interior Mirror**. TEST the system for normal operation.

If the LH exterior mirror and interior mirror (if equipped) does not dim correctly, go to H2 .

NO : REFER to **EXTERIOR LIGHTING** article to diagnose backup lamps.

H2 VERIFY THAT THE FORWARD AND REARWARD FACING SENSORS ARE NOT BLOCKED

- Visually verify that the forward and rearward facing sensors are not blocked. Sources of blockage can include:
  - stickers, window decals or tags.
  - fold-down screens for TVs or DVD players.
  - non-OEM window tinting.
- **Were either of the sensors blocked?**

  YES : If possible, REMOVE the blockage. TEST the system for normal operation. If the blockage cannot be removed, REVIEW the operation of the auto-dimming interior mirror with the customer.

  NO : Go to H3.

H3 CHECK THE OPERATION OF THE INTERIOR AUTO-DIMMING MIRROR - DAYLIGHT CONDITIONS

- Key in ON position.

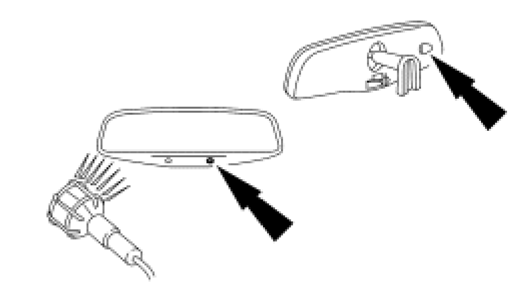

Fig. 53: Checking Operation Of Interior Auto-Dimming Mirror - Daylight Conditions
Courtesy of FORD MOTOR CO.

- Use a bright lamp to simultaneously illuminate the forward facing sensor and the rearward facing sensor. The mirror should adjust to a high reflectance mode (mirror will be clear).
- **Does the mirror adjust to the high reflectance (clear) mode?**

  YES : Go to H4.

  NO : Go to H7.

H4 CHECK THE OPERATION OF THE INTERIOR AUTO-DIMMING MIRROR - NIGHT

TIME CONDITIONS WITH GLARE

- Key in ON position.

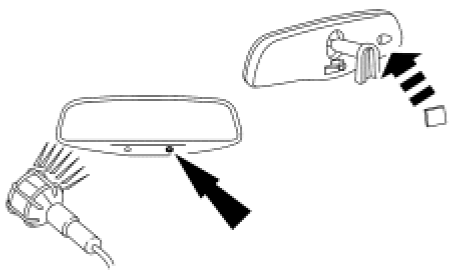

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Fig. 54: Checking Operation Of Interior Auto-Dimming Mirror - Night Time Conditions With Glare
Courtesy of FORD MOTOR CO.

- Simulate night time conditions with glare:

NOTE: Covering the sensor with a finger or hand is not adequate.

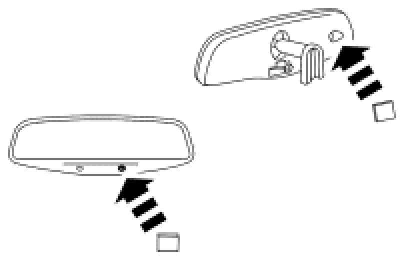
  - cover the forward facing sensor with black electrical tape or other dark material.
  - illuminate the rearward facing sensor. The mirror should darken to a lower reflectance mode.
- **Did the mirror darken to a lower reflectance (darker) mode?**

  YES : Go to H5.

  NO : Go to H7.

H5 CHECK THE OPERATION OF THE INTERIOR AUTO-DIMMING MIRROR - NIGHT TIME CONDITIONS WITHOUT GLARE

- Key in ON position.



N0057547

Fig. 55: Checking Operation Of Interior Auto-Dimming Mirror - Night Time Conditions Without Glare
Courtesy of FORD MOTOR CO.

- Simulate night time conditions without glare:

NOTE: Covering the sensor with a finger or hand is not adequate.

- cover the forward facing sensor with black electrical tape or other dark material.
- cover the rearward facing sensor. The mirror should adjust to the high reflectance mode.

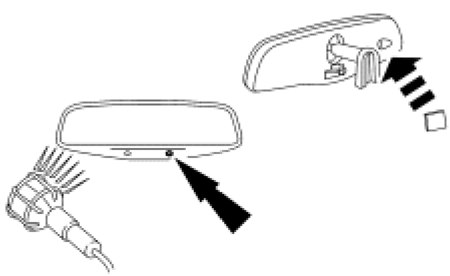
- **Did the mirror adjust to the high reflectance (clear) mode?**

  YES : Go to H6.

  NO : Go to H7.

H6 CHECK THE OPERATION OF THE AUTO-DIMMING MIRROR - NIGHT TIME CONDITIONS WITH THE VEHICLE IN REVERSE

- Key in ON position.



N0057546

Fig. 56: Checking Operation Of Interior Auto-Dimming Mirror - Night Time Conditions With Glare
Courtesy of FORD MOTOR CO.

- Simulate night time conditions with glare:

NOTE: Covering the sensor with a finger or hand is not adequate.

- cover the forward facing sensor with black electrical tape or other dark material.
- illuminate the rearward facing sensor.

- Select REVERSE.
- **Did the mirror adjust to a high reflectance (clear) mode?**

  YES : The system is operating normally at this time. REVIEW operation of the interior auto-dimming mirror feature with the customer.

  NO : Go to H7.

H7 CHECK CIRCUIT CBP41 (BU) FOR VOLTAGE

- Disconnect: Interior Auto-Dimming Mirror C911 (without microphone) or C9012 (with microphone)

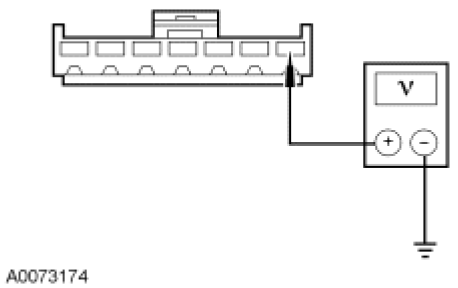


Fig. 57: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- **Without microphone:** Measure the voltage between interior auto-dimming mirror C911-1, circuit CBP31 (BU/OG) harness side and ground.

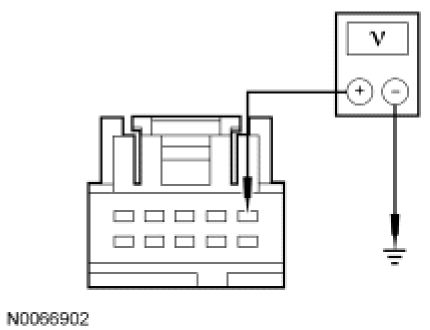


Fig. 58: Measuring Voltage
Courtesy of FORD MOTOR CO.

- **With microphone:** Measure the voltage between interior auto-dimming mirror C9012-1, circuit CBP31 (BU/OG) harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to H8.

  NO : VERIFY that smart junction box (SJB) fuse 31 (10A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

H8 CHECK CIRCUIT GD133 (BK) FOR AN OPEN

- Key in OFF position.

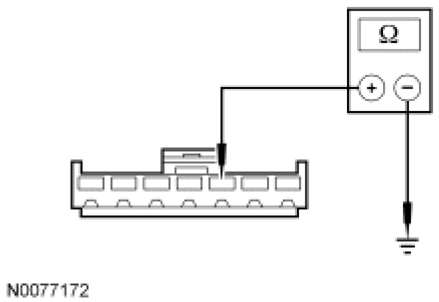


Fig. 59: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **Without microphone:** Measure the resistance between interior auto-dimming mirror C911-3, circuit GD133 (BK) harness side and ground.

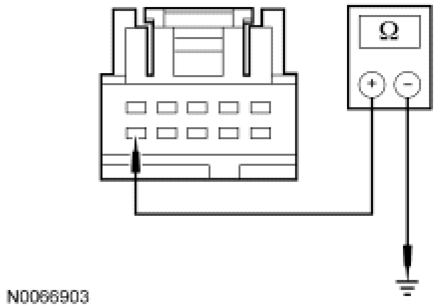


Fig. 60: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **With microphone:** Measure the resistance between interior auto-dimming mirror C9012-10, circuit GD133 (BK) harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to H9.

  NO : REPAIR the circuit. TEST the system for normal operation.

H9 CHECK CIRCUIT CLS10 (GN/BN) FOR VOLTAGE

- Key in ON position.
- Select REVERSE.

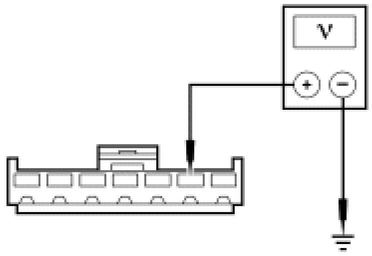


Fig. 61: Measuring Voltage
Courtesy of FORD MOTOR CO.

- **Without microphone:** Measure the voltage between interior auto-dimming mirror C911-2, circuit CLS10 (GN/BN) harness side and ground.

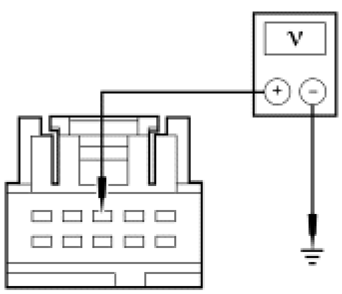


Fig. 62: Measuring Voltage
Courtesy of FORD MOTOR CO.

- **With microphone:** Measure the voltage between interior auto-dimming mirror C9012-3, circuit CLS10 (GN/BN) harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new interior auto-dimming mirror. REFER to **Interior Rear View Mirror**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

H10 CHECK THE INTERIOR MIRROR OUTPUT TO THE LH EXTERIOR MIRROR

- Key in OFF position.
- Disconnect: LH Exterior Mirror C516
- Key in ON position.

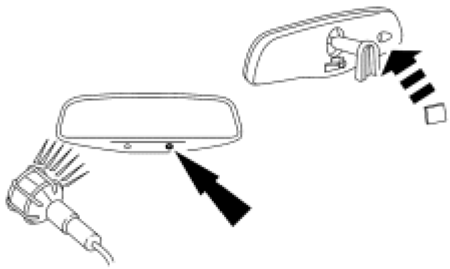


Fig. 63: Checking Operation Of Interior Auto-Dimming Mirror - Night Time Conditions With Glare
Courtesy of FORD MOTOR CO.

- Simulate nighttime conditions with glare:

NOTE: Covering the sensor with a finger or hand is not adequate.

  - cover the forward facing sensor with black electrical tape or other dark material.
  - illuminate the rearward facing sensor. The mirror should darken to a lower reflectance mode.

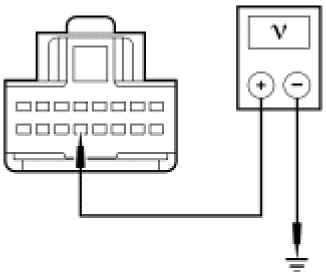


Fig. 64: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between LH exterior mirror C516-13, circuit LRD12 (BU/GY) and ground.
- **Is the voltage greater than 1 volt?**

  YES : Go to H11.

  NO : Go to H15.

H11 CHECK CIRCUIT RRD12 (BN) FOR A SHORT TO VOLTAGE

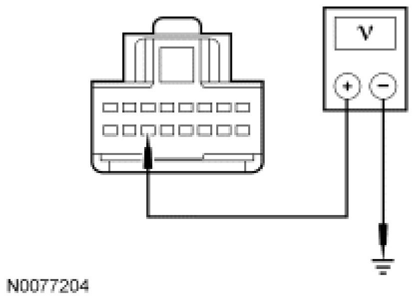


Fig. 65: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between LH exterior mirror C516-14, circuit RRD12 (BN) harness side and ground.
- **Is any voltage present?**

  YES : Go to H12.

  NO : Go to H13.

H12 ISOLATE THE SHORT TO VOLTAGE ON CIRCUIT RRD12 (BN)

- Key in OFF position.
- Disconnect: Interior Auto-Dimming Mirror C911 (without microphone) or C9012 (with microphone)
- Key in ON position.

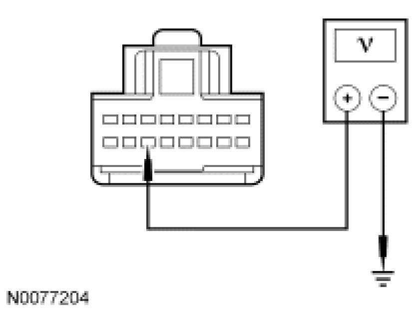


Fig. 66: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between LH exterior mirror C516-14, circuit RRD12 (BN) harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : INSTALL a new interior auto-dimming mirror. REFER to **Auto-Dimming Interior Mirror**. TEST the system for normal operation.

H13 CHECK CIRCUIT RRD12 (BN) FOR GROUND

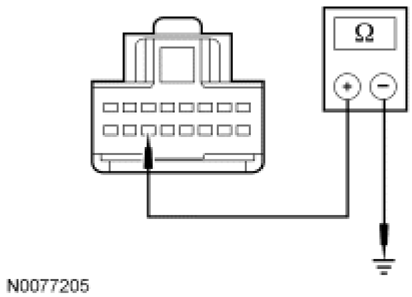


Fig. 67: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH exterior mirror C516-14, circuit RRD12 (BN) harness side and ground.
- **Is the resistance less than 15 ohms?**

  YES : CHECK the LH exterior mirror jumper harness between the vehicle harness and the exterior mirror glass for shorted or open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new LH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new LH exterior mirror glass. REFER to **Exterior Mirror Glass**. TEST the system for normal operation.

  NO : Go to H14.

H14 CHECK CIRCUIT RRD12 (BN) FOR AN OPEN

- Key in OFF position.
- Disconnect: Interior Auto-Dimming Mirror C911 (without microphone) or C9012 (with microphone)

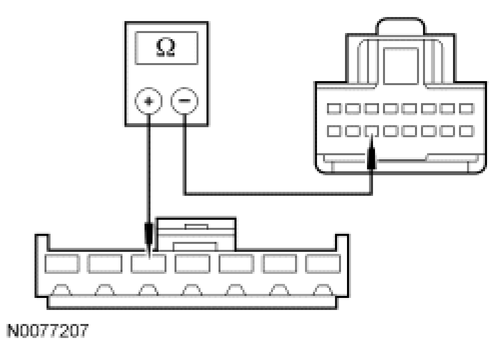


Fig. 68: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **Without microphone:** Measure the resistance between interior auto-dimming mirror C911-5, circuit RRD12 (BN) harness side and LH exterior mirror C516-14, circuit RRD12 (BN) harness side.

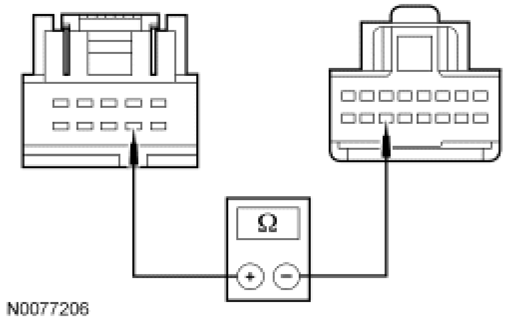


Fig. 69: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **With microphone:** Measure the resistance between interior auto-dimming mirror C9012-7, circuit RRD12 (BN) harness side and LH exterior mirror C516-14, circuit RRD12 (BN) harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL new interior auto-dimming mirror. REFER to **Auto-Dimming Interior Mirror**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

H15 CHECK CIRCUIT LRD12 (BU/GY) FOR AN OPEN

- Key in OFF position.
- Disconnect: Interior Auto-Dimming Mirror C911 (without microphone) or C9012 (with microphone)

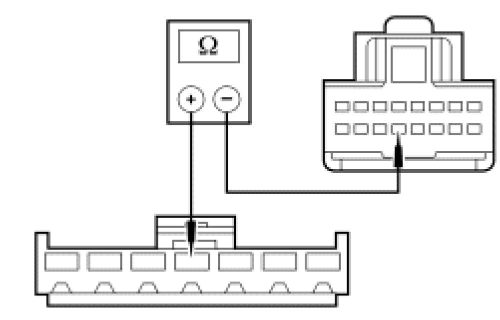


Fig. 70: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **Without microphone:** Measure the resistance between interior auto-dimming mirror C911-4, circuit LRD12 (BU/GY) harness side and LH exterior mirror C516-13, circuit LRD12 (BU/GY) harness side.

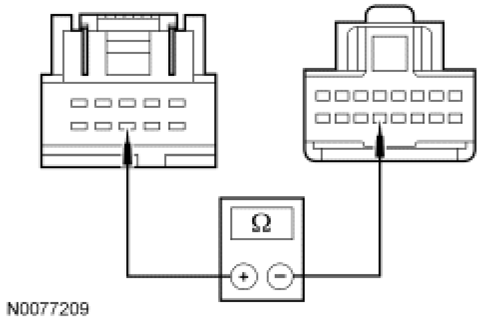


Fig. 71: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **With microphone:** Measure the resistance between interior auto-dimming mirror C9012-8, circuit LRD12 (BU/GY) harness side and LH exterior mirror C516-13, circuit LRD12 (BU/GY) harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to H16.

  NO : REPAIR the circuit. TEST the system for normal operation.

H16 CHECK CIRCUIT LRD12 (BU/GY) FOR A SHORT TO GROUND

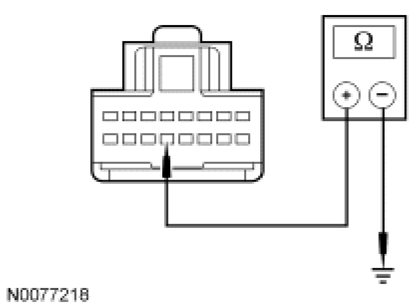


Fig. 72: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH exterior mirror C516-13, circuit LRD12 (BU/GY) harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL new interior auto-dimming mirror. REFER to **Auto-Dimming Interior Mirror**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

REMOVAL AND INSTALLATION

EXTERIOR MIRRORS - EXPLODED VIEW

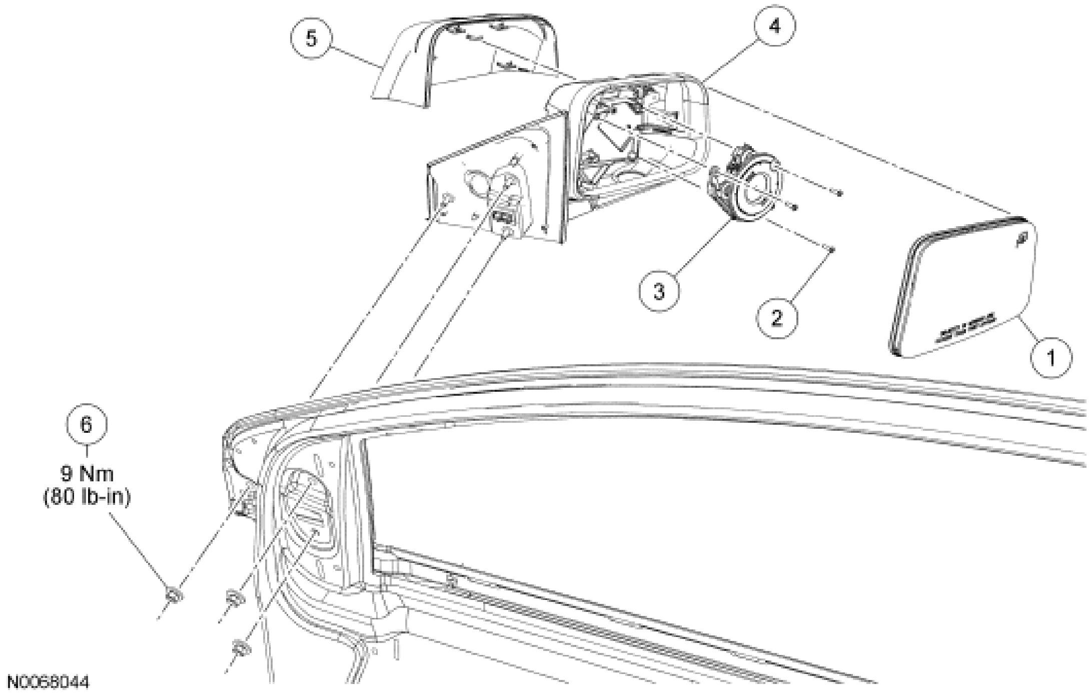


Fig. 73: Exploded View Of Exterior Mirrors With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	17K707	Exterior rear view mirror glass
2	-	Exterior rear view mirror motor mounting screw (3 required)
3	17D696	Exterior rear view mirror motor
4	17682 RH/ 17683 LH	Exterior rear view mirror housing
5	17D743 LH/ 17D742 RH	Exterior rear view mirror cover
6	N621906	Exterior rear view mirror mounting nut (3 required)

1. For additional information, refer to the appropriate procedures in this service information.

EXTERIOR MIRROR

REMOVAL AND INSTALLATION

1. Remove the front door sail panel.

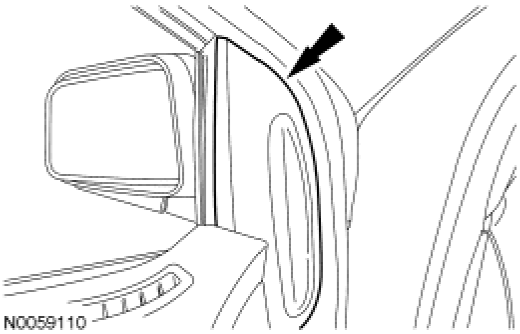


Fig. 74: Identifying Front Door Sail Panel
Courtesy of FORD MOTOR CO.

2. Disconnect the exterior mirror electrical connector.

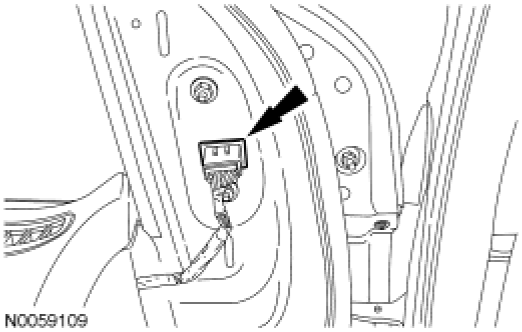


Fig. 75: Identifying Exterior Mirror Electrical Connector
Courtesy of FORD MOTOR CO.

3. Remove the 3 nuts and the exterior mirror.
   - To install, tighten to 9 Nm (80 lb-in).

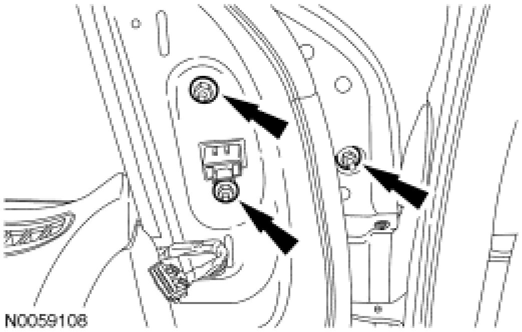


Fig. 76: Identifying Bolts & Exterior Mirror
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.

EXTERIOR MIRROR GLASS

REMOVAL

1. Position the exterior mirror glass in a downward position to obtain a gap at the top edge of the mirror.

> **WARNING:** **Place a shop towel between the hands and the exterior mirror glass for protection in case of glass breakage during mirror service. Failure to follow this instruction may result in serious personal injury.**

2. Disengage the exterior mirror glass.
   - Insert a flat-blade screwdriver between the exterior mirror glass retaining tabs and the exterior mirror glass backing plate and rotate to separate the retaining tabs from the exterior mirror glass backing plate.
   - Continue to insert and rotate the screwdriver until the remaining exterior mirror glass retaining tabs separate from the exterior mirror glass backing plate.
   - Carefully pull the top edge of the exterior mirror glass away from the exterior mirror housing.

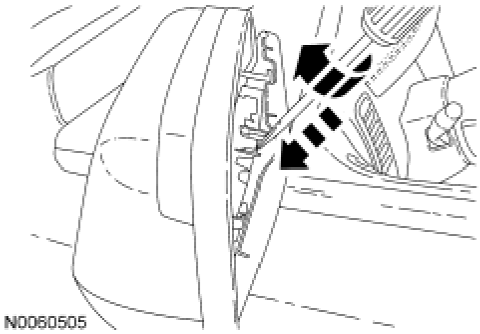


Fig. 77: Pulling Top Edge Of Glass Away From Exterior Mirror Housing
Courtesy of FORD MOTOR CO.

3. If equipped, disconnect the heated mirror and auto-dimming electrical connectors and remove the exterior mirror glass.

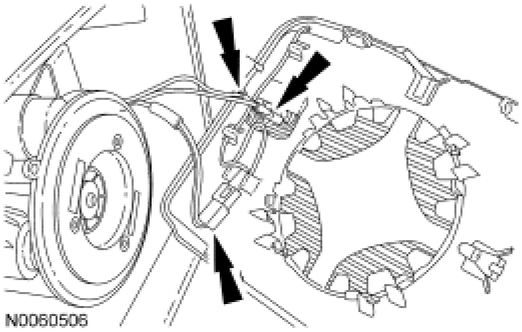


Fig. 78: Identifying Heated Mirror & Auto-Dimming Electrical Connectors
Courtesy of FORD MOTOR CO.

INSTALLATION

1. If equipped, connect the heated mirror and auto-dimming electrical connectors.

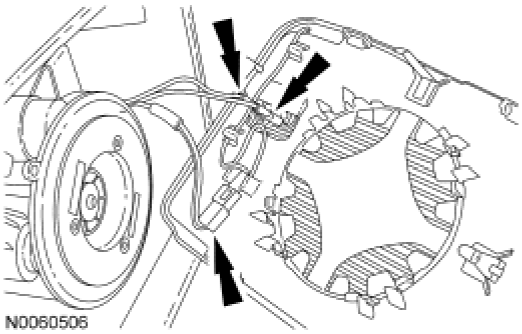


Fig. 79: Identifying Heated Mirror & Auto-Dimming Electrical Connectors
Courtesy of FORD MOTOR CO.

WARNING: **Place a shop towel between the hands and the exterior mirror glass for protection in case of glass breakage during mirror service. Failure to follow this instruction may result in serious personal injury.**

2. Position the exterior mirror glass onto the exterior mirror motor.

NOTE: An audible click will be heard during installation.

3. Firmly press the exterior mirror glass until it snaps onto the exterior mirror motor.
4. Rotate the exterior mirror glass in all directions after the installation to make sure that all of the exterior mirror glass retaining clips are completely fastened.

EXTERIOR MIRROR MOTOR

1. Remove the exterior rear view mirror glass. For additional information, refer to **Exterior Mirror Glass**.
2. Remove the 3 exterior rear view mirror motor screws.

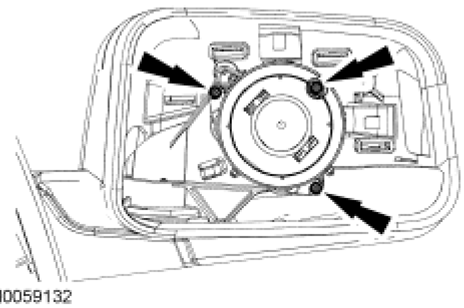


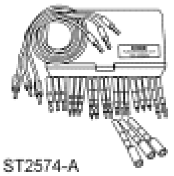
Fig. 80: Identifying Exterior Rear View Mirror Motor Screws

Courtesy of FORD MOTOR CO.

3. Disconnect the exterior rear view mirror motor electrical connector.
4. Remove the exterior rear view mirror motor.
5. To install, reverse the removal procedure.

INTERIOR REAR VIEW MIRROR

Special Tools

Illustration	Tool Name	Tool Number
 ST2574-A	Mirror Remover	501-D118
 ST1793-A	Installer, Rear View Mirror	501-025 (T94P-17700-AH)

REMOVAL

NOTE: Twisting the interior rear view mirror base from right to left may cause a stress fracture to the windshield.

1. Remove the wire cover (if equipped).
2. Remove the compass by pulling down on the compass rearmost edge (if equipped).
3. Insert the special tool between the mirror mount and windshield bracket from the bottom.

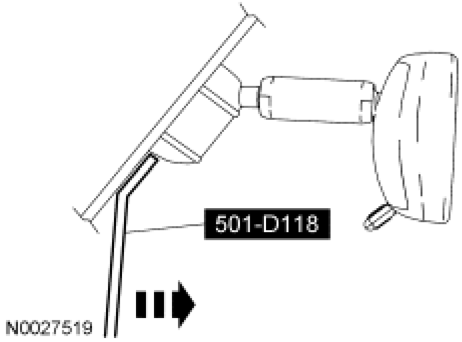


Fig. 81: Inserting Special Tool
Courtesy of FORD MOTOR CO.

4. Release the mirror mount from windshield bracket by pulling the tool away from the windshield.

INSTALLATION

1. Slide the mirror mount over the windshield bracket from the top and adjust the mirror to the upward position.

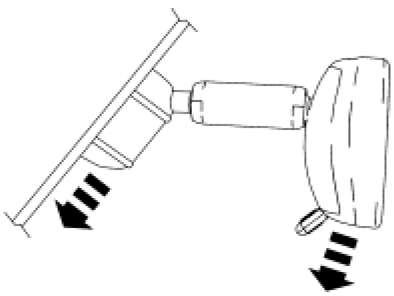


Fig. 82: Installing Mirror Mount Over The Windshield Bracket
Courtesy of FORD MOTOR CO.

2. Using the special tool, press the mirror assembly downward along the windshield until the mount is seated on the windshield bracket.

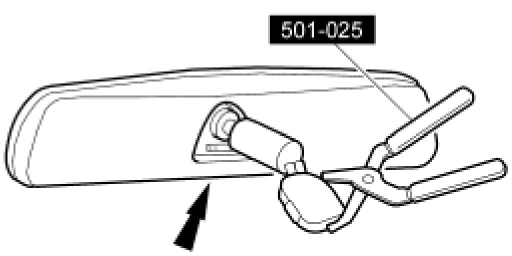


Fig. 83: Locating Mirror Assembly
Courtesy of FORD MOTOR CO.

3. Install compass and wire cover (if equipped).

AUTO-DIMMING INTERIOR MIRROR

Special Tools

Illustration	Tool Name	Tool Number
 ST2574-A	Mirror Remover	501-D118

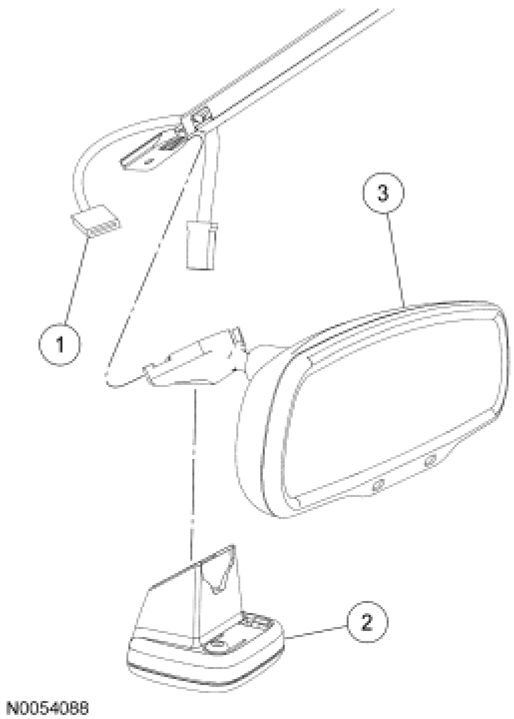


Fig. 84: Exploded View Of Auto-Dimming Interior Mirror
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Interior auto-dimming mirror electrical connector (part of 14A005)
2	19A548	Compass module
3	17700	Interior auto-dimming mirror

REMOVAL

1. Remove the wire cover.
2. Disconnect the electrical connector.

NOTE: If equipped, the compass module does not need to be removed prior to this step.

NOTE: High level mirror shown, others similar.

3. Insert the special tool between the mirror mount and windshield bracket from the top.

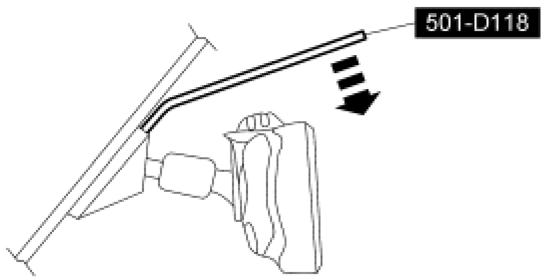


Fig. 85: Inserting Special Tool Between Mirror Mount & Windshield Bracket
Courtesy of FORD MOTOR CO.

4. If equipped, separate the compass module from the mirror assembly by disengaging the compass module locking tabs.

NOTE: Twisting the interior rear view mirror base from right to left may cause a stress fracture to the windshield.

5. Release the mirror mount from the windshield bracket by pulling the tool and mirror down and away from the windshield.

INSTALLATION

1. Slide the mirror mount over the windshield bracket from the top and adjust the mirror to the upward position.

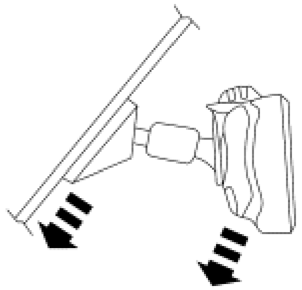


Fig. 86: Sliding Mirror Mount Over Windshield Bracket
Courtesy of FORD MOTOR CO.

2. Quickly press the mirror assembly downward along the windshield until a click is felt. The click indicates the base is engaged to the windshield bracket.
3. Connect the electrical connector and wire cover.
4. If equipped, install the compass module. Check the compass zone and calibration. For additional information, refer to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

EXTERIOR MIRROR COVER

1. Remove the exterior mirror glass. For additional information, refer to **Exterior Mirror Glass**.
2. Depress the 4 tabs and remove the exterior mirror cover.

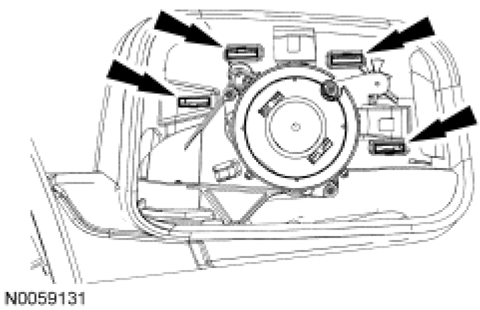


Fig. 87: Locating Tabs On Exterior Mirror Cover
Courtesy of FORD MOTOR CO.

3. To install, reverse the removal procedure.

EXTERIOR MIRROR CONTROL SWITCH

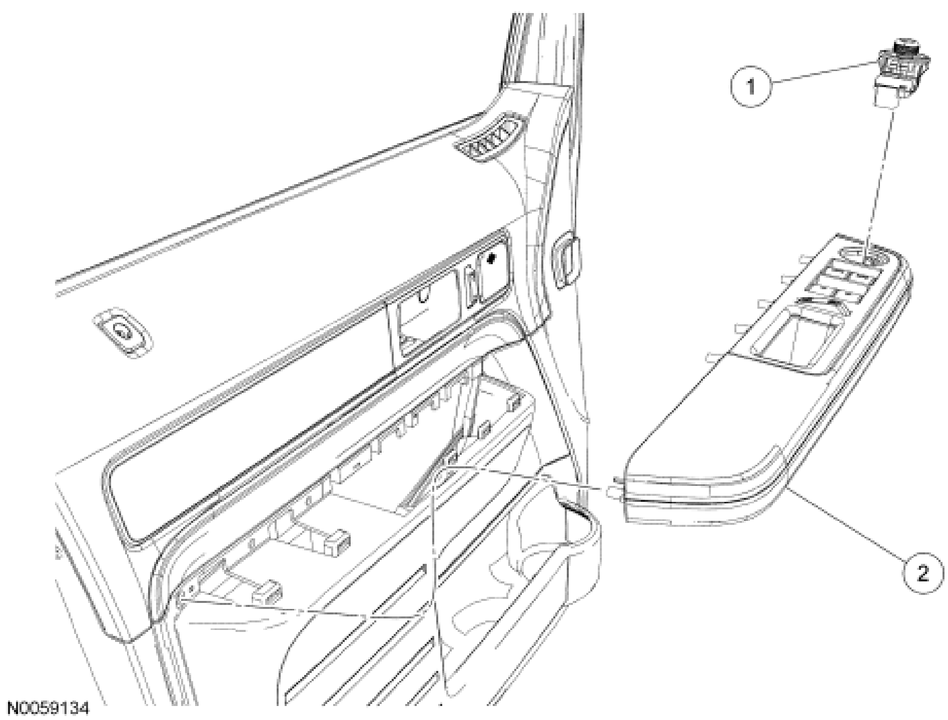


Fig. 88: Exploded View Of Exterior Mirror Control Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description

1	17B676	Exterior rear view mirror control switch
2	-	Front door control switch bezel

REMOVAL AND INSTALLATION

1. Remove the front door control switch bezel.
2. Remove the exterior mirror control switch.
    - Depress the 2 locking tabs.
    - Disconnect the electrical connector.

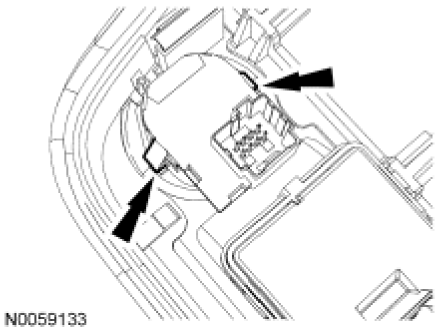


Fig. 89: Locating Locking Tabs On Electrical Connector
Courtesy of FORD MOTOR CO.

3. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Parking Aid - Edge & MKX

SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Azimuth system check object position 1 (P1) and position 5 (P5), distance from sensor	30 cm (12 in) rear
Azimuth system check object position 2 (P2) and position 4 (P4), distance from sensor	91 cm (36 in) rear
Azimuth system check object position 3 (P3), distance from sensor	152 cm (60 in) rear

DESCRIPTION AND OPERATION

PARKING AID

The parking aid system calculates the distance to an object around the rear of the vehicle by the use of 4 ultrasonic sensors. The parking aid system detects objects behind the vehicle when the REVERSE (R) gear is selected.

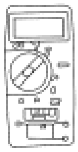
The parking aid system consists of:

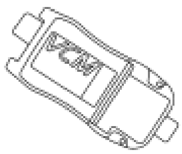
- Parking aid sensors (located in the rear bumper cover)
- Parking aid module (PAM) and parking aid speaker (both located behind the LR quarter trim panel)
- Parking aid disable feature (integral to the instrument cluster (IC) message center)

DIAGNOSTIC TESTS

PARKING AID

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with	

 ST2834-A	appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

NOTE: Both the medium speed controller area network (MS-CAN) and the high speed controller area network (HS-CAN) are used for intermodule communication. A gateway message is transferred from one network to another network through the instrument cluster. Refer to MODULE COMMUNICATIONS NETWORK article.

The parking aid sensors detect objects approximately 1.6 m (5.3 ft) from the rear of the vehicle, 50 cm (1.6 ft) from the rear side of the vehicle, and 16 cm (6 in) above the ground. The parking aid module (PAM) calculates the distance to an object within the 170 degree semicircular azimuth area around the rear of the vehicle. A 750 Hz variable warning tone is generated from a parking aid speaker which is attached to the PAM. The parking aid speaker increases the warning tone rate as the vehicle gets nears an obstacle. When an object is detected within 25 cm (10 in) of the sensors, the warning tone becomes continuous.

The parking aid system is enabled when the ignition switch is in the RUN position and the REVERSE (R) gear is selected. The parking aid system is disabled if a fault is detected in 1 of the 4 sensors, the parking aid speaker or the PAM. This condition is indicated by the parking aid disabled warning in the message center. The PAM is on the MS-CAN and can be diagnosed with a scan tool.

The PAM communicates with the scan tool, the SJB, the audio control module (ACM) and the instrument cluster (IC) or the MS-CAN. The following chart describes network messages used by the PAM:

PAM NETWORK COMMUNICATION MESSAGES

Broadcast Message	Originating Module	Network Type	Receiving Module
Ignition switch position	SJB	MS-CAN	PAM
Parking aid disable switch status	IC	MS-CAN	PAM
Parking aid system status	PAM	MS-CAN	IC
Transmission selector (PRNDL) range	PCM	HS-CAN	IC

Transmission selector (PRNDL) range (gateway)	IC	MS-CAN	PAM
Vehicle speed	PCM	HS-CAN	IC
Vehicle speed (gateway)	IC	MS-CAN	PAM
Parking aid audio volume cutback request	PAM	MS-CAN	ACM

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

VISUAL INSPECTION CHART

Electrical
• Smart junction box (SJB) fuse 35 (10A) • Wiring, terminals or connectors • Parking aid module (PAM) • Parking aid sensors • Parking aid speaker

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.

- If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
- If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the PAM.

NOTE: Follow the non-network DTC diagnostics (B-codes, C-codes, P-codes) prior to the network DTC diagnostics (U-codes).

9. If the DTCs retrieved are related to the concern, go to **PARKING AID MODULE (PAM) DTC CHART** . For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

PARAMETER IDENTIFICATION (PID) CHART

PID	Description
LRI_DIST	Left rear inner sensor distance to object
LRO_DIST	Left rear outer sensor distance to object
RRI_DIST	Right rear inner sensor distance to object
RRO_DIST	Right rear outer sensor distance to object
LRI_ATTEN	Left rear inner sensor attenuation
LRO_ATTEN	Left rear outer sensor attenuation
RRI_ATTEN	Right rear inner sensor attenuation
RRO_ATTEN	Right rear outer sensor attenuation
TRANSGR	Transmission gear position

DTC Charts

PARKING AID MODULE (PAM) DTC CHART

DTC	Description	Action
B1299	Power Supply Sensor Circuit Short to Ground	Go to **Pinpoint Test E** .
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the PAM self-test. If DTC B1342 is retrieved again, INSTALL a new PAM. REFER to **Parking Aid Module**. CLEAR all DTCs. REPEAT the self-test.
B2477	Module Configuration Failure	The PAM is not configurable. CLEAR the DTCs. REPEAT the PAM self-test. If DTC B2477 is retrieved again, INSTALL a new PAM. REFER to **Parking Aid Module**. CLEAR all DTCs. REPEAT the self-test.
C1699	Left Rear Sensor Circuit Short to Vbat	Go to **Pinpoint Test C** .

C1700	Left Rear Sensor Circuit Failure or Blockage	Go to **Pinpoint Test B** .
C1701	Left Rear Sensor Circuit Fault	Go to **Pinpoint Test D** .
C1702	Right Rear Sensor Circuit Short to Vbat	Go to **Pinpoint Test C** .
C1703	Right Rear Sensor Circuit Failure or Blockage	Go to **Pinpoint Test B** .
C1704	Right Rear Sensor Circuit Fault	Go to **Pinpoint Test D** .
C1705	Left Rear Center Sensor Circuit Short to Vbat	Go to **Pinpoint Test C** .
C1706	Left Rear Center Sensor Circuit Failure	Go to **Pinpoint Test B** .
C1707	Left Rear Center Sensor Circuit Fault	Go to **Pinpoint Test D** .
C1708	Right Rear Center Sensor Circuit Short to Vbat	Go to **Pinpoint Test C** .
C1709	Right Rear Center Sensor Circuit Failure	Go to **Pinpoint Test B** .
C1710	Right Rear Center Sensor Circuit Fault	Go to **Pinpoint TestD** .
C1742	Rear Sounder Circuit Failure	Go to **Pinpoint Test F** .
C1743	Rear Sounder Circuit Short to Vbat	Go to **Pinpoint Test F** .
U0140	Lost Communication With Body Control Module (GEM)	Go to **Pinpoint Test G** .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	Go to **Pinpoint Test H** .
U2051	One or More Calibration Files Missing/Corrupt	INSTALL a new PAM. REFER to **Parking Aid Module**. CLEAR all DTCs. REPEAT the self-test.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the parking aid module (PAM)	• Fuse • Wiring, terminals or connectors • PAM	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The parking aid is inoperative/does not operate correctly	• Parking aid sensors alignment • PAM • Rear bumper cover	• Go to **Pinpoint Test A** .
• Continuous or intermittent tone when no obstacles or fault codes are present (certain obstacles may appear "stealthy" to the system, depending on geometric shape, size and material)	• Dirty or iced over parking aid sensor (s)	• CLEAN the rear bumper and sensors with high-pressure water.

	• Parking aid sensor bezel(s) or parking aid sensor(s) locked into the rear bumper incorrectly • Parking aid sensors are not aligned correctly	• REMOVE and correctly INSTALL the parking aid sensor(s) and or bezel(s) as necessary. REFER to **Parking Aid Sensor**.
	• Parking aid sensor (s) • PAM	• CARRY OUT the azimuth system check and elevation system check. REFER to **Azimuth System Check** and **Elevation System Check**.
• The audio control module (ACM) volume does not decrease when transmission is selected to reverse and reverse sensing system is enabled.	• Wiring, terminals or connectors • PAM	• Go to **Pinpoint Test I** .

Pinpoint Tests

Pinpoint Test A: The Parking Aid Is Inoperative/Does Not Operate Correctly

Normal Operation

The parking aid system is enabled when the ignition switch is in the RUN position and the REVERSE (R) gear is selected. The parking aid module (PAM) receives reverse gear input from the instrument cluster (IC) through the medium speed controller area network (MS-CAN). Voltage is supplied to the parking aid sensors from the PAM on circuit LMP07 (BU/WH). The PAM supplies ground to the parking aid sensors on circuit RMP07 (GN/WH). The PAM receives a signal from the parking aid sensors on circuits VMP14 (WH/OG), VMP15 (YE/GN), VMP16 (YE/GY) and VMP17 (YE/OG). The system can be disabled through the message center which is integral to the IC.

This pinpoint test is intended to diagnose the following:

- Parking aid sensors alignment
- PAM
- Rear bumper cover

PINPOINT TEST A: THE PARKING AID IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

A1 CHECK THE DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PAM SELF-TESTS

- Check the PAM DTCs from the continuous and on-demand self-tests.
- **Are any PAM DTCs recorded?**

  YES : REFER to DTC Charts in this service information.

  NO : Go to A2.

A2 CHECK THE PARKING AID SENSORS FOR CORRECT ALIGNMENT

NOTE:	**If the vehicle was in a rear end collision, the parking aid sensors may not be aligned correctly.**

- Check the bumper for correct alignment.
- Carry out the azimuth system check. Refer to **Azimuth System Check**.
- Carry out the elevation system check. Refer to **Elevation System Check**.
- **Does the parking aid system pass both system checks?**

  YES : Go to A3.

  NO : REALIGN or INSTALL a new bumper cover. REFER to **BUMPERS** article. If the vehicle was in a rear end collision, additional body work may be required to bring the parking aid sensors into correct alignment.

A3 CHECK FOR CORRECT REVERSE GEAR INPUT

- Apply the parking brake.
- Key in ON position.
- Select REVERSE.
- Enter the following diagnostic mode on the diagnostic tool: PAM DataLogger
- Monitor the PAM TRANSGR PID.
- **Does the PID indicate YES (transmission in reverse)?**

  YES : Go to A4.

  NO : INSTALL a new PAM. REFER to **Parking Aid Module**. TEST the system for normal operation.

A4 CHECK THE MESSAGE CENTER FOR PARKING AID DISABLE SWITCH OPERATION

- While observing the IC message center, disable and enable the parking aid system.
- **Does the message center display PARK AID OFF when the parking aid system is disabled, and display PARK AID ON when the parking aid system is enabled?**

  YES : Go to A5.

  NO : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article to diagnose the message center.

A5 CHECK FOR CORRECT PAM OPERATION

- Disconnect the PAM connector.
- Check for:

    - corrosion
    - damaged pins
    - pushed-out pins
- Connect the PAM connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PAM. REFER to **Parking Aid Module**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: DTCs C1700, C1703, C1706 And C1709 - Parking Aid Sensor Circuit Failure or Blockage

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Parking Aid for schematic and connector information.

Normal Operation

Voltage is supplied to the parking aid sensors from the parking aid module (PAM) on circuit LMP07 (BU/WH). The PAM supplies ground to the parking aid sensors on circuit RMP07 (GN/WH). The PAM receives a signal from the parking aid sensors on circuits VMP14 (WH/OG), VMP15 (YE/GN), VMP16 (YE/GY) and VMP17 (YE/OG).

DTC Description	Fault Trigger Conditions
C1700 - Left Rear Sensor Circuit Failure or Blockage	A continuous and on-demand DTC that sets when any of the left rear parking aid sensor circuits are open or the sensor signal line is shorted to ground.
C1703 - Right Rear Sensor Circuit Failure or Blockage	A continuous and on-demand DTC that sets when any of the right rear parking aid sensor circuits are open or the sensor signal line is shorted to ground.
C1706 - Left Rear Center Sensor Circuit Failure	A continuous and on-demand DTC that sets when any of the left rear center parking aid sensor circuits are open or the sensor signal line is shorted to ground.
C1709 - Left Rear Center Sensor Circuit Failure	A continuous and on-demand DTC that sets when any of the right rear center parking aid sensor circuits are open or the sensor signal line is shorted to ground.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- PAM

- Parking aid sensor(s)
- Parking aid bumper harness

PINPOINT TEST B: DTCs C1700, C1703, C1706 AND C1709 - PARKING AID SENSOR CIRCUIT FAILURE OR BLOCKAGE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

B1 RETRIEVE THE DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PAM SELF-TESTS

- Check the PAM DTCs from the continuous and on-demand self-tests.
- **Are multiple DTCs recorded?**

  YES : Go to B2.

  NO : For DTCs C1700, C1703, C1706 or C1709, go to B3.

  For all other DTCs, REFER to DTC Charts in this service information.

B2 CHECK THE BUMPER WIRING HARNESS

- Inspect the bumper wiring harness for opens, shorts, grounds, or corrosion.
- **Is the bumper wiring harness OK?**

  YES : Go to B3.

  NO : REPAIR or INSTALL a new bumper wiring harness. CLEAR the DTCs. REPEAT the self-test.

B3 CHECK THE SENSOR CIRCUITRY FOR OPENS

- Key in OFF position.
- Disconnect: Suspect Parking Aid Sensor C4009, C4010, C4011 or C4012
- Disconnect: PAM C4014
- Measure the resistance between the PAM C4014, harness side and the suspect parking aid sensor, harness side as follows:

DTC	Rear Sensor	PAM Connector-Pin	Sensor Connector-Pin	Circuit
C1700	LH outer	C4014-9	C4009-1	LMP07 (BU/WH)
C1700	LH outer	C4014-15	C4009-2	VMP15 (YE/GN)
C1700	LH outer	C4014-12	C4009-3	RMP07 (GN/WH)
C1703	RH	C4014-9	C4011-1	LMP07

	outer			(BU/WH)
C1703	RH outer	C4014-16	C4011-2	VMP17 (YE/OG)
C1703	RH outer	C4014-12	C4011-3	RMP07 (GN/WH)
C1706	LH inner	C4014-9	C4010-1	LMP07 (BU/WH)
C1706	LH inner	C4014-14	C4010-2	VMP14 (WH/OG)
C1706	LH inner	C4014-12	C4010-3	RMP07 (GN/WH)
C1709	RH inner	C4014-9	C4012-1	LMP07 (BU/WH)
C1709	RH inner	C4014-13	C4012-2	VMP16 (YE/GY)
C1709	RH inner	C4014-12	C4012-3	RMP07 (GN/WH)

- **Are the resistances less than 5 ohms?**

  YES : Go to B4.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

B4 CHECK THE SENSOR CIRCUITRY FOR SHORTS TO GROUND

- Measure the resistance between the suspect parking aid sensor, harness side and ground as follows:

DTC	Rear Sensor	Connector-Pin	Circuit
C1700	LH outer	C4009-2	VMP15 (YE/GN)
C1703	RH outer	C4011-2	VMP17 (YE/OG)
C1706	LH inner	C4010-2	VMP14 (WH/OG)
C1709	RH inner	C4012-2	VMP16 (YE/GY)

- **Is the resistance greater than 10,000 ohms?**

  YES : If all of the parking aid sensors recorded DTCs, go to B5.

  If one or more parking aid sensor(s) recorded DTCs, INSTALL a new sensor(s) for the one in question. REFER to **Parking Aid Sensor**. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

B5 CHECK FOR CORRECT PAM OPERATION

- Disconnect the PAM connector.
- Check for:
    - corrosion
    - damaged pins
    - pushed-out pins
- Connect the PAM connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PAM. REFER to **Parking Aid Module**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: DTCs C1699, C1702, C1705 And C1708 - Sensor Circuit Short To Vbat

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Parking Aid for schematic and connector information.

Normal Operation

Voltage is supplied to the parking aid sensors from the parking aid module (PAM) on circuit LMP07 (BU/WH). The PAM supplies ground to the parking aid sensors on circuit RMP07 (GN/WH). The PAM receives a signal from the parking aid sensors on circuits VMP14 (WH/OG), VMP15 (YE/GN), VMP16 (YE/GY) and VMP17 (YE/OG).

DTC Description	Fault Trigger Conditions
C1699 - Left Rear Sensor Circuit Short to Vbat	A continuous and on-demand DTC that sets when the left rear parking aid sensor signal line is shorted to voltage.
C1702 - Right Rear Sensor Circuit Short to Vbat	A continuous and on-demand DTC that sets when the right rear parking aid sensor signal line is shorted to voltage.
C1705 - Left Rear Center Sensor Circuit Short to Vbat	A continuous and on-demand DTC that sets when the left rear center parking aid sensor signal line is shorted to voltage.
C1708 - Right Rear Center Sensor Circuit Short to Vbat	A continuous and on-demand DTC that sets when the right rear center parking aid sensor signal line is shorted to voltage.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Parking aid sensor(s)

- Parking aid bumper harness
- PAM

PINPOINT TEST C: DTCs C1699, C1702, C1705 AND C1708 - SENSOR CIRCUIT SHORT TO VBAT

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

C1 RETRIEVE THE DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PAM SELF-TESTS

- Check the PAM DTCs from the continuous and on-demand self-tests.
- **Are multiple DTCs recorded?**

  YES : Go to C2.

  NO : For DTCs C1699, C1702, C1705 or C1708, go to C3.

  For all other DTCs, REFER to DTC Charts in this service information.

C2 CHECK THE BUMPER WIRING HARNESS

- Inspect the bumper wiring harness for opens, shorts, grounds, or corrosion.
- **Is bumper wiring harness OK?**

  YES : Go to C3.

  NO : REPAIR or INSTALL a new bumper wiring harness. CLEAR the DTCs. REPEAT the self-test.

C3 CHECK THE SENSOR CIRCUITRY FOR SHORTS TO VOLTAGE

- Key in OFF position.
- Disconnect: Suspect Parking Aid Sensor C4009, C4010, C4011 or C4012
- Disconnect: PAM C4014
- Key in ON position.
- Measure the voltage between the suspect parking aid sensor, harness side and ground as follows:

DTC	Rear Sensor	Connector-Pin	Circuit
C1699	LH outer	C4009-2	VMP15 (YE/GN)
C1702	RH outer	C4011-2	VMP17 (YE/OG)
C1705	LH inner	C4010-2	VMP14 (WH/OG)
C1708	RH inner	C4012-2	VMP16 (YE/GY)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to C4.

C4 CHECK THE PARKING AID SENSORS

- Install a known good parking aid sensor(s) for each of the suspect parking aid sensor(s).
- Clear the DTCs. Repeat the self-test.
- Test the system for normal operation.
- **Is the concern still present?**

  YES : If all of the parking aid sensors recorded DTCs, go to C5.

  If one or more parking aid sensor(s) recorded DTCs, INSTALL a new sensor(s) for the one in question. REFER to **Parking Aid Sensor**. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C5 CHECK FOR CORRECT PAM OPERATION

- Disconnect the PAM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the PAM connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PAM. REFER to **Parking Aid Module**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: DTCs C1701, C1704, C1707 And C1710 - Sensor Circuit Fault

Normal Operation

Voltage is supplied to the parking aid sensors from the parking aid module (PAM) on circuit LMP07 (BU/WH). The PAM supplies ground to the parking aid sensors on circuit RMP07 (GN/WH). The PAM receives a signal from the parking aid sensors on circuits VMP14 (WH/OG), VMP15 (YE/GN), VMP16 (YE/GY) and VMP17 (YE/OG).

DTC Description	Fault Trigger Conditions
C1701 - Left Rear Sensor Circuit Fault	A continuous and on-demand DTC that sets when the left rear parking aid sensor has internally failed or has an incorrect attenuation time.

C1704 - Right Rear Sensor Circuit Fault	A continuous and on-demand DTC that sets when the right rear parking aid sensor has internally failed or has an incorrect attenuation time.
C1707 - Left Rear Center Sensor Circuit Fault	A continuous and on-demand DTC that sets when the left rear center parking aid sensor has internally failed or has an incorrect attenuation time.
C1710 - Right Rear Center Sensor Circuit Fault	A continuous and on-demand DTC that sets when the right rear center parking aid sensor has internally failed or has an incorrect attenuation time.

This pinpoint test is intended to diagnose the following:

- Dirty or obstructed parking aid sensor
- Parking aid sensor
- Parking aid bumper harness
- PAM

PINPOINT TEST D: DTCs C1701, C1704, C1707 AND C1710 - SENSOR CIRCUIT FAULT

D1 CHECK THE DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PAM SELF-TESTS

- Check the PAM DTCs from the continuous and on-demand self-tests.
- **Are parking aid DTCs other than C1701, C1704, C1707 or C1710 recorded?**

  YES : DIAGNOSE the other DTCs first. REFER to DTC Charts in this service information.

  NO : Go to D2.

D2 CHECK THE PARKING AID SENSOR OPERATION

NOTE: Make sure the area around the vehicle is clear of anything that might activate the parking aid system.

- Clean the rear bumper and sensors with high-pressure water.
- Carry out the azimuth system check. Refer to **Azimuth System Check**.
- Carry out the elevation system check. Refer to **Elevation System Check**.
- **Does the parking aid system pass both system checks?**

  YES : The system is operating correctly at this time. The concern may have been caused by a dirty or blocked parking aid sensor. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to D3.

D3 CHECK THE PARKING AID SENSOR DISTANCE PIDs

- Make sure the suspect parking aid sensor(s) is flush-mounted in the bezel.
- Key in ON position.

- Enter the following diagnostic mode on the diagnostic tool: PAM DataLogger
- With the brake pedal applied, shift the transmission into REVERSE (R) and monitor the parking aid sensor distance PID. The PID will read 255 cm (100 in) on a correctly functioning sensor with no object behind the vehicle.
- **Does the PID read 255 cm (100 in)?**

  YES : Go to D4.

  NO : Go to D5.

D4 CHECK THE PARKING AID SENSOR ATTENUATION PIDs

- Check the parking aid sensor attenuation PIDs.
- **Do the attenuation PIDs read between 0 and 16?**

  YES : Go to D6.

  NO : Go to D5.

D5 INSTALL A KNOWN GOOD PARKING AID SENSOR

- Install a known good sensor for the suspect parking aid sensor.
- Key in ON position.
- Clear the DTCs. Repeat the self-test. Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : Go to D6.

  NO : INSTALL a new parking aid sensor. REFER to **Parking Aid Sensor**. CLEAR the DTCs. REPEAT the self-test.

D6 CHECK FOR CORRECT PAM OPERATION

- Disconnect the PAM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the PAM connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PAM. REFER to **Parking Aid Module**. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test E: DTC B1299 - Power Supply Sensor Circuit Short To Ground

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Parking Aid for schematic and connector information.

Normal Operation

Voltage is supplied to the parking aid sensors from the parking aid module (PAM) on circuit LMP07 (BU/WH). The PAM supplies ground to the parking aid sensors on circuit RMP07 (GN/WH).

DTC B1299 is a continuous and on-demand DTC that sets when the sensor power supply circuit is shorted to ground or to circuit RMP07 (GN/WH).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Parking aid sensor(s)
- Parking aid bumper harness
- PAM

PINPOINT TEST E: DTC B1299 - POWER SUPPLY SENSOR CIRCUIT SHORT TO GROUND

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

E1 CHECK THE BUMPER WIRING HARNESS

- Inspect the bumper wiring harness for opens, shorts, grounds, or corrosion.
- **Is the bumper wiring harness OK?**

  YES : Go to E2.

  NO : REPAIR or INSTALL a new bumper wiring harness. CLEAR the DTCs. REPEAT the self-test.

E2 CHECK THE LH OUTER SENSOR FOR AN INTERNAL SHORT

- Key in OFF position.
- Disconnect: Parking Aid Sensor C4009
- Key in ON position.
- Clear the DTCs. Repeat the on-demand self-test.
- **Is DTC B1299 still present?**

  YES : Go to E3.

  NO : INSTALL a new LH outer parking aid sensor. REFER to **Parking Aid Sensor**. CLEAR the DTCs. REPEAT the self-test.

E3 CHECK THE RH OUTER SENSOR FOR AN INTERNAL SHORT

- Key in OFF position.
- Disconnect: Parking Aid Sensor C4011
- Key in ON position.
- Clear the DTCs. Repeat the on-demand self-test.
- **Is DTC B1299 still present?**

  YES : Go to E4.

NO : INSTALL a new RH outer parking aid sensor. CONNECT the parking aid sensors. REFER to **Parking Aid Sensor**. CLEAR the DTCs. REPEAT the self-test.

E4 CHECK THE LH INNER SENSOR FOR AN INTERNAL SHORT

- Key in OFF position.
- Disconnect: Parking Aid Sensor C4010
- Key in ON position.
- Clear the DTCs. Repeat the on-demand self-test.
- **Is DTC B1299 still present?**

YES : Go to E5.

NO : INSTALL a new LH inner parking aid sensor. CONNECT the parking aid sensors. REFER to **Parking Aid Sensor**. CLEAR the DTCs. REPEAT the self-test.

E5 CHECK THE RH INNER SENSOR FOR AN INTERNAL SHORT

- Key in OFF position.
- Disconnect: Parking Aid Sensor C4012
- Key in ON position.
- Clear the DTCs. Repeat the on-demand self-test.
- **Is DTC B1299 still present?**

YES : CONNECT the parking aid sensors. Go to E6.

NO : INSTALL a new RH inner parking aid sensor. CONNECT the parking aid sensors. REFER to **Parking Aid Sensor**. CLEAR the DTCs. REPEAT the self-test.

E6 CHECK CIRCUIT LMP07 (BU/WH) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: PAM C4014

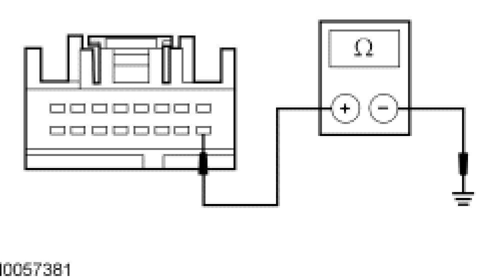


Fig. 1: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PAM C4014-9, circuit LMP07 (BU/WH), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

YES : Go to E7.

NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E7 CHECK CIRCUIT LMP07 (BU/WH) FOR A SHORT TO CIRCUIT RMP07 (GN/WH)

- Key in OFF position.

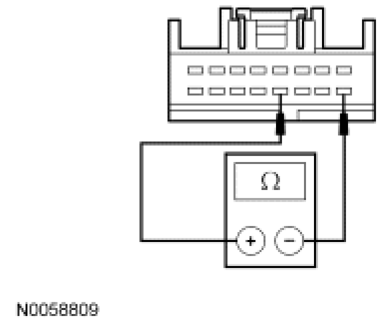


Fig. 2: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PAM C4014-9, circuit LMP07 (BU/WH), harness side and the PAM C4014-12, circuit RMP07 (GN/WH).
- **Is the resistance greater than 10,000 ohms?**

YES : Go to E8.

NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E8 CHECK FOR CORRECT PAM OPERATION

- Disconnect the PAM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the PAM connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new PAM. REFER to **Parking Aid Module**. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: DTC C1742 And C1743 - Rear Sounder Circuit Short To Voltage & Rear Sounder Circuit Failure

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Parking Aid for schematic and connector information.

Normal Operation

A 750 Hz variable warning tone is generated from the parking aid speaker. The parking aid module (PAM) increases the speaker warning tone rate as the vehicle gets closer to an obstacle. Circuits CMP09 (BN/BU) and RMP09 (BU/GN) provide the connection between the PAM and the speaker.

DTC C1742 is a continuous and on-demand DTC that sets when the sounder circuit is open or shorted to ground.

DTC C1743 is a continuous and on-demand DTC that sets when the sounder circuit is shorted to voltage.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- PAM
- Parking aid speaker

PINPOINT TEST F: DTC C1742 - REAR SOUNDER CIRCUIT FAILURE AND DTC C1743 - REAR SOUNDER CIRCUIT SHORT TO VOLTAGE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

F1 RETRIEVE THE DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS

- Key in ON position.
- Retrieve the PAM DTCs from the continuous and on-demand self-tests.
- **Is DTC C1742 or C1743 present?**

  YES : Go to F2.

  NO : For all other DTCs, REFER to DTC Charts in this service information.

F2 MEASURE THE PARKING AID SPEAKER RESISTANCE

- Disconnect: Parking Aid Speaker C3268

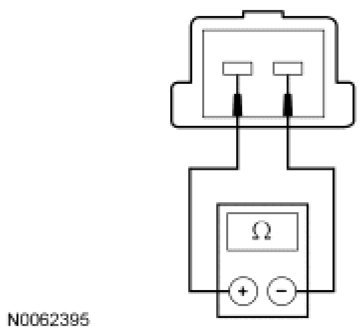


Fig. 3: Measuring Parking Aid Speaker Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the parking aid speaker pin 1, component side and the parking aid speaker pin 2, component side.
- **Is the resistance between 40 and 60 ohms?**

  YES : If DTC C1742 was recorded, go to F3.

  If DTC C1743 was recorded, go to F7.

  NO : INSTALL a new parking aid speaker. REFER to **Parking Aid Speaker**. CLEAR the DTCs. REPEAT the self-test.

F3 CHECK CIRCUIT CMP09 (BN/BU) FOR A SHORT TO GROUND

- Connect: Parking Aid Speaker C3268
- Disconnect: PAM C4014
- Measure the resistance between the PAM C4014-2, circuit CMP09 (BN/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to F5.

  NO : Go to F4.

F4 CHECK CIRCUIT CMP09 (BN/BU) FOR A SHORT TO GROUND WITH THE PARKING AID SPEAKER DISCONNECTED

- Disconnect: Parking Aid Speaker C3268
- Measure the resistance between the PAM C4014-2, circuit CMP09 (BN/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : REPAIR circuit RMP09 (BU/GN). CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR circuit CMP09 (BN/BU). CLEAR the DTCs. REPEAT the self-test.

F5 CHECK CIRCUIT CMP09 (BN/BU) FOR AN OPEN

- Disconnect: Parking Aid Speaker C3268

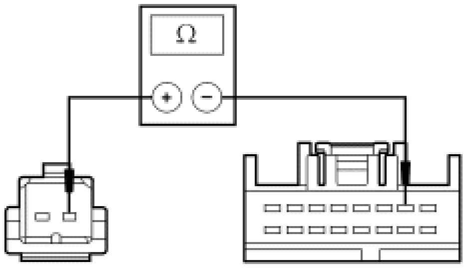


Fig. 4: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PAM C4014-2, circuit CMP09 (BN/BU), harness side and the parking aid speaker C3268-2, circuit CMP09 (BN/BU), harness side.

- **Is the resistance less than 5 ohms?**

  YES : Go to F6.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

F6 CHECK CIRCUIT RMP09 (BU/GN) FOR AN OPEN

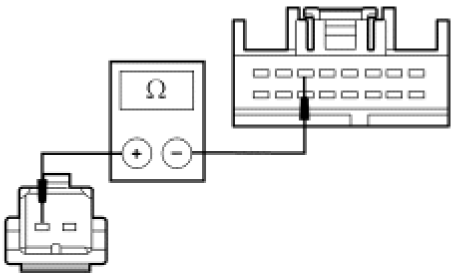


Fig. 5: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PAM C4014-6, circuit RMP09 (BU/GN), harness side and the parking aid speaker C3268-1, circuit RMP09 (BU/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to F8.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

F7 CHECK THE PARKING AID SPEAKER CIRCUITRY FOR SHORTS TO VOLTAGE

- Key in ON position.

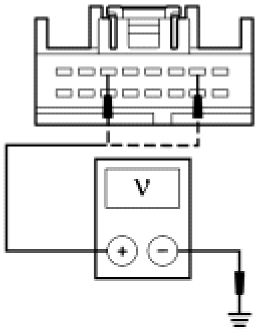


Fig. 6: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the PAM C4014-2, circuit CMP09 (BN/BU), harness side and ground; and between the PAM C4014-6, circuit RMP09 (BU/GN), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to F8.

F8 CHECK FOR CORRECT PAM OPERATION

- Disconnect the PAM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the PAM connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PAM. The PAM and speaker are serviced as one assembly. REFER to **Parking Aid Module**. CLEAR the DTCs. REPEAT the self-test. CARRY OUT the scan tool data link test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: DTC U0140 - Ignition Switch Position Missing

Normal Operation

The parking aid module (PAM) receives the ignition switch state from the smart junction box (SJB) as a network message.

DTC U0140 is a continuous and on-demand DTC that sets in the PAM when ignition switch state messages are not received from the SJB.

This pinpoint test is intended to diagnose the following:

- SJB
- Networked data fault

PINPOINT TEST G: DTC U0140 - IGNITION SWITCH POSITION MISSING

G1 CONFIRM THE DTC WILL SET IN CONTINUOUS MEMORY

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: PAM CMDTCs
- Clear the DTCs. Operate the system and determine if the concern is still present.
- Retrieve continuous PAM DTCs.
- **Is DTC U0140 present?**

  YES : Go to G2.

  NO : System is operating normally at this time.

G2 CHECK THE IGNITION SWITCH VOLTAGE PID

- Enter the following diagnostic mode on the diagnostic tool: PAM DataLogger
- Check the PAM ignition switch voltage PID (IGN_V).
- **Does the PID match the ignition switch position?**

  YES : REFER to **STEERING COLUMN SWITCHES** article.

  NO : Go to G3.

G3 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test H: DTC U0155 - PRNDL Missing

Normal Operation

The parking aid module (PAM) receives the transmission selector (PRNDL) state from the instrument cluster (IC) as a gateway message from the PCM.

DTC U0155 is a continuous and on-demand DTC that sets in the PAM when PRNDL messages are not received from the smart junction box (SJB).

This pinpoint test is intended to diagnose the following:

- IC
- Networked data fault

PINPOINT TEST H: DTC U0155 - PRNDL MISSING

H1 CONFIRM THE DTC WILL SET IN CONTINUOUS MEMORY

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: PAM CMDTCs
- Clear the DTCs. Operate the system and determine if the concern is still present.
- Retrieve continuous PAM DTCs.

- **Is DTC U0155 present?**

  YES : Go to H2.

  NO : System is operating normally at this time.

H2 VERIFY THE IC PRNDL DISPLAY FUNCTIONS CORRECTLY

- Monitor the IC PRNDL display while moving the gearshift lever through the range of positions.
- **Does the PRNDL match all range positions?**

  YES : Go to H3.

  NO : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article to diagnose the PRNDL.

H3 CHECK FOR CORRECT IC OPERATION

- Disconnect the IC connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the IC connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new IC. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test I: The Volume Cutback Is Inoperative

Normal Operation

With the ignition switch in the RUN position and the gear selector in REVERSE (R), the parking aid system calculates the distance to an object by the use of a radar sensor. A 750 Hz variable warning tone is generated by the parking aid sounder. A volume cutback request message is sent to the audio control module (ACM) from the parking aid module (PAM) over the medium speed controller area network (MS-CAN) to decrease the volume of the audio system, so that the parking aid sounder may be clearly heard.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- PAM
- ACM

PINPOINT TEST I: THE VOLUME CUTBACK IS INOPERATIVE

I1 VERIFY THE PAM COMMUNICATES WITH THE INSTRUMENT CLUSTER (IC) MESSAGE CENTER DISPLAY

- Apply the parking brake.
- Key in ON position.
- Apply the brake pedal and place the gear selector in REVERSE (R).
- Disable/enable the parking aid system by pressing the reset button on the message center switch.
- **Can the PAM be disabled/enabled in the IC message center display?**

  YES : Go to I3.

  NO : Go to I2.

I2 VERIFY THE CORRECT PAM IS INSTALLED

- Check to make sure the correct PAM is installed.
- **Has the PAM been replaced prior?**

  YES : VERIFY the correct PAM is installed. If correct, go to I3.

  NO : INSTALL the correct PAM. REFER to **Parking Aid Module**. TEST the system for normal operation.

I3 CHECK FOR CORRECT PAM OPERATION

- Disconnect the PAM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the PAM connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PAM. REFER to **Parking Aid Module**. TEST the system for normal operation.

  NO : The system is operating correctly at this time.

GENERAL PROCEDURES

AZIMUTH SYSTEM CHECK

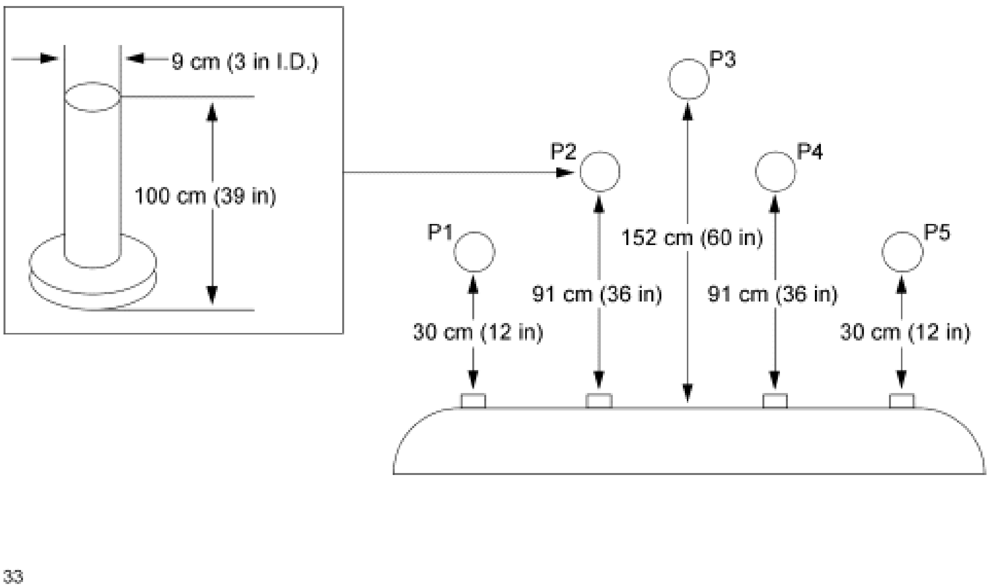


Fig. 7: Minimum Detectable Object Locations
Courtesy of FORD MOTOR CO.

NOTE:	**The object used in this system check can be fabricated from 9 cm O.D. (3 in I.D) plastic pipe 100 cm (39 in) in length (available as PVC pipe, or similar from a hardware or plumbing supply).**
NOTE:	**The following system check should be carried out with the vehicle on a level surface. The specified object locations are approximate, not absolute**
NOTE:	**The parking aid system will default to on when the ignition key is cycled from OFF to ON.**
NOTE:	**The scan tool may be used to monitor distance PIDs. The distance PIDs read between 0 and 255 cm (0 and 8 ft) on a correctly functioning system.**

1. Turn the ignition to the ON position, engine off.
2. Set the parking brake on.
3. Place the gear shift in REVERSE (R).
4. Verify that the parking aid system detects the specified object when placed within the 5 specified locations (P1, P2, P3, P4, P5). The pipe should be inside of these locations.
   - The speaker should beep slowly when objects are detected on the outer edges of the detection zone, and increase as the object is moved closer to the vehicle.

When the object is within 46 cm (18 in) of the rear bumper, the sounder should be on continuously.

ELEVATION SYSTEM CHECK

NOTE: The following system check should be carried out with the vehicle on a 3.0 m wide by 4.5 m deep (10 ft wide by 15 ft deep) smooth concrete surface, free of all obstacles and noise from fan and pneumatic tools.

1. Turn the ignition to the ON position, engine off.

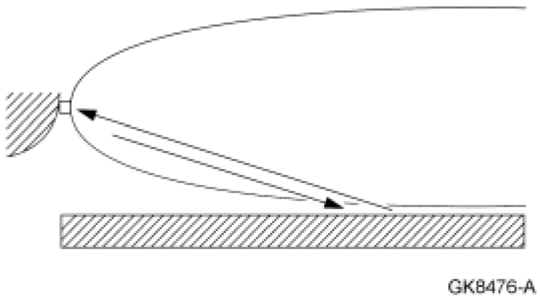


Fig. 8: Checking Parking Aid System
Courtesy of FORD MOTOR CO.

2. Set the parking brake.
3. Place the gear shift in REVERSE (R).
4. Verify that no audible alerts are heard. If audible alerts are heard, check to make sure the bumper is correctly installed and is not tilted downward so that the sensor is pointing at the ground.

REMOVAL AND INSTALLATION

PARKING AID MODULE

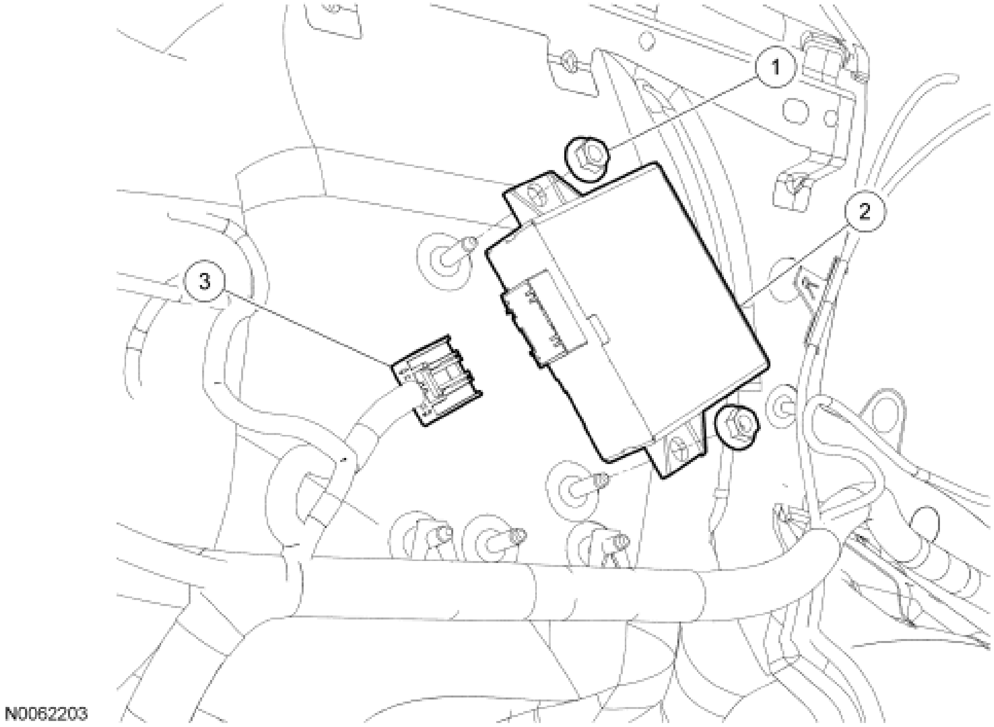


Fig. 9: Exploded View Of Parking Aid Module
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Parking aid module (PAM) nut
2	15K866	PAM
3	-	PAM electrical connector (part of 14A005)

REMOVAL AND INSTALLATION

CAUTION: Electronic modules are sensitive to electrical charges. If exposed to these charges, damage may result.

1. Remove the LH rear quarter trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the 2 nuts and the parking aid module (PAM).
3. Disconnect the PAM electrical connector.
4. To install, reverse the removal procedure.

PARKING AID SENSOR

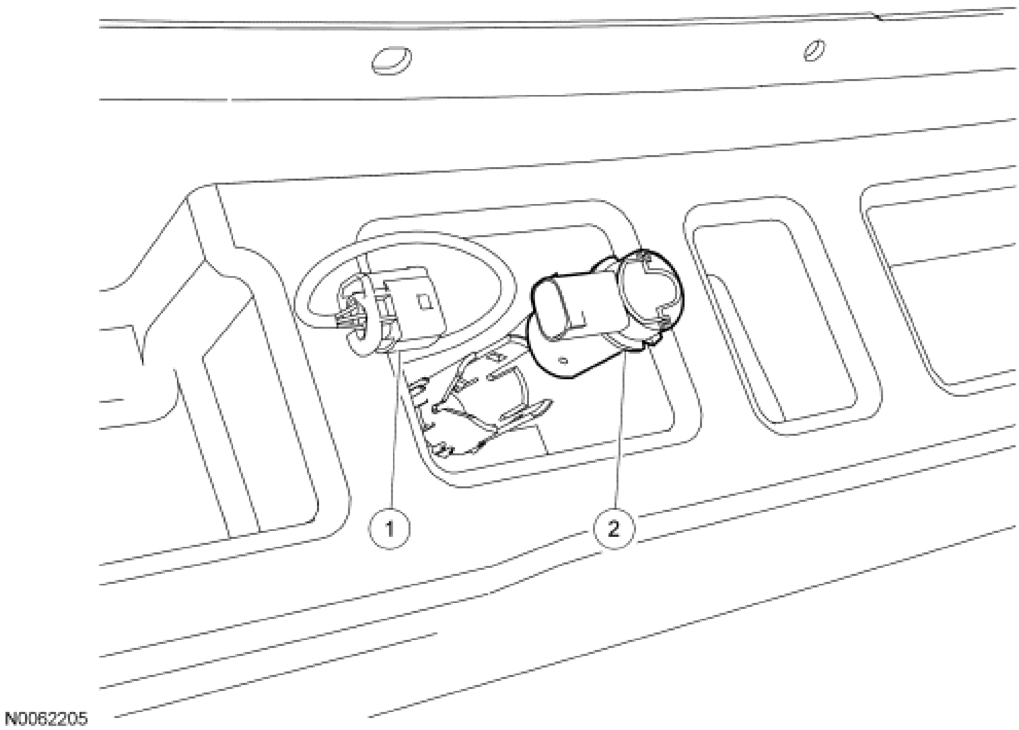


Fig. 10: Exploded View Of Parking Aid Sensor
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Parking aid sensor electrical connectors (part of 14N139)
2	14489	Parking aid sensors

1. Remove the rear bumper cover. For additional information, refer to **BUMPERS** article.
2. Disconnect the parking aid sensor(s) electrical connector(s).
3. Press the retaining tabs and remove the parking aid sensor(s).
4. To install, reverse the removal procedure.

PARKING AID SPEAKER

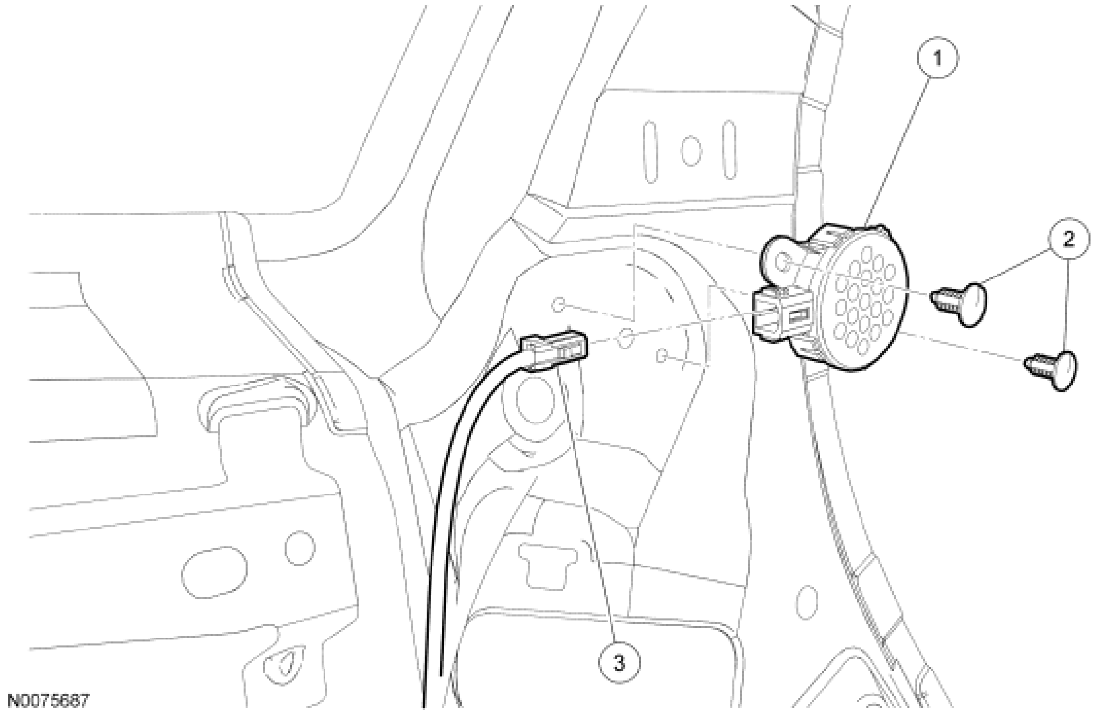


Fig. 11: Identifying Parking Aid Speaker
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	15K864	Parking aid speaker
2	W705635	Parking aid speaker push pins (2 required)
3	-	Parking aid speaker electrical connector (part of 14A005)

REMOVAL AND INSTALLATION

1. Remove the LH rear quarter trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the 2 push pin and the parking aid speaker.
    - Disconnect the parking aid speaker electrical connector.
3. To install, reverse the removal procedure.

2008 BRAKES

Parking Brake Actuation - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Front parking brake cable bracket bolts	23	17	-
Front parking brake cable floor plate bolts	23	17	-
Front parking brake cable-to-control nut	23	17	-
Parking brake control nuts	23	17	-
Rear parking brake cable bracket bolts	23	17	-
Rear parking brake cable-to-support plate bolts	23	17	-
Rear stabilizer bar link nut	35	26	-
Wheel speed sensor bolt	7	-	62

DESCRIPTION AND OPERATION

PARKING BRAKE

The parking brake and actuation system consists of the following components:

- Parking brake cables
- Parking brake control
- Parking brake shoes

The parking brake system is a mechanical system that activates a shoe-and-drum parking brake within the rear brake disc.

The parking brake system is cable-actuated and controlled by an independent pedal-operated parking brake control. The parking brake control applies tension to the front parking brake cable and conduit. The front parking brake cable is coupled to the LH rear parking brake cable and conduit which is coupled to the RH rear parking brake cable. The parking brake cable and conduits actuate the parking brake levers, engaging the parking brake shoes with the parking brake drum and hat assembly. The parking brake warning indicator is located in the instrument cluster. It illuminates to signal the driver that the parking brake is applied or to signal a low brake fluid condition. The warning indicator system is diagnosed in **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

The parking brake cable system tension is self-adjusting.

DIAGNOSTIC TESTS

PARKING BRAKE

Principles of Operation

Parking Brake System - The parking brake system is an independent cable-actuated system controlled by an foot-operated parking brake control that is not self-adjusting. When the parking brake control is pressed, tension is applied to the front cable and is applied to the brake shoes through the equalizer and the rear parking brake cables. To return the system to the released position, the parking brake control is pressed a second time.

Inspection and Verification

NOTE: Prior to carrying out any diagnosis, make sure the red brake warning indicator is functional. Refer to INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES article.

The first indication that something may be wrong in the brake system is a change in the feeling through the parking brake control. The parking brake not holding on an incline or dragging after being released are also indicators of system concerns.

Check the operation of the parking brake system with the vehicle on a hoist and the parking brake control fully released. Check for any damaged cables and install new components as necessary. Carry out the brake system diagnosis.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

VISUAL INSPECTION CHART

Mechanical
• Front parking brake cable and conduit • LH rear parking brake cable and conduit • Parking brake control • Parking brake cable equalizer • Rear parking brake shoes and hardware • RH rear parking brake cable and conduit

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and Go to **Symptom Chart**.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
		• REPAIR or INSTALL new parking brake components as necessary. REFER to **Parking Brake Control**,

• Rear brakes drag	• Parking brake component	**Parking Brake Cable - Rear, LH**, **Parking Brake Cable - Rear, RH**, **Parking Brake Cable - Front** or **Parking Brake Shoes**.
	• Brake caliper guide pins	• INSPECT the brake caliper guide pins. REFER to Diagnosis and Testing in **BRAKE SYSTEM - GENERAL INFORMATION** article. REPAIR or INSTALL new components as necessary.
	• Brake caliper	• INSPECT the brake calipers as necessary. REFER to Diagnosis and Testing in **BRAKE SYSTEM - GENERAL INFORMATION** article. REPAIR or INSTALL new components as necessary.
	• Brake booster	• CARRY OUT the Brake Booster Component Test. REFER to Diagnosis and Testing in **BRAKE SYSTEM - GENERAL INFORMATION** article.
	• Brake master cylinder	• CARRY OUT the Brake Master Cylinder Component Test. REFER to Diagnosis and Testing in **BRAKE SYSTEM - GENERAL INFORMATION** article.
• The parking brake does not apply	• Front parking brake cable • Parking brake control • Parking brake equalizer • Parking brake shoes and hardware • Rear parking brake cables	• Go to **Pinpoint Test A**.
• The parking brake will not release	• Front parking brake cable • Parking brake control • Parking brake control release handle • Parking brake return springs • Parking brake shoes and hardware	• Go to **Pinpoint Test B**.

	• Rear parking brake cables	

Pinpoint Tests

Pinpoint Test A: The Parking Brake Does Not Apply

Normal Operation

When the parking brake control is applied, tension is applied to the front parking brake cable. This tension is applied to both rear cables through the equalizer. The tension in the rear cables pulls on the parking brake shoe actuators and applies the parking brakes.

This pinpoint test is intended to diagnose the following:

- Front parking brake cable
- Parking brake control
- Parking brake shoe actuators
- Parking brake shoes and hardware
- Rear parking brake cables

PINPOINT TEST A: THE PARKING BRAKE DOES NOT APPLY

A1 CHECK THE PARKING BRAKE CONTROL

- Press the parking brake control pedal.
- **Does the parking brake control move?**

  YES : Go to A2.

  NO : Go to A3.

A2 CHECK FOR BROKEN CABLES

- Remove the rear brake disc. Refer to **REAR DISC BRAKE** article.

  NOTE: **Have an assistant press and release the parking brake pedal to help isolate disconnected cables or cables that do not move.**

- Inspect the following items for damage and correct connections:
  - Cable equalizer
  - Front cable
  - LH rear cable and return spring
  - Parking brake control
  - Parking brake shoe actuators
  - RH rear cable and return spring
- **Is any damage found or are any components disconnected?**

YES : CONNECT the component(s) or INSTALL new parking brake component(s) as necessary. TEST the system for normal operation.

NO : INSTALL new parking brake shoes. REFER to **Parking Brake Shoes**. TEST the system for normal operation.

A3 ISOLATE THE PARKING BRAKE CONTROL AND FRONT PARKING BRAKE CABLE

- Disconnect the return spring from the equalizer.
- Relieve the tension in the parking brake cable by loosening the equalizer adjustment nut until the rear cables can be disconnected from the equalizer.
- Disconnect both rear cables from the equalizer.
- Press the parking brake control pedal.
- **Does the parking brake control pedal move?**

YES : Go to A4.

NO : Go to A6.

A4 ISOLATE THE REAR PARKING BRAKE CABLES

- Remove the rear parking brake cable-to-support plate bolts and disconnect the rear parking brake cables from their actuators.
  - To install, tighten the bolts to 23 Nm (17 lb-ft).
- While holding the cable conduit, attempt to slide the LH and the RH cables inside their conduits.
- **Do the cables slide freely inside their conduits?**

YES : Go to A5.

NO : INSTALL new rear brake cable(s). REFER to **Parking Brake Cable - Rear, LH** and/or **Parking Brake Cable - Rear, RH**. TEST the system for normal operation.

A5 ISOLATE THE PARKING BRAKE SHOE ACTUATORS

- Remove the LH and RH parking brake shoes. Refer to **Parking Brake Shoes**.
- Attempt to move the LH and RH parking brake shoe actuators by hand.
- **Do the actuators move?**

YES : INSTALL new parking brake shoes. REFER to **Parking Brake Shoes**. TEST the system for normal operation.

NO : INSTALL new parking brake shoe actuator(s). REFER to Brake Caliper Support Plate in **REAR DISC BRAKE** article. TEST the system for normal operation.

A6 ISOLATE THE FRONT PARKING BRAKE CABLE

- Remove the parking brake control adjustment nut and remove the front parking brake cable from the parking brake control.
- Attempt to slide the front parking brake cable inside the conduit.
- **Does the cable slide freely inside the conduit?**

YES : INSTALL a new parking brake control. REFER to **Parking Brake Control**. TEST the system for normal operation.

NO : INSTALL a new front parking brake cable. REFER to **Parking Brake Cable - Front**. TEST the system for normal operation.

Pinpoint Test B: The Parking Brake Will Not Release

Normal Operation

When the parking brake control is fully applied and the pedal is pressed a second time, the ratchet mechanism and return spring in the parking brake control cause the tension on the parking brake cables to release. The springs on both rear parking brake cables and the spring on the equalizer provide the force necessary to return the system to the released position.

This pinpoint test is intended to diagnose the following:

- Front parking brake cable
- Parking brake control
- Parking brake shoe actuators
- Parking brake shoes and hardware
- Rear parking brake cables

PINPOINT TEST B: THE PARKING BRAKE WILL NOT RELEASE

B1 CHECK THE PARKING BRAKE CONTROL

- Press the parking brake control pedal.
- **Does the parking brake control move?**

  YES : Go to B3.

  NO : Go to B2.

B2 ISOLATE THE PARKING BRAKE CONTROL

- Release the parking brake cable tension at the parking brake control adjusting nut.
- Disconnect the parking brake cable at the parking brake lever.
- Press the parking brake control pedal.
- **Does the parking brake control move?**

  YES : Go to B3.

  NO : INSTALL a new parking brake control. REFER to **Parking Brake Control**. TEST the system for normal operation.

B3 ISOLATE THE FRONT PARKING BRAKE CABLE

- Disconnect the return spring from the equalizer.
- If necessary, relieve the tension in the parking brake cable by loosening the equalizer adjustment nut until the rear cables can be disconnected from the equalizer.
- Disconnect the LH and RH cables from the equalizer.
- Verify that the front cable can slide freely in the conduit.
- **Does the cable slide freely in the conduit?**

  YES : Go to B4.

  NO : INSTALL a new front cable. REFER to **Parking Brake Cable - Front**. TEST the system for normal operation.

B4 ISOLATE THE REAR PARKING BRAKE CABLES

- Remove the rear parking brake cable-to-support plate bolts and disconnect the rear parking brake cables from their actuators.
  - To install, tighten the bolts to 23 Nm (17 lb-ft).
- While holding the cable conduit, attempt to slide the LH and the RH cables inside their conduits.
- **Do the cables slide freely inside their conduits?**

  YES : Go to B5.

  NO : INSTALL new rear brake cable(s). REFER to **Parking Brake Cable - Rear, LH** and/or **Parking Brake Cable - Rear, RH**. TEST the system for normal operation.

B5 ISOLATE THE PARKING BRAKE SHOE ACTUATORS

- Remove the LH and RH parking brake shoes. Refer to **Parking Brake Shoes**.
- Attempt to move the LH and RH parking brake shoe actuators by hand.
- **Do the actuators move?**

  YES : INSTALL new parking brake shoes. REFER to **Parking Brake Shoes**. TEST the system for normal operation.

  NO : INSTALL new parking brake shoe actuator(s). REFER to Brake Caliper Support Plate in **REAR DISC BRAKE** article. TEST the system for normal operation.

GENERAL PROCEDURES

PARKING BRAKE CABLE ADJUSTMENT

NOTE: Cable tension is adjusted in 2 locations, the first location is at the parking brake control, the second location is at the parking brake cable equalizer. The tension must be adjusted equally at both locations.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

   NOTE: The dimension will vary depending on the amount of cable stretch. New cables require cycling the parking brake control 5-10 times to remove the cable slack.

2. Adjust the parking brake control adjustment nut as shown.

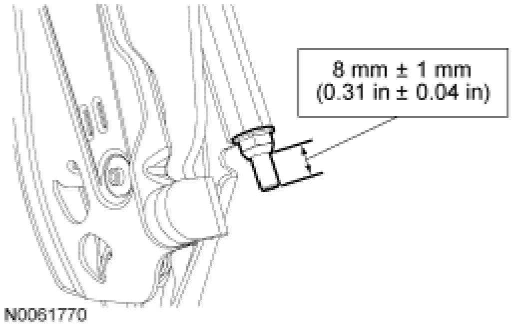


Fig. 1: Adjusting Parking Brake Control Adjustment Nut With Specifications
Courtesy of FORD MOTOR CO.

3. Adjust the parking brake cable equalizer adjustment nut as shown.

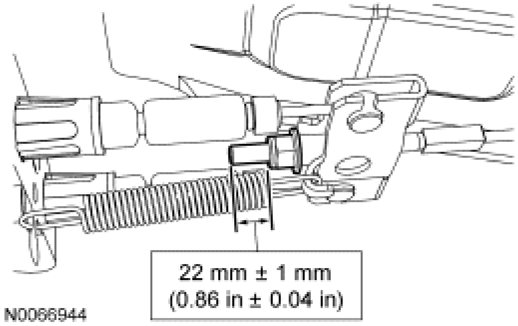


Fig. 2: Adjusting Parking Brake Cable Equalizer Adjustment Nut With Specifications
Courtesy of FORD MOTOR CO.

4. Fully apply the parking brake pedal 3 times to verify correct operation of the parking brake system.
    - With the parking brake cable in the fully released position, brake drag should not be present.

REMOVAL AND INSTALLATION

PARKING BRAKE WARNING INDICATOR SWITCH

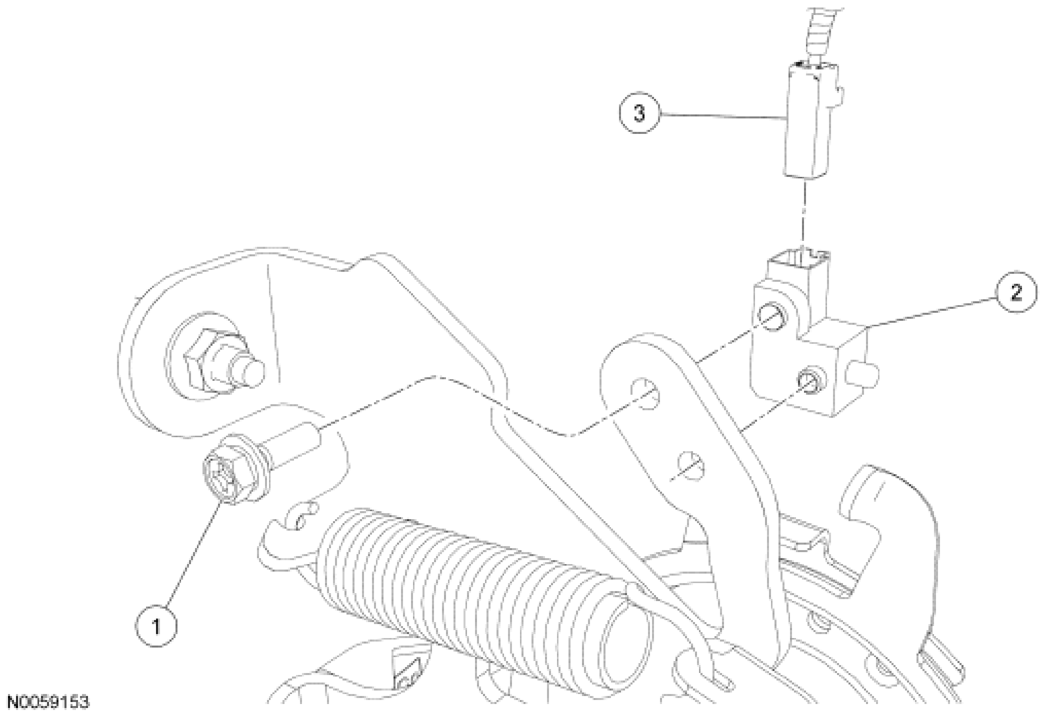


Fig. 3: Exploded View Of Parking Brake Warning Indicator Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Parking brake warning indicator switch screw (part of 15A851)
2	15A851	Parking brake warning indicator switch
3	-	Electrical connector (part of 14A005)

REMOVAL AND INSTALLATION

1. Disconnect the parking brake warning indicator switch electrical connector.
2. Remove the parking brake warning indicator switch screw and the switch.
3. To install, reverse the removal procedure.

PARKING BRAKE CONTROL

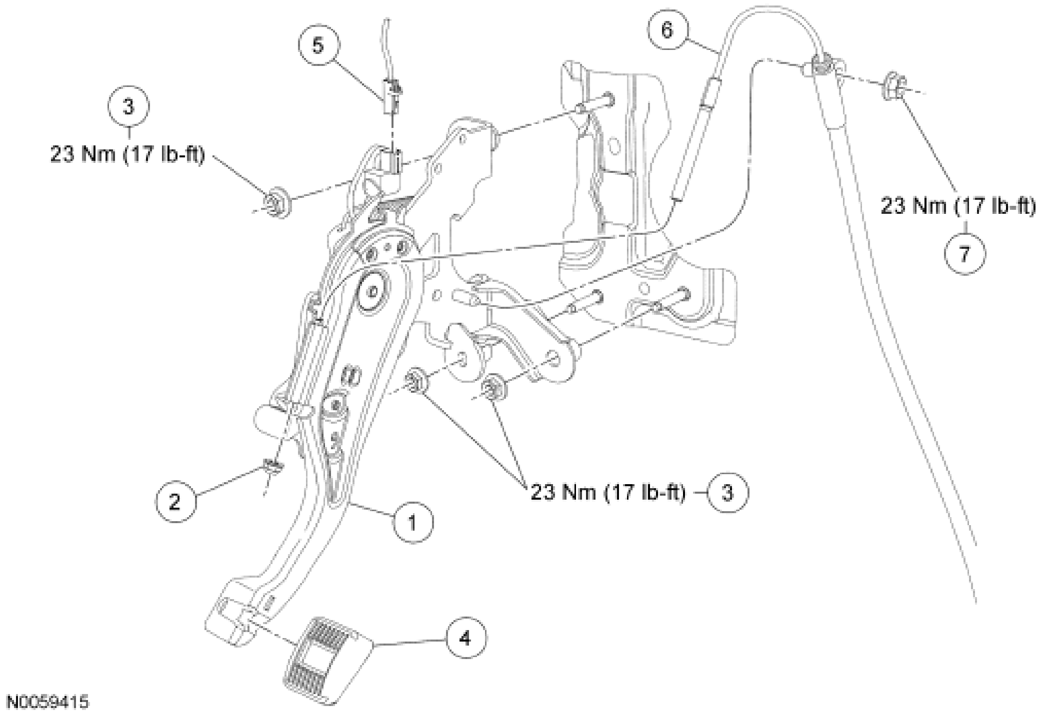


Fig. 4: Exploded View Of Parking Brake Control With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2760	Parking brake control
2	-	Parking brake control adjustment nut (part of 2853)
3	W707144	Parking brake control nuts (3 required)
4	2454	Parking brake control pad
5	15852	Parking brake switch electrical connector (part of 14A005)
6	2853	Front parking brake cable
7	-	Front parking brake cable-to-control nut (part of 2853)

REMOVAL AND INSTALLATION

1. Disconnect the parking brake switch electrical connector.
2. Remove the parking brake control adjustment nut.
3. Remove the front parking brake cable-to-control nut and position the front cable aside.
   - To install, tighten to 23 Nm (17 lb-ft).
4. Remove the 3 parking brake control nuts and the parking brake control.
   - To install, tighten to 23 Nm (17 lb-ft).

5. To install, reverse the removal procedure.
    - Adjust the parking brake cable. For additional information, refer to **Parking Brake Cable Adjustment**.

PARKING BRAKE CABLE - REAR, LH

NOTE: All wheel drive (AWD) vehicles shown, front wheel drive (FWD) vehicles similar.

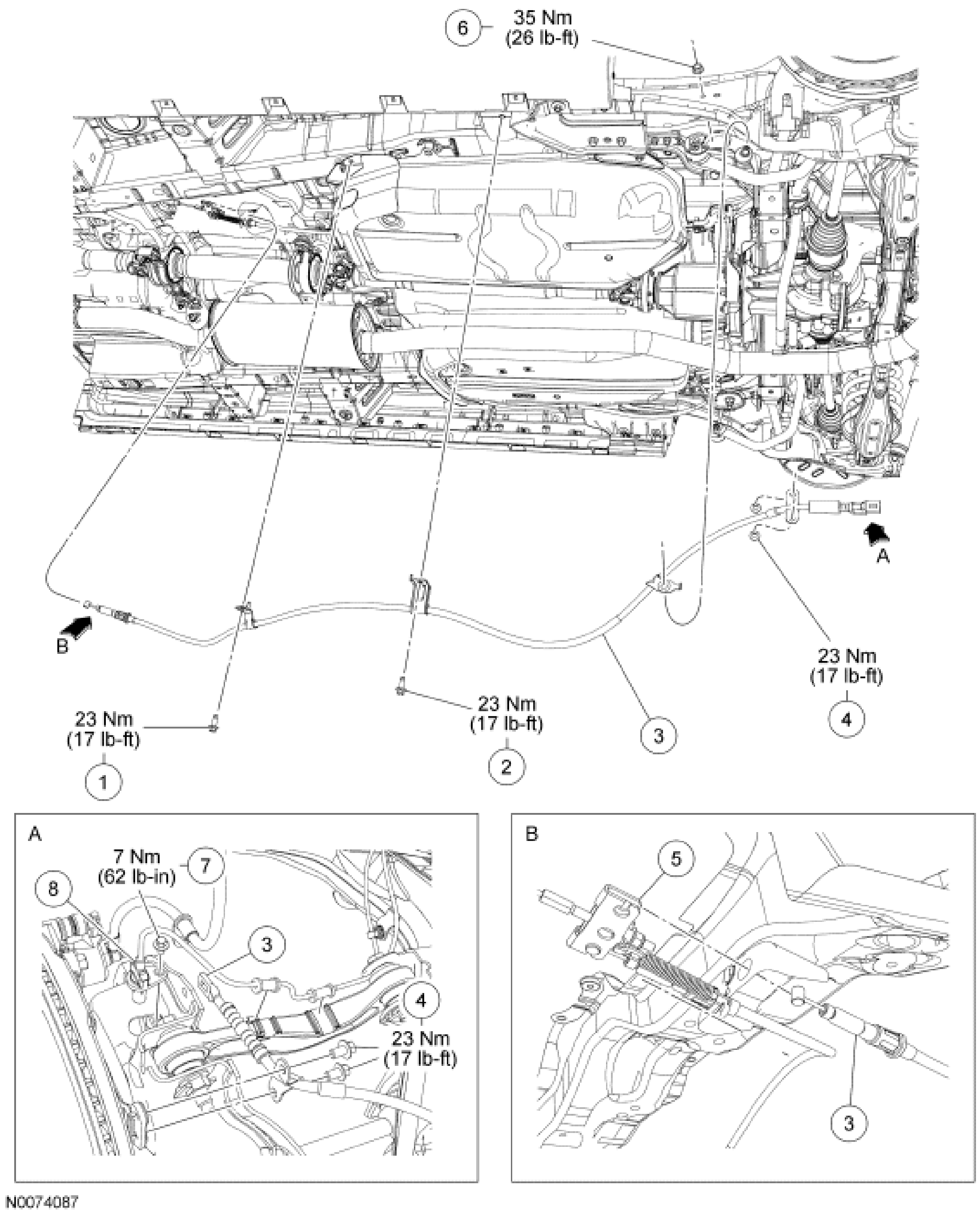


Fig. 5: Exploded View Of Rear LH Parking Brake Cable With Torque Specifications
Courtesy of FORD MOTOR CO.

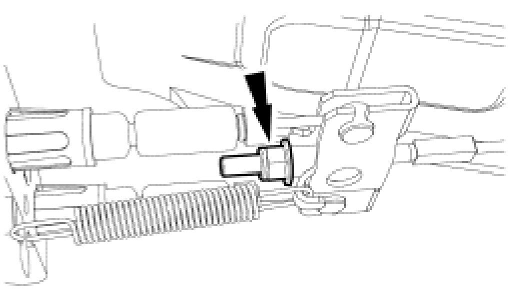
Item	Part Number	Description
1	W708004	Parking brake cable front bracket bolt
2	W708004	Parking brake cable middle bracket bolt

3	2A635	LH parking brake cable
4	W500021	Parking brake cable-to-support plate bolts (2 required)
5	-	Parking brake cable equalizer (part of 2853)
6	W520414	Rear stabilizer bar link nut
7	W500010	Wheel speed sensor bolt
8	2C190	Wheel speed sensor

REMOVAL AND INSTALLATION

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Relieve the tension in the parking brake cable by loosening the equalizer adjustment nut.



N0059407

Fig. 6: Locating Equalizer Adjustment Nut
Courtesy of FORD MOTOR CO.

3. Disconnect the LH parking brake cable from the equalizer.
4. Squeeze the tabs and disconnect the LH parking brake cable from the bracket.

All wheel drive (AWD) vehicles

5. Remove the wheel speed sensor bolt and position the wheel speed sensor aside.
   - To install, tighten to 7 Nm (62 lb-in).

All vehicles

6. Remove the 2 parking brake cable-to-support plate bolts and disconnect the cable from the lever.
   - To install, tighten to 23 Nm (17 lb-ft).
7. Remove the stabilizer bar link nut and position the stabilizer bar link aside.
   - To install, tighten to 35 Nm (26 lb-ft).

8. Remove the parking brake cable front bracket bolt, middle bracket bolt and the parking brake cable.
    - To install, tighten to 23 Nm (17 lb-ft).
9. To install, reverse the removal procedure.
    - Adjust the parking brake cable. For additional information, refer to **Parking Brake Cable Adjustment**.

PARKING BRAKE CABLE - REAR, RH

NOTE: All wheel drive (AWD) vehicles shown, front wheel drive (FWD) vehicles similar.

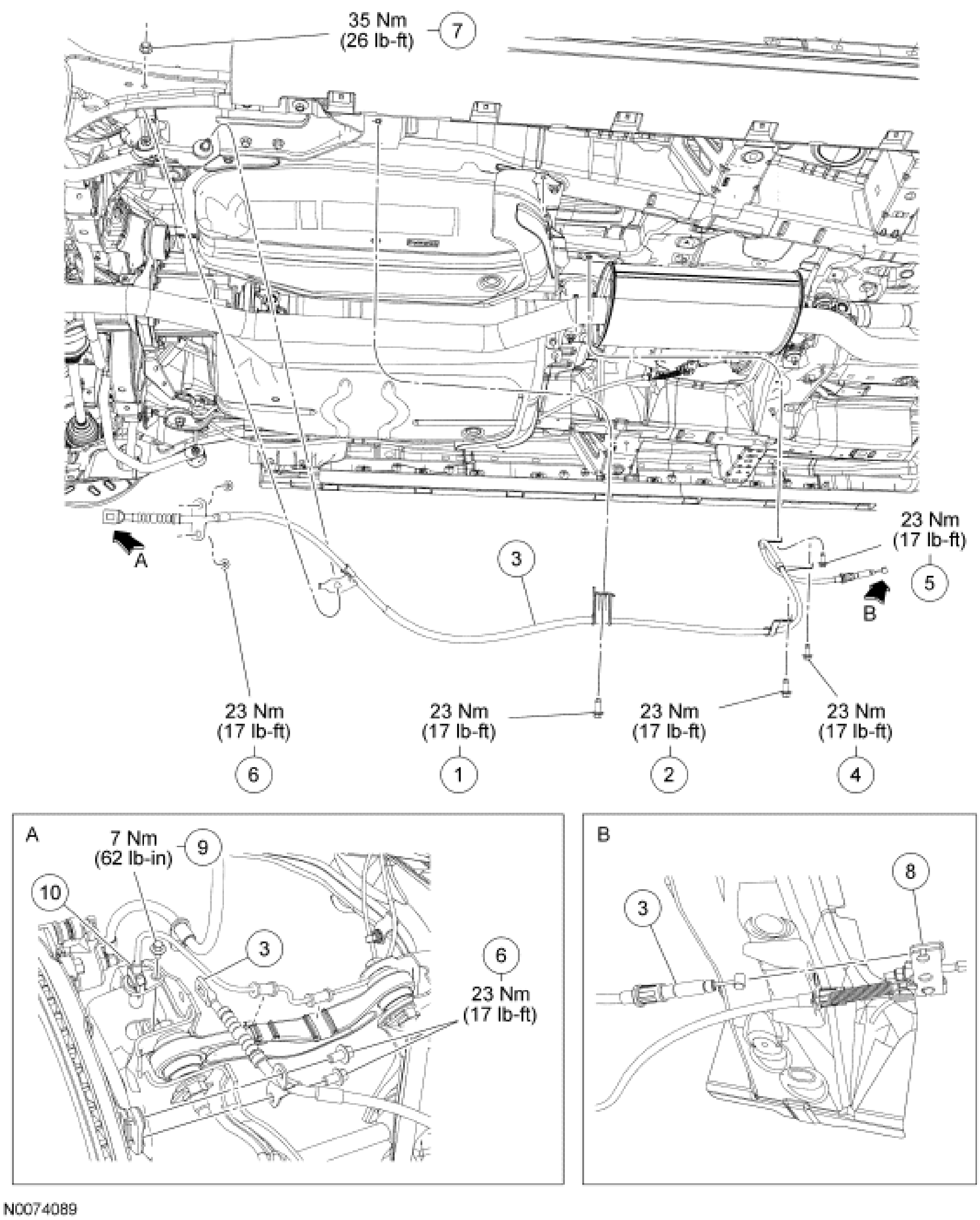


Fig. 7: Exploded View Of Rear RH Parking Brake Cable With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W708004	Parking brake cable rear bracket bolt
2	W708004	Parking brake cable middle bracket bolt

3	2A635	RH parking brake cable
4	W708004	Parking brake cable front LH bracket bolt
5	W708004	Parking brake cable front RH bracket bolt
6	W500021	Parking brake cable-to-support plate bolts (2 required)
7	W520414	Rear stabilizer bar link nut
8	-	Parking brake cable equalizer (part 2853)
9	W500010	Wheel speed sensor bolt
10	2C190	Wheel speed sensor

REMOVAL AND INSTALLATION

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Relieve the tension in the parking brake cable by loosening the equalizer adjustment nut.

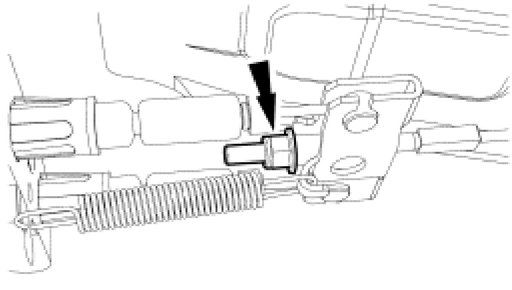


Fig. 8: Locating Equalizer Adjustment Nut
Courtesy of FORD MOTOR CO.

3. Disconnect the RH parking brake cable from the equalizer.
4. Squeeze the tabs and disconnect the RH parking brake cable from the bracket.

All wheel drive (AWD) vehicles

5. Remove the wheel speed sensor bolt and position the wheel speed sensor aside.
   - To install, tighten to 7 Nm (62 lb-in).

All vehicles

6. Remove the 2 parking brake cable-to-support plate bolts and disconnect the cable from the lever.
   - To install, tighten to 23 Nm (17 lb-ft).

7. Remove the stabilizer bar link nut and position the stabilizer bar link aside.
   - To install, tighten to 35 Nm (26 lb-ft).
8. Remove the 4 parking brake cable bracket bolts and the parking brake cable.
   - To install, tighten to 23 Nm (17 lb-ft).
9. To install, reverse the removal procedure.
   - Adjust the parking brake cable. For additional information, refer to **Parking Brake Cable Adjustment**.

PARKING BRAKE CABLE - FRONT

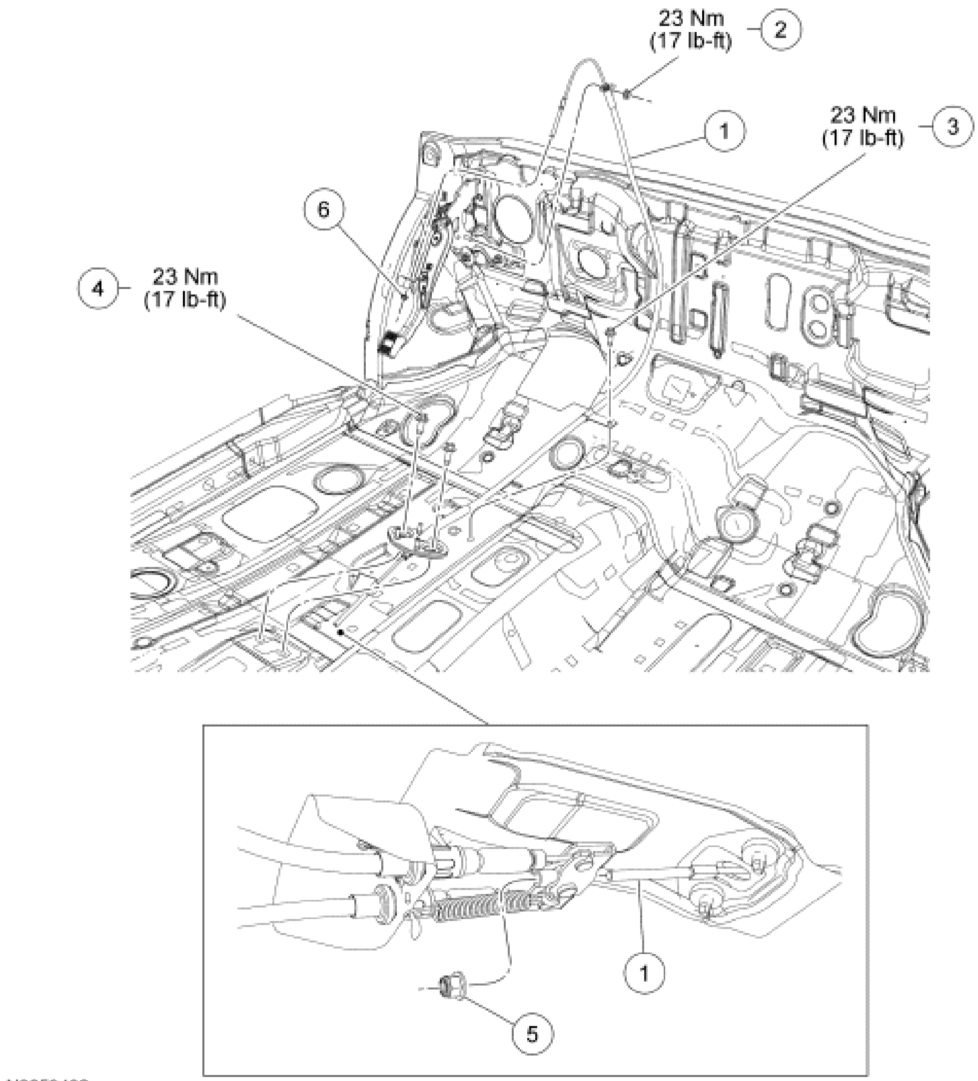


Fig. 9: Exploded View Of Front Parking Brake Cable With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2853	Front parking brake cable
2	-	Front parking brake cable-to-control nut (part of 2853)
3	W708004	Front parking brake cable bracket bolt
4	W708004	Front parking brake cable floor plate bolt (2 required)
5	W520201	Parking brake cable equalizer adjustment nut
6	-	Parking brake control adjustment nut (part of 2853)

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the parking brake cable equalizer adjustment nut and disconnect the front cable from the equalizer.
3. Remove the LH front seat. For additional information, refer to **SEATING** article.
4. Remove the LH front door scuff plate. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
5. Remove the parking brake control adjustment nut.
6. Remove the front parking brake cable-to-control nut and remove the front parking brake cable from the control.
    - To install, tighten to 23 Nm (17 lb-ft).
7. Remove the front parking brake cable bracket bolt.
    - To install, tighten to 23 Nm (17 lb-ft).
8. Remove the 2 front parking brake cable floor plate bolts.
    - To install, tighten to 23 Nm (17 lb-ft).
9. Remove the front parking brake cable.
10. To install, reverse the removal procedure.
    - Adjust the parking brake cable. For additional information, refer to **Parking Brake Cable Adjustment**.

PARKING BRAKE SHOES

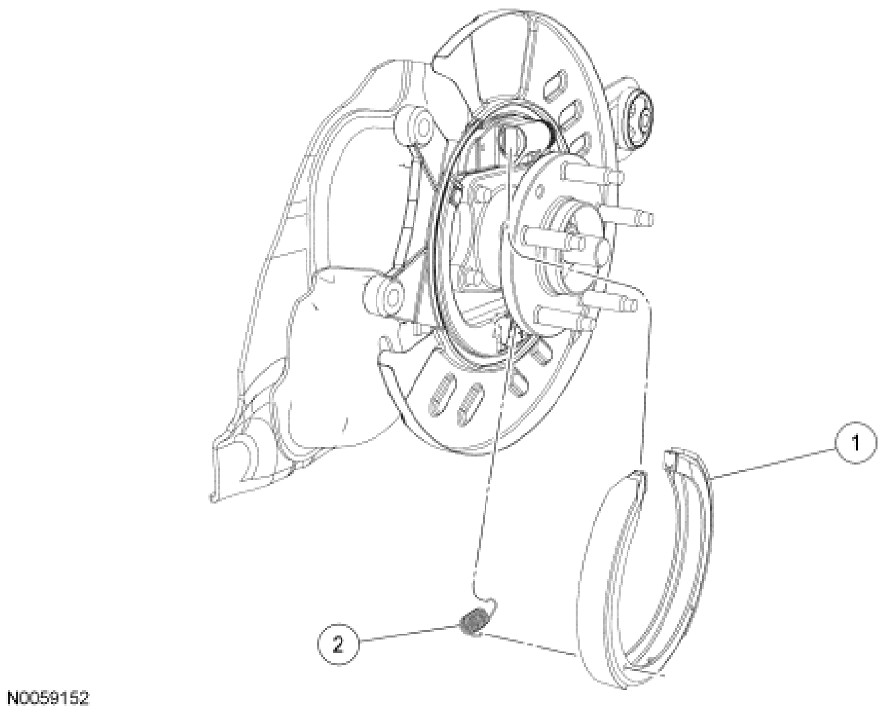


Fig. 10: Exploded View Of Parking Brake Shoes
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2648	Parking brake shoe
2	2L642	Parking brake shoe return spring

REMOVAL AND INSTALLATION

1. Remove the rear brake disc. For additional information, refer to **REAR DISC BRAKE** article.
2. Remove the parking brake shoe return spring.
3. Remove the parking brake shoe.
4. To install, reverse the removal procedure.
   - Check the parking brake for normal operation.

2008 ENGINE PERFORMANCE

Pinpoint Tests - Gasoline Engines

DIAGNOSTIC TESTS

PINPOINT TEST A: NO START

WARNING: **Stop this test at the first sign of a fuel leak and repair as required.**

No open flame. No smoking during fuel delivery checks.

Failure to follow these instructions may result in personal injury.

This pinpoint test is intended to diagnose the following:

- spark (as related to electronic engine control)
- powertrain control module (PCM) (12A650)

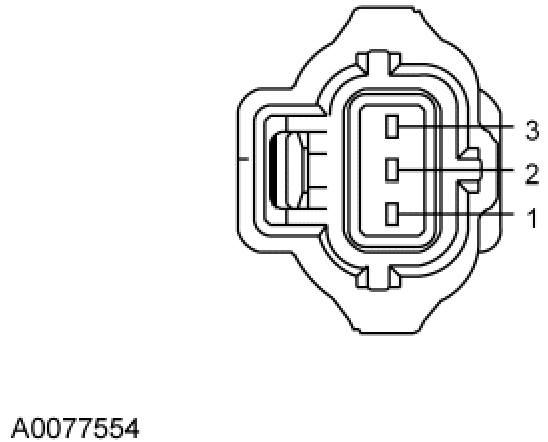


Fig. 1: Throttle Position (TP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

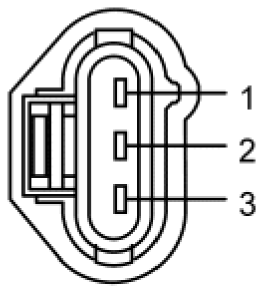


Fig. 2: Throttle Position (TP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Ranger 2.3L	A	1 3	SIGRTN VREF
All other vehicles	B	3 1	SIGRTN VREF

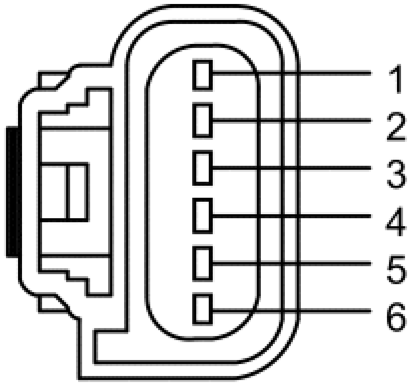


Fig. 3: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

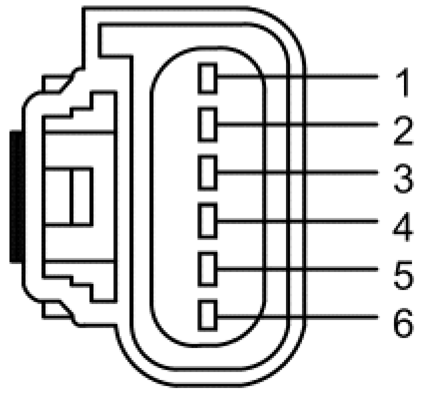


Fig. 4: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - B
Courtesy of FORD MOTOR CO.

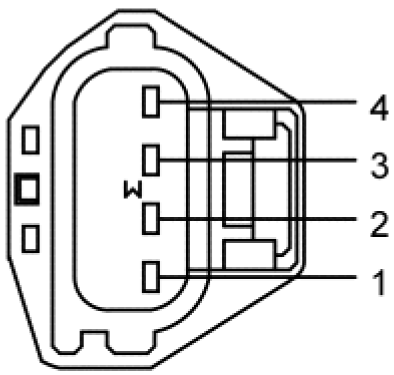


Fig. 5: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus,	A	2 3	ETCRTN ETCREF

Taurus X			
Fusion 2.3L, Milan 2.3L	B	3 5	ETCRTN ETCREF
Fusion 3.0L, Milan 3.0L	B	4 5	ETCRTN ETCREF
All other vehicles	C	3 2	ETCRTN ETCREF

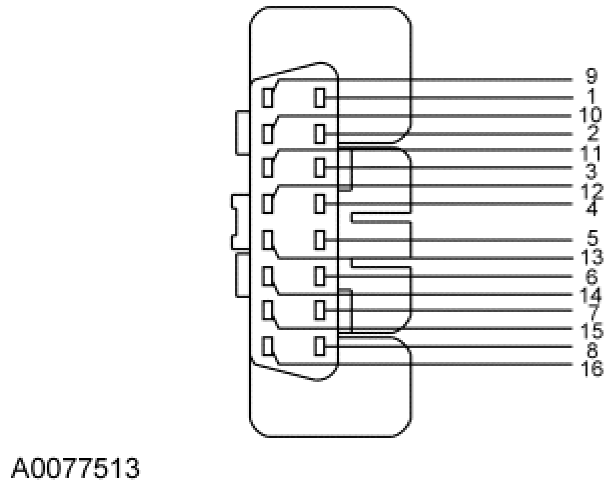


Fig. 6: Data Link Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
13	FEPS (Flash EEPROM Programming Signal)

A1 ATTEMPT TO CRANK THE ENGINE

NOTE: Verify the inertia fuel shutoff (IFS) switch is set (button pushed in). Refer to the Owner's Literature for location.

- **Does the engine crank?**

Yes	No
GO to **A2**.	REFER to the **STARTING SYSTEM - GASOLINE ENGINES -- E-SERIES** and diagnose the engine does not crank symptom.

A2 IDENTIFY THE TYPE OF NO START

NOTE: The purpose of this test step is to identify intermittent no starts in order to determine the proper repair procedure.

- **Does the vehicle start?**

Yes	No
The vehicle has an intermittent no start. refer to **PINPOINT TEST Z**.	GO to **A3**.

A3 DETERMINE THE THROTTLE TYPE

- **Is the vehicle equipped with electronic throttle control?**

Yes	No
GO to **A5**.	GO to **A4**.

A4 CHECK THE VREF VOLTAGE TO TP SENSOR

- Key in OFF position.
- TP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) TP Sensor Connector, Harness Side	(-) TP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **A6**.	refer to **PINPOINT TEST C**.

A5 CHECK VREF VOLTAGE TO ETBTPS SENSOR

- Key in OFF position.
- ETBTPS connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ETBTPS Connector, Harness Side	(-) ETBTPS Connector, Harness Side
ETCREF	ETCRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **A6**.	refer to **PINPOINT TEST C**.

A6 CHECK THE FLASH EEPROM PROGRAMMING SIGNAL (FEPS) CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- TP Sensor connector connected.
- ETBTPS connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) DLC, Harness Side	(-) Vehicle Battery
FEPS - Pin 13	Negative terminal

- **Is the voltage less than 9 V?**

Yes	No
GO to **A7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

A7 CHECK THE RPM IN THE PCM

NOTE: **Connect the scan tool to a reliable voltage source that is powered with the key in the START position (such as directly to the vehicle battery). Also verify that the vehicle battery is fully charged.**

NOTE: **Normal engine cranking speed is between 150 RPM and 350 RPM.**

- Access the PCM and monitor the RPM PID.
- Crank the engine while viewing the RPM PID.
- **Is the RPM between 150 RPM - 350 RPM?**

Yes	No
GO to **A8**.	For base engine concerns, REFER to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** - General Information and diagnose difficult starting symptom. For all others, GO to **JD2**.

A8 CHECK FOR CKP AND CMP SYNCHRONIZATION

- Access the PCM and monitor the SYNC PID.
- Crank the engine while viewing the SYNC PID.
- **Does the SYNC PID read YES?**

Yes	No
GO to **A9**.	GO to **JD2**.

A9 CHECK THE PCM DRIVER SIGNAL TO THE COILS

NOTE: Test lamp bulb filament wattages vary widely. The intensity and duration of blinking depends on the test lamp being used.

- Connect a test lamp between B+ and each coil driver circuit at the harness connector.
- Crank the engine.
- **Does the test lamp blink consistently for each coil driver (1 blink per engine revolution)?**

Yes	No
GO to **A10**.	For coil-on-plug (COP) ignition testing, GO to **JB2**. For coil pack ignition testing, GO to **JC2**.

A10 CHECK THE FUEL PRESSURE

WARNING: **The fuel system remains pressurized when the engine is not running. To prevent injury or fire, use caution when working on the fuel system.**

Refer to the fuel system WARNING information at the beginning of Pinpoint Test HC.

Failure to follow these instructions may result in personal injury.

NOTE: While activating the fuel pump on an electronic returnless fuel system a brief pressure spike may occur.

- Key in OFF position.
- Relieve the fuel pressure. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure.
- Connect the fuel pressure gauge to the Schrader valve using the appropriate fuel pressure test hose and adaptor.
- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Activate the fuel pump to obtain maximum fuel pressure.
- **Is the fuel pressure within specification (refer to the fuel pressure chart in Pinpoint Test HC)?**

Yes	No
GO to **A11**.	refer to **PINPOINT TEST HC**.

A11 CHECK THE FUEL PRESSURE LEAKDOWN

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Activate the fuel pump to obtain maximum fuel pressure.
- Exit output test mode.
- Monitor the fuel pressure.
- Verify the fuel pressure remains within 34 kPa (5 psi) of the maximum pressure for 1 minute after turning the pump off.
- **Does fuel pressure remain within 34 kPa (5 psi)?**

Yes	No
GO to **A12**.	refer to **PINPOINT TEST HC**.

A12 CHECK THE FUEL INJECTORS FOR VOLTAGE

NOTE: **A no start condition typically exists only if greater than half of the fuel injectors are without voltage. Check at least 2 fuel injectors, 1 on each bank on V type engines.**

- Key in OFF position.
- Disconnect 2 fuel injectors.
- Key ON, engine OFF.
- Measure the VPWR voltage at each fuel injector harness connector.
- **Is the voltage greater than 10 volts?**

Yes	No
GO to **A13**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

A13 CHECK THE FUEL INJECTORS' ABILITY TO DELIVER FUEL

- Cycle the key several times to charge the fuel system.
- Disable the fuel pump.
- Monitor the fuel pressure gauge while cranking the engine for at least 5 seconds.
- **Is there a pressure drop greater than 34 kPa (5 psi) while cranking the engine?**

Yes	No
The electronic engine control (EEC) system is not	

the cause of the no start. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	GO to **A14**.

A14 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST B: POWERTRAIN CONTROL MODULE (PCM) POWER RELAY

NOTE: The IGN START/RUN and ground circuits, or the B+ and VPWR circuits may be reversed in the harness connector. Refer to the Wiring Diagrams article Electronic Engine Control Cell for schematic and connector information.

This pinpoint test is intended to diagnose the following:

- harness circuits: B+, IGN START/RUN, INJPWRM, ISP-R, PCMRC, VPWR and GND
- PCM power relay (12A646)
- PCM (12A650)

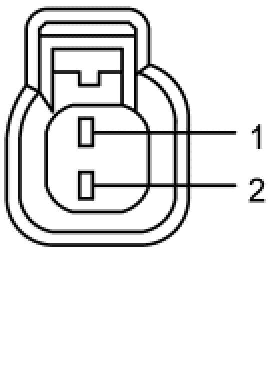


Fig. 7: Injector (INJ) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Fusion 3.0L, Milan 3.0L	A	1	VPWR
All other vehicles	A	2	VPWR

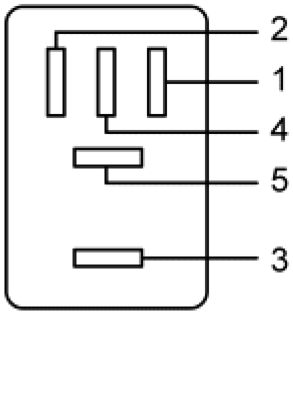


Fig. 8: Powertrain Control Module Power (PCM Power) Relay Connector - A
Courtesy of FORD MOTOR CO.

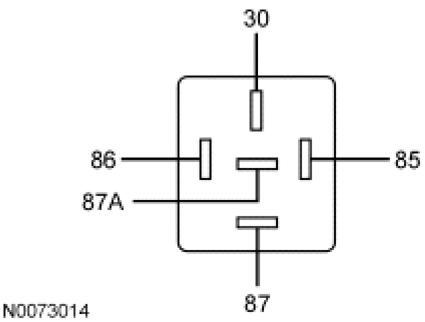


Fig. 9: Powertrain Control Module Power (PCM Power) Relay Connector - B
Courtesy of FORD MOTOR CO.

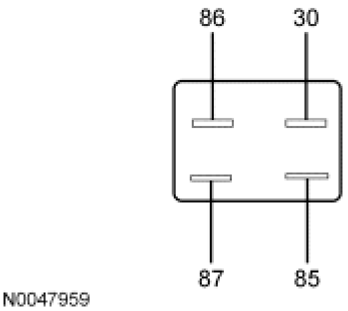


Fig. 10: Powertrain Control Module Power (PCM Power) Relay Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Escape/Mariner, Grand Marquis	A	5 2 1 3	VPWR GND IGN START/RUN B+
Expedition, F-Super Duty, Fusion, Milan, MKZ, Navigator, Sable, Taurus, Taurus X	B	87 86 30, 85	VPWR PCMRC B+
Explorer, Explorer Sport Trac, Mountaineer	B	87 85 30, 86	VPWR PCMRC B+
F-150, Mark LT	A	5 1 2, 3	VPWR PCMRC B+
Focus	A	3 2	VPWR PCMRC

		1, 5	B+
Mustang	C	87 85 30, 86	VPWR PCMRC B+
All other vehicles	B	87 85 86 30	VPWR GND IGN START/RUN B+

Vehicle	Connector	Pin	Circuit
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B33 B51, B52, B53 B7 B8	INJPWRM VPWR ISP-R PCMRC
Escape/Mariner	150 (50-50-50) Pin	B35, B36	VPWR
Expedition, Navigator	140 Pin	B33 B51, B52, B53 B7 B8	INJPWRM VPWR ISP-R PCMRC
Explorer, Explorer Sport Trac, Mountaineer	170 Pin	B35, B36 B46 B37	VPWR ISP-R PCMRC
F-150 4.6L, F-150 5.4L, Mark LT	190 Pin	B51, B52, B53 B17 B40	VPWR ISP-R PCMRC
F-150 4.2L	190 Pin	B33 B51, B52, B53 B17 B40	INJPWRM VPWR ISP-R PCMRC
F-Super Duty	170 Pin	E23 B35, B36 B31 B37	INJPWRM VPWR ISP-R PCMRC
Focus	190 Pin	B21 B67, B68 B42 B38	INJPWRM VPWR ISP-R PCMRC
Fusion, Milan, MKZ	140 Pin	B45 B51, B52 B37 B35	INJPWRM VPWR ISP-R PCMRC
Mustang	170 Pin	E23 B35, B36 B46	INJPWRM VPWR ISP-R

		B37	PCMRC
All other vehicles	170 Pin	B35, B36	VPWR

B1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Is DTC P0685, P0689, or P0690 present?**

Yes	No
For DTCs P0685 or P0690, GO to **B8**. For DTC P0689, GO to **B11**.	GO to **B2**.

B2 CHECK THE B+ AND IGN START/RUN VOLTAGE TO PCM POWER RELAY

- Key in OFF position.
- PCM Power Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Power Relay Connector, Harness Side	(-)
B+	Ground
IGN START/RUN	Ground

- **Are the voltages greater than 10 V?**

Yes	No
For Crown Victoria, Grand Marquis, E-Series, Escape/Mariner, Ranger, and Town Car, GO to **B6**. For all others, GO to **B3**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B3 CHECK THE PCMRC CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM	

Power Relay Connector, Harness Side	(-) PCM Connector, Harness Side
PCMRC	PCMRC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **B4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B4 CHECK THE PCMRC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
PCMRC	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **B5**.

B5 CHECK THE ISP-R VOLTAGE AT THE PCM HARNESS CONNECTOR

- Key in OFF position.
- PCM Power Relay connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ISP-R	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **B7**.	REPAIR the open circuit. CLEAR the DTCs.

	REPEAT the self-test.

B6 CHECK THE PCM POWER RELAY GROUND CIRCUIT FOR AN OPEN

- Measure the voltage between:

(+) PCM Power Relay Connector, Harness Side	(-) PCM Power Relay Connector, Harness Side
B+	GND

- **Is the voltage greater than 10 V?**

Yes	No
GO to **B7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B7 CHECK FOR AN OPEN VPWR CIRCUIT BETWEEN THE PCM AND POWER RELAY

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Power Relay Connector, Harness Side	(-) PCM Connector, Harness Side
VPWR	VPWR

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new PCM Power relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B8 DTCS P0685 OR P0690: CHECK THE PCMRC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- PCM Power Relay connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
PCMRC	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **B9**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

B9 CHECK THE ISP-R CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ISP-R	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **B10**.

B10 CHECK THE INJPWRM CIRCUIT FOR AN OPEN IN THE HARNESS

- INJ connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) INJ Connector, Harness Side
INJPWRM	VPWR

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **B12**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B11 DTC P0689: CHECK THE ISP-R VOLTAGE AT THE PCM HARNESS CONNECTOR

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ISP-R	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **B12**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B12 CHECK FOR CORRECT PCM OPERATION

- Key in OFF position.
- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST C: REFERENCE VOLTAGE (VREF)

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- harness circuits: ETCREF, ETCRTN, SIGRTN and VREF
- accelerator pedal position (APP) sensor (9F836)
- air conditioning pressure (ACP) transducer sensor (19D594)
- differential pressure feedback exhaust gas recirculation (EGR) sensor (9J460)
- EGR system module (ESM) (9Y456)
- fuel rail pressure temperature (FRPT) sensor (9G756)
- fuel tank pressure (FTP) sensor (9C052)
- manifold absolute pressure (MAP) sensor (9F479)
- power steering pressure (PSP) sensor (3N824)
- throttle position (TP) sensor (9B989)
- powertrain control module (PCM) (12A650)

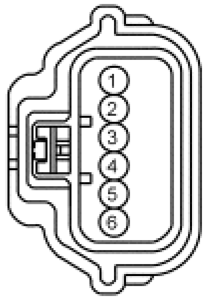


Fig. 11: Accelerator Pedal Position (APP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

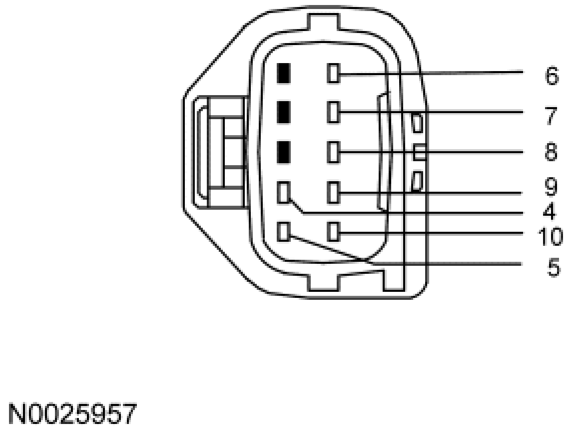


Fig. 12: Accelerator Pedal Position (APP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

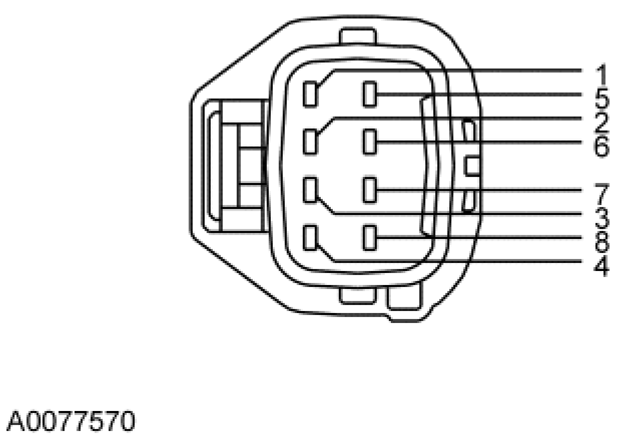


Fig. 13: Accelerator Pedal Position (APP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Focus	A	3, 4 1, 6	ETCRTN ETCREF
Fusion, Milan, MKZ	B	6, 9 10, 8	ETCRTN ETCREF
All other vehicles	C	1, 3 6, 7	ETCRTN ETCREF

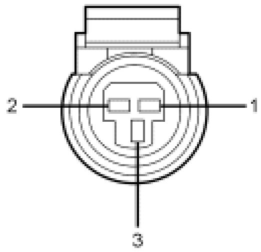


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Fig. 14: Air Conditioning Pressure (ACP) Transducer Sensor Connector - A
Courtesy of FORD MOTOR CO.

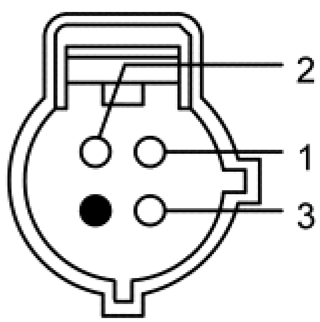

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Fig. 15: Barometric Pressure (BARO) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Fusion, Milan, MKX, MKZ	A	1 2	SIGRTN VREF
All other vehicles	B	1 2	SIGRTN VREF

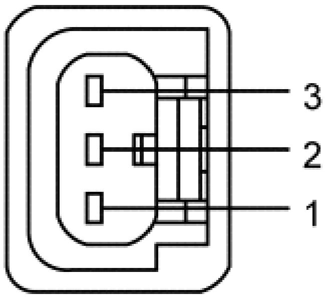

Fig. 16: Differential Pressure Feedback EGR Sensor Connector - A
Courtesy of FORD MOTOR CO.

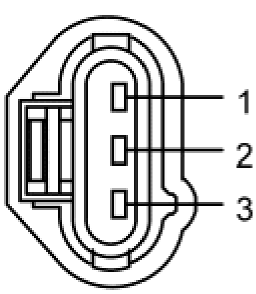

Fig. 17: Differential Pressure Feedback EGR Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Vehicles equipped with a tube mounted differential pressure feedback EGR sensor	A	1 2	VREF SIGRTN
All other vehicles	B	3 2	VREF SIGRTN

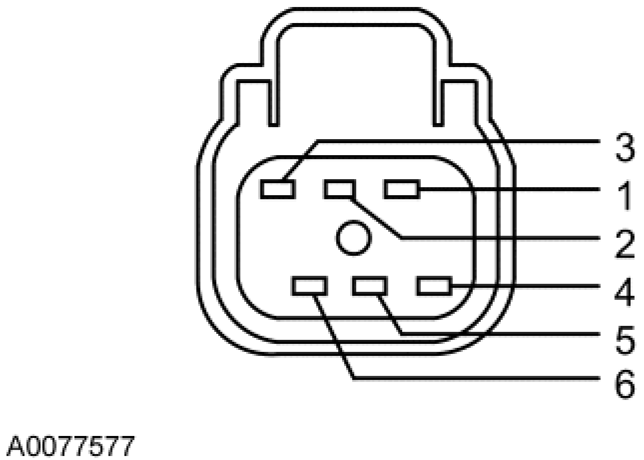

Fig. 18: EGR System Module (ESM) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
6	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

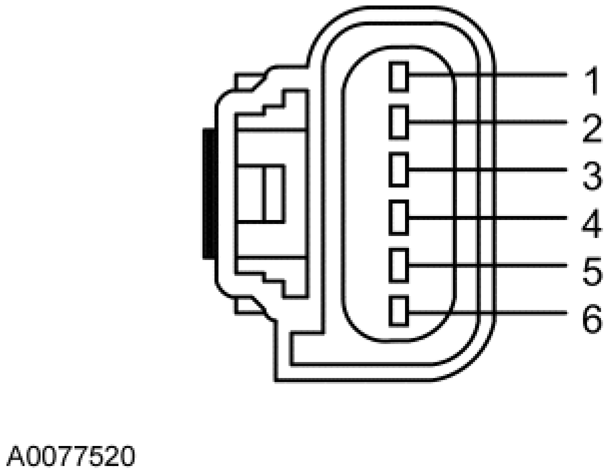

Fig. 19: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

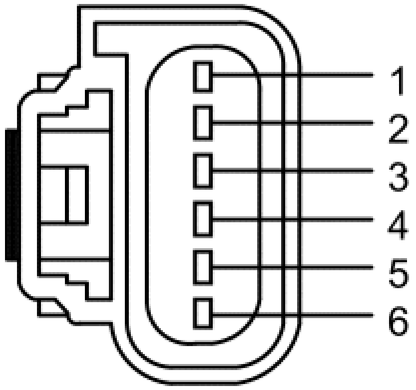

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Fig. 20: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - B
Courtesy of FORD MOTOR CO.

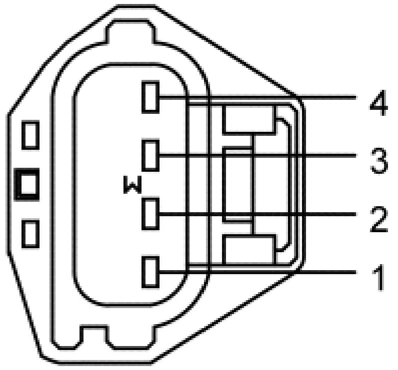

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Fig. 21: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus,	A	2 3	ETCRTN ETCREF

Taurus X			
Fusion 2.3L, Milan 2.3L	B	3 5	ETCRTN ETCREF
Fusion 3.0L, Milan 3.0L	B	4 5	ETCRTN ETCREF
All other vehicles	C	3 2	ETCRTN ETCREF

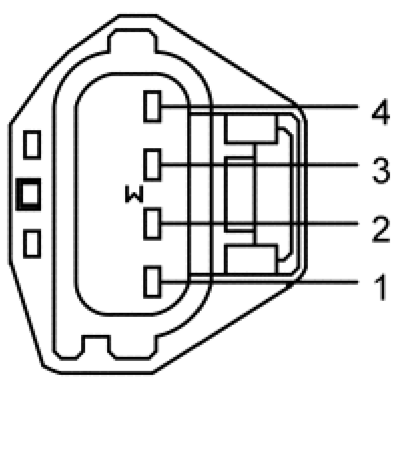

Fig. 22: Fuel Rail Pressure Temperature (FRPT) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	VREF (Reference Voltage)
4	SIGRTN (Signal Return)

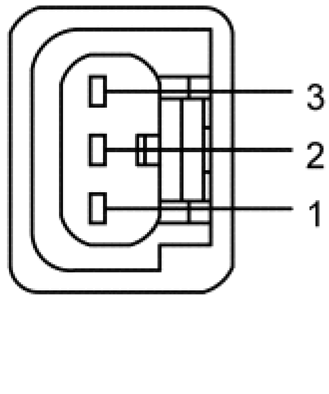

Fig. 23: Differential Pressure Feedback EGR Sensor Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	VREF (Reference Voltage)
2	SIGRTN (Signal Return)

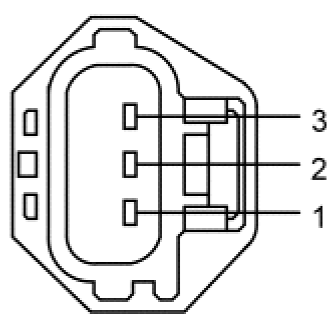

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Fig. 24: Manifold Absolute Pressure (MAP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

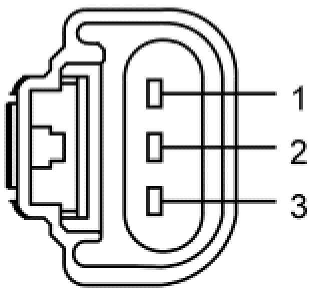

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Fig. 25: Manifold Absolute Pressure (MAP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

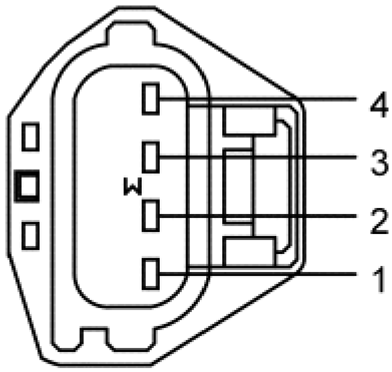

Fig. 26: Manifold Absolute Pressure (MAP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 3.0L	A	3 1	SIGRTN VREF
Fusion 3.0L, Milan 3.0L	B	2 3	SIGRTN VREF
All other vehicles	C	4 2	SIGRTN VREF

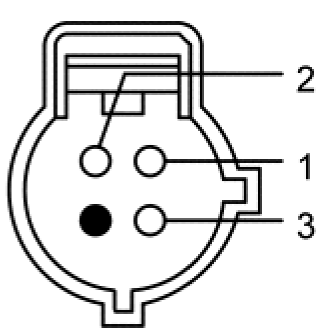

Fig. 27: Barometric Pressure (BARO) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit

2	VREF (Reference Voltage)
1	SIGRTN (Signal Return)

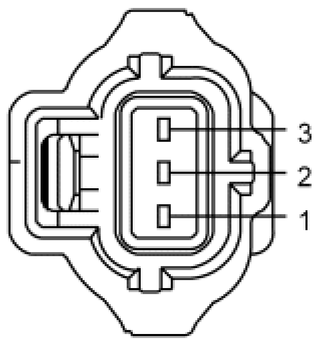

Fig. 28: Throttle Position (TP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

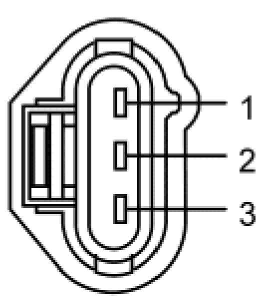

Fig. 29: Throttle Position (TP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Ranger 2.3L	A	3 1	VREF SIGRTN
All other vehicles	B	1 3	VREF SIGRTN

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Mustang, Town Car	170 Pin	B35, B36 B41, E58, T41 B41, B6, E59 B40, E57 B24, B4, E66	VPWR SIGRTN ETCRTN VREF ETCREF
E-Series, F-Super Duty	170 Pin	B35, B36 B41, E58, T41 B18, B6, E59 B40, E57 B16, B4, E66	VPWR SIGRTN ETCRTN VREF ETCREF
Escape/Mariner	150 (50-50-50) Pin	B35, B36 B41, E41, T41 B40, E40	VPWR SIGRTN VREF
Expedition, Navigator	140 Pin	B51, B52, B53 B58, E58 B59, B65, E59 E57 B21, B28, E66	VPWR SIGRTN ETCRTN VREF ETCREF
Explorer, Explorer Sport Trac, Mountaineer	170 Pin	B35, B36 B41, E58, T41 B43, B6, E59 B40, E57 B24, B4, E66	VPWR SIGRTN ETCRTN VREF ETCREF
F-150, Mark LT	190 Pin	B51, B52, B53 B58, E58, T43 B58, B59, E59 B29, E57 B21, B28, E66	VPWR SIGRTN ETCRTN VREF ETCREF
Focus	190 Pin	B67, B68 B58, E64, T40 B44, B60, E60 B52, B66, E63 B45, B61, E59	VPWR SIGRTN ETCRTN VREF ETCREF
Fusion, Milan, MKZ	140 Pin	B51, B52 B58, E58 B59, B60, E59 B33, E57 B21, B28, E66	VPWR SIGRTN ETCRTN VREF ETCREF
Ranger	170 Pin	B35, B36 B41, E58, T41 B40, E57	VPWR SIGRTN VREF
All other vehicles	190 Pin	B51, B52, B53 B58, E58	VPWR SIGRTN

		B59, B65, E59	ETCRTN
		B29, B64	VREF
		B21, B28, E66	ETCREF

SENSORS CONNECTED TO VREF/ETCREF

Applications	TP or ETC	APP	Differential Pressure Feedback EGR or ESM	FTP	ACP	PSPT	FRPT	MAP
Crown Victoria/Grand Marquis	ETC	X	X	X	X		X	
Edge/MKX	ETC	X		X	X			
Escape/Mariner - 2.3L	TP			X			X	X
Escape/Mariner - 3.0L	TP		X	X			X	X
E-Series - 4.6L/5.4L	ETC	X	X	X			X	
E-Series - 6.8L	ETC	X		X			X	
Expedition/Navigator	ETC	X		X				
Explorer/Explorer Sport Trac/Mountaineer	ETC	X	X	X			X	
F-150 - 4.2L	ETC	X	X	X			X	
F-150 - 4.6L	ETC	X	X	X		X	X	
F-150 - 5.4L/Mark LT	ETC	X		X		X	X	
F-Super Duty	ETC	X		X			X	
Focus	ETC	X		X		X		X
Fusion/Milan/MKZ	ETC	X		X	X			X
Mustang - 4.0L	ETC	X	X	X	X		X	
Mustang - 4.6L	ETC	X		X			X	
Mustang - 5.4L	ETC	X	X	X			X	
Ranger - 2.3L	TP			X				X
Ranger - 3.0L/4.0L	TP		X	X				
Taurus/Taurus X/Sable	ETC	X		X	X			
Town Car	ETC	X	X	X	X		X	

NOTE:

- **ETCREF and ETCRTN are internally bussed within the PCM and are dedicated circuits for the APP sensor and the electronic throttle body TP sensor only. Refer to the Wiring Diagrams article Electronic Engine Controls Cell for schematic and connector information.**

C1 CHECK THE REFERENCE VOLTAGE TO SIGRTN/ETCRTN

NOTE: **Diagnostic trouble codes (DTCs) P0642 and P0643 are set due to VREF circuit concerns only. When diagnosing DTC P0642 or P0643, follow the path for VREF**

concerns.

- Key in OFF position.
- Disconnect the suspect sensor.
- Key ON, engine OFF.
- For ETCREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-) Suspect Sensor Connector, Harness Side
ETCREF	ETCRTN

- For VREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-) Suspect Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **C19**.	GO to **C2**.

C2 CHECK THE REFERENCE VOLTAGE TO GROUND

- For ETCREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
ETCREF	Ground

- For VREF concerns.
- Measure the voltage between:

(+) Suspect	

Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **C18**.	GO to **C3**.

C3 CHECK THE REFERENCE VOLTAGE WITH ALL SENSORS DISCONNECTED

NOTE: **Refer to the Sensors Connected To VREF/ETCREF Chart at the beginning of this pinpoint test and the Wiring Diagrams article Electronic Engine Controls Cell to identify the sensors connected to VREF/ETCREF.**

- Key in OFF position.
- Disconnect all of the sensors connected to the VREF/ETCREF circuit.
- Key ON, engine OFF.
- Measure the voltage at the sensor disconnected in C1.
- For ETCREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
ETCREF	Ground

- For VREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For electronic throttle control (ETC) concerns, GO to **C8**.	GO to **C4**.

For all other VREF concerns, GO to **C10**.	

C4 CHECK THE REFERENCE VOLTAGE CIRCUIT FOR AN OPEN

- Key in OFF position.
- Disconnect the PCM.
- For ETCREF concerns.
- Measure the resistance between:

(+) Suspect Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ETCREF	ETCREF

- For VREF concerns.
- Measure the resistance between:

(+) Suspect Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	VREF

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **C5**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

C5 CHECK THE REFERENCE VOLTAGE CIRCUIT FOR A SHORT TO GROUND

- For ETCREF concerns.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ETCREF	ETCRTN

- Measure the resistance between:

(+) PCM	

Connector, Harness Side	(-)
ETCREF	Ground

- For VREF concerns.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
VREF	Ground

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **C6**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

C6 CHECK THE REFERENCE VOLTAGE CIRCUIT FOR A SHORT TO VPWR

- For ETCREF concerns.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ETCREF	VPWR

- For VREF concerns.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	VPWR

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **C7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

C7 CHECK THE REFERENCE VOLTAGE FOR A SHORT TO VOLTAGE

- Key ON, engine OFF.
- For ETCREF concerns.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ETCREF	Ground

- For VREF concerns.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
VREF	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **C20**.

C8 CHECK THE REFERENCE VOLTAGE WITH THE ELECTRONIC THROTTLE CONTROL CONNECTED

NOTE: If this sensor was used for the ETCREF measurement in C3, GO to C9.

- Key in OFF position.
- Connect the electronic throttle body throttle position sensor (ETBTPS).
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector,	(-)

Harness Side	
ETCREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
The concern is intermittent. refer to **PINPOINT TEST Z**.	INSTALL a new ETBTPS. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C9 CHECK THE REFERENCE VOLTAGE WITH THE APP SENSOR CONNECTED

- Key in OFF position.
- Connect the APP sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
ETCREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
The concern is intermittent. refer to **PINPOINT TEST Z**.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C10 CHECK THE REFERENCE VOLTAGE WITH THE TP SENSOR CONNECTED

NOTE: If this sensor was used for the VREF measurement in C3, GO to C11.

- Key in OFF position.
- Connect the TP sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect	

Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to **C11**. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C11 CHECK THE REFERENCE VOLTAGE WITH THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a differential pressure feedback EGR sensor or if this sensor was used for the VREF measurement in C3, GO to C12.**

- Key in OFF position.
- Differential Pressure Feedback EGR Sensor connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to **C12**. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new Differential Pressure Feedback EGR sensor. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C12 CHECK THE REFERENCE VOLTAGE WITH THE ESM CONNECTED

NOTE: **If the vehicle is not equipped with an ESM or if this sensor was used for the VREF measurement in C3, GO to C13.**

- Key in OFF position.
- Connect the ESM.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to **C13**. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C13 CHECK THE REFERENCE VOLTAGE WITH THE MAP SENSOR CONNECTED

NOTE: If the vehicle is not equipped with a MAP sensor or if this sensor was used for the VREF measurement in C3, GO to C14.

- Key in OFF position.
- Connect the MAP sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to **C14**. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new MAP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C14 CHECK THE REFERENCE VOLTAGE WITH THE FRPT SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a FRPT sensor or if this sensor was used for the VREF measurement in C3, GO to C15.**

- Key in OFF position.
- Connect the FRPT sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to **C15**. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new FRPT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C15 CHECK THE REFERENCE VOLTAGE WITH THE FTP SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a FTP sensor or if this sensor was used for the VREF measurement in C3, GO to C16.**

- Key in OFF position.
- Connect the FTP sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No

For additional sensors disconnected, GO to **C16**. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C16 CHECK THE REFERENCE VOLTAGE WITH THE ACP TRANSDUCER SENSOR CONNECTED

NOTE: If the vehicle is not equipped with an ACP transducer sensor or if this sensor was used for the VREF measurement in C3, GO to C17.

- Key in OFF position.
- Connect the ACP transducer sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to **C17**. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new Air Conditioning Pressure (ACP) Transducer Sensor. CLEAR the DTCs. REPEAT the self-test.

C17 CHECK THE REFERENCE VOLTAGE WITH THE PSP SENSOR CONNECTED

- Key in OFF position.
- Connect the PSP sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
The concern is intermittent. refer to **PINPOINT TEST Z**.	INSTALL a new PSP sensor. CLEAR the DTCs. REPEAT the self-test.

C18 CHECK THE SIGRTN OR ETCRTN CIRCUIT(S) FOR AN OPEN

NOTE: Refer to the Wiring Diagrams article Electronic Engine Controls Cell for specific vehicle application and pin locations.

- Key in OFF position.
- Disconnect the PCM.
- For ETCRTN concerns.
- Measure the resistance between:

(+) Suspect Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ETCRTN	ETCRTN

- For SIGRTN concerns.
- Measure the resistance between:

(+) Suspect Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
SIGRTN	SIGRTN

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **C20**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

C19 CHECK THE SUSPECT SENSOR FOR AN INTERNAL SHORT

- Clear the KOEO, KOER, and continuous DTCs.
- Key in OFF position.
- Connect the suspect sensor.
- Key ON, engine OFF.
- Carry out the PCM self-test.
- **Is the concern still present?**

Yes	No
INSTALL a new sensor for the sensor in question. CLEAR the DTCs. REPEAT the self-test.	The concern is intermittent. refer to **PINPOINT TEST Z**.

C20 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DA: INTAKE AIR TEMPERATURE (IAT) SENSOR

This pinpoint test is intended to diagnose the following:

- integrated mass air flow/intake air temperature (MAF/IAT) sensor (12B579)
- harness circuits: IAT and SIGRTN
- powertrain control module (PCM) (12A650)

Voltage values calculated for VREF equal 5 volts. These values can vary by 15% due to sensor and VREF variations.

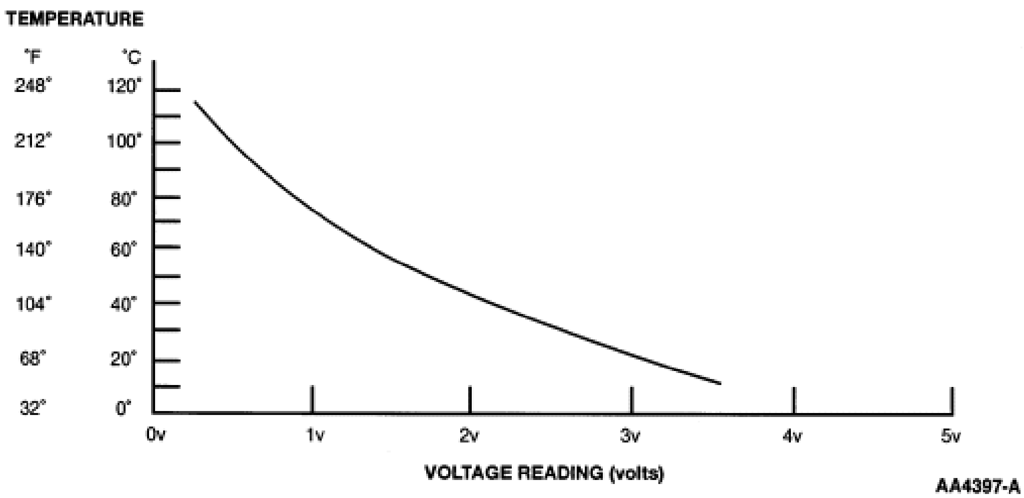

Fig. 30: Temperature Sensor Temperature To Voltage Graph
Courtesy of FORD MOTOR CO.

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
120	248	0.28	1.18
110	230	0.36	1.55
100	212	0.47	2.07
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85
-10	14	4.45	160.31

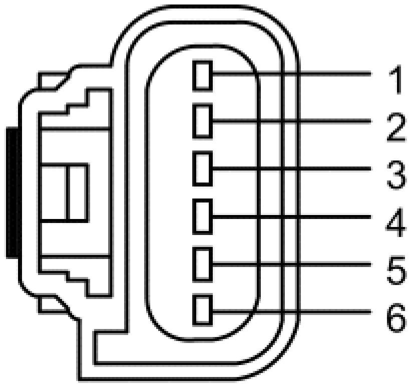

Fig. 31: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	MAF RTN (Mass Air Flow Return)
2	SIGRTN (Signal Return)
1	IAT (Intake Air Temperature)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Town Car	170 Pin	T41 E22	SIGRTN IAT
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B58 B43	SIGRTN IAT
Escape/Mariner 3.0L	150 (50-50-50) Pin	B41 B20	SIGRTN IAT
Escape/Mariner 2.3L	150 (50-50-50) Pin	B41 B39	SIGRTN IAT
Expedition, Fusion, Milan, MKZ, Navigator	140 Pin	B58 B43	SIGRTN IAT
F-150, Mark LT	190 Pin	E58 E22	SIGRTN IAT

Focus	190 Pin	B58 B47	SIGRTN IAT
All other vehicles	170 Pin	E58 E22	SIGRTN IAT

DA1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0111, P0112, P0113, P0114, or P1112 present?**

Yes	No
For DTC P0111, GO to **DA12**. For KOEO and KOER DTC P0112, GO to **DA6**. For KOEO and KOER DTC P0113, GO to **DA2**. For continuous memory DTCs P0112, P0113 or P1112, GO to **DA9**. For DTC P0114, GO to **DA9**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DA2 DTC P0113: CHECK THE IAT SIGNAL CIRCUIT

NOTE: The DTC indicates the sensor signal is greater than the self-test maximum.

- MAF/IAT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MAF/IAT Sensor Connector, Harness Side	(-)
IAT - Pin 1	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **DA3**.	GO to **DA4**.

DA3 CHECK THE IAT SENSOR RESISTANCE

- Key in OFF position.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector,	(-) MAF/IAT Sensor Connector,

Component Side	Component Side
IAT - Pin 1	SIGRTN - Pin 2

- **Is the resistance between 1K - 500K ohms?**

Yes	No
GO to **DA4**.	INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DA4 CHECK THE SIGNAL AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IAT - Pin 1	IAT
SIGRTN - Pin 2	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **DA5**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DA5 CHECK THE SIGNAL FOR A SHORT TO VOLTAGE IN HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MAF/IAT Sensor Connector, Harness Side	(-)
IAT - Pin 1	Ground

- **Is the voltage greater than 1 V?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DA14**.

DA6 DTC P0112: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

NOTE: The DTC indicates the sensor signal is less than the self-test minimum.

- MAF/IAT Sensor connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the IAT PID.
- **Is the voltage greater than 4.2 V?**

Yes	No
INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DA7**.

DA7 CHECK THE IAT CIRCUIT FOR A SHORT TO MAF RTN

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
IAT - Pin 1	MAF RTN - Pin 4

- **Is the resistance less than 5 ohms?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DA8**.

DA8 CHECK THE IAT CIRCUIT FOR A SHORT TO GROUND

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
IAT	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) 12 Volt Vehicle Battery
IAT	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DA14**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DA9 SELF-TEST DTCS P0112, P0113, P0114 OR P1112: INTERMITTENT CHECK

- Key ON, engine OFF.
- Access the PCM and monitor the IAT PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector
- **Is there a large change in the voltage reading?**

Yes	No
DISCONNECT and INSPECT the connector. If OK, INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DA10**.

DA10 CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

- Access the PCM and monitor the IAT PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there a large change in the voltage reading?**

Yes	No

ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DA11**.

DA11 CHECK THE PCM AND VEHICLE HARNESS CONNECTORS

- Key in OFF position.
- PCM connector disconnected.
- MAF/IAT Sensor connector disconnected.
- **Are the connectors and terminals OK?**

Yes	No
The concern is not present at this time. DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DA12 DTC P0111: CHECK THE RESISTANCE OF THE IAT SENSOR WITH THE ENGINE OFF

NOTE: **Verify the engine temperature is at ambient temperature before continuing with this test.**

- Key in OFF position.
- IAT Sensor connector disconnected.
- Measure the resistance between:

(+) IAT Sensor Connector, Component Side	(-) IAT Sensor Connector, Component Side
IAT	SIGRTN

- Refer to the chart at the beginning of this test for the resistance specifications.
- **Is the resistance within specification?**

Yes	No
GO to **DA13**.	INSTALL a new IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DA13 DTC P0111: CHECK THE RESISTANCE OF THE IAT SENSOR

NOTE: Verify the engine is at operating temperature before taking the IAT reading.

- IAT Sensor connector connected.
- Run the engine until the engine temperature stabilizes.
- Key in OFF position.
- IAT Sensor connector disconnected.
- Measure the resistance between:

(+) IAT Sensor Connector, Component Side	(-) IAT Sensor Connector, Component Side
IAT	SIGRTN

- Refer to the chart at the beginning of this test for the resistance specifications.
- **Is the resistance within specification?**

Yes	No
The concern is not present at this time. CARRY OUT the OBD drive cycle to determine if fuel, HO2S, catalyst and misfire monitors can be executed. REFER to On Board Diagnostic (OBD) Drive Cycle. REPEAT the PCM self-test if necessary.	INSTALL a new IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DA14 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
    - pushed out pins
    - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DC: MASS AIR FLOW (MAF) SENSOR

This pinpoint test is intended to diagnose the following:

- mass air flow (MAF) sensor (12B579)
- harness circuits: MAF SIG, MAF RTN, vehicle power (VPWR), power ground (PWRGND), IAT and SIGRTN
- powertrain control module (PCM) (12A650)

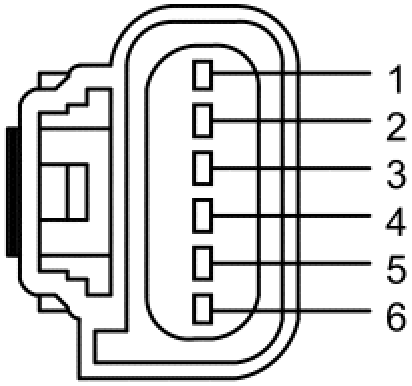

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Fig. 32: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	IAT (Intake Air Temperature)
2	SIGRTN (Signal Return)
4	MAF RTN (Mass Air Flow Return)
3	MAF (Mass Air Flow)
5	PWRGND (Power Ground)
6	VPWR (Vehicle Power)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B41 B42	MAF MAF RTN
Escape/Mariner	150 (50-50-50) Pin	B32	MAF

		B43	MAF RTN
Expedition, Fusion, Milan, MKZ, Navigator	140 Pin	B41 B42	MAF MAF RTN
F-150, Mark LT	190 Pin	E25 E26	MAF MAF RTN
Focus	190 Pin	B40 B41	MAF MAF RTN
All other vehicles	170 Pin	E25 E26	MAF MAF RTN

DC1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0102, P0103, P0104, P1100, or P1101 present?**

Yes	No
For KOER and continuous memory DTC P0102, P0104, GO to **DC5**. For DTC P0103, GO to **DC21**. For KOEO DTC P1101, GO to **DC7**. For KOER and continuous memory DTC P1101, GO to **DC2**. For continuous memory DTC P1100, GO to **DC19**.	For all other symptoms without DTCs, GO to **DC27**.

DC2 DTC P1101: CHECK FOR MAF SENSOR CONTINUOUS MEMORY DTCS

- Retrieve continuous memory DTCs.
- **Is a continuous memory MAF DTC present with the KOER DTC P1101?**

Yes	No
GO to **DC3**.	GO to **DC5**.

DC3 VERIFY CONTINUOUS MEMORY DTC P0102

- **Is a continuous memory DTC P0102 present with the KOER DTC P1101?**

Yes	No
GO to **DC5**.	GO to **DC4**.

DC4 VERIFY CONTINUOUS MEMORY DTC P0103

- **Is a continuous memory DTC P0103 present with the KOER DTC P1101?**

Yes	No
GO to **DC21**.	All other continuous memory DTCs: DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DC5 KOER AND CONTINUOUS MEMORY DTCS P0102, P0104 OR P1101: CHECK THE INTAKE AIR SYSTEM FOR LEAKS, OBSTRUCTIONS, AND DAMAGE

- Key in OFF position.
- Check the air inlet system (air cleaner, housing, duct work) for obstructions or blockage.
- Check for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in the air outlet tube, and worn gaskets between the MAF sensor and the air cleaner assembly. Check the throttle body bore for sludge. Verify the MAF sensor is connected. Repair as necessary.
- **Are there any concerns found during the visual inspection?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DC6**.

DC6 CHECK THE MAF PID

- Access the PCM and monitor the RPM PID.
- Run the engine up to 1,500 RPM for 5 seconds, then bring it back to idle.
- Access the PCM and monitor the MAF PID.
- **Is the voltage less than 0.23 V?**

Yes	No
GO to **DC9**.	GO to **DC7**.

DC7 CHECK THE MAF SIGNAL SENT TO THE PCM

NOTE: **DTC P1101 can be generated by a low charged vehicle battery or the garage exhaust ventilation system. Charge the battery as necessary, then remove the ventilation system and properly vent to the outside atmosphere. Check the air inlet system (air cleaner, housing, duct work) for obstructions or blockage. Repeat the KOEO self-test.**

- Key in OFF position.
- MAF/IAT Sensor connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the MAF PID.

- **Is the voltage less than 0.2 V?**

Yes	No
GO to **DC8**.	GO to **DC9**.

DC8 CHECK THE MAF SIGNAL SENT TO THE PCM

- Key ON, engine running.
- Access the PCM and monitor the MAF PID.
- **Is the voltage between 0.46 - 2.44 V?**

Yes	No
Unable to identify the concern at this time. refer to **PINPOINT TEST Z**.	GO to **DC9**.

DC9 CHECK THE VPWR TO THE MAF SENSOR

- Key in OFF position.
- MAF/IAT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 6	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to **DC10**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC10 CHECK THE PWRGND CIRCUIT TO THE MAF SENSOR

- Measure the voltage between:

(+) Vehicle Battery	(-) MAF/IAT Sensor Connector, Harness Side

Positive terminal	PWRGND - Pin 5

- **Is the voltage greater than 10 V?**

Yes	No
GO to **DC11**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC11 CHECK FOR SHORTS BETWEEN THE CIRCUITS IN THE MAF HARNESS

- Key in OFF position.
- MAF/IAT Sensor connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF - Pin 3	PWRGND - Pin 5
MAF - Pin 3	MAF RTN - Pin 4
MAF - Pin 3	SIGRTN - Pin 2
MAF - Pin 3	IAT - Pin 1

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DC12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DC12 CHECK THE MAF RTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF RTN	MAF RTN - Pin 4

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DC13**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC13 CHECK THE MAF RTN CIRCUIT FOR A SHORT TO PWRGND IN THE HARNESS

- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF RTN - Pin 4	PWRGND - Pin 5

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DC14**.	REPAIR the short circuit to GND. CLEAR the DTCs. REPEAT the self-test.

DC14 CHECK THE MAF CIRCUIT FOR A SHORT TO PWRGND IN THE PCM

- PCM connector connected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF - Pin 3	PWRGND - Pin 5

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DC15**.	GO to **DC31**.

DC15 CHECK THE MAF CIRCUIT VOLTAGE CYCLING INTEGRITY

- Key ON, engine OFF.
- Access the PCM and monitor the MAF PID.

- Connect a 5 amp fused jumper wire between the following:

Point A MAF/IAT Sensor Connector, Harness Side	Point B MAF/IAT Sensor Connector, Harness Side
MAF RTN - Pin 4	PWRGND - Pin 5
MAF - Pin 3	VPWR - Pin 6

- Record the PID reading while both jumpers are installed.
- Remove the VPWR jumper while observing the MAF PID.
- **Does the MAF PID change from greater than 4.50 volts to less than 0.26 volt when the VPWR jumper is removed?**

Yes	No
INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **DC16**.

DC16 CHECK THE MAF CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF	MAF - Pin 3

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DC17**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC17 CHECK THE PWRGND CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) Vehicle Battery
PWRGND - Pin 5	Negative terminal

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DC18**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC18 CHECK THE MAF RTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF RTN	MAF RTN - Pin 4

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DC31**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC19 DTC P1100: CHECK THE MAF CIRCUIT FOR INTERMITTENT VOLTAGE TO THE PCM

- Check for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in the air outlet tube, and worn gaskets between the MAF sensor and the air cleaner assembly. Verify the MAF sensor is connected.
- Key ON, engine running.
- Access the PCM and monitor the MAF PID.
- If idle is not stable, refer to **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** .
- Access the PCM and monitor the RPM PID.

- Run the engine up to 1,500 RPM for 5 seconds, then bring it back to idle.
- Lightly tap on the MAF sensor and wiggle the harness connector to simulate road shock.
- **Does the MAF PID go below 0.23 volt or above 4.6 volts?**

Yes	No
INSPECT the MAF/IAT sensor connector. If OK, INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **DC20**.

DC20 CHECK THE MAF CIRCUIT FOR AN INTERMITTENT OPEN OR SHORTS

- Key ON, engine running.
- Access the PCM and monitor the MAF PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Does the MAF PID go below 0.23 volt or above 4.6 volts?**

Yes	No
REPAIR as necessary. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	Unable to duplicate or identify the concern at this time. CLEAR the DTCs. REPEAT the self-test.

DC21 DTC P0103: CHECK THE MAF SENSOR SCREEN FOR CONTAMINATION

NOTE: **DTC P0103 can be generated by foreign material blocking the MAF sensor screen, causing an air flow restriction.**

- Check the MAF sensor screen for contamination or blockage.
- Check the air cleaner element and air tubes for proper installation and sealing.
- **Are any concerns present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DC22**.

DC22 DTC P0103: CHECK THE MAF SENSOR SIGNAL HIGH INPUT TO THE PCM

- Key ON, engine OFF.
- Access the PCM and monitor the MAF PID.
- **Is the voltage greater than 2.44 V?**

Yes	No
GO to **DC23**.	GO to **DC25**.

DC23 CHECK THE MAF SENSOR SIGNAL SENT TO THE PCM

- Key in OFF position.
- MAF/IAT Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A MAF/IAT Sensor Connector, Harness Side	Point B MAF/IAT Sensor Connector, Harness Side
MAF RTN - Pin 4	PWRGND - Pin 5

- Key ON, engine OFF.
- Access the PCM and monitor the MAF PID.
- **Is the voltage less than 0.1 V?**

Yes	No
CHECK the MAF/IAT sensor electrical connector for damage, corrosion, and water ingress. If OK, INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **DC24**.

DC24 CHECK THE MAF CIRCUIT FOR A SHORT TO VOLTAGE

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
MAF	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **DC26**.	REPAIR the short circuit to PWR. CLEAR the DTCs. REPEAT the self-test.

DC25 CHECK THE MAF SIGNAL SENT TO THE PCM

- Key ON, engine running.
- Access the PCM and monitor the RPM PID.
- Monitor the MAF signal voltage while increasing the engine RPM from idle to approximately 2,500 RPM, and then back to idle.
- Access the PCM and monitor the MAF PID.
- **Is the voltage between 0.23 - 4.6 V?**

Yes	No
This is an intermittent concern. refer to **PINPOINT TEST Z**.	GO to **DC23**.

DC26 VERIFY THE IDLE CONCERN

- PCM connector connected.
- MAF/IAT Sensor connector connected.
- Key ON, engine running.
- **Is an idle concern present?**

Yes	No
DISREGARD DTC P0103 at this time. The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** to diagnose unique idle concerns.	GO to **DC31**.

DC27 SYMPTOMS WITHOUT DTCS: CHECK THE CONDITIONS RELATED TO THE MAF SENSOR

- Check the air inlet system (air cleaner, housing, duct work) for obstructions or blockage.
- Check for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in the air outlet tube, and worn gaskets between the MAF sensor and the air cleaner assembly. Verify the MAF sensor is connected.
- **Is a concern present?**

Yes	No
REPAIR as necessary. RESET the keep alive	

memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **DC28**.

DC28 DTCS P0171, P0172, P0174, P0175, P2195, P2196, P2197 OR P2198: CHECK THE FUNCTIONALITY OF THE MAF SENSOR

NOTE: A MAF PID value of less than 0.6 volt may indicate an incorrectly installed air cleaner or a leak in the air inlet system.

- Key ON, engine running.
- Allow the engine to stabilize at the correct operating temperature.
- Access the PCM and monitor the MAF PID.
- Check that the MAF PID at idle and NEUTRAL is not greater than 30% of the normal MAF listed in the **REFERENCE VALUES** article, Reference Values or not greater than 1.3 volts.
- **Is the PID value within the expected range?**

Yes	No
GO to **DC30**.	GO to **DC29**.

DC29 CHECK TO ISOLATE THE MAF SENSOR FROM A LEAN DRIVEABILITY OCCURRENCE

NOTE: Due to increasingly stringent emission/OBD requirements, a fuel system DTC on some vehicles can be generated without a noticeable driveability concern with or without the MAF sensor disconnected. Under these conditions, if the MAF PID indicates a MAF sensor concern, install a new MAF sensor. Refer to the ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES .

- Key in OFF position.
- MAF/IAT Sensor connector disconnected.
- Key ON, engine running.
- Drive the vehicle on the road.
- **Is the lean driveability symptom (lack of power, spark knock/detonation, buck/jerk or hesitation/surge on acceleration) gone?**

Yes	No
INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **DC30**.

DC30 VERIFY THE DTC

- **Are any of the following DTCs present:**

  P0171, P0172, P0174, P0175, P2195, P2196, P2197, or P2198?

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** to diagnose performance while driving concerns.

DC31 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DD: FUEL RAIL PRESSURE TEMPERATURE (FRPT) SENSOR

WARNING: **Vehicle fuel systems are pressurized even when the engine is not running. To avoid fire or personal injury, disable the fuel delivery system and relieve fuel system pressure before removing any fuel system component. Refer to the fuel system information at the beginning of pinpoint HC. Failure to follow these instructions may result in personal injury.**

NOTE: **With the engine running, the FRP PID value may be 48-70 kPa (7-10 psi) higher than a fuel pressure reading taken with a mechanical gauge.**

This pinpoint test is intended to diagnose the following:

- fuel rail pressure temperature (FRPT) sensor (9G756)

- harness circuits: FRP and FRT
- powertrain control module (PCM) (12A650)

FRPT SENSOR VOLTAGE AND PRESSURE SPECIFICATIONS

Voltage	Pressure (kPa)	Pressure (psi)
4.5	482	70
3.9	413	60
3.4	344	50
2.8	275	40
2.2	207	30
1.6	138	20
1.1	69	10
0.5	0	0

FRPT SENSOR TEMPERATURE, VOLTAGE, AND RESISTANCE SPECIFICATIONS

Temperature		Sensor	
°C	°F	Volts	K Ohms
100	212	0.47	2.073
95	203	0.54	2.405
90	194	0.61	2.800
85	185	0.70	3.273
80	176	0.80	3.840
75	167	0.92	4.524
70	158	1.06	5.351
65	149	1.21	6.356
60	140	1.38	7.584
55	131	1.56	9.091
50	122	1.77	10.949
45	113	1.99	13.252
40	104	2.23	16.123
35	95	2.48	19.720
30	86	2.74	24.253
25	77	3.00	30.000
20	68	3.26	37.332
15	59	3.50	46.745
10	50	3.73	58.911
5	41	3.95	74.745
0	32	4.13	95.501

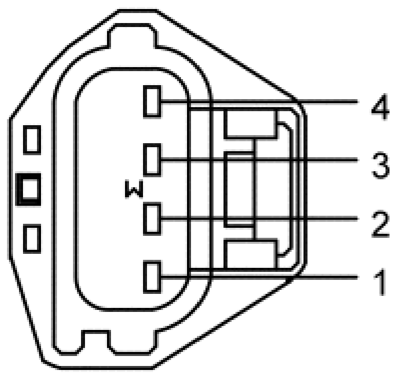

Fig. 33: Fuel Rail Pressure Temperature (FRPT) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
3	FRT (Fuel Rail Temperature)
1	FRP (Fuel Rail Pressure)
4	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	E40 E28 E41 E37	VREF FRT SIGRTN FRP
F-150, Mark LT	190 Pin	E57 E19 E58 E32	VREF FRT SIGRTN FRP
All other vehicles	170 Pin	E57 E19 E58 E32	VREF FRT SIGRTN FRP

DD1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P0180, P0181, P0182, P0183, P0190, P0191, P0192 or P0193 present?**

Yes	No

For DTC P0180, GO to **DD24**. For DTC P0181, GO to **DD26**. For continuous memory DTCs P0182 or P0183, GO to **DD2**. For KOEO and KOER DTCs P0182 or P0183, GO to **DD17**. For continuous memory DTC P0190, GO to **DD3**. For DTC P0191, GO to **DD11**. For continuous memory DTCs P0192 or P0193, GO to **DD16**. For KOEO and KOER DTCs P0192 or P0193, GO to **DD3**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DD2 CHECK THE FRPT AND PCM CONNECTORS FOR DAMAGE

- Key ON, engine OFF.
- Access the PCM and monitor the FRT PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector
  - Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM
- Check the FRPT and PCM connectors for damage and corrosion.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary.	DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DD3 CONTINUOUS MEMORY DTC P0190, KOEO AND KOER DTCS P0192 AND P0193: CHECK THE FRPT SENSOR FOR FUEL LEAKS

NOTE: Repair any fuel pump DTCs prior to this test.

- Key ON, engine running.
- Idle the engine for 2 minutes.
- Inspect the FRPT vacuum hose between the intake manifold and the FRPT sensor for air leaks and correct connection.
- Key in OFF position.
- Remove the vacuum hose from the FRPT.
- Inspect the FRPT and vacuum hose for traces of fuel.

- **Is any fuel present?**

Yes	No
INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DD4**.

DD4 CHECK THE VREF AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Connect the vacuum hose to the FRPT.
- FRPT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FRPT Sensor Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 4

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For DTC P0190, GO to **DD12**. For DTC P0192, GO to **DD5**. For DTC P0193, GO to **DD7**.	refer to **PINPOINT TEST C**.

DD5 INDUCE A HIGH VOLTAGE ON THE FRPT CIRCUIT

- Key in OFF position.
- Connect a 5 amp fused jumper wire between the following:

Point A FRPT Sensor Connector, Harness Side	Point B FRPT Sensor Connector, Harness Side
VREF - Pin 2	FRP - Pin 1

- Key ON, engine OFF.
- Access the PCM and monitor the FRP PID.

- **Is the voltage greater than 4.5 V?**

Yes	No
INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DD6**.

DD6 CHECK THE FRP CIRCUIT FOR A SHORT TO FRT, SIGRTN, AND GND IN THE HARNESS

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRP	SIGRTN
FRP	FRT

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
FRP	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DD28**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DD7 CHECK THE FRP CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
FRP	FRP - Pin 1

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DD8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DD8 CHECK THE FRP CIRCUIT FOR A SHORT TO VREF AND FRT IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRP	VREF
FRP	FRT

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DD9**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DD9 CHECK THE FRP CIRCUIT FOR A SHORT TO VOLTAGE

- Key ON, engine OFF.
- Measure the voltage between:

(+) FRPT Sensor Connector, Harness Side	(-)
FRP - Pin 1	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DD10**.

DD10 INDUCE A LOW VOLTAGE ON THE FRPT CIRCUIT

- Key in OFF position.
- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A FRPT Sensor Connector, Harness Side	Point B FRPT Sensor Connector, Harness Side
FRP - Pin 1	SIGRTN - Pin 4

- Key ON, engine OFF.
- Access the PCM and monitor the FRP PID.
- **Is the voltage less than 0.01 V?**

Yes	No
INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DD28**.

DD11 DTC P0191: CHECK FOR FUEL PUMP DTCS

- Carry out the self-test.
- **Are DTCs P1233, P1234, P1235, P1236, P1237 or P1238 present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DD12**.

DD12 INSPECT ALL THE VACUUM HOSES CONNECTED TO THE INTAKE MANIFOLD FOR LEAKS

- Key in OFF position.
- FRPT Sensor connector connected.
- Key ON, engine running.
- Allow the engine idle to stabilize.
- Inspect all the vacuum hoses connected to the intake manifold for leaks.

- **Are any vacuum hose concerns present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DD13**.

DD13 CHECK THE FRPT CONNECTOR FOR DAMAGE OR CORROSION

- Key in OFF position.
- FRPT Sensor connector disconnected.
- Inspect the sensor, wiring, and connector for damage, corrosion, or water intrusion.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DD14**.

DD14 CHECK THE FRP PID

NOTE: **The fuel pressure is likely to increase after the fuel pressure is relieved with the system closed. The rate and amount of the fuel pressure increase is dependent upon the ambient air and fuel temperatures.**

NOTE: **Prepare to record the FRP PID value within 5 seconds after the engine is shut off and also after the fuel pressure is relieved.**

- FRPT Sensor connector connected.
- Key ON, engine running.
- Allow the engine idle to stabilize.
- Access the PCM and monitor the FRP PID.
- Key in OFF position.
- Key ON, engine OFF.
- Record the FRP PID value within 5 seconds of the key off.
- Relieve the fuel pressure. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure.
- Disable the fuel pump.
- Key ON, engine OFF.
- Record the FRP PID value within 5 seconds of carrying out the fuel system pressure release procedure.
- **Is the difference between the recorded FRP PID values greater than 34 kPa (5 psi)?**

Yes	No

refer to **PINPOINT TEST HC**.	GO to **DD15**.

DD15 COMPARE THE FRP PID TO THE MECHANICAL GAUGE

NOTE: Most mechanical gauges are referenced to atmospheric pressure. The FRPT sensor is referenced to manifold pressure. In order to make a valid comparison, the engine must be off.

NOTE: The vehicle may exhibit a long crank until the fuel system is pressurized.

- Key in OFF position.
- Connect a mechanical fuel pressure gauge.
- Key ON, engine OFF.
- Monitor the mechanical gauge.
- Access the PCM and monitor the FRP PID.
- Compare the FRP PID value to the mechanical gauge.
- Key in OFF position.
- Pressurize the fuel system. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Key ON, engine running.
- Allow the fuel pressure to stabilize.
- Key in OFF position.
- Key ON, engine OFF.
- Compare the FRP PID value to the mechanical gauge.
- **Are the FRP PID values within 34 kPa (5 psi) of the mechanical gauge readings?**

Yes	No
GO to **DD28**.	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DD16 CONTINUOUS MEMORY DTCS P0192 AND P0193: CHECK THE FRPT CIRCUIT FOR AN INTERMITTENT CONCERN

NOTE: Repair any fuel pump DTCs prior to this test.

- Key ON, engine OFF.

- Access the PCM and monitor the FRP PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector
  - Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM
- Check the FRPT connector for damage or corrosion.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

DD17 KOEO AND KOER DTCS P0182 OR P0183: CHECK THE RESISTANCE OF THE FRPT SENSOR

- Key in OFF position.
- FRPT Sensor connector disconnected.
- Measure the resistance between:

(+) FRPT Sensor Connector, Component Side	(-) FRPT Sensor Connector, Component Side
FRT - Pin 3	SIGRTN - Pin 4

- **Is the resistance between 2K - 96K ohms?**

Yes	No
GO to **DD18**.	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DD18 CHECK THE FRPT FOR INTERNAL SHORTS

- Measure the resistance between:

(+) FRPT Sensor	

Connector, Component Side	(-)
FRT - Pin 3	Ground

- Measure the resistance between:

(+) FRPT Sensor Connector, Component Side	(-) FRPT Sensor Connector, Component Side
FRT - Pin 3	FRP - Pin 1
FRT - Pin 3	VREF - Pin 2

- **Are the resistances greater than 10K ohms?**

Yes	No
For DTC P0182, GO to **DD19**. For DTC P0183, GO to **DD21**.	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DD19 CHECK THE FRT CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRT	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
FRT	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DD20**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DD20 FRPT SENSOR: INDUCE A HIGH VOLTAGE ON THE FRT CIRCUIT

- PCM connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the FRT PID.
- **Is the voltage greater than 4.5 V?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	GO to **DD28**.

DD21 CHECK THE FRT AND SIG RTN CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
FRT	FRT - Pin 3
SIGRTN	SIGRTN - Pin 4

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **DD22**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DD22 CHECK THE FRT SIGNAL FOR A SHORT TO VREF AND FRP

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRT	VREF
FRT	FRP

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DD23**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DD23 FOR THE FRPT SENSOR INDUCE A LOW VOLTAGE ON THE FRT CIRCUIT

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A FRPT Sensor Connector, Harness Side	Point B FRPT Sensor Connector, Harness Side
FRT - Pin 3	SIGRTN - Pin 4

- Key ON, engine OFF.
- Access the PCM and monitor the FRT PID.
- **Is the voltage less than 0.2 V?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	GO to **DD28**.

DD24 DTC P0180: CHECK FOR THE PRESENCE OF DTC P0182 OR P0183

- Key ON, engine OFF.
- Carry out the self-test.
- **Are DTCs P0182 or P0183 present?**

Yes	No
GO to **DD17**.	GO to **DD25**.

DD25 CHECK THE FRT CIRCUIT FOR AN INTERMITTENT CONCERN

- PCM connector connected.
- Access the PCM and monitor the FRT PID.
- Carry out a thorough wiggle test on the FRPT sensor harness.
- **Is the FRT signal stable?**

Yes	No

GO to **DD27**.	ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DD26 KOEO AND KOER DTC P0181: CHECK THE FRT PID

NOTE: Allow vehicle temperatures to stabilize prior to temperature sensor tests.

- Key ON, engine OFF.
- The normal test range is 0°C to 100°C (32°F to 212°F).
- Access the PCM and monitor the FRT PID.
- **Is the voltage between 0.4 - 4.5 V?**

Yes	No
GO to **DD27**.	DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DD27 COMPARE THE PIDS AFTER STABILIZING THE VEHICLE TEMPERATURE

- Access the PCM and monitor the FRT, CHT and ECT PIDs.
- **Are the temperature PIDs nearly equal in value?**

Yes	No
The concern is not present at this time. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

DD28 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DF: VEHICLE SPEED CIRCUIT (VSC) CHECK

WARNING: Strict observance of posted speed limits and driving conditions is mandatory when proceeding through the following drive cycles.

Failure to follow these instructions may result in personal injury.

This pinpoint test is intended to diagnose the following:

- harness circuits: VSC
- powertrain control module (PCM) (12A650)

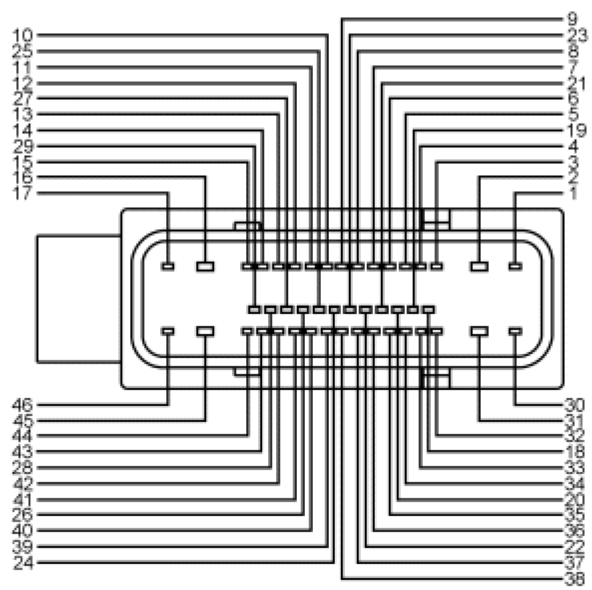

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Fig. 34: Anti-lock Brake System (ABS) Module Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
21	VSC (Vehicle Speed Circuit)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Connector	Pin	Circuit
170 Pin	B29	VSC

DF1 DTCS P0500, P0503, P1500, P1501 AND P1502: CHECK THE VEHICLE SPEED CIRCUIT FOR INTERMITTENT CONCERNS

NOTE: The PCM detected an error in the vehicle speed information received from the ABS control module. This test step checks for the recurrence of this vehicle speed error.

- Key ON, engine OFF.
- Clear the DTCs.
- Gradually increase the vehicle speed to 80 km/h (50 mph).
- Coast to an idle and stop the vehicle.
- Key in OFF position.
- Key ON, engine OFF.
- Retrieve the continuous memory DTCs.
- **Are DTCs P0500, P0503, P1500, P1501 or P1502 present?**

Yes	No
The vehicle speed input is incorrect. GO to **DF2**.	The vehicle speed input is correct. The concern that produced the original DTC may be intermittent. GO to **DF5**.

DF2 CHECK THE VSC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Anti-lock Brake System (ABS) Module connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
VSC - Pin B29	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **DF3**.	GO to **DF6**.

DF3 CHECK FOR AN OPEN VSC BETWEEN THE PCM AND THE ABS CONTROL MODULE

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Anti-lock Brake System (ABS) Module Connector, Harness Side
VSC - Pin B29	VSC - Pin 21

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DF4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test. GO to **DF7**.

DF4 CHECK THE VSC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
VSC - Pin B29	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
REFER to the **VEHICLE DYNAMIC SYSTEMS -- E-SERIES** to continue diagnosis of the ABS control module, speed sensors and wheel speed sensor harness circuits. If these components are working properly, GO to **DF8**.	GO to **DF6**.

DF5 VISUAL INSPECTION

NOTE: Refer to the Wiring Diagrams article for harness, module, and connector locations.

- Key in OFF position.
- Visually inspect the VSC circuit harness and connectors at the PCM, ABS, and other VSC user modules for damage, loose connections, loose grounds, or incorrect routing.
- **Does the visual inspection reveal a concern?**

Yes	No

REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. GO to **DF7**.	Unable to duplicate or identify the concern at this time. REFER to the **VEHICLE DYNAMIC SYSTEMS -- E-SERIES** to continue diagnosis of the ABS control module, speed sensors and wheel speed sensor harness circuits.

DF6 VERIFY IF THE VSC IS SHORTED IN THE HARNESS OR ANOTHER MODULE

- Key in OFF position.
- Determine which, if any, modules are connected to the VSC. Refer to the Wiring Diagrams article. If no other modules are connected to the VSC, go to the YES Action To Take.
- One at a time, disconnect the modules associated with the VSC. After disconnecting each module, test again for a short circuit. (Refer to test step that sent you here). Repeat until each associated module is disconnected or the short circuit is eliminated.
- **Does the short circuit remain after all associated modules are disconnected?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test. GO to **DF7**.	REFER to the Workshop article for further diagnosis of the appropriate module. GO to **DF7**.

DF7 VSC REPAIR VERIFICATION DRIVE CYCLE

NOTE: **Warm the engine to a normal operating temperature before continuing.**

NOTE: **Carry out the VSC drive cycle at least 3 times as described below.**

- Automatic Transmission Drive Cycle:
  - Place the transmission range selector lever in DRIVE range
  - Accelerate heavily to 56 km/h (35 mph)
  - Coast down to an idle and stop the vehicle
  - Cycle the key OFF and ON
- Manual Transmission Drive Cycle:
  - Accelerate moderately to 64 km/h (40 mph), while shifting from first to second gear
  - Coast down to an idle and stop the vehicle
  - Cycle the key OFF and ON
- Key in OFF position.
- Key ON, engine OFF.
- Retrieve the continuous memory DTCs.
- **Are DTCs P0500, P0503, P1500, P1501 or P1502 present?**

Yes	No
REFER to the **VEHICLE DYNAMIC SYSTEMS -- E-SERIES** to continue diagnosis of the ABS control module, speed sensors and wheel speed sensor harness circuits. If these components are working properly, GO to **DF8**.	The repair has been verified.

DF8 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DG: KNOCK SENSOR (KS)

This pinpoint test is intended to diagnose the following:

- knock sensors KS1, KS2 (12A699)
- harness circuits: KS1+, KS1-, KS2+, and KS2-
- powertrain control module (PCM) (12A650)

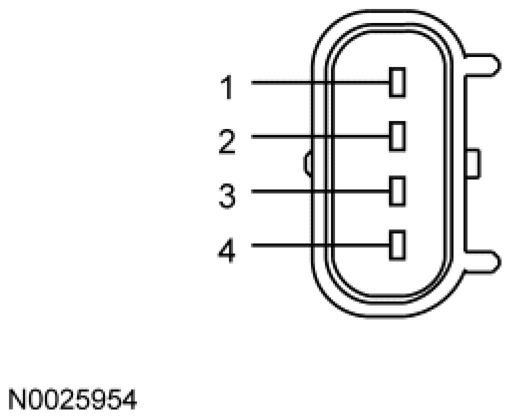

Fig. 35: Knock Sensor 1 (KS1) Connector - A
Courtesy of FORD MOTOR CO.

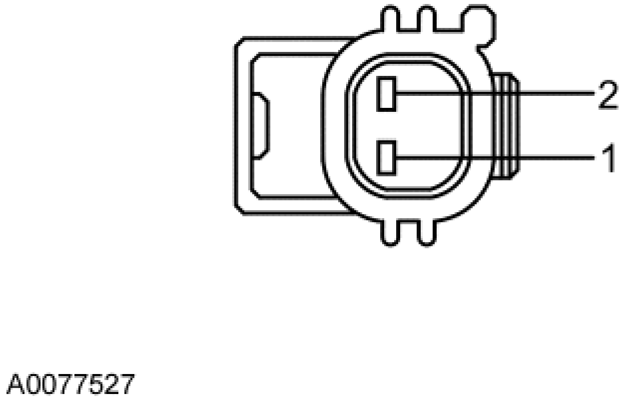

Fig. 36: Knock Sensor 1 (KS1) Connector - A
Courtesy of FORD MOTOR CO.

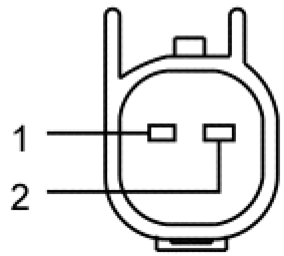

Fig. 37: Knock Sensor 1 (KS1) Connector - C
Courtesy of FORD MOTOR CO.

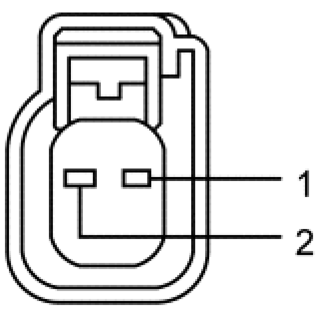

Fig. 38: Knock Sensor 1 (KS1) Connector - D
Courtesy of FORD MOTOR CO.

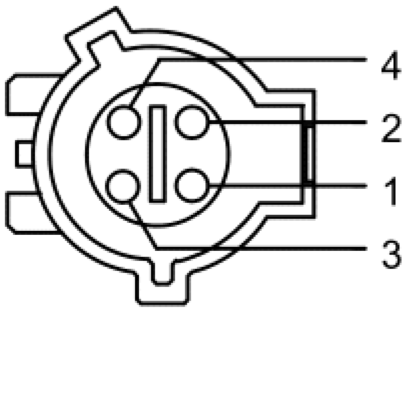

Fig. 39: Knock Sensor 1 (KS1) Connector - E
Courtesy of FORD MOTOR CO.

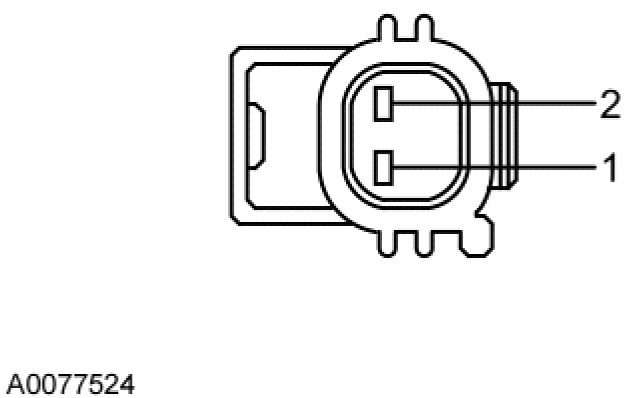

Fig. 40: Knock Sensor 1 (KS1) Connector - F
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, F-Super Duty 6.8L, MKX, Sable, Taurus, Taurus X	A	3 4 1 2	KS2+ KS2- KS1+ KS1-
Escape/Mariner, Fusion 2.3L, Milan 2.3L	B	1 2	KS1+ KS1-

Expedition, Navigator	C	1 2	KS1+ KS1-
F-150 4.2L, Ranger 3.0L	D	1 2	KS1+ KS1-
F-150 5.4L, F-Super Duty 5.4L, Mark LT	C	2 1	KS1+ KS1-
Fusion 3.0L, Milan 3.0L, Ranger 2.3L	B	2 1	KS1+ KS1-
MKZ	A	1 2	KS1+ KS1-
Mountaineer 4.6L	E	1 2	KS1+ KS1-
Mustang 4.6L	E	3 4	KS1+ KS1-
All other vehicles	F	2 1	KS1+ KS1-

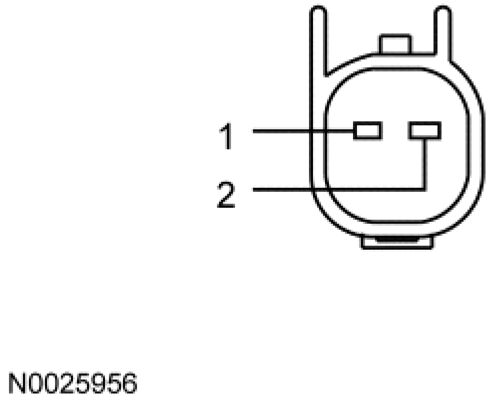

Fig. 41: Knock Sensor 2 (KS2) Connector - A
Courtesy of FORD MOTOR CO.

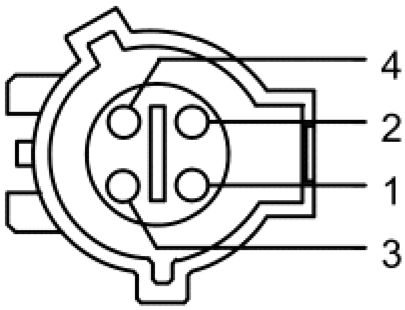

Fig. 42: Knock Sensor 2 (KS2) Connector - B
Courtesy of FORD MOTOR CO.

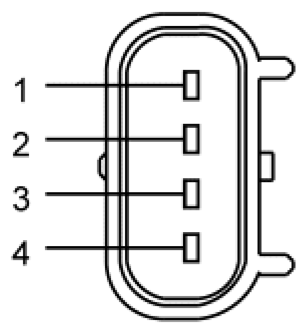

Fig. 43: Knock Sensor 2 (KS2) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition, F-Super Duty 5.4L, Navigator	A	1 2	KS2+ KS2-
F-150, Mark LT	A	2 1	KS2+ KS2-
Mustang	B	1 2	KS2+ KS2-
All other vehicles	C	3 4	KS2+ KS2-

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	E31 E30 E49 E48 B29, B64 B51	KS2+ KS2- KS1+ KS1- VREF VPWR
Escape/Mariner	150 (50-50-50) Pin	E32 E20 E40 B35	KS1+ KS1- VREF VPWR
Expedition, MKZ, Navigator	140 Pin	E31 E30 E49 E48 E57 B51	KS2+ KS2- KS1+ KS1- VREF VPWR
F-150 4.6L, F-150 4.2L	190 Pin	E49 E48 E57 B51	KS1+ KS1- VREF VPWR
F-150 5.4L, Mark LT	190 Pin	E31 E30 E49 E48 E57 B51	KS2+ KS2- KS1+ KS1- VREF VPWR
F-Super Duty, Mustang 4.6L	170 Pin	E31 E30 E49 E48 E57 B35	KS2+ KS2- KS1+ KS1- VREF VPWR
Focus	190 Pin	E46 E47 E63 B67	KS1+ KS1- VREF VPWR
Fusion, Milan	140 Pin	E49 E48 E57 B51	KS1+ KS1- VREF VPWR
All other vehicles	170 Pin	E49 E48 E57	KS1+ KS1- VREF

		B35	VPWR

DG1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P0325, P0326, P0330, or P0331 present?**

Yes	No
For KOER and continuous memory DTCs P0325, P0326, P0330 and P0331, GO to **DG2**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DG2 KOER AND CONTINUOUS MEMORY DTCS P0325, P0326, P0330 AND P0331: CHECK THE INTERNAL RESISTANCE OF THE KS

- KS connector disconnected.
- Measure the resistance between:

(+) KS Connector, Component Side	(-) KS Connector, Component Side
Suspect KS+	Suspect KS-

- **Is the resistance between 4.39M - 5.35M ohms?**

Yes	No
GO to **DG3**.	INSTALL a new KS. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DG3 CHECK THE KS+ CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS+	Suspect KS+

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DG4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DG4 CHECK THE KS- CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS-	Suspect KS-

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DG5**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DG5 CHECK THE KS+ CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) Vehicle Battery
Suspect KS+	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DG6**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DG6 CHECK THE KS- CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) Vehicle Battery
Suspect KS-	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DG7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DG7 CHECK THE KS+ CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS+	VPWR
Suspect KS+	VREF

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DG8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DG8 CHECK THE KS- CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS-	VREF
Suspect KS-	VPWR

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DG9**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DG9 CHECK THE KS+ CIRCUIT FOR INTERMITTENT CONCERNS

NOTE: **Carefully wiggle all accessible wiring and connectors associated with the KS circuit.**

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS+	Suspect KS+

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DG10**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DG10 CHECK THE KS- CIRCUIT FOR INTERMITTENT CONCERNS

NOTE: **Carefully wiggle all accessible wiring and connectors associated with the KS circuit.**

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS-	Suspect KS-

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DG11**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DG11 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY**	The system is operating correctly at this time. The concern may have been caused by a loose or

(EEPROM) , Programming the VID Block for a Replacement PCM.	corroded connector.

PINPOINT TEST DH: THROTTLE POSITION (TP) SENSOR

This pinpoint test is intended to diagnose the following:

- TP sensor (9B989)
- binding or sticking throttle linkage
- harness circuits: TP, SIGRTN, VREF, VPWR, and PWRGND
- powertrain control module (PCM) (12A650)

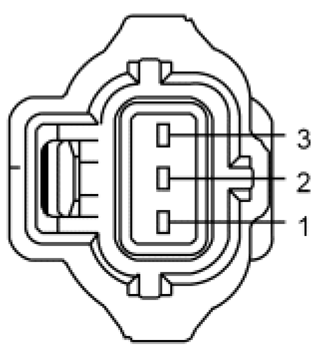

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Fig. 44: Throttle Position (TP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

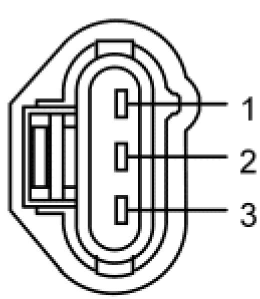

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Fig. 45: Throttle Position (TP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Ranger 2.3L	A	2 1 3	TP SIGRTN VREF
All other vehicles	B	2 3 1	TP SIGRTN VREF

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	E41 B47, B48, B49, B50 B40, E40 B35, B36 E19	SIGRTN PWRGND VREF VPWR TP
Ranger	170 Pin	E58 B47, B48, B49, B50 B40, E57 B35, B36 E61	SIGRTN PWRGND VREF VPWR TP

DH1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0068, P0121, P0122, P0123, P1120, or P1124 present?**

Yes	No
For DTC P0068, GO to **DH18**. For DTC P0121, GO to **DH24**. For KOEO and KOER DTC P0122, GO to **DH14**. For continuous memory DTC P0122, GO to **DH13**. For DTC P0123, GO to **DH9**. For DTC P1120, GO to **DH4**. For DTC P1124, GO to **DH2**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DH2 KOEO AND KOER DTC P1124: CHECK FOR ANY OTHER DTCS

- Key ON, engine OFF.
- Check for KOEO and KOER DTCs.
- **Is DTC P0405 present?**

Yes	No

DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DH3**.

DH3 CHECK FOR A STUCK THROTTLE PLATE OR LINKAGE

- Key in OFF position.
- Visually inspect the throttle linkage and throttle plate for binding or sticking.
- Verify the throttle plate and linkage is at closed throttle position.
- **Does the throttle move freely and return to a closed throttle position?**

Yes	No
The throttle plate and linkage are OK. GO to **DH9**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DH4 DTC P1120: CHECK THE TP CIRCUIT FOR FRAYED WIRES OR CORROSION ON THE CONNECTORS

- Key in OFF position.
- Carry out a visual inspection of the pins on the harness connector at the TP sensor for corrosion.
- Carry out a visual inspection of the harness wires between the TP sensor and the PCM for insulation fraying and corrosion.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DH5**.

DH5 CHECK FOR A STUCK TP SENSOR

- Key ON, engine OFF.
- Slowly move the throttle from the closed throttle position to the wide open throttle position and observe the TP PID.
- Access the PCM and monitor the TP PID.
- **Is the voltage greater than 4.5 V?**

Yes	No
GO to **DH22**.	GO to **DH6**.

DH6 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE TP SENSOR HARNESS CONNECTOR

- TP Sensor connector disconnected.

- Key ON, engine OFF.
- Measure the voltage between:

(+) TP Sensor Connector, Harness Side	(-) TP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **DH7**.	refer to **PINPOINT TEST C**.

DH7 CHECK THE TP CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) TP Sensor Connector, Harness Side
TP	TP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DH8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DH8 CHECK THE TP SENSOR VOLTAGE TO THE PCM

- PCM connector connected.
- TP Sensor connector connected.
- Key ON, engine running.
- Idle the engine for 2 minutes.
- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- Slowly move the throttle from the closed throttle position to the wide open throttle position and observe the TP PID.
- **Is the voltage between 0.17 - 0.49 V?**

Yes	No
INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	If DTC P1120 is still present, GO to **DH22**.

DH9 DTC P0123 OR DTC P1124: INDUCE THE OPPOSITE TP SENSOR VOLTAGE

- TP Sensor connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- **Is the voltage less than 0.17 V?**

Yes	No
GO to **DH10**.	GO to **DH11**.

DH10 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE TP SENSOR VEHICLE HARNESS CONNECTOR

- Key ON, engine OFF.
- Measure the voltage between:

(+) TP Sensor Connector, Harness Side	(-) TP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST C**.

DH11 CHECK THE CIRCUIT FOR A SHORT TO VREF AND VPWR IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side

VPWR	TP
VREF	TP

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DH12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DH12 CHECK FOR AN INTERMITTENT SHORT TO VOLTAGE IN THE TP CIRCUIT

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VPWR	TP
VREF	TP

- Observe the digital multimeter (DMM) for an indication of a concern while shaking, wiggling, and bending the TP circuit between the TP sensor and the PCM.
- **Is a concern present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DH26**.

DH13 CONTINUOUS MEMORY DTC P0122: CHECK THE TP CIRCUIT FOR AN INTERMITTENT CONCERN

- Key ON, engine OFF.
- Clear the PCM DTCs.
- Key ON, engine running.
- Retrieve the continuous memory DTCs.
- **Is DTC P0122 present?**

Yes	No
GO to **DH14**.	refer to **PINPOINT TEST Z**.

DH14 KOEO AND KOER DTC P0122: CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE TP SENSOR VEHICLE HARNESS CONNECTOR

- Key in OFF position.
- TP Sensor connector disconnected.

- Key ON, engine OFF.
- Measure the voltage between:

(+) TP Sensor Connector, Harness Side	(-) TP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **DH15**.	refer to **PINPOINT TEST C**.

DH15 CHECK THE TP CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) TP Sensor Connector, Harness Side
TP	TP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DH16**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DH16 CHECK THE TP CIRCUIT FOR A SHORT TO PWRGND OR SIGRTN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
TP	PWRGND
TP	SIGRTN

- **Are the resistances greater than 10K ohms?**

Yes	No

GO to **DH17**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DH17 INDUCE THE OPPOSITE TP SENSOR VOLTAGE

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A TP Sensor Connector, Harness Side	Point B TP Sensor Connector, Harness Side
VREF	TP

- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- **Is the voltage greater than 4.65 V?**

Yes	No
INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DH26**.

DH18 DTC P0068: CHECK THE RATIONALITY BETWEEN THE TP AND MAF SENSORS

- Attempt to start the engine.
- **Does the engine start?**

Yes	No
GO to **DH19**.	CHECK for major leaks, cracks and openings between the MAF sensor and the throttle body. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. If OK, refer to **PINPOINT TEST A**.

DH19 CHECK THE TP SENSOR FOR MECHANICAL OPERATION

- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- Slowly move the throttle from the closed throttle position to the wide open throttle position and observe the TP PID.
- **Is the voltage between 0.49 - 4.65 V?**

Yes	No
GO to **DH20**.	INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DH20 CHECK THE TP SENSOR SIGNAL HIGH VERSUS THE ENGINE LOAD WHILE DRIVING THE VEHICLE

- Key ON, engine running.
- Access the PCM and monitor the TP PID.
- Access the PCM and monitor the LOAD PID.
- Drive the vehicle, exercising the throttle and TP sensor.
- **Is the TP PID greater than 2.44 volts and the LOAD PID less than 30%?**

Yes	No
LISTEN for air noise around the MAF sensor and throttle body while the engine is running. REPAIR as necessary. If OK, INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DH21**.

DH21 CHECK THE TP SENSOR SIGNAL LOW VERSUS THE ENGINE LOAD WHILE DRIVING THE VEHICLE

- Key ON, engine running.
- Access the PCM and monitor the TP PID.
- Access the PCM and monitor the LOAD PID.
- Drive the vehicle while exercising the throttle and TP sensor near higher gears (preferably overdrive).
- **Is the TP PID less than 0.24 volt and the LOAD PID greater than 55%?**

Yes	No
If continuous memory DTC P0068 is present, INSTALL a new MAF sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DH22 CHECK FOR AN INTERMITTENT TP SIGNAL

- Key ON, engine running.
- Access the PCM and monitor the TP PID.
- Increase the engine speed to 1,500 RPM for 10 seconds.

- Lightly tap on the TP sensor and wiggle the harness connector to simulate road shock.
- **Is the voltage between 0.49 V - 4.65 V?**

Yes	No
GO to **DH23**.	INSPECT the TP sensor connector. REPAIR as necessary. If OK, INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DH23 CHECK THE TP SENSOR HARNESS FOR INTERMITTENT OPENS OR SHORTS

- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- Grasp the vehicle harness closest to the TP sensor connector.
- Shake and bend a small section of the harness all the way to the bulkhead.
- Wiggle, shake, and bend the harness from the bulkhead to the PCM.
- **Is the voltage between 0.49 V - 4.65 V?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DH24 DTC P0121: CHECK FOR OBSTRUCTION OR STICKING CONCERNS

NOTE: Do not attempt to clean the throttle bore and plate area. Cleaning damages the throttle body assembly.

NOTE: Conditions of sticking or obstruction can either be within the cables or throttle body assembly.

- Disconnect the accelerator cable and speed control cable from the throttle body linkage.
- Rotate the throttle body linkage.
- **Does the throttle body rotate freely without a sticking, binding, or grabbing condition?**

Yes	No
INSPECT the cable(s). REPAIR as necessary. REPEAT the self-test. If DTC P0121 is still present,	INSTALL a new throttle body assembly. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL --**

GO to **DH25**.	**E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DH25 CHECK THE FUNCTIONALITY OF THE THROTTLE POSITION SENSOR

- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- While slowly pressing the accelerator from the closed throttle position to the wide open throttle position, observe the TP PID.
- **Does the TP PID display a smooth reading during accelerator movement?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DH26 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DJ: AIR CONDITIONING EVAPORATOR TEMPERATURE (ACET) SENSOR

This pinpoint test is intended to diagnose the following:

- ACET sensor (19C734)
- harness circuits: ACET and SIGRTN
- powertrain control module (PCM) (12A650)

AIR CONDITIONING EVAPORATOR TEMPERATURE (ACET) SENSOR

°C	°F	Voltage	Resistance (K ohms)
100	212	0.47	2.08
90	194	0.61	2.8
80	176	0.80	3.84
70	158	1.05	5.34
60	140	1.37	7.55
50	122	1.77	10.93
40	104	2.23	16.11
30	86	2.74	24.25
20	68	3.26	37.34
10	50	3.73	58.99
0	32	4.14	95.85
-10	14	4.45	160.31
-20	-4	4.66	276.96

These values can vary by 15% due to sensor and VREF variations. Voltage values calculated for VREF are equal to 5 volts.

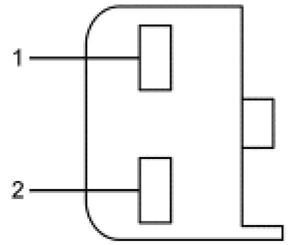

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Fig. 46: Powertrain Control Module (PCM) (12A650)
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	SIGRTN (Signal Return)
2	ACET (Air Conditioning Evaporator Temperature)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Connector	Pin	Circuit
140 Pin	B33, E57 B58, E58 B53	VREF SIGRTN ACET

DJ1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0537, P0538, P1436, or P1437 present?**

Yes	No
For KOEO and KOER DTCs P0538 or P1437, GO to **DJ2**. For KOEO and KOER DTCs P0537 or P1436, GO to **DJ6**. For continuous memory DTCs P0537, P0538, P1436 or P1437, GO to **DJ9**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DJ2 KOEO AND KOER DTCS P0538 OR P1437: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- ACET Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A ACET Sensor Connector, Harness Side	Point B ACET Sensor Connector, Harness Side
ACET - Pin 2	SIGRTN - Pin 1

- Check for self-test DTCs.
- **Are DTCs P0537 or P1436 present?**

Yes	No
INSTALL a new ACET sensor. CLEAR the DTCs. REPEAT the self-test.	GO to **DJ3**.

DJ3 CHECK THE ACET AND SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector disconnected.
- Measure the resistance between:

(+) ACET Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ACET - Pin 2	ACET - Pin B53
SIGRTN - Pin 1	SIGRTN - Pin B58, E58

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **DJ4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DJ4 CHECK THE ACET CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) ACET Sensor Connector, Harness Side	(-)
ACET - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **DJ5**.	REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

DJ5 CHECK THE ACET CIRCUIT FOR A SHORT TO VREF IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ACET - Pin B53	VREF - Pin E57

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DJ10**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DJ6 KOEO AND KOER DTCS P0537 OR P1436: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- ACET Sensor connector disconnected.
- Carry out the KOEO self-test.
- **Are DTCs P0538 or P1437 present?**

Yes	No
INSTALL a new ACET sensor. CLEAR the DTCs. REPEAT the self-test.	GO to **DJ7**.

DJ7 CHECK THE ACET CIRCUIT(S) FOR A SHORT TO SIGRTN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) ACET Sensor Connector, Harness Side	(-) ACET Sensor Connector, Harness Side
ACET - Pin 2	SIGRTN - Pin 1

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DJ8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DJ8 CHECK THE ACET CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) ACET Sensor Connector, Harness Side	(-)
ACET - Pin 2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DJ10**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DJ9 CONTINUOUS MEMORY DTCS P0537, P0538, P1436 OR P1437: CHECK THE ACET AND SIGRTN CIRCUIT FOR AN INTERMITTENT CONCERN

NOTE: **The voltage should be between 4.5 and 5.5 volts. The voltage reading changes suddenly when a concern is detected. For P0537/P1436, a sudden change could indicate a short to ground. For P0538/P1436, a sudden change could indicate an**

open ACET or SIGRTN circuit.

- ACET Sensor connector disconnected.
- Inspect the connectors for signs of damage, water intrusion, or corrosion.
- Measure the voltage between:

(+) ACET Sensor Connector, Harness Side	(-) ACET Sensor Connector, Harness Side
ACET - Pin 2	SIGRTN - Pin 1

- Key ON, engine OFF.
- While monitoring the voltage reading on the digital multimeter (DMM), wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- Key in OFF position.
- **Is there any change in the voltage reading, or is a concern found?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DJ10 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins.
  - corrosion.
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DK: ACCELERATOR PEDAL POSITION (APP) SENSOR

NOTE: After clearing an APP sensor diagnostic trouble code (DTC) to verify a repair or an intermittent concern, apply the accelerator pedal before carrying out the self-test. Take 10 seconds to carry out a full sweep of the accelerator pedal from fully released to fully applied and back to fully released.

This pinpoint test is intended to diagnose the following:

- accelerator pedal position (APP) sensor (9F836)
- harness circuits: ETCRTN, SIGRTN, ETCREF, APP1, APP2, and APP3
- powertrain control module (PCM) (12A650)

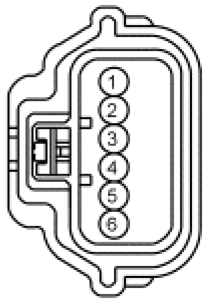

Fig. 47: Accelerator Pedal Position (APP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

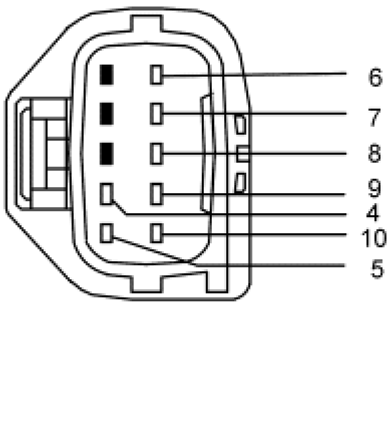

Fig. 48: Accelerator Pedal Position (APP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

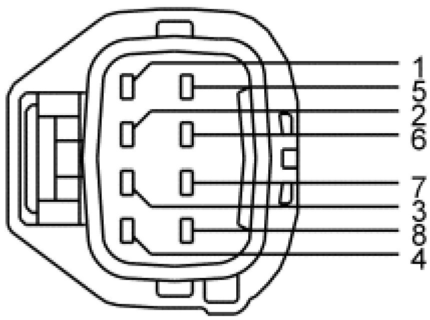

Fig. 49: Accelerator Pedal Position (APP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Focus	A	5 2 3, 4 1, 6	APP2 APP1 ETCRTN ETCREF
Fusion, Milan, MKZ	B	4 5 7 6, 9 10, 8	APP3 APP2 APP1 ETCRTN ETCREF
All other vehicles	C	8 5 2 1, 3 6, 7	APP3 APP2 APP1 ETCRTN ETCREF

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Mustang, Town Car	170 Pin	B41, B6, E59 B24, B4, E66 B35, B36 B28 B17 B5	ETCRTN ETCREF VPWR APP3 APP2 APP1
E-Series, F-Super Duty	170 Pin	B18, B6, E59 B16, B4, E66 B35, B36	ETCRTN ETCREF VPWR

		B28 B17 B5	APP3 APP2 APP1
Expedition, Navigator	140 Pin	B59, B65, E59 B21, B28, E66 B51, B52, B53 B27 B26 B25	ETCRTN ETCREF VPWR APP3 APP2 APP1
Explorer, Explorer Sport Trac, Mountaineer	170 Pin	B43, B6, E59 B24, B4, E66 B35, B36 B28 B17 B5	ETCRTN ETCREF VPWR APP3 APP2 APP1
F-150, Mark LT	190 Pin	B58, B59, E59 B21, B28, E66 B51, B52, B53 B27 B26 B25	ETCRTN ETCREF VPWR APP3 APP2 APP1
Focus	190 Pin	B44, B60, E60 B45, B61, E59 B67, B68 B29 B28	ETCRTN ETCREF VPWR APP2 APP1
Fusion, Milan, MKZ	140 Pin	B59, B60, E59 B21, B28, E66 B51, B52 B27 B26 B25	ETCRTN ETCREF VPWR APP3 APP2 APP1
All other vehicles	190 Pin	B59, B65, E59 B21, B28, E66 B51, B52, B53 B27 B26 B25	ETCRTN ETCREF VPWR APP3 APP2 APP1

DK1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P1575, P2104, P2121, P2122, P2123, P2126, P2127, P2128, P2131, P2132, P2133, or P2138 present?**

Yes	No
	For a lack/loss of power, GO to **DK3**.

For DTC P1575, GO to **DK2**. For all others, GO to **DK4**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DK2 DTC P1575: REPEAT THE KOEO SELF-TEST

NOTE: Make sure the accelerator pedal is not applied during the KOEO self-test.

- Key ON, engine OFF.
- Carry out the KOEO self-test.
- **Are any DTCs present other than P1575?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DK3**.

DK3 CHECK THE ACCELERATOR PEDAL FOR OBSTRUCTION

- Key ON, engine OFF.
- Press the accelerator pedal fully to the floor and release.
- **Does the pedal move freely to the floor and back?**

Yes	No
GO to **DK4**.	ISOLATE and REPAIR the obstruction. CLEAR the DTCs. REPEAT the self-test.

DK4 CHECK THE APP SENSOR SIGNAL VOLTAGE RANGES FOR THE ACCELERATOR PEDAL FULLY APPLIED AND RELEASED POSITIONS

- Access the PCM and monitor the APP1, APP2 and APP3 PIDs.
- Press the accelerator pedal fully to the floor and release.

ACCELERATOR PEDAL FULLY APPLIED VOLTAGE VALUES

Vehicle	APP1	APP2	APP3
E-Series	0.73 - 1.28	3.03 - 4.55	2.59 - 3.89
Expedition, Navigator	0.79 - 2.09	2.75 - 4.33	2.26 - 3.73
Explorer, Explorer Sport Trac, Mountaineer	0.60 - 1.57	3.07 - 4.50	2.57 - 3.89
F-150, Mark	0.60 -	3.07 -	2.57 -

LT	1.57	4.50	3.89
F-Super Duty	0.28 - 0.97	3.45 - 4.71	2.95 - 4.10
Focus	3.69 - 4.60	1.75 - 2.40	-
Fusion, Milan, MKZ	1.20 - 2.50	2.50 - 3.94	2.00 - 3.33
All others	0.48 - 1.76	2.95 - 4.62	2.43 - 4.02

ACCELERATOR PEDAL FULLY RELEASED VOLTAGE VALUES

Vehicle	APP1	APP2	APP3
Focus	0.70 - 0.90	0.30 - 0.50	-
All vehicles	3.43 - 4.69	1.13 - 1.88	0.64 - 1.28

- **Are all APP signals out of range for the pedal fully applied and released positions?**

Yes	No
GO to **DK5**.	For continuous memory DTCs P2121 and P2126 with P2131, GO to **DK24**. For all others, GO to **DK5**.

DK5 CHECK THE VREF VOLTAGE TO APP SENSOR

- Key in OFF position.
- APP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
ETCREF	ETCRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
For E-Series, Explorer, Explorer Sport Trac, F-150, Mark LT, and Mountaineer, GO to **DK6**. For F-Super Duty, GO to **DK7**.	

For Fusion, Milan, and MKZ, GO to **DK10**. For Focus with DTC P2122, P2123, or P2138, GO to **DK12**. For Focus with DTC P2127 or P2128, GO to **DK16**. For all others, GO to **DK11**.	refer to **PINPOINT TEST C**.

DK6 E-SERIES, EXPLORER, EXPLORER SPORT TRAC, F-150, MARK LT, MOUNTAINEER: CHECK THE APP SENSOR FOR THE CORRECT RESISTANCE

NOTE: Make sure the accelerator pedal is fully released when taking the resistance measurements.

- Key in OFF position.
- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Component Side	(-) APP Sensor Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
APP1	ETCREF	550	1,390
APP1	ETCRTN	1,030	2,590
APP1	APP2	2,125	5,335
APP1	APP3	1,930	4,845
APP2	ETCREF	1,785	4,480
APP2	ETCRTN	1,475	3,705
APP2	APP3	2,520	6,330
APP3	ETCREF	1,620	4,070
APP3	ETCRTN	1,135	2,860
ETCREF	ETCRTN	780	1,955
ETCREF	ETCREF	0	10
ETCRTN	ETCRTN	0	10

- **Are all the resistances within specifications?**

Yes	No
For DTCs P2121, P2122 or P2123 alone or in combination, GO to **DK12**. For DTCs P2126, P2127 or P2128 alone or in combination, GO to **DK16**. For DTCs P2131, P2132 or P2133 alone or in combination, GO to **DK20**. For DTC P2104 alone, GO to **DK30**.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal.

For a lack/loss of power, the concern is elsewhere. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction. For all others, GO to **DK24**.	CLEAR the DTCs. REPEAT the self-test.

DK7 F-SUPER DUTY: CHECK THE ACCELERATOR PEDAL CONFIGURATION AND APP SENSOR HOUSING

- Check the configuration of the accelerator pedal and determine the color of the APP sensor housing.
- **Is the vehicle equipped with an adjustable accelerator pedal?**

Yes	No
GO to **DK8**.	For F-Super Duty with a fixed accelerator pedal and a white APP sensor housing, GO to **DK9**. For all others, GO to **DK11**.

DK8 F-SUPER DUTY WITH ADJUSTABLE ACCELERATOR PEDAL: CHECK THE APP SENSOR FOR THE CORRECT RESISTANCE

NOTE: Make sure the accelerator pedal is fully released when taking the resistance measurements.

- Key in OFF position.
- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Component Side	(-) APP Sensor Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
APP1	ETCREF	550	1,390
APP1	ETCRTN	1,030	2,590
APP1	APP2	2,125	5,335
APP1	APP3	1,930	4,845
APP2	ETCREF	1,785	4,480
APP2	ETCRTN	1,475	3,705
APP2	APP3	2,520	6,330
APP3	ETCREF	1,620	4,070
APP3	ETCRTN	1,135	2,860
ETCREF	ETCRTN	780	1,955
ETCREF	ETCREF	0	10
ETCRTN	ETCRTN	0	10

- **Are all the resistances within specifications?**

Yes	No
For DTCs P2121, P2122 or P2123 alone or in combination, GO to **DK12**. For DTCs P2126, P2127 or P2128 alone or in combination, GO to **DK16**. For DTCs P2131, P2132 or P2133 alone or in combination, GO to **DK20**. For DTC P2104 alone, GO to **DK30**. For a lack/loss of power, the concern is elsewhere. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction. For all others, GO to **DK24**.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal. CLEAR the DTCs. REPEAT the self-test.

DK9 F-SUPER DUTY WITH FIXED ACCELERATOR PEDAL AND WHITE APP SENSOR HOUSING: CHECK THE APP SENSOR FOR THE CORRECT RESISTANCE

NOTE: **Make sure the accelerator pedal is fully released when taking the resistance measurements.**

- Key in OFF position.
- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Component Side	(-) APP Sensor Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
APP1	ETCREF	1,080	1,865
APP1	ETCRTN	1,535	2,860
APP1	APP2	2,820	5,225
APP1	APP3	2,775	5,205
APP2	ETCREF	1,995	3,700
APP2	ETCRTN	1,625	3,170
APP2	APP3	3,000	5,835
APP3	ETCREF	1,985	3,735
APP3	ETCRTN	1,440	2,870
ETCREF	ETCRTN	805	1,500
ETCREF	ETCREF	0	10
ETCRTN	ETCRTN	0	10

- **Are all the resistances within specifications?**

Yes	No
For DTCs P2121, P2122 or P2123 alone or in combination, GO to **DK12**. For DTCs P2126, P2127 or P2128 alone or in combination, GO to **DK16**. For DTCs P2131, P2132 or P2133 alone or in combination, GO to **DK20**. For DTC P2104 alone, GO to **DK30**. For a lack/loss of power, the concern is elsewhere. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction. For all others, GO to **DK24**.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal. CLEAR the DTCs. REPEAT the self-test.

DK10 FUSION, MILAN, MKZ: CHECK THE APP SENSOR FOR THE CORRECT RESISTANCE

NOTE: Make sure the accelerator pedal is fully released when taking the resistance measurements.

- Key in OFF position.
- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Component Side	(-) APP Sensor Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
APP1	ETCREF	650	1,340
APP1	ETCRTN	1,210	2,470
APP1	APP2	2,430	4,960
APP1	APP3	2,390	4,880
APP2	ETCREF	2,020	4,120
APP2	ETCRTN	1,650	3,380
APP2	APP3	3,000	6,130
APP3	ETCREF	2,010	4,110
APP3	ETCRTN	1,450	2,970
ETCREF	ETCRTN	900	1,840
ETCREF	ETCREF	0	10
ETCRTN	ETCRTN	0	10

- **Are all the resistances within specifications?**

Yes	No

For DTCs P2121, P2122 or P2123 alone or in combination, GO to **DK12**. For DTCs P2126, P2127 or P2128 alone or in combination, GO to **DK16**. For DTCs P2131, P2132 or P2133 alone or in combination, GO to **DK20**. For DTC P2104 alone, GO to **DK30**. For a lack/loss of power, the concern is elsewhere. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction. For all others, GO to **DK24**.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal. CLEAR the DTCs. REPEAT the self-test.

DK11 ALL OTHERS: CHECK THE APP SENSOR FOR THE CORRECT RESISTANCE

NOTE: Make sure the accelerator pedal is fully released when taking the resistance measurements.

- Key in OFF position.
- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Component Side	(-) APP Sensor Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
APP1	ETCREF	600	1,370
APP1	ETCRTN	720	1,660
APP1	APP2	1,300	2,960
APP1	APP3	1,250	2,860
APP2	ETCREF	750	1,720
APP2	ETCRTN	660	1,520
APP2	APP3	1,230	2,810
APP3	ETCREF	710	1,640
APP3	ETCRTN	580	1,340
ETCREF	ETCRTN	200	470
ETCREF	ETCREF	0	10
ETCRTN	ETCRTN	0	10

- **Are all the resistances within specifications?**

Yes	No
For DTCs P2121, P2122 or P2123 alone or in	

combination, GO to **DK12**. For DTCs P2126, P2127 or P2128 alone or in combination, GO to **DK16**. For DTCs P2131, P2132 or P2133 alone or in combination, GO to **DK20**. For DTC P2104 alone, GO to **DK30**. For a lack/loss of power, the concern is elsewhere. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction. For all others, GO to **DK24**.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal. CLEAR the DTCs. REPEAT the self-test.

DK12 CHECK THE APP1 CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- APP Sensor connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APP1	APP1

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DK13**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DK13 CHECK THE APP1 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) Vehicle Battery
APP1	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No

GO to **DK14**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK14 CHECK THE APP1 CIRCUIT FOR A SHORT IN THE HARNESS

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP1	ETCRTN
APP1	ETCREF

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DK15**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK15 CHECK THE APP1 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) APP Sensor Connector, Harness Side	(-) Vehicle Battery
APP1	Negative terminal

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DK24**.

DK16 CHECK THE APP2 CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- APP Sensor connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APP2	APP2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DK17**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DK17 CHECK THE APP2 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
APP2	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DK18**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK18 CHECK THE APP2 CIRCUIT FOR A SHORT IN THE HARNESS

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP2	ETCRTN
APP2	ETCREF

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DK19**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK19 CHECK THE APP2 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
APP2	Negative terminal

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DK25**.

DK20 CHECK THE APP3 CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APP3	APP3

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DK21**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DK21 CHECK THE APP3 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
APP3	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DK22**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK22 CHECK THE APP3 CIRCUIT FOR A SHORT IN THE HARNESS

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP3	ETCRTN
APP3	ETCREF

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DK23**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK23 CHECK THE APP3 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
APP3	Negative terminal

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DK26**.

DK24 CHECK FOR THE APP1 CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

- Key in OFF position.
- PCM connector disconnected.

- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP1	APP2
APP1	APP3
APP1	ETCREF
APP1	ETCRTN

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DK27**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK25 CHECK FOR THE APP2 CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP2	APP1
APP2	APP3
APP2	ETCREF
APP2	ETCRTN

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DK27**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK26 CHECK FOR THE APP3 CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP3	APP1
APP3	APP2
APP3	ETCREF
APP3	ETCRTN

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DK27**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK27 CHECK THE APP SENSOR CIRCUITS FOR AN INTERMITTENT CONCERN

- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APP1	APP1
APP2	APP2
APP3	APP3

- **Are the resistances less than 5 ohms?**

Yes	No
For Focus, GO to **DK28**. For all others, GO to **DK30**.	ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DK28 CHECK FOR DTCS

- PCM connector connected.
- Key ON, engine OFF.
- Carry out the KOEO self-test.
- **Are DTCs P2122 and P2127 present?**

Yes	No
GO to **DK29**.	GO to **DK30**.

DK29 SIMULATE THE OPPOSITE SIGNAL

- Key in OFF position.
- Connect a 5 amp fused jumper wire between the following:

Point A APP Sensor Connector, Harness Side	Point B APP Sensor Connector, Harness Side
ETCREF	APP1
ETCREF	APP2

- Key ON, engine OFF.
- Access the PCM and monitor the APP1 and APP2 PIDs.
- **Are the voltages greater than 4.5 V?**

Yes	No
INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal. CLEAR the DTCs. REPEAT the self-test.	GO to **DK30**.

DK30 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DL: CYLINDER HEAD TEMPERATURE (CHT) SENSOR

This pinpoint test is intended to diagnose the following:

- cylinder head temperature (CHT) sensor (6G004)
- harness circuits: CHT, VREF, and SIGRTN
- powertrain control module (PCM) (12A650)

On applications that do not use an engine coolant temperature (ECT) sensor, the CHT sensor is used to determine the engine coolant temperature. To cover the entire temperature range of both the CHT and ECT sensors, the PCM has a dual switching resistor circuit on the CHT input. A graph showing the temperature switching from the COLD END line to the HOT END line, with increasing temperature and back with decreasing temperature is included. Note the temperature to voltage overlap zone. Within this zone it is possible to have either a COLD END or HOT END voltage at the same temperature. For example, at 90°C (194°F) the voltage could read either 0.60 volt or 3.71 volts. Refer to the table for the temperature to voltage expected values.

Voltage values calculated for VREF = 5 volts. These values can vary by 15% due to sensor and VREF variations.

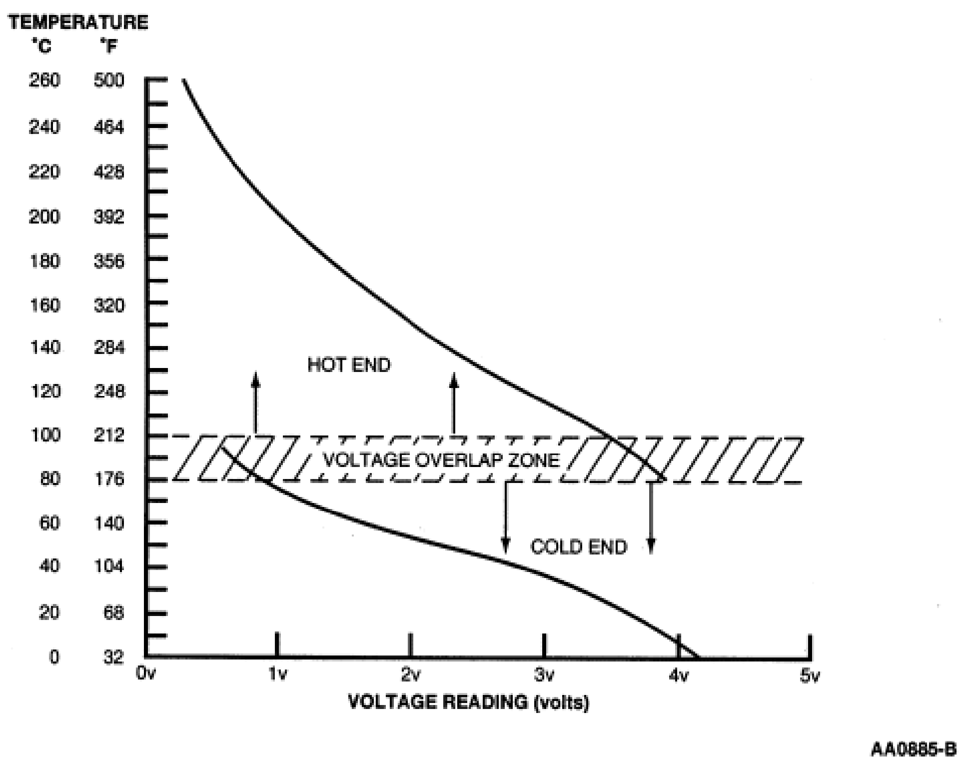

Fig. 50: Cylinder Head Temperature Sensor Voltage Graph
Courtesy of FORD MOTOR CO.

CYLINDER HEAD TEMPERATURE SENSOR EXPECTED VALUES

Temperature		CHT Sensor Values		
°C	°F	Cold End (volts)	Hot End (volts)	Resistance (K ohms)
-40	-40	4.89	-	965.808

-30	-22	4.81	-	513.019
-20	-4	4.67	-	283.664
-10	14	4.45	-	162.584
0	32	4.14	-	96.255
10	50	3.73	-	59.175
20	68	3.26	-	37.387
30	86	2.74	-	24.215
40	104	2.23	-	16.043
50	122	1.76	-	10.85
60	140	1.36	-	7.487
70	158	1.04	-	5.268
80	176	0.79	3.99	3.775
85	185	0.69	3.86	3.215
90	194	0.60	3.71	2.75
95	203	0.53	3.56	2.361
100	212	0.46	3.41	2.034
110	230	-	3.07	1.523
120	248	-	2.74	1.155
130	266	-	2.41	0.8866
140	284	-	2.10	0.6891
150	302	-	1.81	0.5417
160	320	-	1.55	0.4301
170	338	-	1.33	0.3449
180	356	-	1.13	0.2791
190	374	-	0.96	0.2278
200	392	-	0.82	0.1875
210	410	-	0.70	0.155
220	428	-	0.60	0.130
230	446	-	0.51	0.109
240	464	-	0.44	0.092
250	482		0.35	0.078
260	500		0.33	0.067

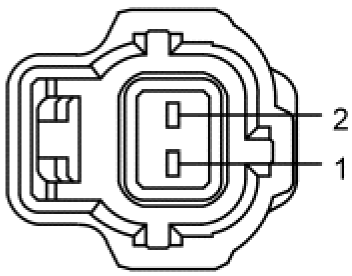

Fig. 51: Cylinder Head Temperature (CHT) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
1	CHT (Cylinder Head Temperature)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B29, B64 E58 E41	VREF SIGRTN CHT
Escape/Mariner	150 (50-50-50) Pin	E40 E41 E33	VREF SIGRTN CHT
Expedition, Fusion, Milan, MKZ, Navigator	140 Pin	E57 E58 E41	VREF SIGRTN CHT
F-150, Mark LT	190 Pin	E57 E58 E41	VREF SIGRTN CHT
Focus	190 Pin	E63 E64 E15	VREF SIGRTN CHT
All other vehicles	170 Pin	E57	VREF

		E58 E41	SIGRTN CHT

DL1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0116, P0119, P0125, P0128, P1116, P1285, P1288, P1289, P128A, P1290, or P1299 present?**

Yes	No
For DTCs P1116 or P1288, GO to **DL2**. For KOEO and KOER DTCs P1289 or P1290, GO to **DL8**. For continuous memory DTCs P0119, P1289, P128A, or P1290, GO to **DL15**. For KOEO or continuous memory DTC P1299, GO to **DL21**. For continuous memory DTCs P0125 or P0128, GO to **DL22**. For continuous memory DTC P0116, GO to **DL24**. For DTC P1285, GO to **DL18**.	For Temperature Warning Indicator Lamp or Gauge (applications with CHT sensor only) symptom, GO to **DL29**. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DL2 SELF-TEST DTCS P1288 OR P1116: CHECK THE COOLING SYSTEM

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

- The DTC indicates the temperature sensor is out of self-test range. The engine is not at normal operating temperature.
- Check the vehicle coolant level.
- **Is the cooling system OK?**

Yes	No
GO to **DL3**.	REFER to the **ENGINE COOLING -- E-SERIES** , for loss of coolant diagnosis. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL3 CHECK IF THE VEHICLE ENGINE STARTS

- Attempt to start the engine.
- **Does the engine start and run normally?**

Yes	No
GO to **DL6**.	GO to **DL4**.

DL4 CHECK THE RESISTANCE OF THE CHT SENSOR WITH THE ENGINE OFF

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to **DL5**.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DL5 CHECK THE CIRCUIT FROM THE MODULE TO THE COMPONENT

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- CHT Sensor connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the CHT PID.
- Using the data collected from the previous step, compare temperature resistance measured at the sensor to the PID temperature voltage measured at the PCM.
- **Does the measured value at the sensor agree with measured PID value at the PCM?**

Yes	No
The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** , for further direction.	GO to **DL12**.

DL6 CHECK THE CHT SENSOR OPERATION

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Carry out the PCM self-test.
- **Are DTCs P1116 or P1288 present?**

Yes	No
GO to **DL7**.	The engine temperature was not stabilized. REPAIR any other DTCs as necessary.

DL7 CHECK THE RESISTANCE OF THE CHT SENSOR

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- The vehicle must be at normal operating temperature.
- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to **DL31**.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DL8 DTCS P1289 OR P1290: ACCESS THE CHT PID AND CHECK THE VOLTAGE

- Key ON, engine OFF.
- Access the PCM and monitor the CHT PID.
- **Is the voltage less than 0.2 V?**

Yes	No

GO to **DL9**.	GO to **DL10**.

DL9 CHECK FOR A GROUNDED CIRCUIT

- CHT Sensor connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the CHT PID.
- **Is the voltage greater than 4.6 V?**

Yes	No
INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DL14**.

DL10 CHECK THE CHT CIRCUIT FOR A SHORT TO VOLTAGE

- CHT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CHT Sensor Connector, Harness Side	(-)
CHT - Pin 1	Ground

- **Is the voltage greater than 5.5 V?**

Yes	No
REPAIR the short circuit to PWR. CHECK the CHT sensor for damage. GO to **DL11**.	GO to **DL11**.

DL11 CHECK THE RESISTANCE OF THE CHT SENSOR WITH THE ENGINE OFF

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to **DL12**.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DL12 CHECK THE SIGNAL AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
CHT - Pin 1	CHT
SIGRTN - Pin 2	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **DL13**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DL13 CHECK THE SENSOR SIGNAL FOR A SHORT TO VREF

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
CHT	VREF

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DL31**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DL14 CHECK THE SENSOR SIGNAL FOR A SHORT TO GROUND

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
CHT	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) 12 Volt Vehicle Battery
CHT	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DL31**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DL15 DTCS P0119, P1289, P1290 OR P128A: INTERMITTENT CHECK

- Key ON, engine OFF.
- Access the PCM and monitor the CHT PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector
- **Is there a large change in the voltage reading?**

Yes	No
DISCONNECT and INSPECT the connector. If OK, INSTALL a new CHT sensor. REFER to the	

ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES . CLEAR the DTCs. REPEAT the self-test.	GO to **DL16**.

DL16 CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

- Access the PCM and monitor the CHT PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there a large change in the voltage reading?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DL17**.

DL17 CHECK THE PCM AND VEHICLE HARNESS CONNECTORS

- PCM connector disconnected.
- CHT Sensor connector disconnected.
- **Are the connectors and terminals OK?**

Yes	No
GO to **DL31**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL18 SELF-TEST DTC P1285: EARLY WARNING OF ENGINE OVERHEAT CONDITION

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

NOTE: **If the electric cooling fan does not operate, return toDIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS for electric cooling fan DTC. Return toNO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX for symptom diagnosis.**

- An engine overheat condition is sensed by the CHT sensor.
- Check the cooling system for:
  - correct coolant level
  - internal or external coolant leaks

- blockage of the radiator
- cooling fan operation

- **Is the cooling system OK?**

Yes	No
GO to **DL19**.	REFER to the **ENGINE COOLING -- E-SERIES** , for loss of coolant diagnosis. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL19 CHECK THE OPERATION OF THE CYLINDER HEAD TEMPERATURE SENSOR

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Carry out the self-test.
- **Is DTC P1285 present?**

Yes	No
GO to **DL20**.	An engine overheat temperature was not detected. REPAIR any other DTCs as necessary.

DL20 CHECK THE RESISTANCE OF THE CHT SENSOR

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- The vehicle must be at normal operating temperature.
- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to **DL31**.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** .

	CLEAR the DTCs. REPEAT the self-test.

DL21 SELF-TEST DTC P1299: INDICATES AN ENGINE OVERHEAT CONDITION

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

NOTE: Refer to DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS for possible causes and additional DTC description information.

- Check the engine coolant level.
- **Is the engine coolant fill level correct?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the engine overheating condition. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the loss of coolant. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL22 SELF-TEST DTCS P0125 OR P0128: CHECK THE ENGINE COOLANT LEVEL

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

NOTE: DTC P0125 or P0128 indicates the engine coolant temperature has not achieved the required engine operation temperature level, since start-up within a specified amount of time.

- Check the engine coolant level.
- **Is the engine coolant fill level correct?**

Yes	No
GO to **DL23**.	REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the loss of coolant. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL23 CHECK THE SENSOR OPERATION

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Access the PCM and monitor the CHT PID.
- **Is the temperature greater than 77°C (170.6°F)?**

Yes	No
The test is complete. CLEAR the DTCs. REPEAT the self-test.	REFER to the **ENGINE COOLING -- E-SERIES** to diagnosis engine not reaching normal operating temperature. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL24 DTC P0116: CHECK THE RESISTANCE OF THE CHT SENSOR WITH THE ENGINE OFF

NOTE: **Verify the engine temperature is at ambient room temperature before continuing with this test. A soak period of 6 hours may be required. Refer toDIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS for information concerning P0116.**

- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- Refer to the chart at the beginning of this test for the resistance specifications.
- **Is the resistance within specification?**

Yes	No
GO to **DL25**.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DL25 DTC P0116: CHECK THE RESISTANCE OF THE CHT SENSOR

NOTE: **Verify the engine is at operating temperature before taking the CHT reading.**

- CHT Sensor connector connected.
- Run the engine until the engine temperature stabilizes.
- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- Refer to the chart at the beginning of this test for the resistance specifications.
- **Is the resistance within specification?**

Yes	No
The concern is not present at this time. CARRY OUT the OBD drive cycle to determine if fuel, HO2S, catalyst and misfire monitors can be executed. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . REPEAT the PCM self-test if necessary.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DL26 DTC P0298: ENGINE OIL OVER TEMPERATURE CONDITION

NOTE: **The engine oil temperature protection strategy in the PCM has been activated. This protects the engine against mechanical damage due to overheating. Refer toDIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS for possible causes and additional DTC description information.**

- Check for an overheating condition and base engine concerns.
- **Are there any overheating or base engine concerns?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DL27**.

DL27 CHECK FOR CHT DTCS

- Carry out the self-test.
- **Are DTCs P1285, P1288, P1289 or P1299 present?**

Yes	No
DISREGARD the engine oil temperature (EOT) diagnostic trouble code (DTC) at this time. ADDRESS the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DL28**.

DL28 ROAD TEST THE VEHICLE AND MONITOR FOR ENGINE OVER TEMPERATURE

- Access the freeze frame data (if available) and record the DTC malfunction conditions.
- Access the PCM and monitor the CHT PID.
- Test drive the vehicle and allow the engine to reach normal operating temperature.
- Observe CHT PID.
- **Does the engine overheat?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the overheat symptom. REPAIR as necessary. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time.

DL29 ENGINE TEMPERATURE WARNING INDICATOR LAMP ON OR TEMPERATURE GAUGE INDICATES HOT, BUT ENGINE IS NOT OVERHEATING

NOTE: The PCM self-test must be carried out prior to entering this pinpoint test.

- **Was the PCM self-test carried out prior to entering this pinpoint test?**

Yes	No
GO to **DL30**.	The concern is elsewhere. RETURN to**PINPOINT TEST QT** for further direction.

DL30 ENGINE TEMPERATURE INDICATOR LAMP ON OR TEMPERATURE GAUGE INDICATES HOT WITH NO DTCS

NOTE: The engine temperature warning indicator (gauge or lamp) is a warning system that gives the driver information during an engine overheating condition. The PCM monitors the CHT sensor and determines if fail-safe cooling mode is needed. If fail-safe cooling mode is needed, the PCM sends a controller area network (CAN) message to the instrument cluster to signal an overheating condition. This causes the instrument cluster indicator to illuminate and forces the temperature gauge to the H (hot) zone. DTC P1285 is stored in the PCM.

NOTE: For Engine Temperature Warning Indicator system problems, refer to the INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES .

- PCM connector disconnected.
- Key ON, engine OFF.
- **Does the engine temperature warning indicator lamp turn OFF (prove out) and\or the temperature gauge return to the normal zone with the PCM disconnected?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the overheat symptom. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	REFER to the **INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES** to diagnose the incorrect temperature gauge. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL31 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DM: MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

This pinpoint test is intended to diagnose the following:

- manifold absolute pressure (MAP) sensor (9F479)
- harness circuits: MAP, SIGRTN, VREF
- powertrain control module (PCM) (12A650)

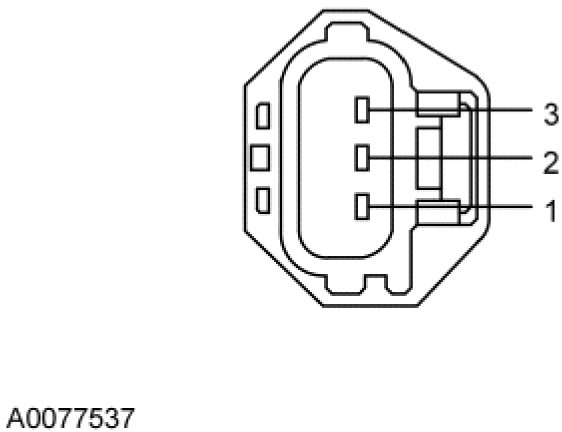

Fig. 52: Manifold Absolute Pressure (MAP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

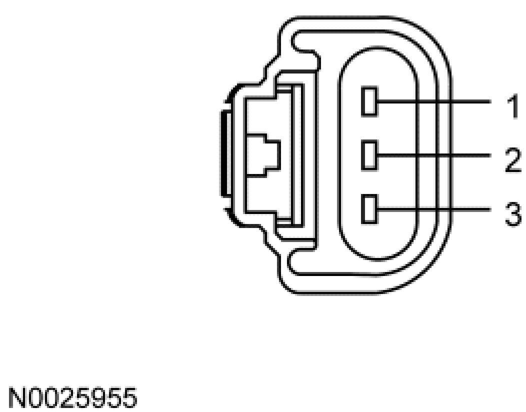

Fig. 53: Manifold Absolute Pressure (MAP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

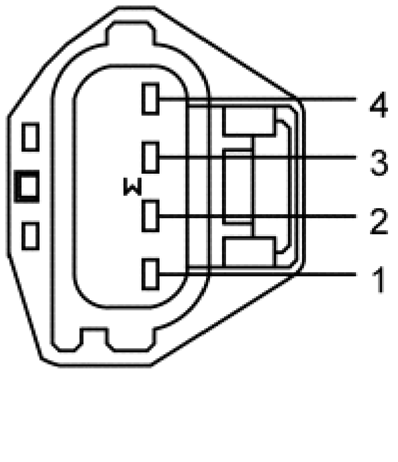

Fig. 54: Manifold Absolute Pressure (MAP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 3.0L	A	2 3 1	MAP SIGRTN VREF
Fusion 3.0L, Milan 3.0L	B	1 2 3	MAP SIGRTN VREF
All other vehicles	C	1 4 2	MAP SIGRTN VREF

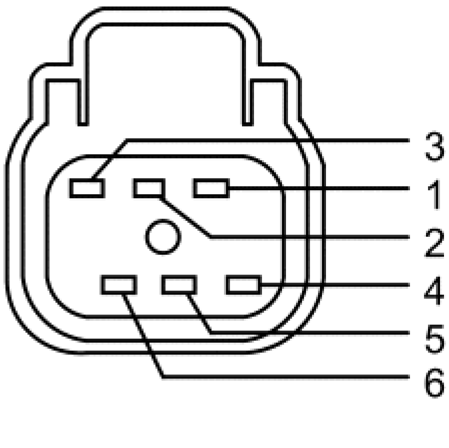

Fig. 55: EGR System Module (ESM) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	VPWR (Vehicle Power)
3	MAP (Manifold Absolute Pressure)
6	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B35, B36 B40, E40 B41, E41, T41 E23	VPWR VREF SIGRTN MAP
F-150	190 Pin	B51, B52, B53 B29, E57 B58, E58, T43 E62	VPWR VREF SIGRTN MAP
Focus	190 Pin	B67, B68 B52, B66, E63 B58, E64, T40 E40	VPWR VREF SIGRTN MAP
Fusion, Milan	140 Pin	B51, B52 B33, E57 B58, E58 E62	VPWR VREF SIGRTN MAP
All other vehicles	170 Pin	B35, B36 B40, E57 B41, E58, T41 E62	VPWR VREF SIGRTN MAP

DM1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0106, P0107, P0108, P0109, P012B, P012C, P012D, or P012E present?**

Yes	No
For vehicles with an EGR system module (ESM), KOEO, KOER DTCs P0107, P0108, P012C, or P012D. GO to **DM2**. For vehicles without an EGR system module (ESM), any DTC P0106, KOEO, KOER DTCs P0107 or P0108, GO to **DM20**. For vehicles with an EGR system module (ESM) continuous memory DTCs P0107, P0108, P012C, P012D or KOEO P0109, or P012E. GO to **DM14**. For vehicles without an EGR system module (ESM)	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

continuous memory DTCs P0107, P0108, or KOEO P0109, GO to **DM26**. For vehicles with an EGR system module (ESM) DTC P0106, or P012B. GO to **DM15**.	

DM2 DTCS P0107 AND P0108: MONITOR THE MAP PID

- Key ON, engine running.
- Carry out the KOER self-test.
- Access the PCM and monitor the MAP PID.
- **Is the voltage between 0.05 - 4.95 V?**

Yes	No
VERIFY the PCM is at the latest calibration level. REPROGRAM if necessary. If the PCM is at the latest calibration level, the concern is not present at this time.	GO to **DM3**.

DM3 VERIFY HARNESS AND CONNECTOR INTEGRITY

- Key in OFF position.
- ESM connector disconnected.
- Carry out a thorough visual inspection of the connector, pins and wires attaching to the pins.
- **Are there any concerns with the wiring or the ESM connection?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DM4**.

DM4 MONITOR THE MAP PID

- ESM connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- **Is the voltage between 0.05 - 4.95 V?**

Yes	No
The concern is not present at this time. CLEAR the DTCs. REPEAT the self-test.	GO to **DM5**.

DM5 DETERMINE THE PRESENT MAP PID VOLTAGE

- Access the PCM and monitor the MAP PID.

- **Is the voltage less than 0.05 V?**

Yes	No
GO to **DM6**.	GO to **DM9**.

DM6 KOEO AND KOER DTC P0107: CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE ESM HARNESS CONNECTOR

- ESM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 6

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to **DM7**.	refer to **PINPOINT TEST C**.

DM7 CHECK THE MAP CIRCUIT FOR A SHORT TO SIGRTN AND GND IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) ESM Connector, Harness Side	(-)
MAP - Pin 3	Ground

- Measure the resistance between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP - Pin 3	SIGRTN - Pin 6

- **Is the resistance greater than 10K ohms?**

Yes	No

GO to **DM8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DM8 INDUCE THE OPPOSITE MAP SENSOR VOLTAGE TO SIMULATE A HIGH CONDITION

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A ESM Connector, Harness Side	Point B ESM Connector, Harness Side
MAP - Pin 3	VREF - Pin 2

- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- **Is the voltage greater than 4.6 V?**

Yes	No
INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DM27**.

DM9 KOEO AND KOER DTC P0108: CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE ESM HARNESS CONNECTOR

- ESM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 6

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to **DM10**.	refer to **PINPOINT TEST C**.

DM10 CHECK THE MAP AND SIGRTN CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP	MAP - Pin 3
SIGRTN	SIGRTN - Pin 6

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **DM11**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DM11 CHECK THE MAP CIRCUIT FOR A SHORT TO VREF IN THE HARNESS

- Measure the resistance between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP - Pin 3	VREF - Pin 2

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DM12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DM12 CHECK THE MAP CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Measure the resistance between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP - Pin 3	VPWR - Pin 4

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DM13**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DM13 INDUCE THE OPPOSITE MAP SENSOR VOLTAGE TO SIMULATE A LOW CONDITION

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A ESM Connector, Harness Side	Point B ESM Connector, Harness Side
MAP - Pin 3	SIGRTN - Pin 6

- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- **Is the voltage less than 0.1 V?**

Yes	No
INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DM27**.

DM14 DTCS P0107, P0108 AND P0109: CHECK THE MAP CIRCUIT(S) FOR INTERMITTENT CONCERNS

- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- Carry out a thorough wiggle test on the ESM harness.
- Lightly tap on the ESM and wiggle the harness connector to simulate road shock.
- **Does a sudden change in voltage occur while monitoring the PID?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DM15 DTC P0106: MAP RANGE/PERFORMANCE

NOTE: **If MAP DTC(s) P0107, P0108 or P0109 are present, diagnose those DTC(s) first. If any mass air flow (MAF) sensor related DTCs are present, diagnose those DTCs prior to diagnosing MAP DTC P0106. Disregard any DTC(s) generated as a result of this test.**

- Key in OFF position.
- ESM connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A ESM Connector, Harness Side	Point B ESM Connector, Component Side
VREF - Pin 2	VREF - Pin 2
SIGRTN - Pin 6	SIGRTN - Pin 6

- Key ON, engine running.
- Measure the voltage between:

(+) ESM Connector, Component Side	(-) Vehicle Battery
MAP - Pin 3	Negative terminal

- **Is the voltage between 1 - 2 V?**

Yes	No
GO to **DM19**.	GO to **DM16**.

DM16 CHECK THE MAP CIRCUIT FOR AN OPEN IN THE ESM HARNESS

- Key in OFF position.
- Remove the jumper wires.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP	MAP - Pin 3

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DM17**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DM17 CHECK THE MAP CIRCUIT FOR A SHORT IN THE ESM HARNESS

- Measure the resistance between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP - Pin 3	SIGRTN - Pin 6
MAP - Pin 3	VREF - Pin 2
MAP - Pin 3	VPWR - Pin 4

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DM18**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DM18 KOEO AND KOER MAP VOLTAGE

NOTE: The MAP PID should change by at least 1.5 volts from key on engine off to key on engine running.

- Key in OFF position.
- ESM connector connected.
- PCM connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- Record the KOEO MAP voltage.
- Key ON, engine running.
- Access the PCM and monitor the MAP PID.
- Record the KOER MAP voltage.
- **Does the MAP PID value change?**

Yes	No
GO to **DM19**.	CHECK the MAP hose for freezing or obstructions. If OK, INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DM19 COMPARE ACTUAL MAP VOLTAGE TO MAP PID VOLTAGE

- Key in OFF position.
- ESM connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

	Point B ESM

Point A ESM Connector, Harness Side	Connector, Component Side
VREF - Pin 2	VREF - Pin 2
SIGRTN - Pin 6	SIGRTN - Pin 6
MAP - Pin 3	MAP - Pin 3

- Measure the voltage between:

(+) ESM Connector, Harness Side	(-)
MAP - Pin 3	Ground

- Record the actual MAP voltage values at key on engine off, idle, 1,000 and 2,000 RPM.
- Access the PCM and monitor the MAP PID.
- Record the MAP PID voltage values at key on engine off, idle, 1,000 and 2,000 RPM.
- **Does the MAP PID voltage stay within 0.5 volt of the actual MAP voltage?**

Yes	No
The concern is not present at this time. CLEAR the DTCs. REPEAT the self-test.	CARRY OUT a visual inspection. CHECK for loose connections, and damaged or corroded pins. WIGGLE the harness, attempting to RECREATE the concern. CLEAR the DTCs. REPEAT the self-test.

DM20 KOEO AND KOER DTCS P0106, P0107 AND P0108: CHECK THE VOLTAGE BETWEEN VREF AND SIGRTN AT THE MAP SENSOR

- MAP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MAP Sensor Connector, Harness Side	(-) MAP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **DM22**.	GO to **DM21**.

DM21 CHECK FOR VREF VOLTAGE AT THE SENSOR

- Measure the voltage between:

(+) MAP Sensor Connector, Harness Side	(-) Vehicle Battery
VREF	Negative terminal

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
REPAIR the open SIGRTN circuit. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST C**.

DM22 CHECK MAP SIGNAL VOLTAGE AT THE SENSOR

- Measure the voltage between:

(+) MAP Sensor Connector, Harness Side	(-) MAP Sensor Connector, Harness Side
MAP	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **DM24**.	GO to **DM23**.

DM23 CHECK THE MAP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) MAP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
MAP	MAP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DM24**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DM24 CHECK THE MAP CIRCUIT FOR A SHORT TO VOLTAGE OR SIGRTN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
MAP	VREF
MAP	SIGRTN
MAP	VPWR

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DM25**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DM25 INDUCE THE OPPOSITE SIGNAL

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A MAP Sensor Connector, Harness Side	Point B MAP Sensor Connector, Harness Side
MAP	SIGRTN

- Access the PCM and monitor the MAP PID.
- **Is the voltage less than 0.1 V?**

Yes	No
INSTALL a new MAP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** .	GO to **DM27**.

CLEAR the DTCs. REPEAT the self-test.	

DM26 DTCS P0107, P0108 AND P0109: CHECK THE MAP CIRCUIT(S) FOR INTERMITTENT CONCERNS

- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- Carry out a thorough wiggle test on the MAP harness.
- Lightly tap on the MAP and wiggle the harness connector to simulate road shock.
- **Does a sudden change in voltage occur while monitoring the PID?**

Yes	No
GO to **DM20**.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DM27 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DP: OUTPUT SHAFT SPEED (OSS) SENSOR/VEHICLE SPEED SENSOR (VSS)/TRANSFER CASE SPEED SENSOR (TCSS)

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- OSS/VSS/TCSS (7F293/7M101/7H103)
- harness circuits: OSS/VSS, TCSS, and SIGRTN

- powertrain control module (PCM) (12A650)

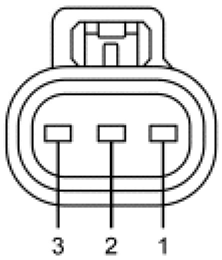

Fig. 56: Output Shaft Sensor/Vehicle Speed Sensor (OSS/VSS) Connector - A
Courtesy of FORD MOTOR CO.

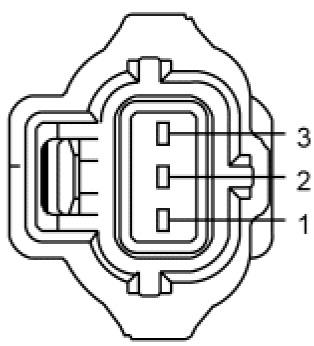

Fig. 57: Output Shaft Sensor/Vehicle Speed Sensor (OSS/VSS) Connector - B
Courtesy of FORD MOTOR CO.

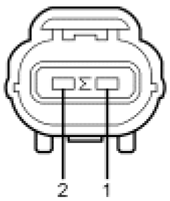

Fig. 58: Output Shaft Sensor/Vehicle Speed Sensor (OSS/VSS) Connector - C
Courtesy of FORD MOTOR CO.

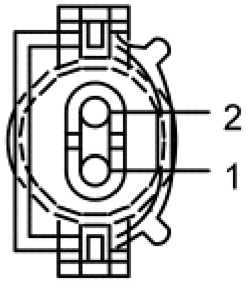

Fig. 59: Output Shaft Sensor/Vehicle Speed Sensor (OSS/VSS) Connector - D
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
F-Super Duty	A	3 2 1	SIGRTN OSS/VSS VPWR
Focus	B	2 1 3	OSS/VSS PWRGND VPWR
Fusion 2.3L, Milan 2.3L	C	2 1	SIGRTN OSS/VSS
Mustang	D	2 1	SIGRTN OSS/VSS
All other vehicles	D	1 2	SIGRTN OSS/VSS

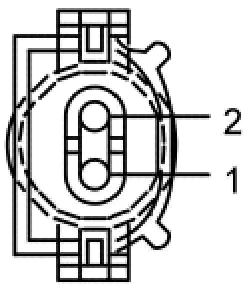

Fig. 60:
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	TCSS (Transfer Case Speed Sensor)
1	SIGRTN (Signal Return)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B35 B47, B48, B49, B50 B41, E41, T41 T4	VPWR PWRGND SIGRTN OSS/VSS
F-150 4.2L	190 Pin	B51 B67, B68, B69, B70 B58, E58, T43 T14	VPWR PWRGND SIGRTN OSS/VSS
F-Super Duty, Mustang, Ranger	170 Pin	B35 B47, B48, B49, B50 B41, E58, T41 T3	VPWR PWRGND SIGRTN OSS/VSS
Focus	190 Pin	B67 B69, B70 B58, E64, T40 T2	VPWR PWRGND SIGRTN OSS/VSS
Fusion, Milan	140 Pin	B51 B67, B68, B69 B58, E58 B65	VPWR PWRGND SIGRTN OSS/VSS

All other vehicles	190 Pin	B51 T16 B67, B68, B69, B70 B58, E58, T43	VPWR TCSS PWRGND SIGRTN

DP1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

NOTE: For vehicles with automatic transmission and output shaft speed (OSS) sensor DTCs, refer to the DIAGNOSTIC METHODS -- GASOLINE ENGINES .

- **Are DTCs P0500, P0503, P0720, P0721, P0722, P0723, P1500, P1501, P1502 or P1900 present?**

Yes	No
For DTCs P0500, P0503, P1500, P1501 or P1502, with manual shift transfer case, GO to **DP16**. For DTCs P0500, P0720, P0721, P0722, P0723, P1502 or P1900, with a manual transmission or an electronic shift transfer case, GO to **DP2**. For DTCs P0503 or P1500, with a manual transmission or an electronic shift transfer case, GO to **DP13**. For DTC P1501, with a manual transmission or an electronic shift transfer case, GO to **DP12**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DP2 DTCS P0500, P0720, P0721, P0722, P0723, P1502 AND P1900: VERIFY THE DRIVE CYCLE

- Access the PCM and monitor the OSS PID.
- Access the PCM and monitor the VSS PID.
- Drive the vehicle.
- Monitor the PID in all transmission gear ranges while increasing and decreasing the speed.
- **Does the PID reading increase and decrease with engine and vehicle speed?**

Yes	No
GO to **DP3**.	GO to **DP4**.

DP3 VISUAL INSPECTION

- OSS/VSS connector disconnected.
- Inspect the OSS/VSS harness for damage.
- Inspect the OSS/VSS vehicle harness connector for damage and proper seating.
- If possible, carry out a wiggle test.

- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

DP4 VERIFY THE TYPE OF OSS/VSS SENSOR

NOTE: The variable reluctance (VR) sensors have 2-wire connectors, Hall-effect sensors have 3-wire connectors.

- Key in OFF position.
- Inspect for a Hall-effect or a VR type of OSS/VSS sensor.
- **Is this a Hall-effect type OSS/VSS sensor?**

Yes	No
GO to **DP5**.	GO to **DP7**.

DP5 CHECK VOLTAGE TO THE OSS/VSS SENSOR

- Key in OFF position.
- OSS/VSS connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) OSS/VSS Connector, Harness Side	(-) Vehicle Battery
VPWR	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to **DP6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DP6 CHECK THE VPWR GROUND TO THE OSS/VSS SENSOR

- Key in OFF position.
- Measure the resistance between:

(+) OSS/VSS	

Connector, Harness Side	(-) Vehicle Battery
PWRGND	Negative terminal

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DP7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DP7 CHECK THE OSS/VSS CIRCUIT FOR A SHORT TO VREF AND VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- OSS/VSS connector disconnected.
- Measure the voltage between:

(+) OSS/VSS Connector, Harness Side	(-) Vehicle Battery
OSS/VSS	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to **DP8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DP8 CHECK THE OSS/VSS CIRCUIT(S) FOR AN OPEN IN THE HARNESS

NOTE: Hall-effect sensors are not equipped with a SIGRTN circuit. Disregard the SIGRTN measurement.

- Key in OFF position.
- PCM connector disconnected.
- OSS/VSS connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) OSS/VSS Connector, Harness Side
OSS/VSS	OSS/VSS

SIGRTN	SIGRTN
PWRGND	PWRGND

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **DP9**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DP9 CHECK THE OSS/VSS CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) OSS/VSS Connector, Harness Side	(-) OSS/VSS Connector, Harness Side
OSS/VSS	PWRGND

- **Is the resistance greater than 10K ohms?**

Yes	No
For Hall-effect sensors, GO to **DP10**. For VR sensors, GO to **DP11**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DP10 CHECK THE OSS/VSS SIGNAL OUTPUT TO THE PCM, HALL-EFFECT TYPE SENSOR

NOTE: The opposite wheel must be held stationary.

- PCM connector disconnected.
- Raise the vehicle to allow for the rotation of the front drive wheels.
- Key ON, engine OFF.
- Transmission gear selector in NEUTRAL.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
OSS/VSS	PWRGND

- The voltage should rise above 5 volts and fall below 1 volt in a regular cycle. Observe several cycles.
- **Does the OSS/VSS output voltage rise and fall as specified?**

Yes	No

GO to **DP22**.	REMOVE the OSS/VSS sensor and inspect the target wheel. REPAIR as necessary. If OK, INSTALL a new OSS/VSS sensor. REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DP11 CHECK THE RESISTANCE OF THE OSS/VSS SENSOR

- Measure the resistance between:

(+) OSS/VSS Connector, Component Side	(-) OSS/VSS Connector, Component Side
OSS/VSS	SIGRTN

- **Is the resistance between 170 - 270 ohms (VSS) or 400 - 1.25K ohms (OSS)?**

Yes	No
GO to **DP22**.	REMOVE the OSS/VSS sensor and inspect the target wheel. REPAIR as necessary. If OK, INSTALL a new OSS/VSS sensor. REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DP12 KOER DTC P1501: CHECK THE VSS PID FOR AN INPUT SIGNAL

- Key ON, engine running.
- Access the PCM and monitor the VSS PID.
- Observe the VSS input to the PCM.
- Increase the engine speed, not greater than 2,000 RPM, several times while observing the VSS PID.
- **Is the reading on the PID less than 5 km/h (3 mph)?**

Yes	No
Unable to duplicate or identify the concern at this time. REFER to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** for possible causes and additional DTC description information. If DTC P1501 still exists, refer to **PINPOINT TEST Z**.	GO to **DP15**.

DP13 DTCS P0503 AND P1500: INSPECT THE VSS AND THE CIRCUIT FOR AN INTERMITTENT

- Visually inspect the VSS and harness circuits for any potential failures.
- Use the following check list for reference:
    - loose wires/connectors
    - pushed out connector pins
    - damaged wiring harness insulation
    - incorrect harness routing
    - incorrect VSS mounting
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DP14**.

DP14 CHECK THE PCM VSS PID FOR AN INPUT SIGNAL

NOTE: For scan tools which have a data record feature, record the data for future playback to help identify any variations.

- Access the PCM and monitor the VSS PID.
- Drive the vehicle at several steady state speeds above and below 50 km/h (30 mph).
- **Are there any indicators of a noisy or intermittent signal with the VSS PID?**

Yes	No
GO to **DP15**.	Unable to duplicate or identify the concern at this time. REPAIR any other DTCs. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.

DP15 CHECK THE VSS HARNESS ROUTING

NOTE: Refer to Pinpoint Test Schematic and Connectors at the beginning of this pinpoint test.

- Check the VSS harness routing:
    - Verify the harness is not routed adjacent to any high current wires such as ignition wires or generator wiring.
    - Verify the VSS harness is shielded and grounded, if applicable.
- Measure the resistance of the VSS harness.
- **Is a concern present?**

Yes	No

REPAIR as necessary.	Unable to duplicate or identify the concern at this time. REFER to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** for possible causes and additional DTC description information. refer to **PINPOINT TEST Z**.

DP16 DTCS P0500, P0503, P1500, P1501 AND P1502: VISUAL INSPECTION OF TCSS

NOTE: **The TCSS provides the rotational speed of the output shaft of the transfer case.**

The PCM uses this information to control the powertrain behavior and on some applications it is used as the source for the vehicle speed information.

- TCSS connector disconnected.
- Inspect the TCSS vehicle harness connector for damage and proper seating.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DP17**.

DP17 CHECK THE RESISTANCE OF THE TCSS

- Measure the resistance between:

(+) TCSS Connector, Component Side	(-) TCSS Connector, Component Side
SIGRTN - Pin 1	TCSS - Pin 2

- **Is the resistance between 1K - 1.25K ohms?**

Yes	No
GO to **DP18**.	INSTALL a new TCSS. REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DP18 CHECK THE TCSS SENSOR OUTPUT

NOTE: **The opposite wheel must be held stationary.**

- With the vehicle in NEUTRAL and the parking brake off, position it on a hoist. Refer to the **JACKING AND LIFTING -- E-SERIES** for the locations of the lifting points.
- Raise the vehicle.
- Measure the frequency between:

(+) TCSS Connector, Component Side	(-) TCSS Connector, Component Side
SIGRTN - Pin 1	TCSS - Pin 2

- Monitor the TCSS signal while rotating the driven wheel as fast as possible.
- **Does the frequency reading increase and decrease with the wheel speed?**

Yes	No
GO to **DP19**.	REMOVE the TCSS and inspect the target wheel. REPAIR as necessary. If OK, INSTALL a new TCSS sensor. REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DP19 CHECK THE TCSS CIRCUIT(S) FOR A SHORT TO GROUND AND VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- TCSS connector disconnected.
- Measure the voltage between:

(+) TCSS Connector, Harness Side	(-)
TCSS - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **DP20**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DP20 CHECK THE CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) TCSS Connector, Harness Side
TCSS	TCSS - Pin 2
SIGRTN	SIGRTN - Pin 1

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **DP21**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DP21 CHECK THE HARNESS FOR A SHORT TO GROUND

- Measure the resistance between:

(+) TCSS Connector, Harness Side	(-) TCSS Connector, Harness Side
SIGRTN - Pin 1	TCSS - Pin 2

- Measure the resistance between:

(+) TCSS Connector, Harness Side	(-)
TCSS - Pin 2	Ground

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DP22**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DP22 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.

- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DR: CAMSHAFT POSITION (CMP) SENSOR

This pinpoint test is intended to diagnose the following:

- camshaft position (CMP) sensor (6B288)
- harness circuits: CMP, CMP2, SIGRTN, VBPWR, VRSRTN, and VRSRTN2
- powertrain control module (PCM) (12A650)

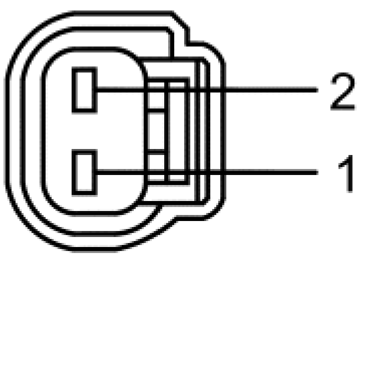

Fig. 61: Camshaft Position (CMP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

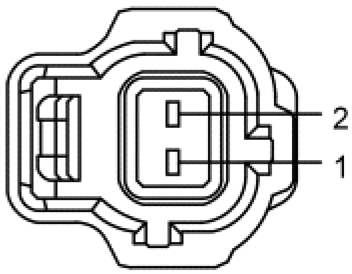

Fig. 62: Camshaft Position (CMP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

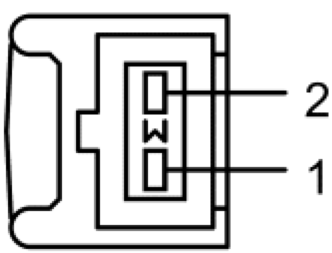

Fig. 63: Camshaft Position (CMP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

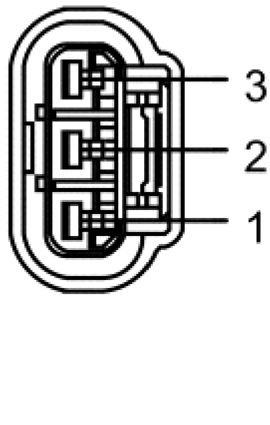

Fig. 64: Camshaft Position (CMP) Sensor Connector - D
Courtesy of FORD MOTOR CO.

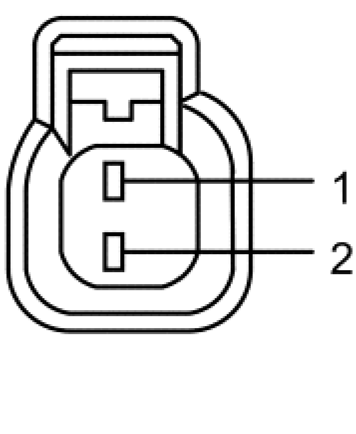

Fig. 65: Camshaft Position (CMP) Sensor Connector - E
Courtesy of FORD MOTOR CO.

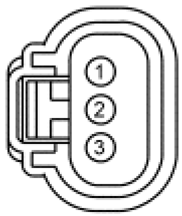

Fig. 66: Camshaft Position (CMP) Sensor Connector - F
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Expedition, F-150 4.6L, F-150 5.4L, Mark LT, MKX, MKZ, Navigator, Sable, Taurus, Taurus X	A	1 2	VRSRTN CMP
Escape/Mariner 2.3L, Ranger 2.3L	B	1 2	SIGRTN CMP
Explorer 4.0L, Explorer Sport Trac 4.0L, Mountaineer 4.0L, Mustang 4.0L, Ranger 4.0L	C	2 1	SIGRTN CMP
Fusion 2.3L, Milan 2.3L	D	1 3 2	VBPWR SIGRTN CMP
Fusion 3.0L, Milan 3.0L	E	2 1	VRSRTN CMP
F-150 4.2L	D	3 1 2	PWRGND VPWR CMP
Focus	F	1	VBPWR

		3 2	SIGRTN CMP
All other vehicles	A	1 2	SIGRTN CMP

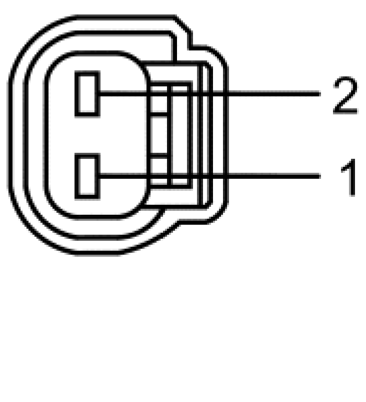

Fig. 67: Camshaft Position 2 (CMP2) Sensor Connector - A
Courtesy of FORD MOTOR CO.

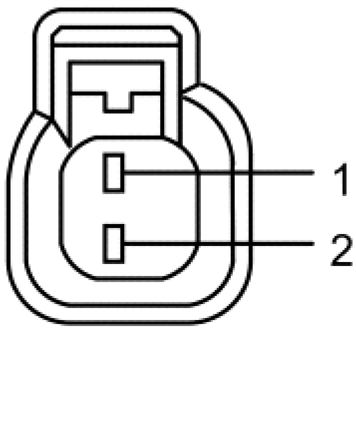

Fig. 68: Camshaft Position 2 (CMP2) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, MKX, MKZ, Sable,	A	1 2	VRSRTN CMP2

Taurus, Taurus X			
Expedition, F-150 5.4L, Mark LT, Navigator	A	1 2	VRSRTN2 CMP2
Fusion 3.0L, Milan 3.0L	B	2 1	VRSRTN CMP2
All other vehicles	A	1 2	SIGRTN CMP2

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	E44 E42 E45	CMP2 VRSRTN CMP
Escape/Mariner	150 (50-50-50) Pin	E41 E25	SIGRTN CMP
Expedition, Navigator	140 Pin	E5 E44 E4 E45	VRSRTN2 CMP2 VRSRTN CMP
Explorer 4.6L, Explorer Sport Trac 4.6L, F-Super Duty 5.4L, Mountaineer 4.6L, Mustang 4.6L	170 Pin	E44 E58 E45	CMP2 SIGRTN CMP
F-150 4.6L	190 Pin	E4 E45	VRSRTN CMP
F-150 4.2L	190 Pin	E45	CMP
F-150 5.4L, Mark LT	190 Pin	E5 E44 E4 E45	VRSRTN2 CMP2 VRSRTN CMP
Focus	190 Pin	E64 E8	SIGRTN CMP
Fusion 3.0L, Milan 3.0L, MKZ	140 Pin	E44 E33 E45	CMP2 VRSRTN CMP
Fusion 2.3L, Milan 2.3L	140 Pin	E58 E45	SIGRTN CMP
All other vehicles	170 Pin	E58	SIGRTN

		E45	CMP

DR1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0340, P0344, P0345, or P0349 present?**

Yes	No
For DTCs P0340, P0344, P0345 or P0349, GO to **DR2**.	For all others, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DR2 CONTINUOUS MEMORY DTCS P0340, P0344, P0345 AND P0349: CHECK IF THE ENGINE STARTS

- Attempt to start the engine.
- **Does the engine start?**

Yes	No
GO to **DR3**.	RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.

DR3 CLEAR AND ATTEMPT TO RETRIEVE THE DTC

NOTE: If DTCs P0340, P0344, P0345, or P0349 are present, ignition, alternator noise, RFI and CKP concerns should be considered.

NOTE: For vehicles with variable camshaft timing (VCT), concerns with the engine oil level, oil filter, oil contamination, or the VCT system may cause camshaft positioning errors.

- Key ON, engine OFF.
- Clear the PCM DTCs.
- Key ON, engine running.
- Increase engine speed to greater than 1,500 RPM for 10 seconds. Repeat this 3 times.
- Retrieve the continuous memory DTCs.
- **Are DTCs P0340, P0344, P0345 or P0349 present?**

Yes	No
GO to **DR4**.	refer to **PINPOINT TEST Z**.

DR4 CHECK THE GENERATOR FOR EXCESSIVE ELECTRICAL NOISE

NOTE: If the generator/regulator is electrically noisy, the noise decreases when the B+ connector is disconnected.

- PCM connector connected.
- CMP Sensor connector connected.
- Key ON, engine running.
- Monitor the generator for an audible electric noise.
- Key in OFF position.
- Generator/regulator B+ connector disconnected.
- Key ON, engine running.
- With the engine running, determine if the generator is still noisy.
- **Does the noise remain constant when the B+ connector is disconnected?**

Yes	No
For continuous memory DTCs P0340 or P0344, GO to **DR5**. For continuous memory DTCs P0345 or P0349, GO to **DR13**.	REFER to the **GENERATOR AND REGULATOR -- E-SERIES** to diagnose the generator is noisy symptom.

DR5 DETERMINE THE CMP SENSOR PHYSICAL TYPE

- Key in OFF position.
- **Is the CMP sensor a synchronizer (gear driven) type?**

Yes	No
GO to **DR6**.	GO to **DR7**.

DR6 VERIFY THE CORRECT INSTALLATION OF THE CMP SENSOR

NOTE: A CMP sensor identifies the cylinder 1 power stroke. A sensor that is improperly installed/indexed can identify the wrong cylinder as 1, produce a tip-in hesitation and generate DTC P0340.

- **Is the CMP sensor installed correctly?**

Yes	No
GO to **DR7**.	INSTALL the CMP sensor correctly. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** for the Camshaft Synchronizer removal and installation procedures. CLEAR the DTCs. REPEAT the self-test.

DR7 DETERMINE THE CMP SENSOR ELECTRONIC TYPE

NOTE: The variable reluctance (VR) sensors have 2-wire connectors, Hall-effect

sensors have 3-wire connectors.

- **Is the CMP sensor a VR type?**

Yes	No
GO to **DR8**.	The CMP sensor is a Hall-effect type. GO to **DR19**.

DR8 CONTINUOUS MEMORY DTCS P0340 AND P0344: CHECK THE CMP SENSOR RESISTANCE

- Key in OFF position.
- CMP Sensor connector disconnected.
- Measure the resistance between:

(+) CMP Sensor Connector, Component Side	(-) CMP Sensor Connector, Component Side
CMP	SIGRTN
CMP	VRSRTN

Vehicle	Minimum Resistance (ohms)	Maximum Resistance (ohms)
Edge, MKX	586	2,033
F-150 4.6L	1,978	5,590
F-150, Mark LT	205	579
MKZ	586	2,033
Taurus, Taurus X, Sable	586	2,033
All others	250	1,000

- **Is the resistance within specification?**

Yes	No
GO to **DR9**.	INSTALL a new CMP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DR9 CHECK THE CMP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CMP Sensor Connector, Harness Side	(-) Vehicle Battery
CMP	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to **DR10**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR10 CHECK THE CMP AND SIGRTN OR VRSRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CMP Sensor Connector, Harness Side
CMP	CMP
SIGRTN	SIGRTN
VRSRTN	VRSRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **DR11**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DR11 CHECK FOR A SHORT IN THE HARNESS BETWEEN THE PCM AND THE CMP SENSOR

- Measure the resistance between:

(+) CMP Sensor Connector, Harness Side	(-) CMP Sensor Connector, Harness Side

CMP	SIGRTN
CMP	VRSRTN

- Measure the resistance between:

(+) CMP Sensor Connector, Harness Side	(-) Vehicle Battery
CMP	Negative terminal
SIGRTN	Negative terminal
VRSRTN	Negative terminal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DR12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR12 CHECK THE CMP SENSOR OUTPUT

- Key in OFF position.
- Generator/regulator B+ connector connected.
- CMP Sensor connector disconnected.
- Key ON, engine running.
- Digital multimeter (DMM) on low voltage AC scale.
- Measure the voltage between:

(+) CMP Sensor Connector, Component Side	(-) CMP Sensor Connector, Component Side
CMP	SIGRTN
CMP	VRSRTN

- Run the engine at approximately 2,500 RPM.
- **Is the voltage greater than 0.25 V?**

Yes	No

For Edge, Expedition, Explorer 4.6L, Explorer Sport Trac 4.6L, F-150 5.4L, F-Super Duty 5.4L, Fusion, Mark LT, Milan, MKX, MKZ, Mountaineer 4.6L, Mustang 4.6L, Navigator, Sable, Taurus, and Taurus X, GO to **DR25**. For all others, GO to **DR26**.	INSTALL a new CMP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DR13 CONTINUOUS MEMORY DTCS P0345 AND P0349: CHECK THE CMP2 SENSOR RESISTANCE

- Key in OFF position.
- CMP2 Sensor connector disconnected.
- Measure the resistance between:

(+) CMP2 Sensor Connector, Component Side	(-) CMP2 Sensor Connector, Component Side
CMP2	SIGRTN
CMP2	VRSRTN
CMP2	VRSRTN2

Vehicle	Minimum Resistance (ohms)	Maximum Resistance (ohms)
Edge, MKX	586	2,033
F-150, Mark LT	205	579
MKZ	586	2,033
Taurus, Taurus X, Sable	586	2,033
All others	250	1,000

- **Is the resistance value(s) within specifications?**

Yes	No
GO to **DR14**.	INSTALL a new CMP2 sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DR14 CHECK THE CMP2 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CMP2 Sensor Connector, Harness Side	(-) Vehicle Battery
CMP2	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to **DR15**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR15 CHECK THE CMP2 AND SIGRTN, VRSRTN, OR VRSRTN2 CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CMP2 Sensor Connector, Harness Side
CMP2	CMP2
SIGRTN	SIGRTN
VRSRTN	VRSRTN
VRSRTN2	VRSRTN2

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **DR16**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DR16 CHECK FOR A SHORT IN THE HARNESS BETWEEN THE PCM AND THE CMP2 SENSOR

- Measure the resistance between:

(+) CMP2 Sensor Connector, Harness Side	(-) CMP2 Sensor Connector, Harness Side
CMP2	SIGRTN
CMP2	VRSRTN
CMP2	VRSRTN2

- Measure the resistance between:

(+) CMP2 Sensor Connector, Harness Side	(-) Vehicle Battery
CMP2	Negative terminal
SIGRTN	Negative terminal
VRSRTN	Negative terminal
VRSRTN2	Negative terminal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DR17**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR17 CHECK FOR A SHORT BETWEEN THE CMP AND THE CMP2 CIRCUITS

- CMP Sensor connector disconnected.
- CMP2 Sensor connector disconnected.
- Measure the resistance between:

(+) PCM	(-) PCM

Connector, Harness Side	Connector, Harness Side
CMP	CMP2

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DR18**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR18 CHECK THE CMP2 SENSOR OUTPUT

- Key in OFF position.
- Generator/regulator B+ connector connected.
- CMP2 Sensor connector disconnected.
- Key ON, engine running.
- DMM on low voltage AC scale.
- Measure the voltage between:

(+) CMP2 Sensor Connector, Component Side	(-) CMP2 Sensor Connector, Component Side
CMP2	SIGRTN
CMP2	VRSRTN
CMP2	VRSRTN2

- Run the engine at approximately 2,500 RPM.
- **Is the voltage greater than 0.25 V?**

Yes	No
For Edge, Expedition, Explorer 4.6L, Explorer Sport Trac 4.6L, F-150 5.4L, F-Super Duty 5.4L, Fusion, Mark LT, Milan, MKX, MKZ,	INSTALL a new CMP2 sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

Mountaineer 4.6L, Mustang 4.6L, Navigator, Sable, Taurus, and Taurus X, GO to **DR25**. For all others, GO to **DR26**.	

DR19 CONTINUOUS MEMORY DTCS P0340 AND P0344: CHECK THE VOLTAGE TO THE CMP SENSOR

- CMP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CMP Sensor Connector, Harness Side	(-) Vehicle Battery
VPWR	Negative terminal
VBPWR	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to **DR20**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DR20 CHECK THE PWRGND OR SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the voltage between:

(+) Vehicle Battery	(-) CMP Sensor Connector, Harness Side
Positive terminal	PWRGND
Positive terminal	SIGRTN

- **Is the voltage greater than 10 V?**

Yes	No
GO to **DR21**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DR21 CHECK THE CMP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CMP Sensor Connector, Harness Side	(-) Vehicle Battery
CMP	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to **DR22**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR22 CHECK FOR AN OPEN CIRCUIT BETWEEN THE PCM AND CMP SENSOR

- Key in OFF position.
- CMP Sensor connector disconnected.
- Measure the resistance between:

(+) CMP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
CMP	CMP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DR23**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DR23 CHECK THE CMP CIRCUIT FOR A SHORT TO PWRGND OR SIGRTN IN THE HARNESS

NOTE: The measurement may be taken at the PCM or CMP connector, whichever is easier to access.

- Measure the resistance between:

(+) CMP Sensor Connector, Harness Side	(-) CMP Sensor Connector, Harness Side
CMP	PWRGND
CMP	SIGRTN

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DR24**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR24 CHECK THE CMP SENSOR FOR CORRECT OPERATION

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A CMP Sensor Connector, Harness Side	Point B CMP Sensor Connector, Component Side
VPWR	VPWR
VBPWR	VBPWR
SIGRTN	SIGRTN
PWRGND	PWRGND

- Key ON, engine running.
- DMM on low voltage DC scale.
- Measure the voltage between:

(+) CMP Sensor Connector, Component Side	(-) Vehicle Battery
CMP	Negative

	terminal

- **Does the voltage switch between LOW (less than 2 volts DC) and HIGH (greater than 8 volts DC)?**

Yes	No
GO to **DR26**.	INSTALL a new CMP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DR25 CHECK THE VARIABLE CAMSHAFT TIMING (VCT) SYSTEM

NOTE: Only diagnose the bank indicated by the DTC.

- Check the VCT system for correct operation.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DR26**.

DR26 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DS: AIR CONDITIONING PRESSURE (ACP) TRANSDUCER SENSOR

This pinpoint test is intended to diagnose the following:

- ACP transducer sensor (19D594)

- harness circuits: ACP, VREF, SIGRTN
- powertrain control module (PCM) (12A650)

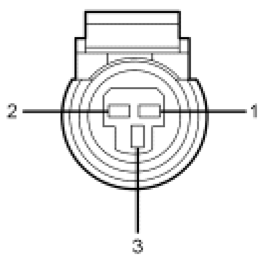

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Fig. 69: Air Conditioning Pressure (ACP) Transducer Sensor Connector - A
Courtesy of FORD MOTOR CO.

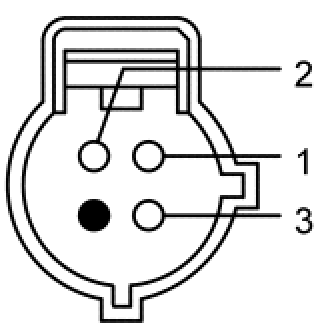

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Fig. 70: Barometric Pressure (BARO) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Fusion, Milan, MKX, MKZ	A	3 1 2	ACP SIGRTN VREF
All other vehicles	B	3 1 2	ACP SIGRTN VREF

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Mustang, Town Car	170 Pin	B40, E57 B35 B47 B26	VREF VPWR PWRGND ACP
Expedition, Navigator	140 Pin	E57 B51 B67 B19	VREF VPWR PWRGND ACP
Explorer, Explorer Sport Trac	170 Pin	B40, E57 B35 B47 B18	VREF VPWR PWRGND ACP
F-150	190 Pin	B29, E57 B51 B67 B10	VREF VPWR PWRGND ACP
Focus	190 Pin	B52, B66, E63 B67 B69 B31	VREF VPWR PWRGND ACP
Fusion, Milan, MKZ	140 Pin	B33, E57 B51 B67 B63	VREF VPWR PWRGND ACP
All other vehicles	190 Pin	B29, B64 B51 B67 B37	VREF VPWR PWRGND ACP

DS1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0532, P0533, P1461, P1462, or P1463 present?**

Yes	No
For DTC P0533, P1461, GO to **DS2**. For DTC P0532, P1462, GO to **DS8**. For DTC P1463, GO to **DS17**.	For symptoms without DTCs, GO to **DS19**. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DS2 DTC P0533, P1461: CHECK THE ACP PID

- Key ON, engine OFF.
- Access the PCM and monitor the ACP_PRESS PID.
- **Is the voltage less than 4.9 V?**

Yes	No
The ACP transducer sensor voltage is now below maximum. To determine if an intermittent condition exists, GO to **DS16**.	GO to **DS3**.

DS3 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE ACP TRANSDUCER SENSOR VEHICLE HARNESS CONNECTOR

- Air Conditioning Pressure (ACP) Transducer Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to **DS4**.	refer to **PINPOINT TEST C**.

DS4 CHECK THE ACP CIRCUIT FOR A SHORT TO VREF

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
ACP	VREF

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DS5**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DS5 CHECK THE ACP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-)
ACP	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **DS6**.	REPAIR the short circuit to PWR. CLEAR the DTCs. REPEAT the self-test.

DS6 CHECK FOR AN OPEN ACP CIRCUIT IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ACP	ACP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DS7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DS7 CHECK THE PCM

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	Point B Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
ACP	SIGRTN

- Key ON, engine OFF.
- Access the PCM and monitor the ACP_PRESS PID.
- **Is the voltage less than 4.9 V?**

Yes	No
INSTALL a new Air Conditioning Pressure (ACP) Transducer Sensor. CLEAR the DTCs. REPEAT the self-test.	GO to **DS23**.

DS8 DTC P0532, P1462: CHECK THE ACP PID

- Key ON, engine OFF.
- Access the PCM and monitor the ACP_PRESS PID.
- **Is the voltage greater than 0.15 V?**

Yes	No
The ACP transducer sensor voltage is now above the minimum. To determine if an intermittent condition exists, GO to **DS16**.	GO to **DS9**.

DS9 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE ACP TRANSDUCER SENSOR VEHICLE HARNESS CONNECTOR

- Air Conditioning Pressure (ACP) Transducer Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Air Conditioning	(-) Air Conditioning

Pressure (ACP) Transducer Sensor Connector, Harness Side	Pressure (ACP) Transducer Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to **DS10**.	refer to **PINPOINT TEST C**.

DS10 SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- Key in OFF position.
- Connect a 5 amp fused jumper wire between the following:

Point A Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	Point B Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
VREF	ACP

- Key ON, engine OFF.
- Access the PCM and monitor the ACP_PRESS PID.
- **Is the voltage greater than 4 V?**

Yes	No
INSTALL a new Air Conditioning Pressure (ACP) Transducer Sensor. CLEAR the DTCs. REPEAT the self-test.	GO to **DS11**.

DS11 CHECK THE ACP CIRCUIT FOR A SHORT TO GND

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Air Conditioning Pressure (ACP)	

Transducer Sensor Connector, Harness Side	(-)
ACP	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DS12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DS12 CHECK THE ACP CIRCUIT FOR A SHORT TO SIGRTN

- Measure the resistance between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
ACP	SIGRTN

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DS13**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DS13 CHECK THE ACP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ACP	ACP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DS14**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DS14 CHECK FOR THE A/C CLUTCH TO ENGAGE

- PCM connector connected.
- Air Conditioning Pressure (ACP) Transducer Sensor connector connected.
- Key ON, engine running.
- While listening for the A/C clutch to engage, turn the A/C on. Repeat if necessary.
- **Does the A/C engage when the A/C is turned on?**

Yes	No
GO to **DS23**.	GO to **DS15**.

DS15 VERIFY THE A/C SYSTEM FUNCTION, INCLUDING THE REFRIGERANT CHARGE

- Restore the vehicle.
- Verify the A/C system function, including the refrigerant charge. Refer to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** .
- **Does the A/C system have the correct refrigerant charge and if so does the A/C system function correctly?**

Yes	No
GO to **DS23**.	REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.

DS16 CHECK THE ACP CIRCUIT FOR AN INTERMITTENT CONCERN

NOTE: A concern is indicated by a sudden change in voltage.

- Key ON, engine OFF.
- Access the PCM and monitor the ACP PID.
- Observe the ACP PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the ACP, SIGRTN, and VREF wires between the ACP sensor and PCM
  - Lightly tap on the ACP transducer sensor to simulate road shock
- **Is a concern present?**

Yes	No

ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DS17 DTC P1463: VERIFY THE A/C CLUTCH CAN DISENGAGE

- Turn the A/C and defroster OFF.
- Key ON, engine running.
- Verify the A/C clutch can disengage.
- **Is the A/C clutch disengaged?**

Yes	No
GO to **DS18**.	REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is always on symptom.

DS18 CHECK FOR VOLTAGE AND GROUND TO THE A/C CLUTCH USING A NON-POWERED TEST LAMP

NOTE: If voltage and ground to the A/C clutch have already been checked or the A/C clutch can be heard clicking on when the A/C is turned on, go to the question at the end of this test step.

- Key in OFF position.
- A/CCS Switch connector disconnected.
- Connect a jumper wire in the A/C low pressure cycling switch harness connector to complete the circuit.
- A/CC Assembly connector disconnected.
- Connect a non-powered test lamp between the voltage pin and ground pin at the A/C clutch harness connector.
- Key ON, engine running.
- Turn the A/C on, and wait 15 seconds.
- Monitor the test lamp.
- Connect the A/C clutch and A/C cycling switch when done testing.
- **Does the lamp illuminate, or can the A/C clutch be heard clicking on?**

Yes	No
GO to **DS19**.	REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.

DS19 DETERMINE IF A SUFFICIENT A/C PRESSURE CHANGE CAN BE DETECTED BY THE ACP PID

- Key ON, engine running.
- Turn the A/C and defroster OFF.
- Access the PCM and monitor the ACP PID.
- Turn the A/C and defroster OFF.
- Five seconds after A/C clutch engagement, note the voltage. If the clutch does not engage, follow the NO answer instructions.
- **Does the PCM-ACP PID change more than 0.3 volt within 5 seconds of clutch engagement?**

Yes	No
The ACP transducer sensor and the PCM can detect a sufficient change in the A/C pressure. For symptom without DTC P1463, REFER to the **SYMPTOM CHARTS** article, Symptom Charts. For all others, REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.	GO to **DS20**.

DS20 CHECK THE A/C SYSTEM PRESSURE AND PRESSURE CHANGE

- Key in OFF position.
- Install an A/C system manifold gauge set and check the A/C system high pressure reading.
- Turn the A/C and defroster OFF.
- Key ON, engine running.
- Note the A/C high pressure reading.
- While monitoring the A/C system high pressure reading, turn the A/C on. Five seconds after clutch engagement, note the pressure (the pressure should increase).
- A/C and defroster OFF.
- **Does the A/C high pressure reading change more than 207 kPa (30 psi) within 5 seconds of clutch engagement?**

Yes	No
GO to **DS21**.	REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.

DS21 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE ACP TRANSDUCER SENSOR VEHICLE HARNESS CONNECTOR

- Key in OFF position.

- Air Conditioning Pressure (ACP) Transducer Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to **DS22**.	refer to **PINPOINT TEST C**.

DS22 CHECK THE ACP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ACP	ACP

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new Air Conditioning Pressure (ACP) Transducer Sensor. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DS23 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins

  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DT: POWER STEERING PRESSURE (PSP) SENSOR

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- PSP sensor (3K215)
- harness circuit(s): PSP, SIGRTN and VREF
- powertrain control module (PCM) (12A650)

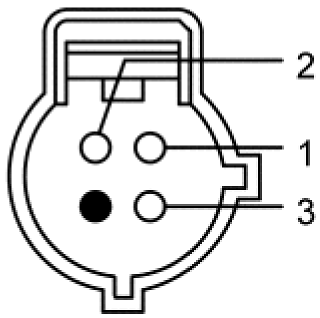

Fig. 71: Barometric Pressure (BARO) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
3	PSP (Power Steering Pressure)

1	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Focus	190 Pin	T29	PSP
All other vehicles	190 Pin	E24	PSP

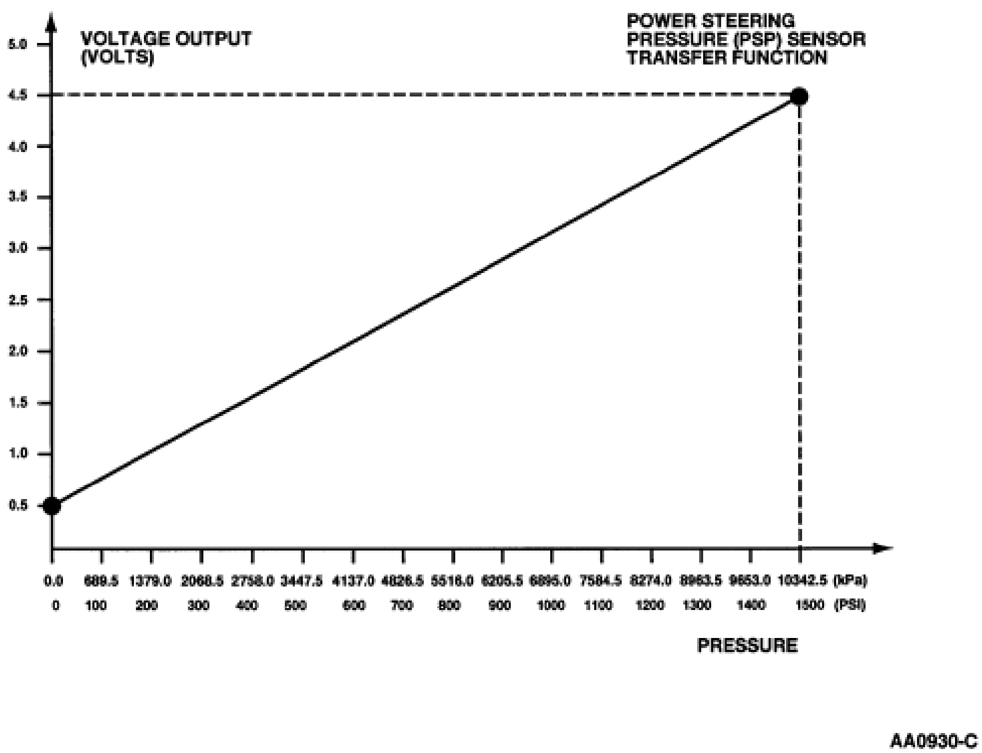

Fig. 72: Power Steering Pressure Sensor Voltage To Pressure Graph
Courtesy of FORD MOTOR CO.

DT1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P0552, P0553, or P1550 present?**

Yes	No
For KOEO and KOER DTCs P0552 or P0553, GO to **DT4**. For continuous memory DTCs P0552 or P0553, GO to **DT8**. For KOEO and KOER DTC P1550, GO to **DT2**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DT2 DTC P1550: MAKE SURE THE STEERING WHEEL IS TURNED

- **Did you turn the steering wheel at least one half turn within 20 seconds of starting the KOER self-test?**

Yes	No
If there are any symptoms with the power steering system (for example, lack of power assist), REFER to the **STEERING SYSTEM - GENERAL INFORMATION -- E-SERIES** to diagnosis the lack of assist or inconsistent assist of steering system. If no symptoms are present with the power steering system, GO to **DT3**.	REPEAT the KOER self-test.

DT3 CHECK THE VOLTAGE BETWEEN VREF AND SIGRTN AT THE PSP SENSOR

- PSP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PSP Sensor Connector, Harness Side	(-) PSP Sensor Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 1

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to **DT4**.	refer to **PINPOINT TEST C**.

DT4 CHECK THE PSP CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PSP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
PSP - Pin 3	PSP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DT5**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DT5 CHECK THE PSP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PSP Sensor Connector, Harness Side	(-)
PSP - Pin 3	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **DT6**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DT6 CHECK THE PSP CIRCUIT FOR A SHORT TO VREF, SIGRTN AND GND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PSP Sensor Connector, Harness Side	(-) PSP Sensor Connector, Harness Side
PSP - Pin 3	VREF - Pin 2
PSP - Pin 3	SIGRTN - Pin 1

- Measure the resistance between:

(+) PSP Sensor Connector, Harness Side	(-)
PSP - Pin 3	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DT7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DT7 CHECK THE SENSOR OPERATION

- Connect a 5 amp fused jumper wire between the following:

Point A PSP Sensor Connector, Harness Side	Point B PSP Sensor Connector, Component Side
VREF - Pin 2	VREF - Pin 2
SIGRTN - Pin 1	SIGRTN - Pin 1
PSP - Pin 3	PSP - Pin 3

- Start engine and allow to idle.
- Measure the voltage between:

(+) PSP Sensor Connector, Component Side	(-)
PSP - Pin 3	Ground

- Observe the voltage while turning the steering wheel at least 1/2 turn right and left.
- **Is the voltage reading between 0.3 and 4.7 volts and does the voltage change when the steering wheel is turned?**

Yes	No
GO to **DT9**.	INSTALL a new PSP sensor. CLEAR the DTCs. REPEAT the self-test.

DT8 CONTINUOUS MEMORY DTCS P0552 OR P0553: CHECK THE POWER STEERING PRESSURE SENSOR CIRCUIT(S) FOR INTERMITTENT CONCERNS

- Key ON, engine OFF.
- Access the PCM and monitor the PSP PID.
- Observe the PSP PID for an indication of a concern while carrying out the following. (a concern is indicated by a sudden change in the voltage):
  - Shake, wiggle, and bend the PSP, VREF, SIGRTN circuit(s).
  - Lightly tap on the power steering pressure sensor to simulate road shock.

- **Is a concern indicated?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DT9 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DU: INTAKE AIR TEMPERATURE 2 (IAT2) SENSOR

This pinpoint test is intended to diagnose the following:

- intake air temperature 2 (IAT2) sensor (12A697)
- harness circuits: IAT2 and SIGRTN
- powertrain control module (PCM) (12A650)

Voltage values calculated for VREF = 5 volts. These values can vary by 15% due to sensor and VREF variations.

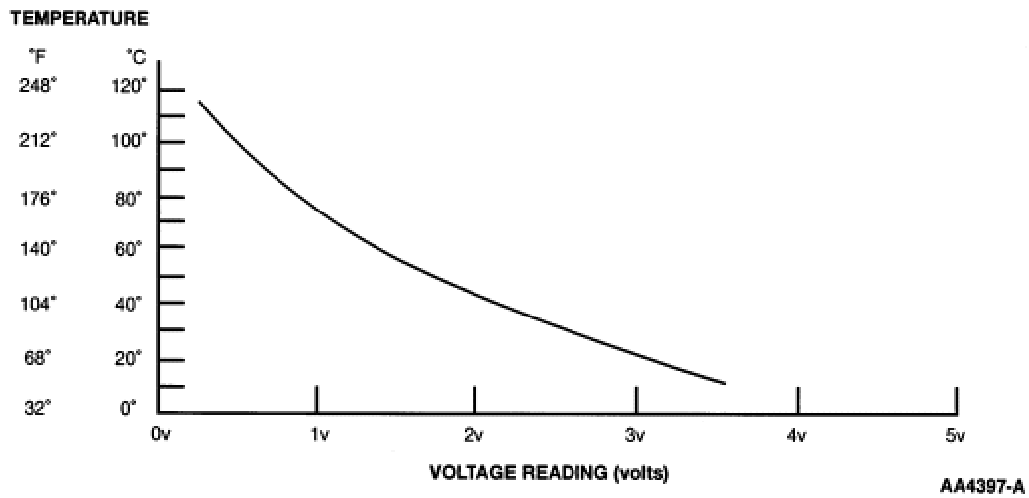

Fig. 73: Temperature Sensor Temperature To Voltage Graph
Courtesy of FORD MOTOR CO.

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
120	248	0.28	1.18
110	230	0.36	1.55
100	212	0.47	2.07
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85
-10	14	4.45	160.31

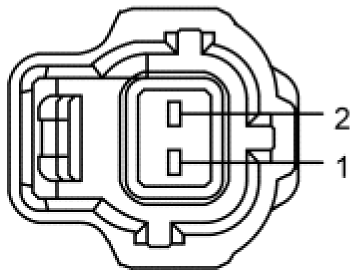

Fig. 74: Canister Vent (CV) Solenoid Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
1	IAT2 (Intake Air Temperature 2)

Connector	Pin	Circuit
170 Pin	B41, E58, T41 B40, E57 E27	SIGRTN VREF IAT2

DU1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0097, P0098, P0127, P1114, or P1115 present?**

Yes	No
For DTCs P0097 or P1114, GO to **DU4**. For DTCs P0098 or P1115, GO to **DU2**. For DTC P0127, GO to **DU6**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DU2 CHECK FOR AN OPPOSITE SIGNAL TO THE PCM

- The DTC indicates the sensor signal is greater than the self-test maximum.
- IAT2 Sensor connector disconnected.
- Key ON, engine OFF.
- Connect a 5 amp fused jumper wire between the following:

Point A IAT2	Point B IAT2

Sensor Connector, Harness Side	Sensor Connector, Harness Side
IAT2 - Pin 1	SIGRTN - Pin 2

- Access the PCM and monitor the IAT2 PID.
- **Is the voltage less than 0.2 V?**

Yes	No
INSTALL a new IAT2 sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DU3**.

DU3 CHECK THE SENSOR SIGNAL FOR A SHORT TO VREF

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
IAT2 - Pin E27	VREF - Pin B40, E57

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DU10**.	REPAIR the short circuit to VREF. CLEAR the DTCs. REPEAT the self-test.

DU4 DTC P1114: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- The DTC indicates the sensor signal is less than the self-test minimum.
- IAT2 Sensor connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the IAT2 PID.
- **Is the voltage greater than 4.2 V?**

Yes	No
INSTALL a new IAT2 sensor. REFER to the	

ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES . CLEAR the DTCs. REPEAT the self-test.	GO to **DU5**.

DU5 CHECK THE SENSOR SIGNAL FOR A SHORT TO GROUND

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
IAT2 - Pin E27	SIGRTN - Pin B41, E58, T41

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) 12 Volt Vehicle Battery
IAT2 - Pin E27	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DU10**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DU6 DTC P0127: CHECK CHARGE AIR COOLER PUMP (CAC) OPERATION

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- **Does the CAC pump run?**

Yes	No
GO to **DU7**.	DIAGNOSE the charge air cooler (CAC) pump. GO to **KP9**.

DU7 CHECK THE CHARGE AIR COOLER (CAC) SYSTEM

- Check the CAC system for low fluid level, cracked, blocked or misrouted coolant lines, cracked or blocked heat exchanger.

- **Is a concern present?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** , Supercharger Cooling to diagnose a loss of coolant. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DU8**.

DU8 SIMULATE THE HIGH IAT2 SIGNAL TO THE PCM

- Key ON, engine OFF.
- Access the PCM and monitor the IAT2 PID.
- Observe the PID while disconnecting the IAT2 sensor.
- **Is the voltage greater than 4.2 V?**

Yes	No
GO to **DU9**.	GO to **DU10**.

DU9 SIMULATE THE LOW IAT2 SIGNAL TO THE PCM

- Key in OFF position.
- IAT2 Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A IAT2 Sensor Connector, Harness Side	Point B IAT2 Sensor Connector, Harness Side
IAT2 - Pin 1	SIGRTN - Pin 2

- Key ON, engine OFF.
- Access the PCM and monitor the IAT2 PID.
- **Is the voltage less than 0.2 V?**

Yes	No
CONNECT the sensor and GO to the **REFERENCE VALUES** article, Reference Values. COMPARE the IAT2 PID to reference values under different road test conditions. If the sensor is not in range, INSTALL a new IAT2 sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DU10**.

DU10 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DV: THROTTLE BODY ASSEMBLY ELECTRONIC THROTTLE CONTROL (ETC)

WARNING: **Substantial opening and closing torque is applied by this system. To prevent injury, be careful to keep fingers away from throttle mechanism when actuated. Failure to follow these instructions may result in personal injury.**

NOTE: The voltage of the TP2 circuit and PID reaches a limit of approximately 4.5 volts at approximately 45 degrees of throttle angle.

This pinpoint test is intended to diagnose the following:

- electronic throttle body (ETB) (9F991)
- electronic throttle body throttle position sensor (ETBTPS) (9E928)
- harness circuits: ETCRTN, ETCREF, TP1, TP2, TACM+, and TACM-
- powertrain control module (PCM) (12A650)

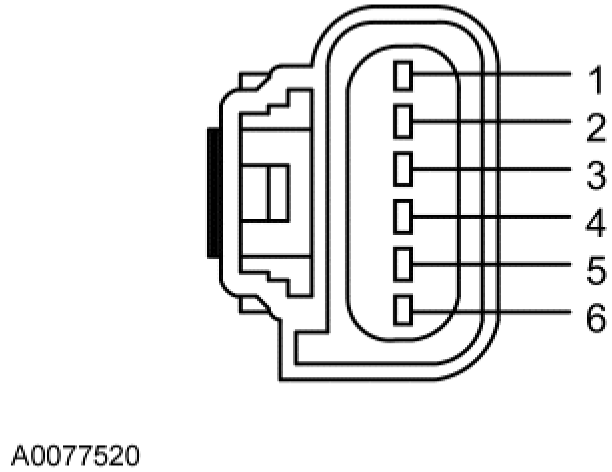

Fig. 75: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

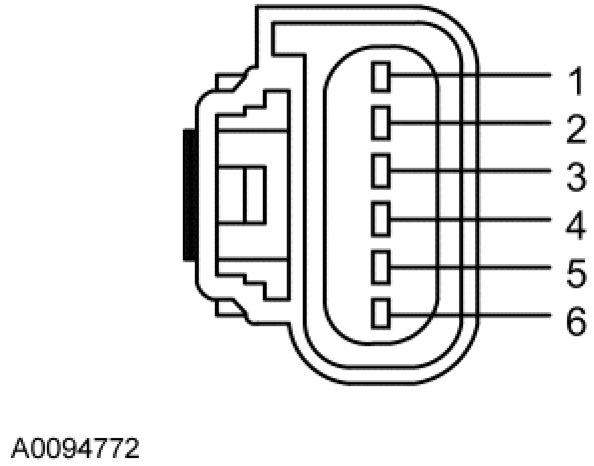

Fig. 76: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - B
Courtesy of FORD MOTOR CO.

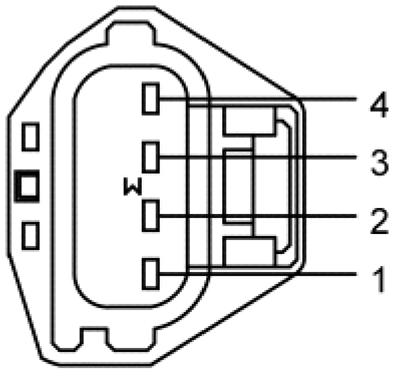

Fig. 77: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus, Taurus X	A	4 1 2 3	TP2 TP1 ETCRTN ETCREF
Fusion 2.3L, Milan 2.3L	B	4 6 3 5	TP2 TP1 ETCRTN ETCREF
Fusion 3.0L, Milan 3.0L	B	6 3 4 5	TP2 TP1 ETCRTN ETCREF
All other vehicles	C	1 4 3 2	TP2 TP1 ETCRTN ETCREF

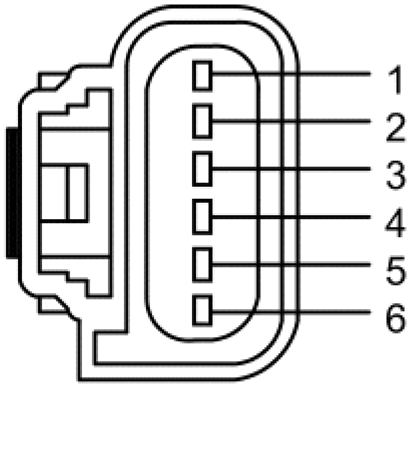

Fig. 78: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

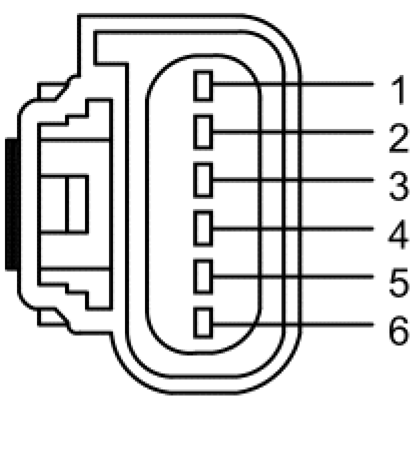

Fig. 79: Electronic Throttle Body Throttle Actuator Control Motor (ETBTACM) Connector - B
Courtesy of FORD MOTOR CO.

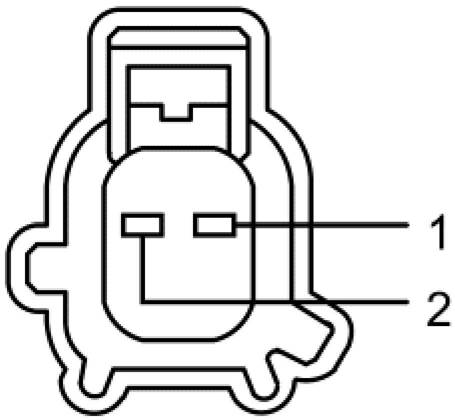

Fig. 80: Electronic Throttle Body Throttle Actuator Control Motor (ETBTACM) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus, Taurus X	A	6 5	TACM- TACM+
Fusion 2.3L, Milan 2.3L	B	2 1	TACM- TACM+
Fusion 3.0L, Milan 3.0L	B	1 2	TACM- TACM+
All other vehicles	C	2 1	TACM- TACM+

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Mustang, Town Car	170 Pin	B24, B4, E66 B41, B6, E59 B35 B47 E51 E34 E60	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2

		E61	TP1
E-Series, F-Super Duty	170 Pin	B16, B4, E66 B18, B6, E59 B35 B47 E51 E34 E60 E61	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1
Expedition, Navigator	140 Pin	B21, B28, E66 B59, B65, E59 B51 B67 E51 E34 E60 E61	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1
Explorer, Explorer Sport Trac, Mountaineer	170 Pin	B24, B4, E66 B43, B6, E59 B35 B47 E51 E34 E60 E61	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1
F-150, Mark LT	190 Pin	B21, B28, E66 B58, B59, E59 B51 B67 E51 E34 E60 E61	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1
Focus	190 Pin	B45, B61, E59 B44, B60, E60 B67 B69 E51 E34 E45 E44	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1
Fusion, Milan, MKZ	140 Pin	B21, B28, E66 B59, B60, E59 B51 B67 E51	ETCREF ETCRTN VPWR PWRGND TACM-

		E34 E60 E61	TACM+ TP2 TP1
All other vehicles	190 Pin	B21, B28, E66 B59, B65, E59 B51 B67 E51 E34 E60 E61	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1

DV1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: Diagnose and repair ETBTPS circuit DTCs before addressing DTC P0068.

- **Are DTCs P0068, P0121, P0122, P0123, P0221, P0222, P0223, P1124, P2100, P2101, P2107, P2111, P2112, or P2135 present?**

Yes	No
For DTC P0068, GO to **DV12**. For DTCs P0121, P0122, P0123, P0221, P0222, P0223, P2111, or P2112, GO to **DV3**. For DTC P1124, GO to **DV2**. For DTC P2100, GO to **DV19**. For DTC P2101, GO to **DV27**. For DTC P2107, GO to **DV18**. For Fusion and Milan with DTC P2135, GO to **DV6**. For all others with DTC P2135, GO to **DV7**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DV2 DTC P1124: REPEAT THE KOEO OR KOER SELF-TEST

NOTE: Make sure the accelerator pedal is not applied during the KOEO and KOER self-tests.

- Key ON, engine OFF.
- Carry out the self-test.
- **Are any DTCs present other than P1124?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DV3**.

DV3 CHECK THE THROTTLE POSITION (TP) OPEN AND CLOSED VOLTAGES

NOTE: **Certain failure mode effects management (FMEM) operating strategies maintain limited vehicle function in the event of a PCM, harness, or component concern and may prevent the throttle plate from opening. If the throttle plate does not open, follow the NO answer.**

- Key ON, engine OFF.
- Access the PCM and monitor the TP1 and TP2 PIDs.
- Press the accelerator pedal to the floor and release.

ELECTRONIC THROTTLE CONTROL THROTTLE POSITION SENSOR SIGNAL VOLTAGES

Accelerator Pedal Position	TP1	TP2
Pedal fully released	3.7 - 4.7	0.3 - 1.9
Pedal fully applied	0.7 - 2.9	4.1 - 4.7

- **Are both PIDs within the chart ranges?**

Yes	No
For DTCs P2111 or P2112, GO to **DV4**. For all others, GO to **DV17**.	GO to **DV4**.

DV4 CHECK FOR OBSTRUCTION OF THE THROTTLE BODY

WARNING: **Substantial opening and closing torque is applied by this system. To prevent injury, be careful to keep fingers away from throttle mechanism when actuated. Failure to follow these instructions may result in personal injury.**

- Key in OFF position.
- Remove the inlet tube from the throttle body.
- Visually inspect for throttle plate obstructions or engine deposits.
- Slowly, push the throttle plate to wide open and release.
- **Does the throttle plate move freely to wide open and back?**

Yes	No
For continuous memory DTCs P0121, P0122, P0123, P0221, P0222, or P0223 alone or together,	

GO to **DV5**. For DTCs P2111, P2112 or continuous memory DTCs P2100, P2101, or P2107 alone or together, GO to **DV19**. For Fusion and Milan with all other DTCs, GO to **DV6**. For all others, GO to **DV7**.	ISOLATE and REPAIR the obstruction. CLEAR the DTCs. REPEAT the self-test.

DV5 CHECK THE VREF VOLTAGE TO TP

- ETBTPS connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ETBTPS Connector, Harness Side	(-) ETBTPS Connector, Harness Side
ETCREF	ETCRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
For Fusion and Milan, GO to **DV6**. For all others, GO to **DV7**.	refer to **PINPOINT TEST C**.

DV6 FUSION, MILAN: CHECK THE RESISTANCE OF THE ETBTPS

NOTE: Do not move the throttle plate during the resistance measurement. Measure the sensor resistance with the throttle plate at the default position.

- Key in OFF position.
- ETBTPS connector disconnected.
- For Fusion 2.3L and Milan 2.3L, measure the resistance between:

(+) ETBTPS Connector, Component Side	(-) ETBTPS Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
ETCREF	ETCRTN	2,000	4,000

- For Fusion 3.0L and Milan 3.0L, measure the resistance between:

(+)	(-)		

ETBTPS Connector, Component Side	ETBTPS Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
TP1	ETCREF	380	987
TP1	ETCRTN	665	1,890
TP2	ETCREF	608	1,932
TP2	ETCRTN	390	1,187
ETCREF	ETCRTN	475	1,365

- **Are all the resistances within specifications?**

Yes	No
GO to **DV8**.	INSTALL a new ETB. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** to INSTALL a new throttle body. CLEAR the DTCs. REPEAT the self-test.

DV7 ALL OTHERS: CHECK THE RESISTANCE OF THE ETBTPS

NOTE: Do not move the throttle plate during the resistance measurement. Measure the sensor resistance with the throttle plate at the default position.

- ETBTPS connector disconnected.
- Measure the resistance between:

(+) ETBTPS Connector, Component Side	(-) ETBTPS Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
TP1	ETCREF	700	1,800
TP1	ETCRTN	1,300	2,800
TP2	ETCREF	1,000	2,400
TP2	ETCRTN	500	1,500
ETCREF	ETCRTN	700	2,100

- **Are all the resistances within the specifications?**

Yes	No
	For E-Series 4.6L, Edge,

GO to **DV8**.	F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus, and Taurus X, INSTALL a new ETB. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** to INSTALL a new throttle body. CLEAR the DTCs. REPEAT the self-test. For all others, INSTALL a new ETBTPS. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** to INSTALL a new TP sensor. CLEAR the DTCs. REPEAT the self-test.

DV8 CHECK THE TP1 AND TP2 CIRCUITS FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ETBTPS Connector, Harness Side	(-)
TP1	Ground
TP2	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DV9**.

DV9 CHECK THE TP1 AND TP2 CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) ETBTPS Connector, Harness Side	(-) PCM Connector, Harness Side
TP1	TP1

TP2	TP2

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **DV10**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DV10 CHECK THE TP1 AND TP2 CIRCUITS FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) ETBTPS Connector, Harness Side	(-) Vehicle Battery
TP1	Negative terminal
TP2	Negative terminal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DV11**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DV11 CHECK THE TP CIRCUITS FOR A SHORT TOGETHER

- Measure the resistance between:

(+) ETBTPS Connector, Harness Side	(-) ETBTPS Connector, Harness Side
TP1	TP2
TP1	ETCREF
TP1	ETCRTN
TP2	ETCREF
TP2	ETCRTN

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DV14**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DV12 DTC P0068: CHECK FOR DTCS

- Carry out the self-test.
- **Are DTCs P0121, P0122, P0123, P0221, P0222, P0223 or P2135 present?**

Yes	No
For DTCs P0121, P0122, P0123, P0221, P0222, and P0223, GO to **DV3**. For Fusion and Milan with DTC P2135, GO to **DV6**. For all others with DTC P2135, GO to **DV7**.	GO to **DV13**.

DV13 CHECK FOR INLET AIR LEAKS

- Check the air inlet system for leaks.
- Listen for air noise around the mass air flow (MAF) sensor and throttle body while the engine is running.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DV14**.

DV14 CHECK FOR A TP2 SIGNAL HIGH VERSUS LOAD WHILE DRIVING THE VEHICLE

- ETBTPS connector connected.
- PCM connector connected.
- Key ON, engine running.
- Access the PCM and monitor the TP2 PID.
- Access the PCM and monitor the LOAD PID.
- Drive the vehicle while exercising the throttle and ETCTP sensor and accessing the PIDS.
- **Is the TP2 PID greater than 2.44 volts and the LOAD PID less than 30%?**

Yes	No
GO to **DC5**.	GO to **DV15**.

DV15 CHECK FOR A TP2 SIGNAL LOW VERSUS LOAD WHILE DRIVING THE VEHICLE

- Key ON, engine running.
- Access the PCM and monitor the TP2 PID.
- Access the PCM and monitor the LOAD PID.
- Drive the vehicle while exercising the throttle and ETCTP sensor and accessing the PIDS.
- **Is the TP2 PID less than 0.24 volt and the LOAD PID greater than 55%?**

Yes	No
GO to **DV16**.	GO to **DV17**.

DV16 CHECK FOR SELF-TEST DTCS

NOTE: After retrieving the continuous memory DTCs, diagnose any non-ETC related DTCs before continuing.

- Key ON, engine OFF.
- Clear the DTCs.
- Drive the vehicle while exercising the throttle.
- Retrieve the continuous memory DTCs.
- **Are any DTCs present?**

Yes	No
For continuous memory DTC P0068, CHECK the MAF sensor and connector for damage and corrosion. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. For E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, Fusion, Milan, MKX, MKZ, Sable, Taurus, and Taurus X with DTC P2135, INSTALL a new ETB. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** to INSTALL a new throttle body. CLEAR the DTCs. REPEAT the self-test. For all others with DTC P2135, INSTALL a new ETBTPS. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** to INSTALL a new TP sensor. CLEAR the DTCs. REPEAT the self-test. For all others, GO to **DV17**.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DV17 CHECK THE TP CIRCUITS FOR AN INTERMITTENT CONCERN

- Access the PCM and monitor the TP1 and TP2 PIDs.
- Wiggle, shake, and bend the harness from the TP to the PCM.
- **Are the voltages between 0.49 - 4.65 V?**

Yes	No
GO to **DV29**.	REPAIR as necessary. If DTC P2100 or P2101 is present, GO to **DV19**.

DV18 DTC P2107: CHECK FOR OTHER SELF-TEST DTCS

NOTE: The DTC P2107 may set when a failure mode effects management (FMEM) action is taken. If the FMEM DTC P2110 is present with other DTCs, diagnose the other DTCs before diagnosing the DTC P2110.

- Key ON, engine OFF.
- Check for self-test DTCs.
- **Are any DTCs present other than P2107 and P2110?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	For DTC P2110, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** and diagnose the DTC. For DTC P2107, GO to **DV23**.

DV19 VISUALLY INSPECT THE ETB

NOTE: Make sure the ETB harness connector is properly connected.

- Key in OFF position.
- Inspect the ETB for damaged housing, harness connector, and harness.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DV20**.

DV20 CHECK THE TACM FOR A SHORT OR OPEN

- ETBTACM connector disconnected.
- Measure the resistance between:

(+) ETBTACM Connector, Component Side	(-) ETBTACM Connector, Component Side
TACM+	TACM-

- **Is the resistance between 1 ohm - 900 ohms?**

Yes	No

GO to **DV21**.	INSTALL a new ETB. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** to INSTALL a new throttle body. CLEAR the DTCs. REPEAT the self-test.

DV21 CHECK THE TACM HARNESS FOR AN OPEN

- PCM connector disconnected.
- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-) PCM Connector, Harness Side
TACM+	TACM+
TACM-	TACM-

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **DV22**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DV22 CHECK THE TACM+ AND TACM- CIRCUITS FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-)
TACM+	Ground
TACM-	Ground

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DV23**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DV23 CHECK THE HARNESS FOR A SHORT TO GND, PWR, ETCREF, AND ETCRTN

- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-) PCM Connector, Harness Side
TACM+	PWRGND
TACM+	VPWR
TACM+	ETCRTN
TACM+	ETCREF
TACM-	PWRGND
TACM-	ETCRTN
TACM-	VPWR
TACM-	ETCREF

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DV24**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DV24 CHECK FOR TACM HARNESS CIRCUITS SHORTED TOGETHER

- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-) ETBTACM Connector, Harness Side
TACM+	TACM-

- **Is the resistance greater than 10K ohms?**

Yes	No
For DTCs P2111 or P2112, GO to **DV25**. For all others, GO to **DV26**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DV25 CHECK FOR AN INTERMITTENT CONCERN

- ETBTACM connector connected.
- PCM connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the TP1 and TP2 PIDs.
- Wiggle, shake, and bend the harness from the TP to the PCM.
- **Are the voltages between 0.49 - 4.65 V?**

Yes	No
GO to **DV26**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DV26 CHECK FOR SELF-TEST CODES

- ETBTACM connector connected.
- PCM connector connected.
- Key ON, engine OFF.
- Carry out the self-test.
- **Is DTC P2101 present?**

Yes	No
GO to **DV27**.	GO to **DV29**.

DV27 CHECK FOR PROPER TACM+ WIRING IN THE HARNESS CONNECTOR

- Key in OFF position.
- ETBTACM connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-) PCM Connector, Harness Side
TACM+	TACM+

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DV28**.	REPAIR the open circuit. WIRE the TACM harness connector per the TACM and PCM connector diagrams. CLEAR the DTCs. REPEAT the self-test.

DV28 CHECK FOR PROPER TACM- WIRING IN THE HARNESS CONNECTOR

- Measure the resistance between:

(+) ETBTACM Connector,	(-) PCM Connector, Harness Side

Harness Side	
TACM-	TACM-

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DV30**.	GO to **DV29**.

DV29 CHECK THE REPAIR THROUGH PROCEDURE

- Key ON, engine OFF.
- Record and clear the DTCs.
- Cycle the accelerator pedal to the floor and back several times.
- Check for self-test DTCs.
- **Are any ETC system related DTCs present?**

Yes	No
GO to **DV30**.	refer to **PINPOINT TEST Z**.

DV30 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DW: HEATED OXYGEN SENSOR (HO2S)

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

WARNING: **While conducting tests on a hot engine take all safety precautions to prevent skin contact with hot engine components. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- HO2S/O2S (9F472)
- HO2S/O2S (9G444)
- harness circuits: HO2S, HO2S Heater, VPWR, and SIGRTN
- powertrain control module (PCM) (12A650)

The pin numbering for the connector is in reference to the connector lock tab. Not all connector key combinations are shown.

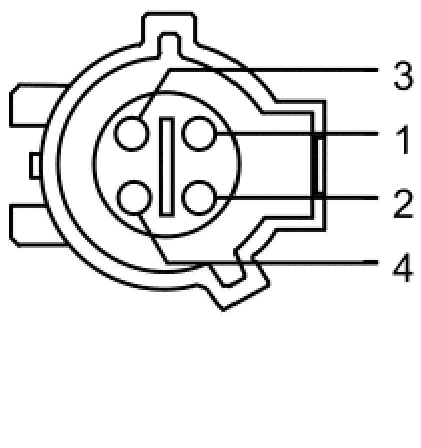

Fig. 81: Heated Oxygen Sensor-Front (HO2S-Front) Connector - A
Courtesy of FORD MOTOR CO.

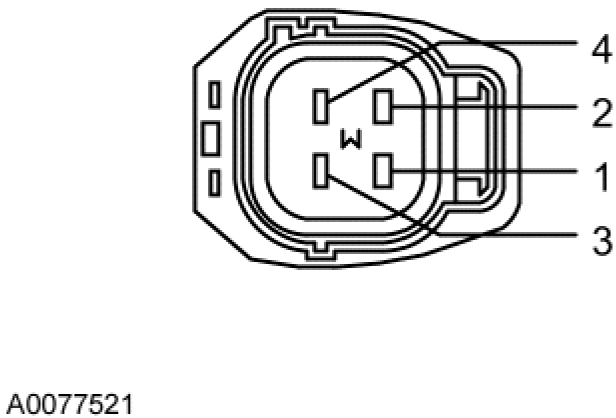

Fig. 82: Heated Oxygen Sensor-Front (HO2S-Front) Connector - B
Courtesy of FORD MOTOR CO.

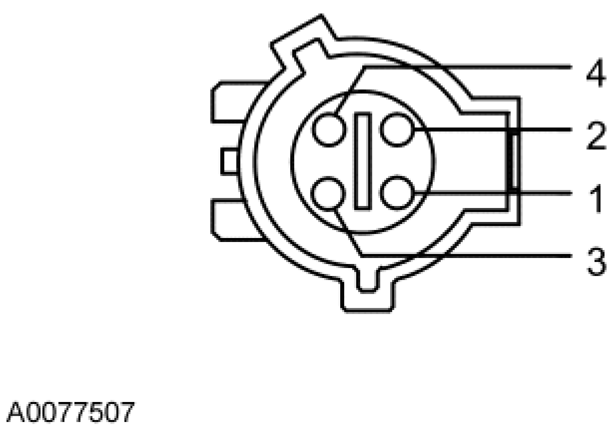

Fig. 83: Heated Oxygen Sensor-Front (HO2S-Front) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria, F-150, Grand Marquis, Mark LT, Mustang, Ranger, Town Car	A	2 4 3 1	VPWR SIGRTN HO2S Signal HO2S Heater
Focus	B	1 3	VPWR SIGRTN

		4 2	HO2S Signal HO2S Heater
All other vehicles	C	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater

The pin numbering for the connector is in reference to the connector lock tab. Not all connector key combinations are shown.

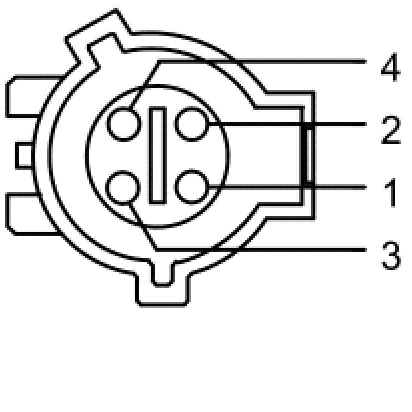

Fig. 84: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - A
Courtesy of FORD MOTOR CO.

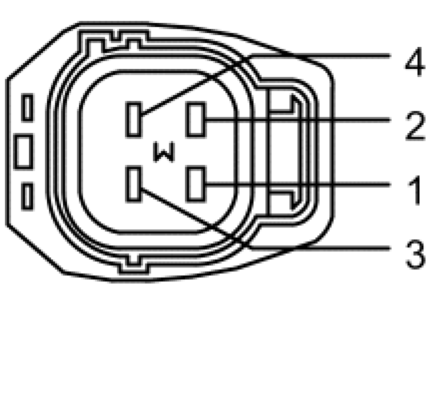

Fig. 85: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - B
Courtesy of FORD MOTOR CO.

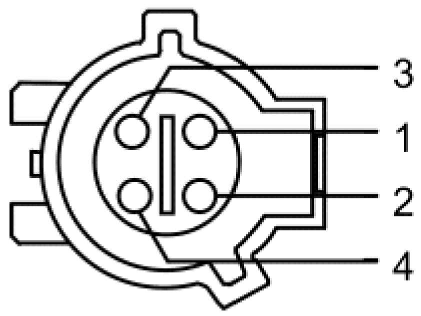

Fig. 86: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner, F-150, Mark LT	A	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater
Focus	B	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater
All other vehicles	C	2 4 3 1	VPWR SIGRTN HO2S Signal HO2S Heater

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series 6.8L, E-Series 5.4L Cutaway or stripped chassis	170 Pin	E28 E69 E29 E70 T24 T47 T25 T48 B14 B38 B35, B36	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 HO2S13 HTR13 VPWR

		B41, E58, T41	SIGRTN
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	E29 E69 E28 E70 E23 E1 E24 E2 B51, B52, B53 B58, E58	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN
Escape/Mariner 3.0L	150 (50-50-50) Pin	E30 E49 E26 E48 T24 T47 T25 T48 B35, B36 B41, E41, T41	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN
Escape/Mariner 2.3L	150 (50-50-50) Pin	E30 E49 T24 T47 B35, B36 B41, E41, T41	HO2S11 HTR11 HO2S12 HTR12 VPWR SIGRTN
Expedition, Navigator	140 Pin	E29 E69 E28 E70 B39 B10 B40 B11 B51, B52, B53 B58, E58	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN
F-150, Mark LT	190 Pin	E29 E69 E28 E70 T22 T1 T21 T12 B51, B52, B53 B58, E58, T43	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN

F-Super Duty 6.8L Narrow frame	170 Pin	E28 E69 E29 E70 B14 B38 B35, B36 B41, E58, T41	HO2S11 HTR11 HO2S21 HTR21 HO2S13 HTR13 VPWR SIGRTN
Focus 2.0L PZEV	190 Pin	E11 E52 T16 T18 T7 T25 B67, B68 B58, E64, T40	HO2S11 HTR11 HO2S12 HTR12 HO2S13 HTR13 VPWR SIGRTN
Focus 2.0L	190 Pin	E11 E52 T16 T18 B67, B68 B58, E64, T40	HO2S11 HTR11 HO2S12 HTR12 VPWR SIGRTN
Fusion 3.0L, Milan 3.0L, MKZ	140 Pin	E28 E69 E29 E70 E3 E23 E4 E24 B51, B52 B58, E58	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN
Fusion 2.3L, Milan 2.3L	140 Pin	E28 E69 E3 E23 B51, B52 B58, E58	HO2S11 HTR11 HO2S12 HTR12 VPWR SIGRTN
Fusion 2.3L PZEV, Milan 2.3L PZEV	140 Pin	E28 E69 E3 E23 E5 E25 B51, B52 B58, E58	HO2S11 HTR11 HO2S12 HTR12 HO2S13 HTR13 VPWR SIGRTN

Ranger 2.3L	170 Pin	E28 E69 T24 T47 B35, B36 B41, E58, T41	HO2S11 HTR11 HO2S12 HTR12 VPWR SIGRTN
All other vehicles	170 Pin	E28 E69 E29 E70 T24 T47 T25 T48 B35, B36 B41, E58, T41	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN

DW1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0040, P0041, P0053, P0054, P0055, P0059, P0060, P0132, P0133, P0135, P0138, P0139, P0141, P0144, P0147, P0152, P0153, P0155, P0158, P0159, P0161, or P1127 present?**

Yes	No
For DTCs P0040 or P0041, GO to **DW2**. For DTCs P0053, P0054, P0055, P0059 or P0060, GO to **DW14**. For DTCs P0132, P0138, P0144, P0152 or P0158, GO to **DW20**. For DTCs P0133 or P0153, GO to **DW3**. For DTCs P0135, P0139, P0141, P0147, P0155, P0159 or P0161, GO to **DW9**. For DTC P1127, GO to **DW19**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DW2 KOER DTCS P0040 AND P0041: CROSSED SENSOR WIRES

- Key in OFF position.
- Check the vehicle repair history.
- Verify the HO2S connectors are connected to the correct engine bank.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DW3 CONTINUOUS MEMORY DTCS P0133 AND P0153: CARRY OUT THE KOER SELF-TEST

- Engine at normal operating temperature.
- Carry out the KOER self-test.
- **Are DTCs P0040, P0041 or P1127 present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DW4**.

DW4 CHECK THE HO2S RESPONSE TEST RESULTS

- Key ON, engine OFF.
- Access the diagnostic monitoring test results for the HO2S11 and HO2S21.
- **Is the indicated value greater than the minimum threshold?**

Yes	No
CLEAR the DTCs. GO to **DW3**.	GO to **DW5**.

DW5 CHECK FOR UNMETERED AIR LEAKS

NOTE: Fuel calculations can be affected by unmetered air leaks.

- Carefully inspect the following areas for potential air leaks:
  - hoses connecting to the mass air flow (MAF) sensor assembly
  - hoses connecting to the throttle body
  - intake manifold gasket leaks
  - PCV system
  - the vacuum lines are disconnected
  - improperly seated engine oil dipstick, tube or oil fill cap
  - exhaust leaks at flanges and gaskets
- **Are any air leaks present?**

Yes	No
REPAIR the source of the air leak. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **DW6**.

DW6 CHECK THE HO2S CIRCUIT CONTINUITY

NOTE: HO2S is displayed as O2S on the scan tool.

- HO2S connector disconnected.
- Check the connector (both halves) for any water contamination.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side
HO2S Signal	VPWR

- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage greater than 1 V?**

Yes	No
INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CHANGE the engine oil and oil filter. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **DW7**.

DW7 CHECK THE HO2S CIRCUIT(S) FOR AN OPEN IN THE HARNESS

NOTE: A vehicle hoist may be required to access the HO2S harness.

- Key in OFF position.
- Remove the jumper wire(s).
- Visually inspect the HO2S harness for exposed wiring, water contamination, corrosion, and proper assembly.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **DW8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DW8 CHECK THE HO2S CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	VPWR

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DW9**.	GO to **DW12**.

DW9 DTCS P0135, P0139, P0141, P0147, P0155, P0159 OR P0161: CHECK FOR A SOURCE OF POTENTIAL HO2S CONTAMINATION

- Investigate the following items as potential sources of HO2S contamination:
  - use of unapproved silicon sealers
  - fuel contaminated by silicon additives
  - excessive oil consumption
  - glycol leaking internally in the engine
  - lead-contaminated fuel
  - short drive cycles in cold weather
  - use of unapproved cleaning agents
- **Is a concern present?**

Yes	No
REPAIR the source of the contamination. CHANGE the engine oil and oil filter. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **DW10**.

DW10 VISUALLY INSPECT THE HO2S HARNESS

- PCM connector connected.
- Visually inspect the HO2S harness for exposed wiring, water contamination, corrosion, and proper assembly.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	For DTCs P0139 or P0159, GO to **DW11**. For all others, GO to **DW12**.

DW11 CHECK THE EXHAUST SYSTEM FOR LEAKS AND MODIFICATIONS

- Check for leaks in the exhaust system.
- Visually inspect the vehicle for aftermarket accessories and performance modifications.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DW25**.

DW12 CHECK THE HO2S AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

NOTE: Verify the harness pins are in the proper location.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **DW13**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DW13 CARRY OUT THE KOEO ON DEMAND SELF-TEST

- Key ON, engine OFF.
- Carry out the KOEO self-test.
- **Are DTCs P0135, P0141, P0147, P0155 or P0161 present?**

Yes	No
GO to **DW14**.	GO to **DW15**.

DW14 DTCS P0053, P0054, P0055, P0059 AND P0060: CHECK FOR VPWR IN THE HARNESS

NOTE: **If DTCs P0053, P0054, P0055, P0059, or P0060 are present, test their related circuits individually.**

- Key in OFF position.
- HO2S connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HO2S Connector, Harness Side	(-) HO2S Connector, Harness Side
VPWR	SIGRTN

- **Is the voltage greater than 10 V?**

Yes	No
GO to **DW15**.	REPAIR the open circuit. CHECK the fuses. CLEAR the DTCs. REPEAT the self-test.

DW15 CHECK THE HO2S HEATER FOR SHORTS IN THE HARNESS

NOTE: **If DTCs P0053, P0054, P0055, P0059, or P0060 are present, test their related circuits individually.**

- Key in OFF position.
- HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) Vehicle Battery
HO2S Heater	Negative terminal

- Measure the resistance between:

(+) HO2S	(-) HO2S

Connector, Harness Side	Connector, Harness Side
HO2S Heater	VPWR
HO2S Heater	SIGRTN
HO2S Heater	HO2S Signal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DW16**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DW16 CHECK THE HO2S HEATER CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Heater	HO2S Heater

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DW17**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DW17 CHECK THE INTERNAL RESISTANCE OF THE HO2S HEATER

- Measure the resistance between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Heater	VPWR

- **Is the resistance between 3 - 30 ohms?**

Yes	No
GO to **DW18**.	INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER

	to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DW18 CHECK THE HO2S HEATER CIRCUIT FOR AN INTERNAL SHORT TO SIGRTN OR GND

- Measure the resistance between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Heater	SIGRTN

- Measure the resistance between:

(+) HO2S Connector, Component Side	(-) Vehicle Battery
HO2S Heater	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DW25**.	INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DW19 KOER DTC P1127: EXHAUST TEMPERATURE OUT OF RANGE

NOTE: Address all other DTCs before proceeding.

- Key ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the HO2S Heater PID.
- **Is the PID state ON?**

Yes	No

CARRY OUT the KOER self-test.	RUN the engine until the PID indicates ON. CARRY OUT the KOER self-test.

DW20 DTCS P0132, P0138, P0144, P0152 AND P0158: VISUALLY INSPECT THE HO2S HARNESS

NOTE: Disconnect the suspect HO2S harness connector. Only the suspect HO2S needs to be diagnosed.

- Key in OFF position.
- HO2S connector disconnected.
- Visually inspect the HO2S harness.
  - check the connector (both halves) for contamination
  - make sure the connector pins are fully seated
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DW21**.

DW21 CHECK THE HO2S SIGNAL LEVEL TOO HIGH

- HO2S connector connected.
- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage less than 1.1 V?**

Yes	No
GO to **DW22**.	GO to **DW23**.

DW22 CARRY OUT A THOROUGH WIGGLE TEST ON THE HO2S HARNESS

- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and monitor the HO2S Signal PID.
- Carry out a thorough wiggle test on the HO2S harness.
- **Does the voltage change during the wiggle test?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

DW23 CHECK THE HO2S SIGNAL FOR A SHORT TO VPWR INSIDE THE SENSOR

- Key in OFF position.
- HO2S connector disconnected.
- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage less than 1.1 V?**

Yes	No
INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **DW24**.

DW24 CHECK THE HO2S CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HO2S Connector, Harness Side	(-)
HO2S Signal	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DW25**.

DW25 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DX: ENGINE COOLANT TEMPERATURE (ECT) SENSOR

NOTE: Engine coolant temperature must be greater than 10°C (50°F) to pass the KOEO self-test and greater than 82°C (180°F) to pass the KOER self-test. to accomplish this, the engine must be at normal operating temperature.

This pinpoint test is intended to diagnose the following:

- engine coolant temperature (ECT) sensor (12A648)
- harness circuits: ECT and SIGRTN
- powertrain control module (PCM) (12A650)

Voltage values calculated for VREF = 5 volts. These values can vary by 15% due to sensor and VREF variations.

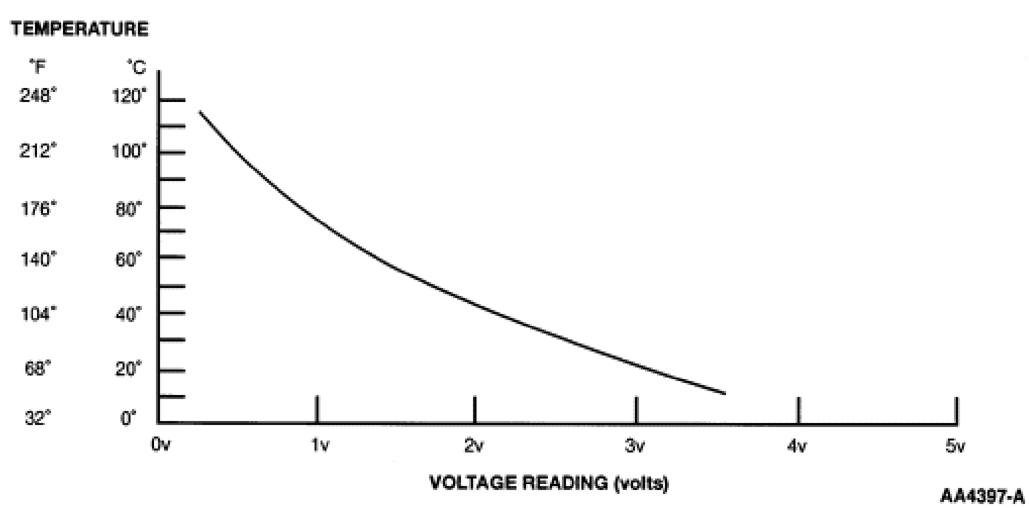

Fig. 87: Temperature Sensor Temperature To Voltage Graph
Courtesy of FORD MOTOR CO.

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
120	248	0.28	1.18
110	230	0.36	1.55

100	212	0.47	2.07
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85
-10	14	4.45	160.31

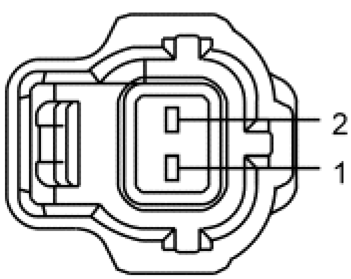

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Fig. 88: Engine Oil Temperature (EOT) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
1	ECT (Engine Coolant Temperature)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	E40 E41 E21	VREF SIGRTN ECT
Fusion, Milan	140 Pin	E57 E58 E18	VREF SIGRTN ECT

All other vehicles	170 Pin	E57 E58 E18	VREF SIGRTN ECT

DX1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0116, P0117, P0118, P0119, P0125, P0128, P0217, P1116, or P1117 present?**

Yes	No
For continuous memory DTC P0116, GO to **DX14**. For KOEO and KOER DTC P0117, GO to **DX12**. For continuous memory DTCs P0117, P0118, P0119, or P1117, GO to **DX16**. For KOEO and KOER DTC P0118, GO to **DX8**. For continuous memory DTCs P0125, or P0128, GO to **DX19**. For DTC P0217, GO to **DX21**. For KOEO and KOER DTC P1116, GO to **DX2**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DX2 DTC P1116: CHECK THE COOLING SYSTEM

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

- The DTC indicates the temperature sensor is out of self-test range. The engine is not at normal operating temperature.
- Check the vehicle coolant level.
- **Is the cooling system OK?**

Yes	No
GO to **DX3**.	REFER to the **ENGINE COOLING -- E-SERIES** , for loss of coolant diagnosis. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DX3 CHECK IF THE VEHICLE ENGINE STARTS

- Attempt to start the engine.
- **Does the engine start and run normally?**

Yes	No

GO to **DX6**.	GO to **DX4**.

DX4 CHECK THE RESISTANCE OF THE ECT SENSOR WITH THE ENGINE OFF

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- Key in OFF position.
- ECT Sensor connector disconnected.
- Measure the resistance between:

(+) ECT Sensor Connector, Component Side	(-) ECT Sensor Connector, Component Side
ECT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to **DX5**.	INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DX5 CHECK THE CIRCUIT FROM THE MODULE TO THE COMPONENT

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- ECT Sensor connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the ECT PID.
- Using the data collected from the previous step, compare temperature resistance measured at the sensor to the PID temperature voltage measured at the PCM.
- **Does the measured value at the sensor agree with the measured PID voltage value at the PCM?**

Yes	No
RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	GO to **DX10**.

DX6 CHECK THE ECT SENSOR OPERATION

- Run the engine until the engine temperature stabilizes.

- Verify the upper radiator hose is hot and the cooling system is pressurized.
- Repeat the KOER self-test.
- **Is DTC P1116 present?**

Yes	No
GO to **DX7**.	The engine temperature was not stabilized. REPAIR any other DTCs as necessary.

DX7 CHECK THE RESISTANCE OF THE ECT SENSOR

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- The vehicle must be at normal operating temperature.
- Key in OFF position.
- ECT Sensor connector disconnected.
- Measure the resistance between:

(+) ECT Sensor Connector, Component Side	(-) ECT Sensor Connector, Component Side
ECT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to **DX25**.	INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DX8 DTC P0118: CHECK THE ECT SIGNAL CIRCUIT

- The DTC indicates the sensor signal is greater than the self-test maximum.
- ECT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ECT Sensor Connector, Harness Side	(-) ECT Sensor Connector, Harness Side

ECT - Pin 1	SIGRTN - Pin 2

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **DX9**.	GO to **DX10**.

DX9 CHECK THE RESISTANCE OF THE ECT SENSOR WITH THE ENGINE OFF

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- Key in OFF position.
- ECT Sensor connector disconnected.
- Measure the resistance between:

(+) ECT Sensor Connector, Component Side	(-) ECT Sensor Connector, Component Side
ECT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to **DX11**.	INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DX10 CHECK THE SIGNAL AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) ECT Sensor Connector, Harness Side
ECT	ECT - Pin 1
SIGRTN	SIGRTN - Pin 2

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **DX25**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DX11 CHECK THE SENSOR SIGNAL FOR A SHORT TO VREF

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ECT	VREF

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DX25**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DX12 DTC P0117: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- The DTC indicates the sensor signal is less than the self-test minimum.
- Possible causes:
  - grounded circuit in the harness
  - incorrect harness connections
  - damaged sensor
  - damaged PCM
- ECT Sensor connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the ECT PID.
- **Is the voltage greater than 4.2 V?**

Yes	No
INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DX13**.

DX13 CHECK THE SENSOR SIGNAL FOR A SHORT TO GROUND

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ECT	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) 12 Volt Vehicle Battery
ECT	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DX25**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DX14 DTC P0116: CHECK THE RESISTANCE OF THE ECT SENSOR WITH THE ENGINE OFF

NOTE: **Verify the engine temperature is at ambient room temperature before continuing with this test. A soak period of 6 hours may be required. Refer toDIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS for information concerning P0116.**

NOTE: **Refer to the chart at the beginning of this test for the resistance specifications.**

- Key in OFF position.
- ECT Sensor connector disconnected.
- Measure the resistance between:

(+) ECT Sensor Connector, Component Side	(-) ECT Sensor Connector, Component Side
ECT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to **DX15**.	INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DX15 DTC P0116: CHECK THE RESISTANCE OF THE ECT SENSOR

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

NOTE: Verify the engine is at operating temperature before taking the ECT reading.

- ECT Sensor connector connected.
- Run the engine until the engine temperature stabilizes.
- Key in OFF position.
- ECT Sensor connector disconnected.
- Measure the resistance between:

(+) ECT Sensor Connector, Component Side	(-) ECT Sensor Connector, Component Side
ECT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
The concern is not present at this time. CARRY OUT the OBD drive cycle to determine if fuel, HO2S, catalyst and misfire monitors can be executed. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DX16 DTCS P0117, P0118, P0119 OR P1117: INTERMITTENT CHECK

- Key ON, engine OFF.
- Access the PCM and monitor the ECT PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector

- **Is there a large change in the voltage reading?**

Yes	No
DISCONNECT and INSPECT the connector. If OK, INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DX17**.

DX17 CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

- Access the PCM and monitor the ECT PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there a large change in the voltage reading?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DX18**.

DX18 CHECK THE PCM AND VEHICLE HARNESS CONNECTORS

- Key in OFF position.
- PCM connector disconnected.
- ECT Sensor connector disconnected.
- **Are the connectors and terminals OK?**

Yes	No
The concern is not present at this time. DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DX19 DTCS P0125 OR P0128: CHECK THE ENGINE COOLANT LEVEL

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

- The DTC indicates the engine coolant temperature has not achieved the required engine operation temperature level, since start-up within a specified amount of time.

- Possible causes:
  - insufficient warm up time
  - leaking or stuck-open thermostat
  - low engine coolant
- Check the engine coolant level.
- **Is the engine coolant fill level correct?**

Yes	No
GO to **DX20**.	REFER to the **ENGINE COOLING -- E-SERIES** , for loss of coolant diagnosis. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DX20 CHECK THE SENSOR OPERATION

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Access the PCM and monitor the ECT PID.
- **Is the temperature greater than 77°C (170.6°F)?**

Yes	No
The test is complete. DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	REFER to the **ENGINE COOLING -- E-SERIES** for cooling system diagnosis. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DX21 DTC P0217: INDICATES AN ENGINE OVERHEAT CONDITION

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

- Check the engine coolant level.
- **Is the engine coolant fill level correct?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the overheating condition. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the loss of coolant. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DX22 DTC P0298: ENGINE OIL OVER TEMPERATURE CONDITION

NOTE: **The engine oil temperature protection strategy in the PCM is activated. This protects the engine against mechanical damage due to overheating.**

- Check for an overheating condition and base engine concerns.
- **Are there any overheating or base engine concerns?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DX23**.

DX23 CHECK FOR ECT DTCS

- Carry out the self-test.
- **Are DTCs P0117, P0118, P1116 or P1117 present?**

Yes	No
DISREGARD the engine oil temperature (EOT) diagnostic trouble code (DTC) at this time. ADDRESS the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DX24**.

DX24 ROAD TEST THE VEHICLE AND MONITOR FOR ENGINE OVER TEMPERATURE

- Access the freeze frame data (if available) and record the DTC concern conditions.
- Access the PCM and monitor the ECT PID.
- Test drive the vehicle and allow the engine to reach normal operating temperature.
- Observe the ECT PID.
- **Does the engine overheat?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the overheat symptom. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. CLEAR the DTCs. REPEAT the self-test.

DX25 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins

  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DY: ENGINE OIL TEMPERATURE (EOT) SENSOR

This pinpoint test is intended to diagnose the following:

- engine oil temperature (EOT) sensor (12A648)
- harness circuits: EOT and SIGRTN
- powertrain control module (PCM) (12A650)

Engine oil temperature must be greater than 10°C (50°F) to pass the KOEO self-test and greater than 66°C (150°F) to pass the KOER self-test.

Voltage values calculated for VREF = 5 volts. These values can vary by 15% due to sensor and VREF variations.

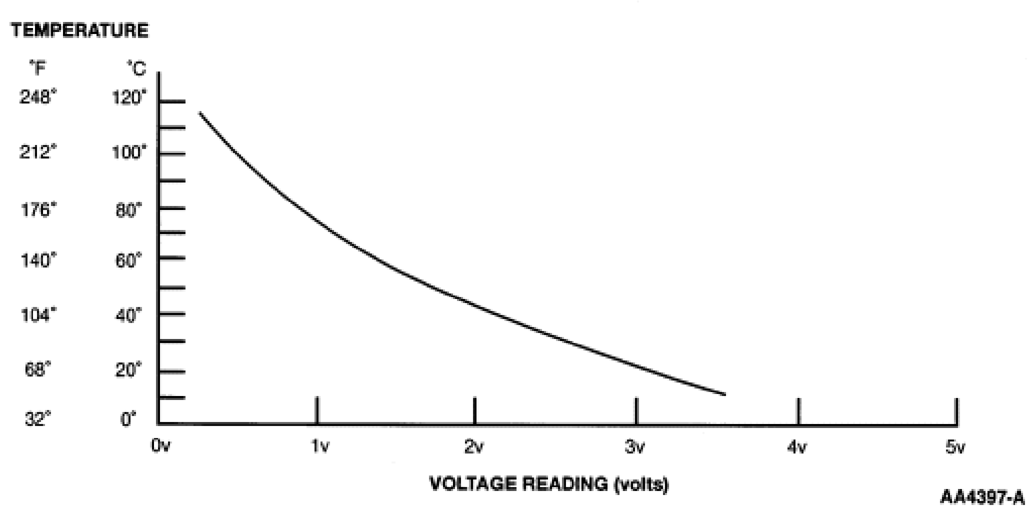

Fig. 89: Temperature Sensor Temperature To Voltage Graph
Courtesy of FORD MOTOR CO.

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
120	248	0.28	1.18
110	230	0.36	1.55
100	212	0.47	2.07
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85
-10	14	4.45	160.31

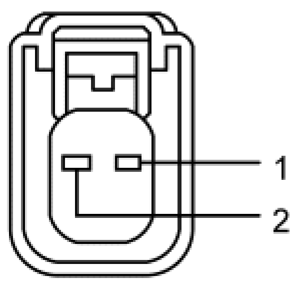

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Fig. 90: Engine Oil Temperature (EOT) Sensor Connector - A
Courtesy of FORD MOTOR CO.

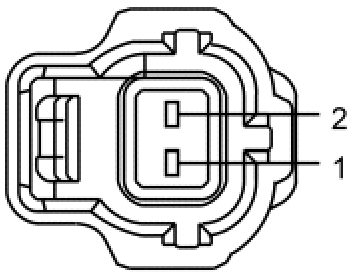

Fig. 91: Engine Oil Temperature (EOT) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Mustang	A	2 1	SIGRTN EOT
All other vehicles	B	2 1	SIGRTN EOT

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Connector	Pin	Circuit
170 Pin	E58 B35 E57 E27	SIGRTN VPWR VREF EOT

DY1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0196, P0197, P0198, P0298, or P1184 present?**

Yes	No
For DTCs P0196 or P1184, GO to **DY2**. For DTCs P0197 or P0198, GO to **DY3**. For continuous memory DTC P0298, GO to **DY14**.	For all others, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DY2 DTCS P0196 OR P1184: CHECK THE EOT SENSOR OPERATION

NOTE: **Before continuing with this pinpoint test, verify the engine oil condition and level are within specification.**

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Carry out the self-test.
- **Are DTCs P0196 or P1184 present?**

Yes	No
GO to **DY3**.	The engine temperature was not stabilized. REPAIR any other DTCs as necessary.

DY3 DTCS P0196, P0197, P0198, P1184 OR P0298: CHECK THE TEMPERATURE SENSOR SIGNAL

- Key ON, engine OFF.
- Access the PCM and monitor the EOT PID.
- **Is the voltage less than 0.3 V?**

Yes	No
GO to **DY4**.	GO to **DY6**.

DY4 SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- Key ON, engine OFF.
- EOT Sensor connector disconnected.
- Access the PCM and monitor the EOT PID.
- **Is the voltage greater than 4.2 V?**

Yes	No
INSTALL a new EOT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DY5**.

DY5 CHECK THE SENSOR SIGNAL FOR A SHORT TO GROUND

- PCM connector disconnected.
- Measure the resistance between:

(+) EOT Sensor Connector, Harness Side	(-) EOT Sensor Connector, Harness Side
EOT	SIGRTN

- Measure the resistance between:

(+) EOT Sensor Connector, Harness Side	(-) Vehicle Battery
EOT	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DY18**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DY6 CHECK FOR HIGH EOT SENSOR VOLTAGE

- Access the PCM and monitor the EOT PID.
- **Is the voltage greater than 4.2 V?**

Yes	No
GO to **DY7**.	GO to **DY11**.

DY7 CHECK THE EOT CIRCUIT VOLTAGE

- EOT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) EOT Sensor Connector, Harness Side	(-) EOT Sensor Connector, Harness Side
EOT	SIGRTN

- **Is the voltage greater than 4.2 V?**

Yes	No
GO to **DY8**.	GO to **DY10**.

DY8 CHECK THE RESISTANCE OF THE EOT SENSOR WITH THE ENGINE OFF

- Key in OFF position.
- EOT Sensor connector disconnected.
- Measure the resistance between:

(+) EOT Sensor Connector, Component Side	(-) EOT Sensor Connector, Component Side
EOT	SIGRTN

- Refer to the chart at the beginning of this test for the resistance specifications.
- **Is the resistance within specification?**

Yes	No
GO to **DY9**.	INSTALL a new EOT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DY9 CHECK THE SENSOR SIGNAL CIRCUIT FOR SHORTS TO PWR

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
EOT - Pin E27	VREF - Pin E57
EOT - Pin E27	VPWR - Pin B35

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DY18**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DY10 CHECK THE SIGNAL AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector,	(-) EOT Sensor

Harness Side	Connector, Harness Side
EOT - Pin E27	EOT
SIGRTN - Pin E58	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **DY18**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DY11 INTERMITTENT CHECK

- Key ON, engine OFF.
- Access the PCM and monitor the EOT PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector
- **Is there a large change in the voltage reading?**

Yes	No
DISCONNECT and INSPECT the connector. REPAIR as necessary. If OK, INSTALL a new EOT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DY12**.

DY12 CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

- Access the PCM and monitor the EOT PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there a large change in the voltage reading?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DY13**.

DY13 CHECK THE RESISTANCE OF THE EOT SENSOR WITH THE ENGINE RUNNING

NOTE: **Refer to the chart at the beginning of this test for the resistance specifications.**

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Measure the resistance between:

(+) EOT Sensor Connector, Component Side	(-) EOT Sensor Connector, Component Side
EOT	SIGRTN

- **Is the resistance within specification for the given engine temperature?**

Yes	No
The concern is not present at this time. refer to **PINPOINT TEST Z**.	INSTALL a new EOT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DY14 DTC P0298: ENGINE OIL OVER TEMPERATURE CONDITION

NOTE: The engine oil temperature protection strategy in the PCM has been activated. This protects the engine against mechanical damage due to overheating.

- Check for an overheating condition and base engine concerns.
- **Are there any overheating or base engine concerns?**

Yes	No
ISOLATE the concern. REPAIR as necessary. REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the overheat symptom. CLEAR the DTCs. REPEAT the self-test.	GO to **DY15**.

DY15 CHECK FOR EOT SENSOR HARDWARE

- The engine oil temperature protection strategy in the PCM can be activated with or without an EOT sensor.
- **Does the vehicle have a EOT sensor?**

Yes	No
GO to **DY3**.	GO to **DY16**.

DY16 IDENTIFY THE CUSTOMER'S DRIVING HABITS

- Identify the customers driving habits.
- Access the freeze frame data (if available) and record the DTC concern conditions.
- **Does the vehicle appear to have been driven in an incorrect transmission gear or at high RPM for an extended period?**

Yes	No
ADVISE the customer that improper transmission gear selection and high RPM for an extended period initializes the engine protection strategy. CLEAR the DTCs. REPEAT the self-test.	GO to **DY17**.

DY17 TYPE OF ENGINE COOLANT SENSOR

NOTE: When an oil temperature sensor is not present, the PCM uses an oil algorithm to infer actual temperature based on input from the engine temperature sensor.

- **Is the vehicle equipped with cylinder head temperature (CHT) sensor?**

Yes	No
GO to **DL26**.	GO to **DX22**.

DY18 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DZ: UNIVERSAL HEATED OXYGEN SENSOR (HO2S)

WARNING: **While conducting tests on a hot engine take all safety precautions to prevent skin contact with hot engine components. Failure to follow these instructions may result in personal injury.**

NOTE: Only diagnose the suspect universal HO2S indicated by the DTC.

This pinpoint test is intended to diagnose the following:

- universal HO2S (9Y460)
- harness circuits: UO2S, UO2SGREF, UO2SHTR, UO2SPC, UO2SPCT, and VPWR
- powertrain control module (PCM) (12A650)

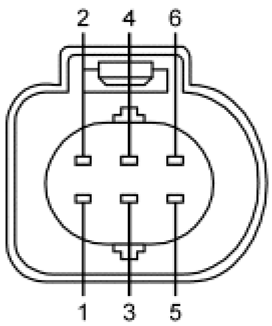

Fig. 92: Universal Heated Oxygen Sensor (HO2S)
Courtesy of FORD MOTOR CO.

Pin	Circuit
5	UO2SPCT (Universal Oxygen Sensor Pumping Current Trim)
1	UO2SPC (Universal Oxygen Sensor Pumping Current)
4	VPWR (Vehicle Power)
2	UO2SGREF (Universal Oxygen Sensor Ground Reference)
6	UO2S (Universal Oxygen Sensor)
3	UO2SHTR (Universal Oxygen Sensor Heater)

Pin	Circuit
E18	UO2S11 (Universal Oxygen Sensor Bank 1, Sensor 1)
E20	UO2S21 (Universal Oxygen Sensor Bank 2, Sensor 1)
E19	UO2SGREF11 (Universal Oxygen Sensor Ground Reference Bank 1, Sensor 1)
E21	UO2SGREF21 (Universal Oxygen Sensor Ground Reference Bank 2, Sensor 1)
E69	UO2SHTR11 (Universal Oxygen Sensor Heater Bank 1, Sensor 1)
E70	UO2SHTR21 (Universal Oxygen Sensor Heater Bank 2, Sensor 1)
E4	UO2SPC11 (Universal Oxygen Sensor Pumping Current Bank 1, Sensor 1)
E6	UO2SPC21 (Universal Oxygen Sensor Pumping Current Bank 2, Sensor 1)

E5	UO2SPCT11 (Universal Oxygen Sensor Pumping Current Trim Bank 1, Sensor 1)
E7	UO2SPCT21 (Universal Oxygen Sensor Pumping Current Trim Bank 2, Sensor 1)

DZ1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0030, P0040, P0050, P0053, P0059, P0130, P0133, P0134, P0135, P0150, P0153, P0154, P0155, P1127, P2096, P2097, P2098, or P2099 present?**

Yes	No
For DTCs P0030 or P0050, GO to **DZ2**. For DTC P0040, GO to **DZ5**. For DTCs P0053, P0059, P0135 or P0155, GO to **DZ6**. For DTCs P0130 or P0150, GO to **DZ11**. For DTCs P0133 or P0153, GO to **DZ15**. For DTCs P0134 or P0154, GO to **DZ18**. For DTC P1127, GO to **DZ19**. For DTCs P2096, P2097, P2098 or P2099, GO to **DZ20**.	For symptoms without DTCs, GO to **DZ23**. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DZ2 DTCS P0030 AND P0050: CHECK FOR MISFIRE CONCERNS AND AFTERMARKET EQUIPMENT

- Key in OFF position.
- Check for the following:
  - misfire concern
  - non-factory or aftermarket equipment that may increase the exhaust temperature
- Universal HO2S connector disconnected.
- Check the universal HO2S connector for damage or corrosion.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DZ3**.

DZ3 CHECK THE UO2SHTR CIRCUIT FOR A SHORT TO VOLTAGE

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Universal HO2S	

Connector, Harness Side	(-)
UO2SHTR - Pin 3	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DZ4**.

DZ4 CHECK THE UO2S, UO2SGREF, UO2SHTR CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2S - Pin 6	UO2S
UO2SGREF - Pin 2	UO2SGREF
UO2SHTR - Pin 3	HO2S Heater

- **Are the resistances less than 5 ohms?**

Yes	No
INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DZ5 DTC P0040: CROSSED SENSOR WIRES

- Key in OFF position.
- Check the vehicle repair history.
- Verify the connectors are connected to the correct engine bank.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DZ6 DTCS P0053, P0059, P0135 AND P0155: CHECK FOR VPWR IN THE HARNESS

- Key in OFF position.
- Universal HO2S connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Universal HO2S Connector, Harness Side	(-)
VPWR - Pin 4	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **DZ7**.	REPAIR the open circuit. CHECK the fuses. CLEAR the DTCs. REPEAT the self-test.

DZ7 CHECK THE UO2SHTR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2SHTR - Pin 3	UO2SHTR

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DZ8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DZ8 CHECK THE UO2SHTR CIRCUIT FOR A SHORT IN THE HARNESS

- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) Vehicle Battery
UO2SHTR - Pin 3	Negative terminal

- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) Universal HO2S Connector, Harness Side
UO2SHTR - Pin 3	UO2S - Pin 6
UO2SHTR - Pin 3	UO2SGREF - Pin 2
UO2SHTR - Pin 3	UO2SPC - Pin 1
UO2SHTR - Pin 3	UO2SPCT - Pin 5
UO2SHTR - Pin 3	VPWR - Pin 4

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DZ9**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DZ9 CHECK THE INTERNAL RESISTANCE OF THE UNIVERSAL HO2S HEATER

- Measure the resistance between:

(+) Universal HO2S Connector, Component Side	(-) Universal HO2S Connector, Component Side
VPWR - Pin 4	UO2SHTR - Pin 3

- **Is the resistance between 1.8 - 9 ohms?**

Yes	No
GO to **DZ10**.	INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ10 CHECK THE UO2SHTR CIRCUIT FOR AN INTERNAL SHORT TO GROUND

- Measure the resistance between:

(+) Universal HO2S Connector, Component Side	(-)
UO2SHTR - Pin 3	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DZ25**.	INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ11 DTCS P0130 AND P0150: CHECK THE UO2S AND UO2SGREF CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector,	(-) PCM Connector,

Harness Side	Harness Side
UO2S - Pin 6	UO2S
UO2SGREF - Pin 2	UO2SGREF

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **DZ12**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DZ12 CHECK THE UO2S, UO2SGREF, UO2SPC, AND UO2SPCT CIRCUITS FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-)
UO2S - Pin 6	Ground
UO2SGREF - Pin 2	Ground
UO2SPC - Pin 1	Ground
UO2SPCT - Pin 5	Ground

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DZ13**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DZ13 CHECK THE UO2S, UO2SGREF, UO2SPC, AND UO2SPCT CIRCUITS FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) Universal HO2S Connector, Harness Side	(-)
UO2S - Pin 6	Ground

UO2SGREF - Pin 2	Ground
UO2SPC - Pin 1	Ground
UO2SPCT - Pin 5	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DZ14**.

DZ14 CHECK THE UO2SGREF CIRCUIT FOR VOLTAGE

- Key in OFF position.
- PCM connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Universal HO2S Connector, Harness Side	(-)
UO2SGREF - Pin 2	Ground

- **Is the voltage between 2.4 - 2.6 V?**

Yes	No
INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **DZ25**.

DZ15 DTCS P0133 AND P0153: CARRY OUT THE KOER SELF-TEST

- Engine at normal operating temperature.
- Carry out the KOER self-test.
- **Are any DTCs present other than P0133 or P0153?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DZ16**.

DZ16 CHECK FOR A SOURCE OF POTENTIAL CONTAMINATION

- Investigate the following items as potential sources of universal HO2S contamination:
  - use of unapproved silicon sealers
  - fuel contaminated by silicon additives
  - excessive oil consumption
  - glycol leaking internally in the engine
  - lead-contaminated fuel
  - short drive cycles in cold weather
  - use of unapproved cleaning agents
- **Is a concern present?**

Yes	No
REPAIR the source of the contamination. CHANGE the engine oil and oil filter. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **DZ17**.

DZ17 CHECK THE UNIVERSAL HO2S RESPONSE TEST RESULTS

- Key ON, engine OFF.
- Access the diagnostic monitoring test results for the HO2S11 and HO2S21.
- **Is the indicated value greater than the minimum threshold?**

Yes	No
Unable to duplicate or identify the concern at this time. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ18 DTCS P0134 AND P0154: CHECK THE UO2SPC CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2SPC - Pin 1	UO2SPC

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DZ19 KOER DTC P1127: EXHAUST TEMPERATURE OUT OF RANGE

NOTE: Address all other DTCs before proceeding.

- Key ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the HTR11 and HTR21 PIDs.
- **Are the PID states ON?**

Yes	No
CARRY OUT the KOER self-test.	RUN the engine until the PID indicates ON. CARRY OUT the KOER self-test.

DZ20 DTCS P2096, P2097, P2098 AND P2099: VISUALLY INSPECT THE UPSTREAM AND DOWNSTREAM HO2S CONNECTORS

- Key in OFF position.
- HO2S connector disconnected.
- Universal HO2S connector disconnected.
- Check for a loose connection, and damaged or corroded terminals.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DZ21**.

DZ21 CHECK FOR LEAKS IN THE EXHAUST SYSTEM

- Visually inspect the exhaust system for the following:
  - exhaust leaks at flanges and gaskets
  - HO2Ss not tightened to specification
  - physical exhaust system concerns
  - aftermarket exhaust
  - punctures or cracks in the catalytic converter
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DZ22**.

DZ22 CHECK FOR POTENTIAL SENSOR CONTAMINATION CONCERNS

- Investigate the following items as potential sources of universal HO2S contamination:
  - use of unapproved silicon sealers
  - fuel contaminated by silicon additives
  - excessive oil consumption
  - glycol leaking internally in the engine
  - lead-contaminated fuel
  - short drive cycles in cold weather
  - use of unapproved cleaning agents
- **Is a concern present?**

Yes	No
REPAIR the source of the contamination. CHANGE the engine oil and oil filter. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **DZ25**.

DZ23 CHECK THE UO2SPCT CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Universal HO2S connector disconnected.

- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2SPCT - Pin 5	UO2SPCT

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DZ24**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DZ24 CHECK THE RESISTANCE OF THE CURRENT TRIM RESISTOR IN THE UNIVERSAL HO2S

- Measure the resistance between:

(+) Universal HO2S Connector, Component Side	(-) Universal HO2S Connector, Component Side
UO2SPCT - Pin 5	UO2SPC - Pin 1

- **Is the resistance between 25 - 330 ohms?**

Yes	No
The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** for further direction.	INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ25 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins

    - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST EM: EMISSION COMPLIANCE

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

NOTE: **Canada and some states or metropolitan areas in the United States require periodic emission, or inspection/maintenance (I/M) tests. All Ford products are designed to pass these tests. If a Ford product fails an I/M test, it is probably because 1) the engine or catalyst temperature was not warm and stabilized before the test, or 2) the vehicle had idled excessively before the test.**

If any new emission components are installed, carry out the following steps before repeating the I/M test procedure:

- Reset the keep alive memory (KAM). Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .
- To relearn some basic adaptive learning (trim) values, run the engine at 2,500 RPM for 1 minute and idle the engine for 2 minutes.

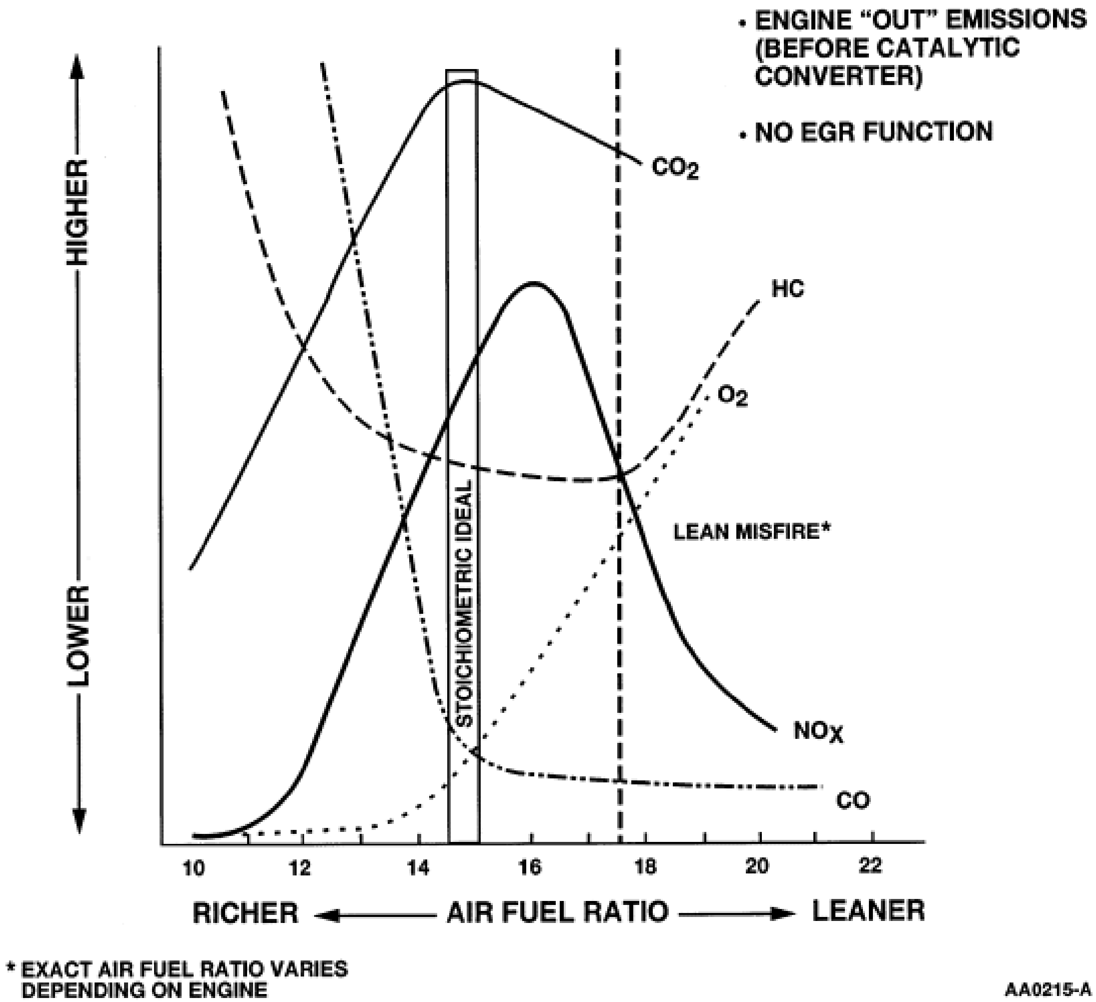

Fig. 93: Exhaust Gas Analysis Chart
Courtesy of FORD MOTOR CO.

Verifying an Excessive Grams Per Mile (GPM) Indication Using a Parts Per Million (PPM) Reading.

For vehicle gas reading(s) that are excessive, compare the actual GPM reading to the gas cut point level needed to pass testing. This gives an indication of how much the PPM reading has to be reduced (if the actual reading is twice the cut point, the baseline reading has to be cut in half or more).

Example:

- The actual HC produced by a vehicle is 1.6 gpm. The cut point for HC in this example is 0.8 gpm. The actual reading is twice the cut point.
- The HC reading obtained for the same vehicle during the baseline drive averages 440 ppm. In order for this vehicle to pass the I/M test, the HC reading from the verification trip must be at least half of the baseline reading, or an average of 220 ppm or less.
- This method only gives a general idea of how much the PPM reading needs to be reduced in order for the vehicle to pass an I/M test that calculates GPM. This test is not exact. Experience still has to be used to

determine if the emission readings are reduced enough for the vehicle to pass the I/M test.

EM1 ANALYZE THE I/M TEST REPORT

- Analyze the I/M test report for data entry errors.
  - model
  - model year
  - correct calibration, if included on the report
  - correct test weight, if included on the report (this number is less than the vehicle's GVW)
- Analyze the I/M test report results.
  - identify high and low gas readings.
  - for reports that include a drive trace, identify during which mode the gas(es) failed. Be aware that if all gases were high early then decreased, the catalyst may have been cool when testing began.
- **Has the I/M test report been analyzed?**

Yes	No
GO to **EM2**.	REPEAT the test step.

EM2 EVAP SYSTEM LEAK OR PURGE FLOW TEST (IF THESE TESTS WERE CARRIED OUT)

- **Does the vehicle fail only an EVAP system leak or purge flow test (if these tests are carried out)?**

Yes	No
This is an EVAP concern only. GO to **EM22**.	GO to **EM3**.

EM3 BASELINE THE VEHICLE

NOTE: Baselining the vehicle exhaust gas readings is important so the baseline readings can be used for comparison after any repair is made.

- Baseline the vehicle using an exhaust gas analyzer. If the vehicle must be driven, be certain any baseline drive used is repeatable. The same drive cycle will be used to verify any repair.
- During the baseline, check for any related symptoms that may be present, such as driveability, transmission shifting or exhaust smoke concerns.
- **Has the vehicle been baselined?**

Yes	No
GO to **EM4**.	REPEAT the test step.

EM4 SYMPTOM CHECKS

- Check if any of the following symptoms are present:

  - transmission concerns
  - idle concerns
  - driveability concerns
  - exhaust smoke
  - cooling system concerns
- **Are any of the symptoms present?**

Yes	No
CARRY OUT the PCM Quick Test. REFER to the **SYMPTOM CHARTS** article, QT: Step 1: Powertrain Control Module (PCM) Quick Test. REFER to the Exhaust Gas Analysis Chart at the beginning of this pinpoint test. After any repair, GO to **EM26**.	GO to **EM5**.

EM5 PRELIMINARY CHECKS

- Carry out the following checks:
  - vacuum lines for leaks and blockages
  - electrical connections
  - proper scheduled maintenance
  - Ford authorized emission controls and components installed on the vehicle
  - intake air tube and air cleaner concerns such as obstructions, leaks, or a dirty air cleaner element
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to **EM26**.	GO to **EM6**.

EM6 CARRY OUT THE PCM QUICK TEST

- Carry out the PCM Quick Test to access any PCM DTCs. For the procedure information, refer to**PINPOINT TEST QT** .
- **Is a concern present?**

Yes	No
FOLLOW the Quick Test direction. After any repair, GO to **EM26**.	GO to **EM7**.

EM7 CHECK FOR EXCESSIVE CARBON MONOXIDE (CO) LEVELS

- **Does the vehicle have excessive CO levels?**

Yes	No
Excessive CO levels indicate the engine is running rich. GO to **EM10**.	GO to **EM8**.

EM8 CHECK FOR EXCESSIVE HYDROCARBON (HC) LEVELS

- **Does the vehicle have excessive HC levels?**

Yes	No
Excessive HC levels with low to normal CO levels indicate the engine is running lean. GO to **EM16**.	GO to **EM9**.

EM9 CHECK FOR EXCESSIVE OXIDES OF NITROGEN (NOX) LEVELS

- **Does the vehicle have excessive NOx levels?**

Yes	No
GO to **EM20**.	VERIFY the test step results.

EM10 HIGH CO LEVELS: CHECK THE HC LEVELS

- **Does the vehicle have excessive HC levels?**

Yes	No
CHECK for the engine running rich and incomplete combustion. GO to **EM11**.	GO to **EM12**.

EM11 CHECK THE SECONDARY IGNITION SYSTEM

- For ignition coil on plug (COP) equipped vehicles, GO to **JB2** and follow the pinpoint test direction.
- For ignition coil pack equipped vehicles, GO to **JC2** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM12**.

EM12 CHECK THE FUEL DELIVERY SYSTEM FOR CONCERNS SUCH AS HIGH FUEL PRESSURE AND THE ABILITY TO HOLD PRESSURE

- refer to **PINPOINT TEST HC** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM13**.

EM13 CHECK FOR VACUUM LEAKS/OBSTRUCTION IN THE PCV SYSTEM (SUCH AS OIL CAP, PCV VALVE, HOSES, CUT GROMMETS, VALVE COVER BOLT TORQUE/GASKET LEAK)

- GO to **HG2** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM14**.

EM14 CHECK THE EXHAUST SYSTEM

- GO to **HF2** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM15**.

EM15 CHECK THE BASE ENGINE

- Check for base engine concerns. Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** .
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to **EM26**.	GO to **EM27**.

EM16 HIGH HC WITH A NORMAL TO LOW CO LEVEL

- Check the fuel delivery system for concerns. refer to **PINPOINT TEST HC** and follow the pinpoint test direction.

- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM17**.

EM17 CHECK THE SECONDARY IGNITION

- For ignition coil on plug (COP) equipped vehicles, GO to **JB2** and follow the pinpoint test direction.
- For ignition coil pack equipped vehicles, GO to **JC2** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM18**.

EM18 CHECK FOR VACUUM LEAKS/OBSTRUCTION IN THE PCV SYSTEM (SUCH AS OIL CAP, PCV VALVE, HOSES, CUT GROMMETS, VALVE COVER BOLT TORQUE/GASKET LEAK)

- GO to **HG2** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM19**.

EM19 CHECK THE BASE ENGINE

- Check for base engine concerns such as intake manifold leaks, improper compression, or valvetrain or camshaft damage. Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** to carry out the intake manifold vacuum test, compression test, and valve train analysis.
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to **EM26**.	GO to **EM27**.

EM20 HIGH NOX WITH NORMAL TO LOW HC AND CO LEVELS: CHECK THE BASE ENGINE

- Check for base engine concerns such as excessive carbon build up in the combustion chamber. Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** to diagnose the abnormal combustion.
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to **EM26**.	GO to **EM21**.

EM21 ADDITIONAL CHECKS

- Check the following:
  - transmission torque converter clutch operation
  - cooling system concerns such as an aftermarket front fascia covering the intake air or intake air system modifications
  - engine running lean concerns such as vacuum leaks or low fuel pressure
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to **EM26**.	GO to **EM27**.

EM22 EVAP SYSTEM CONCERN: PRELIMINARY CHECKS

- Analyze the I/M test report to determine when the concern is present. Attempt to verify the concern.
- Check the following:
  - fuel filler cap
  - capless fuel tank filler pipe (if equipped)
  - EVAP system lines/hoses for proper connections, damage or blockage
  - fuel vapor storage canister damage
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to **EM25**.	GO to **EM23**.

EM23 CARRY OUT THE PCM QUICK TEST

- Carry out the PCM Quick Test to access any PCM DTCs. For the procedure information, refer to**PINPOINT TEST QT** .

- **Is a concern present?**

Yes	No
FOLLOW the Quick Test direction. After any repair, GO to **EM25**.	GO to **EM24**.

EM24 EVAP SYSTEM CHECK

- Check the EVAP system for leaks. Refer to the **EVAPORATIVE EMISSIONS -- E-SERIES** to carry out the evaporative emission system leak test.
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to **EM25**.	VERIFY the test step results. If all the test steps are OK, refer to **PINPOINT TEST Z**. For additional symptoms, REFER to the **SYMPTOM CHARTS** article. After any repair, GO to **EM25**.

EM25 EVAP SYSTEM REPAIR VERIFICATION

- Confirm the vehicle repair.
- Reset the keep alive memory (KAM). Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . Be aware that this will set DTC P1000 and reset the On-Board System Readiness test.
- To relearn some basic adaptive learning (trim) values, run the engine at 2,500 RPM for 1 minute and idle the engine for 2 minutes.
- Carry out the PCM Quick Test to access any PCM DTCs. For the procedure information, refer to**PINPOINT TEST QT** .
- Carry out the EVAP system leak test and flow check.
- **Does the vehicle pass the EVAP system leak test and flow check?**

Yes	No
SAVE any repair documentation that may be required by local/federal laws. RETURN the vehicle to the customer.	The original concern was not repaired, or another concern exists. GO to **EM1**.

EM26 REPAIR AND VERIFICATION

NOTE: **If the vehicle needs to be driven for the baseline test, it may be necessary to drive the vehicle first up to 8 km (5 miles) to relearn some additional adaptive learning (trim) values. Also, during the baseline make sure to use the same**

drive mode that was used for the original baseline test.

- Confirm the vehicle repair.
- Reset the keep alive memory (KAM). Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . Be aware that this will set DTC P1000 and reset the On-Board System Readiness test.
- To relearn some basic adaptive learning (trim) values, run the engine at 2,500 RPM for 1 minute and idle the engine for 2 minutes.
- Carry out the PCM Quick Test to access any PCM DTCs. For the procedure information, refer to**PINPOINT TEST QT** . Repair any other DTCs.
- Carry out the baseline test using the exhaust gas analyzer.
- For I/M 240 emission testing areas:
  - Refer to the beginning of this pinpoint test for information on verifying an excessive grams per mile indication using a parts per million (PPM) reading.
- All others (original gas concentrations reported in parts per million):
  - Verify the gas levels are within the acceptable range
- **Are all gases within the acceptable range?**

Yes	No
SAVE any repair documentation that may be required by local/federal laws. RETURN the vehicle to the customer.	The gas level is still high, or another gas level is above the acceptable range. GO to **EM1**.

EM27 CATALYST DELTA TEMPERATURE TEST

- Complete all previous testing.
- Run the engine for 2 minutes at 2,500 RPM to heat the exhaust system.
- Key in OFF position.
- Disconnect and ground 1 spark plug wire from each cylinder bank (for coil-on-plug applications, disconnect the coil connector).
- Run the engine at approximately 1,000 RPM.
- Disconnect the IAC valve and maintain 1,000 RPM (if equipped).
- Measure the surface temperature at both the inlet and outlet of each catalytic converter.
- Compare the difference in temperature between the inlet and outlet readings of each catalytic converter.
- **Does each catalytic converter have a difference of more than 28°C (50°F) between its inlet and outlet reading?**

Yes	No
The catalytic converter(s) is operating correctly. CONNECT the spark plug wire(s) and the IAC (if equipped). CLEAR the DTCs.	For catalytic converter(s) that have less than 28°C (50°F) difference, testing indicates the catalytic converter(s) is not working. REPEAT the test to

VERIFY the test step results. If all test steps are OK, refer to **PINPOINT TEST Z**. For additional symptoms, REFER to the **SYMPTOM CHARTS** article. After any repair, GO to **EM26**.	verify the results. If the temperature difference is still less than required, INSTALL a new catalytic converter. After any repair, GO to **EM26**.

PINPOINT TEST FB: POWER TAKE OFF (PTO)

This pinpoint test is intended to diagnose the following:

- PTO switch
- harness circuit: PTO, PTOIL
- powertrain control module (PCM) (12A650)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Connector	Pin	Circuit
170 Pin	B7 B42 B9 B26	PTORPM PTOIL PTOENG PTO

FB1 PTO INDICATOR LAMP

- **Did you come to this pinpoint test for an always on/ never on PTO indicator?**

Yes	No
GO to **FB7**.	GO to **FB2**.

FB2 PTO NOT WORKING CORRECTLY: CHECK THE PTO INDICATOR LAMP OPERATION

NOTE: **The following conditions must be met before the PTO engages:**

- **Engine at normal operating temperature**
- **Accelerator pedal is released**
- **TFT within normal operating temperature**
- **Parking brake is applied**
- **Brake pedal is released**
- **Automatic transmission is in the PARK position**
- **Manual transmission - the clutch pedal is released**

NOTE: This step requires operating the PTO component. Refer to the aftermarket manufacturer for the PTO operating instructions. Follow all safety precautions.

- Key ON, engine running.
- Activate the PTO switch.
- **Does the PTO indicator illuminate?**

Yes	No
GO to the aftermarket PTO mechanical manual.	GO to **FB3**.

FB3 CHECK THE INTEGRITY OF THE PTO SWITCH AND THE PTO SWITCH CIRCUIT

- Access the PCM and monitor the PTO PID.
- Cycle the PTO switch, from off to on to off.
- **Does the PTO PID change state?**

Yes	No
GO to **FB4**.	REPAIR the PTO circuit or switch as necessary. CLEAR the DTCs. REPEAT the self-test.

FB4 CHECK THE PTO LOAD PID STATE IN THE PCM

- Access the PCM and monitor the PTOLOAD PID.
- Cycle the PTO switch,
- **Does the PTO LOAD PID change state?**

Yes	No
GO to **FB5**.	REPAIR the PTO ENG circuit or switch as necessary. CLEAR the DTCs. REPEAT the self-test.

FB5 CHECK THE PTOIR_V PID STATE IN THE PCM

NOTE: The PTOIR_V PID represents an analog input which reflects the user requested engine speed.

- Access the PCM and monitor the PTOIR_V PID.
- Cycle the PTO switch,
- **Does the PTOIR_V PID change state?**

Yes	No
	REPAIR the PTO RPM circuit or switch as

GO to **FB6**.	necessary. CLEAR the DTCs. REPEAT the self-test.

FB6 CHECK THE PTOIL PID STATE IN THE PCM

- Access the PCM and monitor the PTOIL PID.
- Cycle the PTO switch,
- **Does the PTOIL PID change state?**

Yes	No
GO to **FB7**.	VERIFY no DTCs are present. VERIFY the vehicle conditions in step FB2 are correct for PTO operation.

FB7 PTO INDICATOR LAMP ALWAYS OFF OR ON: CHECK THE PTOIL_F PID

- Access the PCM and monitor the PTOIL_F PID.
- **Is a concern present?**

Yes	No
REPAIR the circuit as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to the aftermarket PTO mechanical manual.

PINPOINT TEST FD: BRAKE PEDAL INPUTS

This pinpoint test is intended to diagnose the following:

- brake pedal position (BPP) (13480)
- brake pedal switch (BPS) (9F924), (9C872)
- harness circuits: B+, BPP, BPS
- powertrain control module (PCM) (12A650)

Refer to the Wiring Diagrams article for specific vehicle application and pin locations.

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Town Car	170 Pin	B9	BPS
E-Series, F-Super Duty	170 Pin	E65 B8	BPS BPP
Escape/Mariner	150 (50-50-50) Pin	B8	BPP

Expedition, Fusion, Milan, MKZ, Navigator	140 Pin	B47 B46	BPS BPP
Explorer, Explorer Sport Trac, Mountaineer, Mustang	170 Pin	B9 B8	BPS BPP
Focus	190 Pin	B46 B13	BPS BPP
Ranger	170 Pin	B8	BPP
All other vehicles	190 Pin	B47 B46	BPS BPP

FD1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P0504, P0572, P0573, P0703, P1572, or P1703 present?**

Yes	No
For KOEO or continuous memory DTCs P0504, P0572, P0573, P0703, P1703 and continuous memory DTC P1572, GO to **FD3**. For KOER DTCs P0703, or P1703, GO to **FD2**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

FD2 KOER DTCS P0703 AND P1703: VERIFY THE BRAKE PEDAL WAS APPLIED

- **Was the brake pedal applied and released during the KOER self-test?**

Yes	No
GO to **FD3**.	REPEAT the KOER self-test. APPLY and RELEASE the brake pedal during the KOER test. CLEAR the DTCs. REPEAT the self-test.

FD3 DTCS P0572, P0573, P0703, P1572 AND P1703: CHECK THE OPERATION OF THE STOPLAMP

- Key ON, engine OFF.
- Apply and release the brake pedal and check the stop lamp operation.
- **Do the stoplamp operate correctly?**

Yes	No
For Crown Victoria, Grand Marquis, Sable, Taurus,	REFER to the **EXTERIOR LIGHTING -- E-SERIES** to diagnose the inoperative stoplamp.

Taurus X, and Town Car, GO to **FD4**. For all others, GO to **FD5**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

FD4 CHECK THE BRAKE SWITCH OPERATION

- Key ON, engine OFF.
- Access the PCM and monitor the BPP_BOO PID.
- Apply and release the brake pedal while monitoring the brake position PID.
- **Does the PID cycle ON and OFF?**

Yes	No
GO to **FD6**.	REFER to the **MODULE COMMUNICATIONS NETWORK -- E-SERIES** to diagnose the powertrain control module (PCM) not responding to the scan tool. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

FD5 CHECK FOR BPP CIRCUIT CYCLING

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Apply and release the brake pedal while monitoring the voltage.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
BPP	Ground

- **Is voltage less than 1 volt with the brake pedal released and greater than 10 volts with the brake pedal fully applied?**

Yes	No
For Ranger, GO to **FD7**. For all others, GO to **FD6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

FD6 CHECK FOR BPS CIRCUIT CYCLING

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.

- Apply and release the brake pedal while monitoring the voltage.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
BPS	Ground

- **Is voltage greater than 10 volts with the brake pedal released and less than 1 volt with the brake pedal fully applied?**

Yes	No
GO to **FD7**.	REFER to the **SPEED CONTROL -- E-SERIES** . CARRY OUT the diagnostic steps for DTC P1703 to continue diagnose.

FD7 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST FF: POWER STEERING PRESSURE (PSP) SWITCH

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- power steering pressure (PSP) Switch (3N824)
- harness circuits: PSPSW and SIGRTN

- powertrain control module (PCM) (12A650)

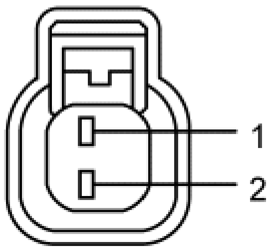

Fig. 94: Positive Crankcase Ventilation Thermal Extension -Harness Side (PCVTE-Harness Side)
Courtesy of FORD MOTOR CO.

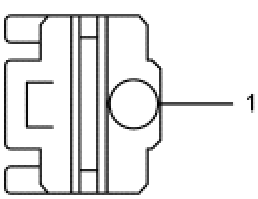

Fig. 95: Power Steering Pressure (PSP) Switch Connector - B
Courtesy of FORD MOTOR CO.

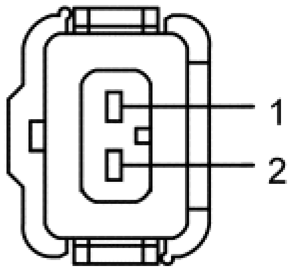

Fig. 96: Power Steering Pressure (PSP) Switch Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Fusion 3.0L, Grand Marquis, Milan 3.0L, Town Car	A	2 1	SIGRTN PSPSW
Edge, Fusion 2.3L, Milan 2.3L, MKX, MKZ	B	1	PSPSW
Ranger	C	2 1	SIGRTN PSPSW
All other vehicles	C	1 2	SIGRTN PSPSW

The PSP and SIGRTN circuits may be reversed in the harness connector. Refer to the Wiring Diagrams article for schematic and connector information.

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, MKX	190 Pin	B17	PSPSW
Explorer, Explorer Sport Trac, Mountaineer	170 Pin	B41 B27	SIGRTN PSPSW

Fusion 3.0L, Milan 3.0L	140 Pin	E58 E65	SIGRTN PSPSW
Fusion 2.3L, Milan 2.3L, MKZ	140 Pin	E65	PSPSW
Ranger	170 Pin	B41 B34	SIGRTN PSPSW
Sable, Taurus, Taurus X	190 Pin	E41 B17	SIGRTN PSPSW
All other vehicles	170 Pin	E58 B34	SIGRTN PSPSW

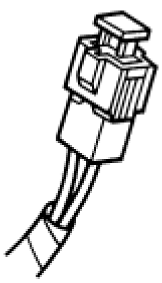

Fig. 97: Shorting Bar For Harness Circuit Without PSP Switch (Typical)
Courtesy of FORD MOTOR CO.

FF1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P1650 or P1651 present?**

Yes	No
For KOEO DTC P1650, GO to **FF3**. For KOER DTC P1650, GO to **FF2**. For continuous memory DTC P1651, GO to **FF7**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

FF2 KOER DTC P1650: CARRY OUT TURNING THE STEERING WHEEL ONE HALF TURN

- **Did you turn the steering wheel at least one half turn within 20 seconds of starting the KOER self-test?**

Yes	No
GO to **FF3**.	CARRY OUT the KOER self-test.

FF3 DTC P1650: CHECK THE PSP PID

- Key ON, engine running.

- Access the PCM and monitor the PSP PID.
- Turn the steering wheel back and forth.
- **Does the PID state change?**

Yes	No
GO to **FF7**.	GO to **FF4**.

FF4 CHECK THE PSP CIRCUITS TO THE PSP SWITCH FOR CYCLING

- Key in OFF position.
- PSP Switch connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the PSP PID.
- For Fusion/Milan 2.3L, Edge/MKX or MKZ,
- Connect a 5 amp fused jumper wire between the following:

Point A PSP Switch Connector, Harness Side	Point B
PSPSW	Ground

- For all others,
- Connect a 5 amp fused jumper wire between the following:

Point A PSP Switch Connector, Harness Side	Point B PSP Switch Connector, Harness Side
PSPSW	SIGRTN

- Remove the jumper wire(s).
- **Does the PID state change?**

Yes	No
INSTALL a new PSP switch. CLEAR the DTCs. REPEAT the self-test.	GO to **FF5**.

FF5 CHECK THE PSP AND SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PSP Switch Connector, Harness Side
PSPSW	PSPSW
SIGRTN	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **FF6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

FF6 CHECK THE PSP CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- Measure the resistance between:

(+) PSP Switch Connector, Harness Side	(-)
PSPSW	Ground

- Measure the resistance between:

(+) PSP Switch Connector, Harness Side	(-) PSP Switch Connector, Harness Side
PSPSW	SIGRTN

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **FF8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

FF7 DTC P1651: CHECK THE PSP CIRCUIT(S) FOR INTERMITTENT CONCERNS

NOTE: **Be aware that P1651 could be set if the vehicle is towed with the engine running, or if a power steering hydraulic concern is present.**

- Key ON, engine OFF.

- Access the PCM and monitor the PSP PID.
- Check for open circuits while carrying out the following (a concern is indicated by a sudden change in the PCM-PSP PID):
  - Shake, wiggle, and bend the PSP and SIGRTN circuit(s).
  - Lightly tap on the PSP to simulate road shock
- PSP Switch connector disconnected.
- Check the PSP circuit for a short to ground. Shake, wiggle and bend the PSP circuits.
- **Is a concern present?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	CONNECT the PSP switch. Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

FF8 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST H: FUEL CONTROL

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

WARNING: **While conducting tests on a hot engine take all safety precautions to prevent skin contact with hot engine components. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- HO2S/O2S (9F472)
- HO2S/O2S (9G444)
- fuel injector(s) (9F593)
- harness circuits: HO2S, HO2S Heater, VPWR, and SIGRTN
- vacuum systems
- powertrain control module (PCM) (12A650)

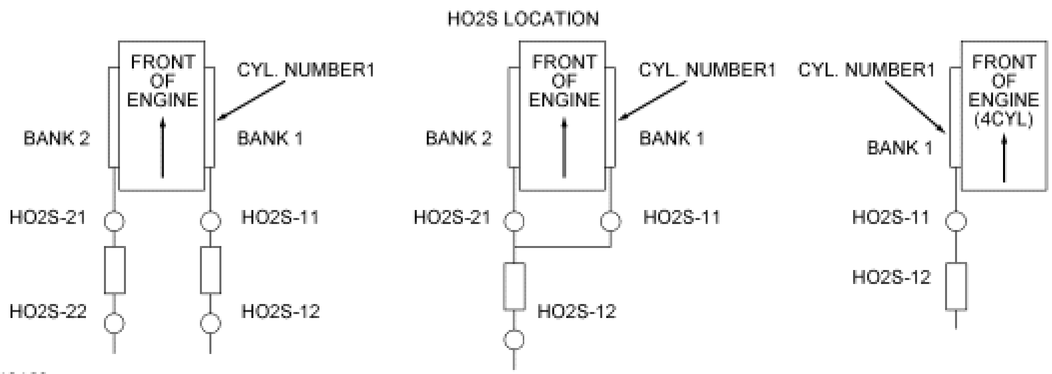

Fig. 98: Identifying HO2S Location (1 Of 2)
Courtesy of FORD MOTOR CO.

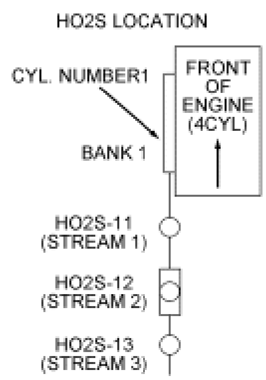

Fig. 99: Identifying HO2S Location (2 Of 2)
Courtesy of FORD MOTOR CO.

The pin numbering for the connector is in reference to the connector lock tab. Not all connector key combinations are shown.

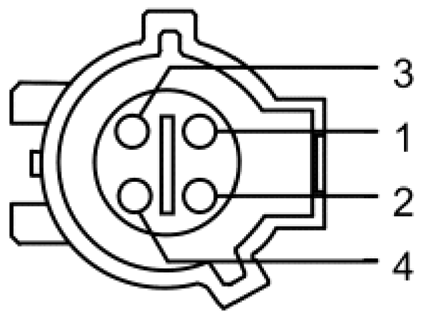

Fig. 100: Heated Oxygen Sensor-Front (HO2S-Front) Connector - A
Courtesy of FORD MOTOR CO.

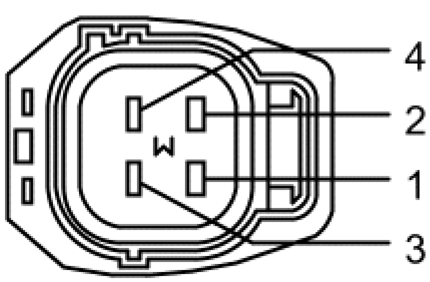

Fig. 101: Heated Oxygen Sensor-Front (HO2S-Front) Connector - B
Courtesy of FORD MOTOR CO.

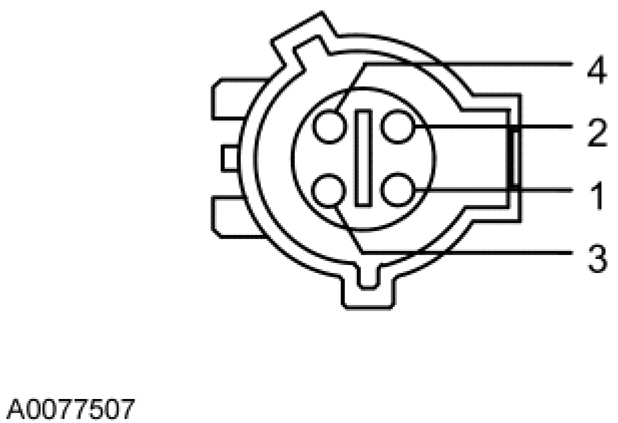

Fig. 102: Heated Oxygen Sensor-Front (HO2S-Front) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria, F-150, Grand Marquis, Mark LT, Mustang, Ranger, Town Car	A	2 4 3 1	VPWR SIGRTN HO2S Signal HO2S Heater
Focus	B	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater
All other vehicles	C	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater

The pin numbering for the connector is in reference to the connector lock tab. Not all connector key combinations are shown.

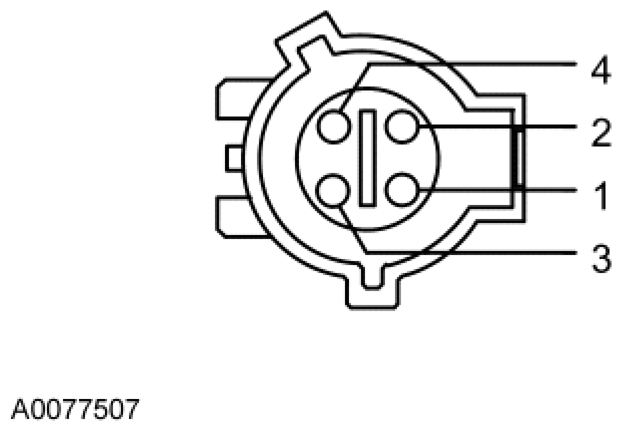

Fig. 103: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - A
Courtesy of FORD MOTOR CO.

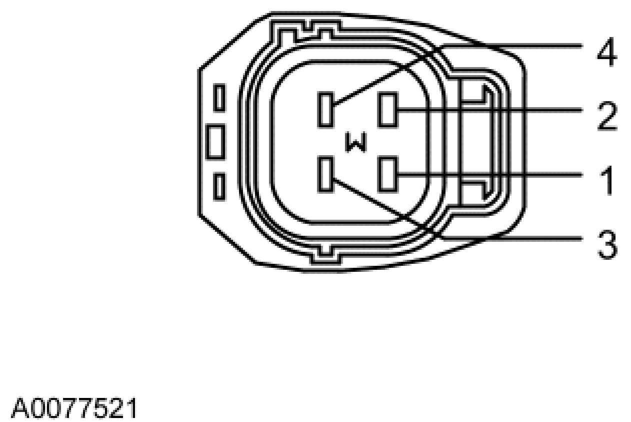

Fig. 104: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - B
Courtesy of FORD MOTOR CO.

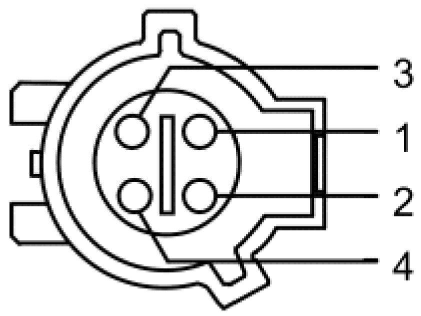

Fig. 105: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner, F-150, Mark LT	A	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater
Focus	B	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater
All other vehicles	C	2 4 3 1	VPWR SIGRTN HO2S Signal HO2S Heater

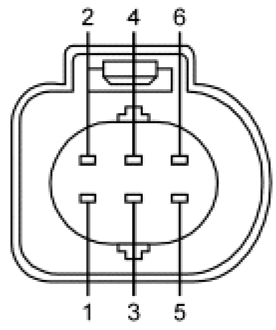

Fig. 106: Universal Oxygen Sensor
Courtesy of FORD MOTOR CO.

Pin	Circuit

1	UO2SPC (Universal Oxygen Sensor Pumping Current)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series 6.8L, E-Series 5.4L Cutaway or stripped chassis	170 Pin	T48 E70 B38 T47 E69 T25 E29 B14 T24 E28 B35 B41, E58, T41	HTR22 HTR21 HTR13 HTR12 HTR11 HO2S22 HO2S21 HO2S13 HO2S12 HO2S11 VPWR SIGRTN
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	E2 E70 E1 E69 E24 E28 E23 E29 B51 B58, E58	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 VPWR SIGRTN
Escape/Mariner 3.0L	150 (50-50-50) Pin	T48 E48 T47 E49 T25 E26 T24 E30 B35 B41, E41, T41	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 VPWR SIGRTN
Escape/Mariner 2.3L	150 (50-50-50) Pin	T47 E49 T24 E30 B35 B41, E41, T41	HTR12 HTR11 HO2S12 HO2S11 VPWR SIGRTN
Expedition, Navigator	140 Pin	B11 E70 B10	HTR22 HTR21 HTR12

		E69 B40 E28 B39 E29 B51 B58, E58	HTR11 HO2S22 HO2S21 HO2S12 HO2S11 VPWR SIGRTN
F-150, Mark LT	190 Pin	T12 E70 T1 E69 T21 E28 T22 E29 B51 B58, E58, T43	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 VPWR SIGRTN
F-Super Duty 6.8L Narrow frame	170 Pin	E70 B38 E69 E29 B14 E28 B35 B41, E58, T41	HTR21 HTR13 HTR11 HO2S21 HO2S13 HO2S11 VPWR SIGRTN
Focus 2.0L PZEV	190 Pin	T25 T18 E52 T7 T16 E11 B67 B58, E64, T40	HTR13 HTR12 HTR11 HO2S13 HO2S12 HO2S11 VPWR SIGRTN
Focus 2.0L	190 Pin	T18 E52 T16 E11 B67 B58, E64, T40	HTR12 HTR11 HO2S12 HO2S11 VPWR SIGRTN
Fusion 3.0L, Milan 3.0L, MKZ	140 Pin	E24 E70 E23 E69 E4 E29 E3 E28	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11

		B51 B58, E58	VPWR SIGRTN
Fusion 2.3L, Milan 2.3L	140 Pin	E23 E69 E3 E28 B51 B58, E58	HTR12 HTR11 HO2S12 HO2S11 VPWR SIGRTN
Fusion 2.3L PZEV, Milan 2.3L PZEV	140 Pin	E25 E23 E69 E5 E3 E28 B51 B58, E58	HTR13 HTR12 HTR11 HO2S13 HO2S12 HO2S11 VPWR SIGRTN
Ranger 2.3L	170 Pin	T47 E69 T24 E28 B35 B41, E58, T41	HTR12 HTR11 HO2S12 HO2S11 VPWR SIGRTN
Sable PZEV, Taurus PZEV, Taurus X PZEV	190 Pin	E6 E4 B51 B58, E58	UO2SPC21 UO2SPC11 VPWR SIGRTN
All other vehicles	170 Pin	T48 E70 T47 E69 T25 E29 T24 E28 B35 B41, E58, T41	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 VPWR SIGRTN

H1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0171, P0172, P0174, P0175, P2195, P2196, P2197, P2198, P2270, P2271, P2272, P2273, P2274, or P2275 present?**

Yes	No
For DTCs P2270, P2271, P2272, P2273, P2274 or P2275, GO to **H32**. For DTCs P0171, P0174, P2195 or P2197, GO to	For all others, GO to**DIAGNOSTIC TROUBLE

H2. For DTCs P0172, P0175, P2196 or P2198, GO to **H7**.	**CODE (DTC) CHARTS AND DESCRIPTIONS** .

H2 DTCS P0171, P0174, P2195 OR P2197: LEAN SYSTEM DTCS

NOTE: Do not clear the DTCs or reset the keep alive memory (KAM).

- Access the PCM and record the engine coolant temperature (ECT) PID from the freeze frame data. The freeze frame data is used to recreate the concern.
- Retrieve and record the self-test DTCs.
- **Are any DTCs present other than the following: P0171, P0174, P2195 or P2197?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **H3**.

H3 CARRY OUT A VISUAL INSPECTION ON THE INTAKE AIR SYSTEM AND ALL VACUUM HOSES

- Key in OFF position.
- Check the intake air system for leaks, obstructions, and damage.
- Inspect the entire length of all the vacuum hoses for:
  - proper connections
  - damage or cracks
  - damaged or cracked vacuum tees
- Verify the integrity of the positive crankcase ventilation (PCV) system.
- Verify the proper PCV valve part number.
- **Is a concern present?**

Yes	No
GO to **H6**.	GO to **H4**.

H4 CHECK FOR THE PRESENCE OF A VACUUM LEAK

NOTE: Fuel trim values at idle are more sensitive to a vacuum leak. The vacuum leak (unmetered air) represents a larger portion of the total air flow at idle than at part throttle.

NOTE: The barometric pressure (BARO) PID is not a recommended PID to monitor when diagnosing a vacuum leak. Barometric pressure is calculated during high

engine load, when the vacuum leak represents a small portion of the total air flow.

NOTE: **When calculating the total fuel correction in the following steps, if LONGFT1 equals +13% and SHRTFT1 equals +23%, the total fuel correction for bank 1 equals +36%. If LONGFT2 equals +24% and SHRTFT2 equals -3% the total fuel correction for bank 2 equals +21%.**

NOTE: **If the freeze frame ECT PID is available, stabilize the engine at the temperature recorded by the freeze frame ECT PID. If the freeze frame ECT PID is not available, maintain the engine coolant temperature between 82°C - 101°C (180°F - 215°F) and the intake air temperature less than 46°C (115°F).**

- Key ON, engine running.
- Access the PCM and monitor the ECT, CHT and IAT PIDs.
- Access the PCM and monitor the LONGFT1, SHRTFT1, LONGFT2 and SHRTFT2 PIDs.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Mathematically add and record the LONGFT PID value to the SHRTFT PID value for each bank, for a total fuel correction at idle.
- Increase the engine speed to 3,500 RPM for 10 seconds. For vehicles with electronic throttle control (ETC), increase the engine speed to the maximum RPM without activating RPM limiting.

  Record the LONGFT1, SHRTFT1, LONGFT2, and SHRTFT2 PID values.
- Mathematically add and record the LONGFT PID value to the SHRTFT PID value for each bank, for a total fuel correction at 3,500 RPM or the maximum allowable RPM for vehicles with ETC.
- **Is the total fuel correction value difference, between idle and 3,500 RPM or the maximum allowable RPM for vehicles with ETC, less than 15 percent?**

Yes	No
No vacuum leak is present. For DTCs P0171 or P0174, GO to **H16**. For Sable, Taurus, and Taurus X PZEVs with DTCs P2195 or P2197, GO to **H15**. For all other vehicles with DTCs P2195 or P2197, GO to **H9**.	GO to **H5**.

H5 LOCATE THE VACUUM LEAK

NOTE: **Do not clamp or pinch a hard plastic hose. Use a vacuum cap or equivalent to restrict the hose.**

NOTE: **Restricting the EVAP vapor hose while the EVAP emission canister is purging**

may shift the SHRTFT. Carry out a visual inspection as necessary.

NOTE: **When monitoring for a decrease in the SHRTFT PIDs in the following steps, if SHRTFT1 equals +15% and the hose is restricted, SHRTFT1 decreases to -7%. The total decrease in the SHRTFT PIDs equals 22%.**

- Locate the vacuum tees for the intake air and PCV systems.
- Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs.
- Restrict the vacuum lines one at a time for 30 seconds. If a vacuum leak is present, the SHRTFT PID values decrease as the hose is restricted.
- **Is the decrease in the SHRTFT PIDs greater than 15 percent when one of the vacuum hoses is restricted?**

Yes	No
GO to **H6**.	INSPECT the intake air system for a vacuum leak in the intake manifold or intake gaskets. REPAIR as necessary. For repair verification, GO to **H6**.

H6 VACUUM LEAK REPAIR VERIFICATION

NOTE: **If the freeze frame ECT PID is available, stabilize the engine at the temperature recorded by the freeze frame ECT PID. If the freeze frame ECT PID is not available, maintain the engine coolant temperature between 82°C - 101°C (180°F - 215°F) and the intake air temperature less than 46°C (115°F).**

- Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Record the SHRTFT1 and SHRTFT2 PID values.
- Key in OFF position.
- Repair the vacuum leak.
- Key ON, engine running.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs.
- Compare the recorded SHRTFT PID values, prior to the vacuum leak repair, to the current SHRTFT PID values.
- **Is the decrease in the SHRTFT PIDs greater than 15 percent?**

Yes	No
RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	A vacuum leak is still present. GO to **H5**.

REPEAT the self-test.	

H7 DTCS P0172, P0175, P2196 OR P2198: RICH SYSTEM DTCS

NOTE: Do not clear the DTCs or reset the keep alive memory (KAM).

- Access the PCM and record the freeze frame data.
- Retrieve and record the self-test DTCs.
- **Are any DTCs present other than the following: P0172, P0175, P2196 or P2198?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **H8**.

H8 INSPECT THE ENTIRE INTAKE AIR SYSTEM FOR DEBRIS, BLOCKAGE OR OTHER DAMAGE

- Check the intake air system for obstructions, restrictions, and damage.
- Check the throttle plate for obstructions or sludge.
- Check the air filter element and housing for blockage.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	For DTCs P0172 or P0175, GO to **H16**. For Sable, Taurus, and Taurus X PZEVs with DTCs P2196 or P2198, GO to **H15**. For all other vehicles with DTCs P2196 or P2198, GO to **H13**.

H9 CHECK THE HO2S AND SIGRTN CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Disconnect the HO2S related to the current DTC.
- PCM connector disconnected.
- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **H10**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

H10 CHECK THE HO2S CIRCUIT FOR A SHORT TO SIGRTN IN THE HARNESS

- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal	SIGRTN

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **H11**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

H11 CHECK THE HO2S CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-)
HO2S Signal	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **H12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

H12 HO2S CIRCUIT TEST (WITH LEAN DTCS)

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side

HO2S Signal	VPWR

- Key ON, engine OFF.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage greater than 1.3 V?**

Yes	No
GO to **H16**.	GO to **H42**.

H13 HO2S CIRCUIT TEST (WITH RICH DTCS)

- Disconnect the HO2S related to the current DTC.
- Key ON, engine OFF.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage less than 0.2 V?**

Yes	No
GO to **H16**.	GO to **H14**.

H14 CHECK THE HO2S CIRCUIT FOR A SHORT TO THE VPWR OR HEATER IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	HO2S Heater
HO2S Signal	VPWR

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **H42**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

H15 CHECK THE UO2SPC CIRCUIT FOR AN OPEN IN THE HARNESS

NOTE: Only the suspect UO2S needs to be diagnosed.

- Key in OFF position.

- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2SPC - Pin 1	UO2SPC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **H16**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

H16 CHECK THE FUEL PRESSURE

WARNING: **When checking the fuel system remember that the fuel system may still be pressurized when the engine is switched off. Always follow the instructions related to fuel system pressure relief. All fuel handling safety precautions must be observed. Failure to follow these instructions may result in personal injury.**

NOTE: **For vehicle specific fuel pressure ranges, refer to the Fuel System Specification Chart in pinpoint test HC.**

- Remove the jumper wire(s).
- HO2S connector connected.
- Relieve the fuel pressure. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure.
- Mechanical fuel pressure gauge connected.
- Pressurize the fuel system. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Key ON, engine running.
- Allow the fuel pressure to stabilize.
- Key in OFF position.
- Key ON, engine running.
- Access the PCM and control the FP PID.
- Run the fuel pump to obtain maximum fuel pressure.
- **Is the fuel pressure within range for the vehicle being diagnosed?**

Yes	No
GO to **H17**.	refer to **PINPOINT TEST HC**.

H17 CHECK THE FUEL SYSTEM FOR PRESSURE STABILITY - FAST LEAKDOWN

NOTE: When the fuel pump is commanded off, the fuel pressure may substantially decrease and then stabilize.

NOTE: During output state control, the fuel pump stays commanded on for only about 5 seconds.

- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and control the FP PID.
- Run the fuel pump to obtain maximum fuel pressure.
- Command the fuel pump off.
- Allow the fuel pressure to stabilize.
- Record the stabilized reading.
- Monitor the fuel pressure for 10 seconds.
- **Does the fuel pressure remain within 34 kPa (5 psi) of the recorded reading after 10 seconds?**

Yes	No
GO to **H19**.	GO to **H18**.

H18 CHECK FOR AN EXTERNAL FUEL LEAK

- Inspect the fuel tank, lines, and filler pipe for a fuel leak.
- **Is a concern present?**

Yes	No
REPAIR as necessary. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. CLEAR the DTCs. REPEAT the self-test.	GO to **H26**.

H19 CHECK THE FUEL SYSTEM FOR PRESSURE STABILITY - SLOW LEAKDOWN

- Continue to monitor the fuel pressure for 1 minute.
- **Does the fuel pressure remain within 34 kPa (5 psi) of the recorded reading (MRFS) or greater than 275 kPa (40 psi) (ERFS) after 1 minute?**

Yes	No
GO to **H20**.	GO to **HC13**.

H20 CHECK THE SEPARATION LEVEL OF THE ETHANOL/WATER MIXTURE AND GASOLINE IN THE FUEL

NOTE: **This step requires the use of a locally obtained 200 ml beaker and a 25 ml graduated cylinder.**

NOTE: **After approximately 3 minutes of standing, the ethanol and water mixes together and settles to the bottom of the 25 ml graduated cylinder. The gasoline rises to the top.**

- Fill the 200 ml beaker with 5 ml of clean water.
- Use the pressure relief valve on the mechanical fuel gauge to drain 22 ml of fuel into an approved clean container.
- Pour 20 ml of fuel from the approved clean container into the 25 ml graduated cylinder.
- Add enough water from the 200 ml beaker to the 25 ml graduated cylinder to bring the total volume of liquid to 24 ml.
- Insert a stopper plug in the opening of the 25 ml graduated cylinder.
- Firmly hold the stopper in place and shake the 25 ml graduated cylinder to mix the water and fuel.
- Allow the liquid to stand and separate for approximately 3 minutes.
- Record the separation level from the 25 ml graduated cylinder where the ethanol/water mixture and gasoline meet.
- **Did the ethanol/water mixture and gasoline separate?**

Yes	No
GO to **H21**.	COMPLETE all steps before continuing. The ethanol/water mixture will separate from the gasoline. If the fuel does not appear to separate, then the fuel is either 100% ethanol or a mixture of ethanol and water.

H21 CALCULATE THE PERCENTAGE OF ETHANOL IN THE FUEL

NOTE: **Use the illustration as an example for calculating the percentage of ethanol in the following steps. If the separation level is at 14 ml the calculation becomes; 14 minus 4, then multiply by 5 to equal 50. The percentage of ethanol in the fuel is 50%.**

- Key in OFF position.
- Take the recorded separation level from the previous step and subtract the amount of water added.
- Multiply the new value by 5. This new value is the percentage of ethanol in the fuel.

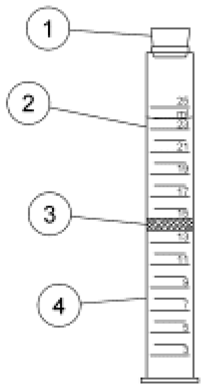

Fig. 107: Calculating Ethanol In Fuel
Courtesy of FORD MOTOR CO.

Item Number	Description
1	Stopper
2	Gasoline
3	Separation Point at 14 ml
4	Ethanol/Water Mixture

- Record the calculated percentage of ethanol in the fuel.
- **Is any ethanol present in the fuel?**

Yes	No
For flex fuel vehicles, GO to **H22**. For all others, GO to **H25**.	GO to **H26**.

H22 COMPARE THE FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

NOTE: When determining if the FF_INF PID value is within 50% of the calculated percentage of ethanol, if the calculated percentage of ethanol value is 40% then the PID value should be between 0 - 90%. The PID value cannot be less than zero.

- Key ON, engine OFF.
- Access the PCM and monitor the FF_INF PID.
- Compare the FF_INF PID to the calculated percentage of ethanol.
- **Is the FF_INF PID value within 50% of the calculated percentage of ethanol?**

Yes	No
GO to **H26**.	GO to **H23**.

H23 RESET THE PERCENT ETHANOL PARAMETER IN THE PCM

NOTE: **Certain customer fueling practices such as only fueling with small amounts of fuel or repeatedly switching between gasoline and an ethanol blend greater than E15 may prevent the PCM from learning the correct ethanol content in the fuel.**

- Reset the keep alive memory (KAM). Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .
- Key ON, engine running.
- Access the PCM and monitor the FF_LRND PID.
- Drive the vehicle approximately 11.3 km (7 miles) or until the FF_LRND PID indicates yes.
- **Is the PID state YES?**

Yes	No
GO to **H24**.	GO to **H42**.

H24 COMPARE THE UPDATED FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and monitor the FF_INF PID.
- **Is the FF_INF PID value within 50% of the calculated percentage of ethanol?**

Yes	No
RETURN the vehicle to the customer. ADVISE the customer of the correct fueling practices when using flex fuel. REFER to the Owner's Literature for additional information. ADVISE the customer to continue to use the same fuel for the next 2-3 refuels. This practice helps to verify the PCM is learning the correct percentage of ethanol in the fuel.	A fuel system concern may be present, which prevents the PCM from learning the correct percentage of ethanol in the fuel, GO to **HC13**.

H25 DETERMINE IF THE PERCENTAGE OF ETHANOL IN THE FUEL IS LESS THAN 25%

- Check the recorded calculated percentage of ethanol in the fuel.
- **Is the calculated percentage of ethanol in the fuel less than 25%?**

Yes	No
GO to **H26**.	REPAIR as necessary. ADVISE the customer of the correct fuel type required for this vehicle. REFER to the Owner's Literature for additional information. CLEAR the DTCs. REPEAT the self-test.

H26 FLOW TEST

- Key in OFF position.
- PCM connector connected.
- Flow test the injector using the fuel injector tester.
- **Is the flow rate for each injector within specification?**

Yes	No
For DTCs P0171, P0172, P0174 or P0175, GO to **DC28**. For DTCs P2195 or P2197, GO to **H27**. For DTCs P2196 or P2198, GO to **H28**.	INSTALL a new fuel injector. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

H27 CHECK THE HO2S OUTPUT VOLTAGE

- HO2S connector disconnected.
- Visually inspect the HO2S circuit for exposed wiring, contamination, corrosion and correct assembly. Repair as necessary.
- Measure the voltage between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Signal	SIGRTN

- Increase the engine speed to 2,000 RPM for 3 minutes.
- Carry out the KOER self-test.
- Monitor the signal voltage during the self-test.
- **Is the voltage greater than 0.5 volt at any time during the self-test?**

Yes	No
GO to **H30**.	INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

H28 ATTEMPT TO RETRIEVE DTC P2195 OR P2197

- HO2S connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B Vehicle Battery
HO2S Signal	Negative terminal

- Carry out the KOER self-test.
- **Are DTCs P2195 or P2197 present?**

Yes	No
GO to **H29**.	GO to **H42**.

H29 HO2S VOLTAGE CHECK

- Key in OFF position.
- Remove the jumper wire(s).
- HO2S connector disconnected.
- Key ON, engine running.
- Increase the engine speed to 2,000 RPM for 30 seconds.
- Measure the voltage between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Signal	SIGRTN

- Carry out the KOER self-test.
- Monitor the signal voltage during the self-test.
- **Is the voltage less than 0.4 volt at any time during the self-test?**

Yes	No
GO to **H30**.	INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

H30 CARRY OUT A THOROUGH WIGGLE TEST ON THE HO2S HARNESS

- Key in OFF position.
- HO2S connector connected.
- Key ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the HO2S Signal PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **While monitoring the HO2S PID, does the HO2S stop switching?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **H31**.

H31 TEST DRIVE THE VEHICLE WHILE MONITORING THE HO2S PID FOR SWITCHING

- Access the PCM and monitor the HO2S Signal PID.
- Access the PCM and monitor the FUELSYS PID.
- Start the engine and let idle until the vehicle goes into the closed loop fuel condition.
- Drive the vehicle in a manner consistent with the freeze frame data in an attempt to simulate the original concern.
- **Does the HO2S PID switch?**

Yes	No
GO to **DC28**.	INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

H32 DTCS P2270, P2272, P2271, P2273, P2274 OR P2275: HO2S LACK OF SWITCHES STUCK LEAN OR RICH

NOTE: Address all continuous memory ignition and misfire DTCs before any KOER HO2S DTCs.

- Key in OFF position.
- Visually inspect for:
  - pinched, shorted, and corroded wiring and pins
  - oil or water contamination
  - crossed sensor wires

- contaminated or damaged sensor
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	For KOER DTCs P2270, P2271, P2272, P2273, P2274 or P2275, GO to **H34**. For continuous memory DTCs P2270, P2271, P2272, P2273, P2274 or P2275, GO to **H33**.

H33 CHECK FOR KOER DTCS

- Key ON, engine OFF.
- Clear the DTCs.
- Key ON, engine running.
- Run the engine at approximately 2,000 RPM. Maintain the engine speed for 3 minutes.
- Retrieve the continuous memory DTCs.
- **Are DTCs P2270, P2271, P2272, P2273, P2274 or P2275 present?**

Yes	No
GO to **H34**.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

H34 CHECK THE HO2S SIGNAL LEVEL TOO HIGH

NOTE: Fuel calculations can be affected by unmetered air leaks.

- Key in OFF position.
- Carefully inspect the following areas for potential air leaks:
  - hoses connecting to the mass air flow (MAF) sensor assembly
  - hoses connecting to the throttle body
  - intake manifold gasket leaks
  - PCV system
  - the vacuum lines are disconnected
  - improperly seated engine oil dipstick, tube or oil fill cap
  - exhaust leaks at flanges and gaskets
- With the vehicle in NEUTRAL, position it on a hoist. Refer to the **JACKING AND LIFTING -- E-SERIES** for the locations of the lifting points.
- Visually inspect for:
  - exhaust leaks at flanges and gaskets
  - HO2S not tightened to specification

- physical exhaust system concerns
- aftermarket exhaust
- punctures or cracks in the catalyst

- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **H35**.

H35 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE HO2S HARNESS

- PCM connector disconnected.
- Disconnect the HO2S harness connector.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
HO2S Signal	Negative terminal

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	SIGRTN
HO2S Signal	VPWR
HO2S Signal	HO2S Heater

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **H36**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

H36 CHECK THE HO2S CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side

HO2S Heater	HO2S Heater
VPWR	VPWR
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **H37**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

H37 CHECK THE HO2S CIRCUIT VOLTAGE

- PCM connector connected.
- HO2S connector connected.
- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage greater than 1.5 V?**

Yes	No
For partial zero emission vehicle (PZEV), GO to **H40**. For all others, GO to **H39**.	GO to **H38**.

H38 CHECK THE HO2S CIRCUIT VOLTAGE

- Key in OFF position.
- PCM connector connected.
- HO2S connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side
HO2S Signal	VPWR

- Key ON, engine OFF.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage greater than 1.5 V?**

Yes	No
INSTALL a new HO2S. REFER to the	

ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **H42**.

H39 CHECK FOR OVER VOLTAGE IN THE PCM

- Key in OFF position.
- HO2S connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HO2S Connector, Harness Side	(-) Vehicle Battery
SIGRTN	Negative terminal
HO2S Signal	Negative terminal

- **Are the voltages less than 1.5 V?**

Yes	No
INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **H42**.

H40 CHECK THE HO2S CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- HO2S connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal	VPWR

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **H41**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

H41 CHECK THE HO2S CIRCUIT VOLTAGE

- PCM connector connected.
- HO2S connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side
HO2S Signal	VPWR

- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage greater than 1.5 V?**

Yes	No
INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **H42**.

H42 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH**	

ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM) , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HC: FUEL DELIVERY SYSTEM

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

WARNING: **The fuel system remains under pressure after the engine is off. Relieve pressure before repairing. Highly flammable mixtures are present. To release pressure from the fuel system, carry out the following:**

- **Connect Rotunda fuel pressure gauge 134-R0087 or equivalent.**
- **Gradually open the testing kit valve to relieve the fuel pressure in the vehicle fuel system and drain the fuel into a suitable container or return it to the fuel tank.**
- **To avoid unnecessary fuel spillage and fire hazard, any time fuel lines are disconnected, the ignition switch must be in the OFF position unless fuel pump operation is required for test purposes.**

Failure to follow these instructions may result in personal injury.

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot**

vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

WARNING: Clean all fuel residue from the engine compartment. If not removed, fuel residue may ignite when the engine is returned to operation. Failure to follow this instruction may result in serious personal injury.

NOTE: Replacement fuel injectors may not be the same color as the original injectors in the vehicle. Verify the replacement injector is correct for the application by part number.

This pinpoint test is intended to diagnose the following:

- chassis components
- engine vacuum
- fuel pressure
- fuel supply line
- fuel supply
- fuel filter (9155)
- fuel injector(s) (9F593)
- fuel pump (9H307)

NOTE: With the engine running, the FRP PID value may be 48-70 kPa (7-10 psi) higher than a fuel pressure reading taken with a mechanical gauge.

FUEL SYSTEM SPECIFICATION CHART (KEY ON, ENGINE OFF VALUES)

Application	Fuel System Type	FRP PID Fuel Pressure (kPa)	FRP PID Fuel Pressure (psi)	External Pressure Gauge (kPa)	External Pressure Gauge (psi)
Crown Victoria/Grand Marquis/Town Car	ERFS (1)	240-485	35-70	240-485	35-70
Edge/MKX	MRFS (2)	-	-	331-485	48-70
Escape/Mariner	ERFS (1)	240-485	35-70	240-485	35-70
E-Series	ERFS (1)	240-485	35-70	240-485	35-70
Expedition/Navigator	MRFS (2)	-	-	331-485	48-70
Explorer/Explorer Sport Trac/Mountaineer	ERFS (1)	240-485	35-70	240-485	35-70
F-150, Mark LT	ERFS (1)	240-485	35-70	240-485	35-70
F-Super Duty	ERFS (1)	240-485	35-70	240-485	35-70
Taurus/Taurus X/Sable	MRFS (2)	-	-	331-485	48-70
Focus	MRFS (2)	-	-	331-485	48-70

Fusion/Milan/MKZ	MRFS (2)	-	-	331-485	48-70
Mustang	ERFS (1)	240-485	35-70	240-485	35-70
Ranger	MRFS (2)	-	-	331-485	48-70

Fuel System Type Definitions:

(1) Electronic Returnless Fuel System (ERFS):

This type of fuel delivery system does not return fuel to the fuel tank by means of a return line. This system does not incorporate a mechanical pressure regulator. Pressure is controlled by continuously varying the fuel pump speed through the fuel pump driver module (FPDM). All vehicles equipped with ERFS use a fuel rail pressure temperature (FRPT) sensor.

(2) Mechanical Returnless Fuel System (MRFS):

This type of fuel delivery system does not return fuel to the fuel tank by means of a return line. Fuel pressure is controlled by a mechanical pressure regulator located on the fuel pump module in the fuel tank. Vehicles equipped with MRFS do not use a fuel rail pressure temperature (FRPT) sensor.

WARNING: **If you see or smell gasoline at any time other than during fueling, do not reset the inertia fuel shutoff (IFS) switch. Failure to follow these instructions may result in personal injury.**

- Key in OFF position.
- Check for fuel leaks in the engine compartment.
- If no leak is present, reset the IFS switch by pushing the reset button on the top of the switch. Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch.
- In the closed position, the button can be pressed an additional 1.57 mm (1/16 in) against a spring.
- Key ON, engine OFF.
- Key in OFF position.
- Key ON, engine OFF.
- Key in OFF position.
- Check for leaking fuel.

HC1 DTC P0148 OR SYMPTOMS WITHOUT DTCS: CHECK THE SYSTEM INTEGRITY

- Visually inspect the complete fuel delivery system for damage and leakage.

  Check the following:

  - fuel lines and connections
  - relays
  - fuel tank

  - fuel pump
  - fuel pressure regulator
  - fuel pulse damper
  - fuel rail at injectors
  - damaged connector pins
  - electrical connectors not fully engaged
- Verify the vehicle has followed the maintenance schedule. A new fuel filter should have been installed within the last 48,280 km (30,000 miles).
- Verify the inertia fuel shutoff (IFS) switch is set (button pushed in). Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch.
- Verify the fuse integrity.
- Verify the battery is fully charged.
- Verify clean sufficient fuel.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HC2**.

HC2 CHECK ALL SYSTEM RELATED DEVICES (SENSOR, DAMPER OR REGULATOR) FOR LEAKAGE

- Key in OFF position.
- FP connector connected.
- Remove the vacuum hose on each system device connected to the fuel rail.
- Inspect for the presence of fuel in the vacuum line of each device connected to the fuel rail.
- Key ON, engine running.
- Check for manifold vacuum at each system related component with a vacuum line.
- Key in OFF position.
- **Are all vacuum lines for system related devices indicating no fuel present?**

Yes	No
GO to **HC3**.	If the vacuum line connected to a component indicates that a fuel leak is present, INSTALL a new component. CLEAR the DTCs. REPEAT the self-test.

HC3 CHECK THE FUEL PRESSURE

- Key in OFF position.
- Relieve the fuel pressure. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure.

- Mechanical fuel pressure gauge connected.
- Key ON, engine OFF.
- Pressurize the fuel system. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure to pressurize the fuel system.
- FP connector connected.
- Cycle the key several times to charge the fuel system.
- Compare the fuel pressure reading to the Fuel System Specification Chart.
- **Is the fuel pressure within range?**

Yes	No
GO to **HC6**.	GO to **HC4**.

HC4 CHECK THE FUEL PUMP GROUND CIRCUIT FOR AN OPEN IN THE HARNESS

NOTE: Refer to the Wiring Diagrams article for schematic and connector information.

- FP connector disconnected.
- Measure the voltage between:

(+) Vehicle Battery	(-) FP Connector, Harness Side
Positive terminal	FPGND

- **Is the voltage greater than 10 V?**

Yes	No
GO to **HC5**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HC5 CHECK THE FUEL PUMP POWER CIRCUIT FOR AN OPEN IN THE HARNESS

NOTE: During output state control, the fuel pump stays commanded on for only about 5 seconds.

- Verify the inertia fuel shutoff (IFS) switch is set (button pushed in). Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch.
- FP connector disconnected.
- Key ON, engine OFF.
- Access the PCM and control the FP PID.

- Be aware that output state control turns off the FP after a calibrated time. If this happens, command the outputs on again to continue testing.
- Measure the voltage between:

(+) FP Connector, Harness Side	(-) Vehicle Battery
FPPWR	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to **HC12**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HC6 CHECK THE SEPARATION LEVEL OF THE ETHANOL/WATER MIXTURE AND GASOLINE IN THE FUEL

NOTE: **This step requires the use of a locally obtained 200 ml beaker and a 25 ml graduated cylinder.**

NOTE: **After approximately 3 minutes of standing, the ethanol and water mixes together and settles to the bottom of the 25 ml graduated cylinder. The gasoline rises to the top.**

- Fill the 200 ml beaker with 5 ml of clean water.
- Use the pressure relief valve on the mechanical fuel gauge to drain 22 ml of fuel into an approved clean container.
- Pour 20 ml of fuel from the approved clean container into the 25 ml graduated cylinder.
- Add enough water from the 200 ml beaker to the 25 ml graduated cylinder to bring the total volume of liquid to 24 ml.
- Insert a stopper plug in the opening of the 25 ml graduated cylinder.
- Firmly hold the stopper in place and shake the 25 ml graduated cylinder to mix the water and fuel.
- Allow the liquid to stand and separate for approximately 3 minutes.
- Record the separation level from the 25 ml graduated cylinder where the ethanol/water mixture and gasoline meet.
- **Did the ethanol/water mixture and gasoline separate?**

Yes	No
	COMPLETE all steps before continuing. The ethanol/water mixture will separate from the

GO to **HC7**.	gasoline. If the fuel does not appear to separate, then the fuel is either 100% ethanol or a mixture of ethanol and water.

HC7 CALCULATE THE PERCENTAGE OF ETHANOL IN THE FUEL

NOTE: Use the illustration as an example for calculating the percentage of ethanol in the following steps. If the separation level is at 14 ml the calculation becomes; 14 minus 4, then multiply by 5 to equal 50. The percentage of ethanol in the fuel is 50%.

- Key in OFF position.
- Take the recorded separation level from the previous step and subtract the amount of water added.
- Multiply the new value by 5. This new value is the percentage of ethanol in the fuel.

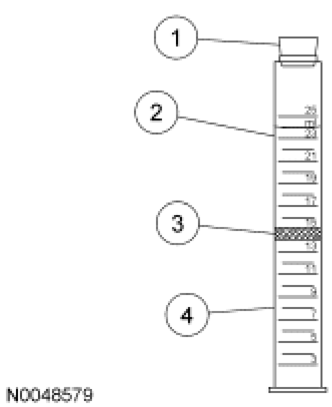

Fig. 108: Calculating Ethanol In Fuel
Courtesy of FORD MOTOR CO.

Item Number	Description
1	Stopper
2	Gasoline
3	Separation Point at 14 ml
4	Ethanol/Water Mixture

- Record the calculated percentage of ethanol in the fuel.
- **Is any ethanol present in the fuel?**

Yes	No
For flex fuel vehicles, GO to **HC8**. For all others, GO to **HC11**.	GO to **HC12**.

HC8 COMPARE THE FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

NOTE: **When determining if the FF_INF PID value is within 50% of the calculated percentage of ethanol, if the calculated percentage of ethanol value is 40% then the PID value should be between 0 - 90%. The PID value cannot be less than zero.**

- Key ON, engine OFF.
- Access the PCM and monitor the FF_INF PID.
- Compare the FF_INF PID to the calculated percentage of ethanol.
- **Is the FF_INF PID value within 50% of the calculated percentage of ethanol?**

Yes	No
GO to **HC12**.	GO to **HC9**.

HC9 RESET THE PERCENT ETHANOL PARAMETER IN THE PCM

NOTE: **Certain customer fueling practices such as only fueling with small amounts of fuel or repeatedly switching between gasoline and an ethanol blend greater than E15 may prevent the PCM from learning the correct ethanol content in the fuel.**

- Reset the keep alive memory (KAM). Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .
- Key ON, engine running.
- Access the PCM and monitor the FF_LRND PID.
- Drive the vehicle approximately 11.3 km (7 miles) or until the FF_LRND PID indicates yes.
- **Is the PID state YES?**

Yes	No
GO to **HC10**.	GO to **HC18**.

HC10 COMPARE THE UPDATED FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and monitor the FF_INF PID.
- **Is the FF_INF PID value within 50% of the calculated percentage of ethanol?**

Yes	No
RETURN the vehicle to the customer. ADVISE the customer of the correct fueling practices when using flex fuel. REFER to the Owner's Literature for	A fuel system concern may be present, which

additional information. ADVISE the customer to continue to use the same fuel for the next 2-3 refuels. This practice helps to verify the PCM is learning the correct percentage of ethanol in the fuel.	prevents the PCM from learning the correct percentage of ethanol in the fuel, GO to **HC12**.

HC11 DETERMINE IF THE PERCENTAGE OF ETHANOL IN THE FUEL IS LESS THAN 25%

- Check the recorded calculated percentage of ethanol in the fuel.
- **Is the calculated percentage of ethanol in the fuel less than 25%?**

Yes	No
GO to **HC12**.	REPAIR as necessary. ADVISE the customer of the correct fuel type required for this vehicle. REFER to the Owner's Literature for additional information. CLEAR the DTCs. REPEAT the self-test.

HC12 CHECK THE FUEL PRESSURE LEAKDOWN

NOTE: **When the fuel pump is commanded off, the fuel pressure may substantially decrease and then stabilize.**

NOTE: **During output state control, the fuel pump stays commanded on for only about 5 seconds.**

- Mechanical fuel pressure gauge connected.
- Key ON, engine OFF.
- Access the PCM and control the FP PID.
- Run the fuel pump to obtain maximum fuel pressure.
- Command the fuel pump off.
- Allow the fuel pressure to stabilize.
- Record the stabilized reading.
- Monitor the fuel pressure for 1 minute.
- **Does the fuel pressure remain within 34 kPa (5 psi) of the recorded reading (MRFS) or greater than 275 kPa (40 psi) (ERFS) after 1 minute?**

Yes	No
For ERFS, GO to **HC14**. For MRFS, GO to **HC15**.	GO to **HC13**.

HC13 CHECK THE FUEL INJECTOR FLOW AND LEAKAGE

NOTE: **Observe the Warnings, Cautions, and Notes.**

- Check the fuel injectors for leakage and flow rate using the injector flow tester or other method such as inspecting the intake manifold for fuel.
- **Are the test results satisfactory?**

Yes	No
For ERFS, GO to **HC14**. For MRFS, GO to **HC15**.	INSTALL a new fuel injector as necessary. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

HC14 COMPARE THE FRP PID TO THE MECHANICAL GAUGE

NOTE: Most mechanical gauges are referenced to atmospheric pressure. The FRPT sensor is referenced to manifold pressure. In order to make a valid comparison, the engine must be off.

NOTE: The vehicle may exhibit a long crank until the fuel system is pressurized.

- Key in OFF position.
- Relieve the fuel pressure. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure.
- Disable the fuel pump.
- Key ON, engine OFF.
- Monitor the mechanical gauge.
- Access the PCM and monitor the FRP PID.
- Compare the FRP PID value to the mechanical gauge.
- Key in OFF position.
- Pressurize the fuel system. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Key ON, engine running.
- Allow the fuel pressure to stabilize.
- Key in OFF position.
- Key ON, engine OFF.
- Compare the FRP PID value to the mechanical gauge.
- **Are the FRP PID values within 34 kPa (5 psi) of the mechanical gauge readings?**

Yes	No
GO to **HC15**.	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of this pinpoint test. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HC15 MONITOR THE FUEL PRESSURE WHILE ROAD TESTING THE VEHICLE

WARNING: **Strict observance of posted speed limits and attention to driving conditions are mandatory when carrying out the road test. Failure to follow these instructions may result in personal injury.**

NOTE: Some concerns may only be present during certain fuel level conditions. Determine the fuel level at the time of the concern. Access the information from the customer information worksheet and the customer.

- Key in OFF position.
- Securely route the mechanical gauge so that the gauge is viewable while road testing the vehicle.
- Key ON, engine running.
- Engine at normal operating temperature.
- Monitor the mechanical gauge.
- From a stop, accelerate to 89 km/h (55 mph) at full throttle. Repeat this 3 times.
- **Is the fuel pressure always greater than 240 kPa (35 psi)?**

Yes	No
For misfire DTC diagnosis, GO to **HD8**. For symptoms without DTCs, the concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** for further direction. For all others, unable to duplicate or identify the concern at this time.	GO to **HC16**.

HC16 CHECK THE FUEL SUPPLY LINE FOR RESTRICTION

NOTE: Observe the Warnings, Cautions, and Notes.

- Key in OFF position.
- Disconnect the fuel supply line at the fuel rail.
- Disconnect the fuel supply line at the fuel pump.
- Check the fuel supply line for restriction.

- Apply 21 to 34 kPa (3 to 5 psi) air pressure to the fuel supply line.
- **Does air flow freely through the line?**

Yes	No
INSTALL a new Fuel Filter assembly. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . GO to **HC17**.	REPAIR the cause of the restriction. CLEAR the DTCs. REPEAT the self-test.

HC17 VERIFY THE REPAIR

WARNING: **Strict observance of posted speed limits and attention to driving conditions are mandatory when carrying out the road test. Failure to follow these instructions may result in personal injury.**

- Key ON, engine running.
- Engine at normal operating temperature.
- Monitor the mechanical gauge.
- From a stop, accelerate to 89 km/h (55 mph) at full throttle. Repeat this 3 times.
- **Is the fuel pressure always greater than 240 kPa (35 psi)?**

Yes	No
The test is complete and no concerns are present.	INSTALL a new FP module. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HC18 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HD: MISFIRE DETECTION MONITOR

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

NOTE: Mechanical noise caused by the front end accessory drive components, mechanically driven cooling fans, or rough roads at high RPM with light load conditions may produce a nonsymmetrical loss of cylinder acceleration, which may result in a misfire.

This pinpoint test is intended to diagnose the misfire detection monitor.

Clearing the powertrain control module (PCM) diagnostic trouble codes (DTCs) erases any PCM recorded freeze frame data. Make sure to record any PCM freeze frame information before proceeding. Refer to**FREEZE FRAME DATA** .

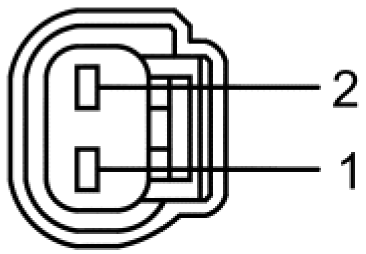

Fig. 109: Camshaft Position (CMP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

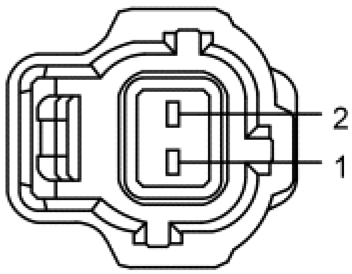

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Fig. 110: Camshaft Position (CMP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

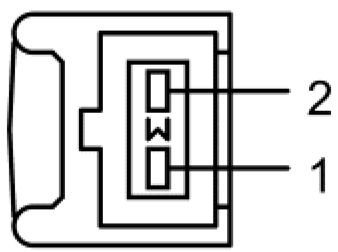

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Fig. 111: Camshaft Position (CMP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

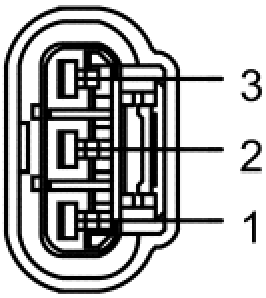

Fig. 112: Camshaft Position (CMP) Sensor Connector - D
Courtesy of FORD MOTOR CO.

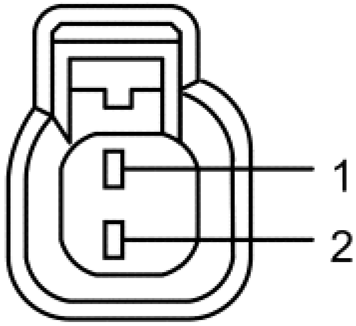

Fig. 113: Camshaft Position (CMP) Sensor Connector - E
Courtesy of FORD MOTOR CO.

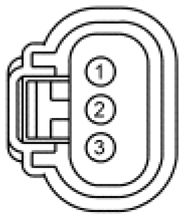

Fig. 114: Camshaft Position (CMP) Sensor Connector - F
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Expedition, F-150 4.6L, F-150 5.4L, Mark LT, MKX, MKZ, Navigator, Sable, Taurus, Taurus X	A	2	CMP
Escape/Mariner 2.3L, Ranger 2.3L	B	1 2	SIGRTN CMP
Explorer 4.0L, Explorer Sport Trac 4.0L, Mountaineer 4.0L, Mustang 4.0L, Ranger 4.0L	C	2 1	SIGRTN CMP
Fusion 2.3L, Milan 2.3L	D	3 2	SIGRTN CMP
Fusion 3.0L, Milan 3.0L	E	1	CMP
F-150 4.2L	D	2 3 1	CMP PWRGND VPWR
Focus	F	3 2	SIGRTN CMP

All other vehicles	A	1 2	SIGRTN CMP

HD1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, P0310, P0315, or P0316 present?**

Yes	No
For DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, P0310 or P0316, GO to **HD2**. For DTC P0315, GO to **HD21**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HD2 DTCS P0300 THROUGH P0310 AND P0316: VIEW THE PCM MISFIRE FREEZE FRAME DATA

NOTE: The misfire freeze frame data may be used to determine the operating conditions when the misfire DTC was set.

- Retrieve and record any available misfire freeze frame data PID values from the PCM.
- Compare recorded freeze frame data PID values to the typical reference values in the **REFERENCE VALUES** article.
- **Are any values out of range?**

Yes	No
REFER to the table in Pinpoint Test Z to find corresponding circuit, and proceed with the intermittent diagnosis. refer to **PINPOINT TEST Z**.	GO to **HD3**.

HD3 CHECK FOR OTHER NON-MISFIRE CONTINUOUS MEMORY DTCS

- Retrieve all continuous memory DTCs.
- **Are there any non-misfire continuous memory DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **HD4**.

HD4 CHECK FOR ANY KOEO SELF-TEST DTCS

- Carry out the KOEO self-test.

- **Are any KOEO DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **HD5**.

HD5 CHECK FOR ANY KOER DTCS

- Carry out the KOER self-test.
- **Are any KOER DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **HD6**.

HD6 CHECK THE IGNITION SYSTEM FOR CONCERNS

- For ignition coil on plug (COP) equipped vehicles, refer to **PINPOINT TEST JB** and follow the pinpoint test direction.
- For ignition coil pack equipped vehicles, refer to **PINPOINT TEST JC** and follow the pinpoint test direction.
- **Is an ignition related concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HD7**.

HD7 CHECK THE FUEL SYSTEM FOR CONCERNS

- refer to **PINPOINT TEST HC** and follow the pinpoint test direction.
- **Is a fuel system related concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HD8**.

HD8 CHECK THE VACUUM SYSTEM

NOTE: Some vacuum leaks can be heard.

- Visually inspect the vacuum hoses for signs of damage or deterioration. A collapsed vacuum hose may cause a blockage to one of the various actuators or sensors. If a blockage is found remove the blockage or install new parts as necessary.
- **Is the vehicle vacuum system OK?**

Yes	No
For vehicles equipped with a differential pressure feedback EGR system, GO to **HD9**. For vehicles equipped with an electric EGR (EEGR) system, GO to **HD10**. For vehicles equipped with an EGR system module (ESM) EGR system, GO to **HD11**. For all others, GO to **HD15**.	REPAIR the vacuum system. CLEAR the DTCs. REPEAT the self-test.

HD9 MONITOR THE DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM RELATED PIDS

- Key ON, engine running.
- Bring the engine to normal operating temperature.
- Access the PCM and monitor the DPFEGR PID.
- Access the PCM and monitor the EGRVR PID.
- Record the PID values with the engine idling.
- Key ON, engine OFF.
- Record the PID values with the engine off.
- Compare the recorded PID values to the typical reference values in the **REFERENCE VALUES** article.
- **Are any values out of range?**

Yes	No
refer to **PINPOINT TEST HE** and diagnose the EGR system.	GO to **HD12**.

HD10 MONITOR THE EEGR SYSTEM RELATED PIDS

- Key ON, engine running.
- Bring the engine to normal operating temperature.
- Access the PCM and monitor the EGRMC1F, EGRMC2F, EGRMC3F and EGRMC4F PIDs.
- Access the PCM and monitor the MAP PID.
- Record the PID values with the engine idling.
- Key ON, engine OFF.
- Record the PID values with the engine off.
- Compare the recorded PID values to the typical reference values in the **REFERENCE VALUES** article.
- **Are any values out of range?**

Yes	No
refer to **PINPOINT TEST KD** and diagnose the EGR system.	GO to **HD13**.

HD11 MONITOR THE ESM SYSTEM RELATED PIDS

- Key ON, engine running.
- Bring the engine to normal operating temperature.
- Access the PCM and monitor the DPFEGR PID.
- Access the PCM and monitor the EGRVR PID.
- Access the PCM and monitor the MAP PID.
- Record the PID values with the engine idling.
- Key ON, engine OFF.
- Record the PID values with the engine off.
- Compare the recorded PID values to the typical reference values in the **REFERENCE VALUES** article.
- **Are any values out of range?**

Yes	No
refer to **PINPOINT TEST HH** and diagnose the EGR system.	GO to **HD14**.

HD12 RECREATE THE MISFIRE SYMPTOM WITH THE DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM DISABLED

NOTE: The PCM may store EGR system related DTCs during this procedure.

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- Key in OFF position.
- EGR Vacuum Regulator Solenoid connector disconnected.
- Access the misfire freeze frame data (if available) and record the operating conditions.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Recreate the misfire symptom using the freeze frame and customer information.
- **Can the symptom be recreated?**

Yes	No
GO to **HD15**.	REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage. REFER to the **ENGINE**

	EMISSION CONTROL -- E-SERIES for more EGR system information. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HD13 RECREATE THE MISFIRE SYMPTOM WITH EEGR SYSTEM DISABLED

NOTE: The PCM may store EGR system related DTCs during this procedure.

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- Key in OFF position.
- EEGR Assembly connector disconnected.
- Access the misfire freeze frame data (if available) and record the operating conditions.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Recreate the misfire symptom using the freeze frame and customer information.
- **Can the symptom be recreated?**

Yes	No
GO to **HD15**.	REMOVE and INSPECT the EEGR for signs of contamination, unusual wear, carbon deposits, binding or other damage. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** for more EGR system information. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HD14 RECREATE THE MISFIRE SYMPTOM WITH THE ESM SYSTEM DISABLED

NOTE: The PCM may store EGR system related DTCs during this procedure.

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- Key in OFF position.
- ESM connector disconnected.
- Access the misfire freeze frame data (if available) and record the operating conditions.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Recreate the misfire symptom using the freeze frame and customer information.
- **Can the symptom be recreated?**

Yes	No
GO to **HD15**.	REMOVE and INSPECT the ESM for signs of contamination, unusual wear, carbon deposits, binding or other damage. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** for more EGR system information. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HD15 CHECK FOR BASE ENGINE CONCERNS

NOTE: The engine temperature may affect the results.

- This step determines if there are any base engine concerns that may have caused the misfire DTC or drive concern.
- Key in OFF position.
- Carry out the following tests in order to evaluate base engine integrity:
  - For vehicles equipped with mechanically driven cooling fans only, rotate the cooling fan by hand. The cooling fan should rotate freely, with no abnormal binding or interference. If binding or interference is present, remove any foreign materials or repair the cooling fan as necessary.
  - Refer to the **ACCESSORY DRIVE -- E-SERIES** and carry out checks in the Visual Inspection Chart.
  - Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** and carry out the Compression Test and Cylinder Leakage Detection.
  - Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** and carry out the Valve Train Analysis.
  - Visually inspect the positive crankcase ventilation (PCV) valve and tube for leaks.
  - Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** and carry out Component Tests.
- **Is a concern present?**

Yes	No
REPAIR as necessary. REFER to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HD19**.

HD16 DTC P1336: IDENTIFY THE CMP SENSOR TYPE

NOTE: The variable reluctance (VR) sensors have 2-wire connectors, Hall-effect sensors have 3-wire connectors.

- Identify which type of CMP sensor the vehicle uses.
- **Does the vehicle use a Hall-effect sensor?**

Yes	No
GO to **HD17**.	GO to **HD18**.

HD17 CHECK THE CMP SENSOR LOW RANGE OUTPUT VOLTAGE

- Key in OFF position.
- CMP Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A CMP Sensor Connector, Harness Side	Point B CMP Sensor Connector, Component Side
VPWR	VPWR
PWRGND	PWRGND

- Key ON, engine running.
- Digital multimeter (DMM) on low voltage DC scale.
- Measure the voltage between:

(+) CMP Sensor Connector, Component Side	(-) 12 Volt Vehicle Battery
CMP	Negative terminal

- **Does the voltage switch between LOW (less than 2 volts DC) and HIGH (greater than 8 volts DC)?**

Yes	No
A Hall-effect CMP sensor that is installed out of synchronization may produce a DTC. To verify the correct CMP sensor installation, REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** , Engine Synchronizer. If the CMP sensor is installed properly, GO to **HD19**.	INSTALL a new CMP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HD18 CHECK THE CMP SENSOR OUTPUT VOLTAGE

- Key in OFF position.
- PCM connector connected.
- CMP Sensor connector disconnected.
- DMM on low voltage AC scale.

- Key ON, engine running.
- Measure the voltage between:

(+) CMP Sensor Connector, Component Side	(-) CMP Sensor Connector, Component Side
CMP	SIGRTN

- Run the engine at approximately 2,500 RPM.
- **Is the voltage greater than 0.25 V?**

Yes	No
GO to **HD19**.	INSTALL a new CMP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HD19 CHECK THE GENERATOR FOR EXCESSIVE ELECTRICAL NOISE

NOTE: If the generator/regulator is electrically noisy, the noise decreases when the B+ connector is disconnected.

- Key ON, engine running.
- Monitor the generator for an audible electric noise.
- Key in OFF position.
- Generator/regulator B+ connector disconnected.
- Key ON, engine running.
- With the engine running, determine if the generator is still noisy.
- **Does the noise remain constant when the B+ connector is disconnected?**

Yes	No
GO to **HD20**.	REFER to the **GENERATOR AND REGULATOR -- E-SERIES** and diagnose the generator is noisy symptom.

HD20 CHECK THE CKP HARNESS FOR INTERMITTENT CONCERNS

NOTE: Chafed CKP wires or other physical damage to the harness may cause an intermittent short in the CKP circuit.

- Key in OFF position.

- Visually check for chafed CKP wires or other physical damage to the CKP harness.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HD21**.

HD21 DTC P0315: CHECK THE PHYSICAL CONDITION OF THE CRANKSHAFT PULSE WHEEL

NOTE: DTC P0315 is set when the PCM is unable to learn and correct for the mechanical variations in the crankshaft pulse wheel tooth spacing (the allowable correction tolerances are exceeded).

- Inspect the crankshaft pulse wheel for damaged teeth.
- Inspect the crankshaft pulse wheel for wobble.
- Check for a loose crankshaft pulse wheel.
- Check the CKP sensor for damage.
- **Are the CKP sensor and crankshaft pulse wheel OK?**

Yes	No
If the CKP is installed properly, GO to **HD22**.	REPAIR as necessary. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** and check for correct CKP sensor installation. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . COMPLETE the Misfire and Fuel Monitors drive cycle procedure to learn the profile. Refer to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . To verify the repair RECREATE the original conditions that set the misfire DTC or caused the symptom using the freeze frame data and customer information. MONITOR the cylinder misfire data in Mode 6 - On Board Test Results and VERIFY the misfire count is below 10. REFER to the scan tool manufacturer's article for specific information on the Mode 6 - On Board Test Results.

HD22 CHECK THE DAMPER AND PULLEY ASSEMBLY

NOTE: For engines that have damper mounted pulse rings, it may be necessary to remove the front cover or other components to observe the crank pulley.

- Observe the crank pulley for wobble.

- Examine the electronic ignition (EI) pulse ring fastened to the harmonic dampener.
- **Does the crank pulley wobble or is the pulse ring loose or damaged?**

Yes	No
INSTALL a new pulley or damper assembly. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . COMPLETE the Misfire and Fuel Monitors drive cycle procedure to learn the profile. Refer to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . To verify the repair RECREATE the original conditions that set the misfire DTC or caused the symptom using the freeze frame data and customer information. MONITOR the cylinder misfire data in Mode 6 - On Board Test Results and VERIFY the misfire count is below 10. REFER to the scan tool manufacturer's article for specific information on the Mode 6 - On Board Test Results.	GO to **HD23**.

HD23 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
    - pushed out pins
    - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HE: EXHAUST GAS RECIRCULATION (EGR) SYSTEMS

This pinpoint test is intended to diagnose the following:

- differential pressure feedback exhaust gas recirculation (EGR) sensor (9J460)

- EGR valve (9D460) (9D475)
- EGR vacuum regulator solenoid (9J459)
- orifice tube assembly (9D477)
- differential pressure feedback EGR sensor pressure hoses
- vacuum lines
- harness circuits: VREF, DPFE, SIGRTN, EVR, VPWR, VREF and PWRGND
- powertrain control module (PCM) (12A650)

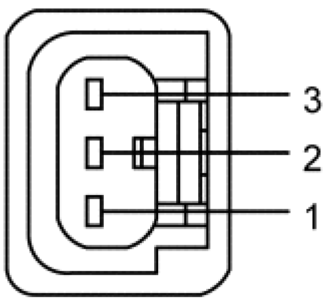

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Fig. 115: Differential Pressure Feedback EGR Sensor Connector - A
Courtesy of FORD MOTOR CO.

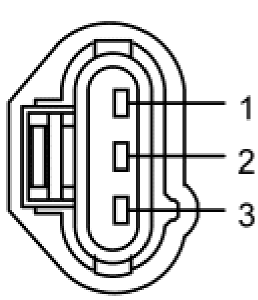

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Fig. 116: Differential Pressure Feedback EGR Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Vehicles equipped with a tube mounted differential pressure feedback EGR sensor	A	3 2 1	DPFE SIGRTN VREF
All other vehicles	B	1 2 3	DPFE SIGRTN VREF

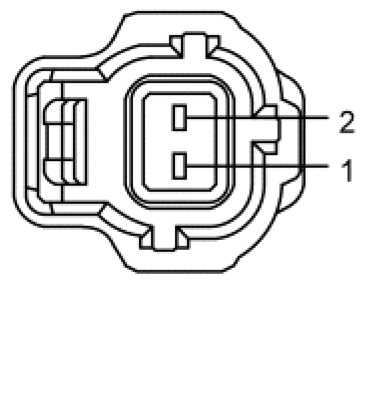

Fig. 117: Camshaft Position (CMP) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	EVR (EGR Vacuum Regulator)
1	VPWR (Vehicle Power)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B47 E27 E40 E41 E44	PWRGND EVR VREF SIGRTN DPFE
Ranger	170 Pin	B47 E63 E57 E58 E21	PWRGND EVR VREF SIGRTN DPFE

HE1 CHECK FOR DTCS

- **Are DTCs P0401, P0402, P0403, P0405, P0406, P1405, P1406, P1408, or P1409 present?**

Yes	No
For DTCs P0401 and P1408, GO to **HE36**. For DTC P0402, GO to **HE13**. For KOEO and KOER DTCs P0403 and P1409, GO to **HE59**. For continuous memory DTCs P0403 and P1409, GO to **HE64**. For DTC P0405, GO to **HE2**. For DTC P0406, GO to **HE6**. For DTC P1405, GO to **HE27**. For DTC P1406, GO to **HE31**.	For symptoms without DTCs, GO to **HE57**. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HE2 DTC P0405: DETERMINE THE PRESENT DPFEGR PID VOLTAGE

NOTE: Depending on the application, verify a prior repair has not resulted in the differential pressure feedback EGR sensor being installed backwards or the vacuum hoses being installed on the opposite ports.

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage less than 0.05 V?**

Yes	No
GO to **HE3**.	An intermittent concern is suspected in the EGR system. GO to **HE12**.

HE3 CHECK THE VREF AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Differential Pressure Feedback EGR Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Differential Pressure Feedback EGR Sensor Connector, Harness Side	(-) Differential Pressure Feedback EGR Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to **HE4**.	refer to **PINPOINT TEST C**.

HE4 CHECK THE DPFE CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
DPFE	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
DPFE	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HE5**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE5 INDUCE THE OPPOSITE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR VOLTAGE

- PCM connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage between 4 - 5.5 V?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before	GO to **HE66**.

starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	

HE6 DTC P0406: DETERMINE THE PRESENT DPFEGR PID VOLTAGE

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage greater than 4 V?**

Yes	No
GO to **HE7**.	An intermittent concern is suspected in the EGR system. GO to **HE12**.

HE7 CHECK THE VREF VOLTAGE TO THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR

- Key in OFF position.
- Differential Pressure Feedback EGR Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Differential Pressure Feedback EGR Sensor Connector, Harness Side	(-) Differential Pressure Feedback EGR Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to **HE8**.	refer to **PINPOINT TEST C**.

HE8 CHECK THE DPFE AND SIGRTN CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Differential Pressure Feedback EGR Sensor Connector, Harness Side
DPFE	DPFE
SIGRTN	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **HE9**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HE9 CHECK THE DPFE CIRCUIT FOR A SHORT TO VREF

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	DPFE

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HE10**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE10 CHECK THE DPFE CIRCUIT FOR A SHORT TO VOLTAGE

- Key ON, engine OFF.
- Measure the voltage between:

(+) Differential Pressure Feedback EGR Sensor Connector, Harness Side	(-) Vehicle Battery
DPFE	Negative terminal

- **Is the voltage less than 0.2 V?**

Yes	No
GO to **HE11**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE11 CHECK THE DPFEGR PID

- Key in OFF position.
- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A Differential Pressure Feedback EGR Sensor Connector, Harness Side	Point B
DPFE	Ground

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the DPFEGR PID greater than 4.5 V with the jumper wire removed and is the DPFEGR PID less than 0.1 V with the jumper wire installed?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. CLEAR the DTCs. REPEAT the self-test.	GO to **HE66**.

HE12 CARRY OUT A THOROUGH WIGGLE TEST ON THE DIFFERENTIAL PRESSURE FEEDBACK EGR HARNESS

- Access the PCM and monitor the DPFEGR PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there any change in the voltage reading, or is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

HE13 DTCS P0402 AND P1405: CHECK FOR SIMULTANEOUS PRESENCE

- **Is DTC P0402 present with DTC P1405?**

Yes	No
GO to **HE28**.	GO to **HE14**.

HE14 DTC P0402: CHECK FOR EGR FLOW AT IDLE WITH THE EGR VACUUM HOSE DISCONNECTED

NOTE: **A pinched or plugged EGR vacuum hose can trap vacuum between the EGR vacuum regulator solenoid and EGR valve, not allowing the EGR valve to close.**

NOTE: **Disregard DTC P1408 if it is generated as a result of carrying out the KOER self-test with the EGR vacuum source hose disconnected.**

- Trace each vacuum hose from the EGR vacuum regulator solenoid and verify each hose is connected correctly.
- Verify the EGR vacuum hose is not pinched or plugged and is routed correctly.
- Disconnect and plug the vacuum hose connected to the EGR valve.
- Carry out the KOER self-test.
- **Does KOER DTC P0402 appear or are you unable to run the KOER self-test due to an engine stall or no start?**

Yes	No
INSPECT the pressure hoses for correct routing, pinching, icing or other blockage. If OK, REMOVE and INSPECT the EGR valve and tube for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. GO to **HE15**.	CONNECT the EGR valve vacuum hose. GO to **HE16**.

HE15 CARRY OUT THE KOER SELF-TEST

- Clear the DTCs.
- Carry out the KOER self-test.
- **Is DTC P0402 present?**

Yes	No
GO to **HE18**.	The test is complete and no concerns are found. CLEAR the DTCs. REPEAT the self-test.

HE16 CHECK FOR EGR FLOW AT IDLE WITH THE EGR VACUUM HOSE CONNECTED

- Key in OFF position.

- Connect the EGR valve vacuum hose.
- Carry out the KOER self-test.
- **Does KOER DTC P0402 appear or are you unable to run the KOER self-test due to an engine stall or no start?**

Yes	No
GO to **HE17**.	INSPECT the pressure hoses for pinching, icing or other blockage. REPAIR as necessary. GO to **HE23**.

HE17 CHECK THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR OUTPUT BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release vacuum.
  - The DPFEGR PID voltage must be between 0.2 and 1.3 volt with the key ON and no vacuum applied.
  - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	GO to **HE18**.

HE18 CHECK EGR FLOW AT IDLE WITH THE EGR VACUUM REGULATOR HARNESS CONNECTOR OFF

- Differential Pressure Feedback EGR Sensor connector connected.
- Disconnect the vacuum hose at the EGR valve and connect the hose to the vacuum gauge.
- Start the engine.
- EGR Vacuum Regulator Solenoid connector disconnected.
- Observe the vacuum gauge:
  - The EGR valve requires vacuum greater than 5.4 kPa (1.6 in-Hg) to begin to open.
  - If the vacuum reading remains greater than 5.4 kPa (1.6 in-Hg) after the EGR vacuum regulator solenoid is disconnected, a concern may be present in the EGR vacuum regulator solenoid.
- **Does the EGR vacuum remain greater than 5.4 kPa (1.6 in-Hg) at idle after the EGR vacuum regulator is disconnected?**

Yes	No
GO to **HE19**.	GO to **HE20**.

HE19 INSPECT THE EGR VACUUM REGULATOR SOLENOID VENT FOR BLOCKAGE

NOTE: **When the EGR valve is closed, the EGR vacuum regulator solenoid vacuum is vented through the solenoid vent to the atmosphere. A plugged EGR vacuum regulator solenoid vent does not allow EGR vacuum to vent to the atmosphere.**

- Key in OFF position.
- Remove the EGR vacuum regulator solenoid vent cap.
- Remove the filter and inspect for blockage or icing.
- **Is the EGR vacuum regulator solenoid vent or vent filter plugged or restricted?**

Yes	No
REPAIR the vent, or if not repairable, INSTALL a new EGR vacuum regulator solenoid. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE20 CHECK THE EGR VACUUM REGULATOR SOLENOID COIL RESISTANCE

- Key in OFF position.
- Measure the resistance between:

(+) EGR Vacuum Regulator Solenoid Connector, Component	(-) EGR Vacuum Regulator Solenoid Connector, Component

Side	Side
VPWR - Pin 1	EVR - Pin 2

- **Is the resistance between 26 - 40 ohms?**

Yes	No
GO to **HE21**.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE21 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
EVR	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HE22**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE22 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR SHORT TO VREF

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
EVR	VREF

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HE66**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE23 CHECK THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR OUTPUT BY APPLYING VACUUM

WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
    - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
    - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
    - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	GO to **HE24**.

HE24 CHECK THE EGR VALVE OPERATION

NOTE: **Typical sensor voltage with no EGR flow is between 0.25 volt and 1.3 volts.**

NOTE: **A higher voltage at idle may be due to a non-seating or heavily carbon EGR valve pintle.**

NOTE: **DPFEGR PID voltage must increase as the valve opens and decrease as the valve closes. A slow return voltage is an indication of a binding or slow closing EGR valve.**

- Differential Pressure Feedback EGR Sensor connector connected.
- Key ON, engine OFF.

- Access the PCM and monitor the DPFEGR PID.
- Disconnect the vacuum hose at the EGR valve and plug the hose.
- Connect the vacuum pump to the EGR valve.
- Start the engine.
- Observe the DPFEGR PID at idle and compare it to the KOEO voltage.
- Apply just enough vacuum to the EGR valve to open it without stalling the engine.
- Quickly release the vacuum.
- Repeat this 3 times.
- Observe the DPFEGR PID.
- **Does the DPFEGR PID voltage indicate an open, binding or slow closing EGR valve?**

Yes	No
REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HE25**.

HE25 CARRY OUT A THOROUGH WIGGLE TEST ON THE EGR VACUUM REGULATOR HARNESS

NOTE: **An intermittent short to GND in the EGR vacuum regulator circuit causes the vacuum applied to the EGR valve to be higher than normal when the short is present. The vacuum available at the EGR valve at idle is normally below 3.4 kPa (1.6 in-Hg) for the valve to begin to open.**

NOTE: **A concern is indicated by a sudden jump in the vacuum reading during the wiggle test.**

- Key in OFF position.
- Remove the vacuum pump.
- Connect the vacuum gauge to the EGR valve vacuum hose.
- Connect a vacuum gauge to the EGR valve vacuum hose using a vacuum tee.
- Key ON, engine running.
- Observe the vacuum gauge.
    - Lightly tap on the EGR vacuum regulator solenoid.
    - Carry out a thorough wiggle test on the EGR vacuum regulator harness.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	CONNECT the vacuum hose(s). GO to **HE26**.

HE26 INSPECT THE EGR VACUUM REGULATOR SOLENOID AND VACUUM HOSES FOR PLUGGING

- Key in OFF position.
- Remove the EGR vacuum regulator solenoid vent cap.
- Remove the filter and inspect for blockage or icing.
- Inspect the pressure hoses for pinching, icing or other blockage.
- **Is the EGR vacuum regulator solenoid vent or vent filter plugged or restricted?**

Yes	No
REPAIR, or if not repairable, INSTALL a new EGR vacuum regulator solenoid. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

HE27 DTC P1405: INSPECT THE UPSTREAM PRESSURE HOSE CONNECTIONS

- Inspect the upstream hose at the differential pressure feedback EGR sensor and orifice tube assembly for a disconnect or a poor connection.

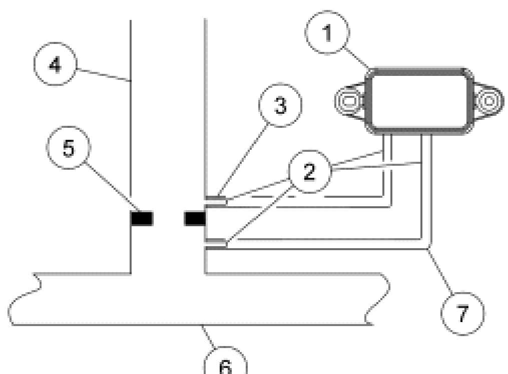

Fig. 118: Typical Differential Pressure Feedback EGR System
Courtesy of FORD MOTOR CO.

TYPICAL DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM

Item Number	Description
1	Differential Pressure Feedback EGR Sensor
2	Pickup Tubes
3	Upstream Pressure Hose
4	To EGR Valve
5	Orifice Tube

	Assembly
6	Exhaust Manifold
7	Downstream Pressure Hose

- **Is vacuum hose off or poorly connected?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HE28**.

HE28 INSPECT THE UPSTREAM PRESSURE HOSE FOR PLUGGING

NOTE: It is essential that only the correct Ford replacement pressure hose be used.

- Visually inspect the upstream pressure hose routing. The hose must not be pinched or have dips in it where water could settle or freeze.
- Remove the upstream pressure hose and carefully inspect for plugging, water, or leaks.
- **Is a concern present?**

Yes	No
REPAIR or INSTALL a new pressure hose as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HE29**.

HE29 CHECK THE ORIFICE TUBE ASSEMBLY AND THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR

- Inspect the upstream connection on the differential pressure feedback EGR sensor for damage or plugging at the sensor.
- Inspect the exhaust manifold side pressure tube at the orifice tube assembly for plugging or damage.
- **Is the differential pressure feedback EGR sensor or orifice tube assembly plugged or damaged?**

Yes	No
REPAIR or INSTALL a new Differential Pressure Feedback EGR sensor or orifice tube assembly as necessary. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402.	GO to **HE30**.

CLEAR the DTCs. REPEAT the self-test.	

HE30 CHECK THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR OUTPUT BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
    - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
    - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
    - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

HE31 DTC P1406: INSPECT THE DOWNSTREAM PRESSURE HOSE CONNECTIONS

NOTE: **If the concern is currently present, DTC P1408 appears when running the KOER self-test.**

- Verify the EGR valve is securely attached and exhaust gases are not leaking from the sealing surface.
- Inspect the downstream hose at the differential pressure feedback EGR sensor and orifice tube assembly for a disconnect or a poor connection.

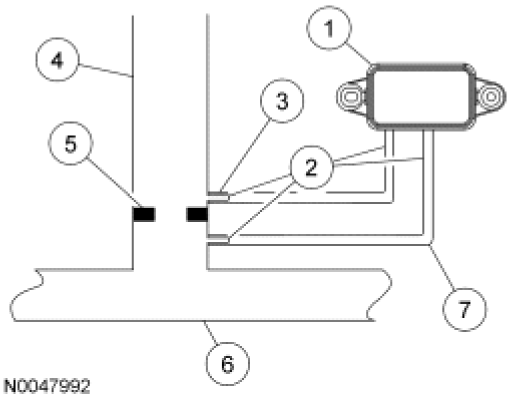

Fig. 119: Typical Differential Pressure Feedback EGR System
Courtesy of FORD MOTOR CO.

TYPICAL DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM

Item Number	Description
1	Differential Pressure Feedback EGR Sensor
2	Pickup Tubes
3	Upstream Pressure Hose
4	To EGR Valve
5	Orifice Tube Assembly
6	Exhaust Manifold
7	Downstream Pressure Hose

- **Is vacuum hose off or poorly connected?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HE32**.

HE32 INSPECT THE DOWNSTREAM PRESSURE HOSE FOR PLUGGING

NOTE: It is essential that only the correct Ford replacement pressure hose be used.

- Visually inspect the downstream pressure hose routing.
- Remove the upstream pressure hose and carefully inspect for plugging, water, or leaks.
- **Is a concern present?**

Yes	No

REPAIR or INSTALL a new pressure hose as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HE33**.

HE33 CHECK THE ORIFICE TUBE ASSEMBLY AND THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR

- Inspect the connections at the differential pressure feedback EGR sensor for plugging or damage.
- Inspect the intake manifold side pressure tube at the orifice tube assembly for plugging or damage.
- **Is the differential pressure feedback EGR sensor or orifice tube assembly plugged or damaged?**

Yes	No
REPAIR or INSTALL a new Differential Pressure Feedback EGR sensor or orifice tube assembly as necessary. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	GO to **HE34**.

HE34 CHECK THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR OUTPUT BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
    - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
    - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
    - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No

GO to **HE35**.	refer to **PINPOINT TEST Z**.

HE35 CHECK THE DPFE CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Differential Pressure Feedback EGR Sensor Connector, Harness Side
DPFE	DPFE
SIGRTN	SIGRTN
VREF	VREF

- **Are the resistances greater than 5 ohms?**

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.

HE36 DTC P0401: CARRY OUT THE KOER SELF-TEST

- Carry out the KOER self-test.
- **Does DTC P1408 appear?**

Yes	No
GO to **HE37**.	GO to **HE53**.

HE37 KOER AND CONTINUOUS MEMORY DTC P1408: RETRIEVE CONTINUOUS MEMORY DTCS

NOTE: **If any DTC other than P1406 appears, note the DTC and refer to DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS after carrying out this**

pinpoint test.

- Retrieve all continuous memory DTCs.
- **Is DTC 1406 present?**

Yes	No
GO to **HE31**.	GO to **HE38**.

HE38 INSPECT THE DIFFERENTIAL PRESSURE FEEDBACK EGR PRESSURE HOSES

- Inspect the pressure hoses for a reverse connection at the differential pressure feedback EGR sensor or at the orifice tube assembly.
- Inspect the hoses for incorrect routing.
- Inspect both hoses for leaks and blockage.
- Inspect the differential pressure feedback EGR sensor and orifice tube assembly for blockage or damage at the pick-up tubes.

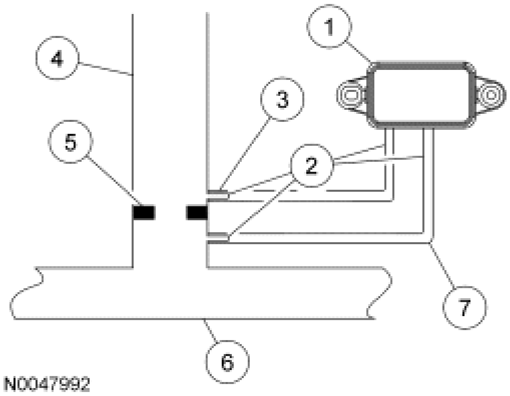

Fig. 120: Typical Differential Pressure Feedback EGR System
Courtesy of FORD MOTOR CO.

TYPICAL DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM

Item Number	Description
1	Differential Pressure Feedback EGR Sensor
2	Pickup Tubes
3	Upstream Pressure Hose
4	To EGR Valve
5	Orifice Tube Assembly
6	Exhaust Manifold
	Downstream Pressure

7	Hose

- **Is a concern present?**

Yes	No
REPAIR or INSTALL a new pressure hose as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HE39**.

HE39 CHECK THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR OUTPUT BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
  - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
  - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	CONNECT all the hoses. GO to **HE40**.

HE40 CHECK THE VREF VOLTAGE TO THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR

- Key in OFF position.
- Differential Pressure Feedback EGR Sensor connector disconnected.

- Key ON, engine OFF.
- Measure the voltage between:

(+) Differential Pressure Feedback EGR Sensor Connector, Harness Side	(-) Differential Pressure Feedback EGR Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to **HE41**.	refer to **PINPOINT TEST C**.

HE41 CHECK THE DPFE CIRCUIT FOR A SHORT TO VREF

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	DPFE

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HE42**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE42 CARRY OUT THE KOER SELF-TEST WHILE MONITORING THE EGR VACUUM

NOTE: **Since the EGR vacuum hose is disconnected, ignore the DTCs during this KOER self-test.**

- PCM connector connected.
- Differential Pressure Feedback EGR Sensor connector connected.
- Disconnect the vacuum hose at the EGR valve and connect the hose to the vacuum gauge.
- Carry out the KOER self-test.

- Monitor the vacuum gauge. Approximately 30 seconds into the test, EGR flow will be requested for a few seconds. Vacuum at this time should increase to greater than 5.4 kPa (1.6 in-Hg) to open the valve.
- **Does the vacuum increase to 10 kPa (3.0 in-Hg) or greater at any time during the KOER self-test?**

Yes	No
GO to **HE43**.	GO to **HE44**.

HE43 CHECK THE EGR VALVE FUNCTION BY APPLYING VACUUM WITH THE HAND PUMP

- Key in OFF position.
- Disconnect the vacuum hose at the EGR valve and plug the hose.
- Connect the vacuum pump to the EGR valve.
- Key ON, engine running.
- Access the PCM and monitor the RPM PID.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds. If the engine wants to stall, increase the engine speed to approximately 1,000 RPM and hold steady.
- Monitor for the following:
  - The EGR valve starts opening at about 5.4 kPa (1.6 in-Hg) vacuum, indicated by an increasing DPFEGR PID voltage.
  - The DPFEGR PID voltage increases until the valve is fully open. The DPFEGR PID voltage must read at least 2.5 volts with full vacuum applied.
  - The DPFEGR PID voltage remains steady with steady vacuum. If voltage drops within a few seconds, the EGR valve or vacuum source may be leaking.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate the EGR valve is operating as described in the test step?**

Yes	No
GO to **HE47**.	GO to **HE44**.

HE44 PHYSICALLY INSPECT ALL VACUUM LINES BETWEEN THE EGR VALVE, EGR VACUUM REGULATOR AND VACUUM SOURCE

- Key in OFF position.
- Inspect all vacuum lines for leaks, kinks, pinches, disconnects, blockage, misrouting or physical damage of any type.
- Inspect the EGR vacuum regulator for cracks or other physical damage.
- **Is a concern present?**

Yes	No

REPAIR as necessary. If the EGR vacuum regulator is damaged, INSTALL a new EGR vacuum regulator. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HE45**.

HE45 PHYSICALLY INSPECT THE EGR VALVE

- Remove and inspect the EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage.
- **Is a concern present?**

Yes	No
REPAIR as necessary. If repair is not possible, INSTALL a new EGR valve. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HE46**.

HE46 CHECK THE ENGINE VACUUM

- EGR vacuum regulator vacuum hoses disconnected.
- Connect a hand held vacuum gauge to the vacuum source.
- Key ON, engine running.
- Engine warm and at idle.
- Observe the vacuum gauge.
- **Is the vacuum gauge steadily reading at least 51 kPa (15 in-Hg)?**

Yes	No
GO to **HE47**.	ISOLATE the base engine concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HE47 CHECK THE VPWR VOLTAGE TO THE EGR VACUUM REGULATOR SOLENOID

- Key in OFF position.
- EGR Vacuum Regulator Solenoid connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) EGR	

Vacuum Regulator Solenoid Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 1	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to **HE48**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HE48 CHECK THE EGR VACUUM REGULATOR SOLENOID COIL RESISTANCE

- Key in OFF position.
- Measure the resistance between:

(+) EGR Vacuum Regulator Solenoid Connector, Component Side	(-) EGR Vacuum Regulator Solenoid Connector, Component Side
VPWR - Pin 1	EVR - Pin 2

- **Is the resistance between 26 - 40 ohms?**

Yes	No
GO to **HE49**.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE49 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector,	(-) Vehicle Battery

Harness Side	
EVR	Negative terminal

- **Is the voltage greater than 1 V?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **HE50**.

HE50 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) EGR Vacuum Regulator Solenoid Connector, Harness Side
EVR	EVR - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HE51**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HE51 INSPECT THE EGR SYSTEM FOR LEAKS, RESTRICTIONS AND POOR CONNECTIONS

- EGR Vacuum Regulator Solenoid connector connected.
- PCM connector connected.
- Visually inspect the EGR system for signs of intermittent failure.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HE52**.

HE52 CHECK THE EGR VACUUM REGULATOR SOLENOID VACUUM FLOW BY GROUNDING THE EVR CIRCUIT

NOTE: **If the EGR vacuum regulator does not react within 2 seconds, an EGR vacuum**

regulator concern may be present.

- Disconnect the vacuum hose at the EGR valve and connect the hose to the vacuum gauge.
- Key ON, engine running.
- Engine warm and at idle.
- Connect a 5 amp fused jumper wire between the following:

Point A EGR Vacuum Regulator Solenoid Connector, Harness Side	Point B Vehicle Battery
EVR - Pin 2	Negative terminal

- **Does the vacuum gauge indicate 13.5 kPa (4.0 in-Hg) or greater within 2 seconds?**

Yes	No
GO to **HE66**.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE53 INSPECT THE DIFFERENTIAL PRESSURE FEEDBACK EGR PRESSURE HOSES

- Visually inspect the upstream pressure hose routing.
- Visually inspect the downstream pressure hose routing.
- Inspect for a reversed connection at the differential pressure feedback EGR sensor or orifice tube assembly.
- The hose must not be pinched or have dips in it where water could settle or freeze.
- Inspect both hoses for leaks and blockage.
- Inspect the differential pressure feedback EGR sensor and orifice tube assembly for blockage or damage at the pick-up tubes.

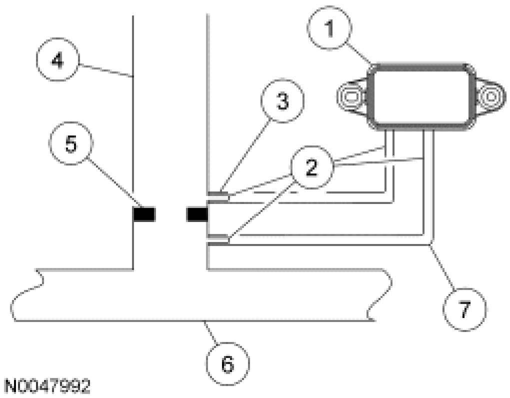

Fig. 121: Typical Differential Pressure Feedback EGR System
Courtesy of FORD MOTOR CO.

TYPICAL DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM

Item Number	Description
1	Differential Pressure Feedback EGR Sensor
2	Pickup Tubes
3	Upstream Pressure Hose
4	To EGR Valve
5	Orifice Tube Assembly
6	Exhaust Manifold
7	Downstream Pressure Hose

- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HE54**.

HE54 CHECK THE EGR VALVE FUNCTION BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.

- Quickly release the vacuum.
  - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
  - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	CONNECT all the hoses. GO to **HE55**.

HE55 CHECK THE EGR VALVE FUNCTION BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the vacuum hose at the EGR valve and plug the hose.
- Connect the vacuum pump to the EGR valve.
- Key ON, engine running.
- Access the PCM and monitor the RPM PID.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds. If the engine wants to stall, increase the engine speed to approximately 1,000 RPM and hold steady.
- Monitor for the following:
  - The EGR valve starts opening at about 5.4 kPa (1.6 in-Hg) vacuum, indicated by an increasing DPFEGR PID voltage.
  - The DPFEGR PID voltage increases until the valve is fully open. The DPFEGR PID voltage must read at least 2.5 volts with full vacuum applied.
  - The DPFEGR PID voltage remains steady with steady vacuum. If voltage drops within a few seconds, the EGR valve or vacuum source may be leaking.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate the EGR valve is operating as described in the test step?**

Yes	No
GO to **HE56**.	REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage. If OK, REMOVE and INSPECT the EGR valve and tube for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HE56 INSPECT THE EGR VACUUM SIGNAL SUPPLY FOR AN INTERMITTENT CONCERN

- Key in OFF position.
- Remove the vacuum hose from the EGR valve and connect to a vacuum gauge.
- Key ON, engine running.
- Connect a 5 amp fused jumper wire between the following:

Point A EGR Vacuum Regulator Solenoid Connector, Harness Side	Point B Vehicle Battery
EVR - Pin 2	Negative terminal

- The solenoid is full ON.
- Vacuum gauge should read above 13.5 kPa (4 in-Hg).
- Observe the vacuum gauge.
- Look for a concern while carrying out the following checks:
  - Lightly tap on the EGR vacuum regulator solenoid.
  - Carry out a thorough wiggle test on the EGR vacuum regulator harness.
  - Inspect the EGR vacuum signal supply for an intermittent concern.
  - Inspect the EGR vacuum regulator solenoid and vacuum hoses for plugging.
  - A concern is indicated by a sudden drop in the vacuum reading.
- **Is a concern indicated?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. Note: In cold climates, the EGR valve may temporarily freeze shut and thaw when the engine warms.

	refer to **PINPOINT TEST Z**.

HE57 EGR DIAGNOSIS BY SYMPTOM: CHECK FOR EGR FLOW WITH THE EGR VACUUM HOSE DISCONNECTED AND PLUGGED

- Carry out the KOER self-test. Repair any other DTCs.
- Possible causes for EGR flow at idle with no related DTCs:
  - EGR valve not fully seating
  - EGR vacuum regulator solenoid vent restricted
  - Damaged EGR vacuum regulator solenoid
- Disconnect and plug the vacuum hose connected to the EGR valve.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Note the voltage.
- Key ON, engine running.
- With the engine at idle, observe the DPFEGR PID voltage. Compare to engine OFF voltage.
- An increase in voltage at idle indicates the differential pressure feedback EGR sensor is sensing EGR flow.
- **Is the DPFEGR PID voltage greater at idle by 0.15 V than with the engine off?**

Yes	No
REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Inspect the EGR vacuum regulator solenoid and vacuum hoses for plugging. INSPECT the EGR vacuum regulator solenoid vent for blockage. GO to **HE58**.

HE58 DETERMINE THE EGR VALVE VACUUM SUPPLY

- **Is a concern present in the EGR valve vacuum supply?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE59 DTCS P0403 AND P1409: CHECK THE EGR VACUUM REGULATOR SOLENOID COIL RESISTANCE

- Key in OFF position.
- EGR Vacuum Regulator Solenoid connector disconnected.
- Measure the resistance between:

(+) EGR Vacuum Regulator Solenoid Connector, Component Side	(-) EGR Vacuum Regulator Solenoid Connector, Component Side
VPWR - Pin 1	EVR - Pin 2

- **Is the resistance between 26 - 40 ohms?**

Yes	No
GO to **HE60**.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE60 CHECK THE VPWR VOLTAGE TO EGR VACUUM REGULATOR SOLENOID

- Key ON, engine OFF.
- Measure the voltage between:

(+) EGR Vacuum Regulator Solenoid Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 1	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to **HE61**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HE61 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

	(-) EGR

(+) PCM Connector, Harness Side	Vacuum Regulator Solenoid Connector, Harness Side
EVR	EVR - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HE62**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HE62 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
EVR	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to **HE63**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE63 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
EVR	PWRGND

- **Is the resistance greater than 10K ohms?**

Yes	No
	REPAIR the short circuit. CLEAR the DTCs.

GO to **HE66**.	REPEAT the self-test.

HE64 CHECK FOR THE PRESENCE OF KOER DTCS P0403 OR P1409

- Carry out the KOER self-test.
- **Are DTCs P0403 or P1409 present?**

Yes	No
GO to **HE59**.	GO to **HE65**.

HE65 CARRY OUT A THOROUGH WIGGLE TEST ON THE EGR VACUUM REGULATOR HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
EVR	PWRGND

- Lightly tap on the EGR vacuum regulator solenoid. Wiggle the EGR vacuum regulator solenoid connector. Carry out a thorough wiggle test on the harness. A concern is indicated by a voltage drop during the wiggle test.
- **Is the voltage greater than 10 V?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

HE66 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No

INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HF: CATALYST EFFICIENCY MONITOR AND EXHAUST SYSTEMS

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- catalytic converter
- exhaust system

HF1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0420 or P0430 present?**

Yes	No
GO to **HF2**.	For symptoms without DTCs, GO to **HF6**. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HF2 CHECK FOR OTHER DTCS

NOTE: **Internal deterioration of a catalytic converter is usually caused by abnormal engine operation upstream of the catalyst. Events that can produce higher than normal temperatures in the catalyst are particularly suspect. For example, misfiring can cause higher than normal catalyst operating temperatures.**

NOTE: **Make sure the customer has not:**

- **refueled the vehicle with leaded gasoline.**
- **noticed a high vehicle oil consumption. An engine that consumes oil at a high rate deposits high levels of phosphorus on the catalyst and reduces the catalyst efficiency.**

- Check for self-test DTCs.
- **Are any DTCs present other than the following: P0420, P0430?**

Yes	No

GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** for pinpoint test direction and REPAIR the misfire DTCs. CLEAR the DTCs. REPEAT the self-test.	GO to **HF3**.

HF3 CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

NOTE: Check the HO2S electrical connectors to make sure the correct HO2S is connected to the correct electrical connector. The electrical connectors are color coded to make sure the correct connection is made.

If the electrical connection of the rear HO2S are interchanged/crossed, the catalyst efficiency monitor test fails.

- Visually inspect the HO2S harness connectors for any indication of crossed wiring.
- Visually inspect the harness for exposed wiring, corrosion and correct routing.
- Visually inspect the PCM connectors for damaged, or pushed out pins, corrosion and loose wires.
- **Are there any concerns with the wiring or the PCM connection?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. CARRY OUT the catalyst monitor drive cycle to verify the repairs.	GO to **HF4**.

HF4 CHECK THE FUEL PRESSURE

WARNING: **The fuel system remains pressurized when the engine is not running. To prevent injury or fire, use caution when working on the fuel system. Failure to follow these instructions may result in personal injury.**

WARNING: **Before repairing or installing a new component in the fuel system, reduce the possibility of injury or fire by following the warning, caution, and handling directions in pinpoint test HC. refer to PINPOINT TEST HC. Failure to follow these instructions may result in personal injury.**

NOTE: Fuel pressure above specification can produce an abnormally rich air/fuel mixture. This rich air/fuel mixture can cause higher than normal catalyst operating temperatures.

NOTE: On electronic returnless fuel system (ERFS), the fuel pressure can be monitored by the scan tool using the fuel rail pressure (FRP) PID.

- Mechanical returnless fuel systems (MRFS):
  - If applicable, inspect the vacuum hose going to the fuel rail pulse damper for proper installation

and cracks. Repair as necessary.

- Connect a Rotunda fuel pressure gauge or equivalent.
- Access the PCM and monitor the FRP PID.
- Start the engine. Record the fuel pressure.
- Compare the recorded fuel pressure reading to the Fuel System Specification Chart found at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**.
- Key in OFF position.
- **Is the fuel pressure within specifications?**

Yes	No
The fuel pressure is OK. If applicable, REMOVE the fuel pressure gauge. GO to **HF5**.	The fuel pressure is out of specification. GO to **HC3**.

HF5 CHECK FOR LEAKS IN THE EXHAUST SYSTEM

NOTE: If a catalyst is in series with a leaking exhaust system, it can fail the catalyst efficiency monitor test.

- Inspect the exhaust system for leaks, cracks, loose connections, punctures, or non-factory modifications.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. CARRY OUT the catalyst monitor drive cycle to verify the repairs.	GO to **HF10**.

HF6 CHECK FOR RESTRICTIONS IN THE EXHAUST SYSTEM

NOTE: A slight pressure in the exhaust system is normal, but excessive exhaust back pressure seriously affects engine operation.

- Inspect the following for damage or restrictions:
  - front and rear exhaust pipes
  - catalytic converter
  - muffler and tailpipe assembly
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HF7**.

HF7 CHECK FOR EXCESSIVE EXHAUST BACK PRESSURE

- The internal condition of exhaust system and its ability to flow can be checked with an exhaust back pressure tool.
- **Is an exhaust back pressure tester available?**

Yes	No
GO to **HF8**.	GO to **HF9**.

HF8 CHECK FOR EXCESSIVE EXHAUST BACK PRESSURE WITH EXHAUST BACK PRESSURE TOOL

NOTE: **Typical exhaust back pressure, when measured near the exhaust manifold and at normal engine operating temperature, should not exceed 20.7 kPa (3 psi) at idle and 55.2 kPa (8 psi) at wide open throttle (WOT) under load.**

- Install an exhaust back pressure tester and follow the tool manufacturer installation and testing instructions.
- **Does the exhaust back pressure test indicate a restriction?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. To continue diagnosis of a symptom (lack of power, loss of power, or no start), REFER to the **SYMPTOM CHARTS** article Symptom Charts.	No indication of restrictions or leaks has been detected in the exhaust system. To continue diagnosis of a symptom (lack of power, loss of power, or no start), REFER to the **SYMPTOM CHARTS** article Symptom Charts.

HF9 CHECK MANIFOLD VACUUM FOR AN INDICATION OF EXCESSIVE EXHAUST SYSTEM RESTRICTION

NOTE: **When the engine is first started and is idled, the reading may be normal 51-74 kPa (15-22 in-Hg), but as the engine RPM is increased, the back pressure caused by a clogged exhaust system causes the needle to slowly drop to 0 kPa (0 in-Hg). The needle then may slowly rise. Excessive exhaust restriction causes the needle to drop to a low point even if the engine is only idling.**

- Attach a vacuum gauge to the intake manifold vacuum source.
- Observe the vacuum gauge while increasing the engine RPM.
- **Does the vacuum gauge indicate an exhaust restriction concern?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. To continue diagnosis of a symptom (lack of power, loss of power, or no start), REFER to the **SYMPTOM CHARTS** article Symptom Charts.	No indication of restrictions or leaks has been detected in the exhaust system. To continue diagnosis of a symptom (lack of power, loss of power, or no start), REFER to the **SYMPTOM CHARTS** article Symptom Charts.

HF10 CARRY OUT THE CATALYST MONITOR DRIVE CYCLE

- Carry out the catalyst monitor drive cycle. Refer to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .
- Retrieve the continuous memory DTCs.
- **Are DTCs P0420 or P0430 present?**

Yes	No
INSTALL a new catalyst between the monitored HO2S sensors, only for the bank referenced, (P0420 Bank 1), (P0430 Bank 2). Do not install a new unmonitored catalyst unless it is repaired as an assembly. REFER to the **EXHAUST SYSTEM -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	The test is complete and no concerns are present.

PINPOINT TEST HG: POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

This pinpoint test is intended to diagnose the following:

- positive crankcase ventilation (PCV) valve (6A666) and related vacuum lines
- electrically heated PCV valve (6A666) and heater circuit, both PCM and non-PCM controlled
- electrically heated PCV tube (9F624) and heater circuit, both PCM and non-PCM controlled
- powertrain control module (PCM) (12A650)
- PCV thermal extension harness (12A580)

NOTE: For the electrically heated PCV system only, refer to POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM .

Electrically Heated PCV

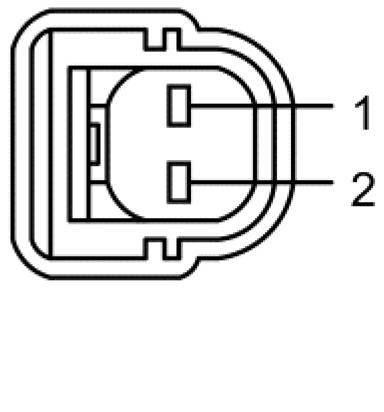

Fig. 122: Positive Crankcase Ventilation Heated Fitting (PCVHF) Connector
Courtesy of FORD MOTOR CO.

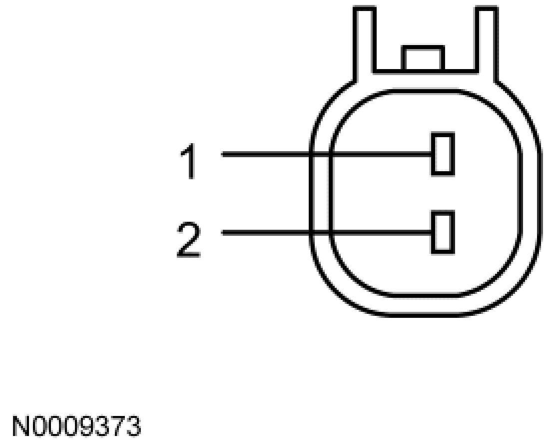

Fig. 123: Positive Crankcase Ventilation (PCV) Connector - B
Courtesy of FORD MOTOR CO.

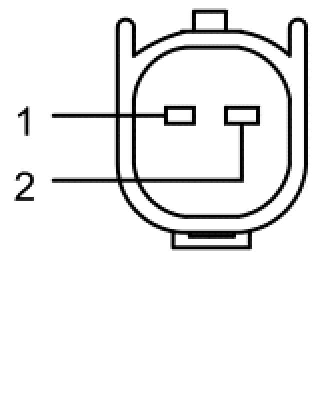

Fig. 124: Positive Crankcase Ventilation (PCV) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria (PCM controlled PCV heater), E-Series 6.8L (PCM controlled PCV heater), E-Series 4.6L (PCM controlled PCV heater), Explorer 4.0L (PCM controlled PCV heater), Explorer Sport Trac 4.0L (PCM controlled PCV heater), F-150 4.2L (PCM controlled PCV heater), F-150 4.6L (PCM controlled PCV heater), Fusion 3.0L (PCM controlled PCV heater), Grand Marquis (PCM controlled PCV heater), Milan 3.0L (PCM controlled PCV heater), Mountaineer 4.0L (PCM controlled PCV heater), Mustang 4.0L (PCM controlled PCV heater), Mustang 5.4L (PCM controlled PCV heater), Town Car (PCM controlled PCV heater)	A	1 2	PCVHC IGN START/RUN
Expedition (Non-PCM controlled heated PCV tube), F-150 5.4L (Non-PCM controlled heated PCV tube), Mark LT (Non-PCM controlled heated PCV tube), Navigator (Non-PCM controlled heated PCV tube)	B	2 1	GND IGN START/RUN
F-Super Duty 5.4L (PCM controlled heated PCV tube)	C	2 1	PCVHC IGN START/RUN

All other vehicles	A	1 2	GND IGN START/RUN

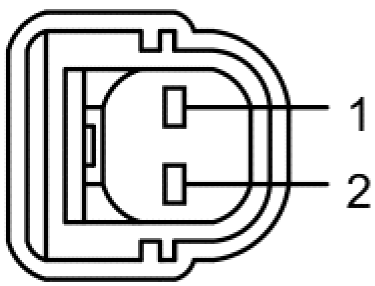

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Fig. 125: Positive Crankcase Ventilation Heated Fitting (PCVHF) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	PCVHF (Positive Crankcase Ventilation Heated Fitting)
2	IGN START/RUN

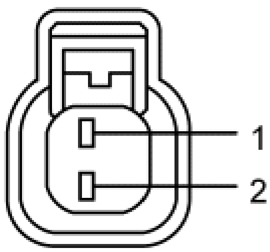

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Fig. 126: Positive Crankcase Ventilation Thermal Extension -Harness Side (PCVTE-Harness Side)
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	GND (Ground)

1	IGN START/RUN

This table is only for vehicles equipped with a PCM controlled PCV heater.

Vehicle	Connector	Pin	Circuit
E-Series, F-Super Duty	170 Pin	E2	PCVHC
F-150	190 Pin	E3	PCVHC
Fusion, Milan	140 Pin	E2	PCVHC
Mustang 5.4L	170 Pin	E67	PCVHC
All other vehicles	170 Pin	E3	PCVHC

HG1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- Check for DTCs P053A, P145E or P1489.
- **Are any of the above listed DTCs present?**

Yes	No
GO to **HG5**.	For all other symptoms without DTCs, GO to **HG2**.

HG2 VISUAL INSPECTION OF THE PCV VALVE

NOTE: If the PCV valve or tube is electrically heated, verify the electrical connection. On some applications the vehicle may be equipped with a thermal harness that only provides electrical continuity when the temperature is less than 5°C (40°F) +/- 4°C (+/- 7°F). Typically this harness is located close to the PCV valve or tube.

NOTE: If the PCV valve is water heated, verify the coolant hose and clip connections.

- Check the PCV valve, hoses and connections for leaks or restrictions.
- Verify the PCV valve maintenance schedule has been followed.
- Verify the proper PCV valve part number.
- Verify the PCV valve is clean.
- Verify the fresh air tube and related hoses are clean and routed correctly.
- **Is a concern present?**

Yes	No
REPAIR as necessary. VERIFY the symptom no longer exists.	For an electrically heated PCV tube, GO to **HG4**. For all others, GO to **HG3**.

HG3 STUCK PCV VALVE CHECK

- Disconnect the PCV valve from the valve cover.
- Shake the PCV valve.
- **Does the PCV valve rattle when shaken?**

Yes	No
REINSTALL the PCV valve. For PCV systems with electrical heating, GO to **HG4**. For PCV systems without electrical heating, GO to **HG12**.	The PCV valve is sticking. INSTALL a new PCV valve. VERIFY the symptom no longer exists.

HG4 CHECK FOR A PCM CONTROLLED PCV HEATER

NOTE: If a thermal extension harness is present then the PCV is non-PCM controlled. Refer to POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM .

- Check if the PCV heater is PCM controlled.
- **Is the PCV heater PCM controlled?**

Yes	No
GO to **HG5**.	GO to **HG8**.

HG5 CHECK THE HARNESS VOLTAGE TO THE PCM CONTROLLED PCV HEATER

- Suspect PCV connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCVHF Connector, Harness Side	(-)
IGN START/RUN - Pin 2	Ground

- Measure the voltage between:

(+) PCV Connector, Harness Side	(-)
IGN START/RUN	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **HG6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HG6 CHECK THE HARNESS CIRCUIT TO THE PCM CONTROLLED PCV HEATER

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCVHF Connector, Harness Side
PCVHF	PCVHF - Pin 1

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCV Connector, Harness Side
PCVHC	PCVHC

- **Is the resistance greater than 5 ohms?**

Yes	No
GO to **HG7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HG7 CHECK THE RESISTANCE OF THE PCM CONTROLLED PCV VALVE OR TUBE HEATER

- Measure the resistance between:

(+) PCVHF Connector, Component Side	(-) PCVHF Connector, Component Side
IGN START/RUN - Pin 2	PCVHF - Pin 1

- Measure the resistance between:

(+) PCV Connector, Component Side	**(-) PCV Connector, Component Side**
IGN START/RUN	PCVHC

- **Is the resistance between 10 - 35 ohms?**

Yes	No
GO to **HG13**.	INSTALL a new PCV valve or tube. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HG8 CHECK THE VOLTAGE AND GROUND AT THE HARNESS ELECTRICALLY HEATED PCV VALVE OR TUBE NON-PCM CONTROLLED

- PCV connector disconnected.
- PCVTE-Harness Side connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCVTE-Harness Side, Harness Side	**(-) PCVTE-Harness Side, Harness Side**
IGN START/RUN - Pin 1	GND - Pin 2

- **Is the voltage greater than 10 V?**

Yes	No
For vehicles with a thermal extension harness, GO to **HG10**. For all others, GO to **HG11**.	GO to **HG9**.

HG9 CHECK THE VOLTAGE CIRCUIT

- PCV connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCV Connector,	**(-)**

Harness Side	
IGN START/RUN	Ground

- **Is the voltage greater than 10 V?**

Yes	No
REPAIR the open GND circuit. TEST the system for normal operation.	REPAIR the open PWR circuit TEST the system for normal operation.

HG10 VALVE RESISTANCE CHECK WITHOUT AN EXTENSION HARNESS

NOTE: **On some applications the vehicle may be equipped with a thermal harness that only provides electrical continuity when the temperature is less than 5°C (40°F) +/- 4°C (+/- 7°F). Typically this harness is located close to the PCV valve or tube.**

- Disconnect the thermal extension harness from the PCV valve.
- Measure the resistance between:

(+) PCV Connector, Component Side	(-) PCV Connector, Component Side
IGN START/RUN	PCVHC

- **Is the resistance between 10 - 35 ohms?**

Yes	No
INSTALL a new thermal extension harness PCV. TEST the system for normal operation.	INSTALL a new PCV.

HG11 CHECK THE RESISTANCE OF THE ELECTRICALLY HEATED PCV VALVE OR TUBE

- Measure the resistance between:

(+) PCV Connector, Component Side	(-) PCV Connector, Component Side
IGN START/RUN	GND

- **Is the resistance between 10 - 35 ohms?**

Yes	No
GO to **HG12**.	INSTALL a new PCV valve or tube. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** .

HG12 PCV SYSTEM CHECK

- Start the engine and warm it until engine temperature is stable.
- Disconnect the closure (fresh air) hose from the remote air cleaner or air outlet tube (the tube connecting the mass air flow sensor and the throttle body).
- Place a stiff piece of paper over the hose end. Wait 1 minute.
- **Does vacuum hold the paper in place?**

Yes	No
The PCV system is OK. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	CHECK for vacuum leaks/obstruction in the PCV system (such as oil cap, PCV valve, hoses, cut grommets, valve cover bolt torque/gasket leak). REFER to the vehicle emissions control information (VECI) label for PCV system components and routing. REPAIR as necessary.

HG13 CHECK IF A CONCERN OR DTC IS STILL PRESENT

- Connect the PCV system.
- Clear the DTCs.
- Carry out the self-test.
- **Is the concern or DTC is still present?**

Yes	No
GO to **HG14**.	Unable to duplicate or identify the concern at this time. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.

HG14 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HH: EXHAUST GAS RECIRCULATION SYSTEM MODULE (ESM)

This pinpoint test is intended to diagnose the following:

- ESM (9Y456)
- orifice tube assembly (9D477)
- differential pressure feedback exhaust gas recirculation (EGR) sensor pressure hoses
- vacuum lines
- harness circuits: DPFE, SIGRTN, EVR, VPWR and VREF
- powertrain control module (PCM) (12A650)

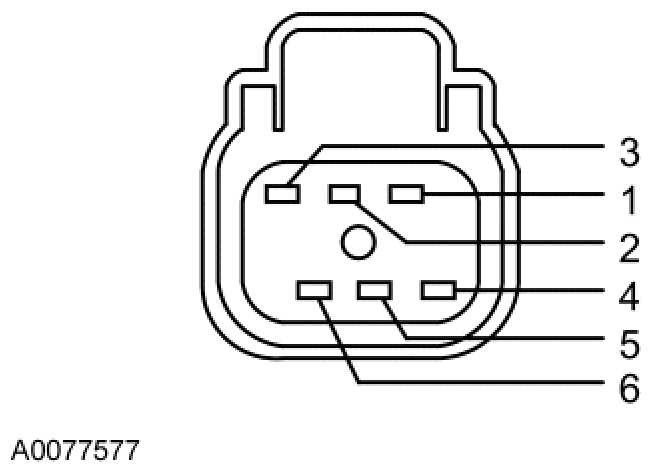

Fig. 127: EGR System Module (ESM) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	EVR (EGR Vacuum Regulator)
4	VPWR (Vehicle Power)
6	SIGRTN (Signal Return)
5	DPFE (Differential Pressure Feedback EGR)
2	VREF (Reference Voltage)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series, F-Super Duty	170 Pin	E63 E58 E57 E58 E21	EVR SIGRTN VREF SIGRTN DPFE
F-150	190 Pin	E63 E58 B29, E57 B58, E58, T43 E21	EVR SIGRTN VREF SIGRTN DPFE
Mustang	170 Pin	E63 E58 B40, E57 B41, E58, T41 E21	EVR SIGRTN VREF SIGRTN DPFE
All other vehicles	170 Pin	E63 E58 E57 B41, E58, T41 E21	EVR SIGRTN VREF SIGRTN DPFE

HH1 CHECK FOR DTCS

- **Are DTCs P0401, P0402, P0403, P0405, P0406, P1408, or P1409 present?**

Yes	No
For DTC P0401, GO to **HH16**. For DTC P0402, GO to **HH12**. For DTCs P0403 and P1409, GO to **HH22**. For DTC P0405, GO to **HH2**. For DTC P0406, GO to **HH5**. For DTC P1408, GO to **HH17**.	For symptoms without DTCs, GO to **HH28**. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HH2 DTC P0405: DETERMINE THE PRESENT DPFEGR PID VOLTAGE

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage less than 0.05 V?**

Yes	No
GO to **HH3**.	GO to **HH11**.

HH3 INDUCE THE OPPOSITE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR SIGNAL

- Key in OFF position.
- ESM connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage between 4 - 6 V?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HH4**.

HH4 CHECK THE DPFE CIRCUIT FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
DPFE	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
DPFE	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HH29**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HH5 DTC P0406: DETERMINE THE PRESENT DPFEGR PID VOLTAGE

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage greater than 4 V?**

Yes	No
GO to **HH6**.	GO to **HH11**.

HH6 CHECK THE VREF VOLTAGE TO THE ESM

- Key in OFF position.
- ESM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) Vehicle Battery
VREF - Pin 2	Negative terminal

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to **HH7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HH7 CHECK THE DPFE CIRCUIT FOR A SHORT TO VOLTAGE

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) Vehicle Battery
DPFE - Pin 5	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to **HH8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HH8 CHECK THE DPFE CIRCUIT FOR A SHORT TO VREF

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	DPFE

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HH9**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HH9 CHECK THE DPFE AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) ESM Connector, Harness Side
DPFE	DPFE - Pin 5
SIGRTN	SIGRTN - Pin 6

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **HH10**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HH10 INDUCE THE OPPOSITE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR VOLTAGE

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A ESM Connector, Harness Side	Point B ESM Connector, Harness Side
DPFE - Pin 5	SIGRTN - Pin 6

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage less than 0.1 V?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HH29**.

HH11 CARRY OUT A THOROUGH WIGGLE TEST ON THE ESM HARNESS

- Access the PCM and monitor the DPFEGR PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there any change in the voltage reading, or is a concern found?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

HH12 DTC P0402: CHECK THE VREF VOLTAGE TO THE ESM

NOTE: Diagnose and repair all circuit concern DTCs before diagnosing range/performance or flow concerns. For circuit concern DTC diagnosis, refer to DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS .

- Key in OFF position.
- ESM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) Vehicle Battery
VREF - Pin 2	Negative terminal

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **HH13**.	refer to **PINPOINT TEST C**.

HH13 SIMULATE THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR SIGNAL WITH A VACUUM PUMP

- Disconnect the downstream differential pressure feedback EGR sensor port hose at the ESM.
- Verify the hose and port are clear and free of obstructions.

- Connect a vacuum pump to the downstream differential pressure feedback EGR sensor port.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
    - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
    - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
    - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HH14**.

HH14 INSPECT THE EGR VACUUM REGULATOR SOLENOID VENT FOR BLOCKAGE

NOTE: When the EGR valve is closed, the EGR vacuum regulator solenoid vacuum is vented through the solenoid vent to the atmosphere. A plugged EGR vacuum regulator solenoid vent does not allow EGR vacuum to vent to the atmosphere.

- EGR vacuum regulator vacuum hoses disconnected.
- Connect a hand vacuum pump to the EGR vacuum regulator source port.
- Apply 34 to 51 kPa (10 to 15 in-Hg) vacuum.
- **Does the EGR vacuum regulator solenoid vacuum bleed off?**

Yes	No
GO to **HH15**.	INSTALL a new EGR vacuum regulator solenoid. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HH15 CHECK THE EGR VALVE FOR CARBON BUILD-UP

- Remove the ESM.
- Visually inspect the EGR valve and valve seat for correct seating, carbon build-up and debris.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time.

HH16 DTC P0401: CARRY OUT THE KOER SELF-TEST

NOTE: Diagnose and repair all circuit concern DTCs before diagnosing range/performance or flow concerns.

- Carry out the KOER self-test.
- **Is DTC P1408 present?**

Yes	No
GO to **HH17**.	GO to **HH18**.

HH17 DTC P1408: CHECK THE VREF VOLTAGE TO THE ESM

- Key in OFF position.
- ESM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) Vehicle Battery
VREF - Pin 2	Negative terminal

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **HH18**.	refer to **PINPOINT TEST C**.

HH18 CHECK THE EGR VACUUM REGULATOR SOLENOID VACUUM

- ESM connector connected.
- Disconnect the EGR vacuum regulator vacuum source hose.
- Connect a vacuum gauge to the EGR vacuum regulator vacuum source hose.
- Key ON, engine running.
- Monitor the vacuum gauge.
- **Is the manifold vacuum greater than 34 kPa (10 in-Hg)?**

Yes	No
GO to **HH19**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HH19 SIMULATE THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR SIGNAL WITH A VACUUM PUMP

- Key in OFF position.
- Disconnect the downstream differential pressure feedback EGR sensor port hose at the ESM.
- Verify the hose and port are clear and free of obstructions.
- Connect a vacuum pump to the downstream differential pressure feedback EGR sensor port.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
    - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
    - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
    - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	CONNECT all the hoses. GO to **HH20**.

HH20 CHECK THE EGR VACUUM REGULATOR SOLENOID OPERATION

- Key ON, engine running.
- Engine at normal operating temperature.
- Allow the engine idle to stabilize.
- Access the PCM and monitor the RPM PID.
- Access output state control.
- Increase the EGR vacuum regulator duty cycle while monitoring the RPM PID.
- **Does the RPM decrease or the engine stall as the EGR vacuum regulator duty cycle is increased?**

Yes	No

Unable to duplicate or identify the concern at this time.	GO to **HH21**.

HH21 CHECK FOR THE PRESENCE OF CARBON BUILD-UP IN THE EGR PASSAGE

NOTE: In certain vehicle applications, carbon build-up may occur downstream of the ESM. An inspection is required to make sure the passage in the upper intake manifold plenum chamber behind the ESM is open to allow exhaust gas flow.

- Key in OFF position.
- Remove the ESM. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** .
- Disconnect the air inlet tube from the throttle body.
- Prop open the throttle body.
- Apply regulated shop air to the EGR port at the location where the ESM attaches to the upper intake manifold.
- **Is a restriction concern present?**

Yes	No
CLEAN the EGR port as necessary and INSTALL the ESM. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HH22 DTCS P0403 AND P1409: CHECK THE EGR VACUUM REGULATOR SOLENOID OPERATION

- Key ON, engine running.
- Engine at normal operating temperature.
- Allow the engine idle to stabilize.
- Access the PCM and monitor the RPM PID.
- Access output state control.
- Increase the EGR vacuum regulator duty cycle while monitoring the RPM PID.
- **Does the RPM decrease or the engine stall as the EGR vacuum regulator duty cycle is increased?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	GO to **HH23**.

HH23 CHECK THE VPWR VOLTAGE TO THE EGR VACUUM REGULATOR SOLENOID

- Key in OFF position.
- ESM connector disconnected.

- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 4	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to **HH24**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HH24 CHECK THE EGR VACUUM REGULATOR SOLENOID COIL RESISTANCE

- Key in OFF position.
- Measure the resistance between:

(+) ESM Connector, Component Side	(-) ESM Connector, Component Side
VPWR - Pin 4	EVR - Pin 1

- **Is the resistance between 26 - 40 ohms?**

Yes	No
GO to **HH25**.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HH25 CHECK THE EVR CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) ESM Connector, Harness Side	(-) PCM Connector, Harness Side
EVR - Pin 1	EVR

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HH26**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HH26 CHECK THE EVR CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
EVR	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to **HH27**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HH27 CHECK THE EVR CIRCUIT FOR A SHORT TO GND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
EVR	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HH29**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HH28 EGR DIAGNOSIS BY SYMPTOM: CHECK FOR EGR FLOW WITH THE EGR VACUUM REGULATOR VACUUM HOSE DISCONNECTED AND PLUGGED

NOTE: An increase in DPFEGR PID voltage at idle indicates EGR flow.

- Carry out the KOER self-test. Repair any other DTCs.
- Possible causes for EGR flow at idle with no related DTCs:
  - EGR valve not fully seating
  - EGR vacuum regulator solenoid vent restricted
  - Damaged EGR vacuum regulator solenoid
- Disconnect and plug the EGR vacuum regulator vacuum source hose.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Record the PID voltage.
- Key ON, engine running.
- With the engine at idle, observe the DPFEGR PID voltage. Compare to engine OFF voltage.
- **Is the idle DPFEGR PID voltage greater than 0.15 V when compared to the KOEO DPFEGR PID voltage?**

Yes	No
REMOVE and INSPECT the ESM for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. If no concerns are present, INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	INSPECT the EGR vacuum regulator solenoid vent for blockage. To continue symptom diagnosis, REFER to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHARTS** .

HH29 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HK: VARIABLE CAMSHAFT TIMING (VCT)

This pinpoint test is intended to diagnose the following:

- VCT solenoid (6L713) or (6B297)
- spider assembly right bank (6C260), or left bank (6C261)
- harness circuits: VPWR and VCT
- powertrain control module (PCM) (12A650)

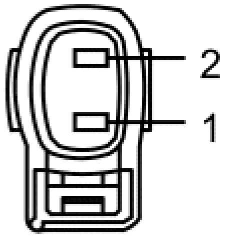

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Fig. 128: Variable Camshaft Timing Bank 1 (VCT1) Solenoid Connector - A
Courtesy of FORD MOTOR CO.

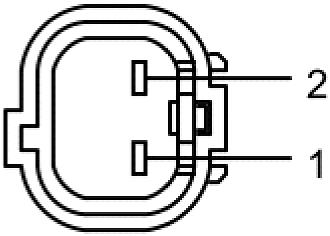

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Fig. 129: Variable Camshaft Timing Bank 1 (VCT1) Solenoid Connector - B
Courtesy of FORD MOTOR CO.

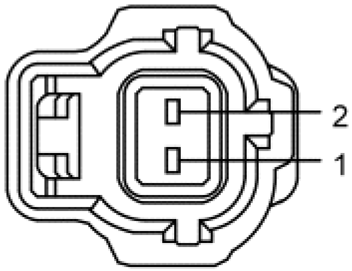

Fig. 130: Variable Camshaft Timing Bank 1 (VCT1) Solenoid Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Fusion 3.0L, Milan 3.0L, MKX, MKZ, Sable, Taurus, Taurus X	A	1 2	VPWR VCT1
Fusion 2.3L, Milan 2.3L	B	2 1	VPWR VCT1
All other vehicles	C	1 2	VPWR VCT1

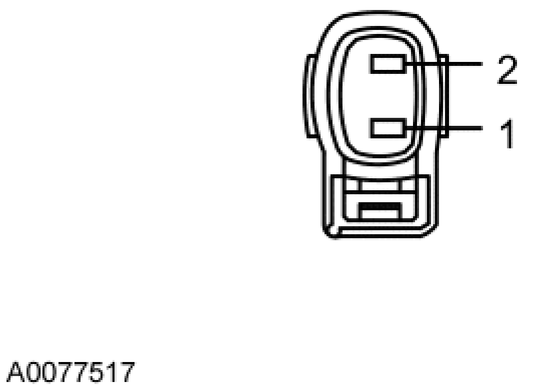

Fig. 131: Variable Camshaft Timing Bank 2 (VCT2) Solenoid Connector - A
Courtesy of FORD MOTOR CO.

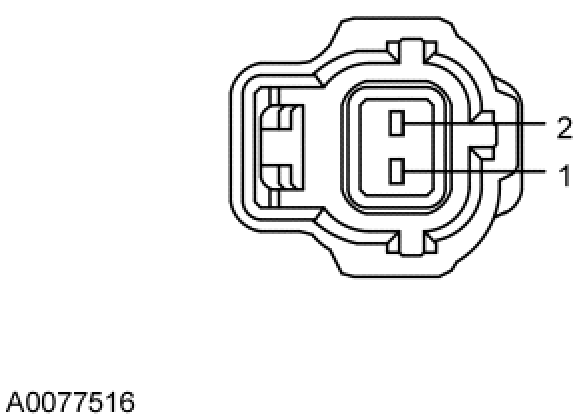

Fig. 132: Variable Camshaft Timing Bank 2 (VCT2) Solenoid Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Fusion 3.0L, Milan 3.0L, MKX, MKZ, Sable, Taurus, Taurus X	A	1 2	VPWR VCT2
All other vehicles	B	1	VPWR

		2	VCT2

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Expedition, Navigator	140 Pin	B51, B52, B53 E68 E67	VPWR VCT2 VCT1
Explorer, Explorer Sport Trac, F-Super Duty, Mountaineer, Mustang	170 Pin	B35, B36 E68 E67	VPWR VCT2 VCT1
Fusion 3.0L, Milan 3.0L, MKZ	140 Pin	B51, B52 E68 E67	VPWR VCT2 VCT1
Fusion 2.3L, Milan 2.3L	140 Pin	B51, B52 E67	VPWR VCT1
All other vehicles	190 Pin	B51, B52, B53 E68 E67	VPWR VCT2 VCT1

HK1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0010, P0011, P0012, P0016, P0018, P0020, P0021, P0022, P052A, P052B, P052C or P052D present?**

Yes	No
For DTCs P0010 or P0020, GO to **HK2**. For DTCs P0011, P0012, P0021, P0022, P052A, P052B, P052C or P052D, GO to **HK17**. For DTCs P0016 and P0018 with or without P0011, P0012, P0021, P0022, P052A, P052B, P052C or P052D, GO to **HK16**.	For symptoms without DTCs, GO to **HK17**. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HK2 DTCS P0010 OR P0020: CHECK FOR VCT DTCS

NOTE: The engine should be at operating temperature before running the self-test.

- Clear the DTCs.
- Carry out the KOER self-test.
- **Are DTCs P0010 or P0020 present?**

Yes	No

For KOER DTC P0010, GO to **HK4**. For KOER DTC P0020, GO to **HK10**.	GO to **HK3**.

HK3 CARRY OUT A THOROUGH WIGGLE TEST ON THE VCT HARNESS

- Carry out a thorough wiggle test on the VCT harness.
- Carry out the KOER self-test.
- **Are DTCs P0010 or P0020 present?**

Yes	No
For KOER DTC P0010, GO to **HK4**. For KOER DTC P0020, GO to **HK10**.	refer to **PINPOINT TEST Z**.

HK4 CHECK THE VCT1 SOLENOID RESISTANCE

- Key in OFF position.
- VCT1 Solenoid connector disconnected.
- Measure the resistance between:

(+) VCT1 Solenoid Connector, Component Side	(-) VCT1 Solenoid Connector, Component Side
VCT1	VPWR

- **Is the resistance between 5 - 14 ohms?**

Yes	No
GO to **HK5**.	INSTALL a new VCT1 solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HK5 CHECK THE VCT1 SOLENOID FOR INTERNAL SHORTS

- Measure the resistance between:

(+) VCT1 Solenoid Connector, Component Side	(-)
VCT1	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HK6**.	INSTALL a new VCT1 solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HK6 CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) VCT1 Solenoid Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **HK7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HK7 CHECK THE VCT1 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) VCT1 Solenoid Connector, Harness Side	(-)
VCT1	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **HK8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HK8 CHECK THE VCT1 CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) VCT1 Solenoid Connector, Harness Side	(-) PCM Connector, Harness Side
VCT1	VCT1

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HK9**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HK9 CHECK THE VCT1 CIRCUIT FOR A SHORT TO GND IN THE HARNESS

- Measure the resistance between:

(+) VCT1 Solenoid Connector, Harness Side	(-)
VCT1	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HK18**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HK10 DTC P0020: CHECK THE VCT2 SOLENOID RESISTANCE

- Key in OFF position.
- VCT2 Solenoid connector disconnected.
- Measure the resistance between:

(+) VCT2 Solenoid Connector, Component Side	(-) VCT2 Solenoid Connector, Component Side

VCT2	VPWR

- **Is the resistance between 5 - 14 ohms?**

Yes	No
GO to **HK11**.	INSTALL a new VCT2 solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HK11 CHECK THE VCT2 SOLENOID FOR INTERNAL SHORTS

- Measure the resistance between:

(+) VCT2 Solenoid Connector, Component Side	(-)
VCT2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HK12**.	INSTALL a new VCT2 solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HK12 CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) VCT2 Solenoid Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **HK13**.	REPAIR the open circuit. CLEAR the DTCs.

	REPEAT the self-test.

HK13 CHECK THE VCT2 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) VCT2 Solenoid Connector, Harness Side	(-)
VCT2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **HK14**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HK14 CHECK THE VCT2 CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) VCT2 Solenoid Connector, Harness Side	(-) PCM Connector, Harness Side
VCT2	VCT2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HK15**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HK15 CHECK THE VCT2 CIRCUIT FOR A SHORT TO GND IN THE HARNESS

- Measure the resistance between:

(+) VCT2 Solenoid	

Connector, Harness Side	(-)
VCT2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HK18**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HK16 CONTINUOUS DTCS P0016, P0018 WITH OR WITHOUT P0011, P0012, P0021, P0022, P052A, P052B, P052C, P052D: CHECK THE FUNCTIONALITY OF THE VCT SYSTEM

NOTE: On 4.6L 3V and 5.4L 3V engines, the VCTADV PID indicates a positive value. For all others, the VCTADV PID indicates a negative value.

- Engine at normal operating temperature.
- Clear the DTCs.
- For DTC P0016.
- Access the PCM and monitor the VCTADV PID.
- For DTC P0018.
- Access the PCM and monitor the VCTADV2 PID.
- Run the engine at idle for 1 minute while monitoring the VCTADV (P0016) or VCTADV2 (P0018) PID.
- Retrieve the continuous memory DTCs.
- **Are DTCs P0016 or P0018 present?**

Yes	No
For a VCTADV PID value between -16 and -46 degrees (2.3L, 3.5L), -14 and -36 degrees (3.0L), or 24 and 73 degrees (4.6L 3V, 5.4L 3V), INSTALL a new VCT solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test. For all others, REFER to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** , Timing Drive Components, to verify the engine timing.	Unable to duplicate or identify the concern at this time.

HK17 CONTINUOUS DTCS P0011, P0012, P0021, P0022, P052A, P052B, P052C OR P052D: CHECK THE OPERATION OF THE VCT SYSTEM

NOTE: Some vehicles require higher RPMs and loads to actuate the VCT system than others. The VCTERR PID should be close to 0 whether actuating or not. During

rapid VCT movements, the VCTERR PID may momentarily deviate from 0.

- For DTCs P0011, P0012, P052A or P052B.
- Access the PCM and monitor the VCTADV PID.
- Access the PCM and monitor the VCTADVERR PID.
- For DTCs P0021, P0022, P052C or P052D.
- Access the PCM and monitor the VCTADV2 PID.
- Access the PCM and monitor the VCTADVERR2 PID.
- Drive the vehicle exercising the throttle to induce VCT movement.
- **Does the VCTADV PID indicate VCT movement while the VCTERR PID maintain close to 0?**

Yes	No
Unable to duplicate or identify the concern at this time.	INSTALL a new VCT solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HK18 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HM: SECONDARY AIR INJECTION (AIR) SYSTEM

This pinpoint test is intended to diagnose the following:

- secondary air injection system relay (14B192)
- electric air injection pump (9A486)
- secondary air injection bypass solenoid (9H465)

- harness circuits: B+, VPWR, AIR, AIRM, ground
- powertrain control module (PCM) (12A650)

- secondary air injection diverter valve (9F491)
- vacuum supply
- hoses
- partial restricted exhaust

Refer to the Wiring Diagrams article for schematic and connector information.

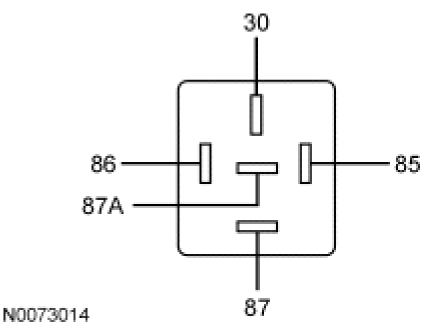

Fig. 133: Powertrain Control Module Power (PCM Power) Relay Connector - B
Courtesy of FORD MOTOR CO.

Pin	Circuit
86	AIR (Secondary Air Injection)
87	AIR_PWR (AIR Pump Power)
30	B+ (Battery Positive Voltage)
85	VPWR (Vehicle Power)

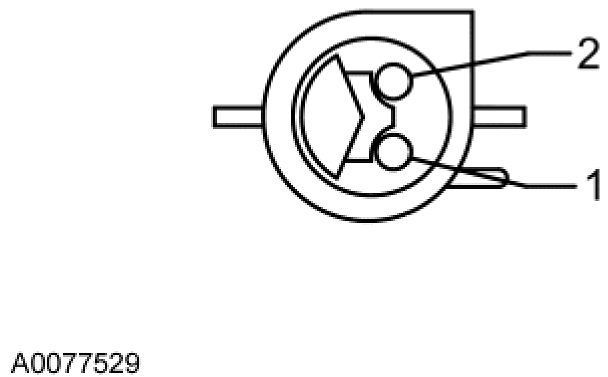

Fig. 134: Secondary Air Pump Connector

Courtesy of FORD MOTOR CO.

Pin	Circuit
2	AIR_PWR (AIR Pump Power)
1	AIR_GND (AIR Pump Ground)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Connector	Pin	Circuit
140 Pin	B58 B66 B67 B33 B51 B50 B1	SIGRTN CASE GND PWRGND VREF VPWR AIRM AIR

HM1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P0410, P0412, P0491, P2257, P2258, or P2448 present?**

Yes	No
GO to **HM2**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HM2 VISUALLY INSPECT THE SECONDARY AIR SYSTEM COMPONENTS AND HOSES

- Visually inspect the secondary AIR system components, connectors and hoses for:
  - damaged hoses
  - obstructions
  - exhaust damage
  - restricted secondary AIR pump inlet
  - water or ice
- **Are the secondary AIR system components and hoses OK?**

Yes	No
GO to **HM3**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HM3 CHECK THE VPWR VOLTAGE TO THE SECONDARY AIR RELAY

- Secondary AIR relay removed.
- Key ON, engine OFF.

- Measure the voltage between:

(+) Secondary AIR Relay Connector, Harness Side	(-)
VPWR - Pin 85	Ground
B+ - Pin 30	Ground

- **Are the voltages greater than 10 V?**

Yes	No
GO to **HM4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HM4 CHECK THE SECONDARY AIR RELAY

- Key in OFF position.
- Carry out the relay component test. Refer to the Wiring Diagrams Cell 149 Component Testing.
- **Does the relay pass the component test?**

Yes	No
GO to **HM5**.	INSTALL a new secondary AIR relay. CLEAR the DTCs. REPEAT the self-test.

HM5 CHECK THE SECONDARY AIR PUMP GROUND CIRCUIT FOR AN OPEN IN THE HARNESS

- Secondary AIR Pump Motor connector disconnected.
- Measure the resistance between:

(+) Secondary Air Pump Connector, Harness Side	(-)
AIR_GND - Pin 1	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HM6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HM6 CHECK THE SECONDARY AIR PUMP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) Secondary AIR Relay Connector, Harness Side	(-) Secondary Air Pump Connector, Harness Side
AIR_PWR - Pin 87	AIR_PWR - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HM7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HM7 CHECK THE SECONDARY AIR CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Secondary AIR Relay Connector, Harness Side
AIR - Pin B1	AIR - Pin 86
AIRM - Pin B50	AIR_PWR - Pin 87

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **HM8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HM8 CHECK THE SECONDARY AIR MONITOR CIRCUIT AND THE SECONDARY AIR PUMP VOLTAGE CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
AIRM - Pin B50	Ground
AIR - Pin B1	Ground

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **HM9**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HM9 CHECK THE SECONDARY AIR MONITOR CIRCUIT AND THE SECONDARY AIR PUMP VOLTAGE CIRCUIT FOR A SHORT TO VOLTAGE

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
AIRM - Pin B50	Ground
AIR - Pin B1	Ground

- **Is any voltage present?**

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **HM10**.

HM10 MEASURE THE VACUUM AT THE SECONDARY AIR SOLENOID VALVE

CAUTION: Running the secondary AIR pump with OTM longer than 2 minutes may overheat and damage the secondary AIR pump. Refer to{Output Test Mode}.

- Key in OFF position.
- Secondary AIR relay installed.
- Secondary AIR Solenoid connector connected.
- PCM connector connected.
- Key ON, engine OFF.
- Connect a vacuum gauge to the control vacuum outlet at the secondary AIR valve.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Observe the vacuum gauge reading at the secondary AIR valve.
- Command the outputs OFF.
- Exit output test mode.
- **Is vacuum present at the secondary AIR diverter valve?**

Yes	No
GO to **HM11**.	INSTALL a new secondary AIR valve. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HM11 CHECK THE SECONDARY AIR PUMP OPERATION

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Disconnect the inlet hose from the secondary AIR valve.
- Command the outputs ON.
- Place your hand over the secondary AIR valve inlet hose.
- Command the outputs OFF.
- Exit output test mode.
- **Is there any air flow from the secondary AIR inlet valve hose?**

Yes	No
INSTALL a new secondary AIR valve. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	INSTALL a new secondary AIR pump. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST HU: INTAKE AIR SYSTEMS

This pinpoint test is intended to diagnose the following:

- accelerator cable linkage to throttle body (9C799)
- air cleaner assembly (including air cleaner element) (9600)
- air inlet tube (9F843)
- clean air tube hose and resonator (9R504) and (9F593)
- intake manifold runner control (IMRC) housing assembly (9U531), (9U524) and (9J447)
- IMRC actuator assembly (9J559)
- IMRC (9G730)
- intake manifold tuning valve (IMTV) (9L490)
- IMTV electric actuator assembly (9L490)
- speed control cable (9A825)
- throttle body assembly (9E926)
- harness circuits: IMRC, MONITOR, SIGNAL, SIGRTN, PWRGND, and VPWR
- harness circuits: IMTV, MONITOR, SIGNAL, and VPWR
- powertrain control module (PCM) (12A650)

IMRCM VOLTAGE VALUES

VEHICLE	IMRC OFF	IMRC ON
Focus, 2.0L	0	5
F-150 5.4L, Mark LT	5	0
All Others	2.5	0

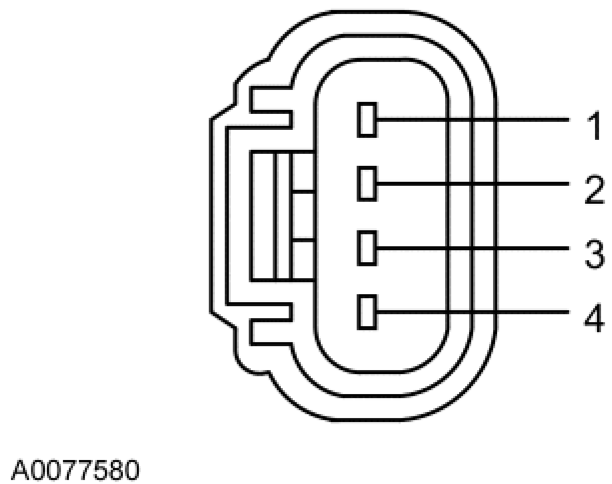

Fig. 135: Intake Manifold Runner Control (IMRC) Actuator Connector - A
Courtesy of FORD MOTOR CO.

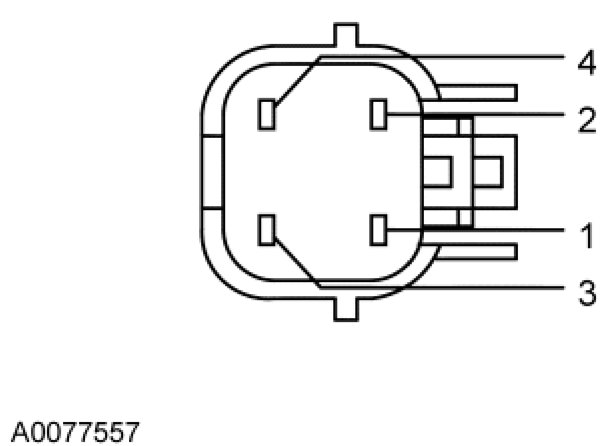

Fig. 136: Intake Manifold Runner Control (IMRC) Actuator Connector - B
Courtesy of FORD MOTOR CO.

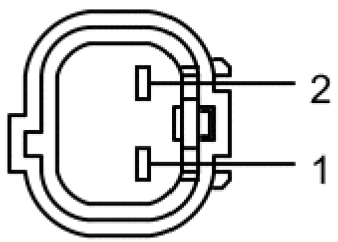

Fig. 137: Intake Manifold Runner Control (IMRC) Actuator Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition 5.4L, F-150 5.4L, F-Super Duty 5.4L, Mark LT 5.4L, Navigator 5.4L	A	4 3 2 1	IMRCM IMRC PWRGND VPWR
Explorer 4.6L, Explorer Sport Trac 4.6L, Mountaineer 4.6L, Mustang 4.6L	A	3 2 1	IMRC PWRGND VPWR
F-150 4.2L	B	4 1 2 3	IMRCM IMRC PWRGND VPWR
Focus	C	2 1	IMRC VPWR
Fusion 2.3L, Milan 2.3L	C	1 2	IMRC VPWR

For most vehicles the IMRCM is integrated into the IMRC connector.

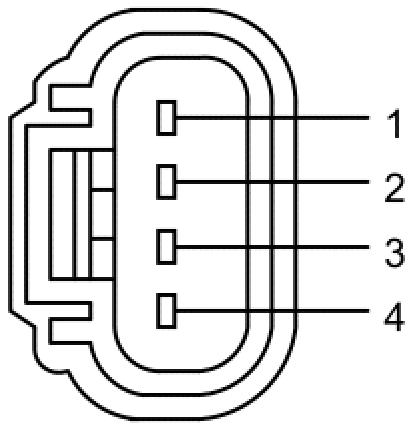

Fig. 138: Intake Manifold Runner Control Monitor (IMRCM) Sensor Connector - A
Courtesy of FORD MOTOR CO.

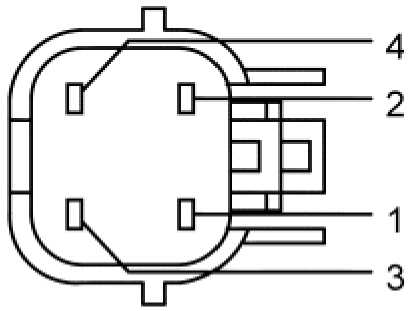

Fig. 139: Intake Manifold Runner Control Monitor (IMRCM) Sensor Connector - B
Courtesy of FORD MOTOR CO.

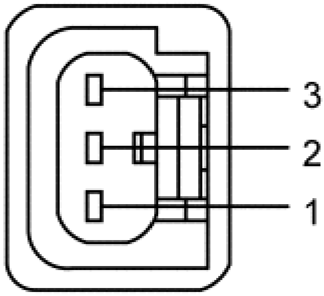

Fig. 140: Intake Manifold Runner Control Monitor (IMRCM) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition 5.4L, F-150 5.4L, F-Super Duty 5.4L, Mark LT 5.4L, Navigator 5.4L	A	2 1 4	PWRGND VPWR IMRCM
F-150 4.2L	B	2 3 4	PWRGND VPWR IMRCM
Focus	C	2 3 1	PWRGND VPWR IMRCM
Fusion 2.3L, Milan 2.3L	C	1	IMRCM

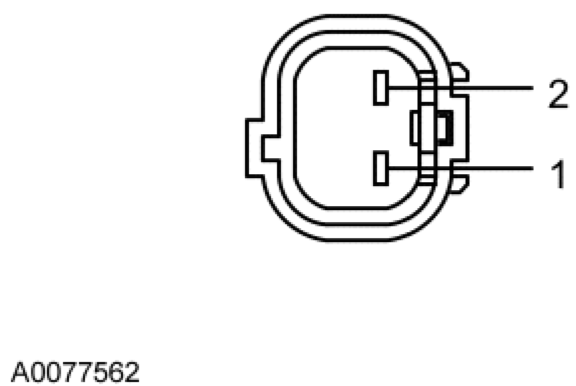

Fig. 141: Intake Manifold Tuning Valve (IMTV) Actuator Connector - A
Courtesy of FORD MOTOR CO.

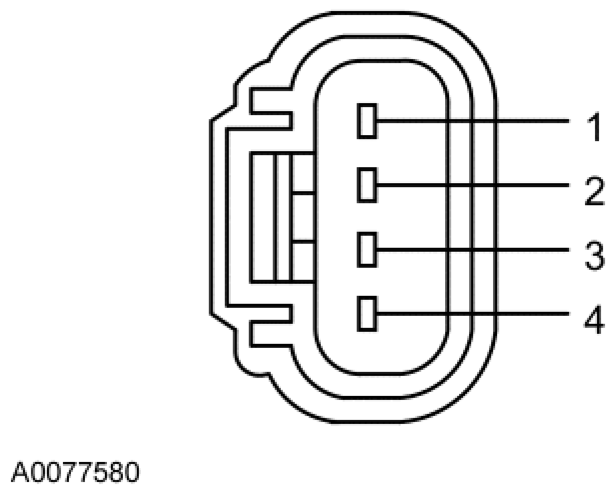

Fig. 142: Intake Manifold Tuning Valve (IMTV) Actuator Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Fusion 2.3L, Milan 2.3L	A	1 2	IMTV VPWR
F-Super Duty 6.8L	B	3 1	IMTV VPWR

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit

Escape/Mariner	150 (50-50-50) Pin	E41 E6 B47	SIGRTN IMTV PWRGND
Expedition, Navigator	140 Pin	E58 B67 E43 E50	SIGRTN PWRGND IMRCM IMRC
F-150, Mark LT	190 Pin	E58 B67 E43 E50	SIGRTN PWRGND IMRCM IMRC
F-Super Duty 5.4L	170 Pin	E58 B47 E43 E50	SIGRTN PWRGND IMRCM IMRC
F-Super Duty 6.8L	170 Pin	E58 E64 B47	SIGRTN IMTV PWRGND
Focus	190 Pin	E64 B69 E25 E22	SIGRTN PWRGND IMRCM IMRC
Fusion, Milan	140 Pin	E58 E64 B67 E43 E50	SIGRTN IMTV PWRGND IMRCM IMRC
All other vehicles	170 Pin	E58 B47 E50	SIGRTN PWRGND IMRC

HU1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0505, P0506, P0660, P0663, P1512, P1513, P1516, P1517, P1518, P1519, P151A, P1520, P1537, P1538, P1549, P2004, P2005, P2006, P2007, P2008, P2014, P2015, P2019, P2020, P2070, or P2071 present?**

Yes	No
For DTCs P0505 or P0506, on vehicles with electronic throttle control (ETC), GO to **HU51**. For DTCs P0505 or P0506, on vehicles without ETC, GO to **HU2**. For DTCs P0660, P0663, P1549, P2070 or P2071, GO to **HU42**.	For vehicles equipped with electronic throttle control (ETC) that have low idle concerns, difficulty

For DTC P151A, Mustang 4.6L, Explorer 4.6L, Explorer Sport Trac 4.6L, and Mountaineer 4.6L. GO to **HU18**. For DTC P151A, all others, GO to **HU17**. For DTCs P1512, P1513, P1516, P1517, P1518, P1519, P1520, P1537, P1538, P2004, P2005, P2006, P2007, P2008, P2014, P2015, P2019 or P2020, GO to **HU15**.	starting, hesitation, loss of RPM, GO to **HU51**. For lack/loss of power, GO to **HU42**. For all other symptoms without DTCs, GO to **HU2**.

HU2 PART THROTTLE SYMPTOM

- **Are any part throttle concerns present?**

Yes	No
GO to **HU7**.	GO to **HU3**.

HU3 CHECK THE BASE IDLE SPEED

NOTE: The vehicle must be at operating temperature and at idle for a minimum of 1 minute.

- Key ON, engine running.
- Determine if the idle speed is incorrect. Refer to the **REFERENCE VALUES** article Typical Reference Value Charts, if necessary.
- Access the PCM and monitor the RPM PID.
- If equipped, read the vehicle tachometer.
- **Is vehicle idle speed correct?**

Yes	No
GO to **HU5**.	GO to **HU4**.

HU4 CHECK THE THROTTLE ARM CONTACTS

- Key in OFF position.
- Check that the throttle arm contacts the return stop.
- **Is the idle speed high?**

Yes	No
GO to **HU9**.	GO to **HU10**.

HU5 CHECK FOR BINDING OR STICKING IN THE THROTTLE SYSTEM

- Gently cycle the throttle from fully closed to fully open and back to fully closed. Check for sticking or binding during rotation.

- **Is a stick and bind condition present?**

Yes	No
GO to **HU6**.	GO to **HU7**.

HU6 ISOLATE THE BINDING AND/OR STICKING CONCERN

NOTE: **Do not attempt to clean the throttle bore and plate area. Cleaning damages the throttle body assembly.**

NOTE: **The sticking or binding condition can either be within the cables or throttle body assembly.**

- Disconnect the accelerator cable and speed control cable from the throttle body linkage.
- Rotate the throttle body linkage.
- **Does the throttle body rotate freely without a sticking, binding or grabbing condition?**

Yes	No
REPAIR the cable(s) causing the concern. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new throttle body assembly. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HU7 CHECK THE FUNCTIONALITY OF THE THROTTLE POSITION (TP) SENSOR

- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- Gently cycle the throttle from fully closed to fully open and back to fully closed.
- **Does the TP PID display a smooth voltage reading?**

Yes	No
GO to **HU8**.	INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HU8 CHECK THE INTAKE AIR SYSTEM FOR LEAKS, OBSTRUCTIONS AND DAMAGE

NOTE: **The Focus air cleaner element is integral to the air cleaner assembly. Inspect the air restriction gauge (if equipped) for a restriction indication.**

- Key in OFF position.
- Remove the air cleaner element. Check the air cleaner for blockage.
- Check for restrictions between the air inlet and the throttle body.
- **Are any restriction concerns present?**

Yes	No
REMOVE the restriction. INSTALL a new air cleaner element. Refer to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	REINSTALL the air cleaner element. GO to **HU9**.

HU9 CHECK THE POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

NOTE: A high idle may indicate an incorrect PCV valve size or a vacuum leak.

- Check that no cracks or leaks are present.
- Remove the PCV valve.
  - Verify a clean PCV valve.
  - Verify the proper PCV valve part number.
- **Are any PCV system concerns present?**

Yes	No
INSTALL a new PCV valve. REPAIR as necessary. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	For high idle, GO to **HU13**. For all others, CONNECT the PCV valve. GO to **HU10**.

HU10 CHECK THE IDLE AIR CONTROL (IAC) VALVE RESPONSE

- Key ON, engine running.
- The vehicle must be at operating temperature and at idle for a minimum of 1 minute.
- IAC connector disconnected.
- **Does the RPM drop or the engine stall?**

Yes	No
GO to **HU12**.	GO to **HU11**.

HU11 CHECK THE IAC VALVE RESPONSE

- **Is the idle speed high?**

Yes	No

GO to **HU13**.	INSTALL a new IAC. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HU12 INSPECT THE THROTTLE BODY PLATE HOLE FOR PLUGGING

NOTE: **Only some applications have a throttle plate hole. If not equipped go to the SYMPTOM CHARTS article, Symptom Charts.**

- Key in OFF position.
- Remove the resonator from the throttle body assembly.
- Inspect the throttle plate hole for any restrictions.
- **Are any restriction concerns present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** , to diagnose performance while driving concerns.

HU13 CHECK FOR VACUUM LEAKS

- Listen for vacuum leaks.
- Inspect the entire intake air system from the mass air flow (MAF) sensor to the intake manifold for leaks such as:
    - cracked or punctured inlet air tube
    - loose connections on the inlet air tube at the air cleaner housing or throttle body
    - IAC valve assembly or gasket
    - EGR valve gasket leak to intake manifold
    - intake manifold assembly or gasket
    - EGR valve diaphragm or control solenoid
    - vacuum supply connectors and hose
- **Are any leaks present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HU14**.

HU14 CHECK THE THROTTLE BODY FOR EXCESSIVE WEAR

- Key in OFF position.

- Remove the throttle body assembly. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for removal and inspection.
- Check the following:
  - excessive wear or grooving in the throttle bore
  - misaligned or worn throttle plate
  - excessive gap between the throttle bore and plate
- **Are any concerns present?**

Yes	No
INSTALL a new throttle body assembly. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** , to diagnose performance while driving concerns.

HU15 DTCS P1512, P1513, P1516, P1517, P1518, P1519, P1520, P1537, P1538, P2004, P2005, P2006, P2007, P2008, P2014, P2015, P2019 OR P2020: VISUAL INSPECTION

NOTE: **If unable to fully carry out the following inspections, answer NO to the question in this step.**

NOTE: **The IMRC return spring is strong on vacuum systems. Make sure the vacuum system operates correctly and the plates open and close fully. On vacuum operated systems the engine must run for 20 seconds to restore vacuum then return to KOEO for testing.**

Some IMRC electrical systems are driven in both directions by the solenoid and do not use a return spring. They can not be opened manually.

- Visually inspect the linkage for possible causes of binding or obstructions. Check the lever/linkage for movement. There may be some tension in one direction but there should be full travel.
- Manually open and close the IMRC plates at the intake manifold while checking for sticking or binding.
- **Is a mechanical concern present?**

Yes	No
GO to **HU16**.	For Explorer 4.6L, Explorer Sport Trac 4.6L, Mountaineer 4.6L, and Mustang 4.6L, GO to **HU18**. For all others, GO to **HU17**.

HU16 CHECK THE IMRC FOR MECHANICAL OPERATION

NOTE: **The IMRC return spring is strong - approximately 0.34 to 0.45 Nm (3 to 4 in-lb).**

NOTE: **Some electric motor applications do not use a return spring and should move freely when open and closed.**

- Disconnect the IMRC linkage or remove the actuator assembly from the manifold.
- Rotate the IMRC plate lever to fully open and to fully closed, contacting both limits.
- Check for sticking or binding during rotation.
- **Is a mechanical concern present?**

Yes	No
REPAIR as necessary or INSTALL a new IMRC. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	CONNECT the IMRC linkage. For Explorer 4.6L, Explorer Sport Trac 4.6L, Mountaineer 4.6L, and Mustang 4.6L, GO to **HU18**. For all others, GO to **HU17**.

HU17 DTC P151A: CHECK THE FUNCTIONALITY OF THE IMRC

WARNING: **Keep fingers clear of the mechanism. Failure to follow these instructions may result in personal injury.**

NOTE: **The vehicle must be at operating temperature and at idle for a minimum of 1 minute.**

- Key ON, engine running.
- Access the PCM and control the IMRC PID.
- Access the PCM and monitor the IMRC1M PID.
- Command IMRC ON then OFF.

IMRCM VOLTAGE VALUES

VEHICLE	IMRC OFF	IMRC ON
Focus, 2.0L	0	5
F-150 5.4L, Mark LT	5	0
All Others	2.5	0

- **Using the table for reference, do the IMRCM voltage values correctly change while the IMRC is cycled?**

Yes	No
refer to **PINPOINT TEST Z**.	GO to **HU19**.

HU18 CHECK THE FUNCTIONALITY OF BI-DIRECTIONAL IMRC

WARNING: **Keep fingers clear of the mechanism. Failure to follow these instructions may result in personal injury.**

NOTE: The vehicle must be at operating temperature and at idle for a minimum of 1 minute.

- Key ON, engine running.
- Access the PCM and control the IMRC PID.
- Access the PCM and monitor the IMRC_F PID.
- Command IMRC ON then OFF.
- **Do the IMRC values correctly change from off to on while the IMRC is cycled and is the IMRCF PID no?**

Yes	No
refer to **PINPOINT TEST Z**.	GO to **HU19**.

HU19 CHECK THE FUNCTIONALITY OF THE IMRC

WARNING: **Keep fingers clear of the mechanism. Failure to follow these instructions may result in personal injury.**

NOTE: The vehicle must be at operating temperature and at idle for a minimum of 1 minute.

- Key ON, engine running.
- Physically monitor the IMRC actuator.
- Access the PCM and control the IMRC PID.
- Command the outputs ON.
- **Do the IMRC levers cycle from fully closed and remain fully open while the outputs are on?**

Yes	No
GO to **HU28**.	GO to **HU20**.

HU20 CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.

- IMRC Actuator connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) IMRC Actuator Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **HU21**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HU21 CHECK THE GROUND CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the voltage between:

(+) IMRC Actuator Connector, Harness Side	(-) IMRC Actuator Connector, Harness Side
VPWR	PWRGND

- **Is the voltage greater than 10 V?**

Yes	No
GO to **HU22**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HU22 VERIFY THE DRIVER CIRCUIT FUNCTION

- Connect a non-powered test lamp between:

(+) IMRC Actuator Connector, Harness Side	(-) IMRC Actuator Connector, Harness Side
VPWR	IMRC

- **Does the test lamp illuminate?**

Yes	No
GO to **HU27**.	GO to **HU23**.

HU23 VERIFY THE DRIVER CIRCUIT FUNCTION WHILE COMMANDING ON IMRC

- Key ON, engine running.
- Access the PCM and control the IMRC PID.
- Connect a non-powered test lamp between:

(+) IMRC Actuator Connector, Harness Side	(-) IMRC Actuator Connector, Harness Side
VPWR	IMRC

- Command the outputs ON.
- **Does the test lamp illuminate?**

Yes	No
GO to **HU26**.	GO to **HU24**.

HU24 CHECK THE IMRC CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) IMRC Actuator Connector, Harness Side	(-) PCM Connector, Harness Side
IMRC	IMRC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HU25**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HU25 CHECK THE IMRC CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) IMRC Actuator Connector, Harness Side	(-)
IMRC	Ground

- **Is the voltage less than 10 V?**

Yes	No
GO to **HU53**.	REPAIR the short circuit to voltage. CLEAR the DTCs. REPEAT the self-test.

HU26 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE IMRC HARNESS

- Key in OFF position.
- PCM connector connected.
- Measure the resistance between:

(+) IMRC Actuator Connector, Harness Side	(-) IMRC Actuator Connector, Harness Side
IMRC	IMRCM
IMRC	PWRGND

- **Are the resistances greater than 10K ohms?**

Yes	No
INSTALL a new IMRC actuator. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HU27**.

HU27 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE IMRC HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) IMRC Actuator Connector, Harness Side	(-) IMRC Actuator Connector, Harness Side
IMRC	IMRCM

IMRC	PWRGND

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **HU53**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.

HU28 CHECK THE IMRCM PID

- Key ON, engine OFF.
- Access the PCM and monitor the IMRC1M PID.
- **Is the IMRCM PID displaying either VREF or approximately 2.5 volts?**

Yes	No
GO to **HU29**.	GO to **HU33**.

HU29 CHECK THE IMRCM CIRCUIT FOR A SHORT TO VPWR

NOTE: **The vehicle must be at operating temperature and at idle for a minimum of 1 minute.**

- Key ON, engine running.
- Access the PCM and control the IMRC PID.
- Command the outputs ON.
- Access the PCM and monitor the IMRC1M PID.
- **Is the voltage less than 1 V?**

Yes	No
GO to **HU35**.	GO to **HU35**.

HU30 CHECK THE IMRCM CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key ON, engine OFF.
- IMRCM Sensor connector disconnected.
- Measure the voltage between:

(+) IMRCM Sensor Connector, Harness Side	(-)

IMRCM	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **HU31**.	GO to **HU32**.

HU31 CHECK THE IMRCM CIRCUIT FOR A SHORT TO VOLTAGE IN THE CONTROL MODULE

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) IMRCM Sensor Connector, Harness Side	(-)
IMRCM	Ground

- **Is the voltage greater than 10 V?**

Yes	No
REPAIR the short circuit to voltage. CLEAR the DTCs. REPEAT the self-test.	GO to **HU53**.

HU32 CHECK THE IMRCM CIRCUIT FOR A SHORT TO VPWR

- Key in OFF position.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Component Side	(-) IMRCM Sensor Connector, Component Side
IMRCM	VPWR

- **Is the resistance greater than 10K ohms?**

Yes	No
CHECK for an intermittent concern. refer to **PINPOINT TEST Z**.	INSTALL a new IMRCM sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** as necessary.

	CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.

HU33 CHECK THE IMRCM CIRCUIT FOR A SHORT TO GROUND

- Key ON, engine OFF.
- Access the PCM and monitor the IMRC1M PID.
- IMRCM Sensor connector disconnected.
- **Does voltage change from less than 1 volt to VREF when disconnecting the IMRCM harness connector?**

Yes	No
INSTALL a new IMRCM sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** as necessary. CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.	GO to **HU34**.

HU34 CHECK THE IMRCM CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) IMRCM Sensor Connector, Harness Side
IMRCM	PWRGND

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HU53**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.

HU35 CHECK THE MONITOR CIRCUIT RESPONSE

- IMRCM Sensor connector disconnected.
- Access the PCM and monitor the IMRC1M PID.
- Connect a 5 amp fused jumper wire between the following:

Point A	

IMRCM Sensor Connector, Harness Side	Point B
IMRCM	Ground

- **Does voltage change from less than 1 volt to VREF when disconnecting the IMRCM harness connector?**

Yes	No
GO to **HU36**.	GO to **HU39**.

HU36 CHECK THE PWRGND CIRCUIT FOR CONTINUITY TO CHASSIS GND

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector connected.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) Vehicle Battery
PWRGND	Negative terminal

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HU37**.	GO to **HU38**.

HU37 CHECK THE MONITOR CIRCUIT FOR AN INTERMITTENT OPEN

- PCM connector disconnected.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IMRCM	IMRCM

- Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module.

- **Is the resistance fluctuating while checking the harness?**

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.	INSTALL a new IMRCM sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** as necessary. CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.

HU38 CHECK THE HARNESS PWRGND CIRCUIT FOR CONTINUITY

- PCM connector disconnected.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
PWRGND	PWRGND

- **Is the resistance less than 5 ohms?**

Yes	No
CHECK the circuit for an intermittent concern. refer to **PINPOINT TEST Z**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.

HU39 CHECK THE IMRCM CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector disconnected.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IMRCM	IMRCM

- **Is the resistance less than 5 ohms?**

Yes	No

GO to **HU40**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.

HU40 CHECK THE MONITOR CIRCUIT FOR AN INTERMITTENT OPEN

- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IMRCM	IMRCM

- Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module.
- **Is the resistance fluctuating while checking the harness?**

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.	GO to **HU53**.

HU41 VERIFY THE REPAIR

- Key ON, engine OFF.
- Clear the PCM DTCs.
- Access the PCM and monitor the IMRC and IMRC_F PIDs.
- Access the PCM and monitor the IMRC1M PID.
- Key ON, engine running.
- Drive the vehicle, obeying all traffic and safety laws.
- Safely carry out 3 acceleration runs from a stop or roll to between 3,000 and 4,000 RPM.
- Watch for any PID change.
- Carry out the PCM self-test.
- **Are any DTCs received?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	The test completed successfully.

HU42 DTCS P0660, P0663, P1549, P2070 OR P2071: VISUAL INSPECTION OF INTAKE MANIFOLD TUNING

VALVE

- Inspect the component for signs of damage.
- Check the harness and connection.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HU43**.

HU43 CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

- IMTV Actuator connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) IMTV Actuator Connector, Harness Side	(-) Vehicle Battery
VPWR	Negative terminal

- **Is the voltage greater than 10.5 V?**

Yes	No
GO to **HU44**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HU44 CHECK THE IMTV CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) IMTV Actuator Connector, Harness Side	(-) PCM Connector, Harness Side
IMTV	IMTV

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HU45**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HU45 CHECK THE IMTV CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
IMTV	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HU46**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HU46 CHECK THE IMTV CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
IMTV	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **HU47**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HU47 CHECK THE IMTV DRIVER CIRCUIT WITH THE PCM CONNECTED

- IMTV Actuator connector disconnected.
- PCM connector connected.
- Key ON, engine OFF.
- Connect a non-powered test lamp between:

(+) IMTV Actuator Connector,	(-) IMTV Actuator Connector,

Harness Side	Harness Side
VPWR	IMTV

- **Does the test lamp illuminate?**

Yes	No
GO to **HU53**.	GO to **HU48**.

HU48 CHECK THE IMTV PCM DRIVER CIRCUIT WHEN COMMANDED ON

- Connect a non-powered test lamp between:

(+) IMTV Actuator Connector, Harness Side	(-) IMTV Actuator Connector, Harness Side
VPWR	IMTV

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Command the outputs OFF.
- Exit output test mode.
- **Does the test lamp illuminate?**

Yes	No
GO to **HU49**.	GO to **HU53**.

HU49 CHECK THE IMTV FOR DAMAGE

- Key in OFF position.
- Remove the IMTV. Refer to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** .
- Visually inspect the shutter for damage.
- Manually rotate the shutter.
- **Is a concern present?**

Yes	No
INSTALL a new IMTV actuator. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HU50**.

HU50 CHECK THE IMTV FOR FUNCTIONALITY WHEN COMMANDED ON

- IMTV Actuator connector connected.
- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Command the outputs OFF.
- Exit output test mode.
- **Does the IMTV shutter rotate?**

Yes	No
The concern is an intermittent. refer to **PINPOINT TEST Z**.	INSTALL a new IMTV actuator. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** as necessary. CLEAR the DTCs. REPEAT the self-test.

HU51 PRELIMINARY DIAGNOSIS FOR DIAGNOSTIC TROUBLE CODES (DTCS) P0505 OR P0506

- Key ON, engine OFF.
- **Are any DTCs present other than P0505 or P0506?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **HU52**.

HU52 MONITOR THE INTAKE AIR SYSTEM RELATED PIDS

NOTE: Verify that the vehicle has reached the normal engine coolant operating temperature of 77°C (170°F). Allow the engine to idle an additional 5 minutes.

NOTE: The ETC_TRIM PID may not be available on all vehicles.

- Access the PCM and monitor the ECT PID.
- Access the PCM and monitor the ETC_TRIM PID.
- Access the PCM and monitor the IACTRIM and IACKAM2 PIDs.
- Mathematically add and record the value of the IACTRIM PID to the IACKAM2 PID value, for the total IAC value at idle.
- **Is the ETC_TRIM PID angle equal to 3.5 degrees or is the total IAC value greater than 0.5 lb/min?**

Yes	No
INSTALL a new throttle body assembly. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** to INSTALL a new throttle body. CLEAR the DTCs. REPEAT the self-test.	RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.

HU53 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HV: COOLING FAN CLUTCH

WARNING: **To avoid the possibility of personal injury or damage to the vehicle, do not operate the engine until the fan blade has been first examined for possible cracks and separation. Failure to follow these instructions may result in personal injury or death.**

NOTE: **Before starting this pinpoint test, turn the clutch fan assembly by hand and check for mechanical binding around the fan shroud or surrounding components. If binding is present, correct the problem then continue with the pinpoint test. If no binding is present, start the engine and warm up to normal operating temperature then continue with the pinpoint test.**

This pinpoint test is intended to diagnose the following:

- cooling fan clutch
- harness circuits: fan speed sensor (FSS), FSS PWRGND, FSS VPWR, fan control variable (FCV), and FCV VPWR
- powertrain control module (PCM) (12A650)

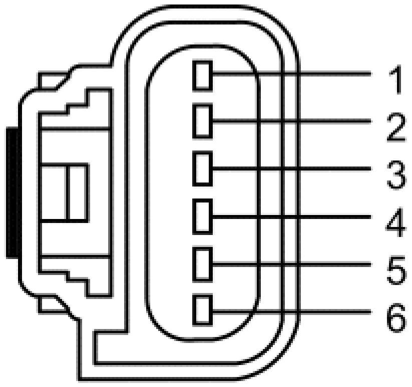

Fig. 143: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	FSS (Fan Speed Sensor)
5	PWRGND (Power Ground)
2	VBPWR (Vehicle Buffered Power)
3	VPWR (Vehicle Power)
6	FCV (Fan Control Variable)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Pin	Circuit
Expedition, Navigator	B51, B52, B53 B45 B67, B68, B69, B70 B20 B48	VPWR FSS PWRGND VBPWR FCV
F-150	B51, B52, B53 E24 B67, B68, B69, B70 B20 B48	VPWR FSS PWRGND VBPWR FCV
All other vehicles	B35, B36 E24 B47, B48, B49, B50 E20 E7	VPWR FSS PWRGND VBPWR FCV

HV1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0480, P0483 or P0528 present?**

Yes	No
For KOEO and KOER DTC P0480, GO to **HV4**. For KOEO and KOER DTCs P0483 or P0528, GO to **HV2**. For continuous memory DTCs P0480 or P0528, GO to **HV10**.	GO to **HV2**.

HV2 CHECK THE COOLING FAN CLUTCH FOR MECHANICAL BINDING

NOTE: The cooling fan clutch uses a viscous coupling. The viscous drag should be smooth during fan rotation. The amount of resistance is dependent upon the final cooling fan operational state before engine shutdown.

- Key in OFF position.
- Manually rotate the cooling fan.
- **Does the cooling fan clutch rotation feel rough or binding?**

Yes	No
INSTALL a new cooling fan clutch. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HV3**.

HV3 CHECK THE COOLING FAN CLUTCH OPERATION

- Key ON, engine running.
- Set the heater controls to OFF.
- Access the PCM and monitor the FANSS PID.
- **Does the FANSS PID indicate any RPM?**

Yes	No
GO to **HV4**.	GO to **HV11**.

HV4 KOEO AND KOER DTC P0480: CHECK THE COOLING FAN CLUTCH ACTUATOR VALVE SOLENOID RESISTANCE

NOTE: If necessary, install terminal adapters on the component side pins to carry out the resistance measurement.

- Key in OFF position.
- Cooling Fan Clutch connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Component Side	(-) Cooling Fan Clutch Connector, Component Side
FCV - Pin 6	VPWR - Pin 3

- **Is the resistance between 6 - 12 ohms?**

Yes	No
GO to **HV5**.	INSTALL a new cooling fan clutch. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HV5 CHECK THE COOLING FAN CLUTCH ACTUATOR VALVE SOLENOID RESISTANCE

- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Component Side	(-)
FCV - Pin 6	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HV6**.	INSTALL a new cooling fan clutch. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HV6 CHECK THE VPWR VOLTAGE TO THE COOLING FAN CLUTCH ACTUATOR VALVE SOLENOID

- Key ON, engine OFF.
- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
VPWR - Pin 3	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **HV7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HV7 CHECK THE FCV CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) PCM Connector, Harness Side
FCV - Pin 6	FCV

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HV8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HV8 CHECK THE FCV CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FCV - Pin 6	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HV9**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HV9 CHECK THE FCV CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) Cooling	

Fan Clutch Connector, Harness Side	(-)
FCV - Pin 6	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **HV19**.

HV10 CONTINUOUS MEMORY DTCS P0480 OR P0528: INTERMITTENT CHECK

NOTE: **Keep the coil arm of the cooling fan clutch secure while checking the wiring harness. If the coil arm rotates, faulty readings may occur.**

- Key ON, engine OFF.
- Access the PCM and monitor the FANSS PID.
- Access the PCM and monitor the FANVAR_F PID.
- While observing the PID wiggle, shake, and bend small sections of the wiring harness while working from the cooling fan clutch to the PCM.
- Check the cooling fan clutch and the PCM connectors for damage and corrosion.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary.	DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HV11 KOEO AND KOER DTC P0528: CHECK THE VOLTAGE AND GROUND TO THE FSS SENSOR

- Cooling Fan Clutch connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) Cooling Fan Clutch Connector, Harness Side
VBPWR - Pin 2	PWRGND - Pin 5

- **Is the voltage greater than 10 V?**

Yes	No
GO to **HV15**.	GO to **HV12**.

HV12 CHECK THE VOLTAGE TO THE FSS SENSOR

- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
VBPWR - Pin 2	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **HV14**.	GO to **HV13**.

HV13 CHECK THE VOLTAGE CIRCUIT TO THE FSS SENSOR FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) PCM Connector, Harness Side
VBPWR - Pin 2	VBPWR

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HV19**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HV14 CHECK THE GROUND CIRCUIT TO THE FSS SENSOR FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) PCM Connector, Harness Side
PWRGND - Pin 5	PWRGND

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HV19**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HV15 CHECK THE FSS CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) PCM Connector, Harness Side
FSS - Pin 4	FSS

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HV16**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HV16 CHECK THE FSS CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FSS - Pin 4	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No

GO to **HV17**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HV17 CHECK THE FSS CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FSS - Pin 4	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **HV18**.

HV18 CHECK THE FUNCTIONALITY OF THE FSS CIRCUIT

- Key in OFF position.
- PCM connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FSS - Pin 4	Ground

- **Is the voltage greater than 10 V?**

Yes	No
INSTALL a new cooling fan clutch. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HV19**.

HV19 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:

- pushed out pins
- corrosion

- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HX: EVAPORATIVE EMISSION (EVAP) SYSTEM AND MONITOR

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

WARNING: **Before repairing or installing a new component in the fuel system, reduce the possibility of injury or fire by following the warning, caution, and handling directions in pinpoint test HC. Failure to follow these instructions may result in personal injury.**

NOTE: **Use this pinpoint test only when directed here.**

The use of a soap solution around the fuel filler cap or capless fuel tank filler pipe (if equipped) or the use of the hydrocarbon emission analyzer to determine an evaporative emission system leak is not recommended. The mandatory Rotunda Evaporative Emission System Leak Tester for On Board Diagnostic (OBD) (including the ultrasonic tester) and the Rotunda Vacutec 522 Leak Detector Smoke Machine are the only devices to be used at this time for evaporative emission system leak detection.

When using the smoke machine, the fuel level in the fuel tank must be less than 85% full.

This pinpoint test is intended to diagnose the following:

- canister vent (CV) solenoid (9F945)
- fuel filler cap (9030)
- capless fuel tank filler pipe (9034)
- fuel tank pressure (FTP) sensor (9C052)

- EVAP canister purge (EVAPCP) valve (9C915). Also known as the vapor management valve (VMV).
- EVAP system leaks using the Rotunda Vacutec Leak Detector Smoke Machine.
- harness circuits: B+, CV, EVAPCP, FTP, FTPREF, SIGRTN, VPWR, VREF and CASE GND
- powertrain control module (PCM) (12A650)

For additional information on the EVAP system, refer to**EVAPORATIVE EMISSION (EVAP) SYSTEMS** , or the **EVAPORATIVE EMISSIONS -- E-SERIES** .

For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, KAPWR provides voltage to the CV solenoid instead of VPWR.

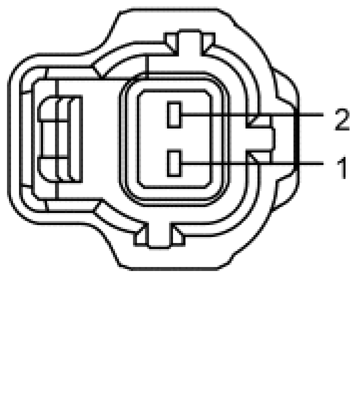

Fig. 144: Canister Vent (CV) Solenoid Connector - A
Courtesy of FORD MOTOR CO.

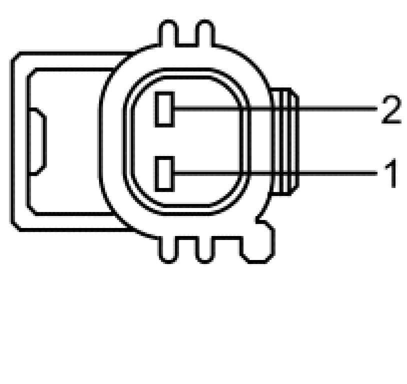

Fig. 145: Canister Vent (CV) Solenoid Connector - B

Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner, Explorer, Explorer Sport Trac, Mountaineer	A	2 1	KAPWR CANV
Mustang	B	2 1	CANV VPWR
All other vehicles	A	1 2	KAPWR CANV

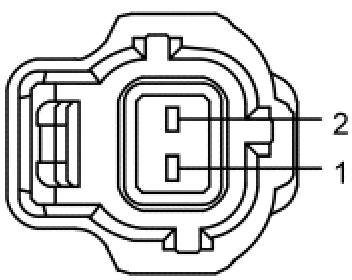

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Fig. 146: EVAP Canister Purge (EVAPCP) Valve Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	EVAPCP (EVAP Canister Purge)
1	VPWR (Vehicle Power)

For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, FTPREF provides voltage to the FTP sensor instead of VREF.

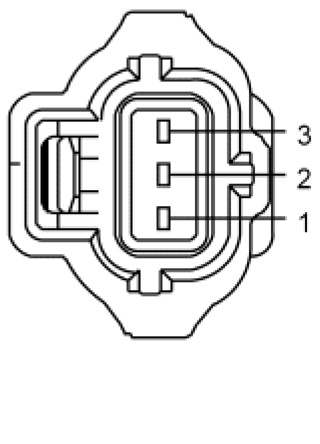

Fig. 147: Fuel Tank Pressure (FTP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

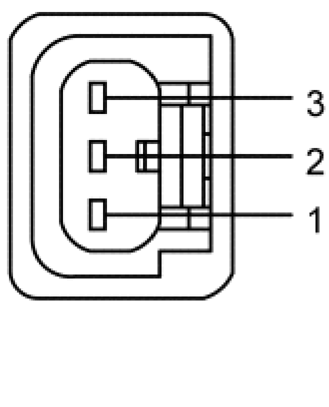

Fig. 148: Fuel Tank Pressure (FTP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series tank design, F-Super Duty tank design	A	3 1 2	FTP FTPREF SIGRTN
Mustang	B	3 2 1	FTP SIGRTN VREF
All other vehicles	B	3 1 2	FTP FTPREF SIGRTN

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series, F-Super Duty	170 Pin	B13 B3 B40 B41 B40 E1	CANV FTP FTPREF SIGRTN VREF EVAPCP
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B61 B44 B29 B58 B29, B64 B50	CANV FTP FTPREF SIGRTN VREF EVAPCP
Escape/Mariner	150 (50-50-50) Pin	B13 B9 B40 B41 B40 B34	CANV FTP FTPREF SIGRTN VREF EVAPCP
Expedition, Navigator	140 Pin	B61 B44 B29 B58 E57 B50	CANV FTP FTPREF SIGRTN VREF EVAPCP
F-150, Mark LT	190 Pin	B61 B44 B65 B58 B29 B50	CANV FTP FTPREF SIGRTN VREF EVAPCP
Focus	190 Pin	B20 B65 B66 B58 B52, B66 B55	CANV FTP FTPREF SIGRTN VREF EVAPCP
Fusion, Milan, MKZ	140 Pin	B61 B44 B29 B58 B33 B4	CANV FTP FTPREF SIGRTN VREF EVAPCP
Mustang	170 Pin	B13	CANV

		B3 B41 B40 E6	FTP SIGRTN VREF EVAPCP
All other vehicles	170 Pin	B13 B3 B40 B41 B40 E6	CANV FTP FTPREF SIGRTN VREF EVAPCP

HX1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0442, P0443, P0446, P0451, P0452, P0453, P0455, P0456, P0457, P0460, P0461, P0462, P0463, P144A, P1450, P1451, or P260F present?**

Yes	No
For DTCs P0442 or P0456, GO to **HX46**. For DTC P0443, GO to **HX2**. For DTCs P0446 or P1451, GO to **HX30**. For DTC P0451, GO to **HX39**. For DTC P0452, GO to **HX18**. For DTC P0453, GO to **HX23**. For DTCs P0455 or P0457, GO to **HX40**. For DTC P0460, GO to **HX38**. For DTCs P0461 through P0463, GO to **HX36**. For DTC P144A, GO to **HX49**. For DTC P1450, GO to **HX8**. For DTC P260F, GO to **HX50**.	For symptoms without DTCs, GO to **HX13**. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HX2 DTC P0443: CHECK THE PCM OUTPUT TO EVAP CANISTER PURGE VALVE

- Key in OFF position.
- EVAPCP Valve connector disconnected.
- Connect a non-powered test lamp between:

(+) EVAPCP Valve Connector, Harness Side	(-) EVAPCP Valve Connector, Harness Side
VPWR - Pin 1	EVAPCP - Pin 2

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .

- Command the outputs ON.
- Command the outputs OFF.
- Exit output test mode.
- **Does the test lamp turn on and off when the output(s) is commanded on and off?**

Yes	No
GO to **HX3**.	GO to **HX4**.

HX3 CHECK THE EVAP CANISTER PURGE VALVE SOLENOID RESISTANCE

- Key in OFF position.
- EVAPCP Valve connector disconnected.
- Measure the resistance between:

(+) EVAPCP Valve Connector, Component Side	(-) EVAPCP Valve Connector, Component Side
EVAPCP - Pin 2	VPWR - Pin 1

- **Is the resistance between 2.5 - 7 ohms?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	INSTALL a new EVAPCP valve. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HX4 CHECK THE VPWR VOLTAGE TO THE EVAP CANISTER PURGE VALVE

- Key ON, engine OFF.
- Measure the voltage between:

(+) EVAPCP Valve Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 1	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to **HX5**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX5 CHECK THE EVAP CANISTER PURGE VALVE CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) EVAPCP Valve Connector, Harness Side
EVAPCP	EVAPCP - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HX6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX6 CHECK THE EVAP CANISTER PURGE VALVE CIRCUIT FOR A SHORT TO PWRGND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
EVAPCP	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HX7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX7 CHECK THE EVAP CANISTER PURGE VALVE CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) EVAPCP Valve Connector, Harness Side	(-)
EVAPCP - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **HX54**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX8 DTC P1450: CHECK FOR VISUAL CAUSES OF EXCESSIVE FUEL TANK VACUUM

NOTE: **If the CV solenoid and the fuel tank assemblies are not accessible during this step, refer to the EVAPORATIVE EMISSIONS -- E-SERIES and FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES for removal instructions.**

- Check for kinks or bends in the fuel vapor hoses/tubes (EVAPCP outlet tube and EVAP canister tube).
- Visually inspect the EVAP canister inlet port, CV solenoid filter, and canister vent hose assembly for contamination or debris.
- Check the CV solenoid filter for blockage or contamination.
- **Is a concern present?**

Yes	No
REMOVE any contamination or debris around the fuel vapor hose/tubes and CV solenoid assembly. REMOVE kinks or bends in the EVAPCP outlet tube, EVAP canister tube, and canister vent hose assembly. CLEAR the DTCs. For repair verification, CARRY OUT the evaporative emission leak check monitor repair verification drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	GO to **HX9**.

HX9 CHECK THE FTP SENSOR VOLTAGE WITH THE FUEL FILLER CAP REMOVED OR THE CAPLESS FUEL TANK FILLER PIPE OPENED

NOTE: **For vehicles with a capless fuel filler pipe, instead of removing the fuel filler cap, install the supplemental refueling adaptor provided with the vehicle to open the capless fuel tank filler pipe.**

- Remove the fuel filler cap.

- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the voltage between 2.4 - 2.8 V?**

Yes	No
GO to **HX13**.	GO to **HX10**.

HX10 CHECK FOR ANY OTHER DTCS

- Check for other 3-wire sensor DTCs (KOEO, KOER, or continuous memory) present with the DTC P1450.
- **Are any other DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **HX11**.

HX11 CHECK THE VOLTAGE TO THE FTP SENSOR

- Key in OFF position.
- FTP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF	SIGRTN
FTPREF	SIGRTN

- **Are the voltages between 4 - 6 V?**

Yes	No
INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. CLEAR the DTCs. For repair verification, CARRY OUT the evaporative emission leak check monitor repair	GO to **HX12**.

verification drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	

HX12 CHECK THE FTPREF OR VREF AND SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF	VREF
SIGRTN	SIGRTN
FTPREF	FTPREF

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **HX54**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX13 CHECK IF THE ENGINE IDLES

- Key ON, engine running.
- **Does the engine stall or is it unable to maintain idle?**

Yes	No
GO to **HX14**.	GO to **HX15**.

HX14 CHECK THE EVAP SYSTEM FOR A STUCK OPEN VALVE

- Key in OFF position.
- Disconnect the fuel vapor to intake manifold line at the EVAPCP valve and cap the line at the EVAPCP valve.
- Key ON, engine running.
- **Does the engine stall or is it unable to maintain idle?**

Yes	No
The EVAP system is not the cause of the symptom. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	INSTALL a new EVAPCP valve. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HX15 CHECK FOR BLOCKAGE IN THE FUEL TANK VENT SYSTEM

NOTE: The CV is normally open and venting to the atmosphere.

- Access the PCM and monitor the EVMV PID.
- Access the PCM and monitor the FTP PID.
- Access the PCM and monitor the EVAPCV PID.
- While monitoring the FTP PID, ramp open the EVAPCP valve by incrementally commanding the EVMV PID to a 1,000 mA.
- **Does the FTP sensor voltage drop below 2 volts when the EVAPCP valve is commanded fully open?**

Yes	No
CHECK for blockage in the vapor line to the CV solenoid. CHECK the CV solenoid filter for blockage or contamination. CHECK the carbon canister for blockage. If OK, INSTALL a new CV solenoid. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HX16**.

HX16 CHECK THE EVAP SYSTEM FOR A STUCK OPEN VALVE

- Key ON, engine running.
- Access the PCM and control the EVMV PID.
- Close the EVAPCP by commanding the EVMV PID to 0 mA.
- Access the PCM and control the EVAPCV PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- **Does the FTPV PID decrease, the engine RPM change, or the engine stall, as an indication that the EVAPCP valve is stuck open?**

Yes	No
INSTALL a new EVAPCP valve. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HX17**.

HX17 EVAP CANISTER PURGE VALVE TEST

- Key ON, engine running.
- Access the PCM and control the EVAPCV PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- Access the PCM and control the EVMV PID.
- While monitoring the FTP PID, ramp open the EVAPCP valve by incrementally commanding the EVMV

PID to a 1,000 mA.

- **Does the FTP PID decrease, the engine RPM change, or the engine stall as an indication that the EVAPCP valve is opening?**

Yes	No
For DTC P1450, unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**. For all others, CHECK the EVAP system for leaks.	CHECK for blockages between the fuel tank, the EVAPCP valve, and the engine intake manifold. CHECK for obstructions in the EVAPCP valve diaphragm and ports. If OK, INSTALL a new EVAPCP valve. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HX18 DTC P0452: CHECK FOR FUEL TANK PRESSURE SENSOR CONNECTOR CONTAMINATION

- Key in OFF position.
- Visually check for liquid fuel contamination of the FTP sensor electrical connector.
- Check for a completely submerged FTP sensor (tank-mounted type only) in the liquid fuel. This can affect the correct FTP voltage reading.
- **Does the FTP sensor and its connector show any signs of fuel contamination?**

Yes	No
REPAIR as necessary. ADJUST the fuel tank overfill. CLEAR the DTCs. REPEAT the self-test.	GO to **HX19**.

HX19 CHECK FOR LOW FTP SENSOR VOLTAGE

NOTE: The FTP sensor voltage with no pressure/vacuum on the fuel tank is between 2.4 and 2.8 volts.

- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the voltage less than 0.22 V?**

Yes	No
GO to **HX20**.	The concern that produced the DTC P0452 is intermittent. refer to **PINPOINT TEST Z**.

HX20 CHECK THE OPPOSITE INDUCED HIGH FTP SENSOR SIGNAL

- Key in OFF position.
- FTP Sensor connector disconnected.

- Connect a 5 amp fused jumper wire between the following:

Point A FTP Sensor Connector, Harness Side	Point B FTP Sensor Connector, Harness Side
VREF	FTP

- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the voltage between 4 - 6 V?**

Yes	No
INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. CLEAR the DTCs. REPEAT the self-test.	GO to **HX21**.

HX21 CHECK THE VREF VOLTAGE TO THE FTP SENSOR

- Remove the jumper wire(s).
- Key ON, engine OFF.
- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to **HX22**.	refer to **PINPOINT TEST C**.

HX22 CHECK THE FTP CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM	(-) PCM

Connector, Harness Side	Connector, Harness Side
FTP	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
FTP	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HX54**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX23 DTC P0453: CHECK FOR HIGH FTP SENSOR VOLTAGE

NOTE: **The FTP sensor voltage with no pressure/vacuum on the fuel tank is between 2.4 and 2.8 volts.**

- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the voltage greater than 4.5 V?**

Yes	No
GO to **HX24**.	The concern that produced the DTC P0453 is intermittent. refer to **PINPOINT TEST Z**.

HX24 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE FTP SENSOR VEHICLE HARNESS CONNECTOR

- Key in OFF position.
- FTP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FTP Sensor Connector,	(-) FTP Sensor Connector,

Harness Side	Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to **HX25**.	refer to **PINPOINT TEST C**.

HX25 CHECK THE FTP CIRCUIT FOR A SHORT TO VOLTAGE

- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) Vehicle Battery
FTP	Negative terminal

- **Is the voltage less than 10 V?**

Yes	No
GO to **HX27**.	GO to **HX26**.

HX26 CHECK THE FTP CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
FTP	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **HX54**.

HX27 CHECK THE FTP CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
FTP	FTP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HX28**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX28 CHECK THE FTP CIRCUIT FOR A SHORT TO VREF

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	FTP

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HX29**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX29 CHECK THE OPPOSITE INDUCED LOW FTP SIGNAL

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A FTP Sensor Connector, Harness Side	Point B FTP Sensor Connector, Harness Side
FTP	SIGRTN

- Key ON, engine OFF.

- Access the PCM and monitor the FTP PID.
- **Is the voltage less than 0.1 V?**

Yes	No
INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. CLEAR the DTCs. REPEAT the self-test.	GO to **HX54**.

HX30 DTCS P0446 OR P1451: CHECK THE PCM OUTPUT TO THE CV SOLENOID

NOTE: **For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, KAPWR provides voltage to the CV solenoid instead of VPWR.**

- Key in OFF position.
- CV Solenoid connector disconnected.
- Connect a non-powered test lamp between:

(+) CV Solenoid Connector, Harness Side	(-) CV Solenoid Connector, Harness Side
VPWR	CANV
KAPWR	CANV

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Command the outputs OFF.
- Exit output test mode.
- **Does the test lamp turn on and off when the output(s) is commanded on and off?**

Yes	No
GO to **HX31**.	GO to **HX32**.

HX31 CHECK THE CV SOLENOID RESISTANCE

NOTE: **For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, KAPWR provides voltage to the CV solenoid instead of VPWR.**

- Key in OFF position.

- Measure the resistance between:

(+) CV Solenoid Connector, Component Side	(-) CV Solenoid Connector, Component Side
KAPWR	CANV
VPWR	CANV

- **Are the resistances between 48 - 65 ohms?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	INSTALL a new CV solenoid. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HX32 CHECK THE VPWR VOLTAGE TO THE CV SOLENOID

NOTE: For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, KAPWR provides voltage to the CV solenoid instead of VPWR.

- Measure the voltage between:

(+) CV Solenoid Connector, Harness Side	(-)
KAPWR	Ground
VPWR	Ground

- **Are the voltages greater than 10 V?**

Yes	No
GO to **HX33**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX33 CHECK THE CANV CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CV Solenoid Connector, Harness Side
CANV	CANV

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HX34**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX34 CHECK THE CANV CIRCUIT FOR A SHORT TO PWRGND IN THE HARNESS

- Measure the resistance between:

(+) CV Solenoid Connector, Harness Side	(-) Vehicle Battery
CANV	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HX35**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX35 CHECK THE CANV CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) CV Solenoid Connector, Harness Side	(-)
CANV	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **HX54**.	REPAIR the short circuit. CLEAR the DTCs.

	REPEAT the self-test.

HX36 DTCS P0461, P0462 AND P0463: CHECK THE INSTRUMENT CLUSTER (IC) MODULE FOR DTCS

- Key ON, engine OFF.
- Carry out the IC self-test.
- **Are any DTCs present?**

Yes	No
REFER to the **INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES** to continue diagnosis.	GO to **HX37**.

HX37 CHECK THE FLI PID

- Key ON, engine running.
- Access the PCM and monitor the FLI PID.
- **Does the FLI PID match the fuel gauge?**

Yes	No
GO to **HX38**.	GO to **HX54**.

HX38 DTC P0460: CHECK FOR FUEL TANK FLOAT LEVEL RESPONSE

NOTE: **A dual-container (saddle type) fuel tank has 2 fuel level sensors. The FLI PID in the PCM is the average value of both fuel level sensors. Some dual-container tanks may require the fuel level to be greater 3/4 full before the fuel level equalizes.**

- Key ON, engine running.
- Access the PCM and monitor the FLI PID.
- Key in OFF position.
- If the fuel level is less than 1/4 (25% on FLI), add approximately 1/4 tank of fuel.
- If the fuel level is greater than 3/4 (75% on FLI), drain approximately 1/4 tank of fuel.
- Key ON, engine running.
- Access the PCM and monitor the FLI PID.
- **Does the FLI PID indicate a movement upward or downward as fuel is either added or drained?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	REFER to the **INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES** to diagnose the incorrect fuel gauge indication

	symptom.

HX39 DTC P0451: CHECK THE FTP SENSOR FOR CORRECT OPERATION

NOTE: For vehicles with a capless fuel filler pipe, instead of removing the fuel filler cap, install the supplemental refueling adaptor provided with the vehicle to open the capless fuel tank filler pipe.

- Key in OFF position.
- Remove the fuel filler cap.
- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the pressure between -0.42 and 0.42 kPa (-1.7 and 1.7 in-H2O)?**

Yes	No
CHECK for kinks or bends in the fuel vapor hoses/tubes between the fuel tank and dust separator. CHECK the EVAP canister ports and canister vent hose assembly for contamination or debris. CHECK the dust separator for blockage. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. CLEAR the DTCs. REPEAT the self-test.

HX40 DTCS P0455 OR P0457: CHECK THE FUEL FILLER CAP OF CAPLESS FUEL TANK FILLER PIPE

NOTE: If the fuel filler cap or capless fuel tank filler pipe is suspected as an EVAP leak source during visual inspection, do not disturb the fuel filler cap or capless fuel tank filler pipe until the repair verification method is complete. If the repair verification method fails, reposition or install a new fuel filler cap and repeat the test. For vehicles with a capless fuel tank filler pipe, install and remove the supplemental refueling adaptor provided with the vehicle to reseal the capless fuel tank filler pipe and repeat the test. This action isolates the fuel filler cap or capless fuel tank filler pipe from the rest of the EVAP system as a potential concern.

- For vehicles with a fuel filler cap, visually inspect the fuel filler cap without initially disturbing it.
  - Verify the fuel filler cap tether is visible and free to move.
  - Check for missing or loose fuel filler cap.
  - Check the fuel filler cap for damage.
- For vehicles with a capless fuel tank filler pipe, visually inspect the capless fuel tank filler pipe inlet without initially disturbing it.
  - Check the capless fuel tank filler pipe inlet for an obstruction that prevents it from sealing.
  - Check the capless fuel tank filler pipe for damage.

- **Is a concern present?**

Yes	No
For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. REPAIR as necessary. GO to **HX46**.	GO to **HX41**.

HX41 CHECK FOR FLI DTCS

- Key ON, engine OFF.
- Carry out the self-test.
- **Are DTCs P0460, P0461, P0462 or P0463 present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **HX42**.

HX42 CHECK THE OPERATION OF THE FUEL GAUGE

NOTE: A fuel gauge that always indicates a fuel level less than a 1/2 tank or always a full tank, may be caused by a fuel level input (FLI) concern.

- Check operation of the fuel gauge.
- **Is the fuel gauge functioning properly?**

Yes	No
GO to **HX43**.	CHECK the functionality of the FLI circuit. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.

HX43 EVAPORATIVE EMISSION SYSTEM VISUAL INSPECTION

- Key in OFF position.
- Visually inspect for:
  - EVAP system lines/hoses (check for proper connections, damage or blockage)
  - loose fuel vapor hose/tube connections to the EVAP system components
  - blocked vacuum hose between the EVAPCP valve and the engine intake manifold
  - damaged fuel tank or fuel filler pipe
- **Are there any concerns found during the visual inspection?**

Yes	No
REPAIR as necessary. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to **HX46**.	GO to **HX44**.

HX44 CHECK THE FTP SENSOR VOLTAGE WITH THE FUEL FILLER CAP REMOVED OR THE CAPLESS FUEL TANK FILLER PIPE OPENED

NOTE: For vehicles with a capless fuel filler pipe, instead of removing the fuel filler cap, install the supplemental refueling adaptor provided with the vehicle to open the capless fuel tank filler pipe.

- Remove the fuel filler cap.
- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the voltage between 2.4 - 2.8 V?**

Yes	No
GO to **HX45**.	INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. REPEAT the test and VERIFY the results. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to **HX46**.

HX45 EVAP CANISTER PURGE VALVE TEST

- Key in OFF position.
- Install the fuel filler cap or remove the supplemental refueling adaptor.
- Key ON, engine running.
- Access the PCM and monitor the EVAPCV PID.
- Access the PCM and monitor the EVMV PID.
- Access the PCM and monitor the FTP PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- While monitoring the FTP PID, ramp open the EVAPCP valve by incrementally commanding the EVMV PID to a 1,000 mA.
- **Does the FTP PID decrease, the engine RPM change, or the engine stall as an indication that the EVAPCP valve is opening?**

Yes	No
GO to **HX46**.	INSTALL a new EVAPCP valve. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . REPEAT the test and VERIFY the results. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to **HX46**.

HX46 DTCS P0442 OR P0456: HOOK UP THE SMOKE MACHINE (ROTUNDA VACUTEC)

NOTE: Removing the Schrader valve from the test port permanently damages the valve.

NOTE: The smoke and air flow from the smoke machine will not pass through liquid fuel. Liquid fuel may be present in the fuel tank filler pipe.

NOTE: Some vehicles are not equipped with an evaporative emission test port. Use a suitable hose adapter in the following diagnostic procedures.

- Key in OFF position.
- Connect the smoke machine power cables to the vehicle battery. Check to see that the smoke machine power indicator lamp is on, indicating a good battery contact.
- For vehicles not equipped with an evaporative emission test port:
  - Disconnect the fuel vapor to intake manifold line at the EVAPCP valve and cap the line.
  - Connect a suitable hose adapter to the fuel vapor to intake manifold connection at the EVAPCP valve.
- For vehicles equipped with an evaporative emission test port:
  - Locate the evaporative emission test port and remove the green cap. The cap is located on or close to the EVAPCP valve.
  - Install the EVAP test port adapter (provided with the Vacutec Smoke Machine) to the test port.
- **Is the smoke machine hook up complete?**

Yes	No
For leak detection, GO to **HX47**. For leak repair verification, GO to **HX48**.	REFER to the smoke machine operator article for additional instructions and for helpful tips.

HX47 CARRY OUT SMOKE MACHINE PHASE 2 - LEAK DETECTION SMOKE TEST

NOTE: If the leak is not detected from the top, check the EVAP system for leaks from under the vehicle.

- **Check the EVAP hoses, EVAPCP valve, CV solenoid, EVAP canister, fuel**

tank, fuel filler pipe, around the fuel tank area, and at the fuel filler cap or capless fuel tank filler pipe inlet.

- **Wiggle the components and connections to simulate road bumps while looking for signs of leaking smoke.**

If the leak is in the fuel tank filler pipe between the check valve and the fuel filler cap or capless fuel tank filler pipe inlet, smoke under pressure may not reach the leak. If leaking smoke is not found, a thorough visual inspection of the fuel tank filler pipe and fuel filler cap or capless fuel tank filler pipe inlet should be done.

- Set the smoke machine to SMOKE.
- Remove the fuel filler cap or install the supplemental refueling adaptor.
- Connect the smoke supply hose nozzle tip into the EVAP service port or suitable hose adapter.
- Key ON, engine OFF.
- Access the PCM and control the EVAPCV PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- For vehicles not equipped with an evaporative emission test port:
  - Start the smoke machine and verify the connection at the EVAPCP valve is correct and not leaking
  - Open the EVAPCP valve by commanding the EVMV PID to 1,000 mA
- Start the smoke machine. If smoke does not exit the fuel tank filler pipe after the system is pressurized, command the EVAPCV PID open to allow air to purge the CV solenoid. Once smoke is seen at the CV solenoid, command the EVAPCV PID close.
  - Install the fuel filler cap or remove the supplemental refueling adaptor once smoke is observed exiting the fuel tank neck area.
  - Continue to smoke the system for 60 seconds to obtain pressure.
  - Press and release the remote starter button in intervals of approximately 15 seconds on and 15 seconds off while checking for exiting smoke.
  - Use the halogen spotlight provided with the smoke machine to follow the EVAP system path and look for smoke exiting at the source of the leak(s).
- **Is the source of the EVAP leak located?**

Yes	No
REPAIR as necessary. CONNECT all the disconnected components. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to **HX48**.	The test passed. CONNECT all the disconnected components. CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to **HX48**.

HX48 CARRY OUT THE SMOKE MACHINE PHASE 1 - LEAK VERIFICATION PRESSURE TEST

- Position the control lever located on the smoke machine to METER.
- Calibrate the smoke machine flow meter using the 0.020 (DTC P0456) or 0.040 (DTC P0442) standard as follows:
  - Insert the air supply hose (transparent hose) nozzle tip into the appropriate EVAP system standard located on the front of the smoke machine.
  - Press the remote starter button on the smoke machine. Observe the position of the flow meter indicator ball.
  - Position the flow meter red pointer flag so that it aligns with the measurement of the indicator ball.
  - Release the button and remove the air supply hose nozzle tip from the EVAP system standard.
- Connect the air supply hose (transparent hose) nozzle tip into the EVAP test port or suitable hose adapter.
- Key ON, engine OFF.
- Access the PCM and control the EVAPCV PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- For vehicles not equipped with an evaporative emission test port, open the EVAPCP valve by commanding the EVMV PID to 1,000 mA.
- Press the remote starter button on the smoke machine. Notice that the ball in the flow meter is all the way at the top. This indicates the system is being pressurized.
- Continue to press the remote starter button until the ball stops descending. Once the ball stops descending, observe if it is above or below the red pointer flag. If the measurement is below the indicator flag, the system has passed the pressure test. If the measurement is above the indicator flag, the EVAP system has an unacceptable leak.
- **Does the EVAP system pass the smoke machine leak verification pressure test?**

Yes	No
The test passed and no concerns are present. CLEAR the DTCs. REPEAT the self-test.	GO to **HX47**.

HX49 DTC P144A: CHECK FOR A BLOCKED FUEL VAPOR TUBE BETWEEN THE FTP SENSOR AND THE FUEL TANK

- Key in OFF position.
- Remove the fuel vapor tube assembly. Refer to the **EVAPORATIVE EMISSIONS -- E-SERIES** .
- Visually inspect the fuel vapor tube for a blockage between the FTP sensor and the connection to the fuel tank or fuel pump module.
- Visually inspect the connection at the fuel tank or fuel pump module for a blockage.
- Attempt to manually remove the blockage.
- **Is the blockage visible and can be removed?**

Yes	No
REMOVE the blockage. INSTALL the Fuel Vapor Tube assembly. REFER to the **EVAPORATIVE**	INSTALL a new Fuel Vapor Tube assembly. REFER to the **EVAPORATIVE EMISSIONS --**

EMISSIONS -- E-SERIES . CLEAR the DTCs. REPEAT the self-test.	**E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HX50 DTC P260F: CHECK FOR THE PRESENCE OF ANY MODULE COMMUNICATION CONCERNS

- Key ON, engine OFF.
- Check for self-test DTCs in all of the vehicle modules.
- **Are any communication concerns or communication DTCs present?**

Yes	No
For communication concerns in the PCM, DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** . For communication concerns in other modules, REFER to the applicable Workshop article part to diagnose the communication DTC.	GO to **HX51**.

HX51 CHECK THE PERFORMANCE OF THE PROCESSOR

- Key in OFF position.
- Disconnect the battery and wait for 1 minute. Refer to the **BATTERY, MOUNTING AND CABLES -- E-SERIES** .
- Connect the battery.
- Key ON, engine running.
- Allow the engine idle to stabilize.
- Access the PCM and monitor the FTP PID.
- **Is the pressure equal to 0 kPa (0 psi)?**

Yes	No
GO to **HX53**.	GO to **HX52**.

HX52 CHECK FOR SELF-TEST DTC P260F

- Idle the engine for 2 minutes.
- Carry out the self-test.
- **Is DTC P260F present?**

Yes	No
GO to **HX53**.	RETURN the vehicle to the customer.

HX53 CHECK THE PCM FOR THE LATEST CALIBRATION

- Program the PCM to the latest calibration.
- Key ON, engine running.
- Idle the engine for 2 minutes.
- Carry out the self-test.
- **Is DTC P260F present?**

Yes	No
GO to **HX54**.	RETURN the vehicle to the customer.

HX54 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HY: GENERATOR/REGULATOR SYSTEM

This pinpoint test is intended to diagnose the following:

- generator/regulator (10346)
- powertrain control module (PCM) (12A650)

HY1 CHECK THE GENERATOR CIRCUITRY AND OPERATION

NOTE: If the concern is still present after checking the generator circuitry in the workshop article, return to the PC/ED to continue generator diagnosis.

- Check for any generator related DTCs. Refer to the **GENERATOR AND REGULATOR -- E-SERIES** to diagnose any generator related DTCs.
- **Is the charging system diagnosed and repaired in the GENERATOR AND REGULATOR -- E-SERIES ?**

Yes	No
The system is operating correctly at this time.	GO to **HY2**.

HY2 CHECK THE GENERATOR MONITOR SIGNAL

- Key ON, engine running.
- Access the PCM and monitor the GENMON PID.
- **Is the duty cycle between 5% and 97% and not excessively fluctuating?**

Yes	No
The system is operating correctly at this time.	GO to **HY3**.

HY3 CHECK FOR CORRECT PCM OPERATION

NOTE: **When the battery (or PCM) is disconnected and connected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The charging system set point may also vary. The vehicle may need to be driven to relearn its strategy.**

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST JB: SECONDARY IGNITION (COP)

NOTE: **A malfunctioning ignition system may cause high catalyst temperatures. Check the components next to the catalyst and muffler for heat damage.**

This pinpoint test is intended to diagnose the following:

- spark plugs (12405)
- secondary side of the coil

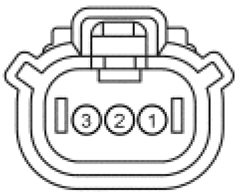

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Fig. 149: Coil On Plug (COP) Connector - A
Courtesy of FORD MOTOR CO.

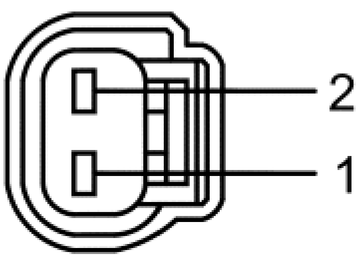

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Fig. 150: Coil On Plug (COP) Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, MKX, MKZ, Taurus, Taurus X, Sable	A	3	IGN START/RUN
Escape/Mariner, Focus, Fusion, Milan, Mustang 5.4L	B	2	IGN START/RUN
All other vehicles	B	1	IGN START/RUN

Vehicle	Firing Order for Coil On Plug Applications

BASE, 4-cylinder applications	1 3 4 2
BASE, 6-cylinder applications	1 4 2 5 3 6
BASE, 8-cylinder applications	1 3 7 2 6 5 4 8
BASE, 10-cylinder applications	1 6 5 10 2 7 3 8 4 9

JB1 CHECK FOR DTCS

- **Are DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, P0310, or P050B present?**

Yes	No
For DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, P0310 or P0316, GO to **JB3**. For DTC P050B, GO to **JB13**.	For symptoms without DTCs, GO to **JB2**. For all other DTCs, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

JB2 VISUAL INSPECTION OF THE IGNITION SYSTEM

- Visually inspect the engine compartment to make sure all coils are properly and securely connected.
- Examine all the wiring harnesses and connectors for damaged, burned, or overheated insulation, and loose or broken conditions.
- Make sure the vehicle battery is in good condition and all of the accessories are turned off.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **JB3**.

JB3 DTC P0301 THROUGH P0310: MISFIRE ON CYLINDERS 1 THROUGH 10

- **Are DTCs P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, or P0310 present?**

Yes	No
For Edge, Escape/Mariner 3.0L, Explorer 4.6L, Explorer Sport Trac 4.6L, F-150 4.6L, F-150 5.4L, Fusion, Milan, MKX, Sable, Taurus, and	GO to **JB6**.

Taurus X, GO to **JB4**. For all others, GO to **JB5**.	

JB4 CHECK SPARK DURATION RELATIVENESS

- Monitor the spark duration PIDs.
- **Are the PIDs relative to each other?**

Yes	No
GO to **JB10**.	INSPECT the coil boot(s) for the missing cylinder (s). INSTALL a new coil boot(s) if necessary. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** , Spark Plugs, and INSPECT the spark plug(s) for the missing cylinder (s). MEASURE the resistance of the spark plug(s). INSTALL a new spark plug(s) if the resistance is lower than 2,000 ohms or higher than 20,000 ohms. If the coil boot(s) and spark plugs are OK, INSTALL a new COP(s) for the missing cylinders. CLEAR the DTCs. REPEAT the self-test.

JB5 CHECK FOR SPARK AT THE CYLINDER(S) INDICATED BY THE DTC(S)

- Key in OFF position.
- Disconnect the ignition coil(s) from the spark plug(s).
- Connect the Air Gap spark tester 303-D037 (D81P-6666-A) or its equivalent to the suspect coil.
- Crank the engine while the accelerator pedal is fully applied.
- Observe the spark tester while cranking the engine.
- **Is a bluish-white spark present?**

Yes	No
GO to **JB8**.	INSPECT the coil boot(s) for the missing cylinder (s). INSTALL a new coil boot(s) if necessary. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** , Spark Plugs, and INSPECT the spark plug(s) for the missing cylinder (s). MEASURE the resistance of the spark plug(s). INSTALL a new spark plug(s) if the resistance is lower than 2,000 ohms or higher than 20,000 ohms. GO to JB7.

JB6 CHECK FOR SPARK AT ALL CYLINDERS

- Key in OFF position.

- Disconnect the ignition coil(s) from the spark plug(s).
- Connect the Air Gap spark tester 303-D037 (D81P-6666-A) or its equivalent to the suspect coil.
- Crank the engine while the accelerator pedal is fully applied.
- Observe the spark tester at each cylinder while cranking the engine.
- **Is a bluish-white spark consistent between all cylinders?**

Yes	No
GO to **JB8**.	INSPECT the coil boot(s) for the missing cylinder (s). INSTALL a new coil boot(s) if necessary. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** , Spark Plugs, and INSPECT the spark plug(s) for the missing cylinder (s). MEASURE the resistance of the spark plug(s). INSTALL a new spark plug(s) if the resistance is lower than 2,000 ohms or higher than 20,000 ohms. RECORD the cylinder(s) with inconsistent spark. GO to **JB7**.

JB7 CHECK THE SECONDARY COIL RESISTANCE FOR THE MISSING CYLINDERS

- Key in OFF position.
- Suspect coil connector disconnected.
- Measure resistance between: Suspect coil connector, IGN START/RUN, component side and ignition coil spring, located in the ignition coil boot.
- **Is the resistance between 5,000 and 6,000 ohms?**

Yes	No
refer to **PINPOINT TEST Z**.	INSTALL a new COP. CLEAR the DTCs. REPEAT the self-test.

JB8 CHECK THE SPARK PLUGS

NOTE: To determine the condition of the spark plugs, refer to the ENGINE - 4.6L AND 5.4L -- E-SERIES and carry out the Spark Plug Inspection.

- Key in OFF position.
- Remove and inspect the plugs for damage, wear, carbon tracking or deposits and proper plug gap.
- **Are the plugs OK?**

Yes	No
GO to **JB9**.	REPAIR the plug(s). ADJUST the gap or INSTALL a new spark plug(s) as necessary. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V)**

	-- E-SERIES . CLEAR the DTCs. REPEAT the self-test.

JB9 CHECK THE SPARK PLUG RESISTANCE

- Measure the spark plug resistance.
- **Is the resistance between 2,000 and 20,000 ohms?**

Yes	No
For Edge, Escape/Mariner 3.0L, Explorer 4.6L, Explorer Sport Trac 4.6L, F-150 4.6L, F-150 5.4L, Fusion, Milan, MKX, Sable, Taurus, and Taurus X, GO to **JB14**. For all others, GO to **JB10**.	INSTALL a new spark plug. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

JB10 TEST DIRECTION FOR SYMPTOM CHARTS

- **Were you directed to this pinpoint test?**

Yes	No
RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	GO to **JB11**.

JB11 TEST DIRECTION FOR PINPOINT TEST HD

- **Were you directed to this pinpoint test from pinpoint test step HD6?**

Yes	No
GO to **HD7**.	GO to **JB12**.

JB12 TEST DIRECTION FOR PINPOINT TEST A

- **Were you directed to this pinpoint test from pinpoint test step A8?**

Yes	No
GO to **A9**.	The concern is intermittent. refer to **PINPOINT TEST Z**.

JB13 DTC P050B: COLD START PERFORMANCE

- **Are any other codes besides P050B present?**

Yes	No
REPAIR all other powertrain related diagnostic trouble codes (DTCs) first.	GO to **JB14**.

JB14 CHECK THE SPARK CAPTURE CIRCUIT

- Access the PCM and monitor the IGNPCM_F PID.
- **Is a concern indicated?**

Yes	No
GO to **JB16**.	GO to **JB15**.

JB15 CHECK THE IGNITION TIMING PID

- Access the PCM and monitor the IGNX_F PIDs.
- **Is a concern indicated?**

Yes	No
Visually inspect the COP harness for damage, exposed wiring, water contamination, corrosion, and correct assembly. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **JB16**.

JB16 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST JC: SECONDARY IGNITION (COIL PACK)

This pinpoint test is intended to diagnose the following:

- spark plugs (12405)
- spark plug wires (12280, 12281)

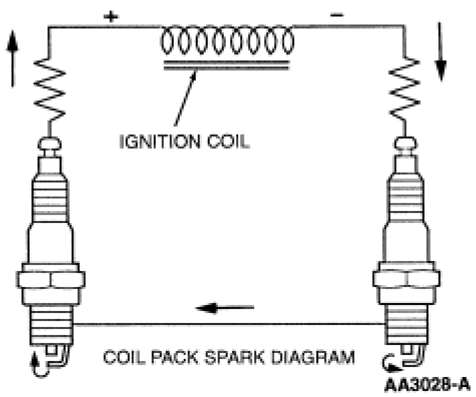

Fig. 151: Coil Pack Spark Diagram
Courtesy of FORD MOTOR CO.

Explorer 4.0L, Explorer Sport Trac 4.0L, F150 4.2L, Mountaineer 4.0L, Mustang 4.0L, Ranger.

JC1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306 or P050B present?**

Yes	No
For DTCs P0301, P0302, P0303, P0304, P0305 or P0306, GO to **JC13**. For DTC P0300, GO to **JC2**. For DTC P050B, GO to **JC18**.	For all other DTCs, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

JC2 VISUAL INSPECTION OF THE IGNITION SYSTEM

- Visually inspect the engine compartment to make sure all coils and spark plug wires are properly and securely connected.
- Examine all wiring harnesses and connectors for damaged, burned or overheated insulation and loose or broken conditions.
- Make sure the vehicle battery is in good condition and all accessories are turned off.
- **Is a concern present?**

Yes	No
REPAIR as necessary.	For a coil pack using an engine analyzer, GO to **JC3**.

CLEAR the DTCs. REPEAT the self-test.	For a coil pack not using an engine analyzer, GO to **JC12**.

JC3 CONNECT THE ENGINE ANALYZER

- Obtain an engine analyzer to diagnose concerns in the secondary side of the ignition system.
- **Is the engine analyzer connected?**

Yes	No
GO to **JC4**.	REPEAT Step JC2.

JC4 CHECK FOR THE IGNITION PATTERN

- Observe the pattern on a scope while cranking the engine.

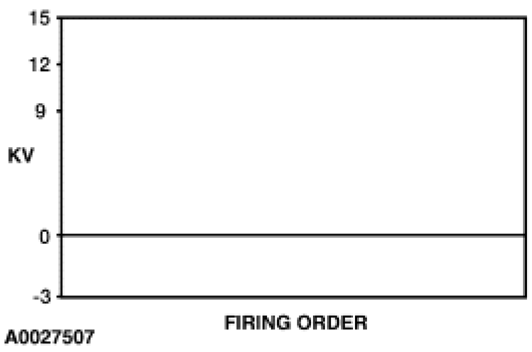

Fig. 152: Ignition Firing Pattern (No Spark)
Courtesy of FORD MOTOR CO.

- **Is the pattern flat, which indicates no spark on all cylinders?**

Yes	No
An IGN/START/RUN circuit concern. CHECK the condition of the related fuses/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the IGN START/RUN circuit for a short to ground. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **JC5**.

JC5 CHECK FOR A NORMAL IGNITION PATTERN

NOTE: Spark plugs may be fired more than once per combustion event. Multi-strike operating mode is RPM dependent.

- Key ON, engine running. If no start, crank the engine.

Fig. 153: Normal Ignition Firing Pattern
Courtesy of FORD MOTOR CO.

- **Are the patterns even and is the average value of spark plug firing voltage between 9 kV and 15 kV (higher during engine crank/no start)?**

Yes	No
refer to **PINPOINT TEST Z**.	GO to **JC6**.

JC6 IGNITION PATTERN EVALUATION

- **Is the ignition pattern normal?**

Yes	No
GO to **JC7**.	GO to **JC8**.

JC7 TEST DIRECTION

- **Were you directed to this pinpoint test from pinpoint test step A8?**

Yes	No
GO to **A9**.	GO to **JC8**.

JC8 CHECK FOR MISSING SPARK PATTERNS

- Observe for missing spark pattern.

Fig. 154: Identifying Missing Spark Pattern
Courtesy of FORD MOTOR CO.

- **Is the spark pattern inconsistent?**

Yes	No
INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire if the resistance is greater than 7,000 ohms per 30.5 cm (1 foot). REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test. GO to **JE2**.	GO to **JC9**.

JC9 CHECK FOR A HIGH SPARK PLUG FIRING VOLTAGE

- Observe for a high spark plug firing voltage.

Fig. 155: Identifying High Spark Plug Firing Voltage
Courtesy of FORD MOTOR CO.

- **Is the average value of the spark plug firing voltage greater than 15 Kv?**

Yes	No
INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark	

plug wires. INSTALL a new spark plug wire if the resistance is greater than 7,000 ohms per 30.5 cm (1 foot). REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **JC10**.

JC10 CHECK FOR LOW SPARK PLUG FIRING VOLTAGE

- Check the spark plug firing voltage average pattern.

Fig. 156: Identifying Low Spark Plug Firing Voltage Pattern
Courtesy of FORD MOTOR CO.

- **Is there consistently low spark plug firing voltage or sloping spark line on one or more cylinders?**

Yes	No
INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire if the resistance is greater than 7,000 ohms per 30.5 cm (1 foot). MEASURE the resistance of the spark plug (s). INSTALL a new spark plug(s) if the resistance is lower than 2,000 or higher than 20,000 ohms. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **JC11**.

JC11 CHECK FOR EVENESS BETWEEN CYLINDERS

- Check the spark plug firing voltage average pattern.

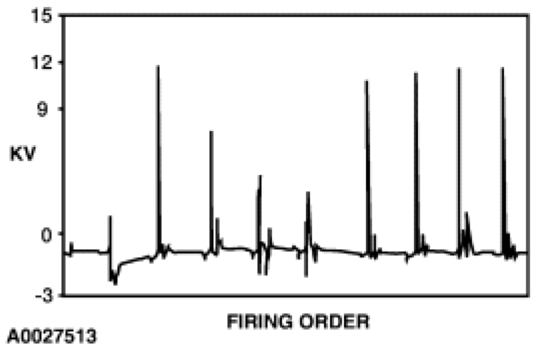

Fig. 157: Identifying Unevenness Between Cylinders Pattern
Courtesy of FORD MOTOR CO.

- **Is the evenness of spark plug firing voltage greater than 6 kV?**

Yes	No
INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire if the resistance is greater than 7,000 ohms per 30.5 cm (1 foot). CHECK for damaged spark plugs or narrow spark plug gaps. MEASURE the resistance of the spark plug(s). INSTALL a new spark plug(s) if the resistance is lower than 2,000 or higher than 20,000 ohms. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

JC12 DTCS P0301 THROUGH P0306: MISFIRE ON CYLINDERS 1 THROUGH 6

- **Are DTCs P0300, P0301, P0302, P0303, P0304, P0305, or P0306 present?**

Yes	No
GO to **JC13**.	GO to **JC14**.

JC13 CHECK FOR SPARK AT THE CYLINDER(S) INDICATED BY THE DTC(S)

- Key in OFF position.
- Disconnect the spark plug wire(s) from the spark plug(s).
- Connect the Air Gap spark tester 303-D037 (D81P-6666-A) or its equivalent to a spark plug wire.
- Crank the engine while the accelerator pedal is fully applied.
- Check for spark while cranking the engine.
- **Is the bluish-white spark present?**

Yes	No

GO to **JC16**.	INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire(s) if the resistance is greater than 7,000 ohms per 30.5 cm (1 foot). REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . If the spark plug wires are OK, GO to **JC15**.

JC14 CHECK FOR SPARK AT ALL CYLINDERS

- Key in OFF position.
- Disconnect the spark plug wire(s) from the spark plug(s).
- Connect the Air Gap spark tester 303-D037 (D81P-6666-A) or its equivalent to a spark plug wire.
- Crank the engine while the accelerator pedal is fully applied.
- Check for spark while cranking the engine.
- **Is the bluish-white spark present?**

Yes	No
GO to **JC16**.	INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire(s), if the resistance is greater than 7,000 ohms per 30.5 cm (1 foot). REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . If the spark plug wires are OK, GO to **JC15**.

JC15 CHECK THE SECONDARY COIL RESISTANCE FOR THE MISSING CYLINDERS

NOTE: **Two adjacent coil towers share a common coil and are called a matched pair. For 6-tower coil pack (6 cylinder) applications, the matched pairs are 1 and 5, 2 and 6, and 3 and 4. For Mustang the matched pairs are 1 and 4, 2 and 5, and 3 and 6. For 4-tower coil pack (4 cylinder) applications, the matched pairs are 1 and 4, and 2 and 3.**

- Key in OFF position.
- Ignition coil pack disconnected.
- Disconnect spark plug wires from the coil pack.
- Measure the resistance of each matched pair.
- **Is the resistance between 9,500 and 15,500 ohms?**

Yes	No

refer to **PINPOINT TEST Z**.	INSTALL a new ignition coil pack. CLEAR the DTCs. REPEAT the self-test.

JC16 CHECK THE SPARK PLUGS

- Key in OFF position.
- Check for damaged spark plugs or narrow spark plug gaps.
- **Are the plugs OK?**

Yes	No
GO to **JC17**.	REPAIR the spark plug(s). ADJUST the gap or INSTALL a new spark plug(s) as necessary. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

JC17 CHECK THE SPARK PLUG RESISTANCE

- Measure the spark plug resistance.
- **Is the resistance between 2,000 and 20,000 ohms?**

Yes	No
refer to **PINPOINT TEST Z**.	INSTALL a new spark plug(s). REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

JC18 DTC P050B: COLD START PERFORMANCE

- **Are any other codes besides P050B present?**

Yes	No
REPAIR all other powertrain related diagnostic trouble codes (DTCs) first.	GO to **JC19**.

JC19 CHECK THE SPARK CAPTURE CIRCUIT

- Access the PCM and monitor the IGNPCM_F PID.
- **Is a concern indicated?**

Yes	No
GO to **JC21**.	GO to **JC20**.

JC20 CHECK THE IGNITION TIMING PID

- Access the PCM and monitor the IGNX_F PIDs.
- **Is a concern indicated?**

Yes	No
Visually inspect the coil pack harness for damage, exposed wiring, water contamination, corrosion, and correct assembly. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **JC21**.

JC21 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST JD: CRANKSHAFT POSITION (CKP) SENSOR

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- crankshaft position (CKP) sensor (6C315)
- harness circuits: CKP(+) and CKP(-)
- powertrain control module (PCM) (12A650)

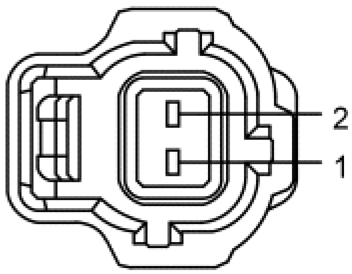

Fig. 158: Crankshaft Position (CKP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

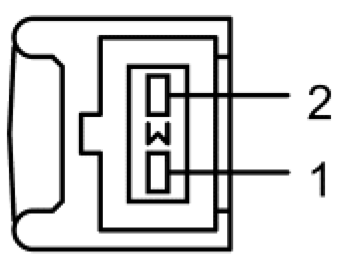

Fig. 159: Crankshaft Position (CKP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

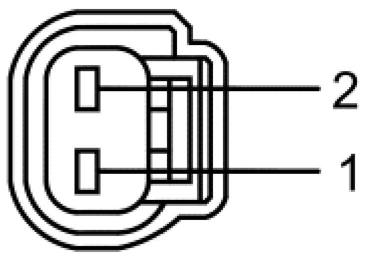

Fig. 160: Crankshaft Position (CKP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Focus, Fusion 2.3L, Milan 2.3L, Ranger 2.3L	A	2 1	CKP- CKP+
Explorer 4.0L, Explorer Sport Trac 4.0L, Mountaineer 4.0L, Mustang 4.0L, Ranger 4.0L	B	2 1	CKP- CKP+
All other vehicles	C	1 2	CKP- CKP+

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, F-150, Mark LT, MKX, Sable, Taurus, Taurus X	190 Pin	E47 E46	CKP+ CKP-
Escape/Mariner	150 (50-50-50) Pin	E34 E45	CKP+ CKP-
Expedition,	140 Pin	E47	CKP+

Fusion, Milan, MKZ, Navigator		E46	CKP-
Focus	190 Pin	E58 E42	CKP+ CKP-
All other vehicles	170 Pin	E47 E46	CKP+ CKP-

JD1 CHECK THE CKP SENSOR SIGNAL SENT TO THE PCM

NOTE: The battery should be fully charged and the starting system should be functioning properly.

- Disable the inertia switch.
- Key ON, engine OFF.
- Access the PCM and monitor the RPM PID.
- Crank the engine.
- **Is the RPM greater than 150 RPM?**

Yes	No
For DTC P1336 with no start, refer to **PINPOINT TEST A**. For DTC P1336, GO to **HD16**. For all others, the CKP, PCM, and harness are working properly. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	GO to **JD2**.

JD2 CHECK THE TIMING COVER, CKP SENSOR AND EXTERNAL TRIGGER WHEEL (OUTSIDE THE TIMING COVER) FOR OBVIOUS PHYSICAL DAMAGE

- Key in OFF position.
- Visually check the timing cover, CKP sensor and external trigger wheel (outside the timing cover) for obvious physical damage.
- **Do any parts appear physically damaged?**

Yes	No
REPAIR as necessary. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **JD3**.

JD3 CHECK FOR PROPER CKP BIAS VOLTAGES IN THE PCM

- CKP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CKP Sensor Connector, Harness Side	(-) Vehicle Battery
CKP+	Negative terminal
CKP-	Negative terminal

- **Are the voltages between 1 - 3 V?**

Yes	No
GO to **JD4**.	GO to **JD6**.

JD4 CHECK THE CKP SENSOR RESISTANCE

- Key in OFF position.
- Measure the resistance between:

(+) CKP Sensor Connector, Component Side	(-) CKP Sensor Connector, Component Side
CKP+	CKP-

- **Is the resistance between 250 - 1K ohms?**

Yes	No
GO to **JD5**.	INSTALL a new CKP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

JD5 CHECK THE CKP HARNESS SHIELD GROUND

NOTE: **The harness shield protects the CKP signal from electrical noise and is grounded at one end, typically near the PCM.**

NOTE: Carry out the following resistance measurement between the CKP shield and the ground.

- Measure the resistance between:

(+) CKP_SHLD Assembly Connector, Harness Side	(-)
CKP_SHLD	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **JD6**.	REPAIR the open circuit. CHECK for a poor ground connection. CLEAR the DTCs. REPEAT the self-test.

JD6 CHECK FOR SHORT BETWEEN CKP(+) AND CKP(-) IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) CKP Sensor Connector, Harness Side	(-) CKP Sensor Connector, Harness Side
CKP+	CKP-

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **JD7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

JD7 CHECK THE CKP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) CKP Sensor Connector,	(-) PCM Connector, Harness Side

Harness Side	
CKP-	CKP-
CKP+	CKP+

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **JD8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

JD8 CHECK THE CKP CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) CKP Sensor Connector, Harness Side	(-) Vehicle Battery
CKP+	Negative terminal
CKP-	Negative terminal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **JD9**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

JD9 CHECK THE CKP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
CKP+	Negative terminal
CKP-	Negative terminal

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **JD10**.

JD10 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST JE: INTEGRATED IGNITION COIL PACK A, B, OR C FAILURE

This pinpoint test is intended to diagnose the following:

- ignition coil packs (12029)
- ignition coil harness
- IGN START/RUN circuit to coil packs
- powertrain control module (PCM) (12A650)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

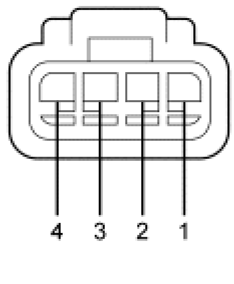

Fig. 161: Coil Pack Assembly Connector - A
Courtesy of FORD MOTOR CO.

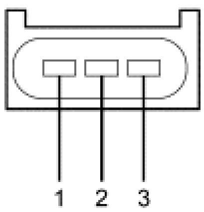

Fig. 162: Coil Pack Assembly Connector - B
Courtesy of FORD MOTOR CO.

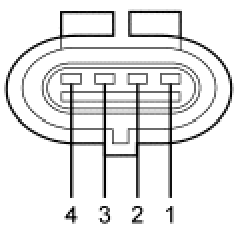

Fig. 163: Coil Pack Assembly Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
F-150	A	2 3 1 4	CD C CD B CD A IGN START/RUN
Ranger 2.3L	B	3 1 2	CD B CD A IGN START/RUN
Ranger 3.0L	A	2 1 3 4	CD C CD B CD A IGN START/RUN
Ranger 4.0L	C	3 4 2 1	CD C CD B CD A IGN START/RUN
All other vehicles	C	3 2 4 1	CD C CD B CD A IGN START/RUN

IGNITION COIL TO CYLINDER CORRELATION

Vehicle	Related DTC	Cylinder Number	Ignition Coil	Coil Driver (CD)	PCM Pin
2.3L Ranger	P0351	1	A	A	E17
	P0352	2	B	B	E12
	P0352	3	B	B	E12
	P0351	4	A	A	E17
3.0L/4.0L Ranger	P0351	1	A	A	E12
	P0353	2	C	C	E16
	P0352	3	B	B	E17
	P0352	4	B	B	E17
	P0351	5	A	A	E12
	P0353	6	C	C	E16
All others	P0351	1	A	A	E17
	P0353	2	C	C	E16
	P0352	3	B	B	E12
	P0352	4	B	B	E12
	P0351	5	A	A	E17
	P0353	6	C	C	E16

JE1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0350, P0351, P0352, or P0353 present?**

Yes	No
GO to **JE2**.	For all other DTCs, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

JE2 DETERMINE WHICH COIL IS NOT FIRING PROPERLY

NOTE: **Electronic ignition engine timing is entirely controlled by the PCM. Electronic ignition timing is NOT adjustable. Do not attempt to check base timing. You will receive false readings.**

- Determine which coil is not firing properly using the information from Pinpoint Test JB or a DTC and the table at the beginning of this pinpoint test.
- Record the suspect cylinder, coil and PCM pin number from the table.
- **Is the suspect cylinder number, coil driver and PCM pin number recorded?**

Yes	No
GO to **JE3**.	To obtain the required information, REPEAT step JE2.

JE3 DTC P0351, P0352, P0353: CHECK IGN START/RUN VOLTAGE TO THE COIL PACK

- Suspect coil connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Coil Pack Assembly Connector, Harness Side	(-)
IGN START/RUN	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **JE4**.	The IGN START/RUN has a circuit concern. CHECK the condition of the related fuses/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the IGN START/RUN circuit for a short to ground. REPAIR as necessary. CARRY OUT the misfire monitor drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . CLEAR the DTCs. REPEAT the self-test.

JE4 CHECK THE FUNCTIONALITY OF THE SUSPECT COIL DRIVER (CD) CIRCUIT

- Key in OFF position.
- Connect a test lamp between IGN START/RUN and the suspect CD circuit (determined from the table) at the coil pack harness connector.
- Crank the engine while the accelerator pedal is fully applied.
- Observe the test lamp while cranking the engine.
- **Does the test lamp blink consistently?**

Yes	No
GO to **JE8**.	GO to **JE5**.

JE5 CHECK THE SUSPECT CD CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Coil Pack Assembly Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect coil driver	Suspect coil driver

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **JE6**.	REPAIR the open circuit. CARRY out the misfire monitor drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . CLEAR the DTCs. REPEAT the self-test.

JE6 CHECK THE SUSPECT CD CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
Suspect coil driver	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CARRY out the misfire monitor drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . CLEAR the DTCs. REPEAT the self-test.	GO to **JE7**.

JE7 CHECK THE SUSPECT CD CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM	

Connector, Harness Side	(-)
Suspect coil driver	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **JE9**.	REPAIR the short circuit. CARRY out the misfire monitor drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . CLEAR the DTCs. REPEAT the self-test.

JE8 CHECK THE SUSPECT COIL FOR DAMAGE

- Key in OFF position.
- Remove the spark plug wire from the suspect coil tower (as determined from the table).
- Connect the Air Gap Spark Tester 303-D037 (D81P-6666-A) or equivalent to the suspect spark plug wire.
- Crank the engine while the accelerator pedal is fully applied.
- Observe the spark tester while cranking the engine.
- **Is a bluish-white spark present?**

Yes	No
refer to **PINPOINT TEST Z**.	INSTALL a new coil pack as needed. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CARRY out the misfire monitor drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . CLEAR the DTCs. REPEAT the self-test.

JE9 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
    - pushed out pins
    - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH	

ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM) , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST JF: INTEGRATED IGNITION COIL ON PLUG COIL A THROUGH J FAILURE

This pinpoint test is intended to diagnose the following:

- ignition coils (12029)
- ignition coil harness
- ignition coils relay
- powertrain control module (PCM) (12A650)

N0073029

Fig. 164: Coil On Plug (COP) Connector - A
Courtesy of FORD MOTOR CO.

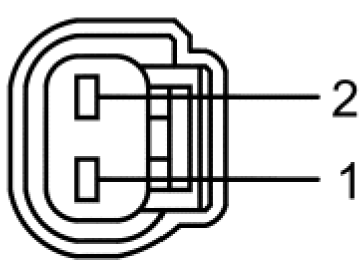

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Fig. 165: Coil On Plug (COP) Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit

Edge, MKX, MKZ, Taurus, Taurus X, Sable	A	1 3	COP IGN START/RUN
Escape/Mariner, Focus, Fusion, Milan, Mustang 5.4L	B	1 2	COP IGN START/RUN
All other vehicles	B	2 1	COP IGN START/RUN

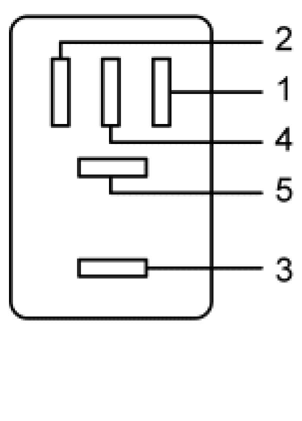

Fig. 166: Powertrain Control Module Power (PCM Power) Relay Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	GND (Ground)
2	IGN START/RUN
5	B+ (Battery Positive Voltage)
3	VPWR (Vehicle Power)

IGNITION COIL TO CYLINDER CORRELATION

Vehicle	Related DTC	Cylinder Number	Ignition Coil	Coil Driver (CD)	PCM Pin
2.3L Escape, 2.3L Mariner	P0351	1	A	A	E1
	P0352	2	B	D	E12
	P0353	3	C	B	E24

	P0354	4	D	C	E35
Focus	P0351	1	A	A	E70
	P0352	2	B	D	E50
	P0353	3	C	B	E66
	P0354	4	D	C	E69
2.3L Fusion, 2.3L Milan	P0351	1	A	A	E17
	P0352	2	B	D	E11
	P0353	3	C	B	E12
	P0354	4	D	C	E16
6-Cylinder Applications	P0351	1	A	A	E17
	P0352	2	B	C	E16
	P0353	3	C	E	E15
	P0354	4	D	B	E12
	P0355	5	E	D	E11
	P0356	6	F	F	E10
3.0L Escape, 3.0L Mariner	P0351	1	A	A	E1
	P0352	2	B	C	E12
	P0353	3	C	E	E24
	P0354	4	D	B	E35
	P0355	5	E	D	E36
	P0356	6	F	F	E22
8-Cylinder Applications	P0351	1	A	A	E17
	P0352	2	B	D	E11
	P0353	3	C	B	E12
	P0354	4	D	G	E14
	P0355	5	E	F	E10
	P0356	6	F	E	E15
	P0357	7	G	C	E16
	P0358	8	H	H	E9
10-Cylinder Applications	P0351	1	A	A	E17
	P0352	2	B	E	E11
	P0353	3	C	G	E12
	P0354	4	D	I	E14
	P0355	5	E	C	E10
	P0356	6	F	B	E15
	P0357	7	G	F	E16
	P0358	8	H	H	E9
	P0359	9	I	J	E13
	P0360	10	J	D	E8

JF1 DETERMINE WHICH COIL IS NOT FIRING PROPERLY

NOTE: Electronic ignition engine timing is entirely controlled by the PCM. Electronic ignition timing is NOT adjustable. Do not attempt to check base timing. You will receive false readings.

- Determine which coil is not firing properly using the information from Pinpoint Test JB or a DTC and the table at the beginning of this pinpoint test.
- Record the suspect cylinder, coil and PCM pin number from the table.
- **Is the suspect cylinder number, coil driver and PCM pin number recorded?**

Yes	No
GO to **JF2**.	REPEAT the test step to obtain the required information.

JF2 CHECK THE FUNCTIONALITY OF THE SUSPECT COIL DRIVER CIRCUIT

NOTE: This step may cause fuel pump related DTCs to set. Disregard any fuel pump related DTCs at this time.

NOTE: Test lamp bulb filament wattages vary widely. The intensity and duration of blinking depends on the test lamp being used.

- Key in OFF position.
- Suspect coil connector disconnected.
- Remove the fuel pump fuse to disable the fuel pump.
- Connect a non-powered test lamp between the IGN START/RUN and suspect coil driver, harness side.
- Observe the test lamp while cranking the engine.
- **Is the test lamp blinking consistently?**

Yes	No
GO to **JF3**.	GO to **JF4**.

JF3 CHECK THE FUNCTIONALITY OF THE SUSPECT COIL

- Key in OFF position.
- Carry out a visual inspection. Closely inspect the coil case and boot for carbon tracking, cracks and torn or improperly installed boots.
- Remove the suspect COP from the spark plug.
- Connect the Air Gap Spark Tester 303-DO37 (D81P-6666-A) or equivalent.
- Suspect coil connector connected.
- Crank the engine.
- Observe the spark tester while cranking the engine.

- **Is a bluish-white spark present?**

Yes	No
refer to **PINPOINT TEST Z**.	INSTALL a new suspect coil. If necessary, INSTALL a new spark plug. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

JF4 CHECK THE IGN START/RUN VOLTAGE TO THE SUSPECT COIL

- Key ON, engine OFF.
- Suspect coil connector disconnected.
- Measure the voltage between:

(+) COP Connector, Harness Side	(-) Vehicle Battery
IGN START/RUN	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to **JF5**.	For Crown Victoria, Grand Marquis, and Town Car, GO to **JF9**. For all others, REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

JF5 CHECK THE SUSPECT COIL DRIVER CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Suspect coil connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) COP Connector, Harness Side
Suspect coil driver	COP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **JF6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

JF6 CHECK THE SUSPECT COIL DRIVER CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
Suspect coil driver	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to **JF7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

JF7 CHECK THE SUSPECT COIL DRIVER CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
Suspect coil driver	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **JF12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test. If the concern or DTC is still present, GO to **JF8**.

JF8 CHECK THE SUSPECT COIL FOR DAMAGE

- PCM connector connected.
- Connect the Air Gap Spark Tester 303-D037 (D81P-6666-A) or equivalent to the suspect coil.

- Crank the engine while the accelerator pedal is fully applied.
- Observe the spark tester while cranking the engine.
- **Is a bluish-white spark present?**

Yes	No
If necessary, INSTALL a new spark plug. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	INSTALL a new suspect coil. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

JF9 CHECK VPWR CIRCUIT CONTINUITY BETWEEN THE SUSPECT COIL AND IGNITION COILS RELAY

- Key in OFF position.
- Ignition Coils Relay connector disconnected.
- Measure the resistance between:

(+) Ignition Coils Relay Connector, Harness Side	(-) Suspect coil Connector, Harness Side
VPWR - Pin 3	IGN START/RUN

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **JF10**.	REPAIR the open circuit. The open is between the splice and the ignition coils relay. CLEAR the DTCs. REPEAT the self-test.

JF10 CHECK THE B+ AND IGN START/RUN VOLTAGE TO IGNITION COILS RELAY

- Key ON, engine OFF.
- Measure the voltage between:

(+) Ignition Coils Relay Connector, Harness Side	(-)
B+ - Pin 5	Ground
IGN START/RUN - Pin 2	Ground

- **Are the voltages greater than 10 V?**

Yes	No
GO to **JF11**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

JF11 CHECK THE IGNITION COILS RELAY GND CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the voltage between:

(+) Ignition Coils Relay Connector, Harness Side	(-) Ignition Coils Relay Connector, Harness Side
B+ - Pin 5	GND - Pin 1

- **Is the voltage greater than 10 V?**

Yes	No
INSTALL a new Ignition Coils relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

JF12 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KA: FUEL PUMP (FP) RELAY

This pinpoint test is intended to diagnose the following:

- fuel pump relay (9345)
- inertia fuel shutoff (IFS) switch (9341)
- harness circuits: B+, VPWR, FP, GND, FPM, and FP PWR
- powertrain control module (PCM) (12A650)

The VPWR and FP circuits may be reversed in the harness connector. Refer to the Wiring Diagrams article for schematic and connector information.

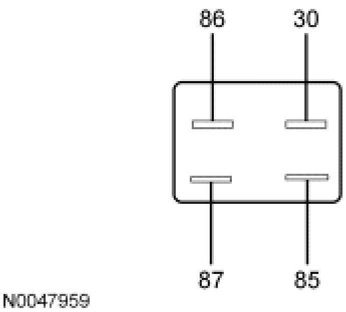

Fig. 167: Powertrain Control Module Power (PCM Power) Relay Connector - A
Courtesy of FORD MOTOR CO.

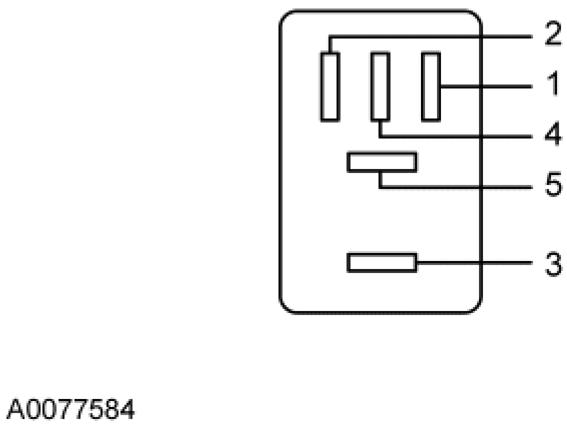

Fig. 168: Powertrain Control Module Power (PCM Power) Relay Connector - B
Courtesy of FORD MOTOR CO.

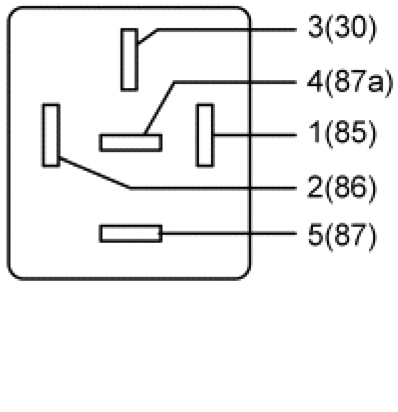

Fig. 169: Powertrain Control Module Power (PCM Power) Relay Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition, Focus, Navigator, Sable, Taurus, Taurus X	A	30 87 85 86	B+ FPPWR FP VPWR
Ranger	B	3 5 1 2	B+ FPPWR FP VPWR
All other vehicles	C	3 5 1 2	B+ FPPWR FP VPWR

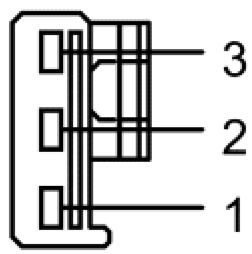

Fig. 170: Inertia Fuel Shutoff (IFS) Switch Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	FPPWR-B (Fuel Pump Power - B)
2	FPPWR-A (Fuel Pump Power - A)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Expedition, Fusion, Milan, MKZ, Navigator	140 Pin	B30 B62	FPM FP
Focus	190 Pin	B32 B19	FPM FP
Ranger	170 Pin	B21 B12	FPM FP
All other vehicles	190 Pin	B30 B62	FPM FP

KA1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0230, P0231, P0232, or P1641 present?**

Yes	No
For KOEO and KOER DTCs P0230 or P1641, GO to **KA2**. For continuous memory DTCs P0230 or P1641, GO	

to **KA32**. For KOEO and KOER DTC P0231, GO to **KA24**. For continuous memory DTC P0231, GO to **KA31**. For KOEO and KOER DTC P0232, GO to **KA12**. For continuous memory DTC P0232, GO to **KA29**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

KA2 KOEO AND KOER DTCS P0230 AND P1641: CHECK FOR THE PRESENCE OF DTC P0685 OR P0690

- Carry out the self-test.
- **Are DTCs P0685 or P0690 present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **KA3**.

KA3 CHECK THE VPWR VOLTAGE TO FUEL PUMP RELAY

- FP Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FP Relay Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KA4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KA4 CHECK THE FUEL PUMP RELAY

- Key in OFF position.
- Carry out the FP relay component test. Refer to the Wiring Diagrams Cell 149 Component Testing.
- **Does the FP relay pass the component test?**

Yes	No
GO to **KA5**.	INSTALL a new FP relay. CLEAR the DTCs. REPEAT the self-test.

KA5 CHECK THE FP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FP Relay Connector, Harness Side	(-)
FP	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KA6**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KA6 CHECK THE FUEL PUMP CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) FP Relay Connector, Harness Side	(-)
FP	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KA7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KA7 CHECK THE FUEL PUMP CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FP Relay Connector, Harness Side	(-) PCM Connector, Harness Side
FP	FP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KA8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KA8 CHECK FOR KOEO DTCS

- Carry out the KOEO self-test.
- **Are DTCs P0231 or P0232 present?**

Yes	No
GO to **KA9**.	GO to **KA34**.

KA9 CHECK THE FP PRIMARY CIRCUIT INSIDE THE PCM

- PCM connector connected.
- FP Relay connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the FP_F PID.
- **Is the PID state YES?**

Yes	No
GO to **KA34**.	GO to **KA10**.

KA10 CHECK THE FUEL PUMP PRIMARY CIRCUIT INSIDE THE PCM WHILE CRANKING THE ENGINE

- Access the PCM and monitor the FP_F PID.
- While observing the PID, crank the engine.
- **Does the PID display indicate a concern during crank?**

Yes	No
GO to **KA34**.	The fuel pump primary circuit is OK in the harness and PCM. GO to **KA11**.

KA11 IS DTC P0231 PRESENT IN THE KOEO SELF-TEST?

- Carry out the KOEO self-test.
- **Is DTC P0231 present?**

Yes	No
GO to **KA24**.	GO to **KA12**.

KA12 KOEO AND KOER DTC P0232: DOES THE ENGINE START?

- **Does the engine start?**

Yes	No
GO to **KA13**.	GO to **KA18**.

KA13 VERIFY THE FUEL PUMP IS OFF

- Key ON, engine OFF.
- Wait for 5 seconds.
- The fuel pump is located above the fuel tank. Listen for the sound of the fuel pump operating which can be heard from outside the vehicle.
- **Is fuel pump off with the key ON?**

Yes	No
GO to **KA15**.	GO to **KA14**.

KA14 CHECK FOR FUEL PUMP RELAY CONTACTS ALWAYS CLOSED

- FP Relay connector disconnected.
- Key ON, engine OFF.
- **Is fuel pump off with the key ON?**

Yes	No
INSTALL a new FP relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the short circuit. The short circuit is between the FPPWR and FPM circuits or in the INJPWRM circuit. CLEAR the DTCs. REPEAT the self-test.

KA15 CHECK THE FPM CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- FP Relay connector disconnected.
- Measure the resistance between:

(+) FP Relay Connector, Harness Side	(-) PCM Connector, Harness Side
FPPWR	FPM

- **Is the resistance less than 5 ohms?**

Yes	No
	REPAIR the open circuit. The concern is between

GO to **KA16**.	the splice and the PCM. CLEAR the DTCs. REPEAT the self-test.

KA16 IS KOEO DTC P0231 PRESENT?

- Carry out the KOEO self-test.
- **Is DTC P0231 present?**

Yes	No
GO to **KA34**.	GO to **KA17**.

KA17 CHECK THE FPM PRIMARY CIRCUIT INSIDE THE PCM

- PCM connector connected.
- FP Relay connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- **Is the PID state OFF?**

Yes	No
The concern is not present at this time. The FPM circuit is OK in the harness and PCM. Disregard DTC P0232 at this time. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	GO to **KA34**.

KA18 CHECK IF THE INERTIA FUEL SHUTOFF (IFS) SWITCH IS TRIPPED

- **Is the IFS switch tripped?**

Yes	No
RESET the IFS switch. CLEAR the DTCs. REPEAT the self-test.	GO to **KA19**.

KA19 CHECK THE INERTIA FUEL SHUTOFF

- IFS Switch connector disconnected.
- Measure the resistance between:

(+) IFS Switch Connector, Component Side	(-) IFS Switch Connector, Component Side
FPPWR-A - Pin	FPPWR-B - Pin

2	1

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KA20**.	INSTALL a new IFS switch. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KA20 CHECK THE FP PWR CIRCUIT FOR AN OPEN IN THE HARNESS

- FP Relay connector disconnected.
- Measure the resistance between:

(+) IFS Switch Connector, Harness Side	(-) FP Relay Connector, Harness Side
FPPWR-A - Pin 2	FPPWR

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KA21**.	REPAIR the open circuit. CHECK for an open circuit between the IFS switch and the FPM splice. REFER to the Wiring Diagrams article for schematic and connector information. CLEAR the DTCs. REPEAT the self-test.

KA21 CHECK THE FUEL PUMP GROUND CIRCUIT FOR AN OPEN IN THE HARNESS

- FP connector disconnected.
- Measure the resistance between:

(+) FP Connector, Harness Side	(-)
FPGND	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
	REPAIR the open circuit. CLEAR the DTCs.

GO to **KA22**.	REPEAT the self-test.

KA22 CHECK THE FP PWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FP Connector, Harness Side	(-) IFS Switch Connector, Harness Side
FPPWR	FPPWR-B - Pin 1

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KA23**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KA23 CHECK THE INTERNAL RESISTANCE OF THE FUEL PUMP

- Measure the resistance between:

(+) FP Connector, Harness Side	(-) FP Connector, Harness Side
FPPWR	FPGND

- **Is the resistance less than 10 ohms?**

Yes	No
The fuel pump circuit is OK in the harness and PCM. Disregard DTC P0232 at this time. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	INSTALL a new FP. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KA24 KOEO AND KOER DTC P0231: IS KOEO DTC P0230 ALSO PRESENT?

- Carry out the KOEO self-test.
- **Is DTC P0230 present?**

Yes	No
GO to **KA3**.	GO to **KA25**.

KA25 DOES THE ENGINE START?

- **Does the engine start?**

Yes	No
GO to **KA15**.	GO to **KA26**.

KA26 CHECK IF THE IFS SWITCH IS TRIPPED

- **Is the IFS switch tripped?**

Yes	No
RESET the IFS switch. CLEAR the DTCs. REPEAT the self-test.	GO to **KA27**.

KA27 CHECK THE B+ CIRCUIT VOLTAGE TO THE FP RELAY

- FP Relay connector disconnected.
- Measure the voltage between:

(+) FP Relay Connector, Harness Side	(-)
B+	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KA28**.	A B+ circuit concern is present. CHECK the condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before installing a new fuse/fuse link. CLEAR the DTCs. REPEAT the self-test.

KA28 CHECK THE FP PWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FP Relay Connector, Harness Side	(-)
FPPWR	Ground

- **Is the resistance less than 10 ohms?**

Yes	No
INSTALL a new FP relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. The open is between the splice and the FP relay. CLEAR the DTCs. REPEAT the self-test.

KA29 CONTINUOUS MEMORY DTC P0232: IS A CONTINUOUS DTC P0230 PRESENT?

- Retrieve the continuous memory DTCs.
- **Is DTC P0230 present?**

Yes	No
GO to **KA33**.	GO to **KA30**.

KA30 CHECK THE FUEL PUMP SECONDARY CIRCUITS FOR A CONCERN

NOTE: Be aware that DTC P0232 could be set if the IFS switch is tripped then reset, or if voltage is supplied to the FP PWR circuit when the PCM expects the fuel pump to be off. The fuel pump prime procedure produces this.

NOTE: The FPM PID turns ON when a concern is present.

- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- Observe the FPM PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FPPWR circuit between the FP RLY and the FP
  - Shake, wiggle, and bend the FP GND
  - Shake, wiggle, and bend the FPM circuit between the PCM and the splice to the FPPWR circuit
  - Shake, wiggle, and bend the INJPWRM circuit between the PCM and the splice to the FPPWR circuit
  - Lightly tap on the FP, IFS, and FP RLY to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KA31 CONTINUOUS MEMORY DTC P0231: CHECK THE HARNESS

- PCM connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A PCM Connector, Harness Side	Point B
FP	Ground

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
FPM	Ground

- The FP turns on and the voltage will be greater than 10 V.
- Check for an indication of a concern while carrying out the following. The voltage changes suddenly when a concern is present.
    - Shake, wiggle, and bend the B+ supply to the FP relay
    - Shake, wiggle, and bend the FP PWR circuit between the FP relay and the FPM splice
    - Lightly tap on the FP relay to simulate road shock
- Key in OFF position.
- Visually inspect the FP relay and its loom connector for damage and corrosion.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KA32 CONTINUOUS MEMORY DTC P0230: CHECK FOR THE PRESENCE OF DTC P0685 OR P0690

- Carry out the self-test.
- **Are DTCs P0685 or P0690 present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **KA33**.

KA33 CHECK THE FP PRIMARY CIRCUITS

NOTE: The PID indicates YES when a concern is present.

- Key ON, engine OFF.
- Wait for 5 seconds.
- Access the PCM and monitor the FP_F PID.
- Observe the FP_F PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FP circuit between the PCM and the FP relay
  - Shake, wiggle, and bend the VPWR circuit between the electronic engine control power relay and the FP relay
  - Lightly tap on the FP relay to simulate road shock
- Key in OFF position.
- Visually inspect the PCM connector and wires as far back as the main loom for damage.
- Visually inspect the FPR connector and wires as far back as the main loom for damage.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KA34 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KB: FUEL PUMP DRIVER MODULE

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- fuel pump driver module (FPDM) (9D370) and (9D372)
- FPDM power supply relay
- inertia fuel shutoff (IFS) switch (9341)
- harness circuits: B+, GND, FPC, FPM, FPM2, FP PWR, FP2PWR, FP RTN, FP2RTN, VPWR Fuel, VPWR Fuel 2, and PWRGND
- powertrain control module (PCM) (12A650)

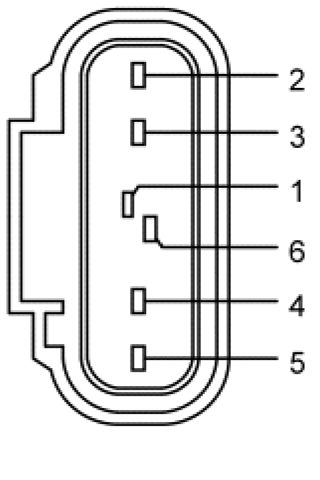

Fig. 171: Fuel Pump Driver Module (FPDM2) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	FPRTN (Fuel Pump Return)
4	FPPWR (Fuel Pump Power)
6	FPC (Fuel Pump Command)
1	FPM (Fuel Pump Monitor)
3	PWRGND (Power Ground)
5	VPWR Fuel

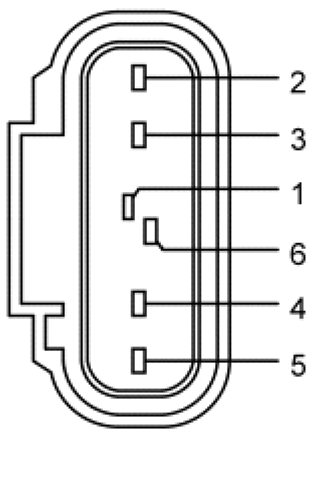

Fig. 172: Fuel Pump Driver Module 2 (FPDM2) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	FP2RTN (Fuel Pump 2 Return)
4	FP2PWR (Fuel Pump 2 Power)
6	FPC (Fuel Pump Command)
1	FPM2 (Fuel Pump Monitor 2 - Rear\Secondary Pump)
3	PWRGND (Power Ground)
5	VPWR Fuel 2

Refer to the Wiring Diagrams article for schematic and connector information. For F-150 and Mark LT, the FPDM PWR relay is integral to the PDJB.

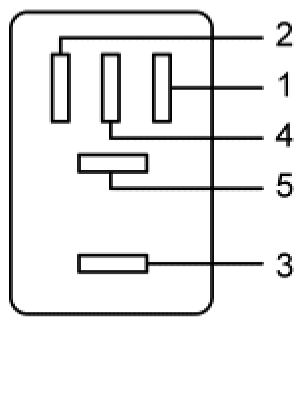

Fig. 173: Powertrain Control Module Power (PCM Power) Relay Connector - A

Courtesy of FORD MOTOR CO.

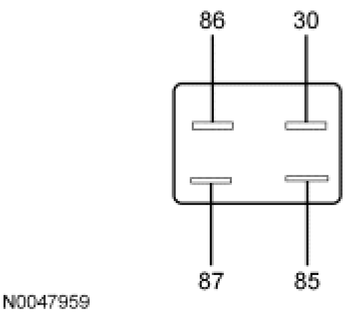

Fig. 174: Fuel Pump Driver Module Power (FPDM PWR) Relay Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Town Car	A	5 1 2 3	VPWR Fuel GND VPWR B+
Escape/Mariner, F-Super Duty	B	87 85 86 30	VPWR Fuel GND VPWR B+
All other vehicles	A	5 2 1 3	VPWR Fuel GND VPWR B+

Refer to the Wiring Diagrams article for schematic and connector information.

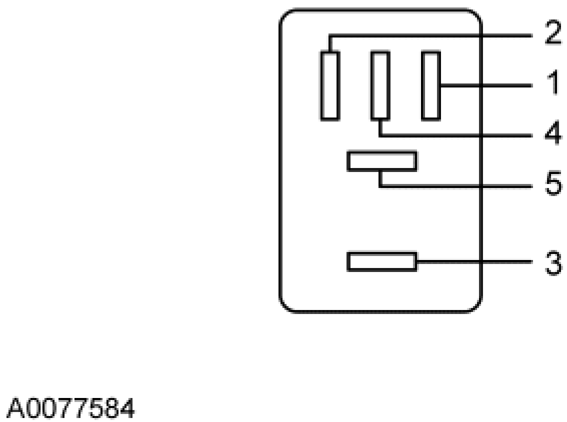

Fig. 175: Powertrain Control Module Power (PCM Power) Relay Connector - A

Courtesy of FORD MOTOR CO.

Pin	Circuit
5	VPWR Fuel 2
2	GND (Ground)
1	VPWR (Vehicle Power)
3	B+ (Battery Positive Voltage)

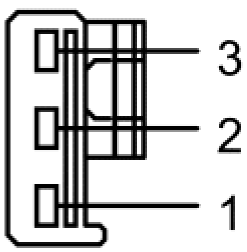

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Fig. 176: Inertia Fuel Shutoff (IFS) Switch Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	VPWR Fuel - A
1	VPWR Fuel - B

This applies to applications with an FPDM PWR relay integral to the PDJB.

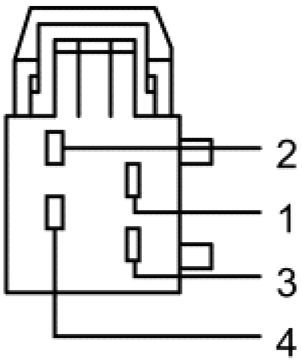

Fig. 177: Power Distribution Junction Box (PDJB) Connector - B
Courtesy of FORD MOTOR CO.

Pin	Circuit
3	VPWR Fuel

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B12 B21	FPC FPM
F-150, Mark LT	190 Pin	B62 B30	FPC FPM
Mustang 5.4L	170 Pin	T18 B12 B21	FPM2 FPC FPM
All other vehicles	170 Pin	B12 B21	FPC FPM

KB1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P1233, P1234, P1235, P1236, P1237, P1238, or P1641 present?**

Yes	No
For DTC P1233, GO to **KB2**. For DTC P1234, GO to **KB38**. For DTCs P1235 or P1641, GO to **KB20**. For DTC P1236, GO to **KB50**. For DTC P1237, GO to **KB26**. For DTC P1238, GO to **KB56**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

KB2 DTC P1233: IS DTC P1233 PRESENT IN THE KOEO SELF-TEST?

NOTE: The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1233 applies to the FPDM mounted on the driver side of the luggage compartment.

- Carry out the KOEO self-test.
- **Is DTC P1233 present?**

Yes	No
GO to **KB3**.	The PCM is now receiving a signal from the FPDM. One possible cause of DTC P1233 is that the IFS switch was tripped, then reset. For a no start (engine cranks), DISREGARD the DTC at this time. RETURN to the **SYMPTOM CHARTS** article Symptom Charts and continue as directed. After repairing the no start, to diagnose the intermittent causes of P1233, GO to **KB19**. For all others, GO to **KB19**.

KB3 DOES THE ENGINE START?

NOTE: The Mustang 5.4L starts with 1 FPDM disabled.

- **Does the engine start?**

Yes	No
For Mustang 5.4L, GO to **KB4**. For all others, to check the FPM circuit, GO to **KB15**.	VERIFY the IFS switch is set (button pressed). If OK, GO to **KB4**.

KB4 CHECK THE VOLTAGE AND GROUND CIRCUITS TO THE FPDM

- FPDM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-) FPDM Connector, Harness Side
VPWR Fuel - Pin 5	PWRGND - Pin 3

- **Is the voltage greater than 10 V?**

Yes	No
For Mustang 5.4L, to check the FPM circuit, GO to **KB15**. For all others, INSTALL a new FPDM. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **KB5**.

KB5 CHECK THE VOLTAGE TO THE FPDM

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
VPWR Fuel - Pin 5	Ground

- **Is the voltage greater than 10 V?**

Yes	No
REPAIR the open circuit. The FPDM ground circuit is open. CLEAR the DTCs. REPEAT the self-test.	There is no voltage to the FPDM. For F-150, and Mark LT, GO to **KB11**. For all others, GO to **KB6**.

KB6 CHECK THE B+ VOLTAGE TO THE FPDM POWER SUPPLY RELAY

- Key in OFF position.
- FPDM PWR Relay connector disconnected.
- Measure the voltage between:

(+) FPDM PWR Relay Connector, Harness Side	(-)
B+	Ground

- **Is the voltage greater than 10 V?**

Yes	No
	A B+ circuit concern is present. CHECK the

GO to **KB7**.	condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before installing a new fuse/fuse link. CLEAR the DTCs. REPEAT the self-test.

KB7 CHECK THE VPWR VOLTAGE TO THE FPDM POWER SUPPLY RELAY

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM PWR Relay Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KB8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB8 CHECK FOR GROUND TO THE FPDM POWER SUPPLY RELAY

- Measure the resistance between:

(+) FPDM PWR Relay Connector, Harness Side	(-)
GND	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KB9**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB9 CHECK THE VPWR FUEL CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FPDM	(-) FPDM

Connector, Harness Side	PWR Relay Connector, Harness Side
VPWR Fuel - Pin 5	VPWR Fuel

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new FPDM relay. CLEAR the DTCs. REPEAT the self-test.	GO to **KB10**.

KB10 ISOLATE THE OPEN IN THE FPDM CIRCUIT

- IFS Switch connector disconnected.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-) IFS Switch Connector, Harness Side
VPWR Fuel - Pin 5	VPWR Fuel - B - Pin 1

- Measure the resistance between:

(+) FPDM PWR Relay Connector, Harness Side	(-) IFS Switch Connector, Harness Side
VPWR Fuel	VPWR Fuel - A - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new IFS switch. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . VERIFY the IFS switch is set (button pressed). CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB11 CHECK THE FUEL PUMP FUSE

NOTE: These steps are for applications with a FPDM PWR relay integral to the PDJB.

- Key in OFF position.
- Check the FPDM power supply relay fuse. Refer to the Wiring Diagrams article for schematic and connector information.
- **Is the fuse OK?**

Yes	No
GO to **KB12**.	INSTALL a new fuse. CHECK the associated circuits for a short to ground before installing the fuse. CLEAR the DTCs. REPEAT the self-test.

KB12 CHECK FOR VOLTAGE TO THE IFS SWITCH

- IFS Switch connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) IFS Switch Connector, Harness Side	(-)
VPWR Fuel - A - Pin 2	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KB14**.	GO to **KB13**.

KB13 CHECK THE VPWR FUEL CIRCUIT FOR AN OPEN BETWEEN THE IFS AND PDJB

- Key in OFF position.
- PDJB connector disconnected. Refer to the Wiring Diagrams article for schematic and connector information.
- Measure the resistance between:

(+) IFS Switch Connector, Harness Side	(-) PDJB Connector, Harness Side
VPWR Fuel - A - Pin 2	VPWR Fuel - Pin 3

- **Is the resistance less than 5 ohms?**

Yes	No
CHECK the fuel pump fuse. REPAIR as necessary. If OK, INSTALL a new FP RLY/PDJB. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB14 CHECK THE IFS FOR AN OPEN

- Key in OFF position.
- Measure the resistance between:

(+) IFS Switch Connector, Component Side	(-) IFS Switch Connector, Component Side
VPWR Fuel - A - Pin 2	VPWR Fuel - B - Pin 1

- **Is the resistance less than 5 ohms?**

Yes	No
REPAIR the open circuit. The VPWR fuel circuit is open. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new IFS switch. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB15 CHECK THE FPM CIRCUIT FOR AN OPEN IN THE HARNESS

- FPDM connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-) PCM Connector, Harness Side
FPM - Pin 1	FPM

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KB16**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB16 CHECK THE FPM CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
FPM - Pin 1	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KB17**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB17 CHECK THE FPM CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-)
FPM - Pin 1	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KB18**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB18 CHECK FOR FPM OUTPUT FROM THE FPDM

NOTE: It is OK for the voltage to cycle below this range and then return within range.

- FPDM connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
FPM	Ground

- **Is the voltage between 0.02 - 1 V?**

Yes	No
GO to **KB64**.	INSTALL a new FPDM. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB19 CHECK THE CIRCUITS THAT MAY CAUSE AN INTERMITTENT LOSS OF VOLTAGE TO THE FPDM

NOTE: Be aware that P1233 could be set if the IFS switch is tripped then reset.

NOTE: With no concern present, the FPDM sends a 50% duty cycle (all OK) to the PCM on the FPM circuit. Depending on the scan tool type, the FPM PID may display 50%, or a random value that is fluctuating between 85% and 115%.

- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- Observe the FPM PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the PWRGND circuit to the FPDM
  - Shake, wiggle, and bend the VPWR fuel circuit to the FPDM
  - Shake, wiggle, and bend the FPM circuit between the FPDM and the PCM
  - Shake, wiggle, and bend the B+ and ground circuits to the FPDM power supply relay
  - Lightly tap on the IFS switch to simulate road shock
  - Lightly tap on the FPDM to simulate road shock
  - Lightly tap on the FPDM power supply relay to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KB20 DTC P1235: IS DTC P1235 PRESENT IN THE KOEO SELF-TEST?

NOTE: The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1235 applies to the FPDM mounted on the driver side of the luggage compartment.

NOTE: For ETC applications, check if ETC DTC P2105 is present. An ETC system concern could cause P1235, and should be diagnosed first.

- Carry out the KOEO self-test.
- **Is DTC P1235 present?**

Yes	No
GO to **KB21**.	GO to **KB25**.

KB21 CHECK THE FPC CIRCUIT FOR AN OPEN IN THE HARNESS

- FPDM connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FPDM Connector, Harness Side
FPC	FPC - Pin 6

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KB22**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB22 CHECK THE FPC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- FPDM2 connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
FPC - Pin 6	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KB23**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB23 CHECK THE FPC CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.

- Measure the resistance between:

(+) FPDM Connector, Harness Side	**(-)**
FPC - Pin 6	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KB24**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB24 CHECK THE FPC CIRCUIT IN THE FPDM

- FPDM connector connected.
- FPDM2 connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	**(-)**
FPC	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KB64**.	INSTALL a new FPDM. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB25 CHECK THE FPC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORTS

NOTE: **With no concern present, the FPDM sends a 50% duty cycle (all OK) to the PCM on the FPM circuit. Depending on the scan tool type, the FPM PID may display 50%, or a random value that is fluctuating between 85% and 115%.**

- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- Observe the FPM PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FPC circuit between FPDM and the PCM

- Lightly tap on the FPDM to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KB26 DTC P1237: IS DTC P1237 PRESENT IN THE KOEO SELF-TEST?

NOTE: The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1237 applies to the FPDM mounted on the driver side of the luggage compartment.

- Carry out the KOEO self-test.
- **Is DTC P1237 present?**

Yes	No
GO to **KB27**.	DTC P1237 is possibly intermittent, GO to **KB33**.

KB27 DOES THE ENGINE START?

NOTE: The Mustang 5.4L starts with 1 FPDM disabled.

- FPDM2 connector disconnected.
- **Does the engine start?**

Yes	No
GO to **KB36**.	GO to **KB28**.

KB28 CHECK THE FPPWR, FPRTN AND INTERNAL FUEL PUMP CIRCUIT RESISTANCE

- Key in OFF position.
- FPDM connector disconnected.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-) FPDM Connector, Harness Side
FPPWR - Pin 4	FPRTN - Pin 2

- **Is the resistance less than 10 ohms?**

Yes	No
GO to **KB29**.	ISOLATE the concern, GO to **KB32**.

KB29 CHECK THE FPRTN CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
FPRTN - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KB30**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB30 CHECK THE FPPWR CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- FP connector disconnected.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-)
FPPWR - Pin 4	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KB31**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB31 CHECK FOR VOLTAGE TO FP

NOTE: During output test mode, the fuel pump stays commanded on for only about 5 seconds.

- FPDM connector connected.
- FP connector disconnected.

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Measure the voltage between:

(+) FP Connector, Harness Side	(-) FP Connector, Harness Side
FPPWR	FPRTN

- **Is the voltage greater than 10 V?**

Yes	No
INSTALL a new FP. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	VERIFY the vehicle battery was at a proper charge during the test. VERIFY the pump ON command did not time out before the voltage check was made. REPEAT as necessary. If OK, INSTALL a new FPDM. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB32 ISOLATE THE OPEN CIRCUIT

- FP connector disconnected.
- Measure the resistance between:

(+) FP Connector, Harness Side	(-) FPDM Connector, Harness Side
FPPWR	FPPWR - Pin 4
FPRTN	FPRTN - Pin 2

- Measure the resistance between:

(+) FP Connector, Component Side	(-) FP Connector, Component Side
FPPWR	FPRTN

- **Is the resistance less than 10 ohms?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	REPAIR the open circuit. If the open is internal to the pump, INSTALL a new FP. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB33 VERIFY THE DTC P1237 IS INTERMITTENT

- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- **Is the FPM PID 75% (or varying between 250% and 400%)?**

Yes	No
A concern is present. GO to **KB27**.	CHECK for an intermittent concern, GO to **KB34**.

KB34 CHECK THE FPPWR AND FPRTN CIRCUIT FOR AN INTERMITTENT OPEN OR SHORTS

NOTE: With no concern present, the FPDM sends a 50% duty cycle (all OK) to the PCM on the FPM circuit. Depending on the scan tool type, the FPM PID may display 50%, or a random value that is fluctuating between 85% and 115%.

- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- Observe the FPM PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FPPWR and FPRTN circuits between the FPDM and the FP
  - Lightly tap on the FP and FPDM to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KB35**.

KB35 CHECK THE FPPWR CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

NOTE: The lamp turns on when a concern is present.

- Key in OFF position.
- FPDM connector disconnected.
- Connect a non-powered test lamp between:

(+) FPDM Connector, Harness Side	(-) FPDM Connector, Harness Side
FPPWR - Pin 4	VPWR Fuel - Pin 5

- Key ON, engine OFF.
- Observe the test lamp for an indication of a concern. Shake, wiggle, and bend the FPPWR circuit between the FPDM and the FP.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KB36 CHECK THE FPPWR CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- FPDM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
FPPWR - Pin 4	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KB37**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB37 CHECK THE FPRTN CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- FPDM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-) FPDM Connector, Harness Side
VPWR Fuel -	FPRTN - Pin 2

Pin 5	

- **Is the voltage less than 1 V?**

Yes	No
INSTALL a new FPDM. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB38 DTC P1234: IS DTC P1234 PRESENT IN THE KOEO SELF-TEST?

NOTE: The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1234 applies to the FPDM2 mounted on the passenger side of the luggage compartment.

- Carry out the KOEO self-test.
- **Is DTC P1234 present?**

Yes	No
GO to **KB39**.	The PCM is now receiving a signal from FPDM2. One possible cause of DTC P1234 is that the IFS switch was tripped, then reset. GO to **KB49**.

KB39 CHECK THE VOLTAGE AND GROUND CIRCUITS TO THE FPDM2

- FPDM2 connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM2 Connector, Harness Side	(-) FPDM2 Connector, Harness Side
VPWR Fuel 2 - Pin 5	PWRGND - Pin 3

- **Is the voltage greater than 10 V?**

Yes	No
To check the FPM2 circuit, GO to **KB45**.	GO to **KB40**.

KB40 CHECK VOLTAGE TO FPDM2

- Measure the voltage between:

(+) FPDM2 Connector, Harness Side	(-)
VPWR Fuel 2 - Pin 5	Ground

- **Is the voltage greater than 10 V?**

Yes	No
REPAIR the open circuit. The FPDM2 ground circuit is open. CLEAR the DTCs. REPEAT the self-test.	There is no voltage to the FPDM2. GO to **KB41**.

KB41 CHECK THE B+ VOLTAGE TO THE FPDM2 POWER SUPPLY RELAY

- Key in OFF position.
- FPDM2 PWR Relay connector disconnected.
- Measure the voltage between:

(+) FPDM2 PWR Relay Connector, Harness Side	(-)
B+ - Pin 3	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KB42**.	A B+ circuit concern is present. CHECK the condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before installing a new fuse/fuse link. CLEAR the DTCs. REPEAT the self-test.

KB42 CHECK THE VPWR VOLTAGE TO THE FPDM2 POWER SUPPLY RELAY

- Measure the voltage between:

(+) FPDM2 PWR Relay Connector,	(-)

Harness Side	
VPWR - Pin 1	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KB43**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB43 CHECK FOR GROUND TO THE FPDM2 POWER SUPPLY RELAY

- Key in OFF position.
- Measure the resistance between:

(+) FPDM2 PWR Relay Connector, Harness Side	(-)
GND - Pin 2	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KB44**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB44 CHECK THE VPWR FUEL 2 CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-) FPDM2 PWR Relay Connector, Harness Side
VPWR Fuel 2 - Pin 5	VPWR Fuel 2 - Pin 5

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new FPDM2 PWR relay. CLEAR the DTCs. REPEAT the self-test.	GO to **KB49**.

KB45 CHECK THE FPM2 CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- FPDM2 connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-) PCM Connector, Harness Side
FPM2 - Pin 1	FPM2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KB46**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB46 CHECK THE FPM2 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM2 Connector, Harness Side	(-)
FPM2 - Pin 1	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KB47**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB47 CHECK THE FPM2 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-)
FPM2 - Pin 1	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KB48**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB48 CHECK FOR FPM2 OUTPUT FROM THE FPDM2

NOTE: It is OK for the voltage to cycle below this range and then return within range.

- FPDM2 connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
FPM2	Ground

- **Is the voltage between 0.02 - 1 V?**

Yes	No
GO to **KB64**.	INSTALL a new FPDM2. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB49 CHECK CIRCUITS THAT MAY CAUSE AN INTERMITTENT LOSS OF VOLTAGE SUPPLY TO THE FPDM2

NOTE: Be aware that P1234 could be set if the IFS switch is tripped then reset.

NOTE: With no concern present, the FPDM2 sends a 50% duty cycle (all OK) to the PCM on the FPM2 circuit. Depending on the scan tool type, the FPM2 PID may display 50%, or a random value that is fluctuating between 85% and 115%.

- Key ON, engine OFF.
- Access the PCM and monitor the FPM2 PID.
- Observe the FPM2 PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the PWRGND circuit to the FPDM2
  - Shake, wiggle, and bend the VPWR fuel 2 circuit to the FPDM2
  - Shake, wiggle, and bend the FPM2 circuit between the FPDM2 and the PCM
  - Shake, wiggle, and bend the B+ and ground circuits to the FPDM2 power supply relay
  - Lightly tap on the IFS switch to simulate road shock

- Lightly tap on the FPDM2 to simulate road shock
- Lightly tap on the FPDM2 power supply relay to simulate road shock

- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KB50 DTC P1236: IS DTC P1236 PRESENT IN THE KOEO SELF-TEST?

- The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1236 applies to the FPDM2 mounted on the passenger side of the luggage compartment.
- Carry out the KOEO self-test.
- **Is DTC P1236 present?**

Yes	No
GO to **KB51**.	GO to **KB55**.

KB51 CHECK THE FPC CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- FPDM2 connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FPDM2 Connector, Harness Side
FPC	FPC - Pin 6

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KB52**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB52 CHECK THE FPC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- FPDM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM2 Connector, Harness Side	(-)
FPC - Pin 6	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KB53**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB53 CHECK THE FPC CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-)
FPC - Pin 6	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KB54**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB54 CHECK THE FPC CIRCUIT IN THE FPDM2

- FPDM2 connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
FPC	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KB64**.	INSTALL a new FPDM2. REFER to the **FUEL SYSTEM - GENERAL INFORMATION -**

	GASOLINE AND DIESEL -- E-SERIES . CLEAR the DTCs. REPEAT the self-test.

KB55 CHECK THE FPC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORTS

NOTE: With no concern present, the FPDM2 sends a 50% duty cycle (all OK) to the PCM on the FPM2 circuit. Depending on the scan tool type, the FPM2 PID may display 50%, or a random value that is fluctuating between 85% and 115%.

- Key ON, engine OFF.
- Access the PCM and monitor the FPM2 PID.
- Observe the FPM2 PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FPC circuit between FPDM2 and the PCM
  - Lightly tap on the FPDM2 to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KB56 DTC P1238: IS DTC P1238 PRESENT IN THE KOEO SELF-TEST?

NOTE: The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1238 applies to the FPDM2 mounted on the passenger side of the luggage compartment.

- Carry out the KOEO self-test.
- **Is DTC P1238 present?**

Yes	No
GO to **KB57**.	CHECK for an intermittent concern, GO to **KB63**.

KB57 CHECK THE FP2PWR, FP2RTN AND INTERNAL FUEL PUMP CIRCUIT RESISTANCE

- Key in OFF position.
- FPDM2 connector disconnected.
- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-) FPDM2 Connector, Harness Side
FP2PWR - Pin 4	FP2RTN - Pin 2

- **Is the resistance less than 10 ohms?**

Yes	No
GO to **KB58**.	ISOLATE the concern, GO to **KB62**.

KB58 CHECK THE FP2PWR AND FP2RTN CIRCUIT(S) FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- FP connector disconnected. Refer to the Wiring Diagrams article for schematic and connector information.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM2 Connector, Harness Side	(-)
FP2PWR - Pin 4	Ground
FP2RTN - Pin 2	Ground

- **Are the voltages less than 1 V?**

Yes	No
GO to **KB59**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB59 CHECK THE FP2PWR AND FP2RTN CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-)
FP2PWR - Pin 4	Ground
FP2RTN - Pin 2	Ground

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **KB60**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB60 CHECK FOR A SHORT BETWEEN THE FP2PWR AND FP2RTN CIRCUITS

- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-) FPDM2 Connector, Harness Side
FP2PWR - Pin 4	FP2RTN - Pin 2

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KB61**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB61 CHECK FOR VOLTAGE TO THE FP

NOTE: During output test mode, the fuel pump stays commanded on for only about 5 seconds.

- FPDM2 connector connected.
- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Measure the voltage between:

(+) FP Connector, Harness Side	(-) FP Connector, Harness Side
FP2PWR	FP2RTN

- **Is the voltage greater than 10 V?**

Yes	No
INSTALL a new FP. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	VERIFY the vehicle battery was at a proper charge during the test. VERIFY the pump ON command did not time out before the voltage check was made. REPEAT as necessary. If OK, INSTALL a new FPDM2. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB62 ISOLATE THE OPEN CIRCUIT

- FP connector disconnected. Refer to the Wiring Diagrams article for schematic and connector information.
- Measure the resistance between:

(+) FP Connector, Harness Side	(-) FPDM2 Connector, Harness Side
FP2PWR	FP2PWR - Pin 4
FP2RTN	FP2RTN - Pin 2

- Measure the resistance between:

(+) FP Connector, Component Side	(-) FP Connector, Component Side
FP2PWR	FP2RTN

- **Is the resistance less than 10 ohms?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	REPAIR the open circuit. If the open is internal to the pump, INSTALL a new FP. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB63 CHECK THE FP2PWR AND FP2RTN CIRCUIT FOR AN INTERMITTENT OPEN OR SHORTS

NOTE: **With no concern present, the FPDM2 sends a 50% duty cycle (all OK) to the PCM on the FPM2 circuit. Depending on the scan tool type, the FPM2 PID may display 50%, or a random value that is fluctuating between 85% and 115%.**

- Key ON, engine OFF.
- Access the PCM and monitor the FPM2 PID.
- Observe the FPM2 PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FP2PWR and FP2RTN circuits between the FPDM2 and the FP
  - Lightly tap on the FP and FPDM2 to simulate road shock
- **Is a concern present?**

Yes	No

ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

KB64 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KD: ELECTRIC EXHAUST GAS RECIRCULATION (EEGR) SYSTEM

This pinpoint test is intended to diagnose the following:

- EEGR system
- EEGR stepper motor (9D475)
- harness circuits: EGRMC1, EGRMC2, EGRMC3, EGRMC4 and VPWR
- powertrain control module (PCM) (12A650)

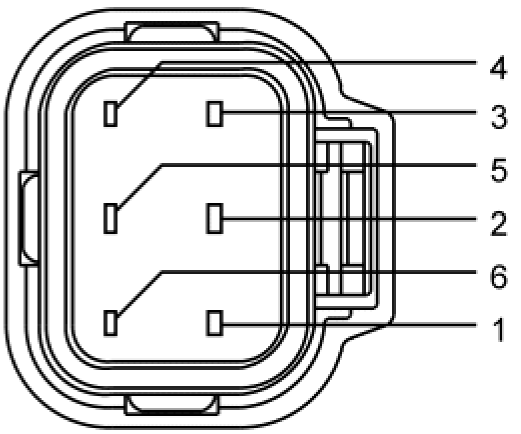

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Fig. 178: Electric Exhaust Gas Recirculation (EEGR) Assembly Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
6	EGRMC4 (EGR Motor Control 4)
4	EGRMC3 (EGR Motor Control 3)
3	EGRMC2 (EGR Motor Control 2)
1	EGRMC1 (EGR Motor Control 1)
5	VPWR (Vehicle Power)
2	VPWR (Vehicle Power)

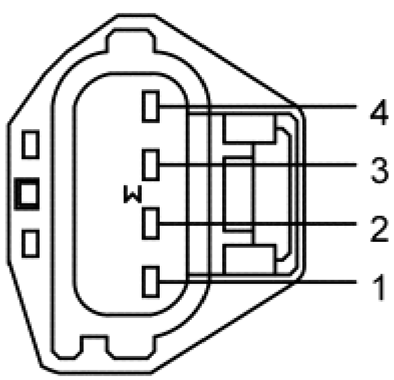

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Fig. 179: Manifold Absolute Pressure (MAP) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	MAP (Manifold Absolute Pressure)
4	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B35 E11 E10 E9 E8	VPWR EGRMC4 EGRMC3 EGRMC2 EGRMC1
Focus	190 Pin	B67 E56	VPWR EGRMC4

		E54 E37 E36	EGRMC3 EGRMC2 EGRMC1
Ranger	170 Pin	B35 E56 E39 E13 E8	VPWR EGRMC4 EGRMC3 EGRMC2 EGRMC1
All other vehicles	140 Pin	B51 E9 E8 E7 E6	VPWR EGRMC4 EGRMC3 EGRMC2 EGRMC1

KD1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0400, P0403, or P1408 present?**

Yes	No
For DTCs P0400 and P1408, GO to **KD9**. For DTC P0403, GO to **KD2**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

KD2 DTC P0403: EGR CONTROL CIRCUIT - CHECK THE CONNECTION OF THE EEGR HARNESS CONNECTOR TO THE EEGR

NOTE: If the DTC is intermittent, wiggle the harness and connectors when taking measurements.

- Check the connection of the EEGR harness connector to the EEGR.
- **Are the connector contacts clean and correctly seated?**

Yes	No
GO to **KD3**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

KD3 CHECK FOR VPWR AT THE EEGR HARNESS CONNECTOR

- Key ON, engine OFF.
- EEGR Assembly connector disconnected.
- Measure the voltage between:

(+) EEGR Assembly Connector,	(-) Vehicle Battery

Harness Side	
VPWR - Pin 2	Negative terminal
VPWR - Pin 5	Negative terminal

- **Are the voltages greater than 10 V?**

Yes	No
GO to **KD4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KD4 CHECK THE EEGR CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) EEGR Assembly Connector, Harness Side	(-) PCM Connector, Harness Side
EGRMC1 - Pin 1	EGRMC1
EGRMC2 - Pin 3	EGRMC2
EGRMC3 - Pin 4	EGRMC3
EGRMC4 - Pin 6	EGRMC4

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **KD5**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KD5 CHECK THE EEGR CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) EEGR Assembly Connector,	(-) Vehicle Battery

Harness Side	
EGRMC1 - Pin 1	Negative terminal
EGRMC2 - Pin 3	Negative terminal
EGRMC3 - Pin 4	Negative terminal
EGRMC4 - Pin 6	Negative terminal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **KD6**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KD6 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE EEGR HARNESS

NOTE: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
EGRMC3	EGRMC1
EGRMC3	EGRMC2
EGRMC3	EGRMC4
EGRMC1	EGRMC2
EGRMC1	EGRMC4
EGRMC2	EGRMC4

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **KD7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KD7 CHECK THE EEGR CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) EEGR Assembly Connector, Harness Side	(-) Vehicle Battery
EGRMC1 - Pin 1	Negative terminal
EGRMC2 - Pin 3	Negative terminal
EGRMC3 - Pin 4	Negative terminal
EGRMC4 - Pin 6	Negative terminal

- **Are the voltages greater than 0.1 V?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **KD8**.

KD8 CHECK THE EEGR COILS FOR AN OPEN

- Key in OFF position.
- Measure the resistance between:

(+) EEGR Assembly Connector, Component Side	(-) EEGR Assembly Connector, Component Side
EGRMC1 - Pin 1	VPWR - Pin 2
EGRMC2 - Pin 3	VPWR - Pin 2
EGRMC3 - Pin 4	VPWR - Pin 5
EGRMC4 - Pin 6	VPWR - Pin 5

- **Are the resistances between 15 - 24 ohms?**

Yes	No
GO to **KD12**.	INSTALL a new EEGR assembly. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** .

	CLEAR the DTCs. REPEAT the self-test.

KD9 DTCS P0400 AND P1408: CHECK FOR STUCK OR STICKY EGR VALVE OPERATION BY COMPARING ACTUAL MAP VOLTAGE TO MAP PID VOLTAGE

NOTE: Repair the following DTCs first, if present: P0102, P0103, P0107, P0108, P1100, P1101.

- Key in OFF position.
- MAP Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A MAP Sensor Connector, Harness Side	Point B MAP Sensor Connector, Component Side
VREF - Pin 2	VREF - Pin 2
SIGRTN - Pin 4	SIGRTN - Pin 4

- Key ON, engine running.
- Measure the voltage between:

(+) MAP Sensor Connector, Component Side	(-) Vehicle Battery
MAP - Pin 1	Negative terminal

- **Is the voltage between 1 - 2 V?**

Yes	No
GO to **KD10**.	CHECK the MAP harness for open and short circuits.

KD10 COMPARE ACTUAL MAP VOLTAGE TO MAP PID VOLTAGE EGR

- Key in OFF position.
- Remove the jumper wires.
- MAP Sensor connected.
- Record the actual MAP voltage values at KOEO, idle, 1,000 and 2,000 RPM.

- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- Note the MAP PID voltage.
- Key ON, engine running.
- Note the MAP PID voltage.
- Increase engine speed to 1,000 RPM.

  Note the MAP PID voltage.

- Increase engine speed to 2,000 RPM.

  Note the MAP PID voltage.

- **Does the MAP PID voltage stay within 0.5 V of the actual MAP voltage?**

Yes	No
The concern is not present at this time. Make sure the MAP sensor is correctly seated and the vacuum source is not blocked.	GO to **KD11**.

KD11 CARRY OUT THE KOER SELF-TEST

- **Is DTC P1408 retrieved again?**

Yes	No
INSTALL a new EEGR assembly. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	REFER to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** .

KD12 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH**	

ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM) , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KE: IDLE AIR CONTROL (IAC) VALVE

This pinpoint test is intended to diagnose the following:

- idle air control (IAC) valve (9F715)
- harness circuits: IAC, PWR and B+ (IAC-RC)
- powertrain control module (PCM) (12A650)

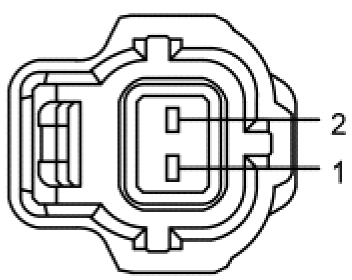

Fig. 180: Idle Air Control (IAC) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	IAC (Idle Air Control)
1	PWR (POWER)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	E39	IAC
Ranger	170 Pin	E33	IAC

KE1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0505, P0506, P0507, P0511, P1504, P1506, or P1507 present?**

Yes	No
For DTCs P0505, P0506, P0511, P1504 or P1507, GO to **KE2**. For DTCs P0507 or P1506, GO to **KE15**.	For all other symptoms without DTCs, GO to **KE2**.

KE2 DTCS P0505, P0506, P0511, P1504 OR P1507: CHECK FOR INLET AIR LEAKS (OR STARTS ONLY AT PART THROTTLE)

- With the engine running at idle (if possible), listen for vacuum leaks.
- Inspect the entire intake air system from the mass air flow (MAF) sensor to the intake manifold for leaks such as:
  - damaged or loose IAC air tubes.
  - cracked or punctured intake air tube.
  - loose intake air tube at the air cleaner housing or throttle body.
  - IAC valve or gasket seal.
  - EGR valve gasket seal.
  - vacuum supply connector and hose.
  - PCV valve, connectors and hoses.
- **Are any leaks present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KE3**.

KE3 CHECK FOR VOLTAGE TO THE IAC SOLENOID

NOTE: If EGR DTC P0402 is output during the self-test, diagnose it first before continuing with this pinpoint test.

- IAC connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) IAC Connector, Harness Side	(-) Vehicle Battery
PWR - Pin 1	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No

GO to **KE4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KE4 CHECK THE RESISTANCE OF THE IAC VALVE

- Key in OFF position.
- IAC connector disconnected.
- Measure the resistance between:

(+) IAC Connector, Component Side	(-) IAC Connector, Component Side
PWR - Pin 1	IAC - Pin 2

- **Is the resistance between 6 ohms - 15 ohms?**

Yes	No
GO to **KE5**.	INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KE5 CHECK THE IAC VALVE FOR AN INTERNAL SHORT TO THE IAC CASE

- Measure the resistance between:

(+) IAC Connector, Component Side	(-) IAC Connector, Component Side
IAC - Pin 2	IAC Case

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KE6**.	INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KE6 CHECK THE IAC CIRCUIT FOR AN OPEN IN THE HARNESS

- IAC connector disconnected.

- PCM connector disconnected.
- Measure the resistance between:

(+) IAC Connector, Harness Side	(-) PCM Connector, Harness Side
IAC - Pin 2	IAC

- **Is the resistance less than 5 ohms?**

Yes	No
For IAC-RC applications, GO to **KE7**. For all others, GO to **KE8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KE7 CHECK IAC-RC FOR VOLTAGE

- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
IAC-RC	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KE8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KE8 CHECK THE IAC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
IAC	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No

GO to **KE9**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KE9 CHECK THE IAC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
IAC	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KE10**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KE10 CHECK FOR A DROP IN IDLE RPM WITH THE IAC DISCONNECTED

- PCM connector connected.
- IAC connector connected.
- Key ON, engine running.
- Bring the engine to normal operating temperature.
- Transmission in PARK or NEUTRAL.
- Disconnect the IAC valve.
- **Does the RPM drop or the engine stall?**

Yes	No
GO to **KE12**.	GO to **KE11**.

KE11 CHECK FOR A STUCK IAC PINTLE

- Key in OFF position.
- Inspect the entire intake air system for debris, blockage or other damage.
- Remove and inspect the IAC valve and check the pintle movement.
- Check the air tubes (if equipped) for blockage or damage.
- Remove and inspect the air cleaner element for excessive dirt.
- **Is the IAC valve OK?**

Yes	No

GO to **KE12**.	INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KE12 VERIFY THE DTC

- **Is DTC P0511 or P1504 present in continuous memory or from the KOER self-test?**

Yes	No
GO to **KE22**.	GO to **KE13**.

KE13 CHECK THE IAC SIGNAL FROM THE PCM

NOTE: **If stalling occurs, place a shim under the hard stop screw to maintain idle conditions.**

NOTE: **With the engine at normal operating temperature, closed throttle and all accessories off, the IAC duty cycle should be between approximately 22% and 65%.**

- PCM connector connected.
- IAC connector connected.
- Key ON, engine running.
- Access the PCM and monitor the RPM PID.
- Access the PCM and monitor the IAC PID.
- Slowly increase the engine speed to 3,000 RPM and return to closed throttle. (Note: If closed throttle RPM is significantly higher than normal, ignore this step).
- **Is the percentage between 22 - 65%?**

Yes	No
GO to **KE14**.	INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KE14 VERIFY THE DTC

- **Is DTC P0506, P0511, P1504 or P1507 present in continuous memory?**

Yes	No
	INSPECT the throttle body for damage. REPAIR as necessary. If OK, INSTALL a new IAC valve.

GO to **KE20**.	REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .

KE15 DTCS P0507 OR P1506: CHECK FOR INLET AIR LEAKS

- Key ON, engine running.
- With the engine running at idle, listen for vacuum leaks.
- Inspect the entire intake air system from the mass air flow (MAF) sensor to the intake manifold for leaks such as:
  - damaged or loose IAC air tubes.
  - cracked or punctured intake air tube.
  - loose intake air tube at the air cleaner housing or throttle body.
  - IAC valve or gasket seal.
  - EGR valve gasket seal.
  - vacuum supply connector and hose.
  - PCV valve, connectors and hoses.
- **Are any leaks present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KE16**.

KE16 CHECK FOR EVAP DTCS

NOTE: EVAP system malfunctions can cause IAC DTCs or idle speed concerns.

- **Are any EVAP DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **KE17**.

KE17 CHECK THE IAC VALVE FOR CORRECT FUNCTION

- Key ON, engine running.
- Bring the engine to normal operating temperature.
- Transmission in PARK or NEUTRAL.

- Disconnect the IAC Valve.
- **Does the RPM drop or the engine stall?**

Yes	No
GO to **KE18**.	INSPECT the throttle body for damage. REPAIR as necessary. If OK, INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . CLEAR the DTCs. REPEAT the self-test.

KE18 CHECK THE IAC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

NOTE: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Key in OFF position.
- Scan tool connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
IAC	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KE19**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KE19 VERIFY THE SYMPTOM

- **Is a fast idle symptom currently present?**

Yes	No
GO to **KE22**.	GO to **KE20**.

KE20 CHECK THE IAC SYSTEM FOR AN INTERMITTENT OPEN OR SHORT

- PCM connector connected.

- Key ON, engine running.
- Access the PCM and monitor the IAC PID.
- Access the PCM and monitor the RPM PID.
- With the engine at normal operating temperature, closed throttle and all accessories off, the IAC duty cycle should be between approximately 22% and 65%.
- Observe the PIDs while carrying out the following at idle:
  - Lightly tap on the and wiggle the harness connector to simulate road shock.
  - Grasp the vehicle harness closest to the IAC valve. Shake and bend a small section of the harness from the IAC to the bulkhead and from the bulkhead to the PCM.
- **Do the IAC or RPM PIDs suddenly change in value, indicating a concern?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KE21**.

KE21 VERIFY THE SYMPTOM

- **Is an idle quality, starting or stalling symptom currently present?**

Yes	No
INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** to diagnose fast idle concerns.

KE22 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KF: FAN CONTROL (FC) RELAYS

This pinpoint test is intended to diagnose the following:

- LFC, MFC, HFC relays
- harness circuits: HFC, LFC, MFC, VPWR
- powertrain control module (PCM) (12A650)

Although the PCM output circuits are called low, medium and high fan control (FC), cooling fan operation is controlled by a combination of these outputs.

Refer to**ENGINE CONTROL COMPONENTS** .

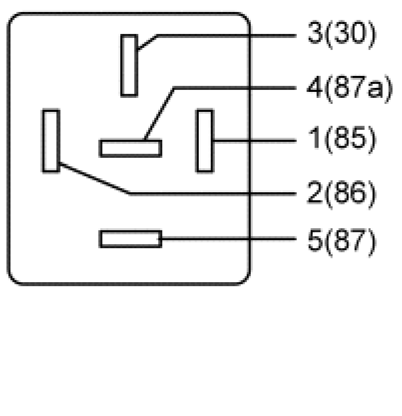

Fig. 181: Low Fan Control (LFC) Relay Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	LFC (Low Fan Control)
1	VPWR (Vehicle Power)

NOTE: The VPWR and LFC circuits may be reversed in the harness connector. Also, the LFC circuit may be wired to 2 separate relays. Refer to the Wiring Diagrams article for additional information.

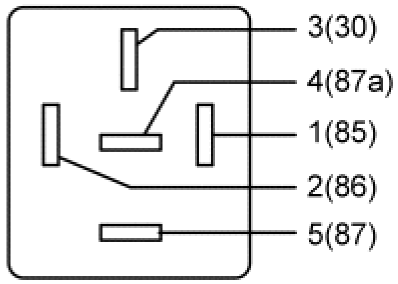

Fig. 182: Medium Fan Control (MFC) Relay Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	MFC (Medium Fan Control)
1	VPWR (Vehicle Power)

NOTE: The VPWR and MFC circuits may be reversed in the harness connector. Also, the MFC circuit may be wired to 2 separate relays. Refer to the Wiring Diagrams article for additional information.

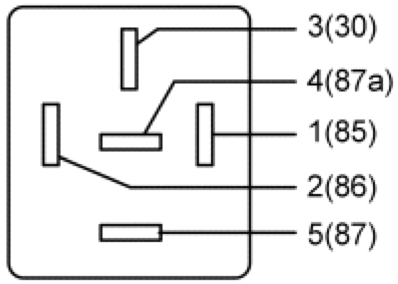

Fig. 183: High Fan Control (HFC) Relay Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	HFC (High Fan Control)

1	VPWR (Vehicle Power)

NOTE: The VPWR and HFC circuits may be reversed in the harness connector. Also, the HFC circuit may be wired to 2 separate relays. Refer to the Wiring Diagrams article for additional information.

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Pin	Circuit
Escape/Mariner 2.3L	B38 B17 B39	HFC MFC LFC
Focus	B18 B34	HFC LFC
Mustang	E4 E7	HFC LFC
Ranger	E7	LFC
All other vehicles	B38 B39	HFC LFC

KF1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0480, P0481, P0482, P1474, P1477 or P1479 present?**

Yes	No
For KOEO and KOER DTCs P0480 or P1474, GO to **KF3**. For continuous memory DTCs P0480 or P1474, GO to **KF36**. For DTCs P0481, P0482, P1477 or P1479, GO to **KF2**.	For fans always on: components, GO to **KF47**. For fans always on: all others, GO to **KF46**. For cooling fan circuits, GO to **KF47**. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

KF2 DTCS P0481, P0482, P1477 OR P1479: CHECK FOR THE PRESENCE OF THESE DTCS

- **Are DTCs P0481, P0482, P1477, or P1479 present? P0481 or P1479.**

Yes	No
For KOEO and KOER DTCs P0481 or P1479, Escape 3.0L, Mariner 3.0L. GO to **KF27**. For continuous memory DTCs P0481 or P1479, Escape 3.0L, Mariner 3.0L. GO to **KF44**. For KOEO and KOER DTCs P0481 or P1479, all others, GO to **KF13**.	For KOEO and KOER DTCs P0482 or P1477, Focus, GO to **KF18**. For continuous memory DTCs P0482 or P1477, Focus, GO to **KF42**. For KOEO and KOER DTCs P0482 or P1477, all others, GO to **KF8**.

For continuous memory DTCs P0481 or P1479, all others, GO to **KF38**.	For continuous memory DTCs P0482 or P1477, all others, GO to **KF40**.

KF3 KOEO AND KOER DTCS P0480 OR P1474: CHECK THE VPWR VOLTAGE TO THE LOW SPEED FC RELAY

- LFC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) LFC Relay Connector, Harness Side	(-)
VPWR - Pin 1	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KF4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF4 CHECK FOR LFC CIRCUIT CYCLING

- Key ON, engine OFF.
- Connect a non-powered test lamp between:

(+) LFC Relay Connector, Harness Side	(-) LFC Relay Connector, Harness Side
VPWR - Pin 1	LFC - Pin 2

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new LFC relay. CLEAR the DTCs. REPEAT the self-test.	GO to **KF5**.

KF5 CHECK THE LFC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Remove the test lamp.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) LFC Relay Connector, Harness Side	(-)
LFC - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KF6**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF6 CHECK THE LFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) LFC Relay Connector, Harness Side	(-)
LFC - Pin 2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KF7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF7 CHECK THE LFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) LFC Relay Connector, Harness Side	(-) PCM Connector, Harness Side
LFC - Pin 2	LFC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KF59**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF8 KOEO AND KOER DTCS P0482 OR P1477: CHECK THE VPWR VOLTAGE TO THE MEDIUM SPEED FC RELAY

- MFC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MFC Relay Connector, Harness Side	(-)
VPWR - Pin 1	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KF9**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF9 CHECK FOR MFC CIRCUIT CYCLING

- Key ON, engine OFF.
- Connect a non-powered test lamp between:

(+) MFC Relay Connector, Harness Side	(-) MFC Relay Connector, Harness Side
VPWR - Pin 1	MFC - Pin 2

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new MFC relay. CLEAR the DTCs.	GO to **KF10**.

REPEAT the self-test.	

KF10 CHECK THE MFC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Remove the test lamp.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MFC Relay Connector, Harness Side	(-)
MFC - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KF11**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF11 CHECK THE MFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) MFC Relay Connector, Harness Side	(-)
MFC - Pin 2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KF12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF12 CHECK THE MFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) MFC Relay	(-) PCM

Connector, Harness Side	Connector, Harness Side
MFC - Pin 2	MFC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KF59**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF13 KOEO AND KOER DTCS P0481 OR P1479: CHECK THE VPWR VOLTAGE TO THE HIGH SPEED FC RELAY

- HFC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC Relay Connector, Harness Side	(-)
VPWR - Pin 1	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KF14**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF14 CHECK FOR HFC CIRCUIT CYCLING

- Key ON, engine OFF.
- Connect a non-powered test lamp between:

(+) HFC Relay Connector, Harness Side	(-) HFC Relay Connector, Harness Side
VPWR - Pin 1	HFC - Pin 2

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Command the high speed fan ON.

- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new HFC relay. CLEAR the DTCs. REPEAT the self-test.	GO to **KF15**.

KF15 CHECK THE HFC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Remove the test lamp.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC Relay Connector, Harness Side	(-)
HFC - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KF16**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF16 CHECK THE HFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) HFC Relay Connector, Harness Side	(-)
HFC - Pin 2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KF17**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF17 CHECK THE HFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) HFC Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC - Pin 2	HFC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KF59**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF18 KOEO AND KOER DTCS P0482 OR P1477: CHECK THE VPWR VOLTAGE TO THE MFC1 RELAY

NOTE: **This application has 2 relays wired to the MFC circuit. This procedure may call out MFC1 and MFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2.**

- MFC1 Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MFC1 Relay Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KF19**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF19 CHECK FOR MFC CIRCUIT CYCLING

- Connect a non-powered test lamp between:

(+) MFC1 Relay	(-) MFC1 Relay

Connector, Harness Side	Connector, Harness Side
VPWR	MFC

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new MFC1 relay at the end of diagnostics. Leave the relay disconnected. CLEAR the DTCs. REPEAT the self-test. GO to **KF24**.	Leave the test lamp connected. GO to **KF20**.

KF20 CHECK FOR MFC CIRCUIT CYCLING WITH THE MFC2 RLY DISCONNECTED

- Connect a non-powered test lamp between:

(+) MFC1 Relay Connector, Harness Side	(-) MFC1 Relay Connector, Harness Side
VPWR	MFC

- MFC2 Relay connector disconnected.
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new MFC2 relay. CLEAR the DTCs. REPEAT the self-test.	GO to **KF21**.

KF21 CHECK THE MFC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MFC1 Relay Connector, Harness Side	(-)
MFC	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KF22**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF22 CHECK THE MFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) MFC1 Relay Connector, Harness Side	(-)
MFC	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KF23**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF23 CHECK THE MFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) MFC1 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
MFC	MFC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KF59**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF24 VERIFY THERE IS NOT AN OPEN IN THE CIRCUIT SPECIFIC TO THE MFC2 RELAY

- Access the PCM and monitor the MFC_F PID.
- Command the high speed fan ON.
- Command the outputs OFF.
- Command the low speed fan ON.
- Command the outputs OFF.
- **Does the PID indicate a concern (yes) when either the high or low speed cooling fan output is commanded on and off?**

Yes	No
GO to **KF25**.	INSTALL a new MFC relay. CLEAR the DTCs. REPEAT the self-test.

KF25 CHECK THE VPWR VOLTAGE TO THE MFC2 RELAY

- MFC2 Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MFC2 Relay Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KF26**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF26 CHECK THE MFC CIRCUIT BETWEEN THE MEDIUM SPEED FC RELAY(S)

- Key in OFF position.
- Measure the resistance between:

(+) MFC1 Relay Connector, Harness Side	(-) MFC2 Relay Connector, Harness Side
MFC	MFC

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new MFC relay(s). CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF27 KOEO AND KOER DTCS P0481 OR P1479: CHECK THE VPWR VOLTAGE TO THE HFC1 RELAY

NOTE: This application has 2 relays wired to the HFC circuit. This procedure may call out HFC1 and HFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2.

- HFC1 Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC1 Relay Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KF28**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF28 CHECK FOR HFC CIRCUIT CYCLING

- Connect a non-powered test lamp between:

(+) HFC1 Relay Connector, Harness Side	(-) HFC1 Relay Connector, Harness Side
VPWR	HFC

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is**

commanded on and off?

Yes	No
INSTALL a new HFC1 relay at the end of diagnostics. Leave the relay disconnected. CLEAR the DTCs. REPEAT the self-test. GO to **KF33**.	Leave the test lamp connected. GO to **KF29**.

KF29 CHECK FOR HFC CIRCUIT CYCLING WITH THE HFC2 RLY DISCONNECTED

- Connect a non-powered test lamp between:

(+) HFC1 Relay Connector, Harness Side	(-) HFC1 Relay Connector, Harness Side
VPWR	HFC

- HFC2 Relay connector disconnected.
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new HFC2 relay. CLEAR the DTCs. REPEAT the self-test.	GO to **KF30**.

KF30 CHECK THE HFC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC1 Relay Connector, Harness Side	(-)
HFC	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KF31**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF31 CHECK THE HFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) HFC1 Relay Connector, Harness Side	(-)
HFC	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KF32**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF32 CHECK THE HFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) HFC1 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC	HFC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KF59**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF33 VERIFY THERE IS NOT AN OPEN IN THE CIRCUIT SPECIFIC TO THE HFC2 RELAY

- Access the PCM and monitor the HFC_F PID.
- Command the high speed fan ON.
- Command the outputs OFF.
- Command the low speed fan ON.
- Command the outputs OFF.

- **Does the PID indicate a concern (yes) when either the high or low speed cooling fan output is commanded on and off?**

Yes	No
GO to **KF34**.	INSTALL a new HFC1 relay. CLEAR the DTCs. REPEAT the self-test.

KF34 CHECK THE VPWR VOLTAGE TO HFC2 RLY

- HFC2 Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC2 Relay Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KF35**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF35 CHECK THE HFC CIRCUIT BETWEEN THE HIGH SPEED FC RELAY(S)

- Key in OFF position.
- Measure the resistance between:

(+) HFC1 Relay Connector, Harness Side	(-) HFC2 Relay Connector, Harness Side
HFC	HFC

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new HFC relay(s). CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF36 CONTINUOUS MEMORY DTCS P0480 OR P1474: CHECK THE LFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO VOLTAGE

NOTE: If the test lamp does not turn on, command the high speed fan on.

- A/C and defrost off.
- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- LFC Relay connector disconnected.
- Connect a non-powered test lamp between:

(+) LFC Relay Connector, Harness Side	(-) LFC Relay Connector, Harness Side
VPWR - Pin 1	LFC - Pin 2

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is detected.
  - Shake, wiggle, and bend the LFC circuit(s).
  - Shake, wiggle, and bend the VPWR circuit to the LFC relay.
  - Inspect the LFC relay component for signs of damage.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KF37**.

KF37 CHECK THE LFC CIRCUIT FOR AN INTERMITTENT SHORT TO GROUND

- Key ON, engine OFF.
- Command the outputs OFF.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns on when a concern is detected.
  - Shake, wiggle, and bend the LFC circuit
  - Lightly tap on the LFC RLY to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KF38 CONTINUOUS MEMORY DTCS P0481 OR P1479: CHECK THE HFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO VOLTAGE

NOTE: If the test lamp does not turn on, command the low speed fan ON.

- A/C and defrost off.
- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- HFC Relay connector disconnected.
- Connect a non-powered test lamp between:

(+) HFC Relay Connector, Harness Side	(-) HFC Relay Connector, Harness Side
VPWR - Pin 1	HFC - Pin 2

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the high speed fan ON.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is detected.
  - Shake, wiggle, and bend the HFC circuit(s)
  - Shake, wiggle, and bend the VPWR circuit to the HFC relay
  - Lightly tap on the HFC RLY to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KF39**.

KF39 CHECK THE HFC CIRCUIT FOR AN INTERMITTENT SHORT TO GROUND

- Key ON, engine OFF.
- Command the outputs OFF.
- Observe the test lamp for an indication of a concern. Note that the lamp illuminates when a concern is detected. Wiggle, shake, and bend the HFC circuit(s). Shake, wiggle, and bend the PCM on both high speed FC relays.
- **Is a concern present?**

Yes	No
	Unable to duplicate or identify the concern at this

ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	time. refer to **PINPOINT TEST Z**.

KF40 CONTINUOUS MEMORY DTCS P0482 OR P1477: CHECK THE MFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO VOLTAGE

NOTE: If the test lamp does not turn on, command the high speed fan on.

- A/C and defrost off.
- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- MFC Relay connector disconnected.
- Connect a non-powered test lamp between:

(+) MFC Relay Connector, Harness Side	(-) MFC Relay Connector, Harness Side
VPWR - Pin 1	MFC - Pin 2

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is detected.
  - Shake, wiggle, and bend the MFC circuit(s).
  - Shake, wiggle, and bend the VPWR circuit to the MFC relay.
  - Inspect the MFC RLY component for signs of damage.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KF41**.

KF41 CHECK THE MFC CIRCUIT FOR AN INTERMITTENT SHORT TO GROUND

- Key ON, engine OFF.
- Command the outputs OFF.
- Observe the test lamp for an indication of a concern. Note that the lamp illuminates when a concern is detected. Wiggle, shake, and bend the HFC circuit(s). Shake, wiggle, and bend the PCM on both high speed FC relays.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KF42 CONTINUOUS MEMORY DTCS P0482 OR P1477: CHECK THE MFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO VOLTAGE

NOTE: This application has 2 relays wired to the MFC circuit. This procedure may call out MFC1 and MFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2.

NOTE: If the test lamp does not turn on, command the high speed fan ON.

- AC and defroster OFF.
- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- MFC1 Relay connector disconnected.
- Connect a non-powered test lamp between:

(+) MFC1 Relay Connector, Harness Side	(-) MFC1 Relay Connector, Harness Side
VPWR	MFC

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is detected.
  - Shake, wiggle, and bend the MFC circuit between the PCM and both medium speed FC relays
  - Shake, wiggle, and bend the VPWR circuit to both medium speed FC relays
  - Lightly tap on the medium speed FC relay that is still connected to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KF43**.

KF43 CHECK THE MFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key ON, engine OFF.
- Command the outputs OFF.
- Exit output test mode.
- Observe the test lamp for an indication of a concern. Note that the lamp illuminates when a concern is detected. Wiggle, shake, and bend the MFC circuit(s).
- Inspect the medium speed FC relay that is disconnected for intermittent concerns.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

KF44 CONTINUOUS MEMORY DTCS P0481 OR P1479: CHECK THE HFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO VOLTAGE

NOTE: **This application has 2 relays wired to the HFC circuit. This procedure may call out HFC1 and HFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2.**

NOTE: **If the test lamp does not turn on, command the high speed fan ON.**

- A/C and defroster OFF.
- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- HFC1 Relay connector disconnected.
- Connect a non-powered test lamp between:

(+) HFC1 Relay Connector, Harness Side	(-) HFC1 Relay Connector, Harness Side
VPWR	HFC

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is detected.
  - Shake, wiggle, and bend the PCM and both high speed FC relays.
  - Shake, wiggle, and bend the VPWR circuit to both high speed FC relays
  - Lightly tap on the high speed FC relay that is still connected to simulate road shock

- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KF45**.

KF45 CHECK THE HFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key ON, engine OFF.
- Command the outputs OFF.
- Exit output test mode.
- Observe the test lamp for an indication of a concern. Note that the lamp illuminates when a concern is detected. Wiggle, shake, and bend the HFC circuit(s) between the PCM and on both high speed FC relays.
- Inspect the high speed FC relay that is disconnected for intermittent concerns.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

KF46 THE COOLING FAN ALWAYS RUNS (NO DTCS): VERIFY THE FAN IS NOT ON BECAUSE OF A/C HIGH PRESSURE SWITCH INPUT TO THE PCM

- Key ON, engine running.
- Access the PCM and monitor the ACP PID.
- **Is the PID state CLOSED?**

Yes	No
The PCM turns the fan on when the medium pressure, normally open contacts of the ACHP switch are closed. GO to **KF57**.	The input is OK. GO to **KF47**.

KF47 COOLING FAN CONCERN (NO DTCS): CHECK THE FAN CONTROL PRIMARY CIRCUITS

NOTE: Chose the PIDs below as appropriate, according to which circuits the vehicle has.

- Verify that the A/C is OFF.
- Verify engine temperature is below the temperature where the cooling fan comes on.
- Key ON, engine OFF.
- Access the PCM and monitor the LFC_F, MFC_F and HFC_F PIDs.

- **Does either PID indicate a concern?**

Yes	No
A concern is present in the primary circuit(s). GO to **KF48**.	For all except Ranger, the PCM primary circuit(s) is OK. To check for secondary wiring, REFER to the **ENGINE COOLING -- E-SERIES** , for cooling system diagnosis. For Ranger: GO to **KF50**.

KF48 DOES THE LFCF PID INDICATE A CONCERN?

- **Does the LFCF PID indicate a concern?**

Yes	No
The low fan control (LFC) circuitry has a primary circuit concern. GO to **KF3**.	GO to **KF49**.

KF49 DOES THE MFCF PID INDICATE A CONCERN?

- **Does the MFCF PID indicate a concern?**

Yes	No
The medium fan control (MFC) primary circuitry has a circuit concern. For Focus, GO to **KF18**. For all others, GO to **KF8**.	The high fan control (HFC) primary circuitry has a circuit concern. For Escape 3.0L, and Mariner 3.0L, GO to **KF27**. For all others, GO to **KF13**.

KF50 IS THE SYMPTOM: COOLING FAN ALWAYS RUNS?

- **Is the symptom: cooling fan always runs?**

Yes	No
GO to **KF56**.	GO to **KF51**.

KF51 ELECTRIC COOLING FAN CONCERN (WITH NO DTCS): ELECTRIC COOLING FAN FUNCTIONAL CHECK

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- **Does the fan operate?**

Yes	No
All cooling fan circuit checks are OK. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts to continue diagnosis.	GO to **KF52**.

KF52 FAN INOPERATIVE: COMMAND THE LOW SPEED FAN ON AND CHECK FOR VOLTAGE TO THE CF

- Key in OFF position.
- CF Motor connector disconnected.
- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Measure the voltage between:

(+) CF Motor Connector, Harness Side	(-)
FAN PWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KF53**.	GO to **KF54**.

KF53 CHECK THE GROUND CIRCUIT TO THE COOLING FAN

- Key in OFF position.
- Measure the resistance between:

(+) CF Motor Connector, Harness Side	(-)
GND	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new CF motor. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF54 CHECK THE B+ VOLTAGE TO THE FC RELAY

- FC Relay connector disconnected.

- Measure the voltage between:

(+) FC Relay Connector, Harness Side	(-)
B+	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KF55**.	REPAIR the open circuit. There is a B+ circuit concern. CHECK the condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before replacing the fuse/fuse link. CLEAR the DTCs. REPEAT the self-test.

KF55 CHECK THE FAN PWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FC Relay Connector, Harness Side	(-) CF Motor Connector, Harness Side
FAN PWR	FAN PWR

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new FC relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF56 CHECK FOR FC RLY CONTACTS ALWAYS CLOSED

NOTE: Verify the A/C and defrost are off.

- FC Relay connector disconnected.
- Key ON, engine OFF.
- **Does the fan run with the key in the ON position?**

Yes	No
REPAIR the short circuit to PWR. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new FC relay. CLEAR the DTCs. REPEAT the self-test.

KF57 CHECK THE A/CHPSW (MEDIUM PRESSURE, NORMALLY OPEN CONTACTS)

- A/CHPSW connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the ACP PID.
- **Is the PID state CLOSED?**

Yes	No
GO to **KF58**.	CONNECT the A/CHPSW. REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** , to diagnose the A/C system pressure. If OK, INSTALL a new A/CHPSW. CLEAR the DTCs. REPEAT the self-test.

KF58 CHECK THE A/CPSW CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) A/CHPSW Connector, Harness Side	(-)
A/CPSW	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
VERIFY the results of the previous test steps. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts to continue diagnosis.	REPAIR the short circuit to GND. CLEAR the DTCs. REPEAT the self-test.

KF59 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KG: FUEL INJECTOR

This pinpoint test is intended to diagnose the following:

- fuel injector(s) (9F593)
- harness circuits: VPWR and INJ 1 - 10
- powertrain control module (PCM) (12A650)

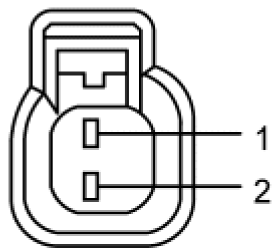

Fig. 184: Injector (INJ) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Fusion 3.0L, Milan 3.0L	A	2 1	INJ VPWR
All other vehicles	A	1 2	INJ VPWR

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series 6.8L, F-Super Duty 6.8L	170 Pin	E52 E35 E53	INJ1 INJ2 INJ3

		E36 E54 E37 E55 E38 E56 E39	INJ4 INJ5 INJ6 INJ7 INJ8 INJ9 INJ10
Edge, F-150 4.2L, MKX, Sable, Taurus, Taurus X	190 Pin	E52 E35 E53 E36 E54 E37	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6
Escape/Mariner 3.0L	150 (50-50-50) Pin	E2 E5 E13 E4 E3 E15	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6
Escape/Mariner 2.3L	150 (50-50-50) Pin	E2 E3 E4 E5	INJ1 INJ2 INJ3 INJ4
Expedition, Navigator	140 Pin	E52 E35 E53 E36 E54 E37 E55 E38	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8
Explorer 4.0L, Explorer Sport Trac 4.0L, Mountaineer 4.0L, Mustang 4.0L, Ranger 4.0L, Ranger 3.0L	170 Pin	E52 E35 E53 E36 E54 E37	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6
F-150 4.6L, F-150 5.4L, Mark LT	190 Pin	E52 E35 E53 E36 E54 E37 E55 E38	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8

Focus	190 Pin	E1 E2 E3 E4	INJ1 INJ2 INJ3 INJ4
Fusion 3.0L, Milan 3.0L, MKZ	140 Pin	E52 E35 E53 E36 E54 E37	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6
Fusion 2.3L, Milan 2.3L	140 Pin	E52 E35 E53 E36	INJ1 INJ2 INJ3 INJ4
Ranger 2.3L	170 Pin	E52 E35 E53 E36	INJ1 INJ2 INJ3 INJ4
All other vehicles	170 Pin	E52 E35 E53 E36 E54 E37 E55 E38	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8

KG1 DTCS P0201 THROUGH P0210 OR SYMPTOMS WITHOUT DTCS: CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

NOTE: **Disconnect the suspect fuel injector harness connector. Only the suspect injector needs to be diagnosed.**

NOTE: **On some vehicles, the injector voltage is only present when the fuel pump relay is energized. Measure the injector voltage within 2 seconds of the key ON.**

- Key in OFF position.
- INJ connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) INJ Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KG2**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KG2 CHECK THE INJ CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) INJ Connector, Harness Side
Suspect INJ	INJ

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KG3**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KG3 CHECK THE INJ CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) INJ Connector, Harness Side	(-)
INJ	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KG4**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KG4 CHECK THE INJ CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) INJ Connector, Harness Side	(-)
INJ	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **KG5**.

KG5 CHECK THE RESISTANCE OF THE FUEL INJECTOR

- Key in OFF position.
- Measure the resistance between:

(+) INJ Connector, Component Side	(-) INJ Connector, Component Side
VPWR	INJ

- **Is the resistance between 11 - 18 ohms?**

Yes	No
GO to **KG6**.	INSTALL a new fuel injector. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

KG6 CHECK THE FUNCTIONALITY OF THE INJ CIRCUIT

- PCM connector connected.
- Key ON, engine OFF.
- Connect a non-powered test lamp between:

(+) INJ Connector, Harness Side	(-) INJ Connector, Harness Side
VPWR	INJ

- Key ON, engine running.

- **Is the test lamp blinking?**

Yes	No
GO to **KG7**.	GO to **KG8**.

KG7 CARRY OUT A THOROUGH WIGGLE TEST ON THE FUEL INJECTOR HARNESS

- Key in OFF position.
- INJ connector connected.
- Key ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the INJ_F PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the fuel injector to the PCM.
- **Are any injector values fluctuating in and out of range?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KG8 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KJ: SUPERCHARGER BYPASS CONTROL

This pinpoint test is intended to diagnose the following:

- supercharger bypass actuator
- vacuum hoses

KJ1 CHECK FOR DTCS

NOTE: **DTCs P1227 and P1228 are for informational purposes only and are usually accompanied by other DTCs. If concerns are present with the mass air flow (MAF) sensor, the exhaust gas recirculation (EGR) valve, or the manifold absolute pressure (MAP) sensor, DTCs P1227 or P1228 may be set. Diagnose all other DTCs before diagnosing DTCs P1227 or P1228.**

- **Are DTCs P1227, or P1228 present?**

Yes	No
GO to **KJ2**.	For lack/loss of power, GO to **KJ3**. For all other symptoms without DTCs, GO to **KJ2**.

KJ2 DTCS P1227 OR P1228: VERIFY THE DTC

- Record and clear the DTCs.
- Drive the vehicle at normal operating temperature with the engine exceeding 2,000 RPM.
- Check for DTCs.
- **Are any other DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **KJ4**.

KJ3 CHECK THE IAT2 PID

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

- Key ON, engine running.
- Access the PCM and monitor the IAT2 PID.
- **Is the temperature greater than 110°C (230°F)?**

Yes	No

CHECK for low fluid level in the charge air cooler (CAC) system. CHECK for damaged CAC lines. REFER to the **ENGINE COOLING -- E-SERIES** , Supercharger Cooling to diagnose a loss of coolant.	GO to **KJ4**.

KJ4 CHECK THE SUPERCHARGER BYPASS ACTUATOR VACUUM HOSES

NOTE: For vehicle specific vacuum hose routing, refer to the VECI label located in the front of the engine compartment.

- Check for holes, cracks, bends or kinks in the vacuum lines going to the supercharger bypass actuator.
- Check for any disconnected hoses at the supercharger bypass actuator.
- **Are any concerns present?**

Yes	No
REPAIR or INSTALL new vacuum lines as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KJ5**.

KJ5 CHECK THE BYPASS VALVE ACTUATOR

NOTE: Additional DTCs may set as a result of disconnecting the vacuum line in this step.

- Visually inspect the bypass valve actuator for damage.
- Key in OFF position.
- Note the position of the supercharger bypass actuator linkage.
- Key ON, engine running.
- Note the position of the supercharger bypass actuator linkage.
- Disconnect the supercharger bypass actuator upper vacuum hose.
- **Does the supercharger bypass actuator linkage move when the engine is started, and return to the original position when the supercharger bypass actuator vacuum line is disconnected?**

Yes	No
The concern is not present at this time. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** to diagnose lack/loss of power concerns.	INSTALL a new supercharger bypass actuator. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST KM: AIR CONDITIONING CLUTCH (A/CC) RELAY CIRCUIT

WARNING: Crown Victoria Police Interceptor vehicles equipped with fire suppression

system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.

This pinpoint test is intended to diagnose the following:

- A/CC relay
- harness circuits: VPWR, A/CCR, A/CCS
- powertrain control module (PCM) (12A650)

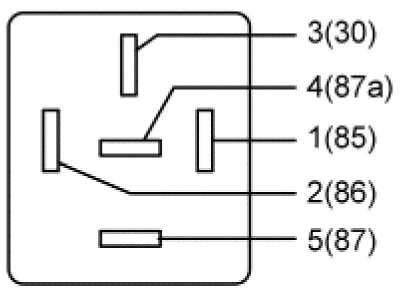

Fig. 185: Air Conditioning Clutch (A/CC) Relay Connector - A
Courtesy of FORD MOTOR CO.

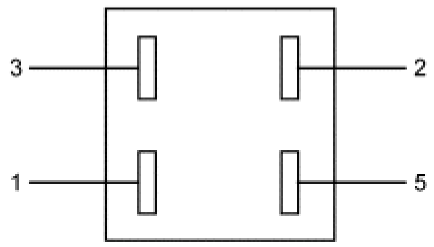

Fig. 186: Air Conditioning Clutch (A/CC) Relay Connector - B
Courtesy of FORD MOTOR CO.

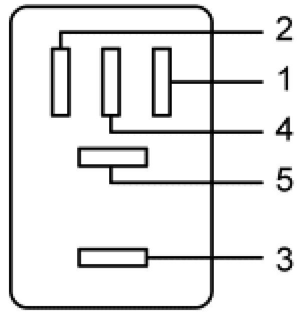

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Fig. 187: Air Conditioning Clutch (A/CC) Relay Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition, F-150, Mark LT, Navigator	A	1 2	A/CCR VPWR
Focus	B	2 1	A/CCR VPWR
All other vehicles	C	1 2	A/CCR VPWR

The VPWR and A/CCR circuits may be reversed in the harness connector. Refer to the Wiring Diagrams article for additional information.

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series, F-Super Duty	170 Pin	E3	A/CCR
Edge, F-150, Mark LT, MKX, Sable, Taurus, Taurus X	190 Pin	B18	A/CCR
Escape/Mariner	150 (50-50-50) Pin	B25	A/CCR
Expedition,	140 Pin	B18	A/CCR

Navigator			
Focus	190 Pin	B2	A/CCR
Fusion, Milan, MKZ	140 Pin	B64	A/CCR
All other vehicles	170 Pin	B14	A/CCR

KM1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0534, P0645, P1460, P1464 or P1469 present?**

Yes	No
For KOEO and KOER DTCs P0645 or P1460, GO to **KM2**. For continuous memory DTCs P0645 or P1460, GO to **KM10**. For KOEO and KOER DTC P1464, GO to **KM8**. For continuous memory DTCs P0534 or P1469, GO to **KM12**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

KM2 KOEO AND KOER DTCS P1460 OR P0645: VERIFY THAT THE ACCS PID IS OFF

NOTE: **Verify the A/C and the defrost are off during KOEO/KOER self-tests. If the vehicle is not equipped with A/C, the A/CCR circuit is not used and DTC P1460/P0645 can be ignored.**

- Key ON, engine running.
- A/C and defroster OFF.
- Access the PCM and monitor the ACCS PID.
- **Is the PID state OFF?**

Yes	No
GO to **KM3**.	REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.

KM3 CHECK THE VPWR VOLTAGE TO THE A/CC RELAY

- Key in OFF position.
- A/CC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) A/CC Relay Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KM4**.	REPAIR the open circuit. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.

KM4 CHECK THE A/CC RELAY

- Key in OFF position.
- Carry out the A/CC relay component test. Refer to the Wiring Diagrams Cell 149 Component Testing.
- **Does the A/CC relay pass the component test?**

Yes	No
GO to **KM5**.	INSTALL a new A/CC relay. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. CLEAR the DTCs. REPEAT the self-test.

KM5 CHECK THE A/CCR (WAC) CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) A/CC Relay Connector, Harness Side	(-)
A/CCR	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KM6**.	REPAIR the short circuit. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch.

	REPEAT the self-test.

KM6 CHECK THE A/CCR (WAC) CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) A/CC Relay Connector, Harness Side	(-)
A/CCR	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KM7**.	REPAIR the short circuit. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.

KM7 CHECK THE A/CCR (WAC) CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) A/CC Relay Connector, Harness Side	(-) PCM Connector, Harness Side
A/CCR	A/CCR

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KM14**.	REPAIR the open circuit. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.

KM8 KOEO AND KOER DTC P1464: VERIFY THE A/C AND DEFROST ARE OFF DURING THE SELF-TEST

- Verify the A/C and defrost are off during the self-test.
- **Are the A/C and defrost off during the self-test?**

Yes	No
GO to **KM9**.	Turn the A/C and defrost off. REPEAT the self-test where DTC P1464 was retrieved.

KM9 CHECK THE ACCS PID

- Key ON, engine OFF.
- A/C and defroster OFF.
- Access the PCM and monitor the ACCS PID.
- **Is the PID state ON?**

Yes	No
The ACCS PID indicates the PCM is being requested to turn the A/C on. REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.	The ACCS PID indicates that the ACCS input to the PCM is low. VERIFY the test step results. Turn off the A/C and defrost. REPEAT the self-test.

KM10 CONTINUOUS MEMORY DTCS P1460 OR P0645: CHECK THE A/CCR (WAC) CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

NOTE: If the vehicle is not equipped with A/C, the A/CCR circuit is not used and the P1460/P0645 can be ignored.

NOTE: The A/C clutch clicks on when a concern is present.

- Key ON, engine OFF.
- Check the A/CCR (WAC) circuit for short to ground while carrying out the following:
    - Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module
    - Lightly tap on the A/CC relay to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.	GO to **KM11**.

KM11 CHECK THE A/CCR (WAC) FOR AN OPEN OR SHORT CIRCUIT TO VOLTAGE

NOTE: The A/C clutch clicks off if a concern is present.

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Check the A/CCR (WAC) circuit for an open or short to voltage while carrying out the following:
  - Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module
  - Lightly tap on the A/CC relay to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KM12 CONTINUOUS MEMORY DTCS P0534 OR P1469: CHECK FOR CAUSES OF FAST A/CCS CYCLING

- Check the following:
  - A/C system pressure
  - A/CCS cycle times

  REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.

- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary.	GO to **KM13**.

KM13 CHECK FOR INTERMITTENT OPEN IN THE A/CCS CIRCUIT

NOTE: The ACCS PID turns off and on quickly when a concern is present, indicating an intermittent open.

- Key ON, engine OFF.
- Access the PCM and monitor the ACCS PID.
- Turn on the A/C switch.
- Check the A/CCR (WAC) circuit for an open or short to voltage while carrying out the following:
  - Wiggle, shake, and bend small sections of the wiring harness while working from the component to

the module.
    - Lightly tap on the pressure switch (PS) (to simulate road shock).
- Inspect the A/CCS connector.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KM14 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
    - pushed out pins
    - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KN: VARIABLE SPEED ELECTRIC COOLING FAN

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- variable speed electric cooling fan (8T00)
- harness circuits: FCV, B+, GND
- powertrain control module (PCM) (12A650)

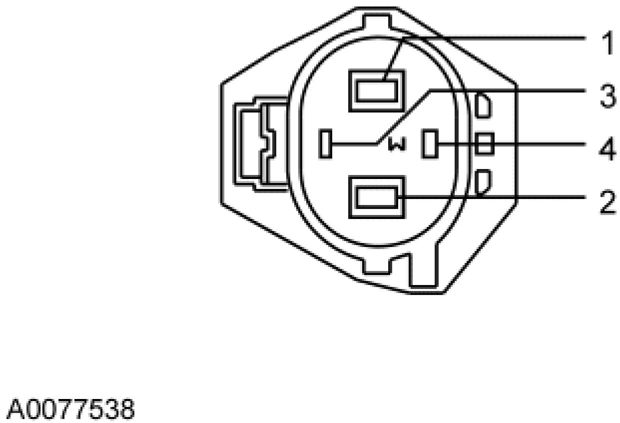

Fig. 188: Cooling Fan (CF) Motor Connector (1 Of 2)
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	FCV (Fan Control Variable)
2	GND (Ground)
1	B+ (Battery Positive Voltage)

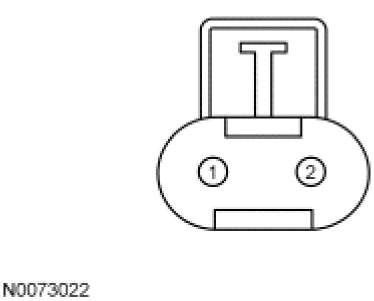

Fig. 189: Cooling Fan (CF) Motor Connector (2 Of 2)
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	GND (Ground)
2	VPWR (Vehicle Power)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Town Car	170 Pin	E7	FCV

Fusion, Milan, MKZ	140 Pin	B8	FCV
All other vehicles	190 Pin	B48	FCV

KN1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Is DTC P0480 or P0483 present?**

Yes	No
For KOEO and KOER DTC P0480, GO to **KN2**. For continuous memory DTC P0480, GO to **KN9**. For continuous memory DTC P0483, GO to **KN15**.	For electric cooling fan(s) does not operate (low, medium, high or variable speed), GO to **KN11**.

KN2 KOEO AND KOER DTC P0480: CHECK THE B+ AND GND CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- CF Module connector disconnected.
- Rotate the fan by hand. The fan should rotate freely, with no abnormal binding. If binding is present, remove any foreign materials or install a new fan assembly as required.
- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-) CF Module Connector, Harness Side
B+ - Pin 1	GND - Pin 2

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KN4**.	GO to **KN3**.

KN3 CHECK THE VOLTAGE TO THE COOLING FAN MODULE USING GROUND AS A REFERENCE

- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-)
B+ - Pin 1	Ground

- **Is the voltage greater than 10 V?**

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.	A B+ circuit concern is present. CHECK the condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before installing a new fuse/fuse link.

KN4 CHECK THE FCV CIRCUIT(S)

- Connect the 1.6K ohms resistor between the FCV and B+ circuits at the CF module harness connector (this simulates cooling fan circuitry).
- Key ON, engine OFF.
- Carry out the KOEO self-test.
- **Is DTC P0480 present?**

Yes	No
GO to **KN6**.	For Crown Victoria, Grand Marquis, and Town Car, GO to **KN5**. For all others, INSTALL a new CF module. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KN5 CHECK THE COOLING FAN OPERATION

- CF Motor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A 12 Volt Vehicle Battery	Point B CF Motor Connector, Component Side
Positive terminal	VPWR - Pin 2

- Connect a 5 amp fused jumper wire between the following:

Point A Vehicle Battery	Point B CF Motor Connector, Component Side
Negative	GND - Pin 1

terminal	

- **Does the cooling fan motor operate correctly?**

Yes	No
INSTALL a new CF module. REFER to the **ENGINE COOLING -- E-SERIES** .	INSTALL a new Cooling Fan. REFER to the **ENGINE COOLING -- E-SERIES** .

KN6 CHECK THE FCV CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-)
FCV - Pin 4	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KN7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KN7 CHECK THE FCV CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) CF Module Connector, Harness Side	(-)
FCV - Pin 4	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KN8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KN8 CHECK FOR AN OPEN CIRCUIT BETWEEN THE PCM AND COOLING FAN MODULE

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CF Module Connector, Harness Side
FCV	FCV - Pin 4

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KN16**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KN9 CONTINUOUS MEMORY DTC P0480: CHECK THE B+ AND GND CIRCUIT FOR AN INTERMITTENT CONCERN

- Key in OFF position.
- CF Module connector disconnected.
- Rotate the fan by hand. The fan should rotate freely, with no abnormal binding. If binding is present, remove any foreign materials or install a new fan assembly as required.
- Connect a non-powered test lamp between:

(+) CF Module Connector, Harness Side	(-) CF Module Connector, Harness Side
B+ - Pin 1	GND - Pin 2

- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is present.
  - Shake, wiggle, and bend the B+ and GND circuits to the CF
  - Shake, wiggle, and bend the associated fuse
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KN10**.

KN10 CHECK THE FCV CIRCUIT(S) FOR INTERMITTENT CONCERNS

- Connect the 1.6 K ohms resistor between the FCV and B+ circuits at the CF harness connector (this simulates cooling fan circuitry).

- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-)
FCV - Pin 4	Ground

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Observe the digital multimeter (DMM) for an indication of a concern while shaking, wiggling, and bending the FCV circuit between the CF module and the PCM. Note that voltage changes suddenly when a concern is detected.
- Command the outputs OFF.
- Exit output test mode.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

KN11 COOLING FAN MOTOR DOES NOT OPERATE (WITH NO DTCS): COMMAND THE FAN ON TO CHECK OPERATION

- Carry out the KOEO self-test.
- Listen to the fan.
- **Does the fan operate sometime during the KOEO self-test?**

Yes	No
The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** for further direction.	GO to **KN12**.

KN12 CHECK THE B+ AND GND CIRCUITS TO THE COOLING FAN MODULE

- Key in OFF position.
- CF Module connector disconnected.
- Rotate the fan by hand. The fan should rotate freely, with no abnormal binding. If binding is present, remove any foreign materials or install a new fan assembly as required.
- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-) CF Module Connector, Harness Side
B+ - Pin 1	GND - Pin 2

- **Is the voltage greater than 10 V?**

Yes	No
For Crown Victoria, Grand Marquis, and Town Car, GO to **KN13**. For all others, INSTALL a new CF module. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **KN14**.

KN13 CHECK THE COOLING FAN OPERATION

- CF Motor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A 12 Volt Vehicle Battery	Point B CF Motor Connector, Component Side
Positive terminal	VPWR - Pin 2

- Connect a 5 amp fused jumper wire between the following:

Point A Vehicle Battery	Point B CF Motor Connector, Component Side
Negative terminal	GND - Pin 1

- **Does the cooling fan motor operate correctly?**

Yes	No
INSTALL a new CF module. REFER to the **ENGINE COOLING -- E-SERIES** .	INSTALL a new Cooling Fan. REFER to the **ENGINE COOLING -- E-SERIES** .

KN14 CHECK THE VOLTAGE TO THE COOLING FAN MODULE USING GROUND AS A REFERENCE

- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-)
B+ - Pin 1	Ground

- **Is the voltage greater than 10 V?**

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.	A B+ circuit concern is present. CHECK the condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before installing a new fuse/fuse link. CLEAR the DTCs. REPEAT the self-test.

KN15 CONTINUOUS MEMORY DTC P0483: CHECK FOR A COOLING FAN MOTOR OBSTRUCTION OR A COOLING FAN MOTOR MECHANICAL FAILURE

- **Is a cooling fan motor obstruction or a cooling fan motor mechanical failure present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	CLEAR the DTCs. REPEAT the self-test.

KN16 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Replacement PCM.	

PINPOINT TEST KP: CHARGE AIR COOLER (CAC) PUMP

This pinpoint test is intended to diagnose the following:

- CAC pump relay (14B192)
- CAC pump (8501)
- harness circuits: CAC, VPWR and GND
- powertrain control module (PCM) (12A650)

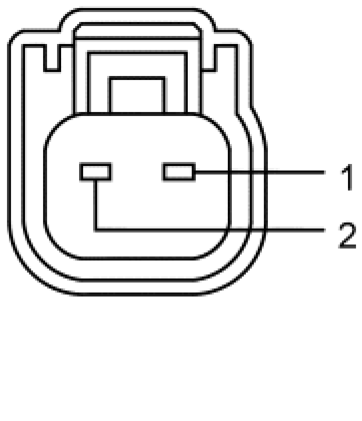

Fig. 190: Charge Air Cooler (CAC) Pump Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	GND (Ground)
1	PUMPPWR (Pump Power)

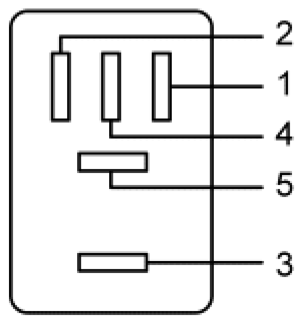

Fig. 191: Powertrain Control Module Power (PCM Power) Relay Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
5	PUMPPWR (Pump Power)
3	B+ (Battery Positive Voltage)
2	CAC (Charge Air Cooler)
1	VPWR (Vehicle Power)

Pin	Circuit
E64	CAC (Charge Air Cooler)

KP1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Is DTC P1229 present?**

Yes	No
For DTC P1229, GO to **KP2**.	For a boost gauge indicates higher than normal boost, GO to **KP9**.

KP2 DTC P1229: CHECK THE VOLTAGE TO THE CAC PUMP RELAY COIL

- Key in OFF position.
- CAC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CAC Relay	

Connector, Harness Side	(-)
VPWR - Pin 1	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KP3**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KP3 CHECK THE CAC PUMP RELAY

- Key in OFF position.
- Remove the relay from the power distribution box.
- Measure the resistance between:

(+) CAC Relay Connector, Component Side	(-) CAC Relay Connector, Component Side
CAC - Pin 2	VPWR - Pin 1

- **Is the resistance between 65 - 100 ohms?**

Yes	No
GO to **KP4**.	INSTALL a new CAC relay. CLEAR the DTCs. REPEAT the self-test.

KP4 CHECK THE CAC PUMP RELAY

- Carry out the CAC pump relay component test. Refer to the Wiring Diagrams Cell 149 Component Testing.
- **Does the CAC pump relay pass the component test?**

Yes	No
GO to **KP5**.	INSTALL a new CAC relay. CLEAR the DTCs. REPEAT the self-test.

KP5 CHECK FOR AN OPEN CIRCUIT BETWEEN THE PCM AND THE CAC RELAY

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CAC Relay Connector, Harness Side
CAC - Pin E64	CAC - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KP6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KP6 CHECK FOR A SHORT TO VOLTAGE BETWEEN THE PCM AND THE CAC RELAY

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
CAC - Pin E64	Negative terminal

- **Is the voltage less than 0.5 V?**

Yes	No
GO to **KP7**.	REPAIR the short circuit to PWR. CLEAR the DTCs. REPEAT the self-test.

KP7 CHECK BETWEEN THE PCM AND THE CAC RELAY FOR A SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
CAC - Pin E64	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KP8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KP8 CHECK THE SCICP PID

- PCM connector connected.
- Access the PCM and monitor the SCICP PID.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- **Is the SCICP PID on?**

Yes	No
If the CAC reservoir is full, there is no air flow blockage at the CAC radiator, the IAT2 and connecting circuits are not high resistance or open, CAC hoses are not reversed and DTC P1229 is present in KOEO and KOER, GO to **KP15**.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KP9 CHECK THE CAC FOR MECHANICAL OPERATION

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Observe the CAC pump.
- Command the outputs OFF.
- **Does the CAC pump run?**

Yes	No
CHECK for low fluid level in the CAC system. CHECK for cracked or incorrectly routed CAC lines or airflow blockage at the CAC radiator. REPAIR the system as necessary. If the symptom still exists, RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** to diagnose boost gauge indicates higher than normal boost.	GO to **KP10**.

KP10 CHECK THE VOLTAGE AND GROUND CIRCUITS AT THE CAC PUMP

- Charge Air Cooler (CAC) Pump connector disconnected.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Measure the voltage between:

(+) Charge	(-) Charge Air

Air Cooler (CAC) Pump Connector, Harness Side	Cooler (CAC) Pump Connector, Harness Side
PUMPPWR - Pin 1	GND - Pin 2

- **Is the voltage greater than 10 V?**

Yes	No
INSTALL a new Charge Air Cooler (CAC) Pump. REFER to the **ENGINE COOLING -- E-SERIES** , Supercharger Cooling. CLEAR the DTCs. REPEAT the self-test.	GO to **KP11**.

KP11 CHECK THE CAC VOLTAGE CIRCUIT TO GND

- Measure the voltage between:

(+) Charge Air Cooler (CAC) Pump Connector, Harness Side	(-) Vehicle Battery
PUMPPWR - Pin 1	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KP12**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KP12 CHECK THE INTEGRITY OF THE CAC PUMP GROUND CONNECTION

- Charge Air Cooler (CAC) Pump connector disconnected.
- Measure the resistance between:

(+) Charge Air Cooler (CAC) Pump Connector, Harness Side	(-) Vehicle Battery
GND - Pin 2	Negative terminal

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KP13**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KP13 CHECK THE VOLTAGE TO THE CAC PUMP RELAY

- CAC Relay connector disconnected.
- Measure the voltage between:

(+) CAC Relay Connector, Harness Side	(-)
B+ - Pin 3	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **KP14**.	REPAIR the open circuit. CHECK the fuses. CLEAR the DTCs. REPEAT the self-test.

KP14 CHECK FOR AN OPEN CAC PUMP CIRCUIT

- Measure the resistance between:

(+) CAC Relay Connector, Harness Side	(-) Charge Air Cooler (CAC) Pump Connector, Harness Side
PUMPPWR - Pin 5	PUMPPWR - Pin 1

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new CAC pump relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KP15 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.

- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. refer to **PINPOINT TEST Z**.

PINPOINT TEST NC: IGNITION ENGINE SPEED INPUT CIRCUIT

This pinpoint test is intended to diagnose the powertrain control module (PCM) (12A650).

NC1 CONTINUOUS MEMORY DTC P0320: ERRATIC IGNITION

- Verify all 2-way radio installations. Carefully follow the manufacturer's installation instructions regarding the routing of the antenna and voltage leads.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **NC2**.

NC2 NO START CONCERN

- **Is the customer complaint no start?**

Yes	No
refer to **PINPOINT TEST A**.	GO to **NC3**.

NC3 INTERMITTENT CONDITION

- **Is this an intermittent condition?**

Yes	No
refer to **PINPOINT TEST Z**.	refer to **PINPOINT TEST JD**.

PINPOINT TEST ND: ENGINE RPM\VEHICLE SPEED LIMITER REACHED

NOTE: Enter this pinpoint test only when directed here.

ND1 DTCS P0219, P0297 OR P1270: EXCESSIVE ENGINE RPM OR VEHICLE SPEED

- P0219 (engine over speed), P0297 (vehicle over speed) or P1270 DTCs indicate the vehicle was operated in a manner which caused the engine or vehicle speed to exceed a calibrated limit.
    - Excessive engine RPM in NEUTRAL or operated in the wrong transmission gear.
    - Excessive wheel slippage (water, ice, mud or snow).
    - Vehicle driven at a high rate of speed.
- **Was the vehicle operating in any of the above conditions?**

Yes	No
The on-board diagnostics (OBD) system is OK. RETURN the vehicle to customer with information about the DTC.	REFER to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** . If there are no other symptoms, RETURN the vehicle to the customer with information about the DTC.

PINPOINT TEST QA: UNABLE TO ACTIVATE SELF-TEST/NETWORK COMMUNICATION ERROR

This pinpoint test is intended to diagnose the following:

- unable to communicate with PCM
- unable to activate the PCM self-test.
- incorrect self-test procedure
- harness circuits: ISP-R, PCMRC, PWRGND and VPWR

VREF INFORMATION TABLE

Application	Engine	Measure the PCM VREF at:
Edge/MKX	All	ETBTPS
Escape/Mariner	All	TP Sensor or FRPT
Expedition/Navigator	All	ETBTPS
Focus	All	ETBTPS
Fusion/Milan/MKZ	All	ETBTPS
Ranger	All	TP Sensor
Taurus/Taurus X/Sable	All	ETBTPS
All Others	All	FRPT

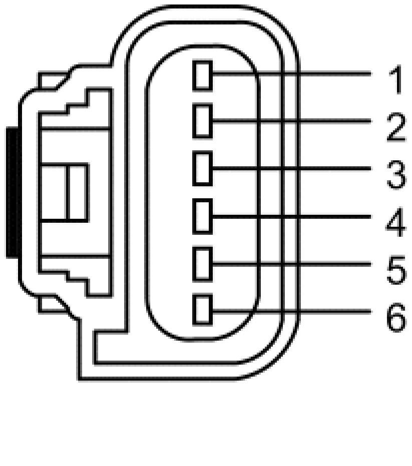

Fig. 192: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

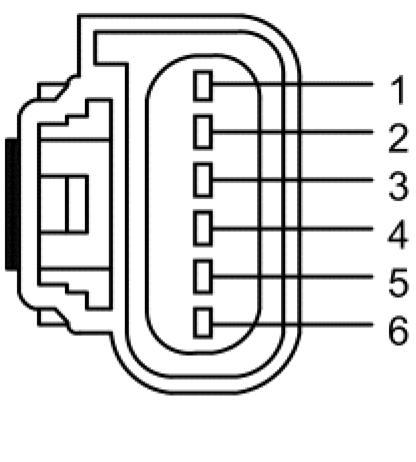

Fig. 193: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - B
Courtesy of FORD MOTOR CO.

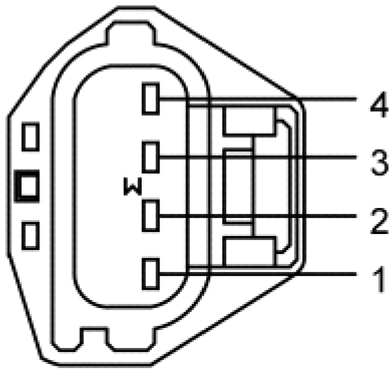

Fig. 194: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus, Taurus X	A	2 3	ETCRTN ETCREF
Fusion 2.3L, Milan 2.3L	B	3 5	ETCRTN ETCREF
Fusion 3.0L, Milan 3.0L	B	4 5	ETCRTN ETCREF
All other vehicles	C	3 2	ETCRTN ETCREF

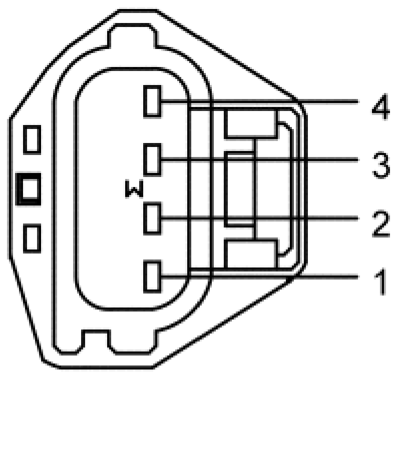

Fig. 195: Fuel Rail Pressure Temperature (FRPT) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

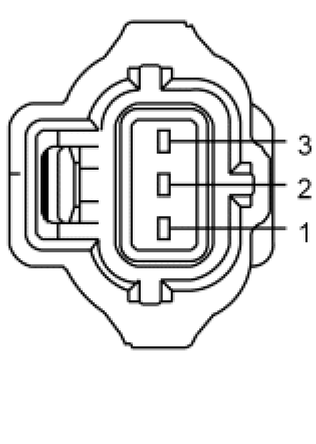

Fig. 196: Throttle Position (TP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

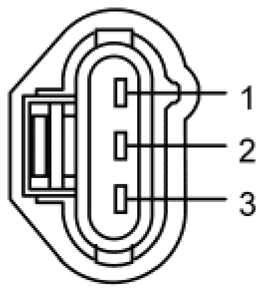

Fig. 197: Throttle Position (TP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Ranger 2.3L	A	1 3	SIGRTN VREF
All other vehicles	B	3 1	SIGRTN VREF

Vehicle	Connector	Pin	Circuit
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B67, B68, B69, B70 B51, B52, B53 B8 B7	PWRGND VPWR PCMRC ISP-R
Escape/Mariner	150 (50-50-50) Pin	B47, B48, B49, B50 B35, B36	PWRGND VPWR
Expedition, Navigator	140 Pin	B67, B68, B69, B70 B51, B52, B53 B8 B7	PWRGND VPWR PCMRC ISP-R
Explorer, Explorer Sport Trac, Mountaineer, Mustang	170 Pin	B47, B48, B49, B50 B35, B36 B37 B46	PWRGND VPWR PCMRC ISP-R
F-150, Mark LT	190 Pin	B67, B68, B69, B70 B51, B52, B53 B40 B17	PWRGND VPWR PCMRC ISP-R
F-Super Duty	170 Pin	B47, B48, B49, B50	PWRGND

		B35, B36 B37 B31	VPWR PCMRC ISP-R
Focus	190 Pin	B69, B70 B67, B68 B38 B42	PWRGND VPWR PCMRC ISP-R
Fusion, Milan, MKZ	140 Pin	B67, B68, B69 B51, B52 B35 B37	PWRGND VPWR PCMRC ISP-R
All other vehicles	170 Pin	B47, B48, B49, B50 B35, B36	PWRGND VPWR

QA1 CARRY OUT A VEHICLE INSPECTION AND VERIFY THE SELF-TEST PROCEDURE

NOTE: **If the self-test or communication concern occurred after a failed or an aborted reprogram, the module may be blank. Attempt to reprogram the module again before continuing with this pinpoint test.**

- Visually inspect the following for obvious signs of electrical damage:
  - harness wiring
  - electrical connections
- Verify the correct procedure was used to activate the self-test for the scan tool. Refer to**SCAN TOOL SETUP AND FUNCTIONALITY** .
- **Was the correct self-test procedure used?**

Yes	No
GO to **QA2**.	REFER to**SCAN TOOL SETUP AND FUNCTIONALITY** .

QA2 CARRY OUT THE NETWORK TEST

- Key ON, engine OFF.
- Carry out the network test.
- **Do all modules indicate pass?**

Yes	No
REFER to Symptom Charts, **PINPOINT TEST QT** .	If only PCM indicates fail, GO to **QA3**. For network test or all other modules indicates fail, REFER to the **MODULE COMMUNICATIONS NETWORK -- E-SERIES** to diagnose The Powertrain Control Module (PCM) Does Not Respond To The Scan Tool Or No High Speed

	Controller Area Network (HS-CAN) Communication Symptom.

QA3 CHECK FOR VREF VOLTAGE AT A SENSOR

NOTE: PCM voltage and ground can be determined by measuring VREF voltage at a sensor. Refer to the VREF Information Table at the beginning of this pinpoint test for the vehicle application and the applicable sensor to test.

- Key in OFF position.
- Disconnect the applicable sensor.
- Key ON, engine OFF.
- Measure the voltage between the applicable sensor VREF circuit, harness side and the applicable sensor SIGRTN circuit, harness side.
- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
REFER to the **MODULE COMMUNICATIONS NETWORK -- E-SERIES** to diagnose The Powertrain Control Module (PCM) Does Not Respond To The Scan Tool Or No High Speed Controller Area Network (HS-CAN) Communication Symptom.	For Crown Victoria, Grand Marquis, E-Series, Escape/Mariner, Ranger, and Town Car, GO to **QA6**. For all others, GO to **QA4**.

QA4 CHECK THE ISP-R VOLTAGE AT THE PCM HARNESS CONNECTOR

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ISP-R	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **QA5**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

QA5 CHECK THE PCM VPWR CIRCUITS FOR VOLTAGE

- Key in OFF position.
- Disconnect the PCM.
- Connect a 5 amp fused jumper wire between the following:

Point A PCM Connector, Harness Side	Point B
PCMRC	Ground

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
VPWR	Ground

- **Are the voltages greater than 10 V?**

Yes	No
GO to **QA7**.	refer to **PINPOINT TEST B**.

QA6 CHECK THE PCM VPWR CIRCUITS FOR VOLTAGE

- Key in OFF position.
- Disconnect the PCM.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
VPWR	Ground

- **Are the voltages greater than 10 V?**

Yes	No
GO to **QA7**.	refer to **PINPOINT TEST B**.

QA7 CHECK THE PCM GROUND CIRCUITS FOR AN OPEN

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	**(-)**
PWRGND	Ground

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **QA8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

QA8 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the network test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST QB: DTCS P0603 OR P1633: KEEP ALIVE POWER (KAPWR)

This pinpoint test is intended to diagnose the following:

- battery terminal condition
- KAPWR wire routing
- harness circuit: KAPWR
- powertrain control module (PCM) (12A650)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, F-150, Mark LT, MKX, Sable, Taurus, Taurus X	190 Pin	B54	KAPWR
Escape/Mariner	150 (50-50-50) Pin	B45	KAPWR
Expedition, Fusion, Milan, MKZ, Navigator	140 Pin	B54	KAPWR
Focus	190 Pin	B62	KAPWR
All other vehicles	170 Pin	B45	KAPWR

QB1 CHECK THE 12-VOLT BATTERY TERMINALS

NOTE: If the KAPWR is interrupted to the PCM when a breakout box is installed or the battery is disconnected, DTC P0603/P1633 can be generated on the first power-up.

NOTE: If DTC P0603 occurred right after or during an unsuccessful reprogramming of the PCM, clear the DTCs and repeat the PCM self-test. If DTC P0603 is retrieved again, continue with this pinpoint test.

- Inspect the 12-volt battery cables for loose connections and for corrosion.
- **Are the 12-volt battery terminal connections in good condition?**

Yes	No
GO to **QB2**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

QB2 INSPECT THE ENGINE COMPARTMENT FOR CORRECT WIRE ROUTING

- Inspect the electronic engine control (EEC) system wiring for correct wire routing.
- Check the wiring routing to establish if any of the electrical connectors are being stressed due to poorly routed wiring. If necessary re-route and secure the wiring.
- Visually inspect the wiring and connectors.
- **Is a concern present?**

Yes	No

REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **QB3**.

QB3 CHECK KAPWR TO THE PCM

- Key in OFF position.
- PCM connector disconnected.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) 12 Volt Vehicle Battery
KAPWR	Negative terminal

- While observing the multimeter, grasp the EEC harness and wiggle, shake or bend a small section while working from the battery to the PCM.
- **Is the voltage greater than 10 V?**

Yes	No
GO to **QB4**.	ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

QB4 CHECK FOR A REPEAT OF THE DTC

- PCM connector connected.
- Clear all DTCs that may have been caused by the PCM disconnect.
- Test drive the vehicle and allow the engine to reach normal operating temperature.
- Carry out the PCM self-test.
- **Is DTC P0603 or P1633 present?**

Yes	No
GO to **QB5**.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

QB5 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.

- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST QC: DTC P1000: ON-BOARD DIAGNOSTIC (OBD) SYSTEMS READINESS TEST NOT COMPLETE

NOTE: **Diagnostic trouble code (DTC) P1000 indicates that all the OBD monitors have not yet been successfully tested. In some areas, this DTC must be cleared to pass an inspection/maintenance test. The customer should be informed that the law specifies additional city and highway driving must be done to complete the check of the OBD system. This additional driving must occur before the vehicle is tested at the inspection/maintenance station. The amount of driving required varies with individual driving patterns. To complete this requirement in the shortest amount of time, refer toON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE .**

It is not necessary to clear DTC P1000 from the powertrain control module (PCM) by driving the vehicle unless it is requested by the customer to pass an inspection/maintenance test.

The only way DTC P1000 can be removed from memory is when all the OBD monitors are successfully completed.

DTC P1000 is set by the PCM under any of the following conditions.

- The vehicle is new from the factory and has not yet completed an OBD drive cycle.
- The battery or PCM is disconnected.
- An OBD monitor concern occurred before completion of an OBD drive cycle.
- The PCM DTCs have been cleared with a scan tool as part of a repair process.
- The PCM has been flashed and the vehicle has not yet completed an OBD drive cycle.
- DTC P1000 may not clear if the vehicle is equipped with a power take off (PTO) and the PTO is engaged or damaged.

QC1 CONTINUOUS MEMORY DTC P1000: CHECK FOR ANY OTHER DTCS

NOTE: **Enter this pinpoint test only if DTC P1000 was retrieved from continuous memory. Ignore DTC P1000 in KOEO or KOER memory.**

- DTC P1000 indicates all of the OBD monitors have not yet been successfully tested.

- **Are any other DTCs received with P1000?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **QC2**.

QC2 CHECK FOR PTO

- **Is the vehicle equipped with PTO?**

Yes	No
GO to **QC3**.	GO to **QC4**.

QC3 CHECK THE PTO PID

- Key ON, engine running.
- Access the PCM and monitor the PTO PID.
- Cycle the PTO switch/actuator ON and OFF. (Follow the PTO aftermarket instructions).
- **Does the PTO PID cycle ON and OFF?**

Yes	No
GO to **QC4**.	GO to **FB2**.

QC4 REQUEST TO CLEAR DTC P1000

NOTE: **An entire OBD drive cycle has not yet been completed to clear DTC P1000 from the PCM.**

- **Has the customer requested DTC P1000 be cleared from the PCM memory?**

Yes	No
CARRY OUT an OBD drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	INFORM the customer that if the law in your area requires additional driving in order to clear DTC P1000 from the PCM memory, it must be completed before an inspection/maintenance test.

PINPOINT TEST QD: DTC P1260: PASSIVE ANTI-THEFT SYSTEM

NOTE: **The passive anti-theft system (PATS) uses radio frequency identification technology to deter a drive away theft. Passive means that it does not require any activity from the user. The PATS uses a specially encoded ignition key. Each encoded ignition key contains a permanently installed electronic device**

called a transponder. Each transponder contains a unique electronic identification code. Each encoded ignition key must be programmed into the vehicle before it can be used to start the engine. DTC P1260 is stored any time the PCM disables the vehicle because of the PATS.

QD1 CHECK FOR PATS DTCS

- Repair all PATS DTCs before P1260. Refer to the **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS) -- E-SERIES** for System Description, Operation and Self-Test.
- **Are all PATS DTCs diagnosed?**

Yes	No
GO to **QD2**.	REFER to the **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS) -- E-SERIES** to diagnose any PATS related DTCs.

QD2 CHECK FOR ANY OTHER POWERTRAIN DTCS

- Repair all powertrain DTCs other than P1260.
- **Are all other powertrain DTCs diagnosed?**

Yes	No
GO to **QD3**.	DISREGARD DTC P1260. DIAGNOSE all other powertrain DTCs. REFER to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

QD3 ATTEMPT TO START THE ENGINE

- Carry out a keep alive memory reset to clear DTC P1260. Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .
- Attempt to start the engine.
- **Does the engine start?**

Yes	No
No system concerns exist at the present time. For intermittent no start or start stalls, CHECK for intermittent PATS concerns. (PATS cannot stall the engine after 1 second of operation). For intermittent stalls while driving, VERIFY scan tool-to-PCM communication during the concern. If a PCM communication error occurs, the possible causes are: loss of PWR or GND to the PCM, damaged PCM PWR relay, or a damaged EEC PWR diode. REPAIR as necessary.	DTC P1260 is not the cause of the No Start. REFER to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** .

CLEAR the DTCs. REPEAT the self-test.	

PINPOINT TEST QE: ELECTRONIC THROTTLE CONTROL (ETC) SYSTEM

NOTE: **Diagnose and repair the following DTCs through DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS and the Workshop article respectively before entering this pinpoint test:**

- **P0715**
- **P0720**
- **P0731-P0735**
- **P0102-P0104**
- **P0321**
- **C1165**
- **U1027**

This pinpoint test is intended to diagnose the informational powertrain control module (PCM) diagnostic trouble codes (DTCs).

The informational DTCs are the result of limited operating strategy (LOS) or failure mode effects management (FMEM) operating strategy that maintains limited vehicle function in the event of a PCM, harness, or component concern.

Circuit DTCs can be accompanied by the informational DTCs, and should be diagnosed first. Informational DTCs without circuit DTCs may or may not indicate the actual concern and should be diagnosed as a symptom.

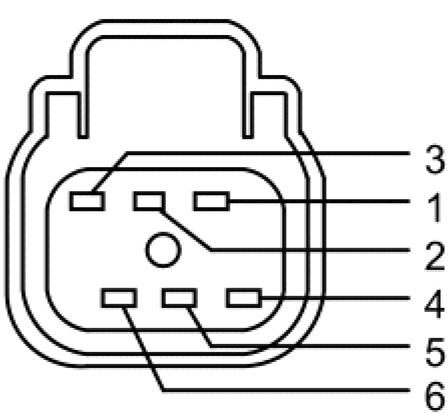

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Fig. 198: EGR System Module (ESM) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
6	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

QE1 CHECK FOR DTCS

NOTE: For DTC P061B, make sure the air cleaner and air inlet are correctly seated and properly installed before continuing diagnosis.

- **Are any DTCs present other than the following: P0600, P060A, P060B, P060C, P060D, P061B, P061C, P061D, P061F, P062C, P1674, P2104, P2105, P2110, or U0300?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	For Focus with DTC P0600, GO to **QE2**. For all others with DTC P0600, GO to **QE18**. For DTCs P060A, P060C, P060D, P061D, P1674 or U0300, GO to **QE2**. For DTC P060B, GO to **QE3**. For DTC P061B, GO to **QE13**. For DTC P061C, GO to **QE5**. For DTC P061F, GO to **QE7**. For DTCs P062C, P2104, P2105 or P2110, GO to **QE8**.

QE2 DTCS P060A, P060C, P060D, P061D, P1674 OR U0300: CHECK THE PCM FOR THE LATEST CALIBRATION

- Program the PCM to the latest calibration.
- Key in OFF position.
- Key ON, engine OFF.
- Key in OFF position.
- Key ON, engine running.
- Use the customer information to recreate the concern.
- Carry out the self-test.
- **Are DTCs P060A, P060C, P060D, P061D, P1674 or U0300 present?**

Yes	No
GO to **QE18**.	The concern is not present at this time.

QE3 DTC P060B: CHECK FOR REFERENCE VOLTAGE CONCERNS

- Inspect the PCM harness for damage.
- Verify the correct operation of the sensors using ETCREF, VREF and related circuits. refer to **PINPOINT TEST C** and follow the pinpoint test direction.

- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **QE4**.

QE4 CHECK FOR AN INTERMITTENT CONCERN

- Clear the DTCs.
- Carry out the self-test.
- **Is DTC P060B present?**

Yes	No
GO to **QE18**.	The concern is not present at this time.

QE5 DTC P061C: CHECK THE CKP SENSOR FOR CORRECT OPERATION

- Verify correct operation of the CKP sensor and related circuits. refer to **PINPOINT TEST JD** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **QE6**.

QE6 CHECK THE CMP SENSOR FOR CORRECT OPERATION

- Verify correct operation of the CMP sensor and related circuits. refer to **PINPOINT TEST DR** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **QE7**.

QE7 DTC P061F: VERIFY THE CUSTOMER CONCERN

- Clear the DTCs.
- Use the customer information to recreate the concern.
- Carry out the self-test.
- **Are DTCs P061C or P061F present?**

Yes	No

GO to **QE18**.	The concern is not present at this time.

QE8 DTCS P062C, P2104, P2105 OR P2110: CHECK FOR DTCS IN OTHER VEHICLE MODULES

- Check for self-test DTCs in all of the vehicle modules.
- **Are any DTCs present?**

Yes	No
REFER to the applicable Workshop article part to diagnose the DTC.	GO to **QE9**.

QE9 CHECK FOR THE PRESENCE OF ANY MODULE COMMUNICATION CONCERNS

- Check for self-test DTCs in all of the vehicle modules.
- **Are any communication concerns or communication DTCs present?**

Yes	No
For communication concerns in the PCM, DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** . For communication concerns in other modules, REFER to the applicable Workshop article part to diagnose the communication DTC.	For DTC P062C, GO to **QE16**. For DTC P2104, GO to **QE10**. For DTC P2105, GO to **QE11**. For DTC P2110, GO to **QE15**.

QE10 DTC P2104: CHECK FOR THE PRESENCE OF PCM DTCS

- Clear the PCM DTCs.
- Check for self-test DTCs.
- **Are any DTCs present other than P2104?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	refer to **PINPOINT TEST DK**.

QE11 DTC P2105: CHECK FOR THE PRESENCE OF PCM DTCS

NOTE: **P2105 may be set in combination with other DTCs. Diagnose other DTCs first.**

- Clear the PCM DTCs.
- Check for self-test DTCs.

- **Are any DTCs present other than P2105?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **QE12**.

QE12 CARRY OUT A VISUAL INSPECTION

- Key in OFF position.
- Visually inspect the following for obvious signs of damage:
    - ETB
    - PCM
- Check the harness for routing, alterations, incorrect shielding, or electrical interference from other systems. Make sure aftermarket wiring is not routed near the PCM.
- Verify aftermarket equipment does not generate radio frequency interference/electromagnetic interference (RFI/EMI).
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **QE18**.

QE13 DTC P061B: CHECK FOR THE PRESENCE OF PCM DTCS

NOTE: **An intermittent CKP sensor or harness concern may cause DTC P061B to set. Check for intermittent CKP sensor and harness concerns.**

- Clear the PCM DTCs.
- Check for self-test DTCs.
- **Are any DTCs present other than P061B?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	For Crown Victoria, E-Series 4.6L, Explorer 4.0L, Explorer Sport Trac 4.0L, F-150 4.2L, F-150 4.6L, F-Super Duty 6.8L, Grand Marquis, Mountaineer 4.0L,

	Mustang 4.0L, Mustang 5.4L, and Town Car, GO to **QE14**. For all others, CHECK for an intermittent concern with an ETC related harness or sensor. refer to **PINPOINT TEST Z**.

QE14 CHECK THE MAP INPUT FOR AN OFFSET SIGNAL

- Key in OFF position.
- Allow the vehicle to cool down.
- ESM connector disconnected.
- Measure the resistance between:

(+) ESM Connector, Component Side	(-) ESM Connector, Component Side
VREF - Pin 2	SIGRTN - Pin 6

- **Is the resistance greater than 2K ohms?**

Yes	No
For Crown Victoria, Grand Marquis, Explorer 4.0L, Explorer Sport Trac 4.0L, Mountaineer 4.0L, and Town Car, GO to **QE16**. For all others, CHECK for an intermittent concern with an ETC related harness or sensor. refer to **PINPOINT TEST Z**.	INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

QE15 DTC P2110: CHECK FOR THE PRESENCE OF PCM DTCS

NOTE: P2110 sets in combination with other DTCs.

- Clear the PCM DTCs.
- Check for self-test DTCs.
- **Are any DTCs present other than P2110?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO	

to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **QE18**.

QE16 CHECK FOR ABS AND WHEEL SPEED SENSOR CONCERNS

NOTE: Refer to the REFERENCE VALUES article Reference Values for the typical diagnostic reference values.

- ESM connector connected.
- Key ON, engine running.
- Access the PCM and monitor the ISS_SRC, OSS_SRC and TSS PIDs.
- Access the PCM and monitor the VSS PID.
- Access the ABS and monitor the LF_WSPD, LR_WSPD, RF_WSPD and RR_WSPD PIDs.
- Road test the vehicle under various load conditions while comparing the PIDs. Check for signals that are intermittent or do not correspond.
- **Do the PID values correspond with the vehicle operating conditions?**

Yes	No
For Explorer 4.0L, Explorer Sport Trac 4.0L, F-150 5.4L, Mark LT, and Mountaineer 4.0L, GO to **QE17**. For all others, CHECK for an intermittent concern with an ETC related harness or sensor. refer to **PINPOINT TEST Z**.	REFER to the **VEHICLE DYNAMIC SYSTEMS -- E-SERIES** to diagnose any ABS concerns.

QE17 CHECK FOR A TRANSFER CASE MECHANICAL CONCERN

- Stop the vehicle.
- Select 4WD Low.
- **Does the vehicle shift into 4WD Low?**

Yes	No
CHECK for an intermittent concern with an ETC related harness or sensor. refer to **PINPOINT TEST Z**.	REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** , Four Wheel Drive (4WD) Systems to diagnose any transfer case concerns.

QE18 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:

- pushed out pins
- corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST TA: CLUTCH PEDAL POSITION (CPP) SWITCH

This pinpoint test is intended to diagnose the following:

- CPP (11A152/7C534)
- harness circuits: CPP / CPP BT and SIGRTN / GND
- powertrain control module (PCM) (12A650)

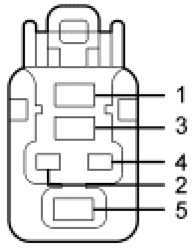

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Fig. 199: Clutch Pedal Position (CPP) Switch Connector - A
Courtesy of FORD MOTOR CO.

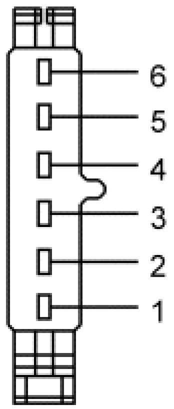


Fig. 200: Clutch Pedal Position (CPP) Switch Connector - B
Courtesy of FORD MOTOR CO.

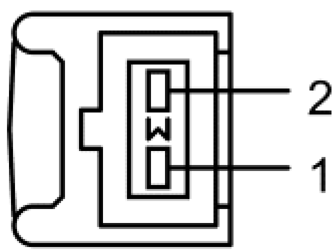


Fig. 201: Clutch Pedal Position (CPP) Switch Connector - C
Courtesy of FORD MOTOR CO.

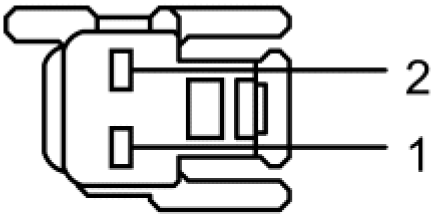


Fig. 202: Clutch Pedal Position (CPP) Switch Connector - D
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	A	2 4	SIGRTN CPP
F-150	B	2 1	GND CPP
Mustang	C	2 1	GND CPP
Ranger	B	5 6	GND CPP
All other vehicles	D	2 1	GND CPP

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B41, E41, T41 T27	SIGRTN CPP
F-150	190 Pin	B39 B58, E58, T43	CPP-BT SIGRTN
F-Super Duty	170 Pin	B34 B41, E58, T41	CPP-BT SIGRTN
Focus	190 Pin	T26 B58, E64, T40	CPP-BT SIGRTN
Fusion, Milan	140 Pin	B18 B58, E58	CPP-BT SIGRTN
All other vehicles	170 Pin	B41, E58, T41 B33	SIGRTN CPP

TA1 DTC P0704, P0830: CHECK THE CPP SWITCH

WARNING: **Block all wheels, set the parking brake and firmly apply the service brake to reduce the risk of vehicle movement during this procedure. Failure to follow these instructions may result in serious personal injury.**

NOTE: During self-test, the clutch pedal must be down and gearshift lever in NEUTRAL.

- Key ON, engine OFF.
- Access the PCM and monitor the CPP PID.
- **Does the reading cycle when the CPP switch is activated?**

Yes	No
This may be an intermittent circuit concern. INSPECT connectors for signs of damage, water intrusion, corrosion. REPAIR as necessary.	GO to **TA2**.

TA2 CHECK THE SWITCH CIRCUIT RESISTANCE

NOTE: The CPP switch is located near the clutch pedal.

NOTE: Measure the CPP switch resistance with the clutch pedal pressed down.

- Inspect the switches and brackets for damage. Repair as necessary.
- CPP Switch connector disconnected.
- For Focus or Escape,
- Measure the resistance between:

(+) CPP Switch Connector, Component Side	(-) CPP Switch Connector, Component Side
CPP	SIGRTN

- For all others,
- Measure the resistance between:

(+) CPP Switch Connector, Component	(-) CPP Switch Connector, Component

Side	Side
CPP	GND

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **TA3**.	INSTALL a new CPP switch. CLEAR the DTCs. REPEAT the self-test.

TA3 CHECK THE CPP FOR INTERNAL SHORTS

NOTE: Measure the CPP switch resistance with the clutch pedal released.

- For Focus or Escape,
- Measure the resistance between:

(+) CPP Switch Connector, Component Side	(-) CPP Switch Connector, Component Side
CPP	SIGRTN

- For all others,
- Measure the resistance between:

(+) CPP Switch Connector, Component Side	(-) CPP Switch Connector, Component Side
CPP	GND

- **Is the resistance greater than 10K ohms?**

Yes	No
For Focus or Escape, GO to **TA5**. For all others, GO to **TA4**.	INSTALL a new CPP switch. CLEAR the DTCs. REPEAT the self-test.

TA4 CHECK THE CPP AND GROUND CIRCUITS FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) CPP Switch Connector, Harness Side	(-) PCM Connector, Harness Side
CPP	CPP

- Measure the resistance between:

(+) CPP Switch Connector, Harness Side	(-)
GND	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **TA6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

TA5 CHECK THE CPP AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CPP Switch Connector, Harness Side
CPP	CPP
SIGRTN	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to **TA6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

TA6 CHECK THE CPP CIRCUIT FOR A SHORT TO VOLTAGE

- Key ON, engine OFF.
- Measure the voltage between:

(+) CPP	

Switch Connector, Harness Side	(-)
CPP	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **TA7**.	REPAIR the short circuit to PWR. CLEAR the DTCs. REPEAT the self-test.

TA7 CHECK THE CPP CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) CPP Switch Connector, Harness Side	(-)
CPP	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **TA8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

TA8 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Replacement PCM.	

PINPOINT TEST TB: TRANSMISSION CONTROL SWITCH (TCS)/ TRANSMISSION CONTROL INDICATOR LAMP (TCIL)

This pinpoint test is intended to diagnose the following:

- TCS
- TCIL
- harness circuits: TCS and TCIL
- powertrain control module (PCM) (12A650)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series	170 Pin	B43 B27	TCIL TCS
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B16	TCS
Escape/Mariner	150 (50-50-50) Pin	B27	TCS
F-150, Mark LT	190 Pin	B45	TCS
F-Super Duty	170 Pin	B27	TCS
Focus	190 Pin	T30	TCS
Fusion	140 Pin	B16	TCS
All other vehicles	170 Pin	B29	TCS

TB1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Is DTC P1780 present?**

Yes	No
GO to **TB2**.	For TCIL never on, GO to **TB10**. For TCIL always on, GO to **TB8**.

TB2 DTC P1780: CHECK THE TCS FUNCTION

NOTE: Verify the TCS was cycled during self-test.

- Key ON, engine OFF.

- Access the PCM and monitor the TCS PID.
- Apply and release the TCS and then hold it applied for 3 seconds. Release the switch.
- **Does the TCS PID change from ON to OFF and does the PID indicate ON when the switch is applied?**

Yes	No
REPEAT the KOER self-test and cycle the TCS during the test.	GO to **TB3**.

TB3 CHECK THE TCS VOLTAGE

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
TCS	Ground

- Monitor the voltage while applying and releasing the TCS several times.
- **Does the voltage change states?**

Yes	No
GO to **TB12**.	GO to **TB4**.

TB4 CHECK THE TCS CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- TCS connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
TCS	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **TB5**.	REPAIR the short circuit. CLEAR the DTCs.

	REPEAT the self-test.

TB5 CHECK FOR VOLTAGE TO THE TCS

- Key ON, engine OFF.
- Measure the voltage between:

(+) TCS Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to **TB6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

TB6 CHECK THE TCS CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) TCS Connector, Harness Side
TCS	TCS

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **TB7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

TB7 CHECK THE TCS CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) TCS Connector, Harness Side	(-)
TCS	Ground

- **Is the voltage less than 1 V?**

Yes	No
INSTALL a new TCS. REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

TB8 TCIL ALWAYS ON: CHECK THE TCIL FUNCTION

- Key ON, engine OFF.
- Apply and release the TCS.
- **Does the TCIL change state?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	GO to **TB9**.

TB9 CHECK THE TCIL CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

NOTE: The TCIL turns off when the PCM is disconnected.

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- **Does the TCIL change state?**

Yes	No
GO to **TB12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

TB10 TCIL NEVER ON: CHECK FOR KOER P1780

- Carry out the PCM KOER self-test.
- **Is DTC P1780 present?**

Yes	No
REPAIR the DTC. CLEAR the DTCs. REPEAT the self-test. GO to **TB2**.	GO to **TB11**.

TB11 CHECK FOR VOLTAGE TO THE TCIL

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Connect a 5 amp fused jumper wire between the following:

Point A PCM Connector, Harness Side	Point B Vehicle Battery
TCIL	Negative terminal

- **Does the TCIL illuminate?**

Yes	No
GO to **TB12**.	CHECK the indicator bulb and the fuse. If OK, the open is in the wiring between the ignition switch and the TCIL pin at the harness connector. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

TB12 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST Z: INTERMITTENT

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to**

follow these instructions may result in personal injury.

This pinpoint test is intended to diagnose and isolate intermittent concerns for the following:

- all electronic engine control (EEC) subsystems

This chart is used to determine which test to run for the suspect circuit. PIDs corresponding to each circuit are listed. Some circuits do not have an associated PID or the PID may not be available and has to be measured with a digital multimeter (DMM). More specific information on the PID can be found. If the vehicle has a coil pack system with a no start condition, carry out the ignition test.

PCM PIDS/SIGNALS

PCM/TCM PIDS/SIGNALS	Associated Circuit	Test Type
ACCS	A/CCS	input
ACET	ACET	input
ACP	ACPSW	input
AIR	AIR	output
AIRM	AIRM	input
APP1	APPS	input
APP2	APPS	input
APP3	APPS	input
BPP/BOO	BPP	input
BPA	BPS	input
Use DMM	CD A-J (primary)	output
CHT	CHT	input
CKP	CKP	input
CMP	CMP	input
CPP/PNP	CPP	input
DPFEGR	DPFE	input
ECT	ECT	input
EGRMC1	EGRMC1	output
EGRMC2	EGRMC2	output
EGRMC3	EGRMC3	output
EGRMC4	EGRMC4	output
EGRMDSD	EGRMC	output
EVR	EVR	output
EOT	EOT	input
EPC, EPCV	EPC	output
EVAPCV	CV	output
EVAPPDC	VMV	output
EVAPPF	VMV	output
FANDC	VDF	output

FANSS	FANSS	input
FLI	FLI	input
FP	FP	output
FPM	FPM	input
FP M	FPM	input
FRP	FRP	input
FRT	FRT	input
FTP	FTP	input
HFC	HFC	output
HOS11	HEGO	input
HOS12	HEGO	input
HOS13	HEGO	input
IAC	IAC	output
IAT	IAT	input
IAT2	IAT 2	input
IMRC	IMRC	output
IMRC1M	IMRCM	input
IMTV1	IMTV1	output
IMTV2	IMTV2	output
KS1	KS1	input
KS2	KS2	input
LFC	LFC	output
MAF, MAF V	MAF	input
MAP V	MAP	input
O2S11	O2S	input
O2S12	O2S	input
O2S13	O2S	input
OSS	OSS	input
PSP	PSP	input
PSPT	PSP	input
PTO	PTO	input
TACM (+)	TACM (+)	output
TACM (-)	TACM (-)	output
TP1	TP1	input
TP2	TP2	input
TCIL	TCIL	output
TP	TP	input
VCT1	VCT1	output
VCT2	VCT2	output
VPWR	VPWR	input
Use DMM	VREF	output

	VSO	output
VSS	VSS+	input
WAC	WAC	output

Z1 DIRECTION FOR INTERMITTENT DIAGNOSTIC PATH

NOTE: **Proceed with this step only if the powertrain control module (PCM) was not previously cleared. Record freeze frame data prior to clearing the PCM DTCs. Clearing the DTCs clears any freeze frame data and eliminates FMEM. This helps to recreate the original conditions that set the DTCs or caused the symptom.**

- Key ON, engine OFF.
- Clear the PCM DTCs.
- **Are the PCM DTCs cleared?**

Yes	No
GO to **Z2**.	RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .

Z2 SELECT THE PIDS AND/OR SIGNALS RELATED TO THE SYSTEM

- A list of related PIDs and/or signals are needed for use with the scan tool to monitor the suspect areas. Obtain the customer symptom description. Use the Reference Value Symptom chart and proceed to the Reference Value PID/Signal Measurement chart located at the beginning of Reference Values.
- Highlight each available PID/signal recommended by the charts under the PID/signal selection menu on the scan tool.
- **Are all available PIDs/signals related to the symptom selected?**

Yes	No
GO to **Z3**.	REPEAT the test step. GO to **Z2**.

Z3 DECISION TO VERIFY THE SYMPTOM

NOTE: **The path to symptom verification is optional, but is recommended for several reasons. For example: the vehicle is back for a repeat repair, or there is no DTC present.**

- **Is a concern symptom detected?**

Yes	No
GO to **Z10**.	GO to **Z4**.

Z4 COLLECT ANY SYMPTOM RELATED DATA TO AID IN VERIFICATION

NOTE: Only MIL codes trigger freeze frame data. Refer to the scan tool instruction article to retrieve the freeze frame information.

- Prepare the freeze frame data for use with information from the Symptom Charts.
- Check for continuous memory DTCs that should have been recorded from an earlier pinpoint test.
- Access the information from the customer information worksheet and the customer if available. Access any other symptom related data available, such as TSBs and OASIS reports.
- **Is all available data recorded?**

Yes	No
GO to **Z5**.	GATHER as much data as possible to aid in isolating the intermittent concern area. REPEAT the test step. GO to **Z4**.

Z5 RECREATE THE SYMPTOM USING ALL AVAILABLE DATA

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- With the scan tool, select and monitor the same PIDs as displayed in freeze frame along with any previously selected PIDs/signals from step Z2. Using the freeze frame data recorded earlier, recreate the conditions described by each freeze frame PID. Pay special attention to ECT, LOAD, RPM and VSS. Also, use any available data from the customer, TSBs, and other sources to aid in producing the correct conditions for recreating the symptom.
- When the symptom occurs, press the trigger to begin recording. Refer to the scan tool instruction article for information on the recorder function.
- **Can the symptom be recreated?**

Yes	No
GO to **Z10**.	GO to **Z6**.

Z6 RECREATE THE SYMPTOM

NOTE: PIDs for output in the Reference Value Charts represent command values only. Circuit measurements with a digital multimeter indicate the actual output status. Therefore, in the case of a concern, the PID and circuit reading on the vehicle may not correspond with each other. PIDs for PCM circuits with a mismatch in the digital multimeter measurement indicate a possible PCM concern.

- The road test is the last attempt to locate the area of concern before physically disturbing vehicle circuits.
- The Intermittent Road Test Procedure is a set of instructions for monitoring PIDs/signals with a scan tool and circuit measurements with a digital multimeter. This is done under 4 different conditions - key

on/engine off, hot idle, 48 km/h (30 mph) and 88 km/h (55 mph). Use the typical diagnostic reference values to compare with the actual vehicle.

- Locate the correct Reference Value Chart.
- Setup the vehicle to measure the circuits with a digital multimeter and a scan tool.
- Connect a scan tool to the DLC.
- Key ON, engine OFF.
- With the scan tool, select and monitor PIDs and measure the circuits shown in the Reference Value Chart.
- Compare the scan tool PIDs and digital multimeter values to the Reference Value Charts.
- **Are any values out of range?**

Yes	No
GO to **Z10**.	GO to **Z7**.

Z7 RECREATE THE SYMPTOM USING THE HOT IDLE ROAD TEST

NOTE: The engine temperature should be at least 87°C (189°F).

- Key ON, engine running.
- Continue to monitor the PIDs and circuits as in the previous step.
- **Are any values out of range?**

Yes	No
GO to **Z10**.	GO to **Z8**.

Z8 RECREATE THE SYMPTOM DURING AN 48 KM/H (30 MPH) ROAD TEST

- Drive the vehicle on a preplanned route.
- Continue to monitor the PIDs and circuits as in the previous step.
- **Are any values out of range?**

Yes	No
GO to **Z10**.	GO to **Z9**.

Z9 RECREATE THE SYMPTOM DURING AN 88 KM/H (55 MPH) ROAD TEST

- Continue to drive the vehicle on the preplanned route.
- Continue to monitor the PIDs and circuits as in the previous step.
- **Are any values out of range?**

Yes	No
	It is now necessary to physically disturb the selected

GO to **Z10**.	vehicle circuits in an attempt to recreate the intermittent concern. GO to **Z10**.

Z10 SELECT THE CIRCUITS FROM THE PCM PIDS/SIGNALS CHART

NOTE: From the same chart, be sure to select and proceed with the appropriate test type.

NOTE: The Input Test step should be used on sensing inputs such as temperature, position or oxygen.

NOTE: The Output Test step should be used on output devices such as relays, coils or solenoids.

- Remain in the PID/Signal selection menu with the scan tool.
- Highlight only the PIDs/signals from step Z2.
- Proceed to the PCM PIDS/SIGNALS chart located at the beginning of this test.
- Match the selected PIDs/signals to the corresponding circuit in the chart. There may be more than one circuit to test. If a PID/signal recording was made with the scan tool, it may be helpful to replay it at this time. Refer to the scan tool instruction article for additional information.
- **Has a test been chosen?**

Yes	No
For the input test step, GO to **Z11**. For the output test step, GO to **Z15**.	To diagnose other driveability symptoms, REFER to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** .

Z11 KOEO INPUT TEST PROCEDURE FOR THE PCM SENSORS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

- Using the circuits chosen from the PCM PIDS/SIGNALS Chart, select only the recommended PIDs/signals to monitor with the scan tool. If a PID is not available for the circuit, use a digital multimeter to check the value.
- Proceed to the area of the suspect wiring or component concern.
- Key ON, engine OFF.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM while tapping on the component.

- Monitor while wiggling the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Are there abrupt changes in the PID values that do not compare with the values?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to **Z12**.

Z12 KOER INPUT TEST PROCEDURE FOR THE PCM SENSORS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

- Key ON, engine running.
- Continue to monitor the PIDs and circuits as in the previous step.
- Proceed to the area of the suspect wiring or component concern.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM while tapping on the component.
- Monitor while wiggling the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Are any values fluctuating in and out of range?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to **Z13**.

Z13 KOEO WATER SOAK TEST PROCEDURE FOR THE PCM SENSORS, EXCLUDING HIGH VOLTAGE CIRCUITS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

- Key ON, engine OFF.
- Continue to monitor the PIDs and circuits as in the previous step.
- Proceed to the area of the suspect wiring or component concern.
- If the input is a switch type-component, turn it on manually.

- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Monitor while spraying the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Are any values fluctuating in and out of range?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to **Z14**.

Z14 KOER WATER SOAK TEST PROCEDURE FOR THE PCM SENSORS, EXCLUDING HIGH VOLTAGE CIRCUITS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

- Key ON, engine running.
- Continue to monitor the PIDs and circuits as in the previous step.
- Proceed to the area of the suspect wiring or component concern.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Monitor while spraying the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Are any values fluctuating in and out of range?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to **Z15**.

Z15 KOER WIGGLE TEST PROCEDURE FOR THE PCM SENSORS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

NOTE: Remember that PIDs selected from the PCM PIDS/SIGNALS Chart display commanded values only. A digital multimeter measurement is needed to display the actual values. Be sure to compare them. Look for fluctuations to occur

during any part of the following test. The output state test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators.

- Using the circuits chosen from the PCM PIDS/SIGNALS Chart, select only the recommended PIDs/signals to monitor with the scan tool. If a PID is not available for the circuit, use a DMM to check the value.
- Key ON, engine OFF.
- With the scan tool, turn on selected outputs using output state control. Refer to the scan tool instruction article.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PID or DMM while tapping on the component.
- Monitor while wiggling the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the Reference Value Charts?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to **Z16**.

Z16 KOER OUTPUT TEST PROCEDURE FOR THE PCM ACTUATORS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

NOTE: **Remember that PIDs selected from the PCM PIDS/SIGNALS Chart display commanded values only. A digital multimeter measurement is needed to display the actual values. Be sure to compare them. Look for fluctuations to occur during any part of the following test. The output state test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators.**

- Key ON, engine running.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PIDs with the scan tool and note the values. Compare the scan tool values with values from a digital multimeter with the engine at idle. Look for fluctuations in the values while tapping on the suspect component.
- If a coil for a coil on plug application is suspect, turn off the key. Gain access to the coil and measure continuity from the spark plug terminal to the signal terminal while tapping the coil. A large fluctuation in

resistance indicates an intermittent open or short.

- Monitor while wiggling the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Is there a scan tool to DMM value mismatch or an idle fluctuation?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to **Z17**.

Z17 KOEO WATER SOAK TEST PROCEDURE FOR THE PCM ACTUATORS, EXCLUDING HIGH VOLTAGE CIRCUITS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

NOTE: **Remember that PIDs selected from the PCM PIDS/SIGNALS Chart display commanded values only. A digital multimeter measurement is needed to display the actual values. Be sure to compare them. Look for fluctuations to occur during any part of the following test. The output state test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators.**

- Key ON, engine OFF.
- With the scan tool, turn on selected outputs using output state control. Refer to the scan tool instruction article.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the Reference Value Charts?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to **Z18**.

Z18 KOER WATER SOAK TEST PROCEDURE FOR THE PCM ACTUATORS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

- Key ON, engine running.
- Using the circuits chosen from the PCM PIDS/SIGNALS Chart, select only the recommended PIDs/signals to monitor with the scan tool. If a PID is not available for the circuit, use a DMM to check the value.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Monitor while spraying the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the Reference Value Charts?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to **Z19**.

Z19 INSPECT FOR INTERMITTENT MECHANICAL CONCERNS

NOTE: It is possible for an intermittent mechanical concern to cause a good PCM system to react abnormally.

- An inspection of DTC related mechanical systems should have been carried out in an earlier part. If not, visually inspect at this time.
- Look for possible vacuum lines, wires, cables, linkage or hoses that may become kinked, shorted or restricted during normal engine operation.
- This may include engine/transmission gear changes, acceleration and deceleration, rough roads and various engine RPM and torque related conditions.
- **Is a mechanical concern detected?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	It is necessary to seek additional help. REFER to the Professional Technician Society (PTS) web site, the OASIS system or the Technical Hotline. A vehicle data recorder (VDR) or similar recorder may also be useful.

2008 STEERING

Power Steering - Edge & MKX

SPECIFICATIONS

MATERIAL SPECIFICATIONS

Item	Specification	Fill Capacity
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V	946 ml (2.0 pt)

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Driveshaft bolts	70	52	-
Inner tie rod	103	76	-
Middle subframe nuts	150	111	-
Outer tie-rod end nuts	48	35	-
Power steering fluid cooler nuts	7	-	62
Power steering fluid cooler-to-subframe bolt	9	-	80
Power steering fluid reservoir nuts	8	-	71
Power steering pressure switch	20	15	-
Power steering pump bolts	24	18	-
Pressure line bracket-to-steering gear bolts	9	-	80
Pressure line-to-power steering pump banjo bolt	48	35	-
Pressure line-to-steering gear banjo bolt	48	35	-
Return hose bracket-to-subframe bolts	9	-	80
Steering gear heat shield bolts	6	-	53
Steering gear mounting bolts[a]	-	-	-
Steering gear-to-fluid cooler return hose bracket bolts	9	-	80
Subframe support bracket bolts	103	76	-
Subframe support bracket nuts	150	111	-
Tie-rod jam nuts	90	66	-

DESCRIPTION AND OPERATION

POWER STEERING

The power steering system consists of the following components:

- Power steering pump

- Power steering fluid reservoir
- Power steering pressure and return lines/hoses
- Power steering fluid cooler
- Power steering gear
- Inner tie rod

The power steering system uses a vane-type pump to move the fluid from the reservoir to the steering gear and through the rest of the steering hydraulic system. The power steering pump is mounted to the engine and driven by the engine accessory drive belt. Power steering fluid flows into the pump from the reservoir. The power steering fluid is then trapped between the pump vanes and moved to the high-pressure side of the pump creating a flow of fluid. The restriction of this flow by the steering gear creates the pressure that provides the steering assist. A combined pressure relief/flow valve is built into the pump to control the maximum pressure and flow provided to the steering system. This action prevents damage to the system and provides the correct level of assist during all engine speeds. While under pressure, the power steering fluid flows through the high-pressure power steering line to the steering gear. The fluid exits the gear and flows through the return line, cooler and finally to the reservoir. The reservoir slows the fluid, allows air to escape and filters the fluid before returning it to the pump.

DIAGNOSTIC TESTS

POWER STEERING

Refer to **STEERING SYSTEM - GENERAL INFORMATION** .

REMOVAL AND INSTALLATION

POWER STEERING FLUID RESERVOIR

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

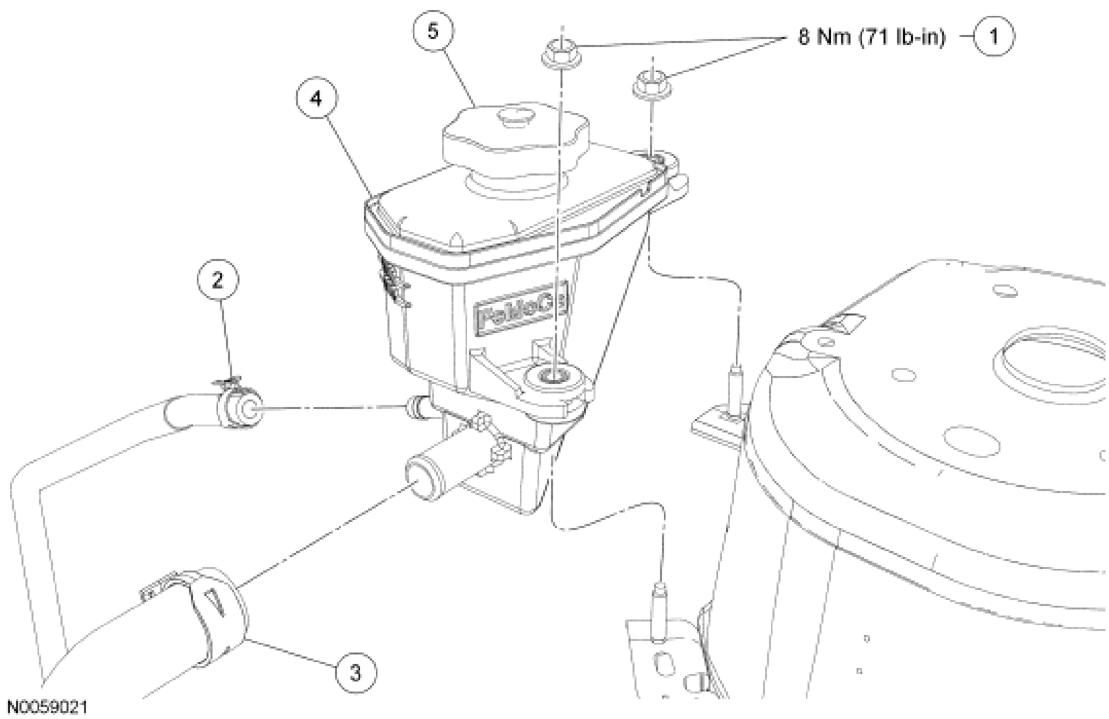


Fig. 1: Exploded View Of Power Steering Fluid Reservoir With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W707142	Power steering fluid reservoir nuts (2 required)
2	3A713B	Return hose
3	3E525	Power steering pump supply hose
4	3R700	Power steering fluid reservoir
5	3A006	Power steering fluid reservoir cap

REMOVAL AND INSTALLATION

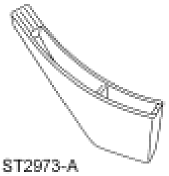
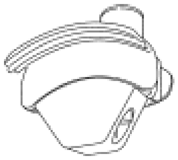
CAUTION: While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

1. Using a suitable suction device, remove the power steering fluid from the fluid reservoir.
2. Remove the 2 power steering fluid reservoir nuts and lift the reservoir from the mounting studs.
   - To install, tighten to 8 Nm (71 lb-in).
3. Release the clamp and disconnect the return hose from the power steering fluid reservoir.
4. Release the clamp and disconnect the power steering pump supply hose from the power steering fluid reservoir.
   - Remove the reservoir.

5. To install, reverse the removal procedure.
    - Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** .

POWER STEERING PUMP

Special Tools

Illustration	Tool Name	Tool Number
 ST2973-A	Power Steering Belt Removal Tool	303-1252/1
 ST2974-A	Power Steering Belt Installation Tool	303-1252/2

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

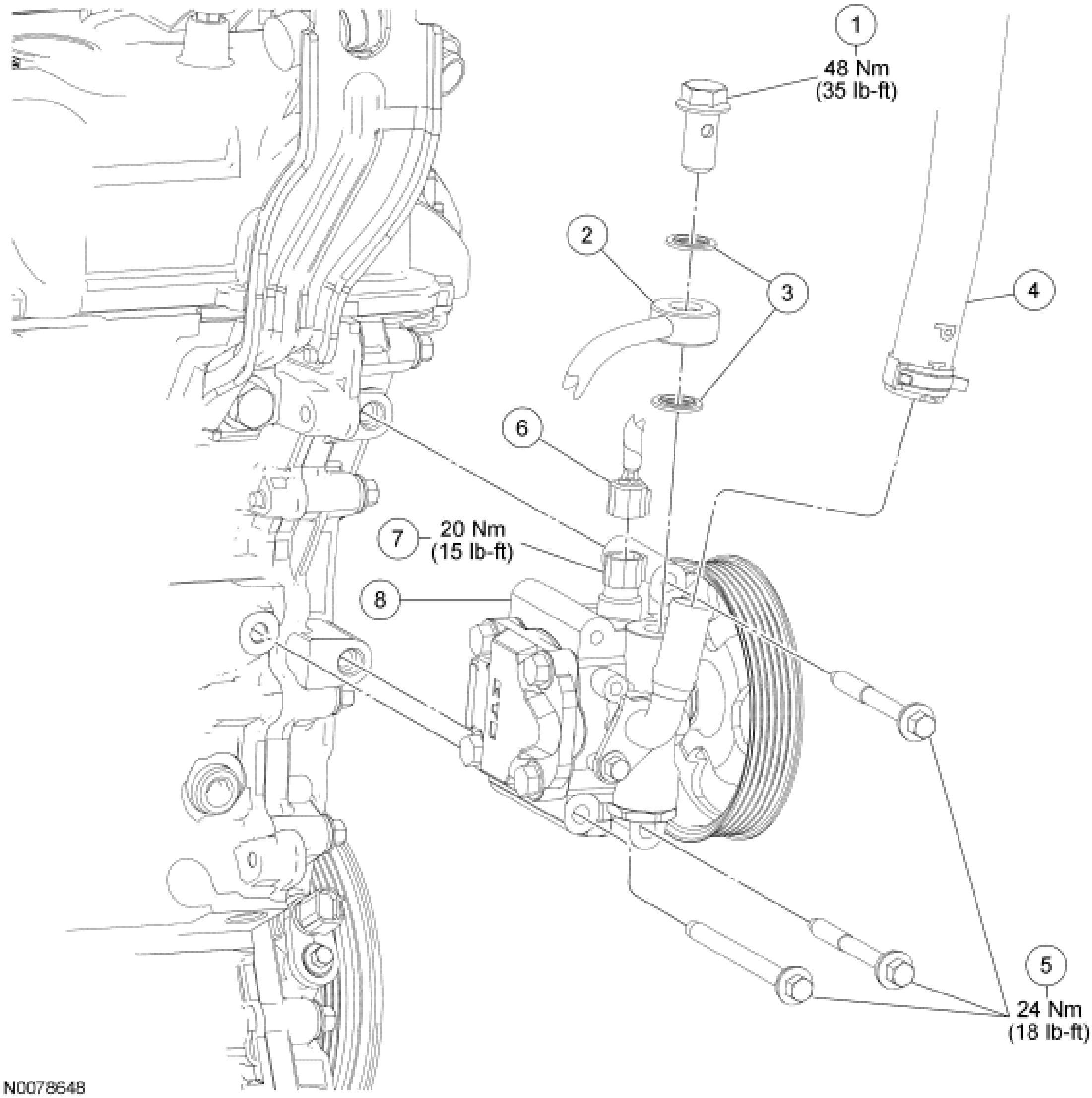


Fig. 2: Exploded View Of Power Steering Pump With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3N623	Pressure line-to-power steering pump banjo bolt (also part of kit 3A719)
2	3A719	Pressure line kit
3	3N626	Pressure line seals (2 required) (also part of kit 3A719)
4	3E525	Power steering pump supply hose
5	W503299	Power steering pump bolts (3 required)
6	-	Power steering pressure switch electrical connector
7	3N824	Power steering pressure switch

8	3A696	Power steering pump

REMOVAL

CAUTION: While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** .
2. Using a suitable suction device, remove the power steering fluid from the fluid reservoir.
3. Remove the RH inner fender splash shield. For additional information, refer to **FRONT END BODY PANELS** .
4. Using the special tool, disengage the power steering pump belt from the power steering pump pulley and position it aside.
   - Install the removal tool between the belt and the pulley and turn the crankshaft bolt clockwise to disengage the belt.

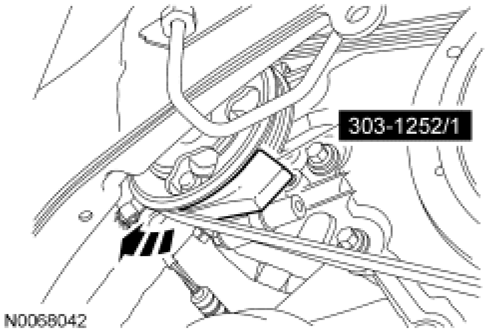


Fig. 3: Installing Removal Tool (303-1252/1) Between Belt & Pulley & Turn Crankshaft Bolt Clockwise
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

5. Remove the 4 bolts and position the driveshaft aside.

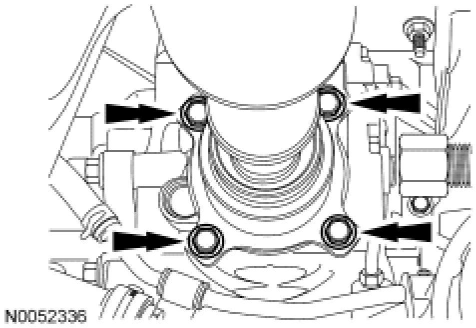


Fig. 4: Locating Driveshaft Aside Bolts
Courtesy of FORD MOTOR CO.

All vehicles

6. Using a suitable jack, support the rear of the subframe.
7. Remove the 2 nuts, 4 bolts and the subframe support brackets.

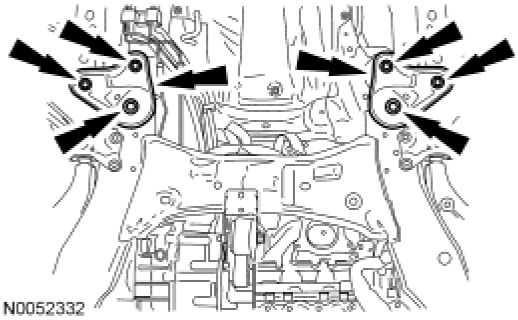


Fig. 5: Locating Subframe Support Brackets, Nuts & Bolts
Courtesy of FORD MOTOR CO.

8. Remove the 2 middle subframe nuts.

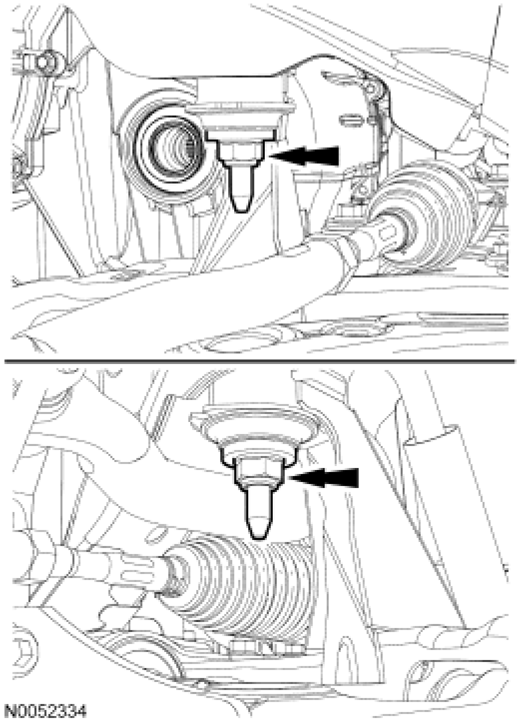


Fig. 6: Locating Middle Subframe Nuts
Courtesy of FORD MOTOR CO.

9. Lower the rear of the subframe.
10. Release the clamp and disconnect the power steering pump supply hose from the power steering pump.
11. Disconnect the power steering pressure switch electrical connector.
12. Remove the pressure line-to-power steering pump banjo bolt and disconnect the pressure line from the pump.
    - Discard the 2 seals.
13. Remove the 3 power steering pump bolts and the pump.

INSTALLATION

All vehicles

1. Position the power steering pump and install the 3 bolts.
    - Tighten to 24 Nm (18 lb-ft).

CAUTION: New seals must be installed any time the power steering pressure line is disconnected from the power steering pump, or a fluid leak may occur.

2. Position the pressure line and install the pressure line-to-power steering pump banjo bolt and seals.
    - Tighten to 48 Nm (35 lb-ft).

3. Connect the power steering pressure switch electrical connector.
4. Connect the power steering pump supply hose and secure the clamp.
5. Using the jack, raise the rear of the subframe.
6. Install the 2 middle subframe nuts.
   - Tighten to 150 Nm (111 lb-ft).

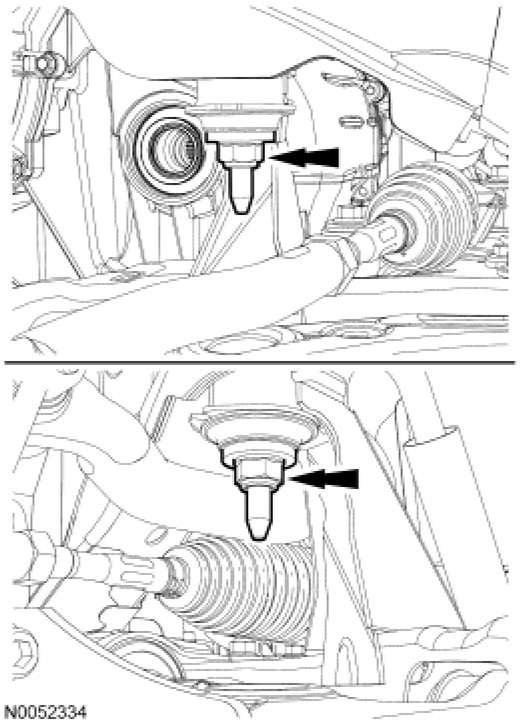


Fig. 7: Locating Middle Subframe Nuts
Courtesy of FORD MOTOR CO.

7. Install the 2 nuts, 4 bolts and the subframe support brackets.
   - Tighten the nuts to 150 Nm (111 lb-ft).
   - Tighten the bolts to 103 Nm (76 lb-ft).

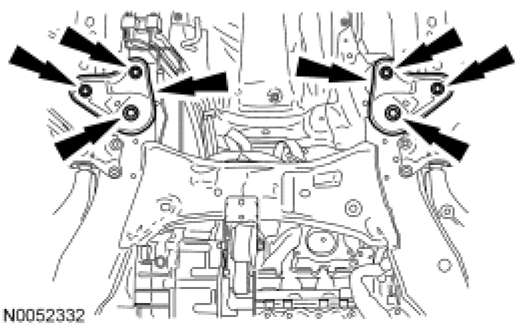


Fig. 8: Locating Subframe Support Brackets, Nuts & Bolts

Courtesy of FORD MOTOR CO.

AWD vehicles

8. Position the driveshaft and install the 4 bolts.
   - Tighten to 70 Nm (52 lb-ft).

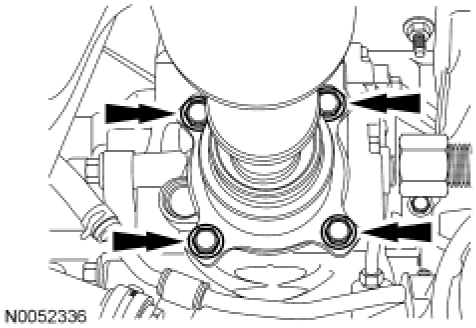


Fig. 9: Locating Driveshaft Aside Bolts
Courtesy of FORD MOTOR CO.

All vehicles

CAUTION: After installation, make sure the belt is correctly seated on the crankshaft and power steering pulley or damage to the belt may occur.

9. Using the special tool, install the power steering belt onto the power steering pump pulley.
   - Position the belt around the special tool and the power steering pump pulley. Make sure that the belt is engaged with the pulley and rotate the crankshaft clockwise to install the belt.

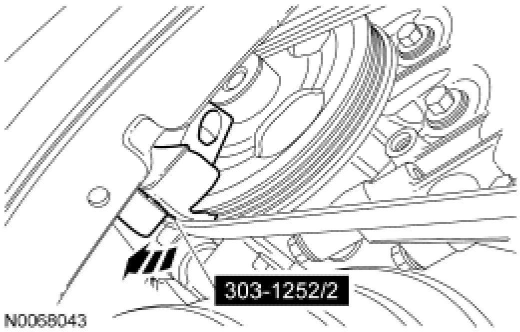


Fig. 10: Installing Power Steering Belt Onto Power Steering Pump Pulley Using Special Tool (303-1252/2)
Courtesy of FORD MOTOR CO.

10. Install the RH inner fender splash shield. For additional information, refer to **FRONT END BODY PANELS** .

11. Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** .

POWER STEERING PUMP TO STEERING GEAR PRESSURE LINE

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

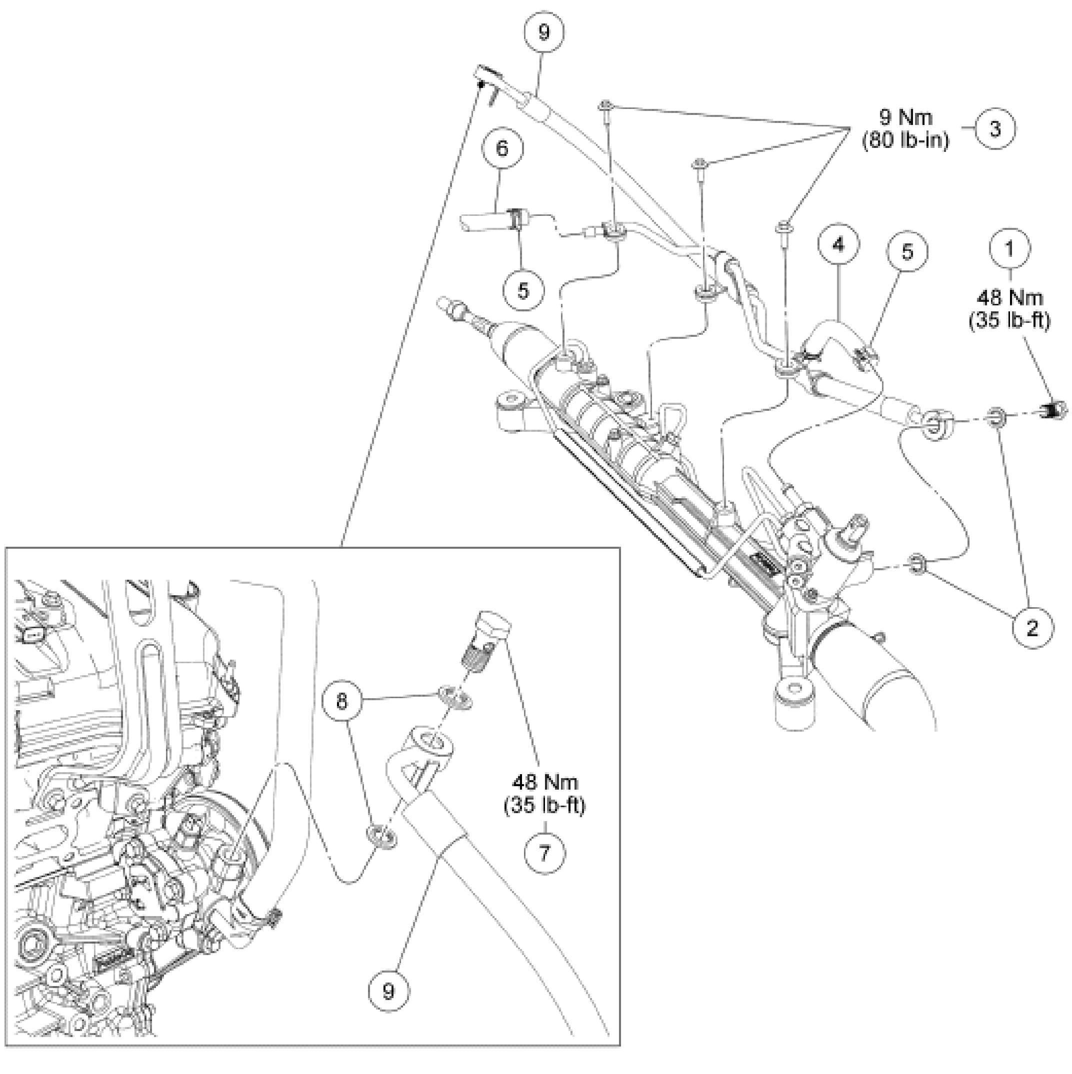


Fig. 11: Exploded View Of Power Steering Pump To Steering Gear Pressure Line With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3N623	Pressure line-to-steering gear banjo bolt (also part of kit 3A719)
2	3N626	Pressure line-to-steering gear seals (2 required) (also part of kit 3A719)
3	W711787	Pressure line bracket-to-steering gear bolts (3 required) (also part of kit 3A719)
4	-	Return hose (part of kit 3A719)
5	3C750	Clamps (also part of kit 3A719)
6	3A713C	Return hose
7	3N623	Pressure line-to-power steering pump banjo bolt (also part of kit 3A719)
8	37626	Pressure line-to-power steering pump seals (2 required) (also part of kit 3A719)
9	3A719	Pressure line kit

REMOVAL AND INSTALLATION

CAUTION: When repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** .
2. Remove the pressure line-to-steering gear banjo bolt and disconnect the pressure line from the steering gear.
   - Discard the 2 seals.
   - To install, tighten to 48 Nm (35 lb-ft).
3. Release the clamp and disconnect the return hose from the steering gear.
4. Release the clamp and disconnect the return hose from the return line.
5. Remove the 3 pressure line bracket-to-steering gear bolts.
   - To install, tighten to 9 Nm (80 lb-in).
6. Disconnect the purge valve electrical connector.

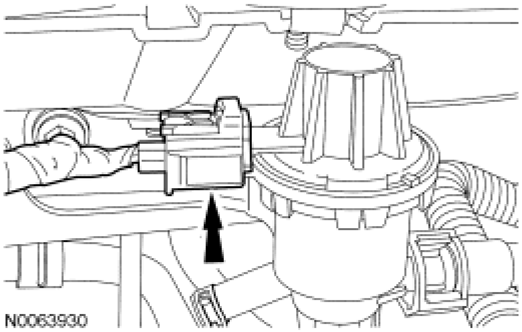


Fig. 12: Locating Purge Valve Electrical Connector
Courtesy of FORD MOTOR CO.

7. Disconnect the 3 PCM electrical connectors and position the wiring harness aside.

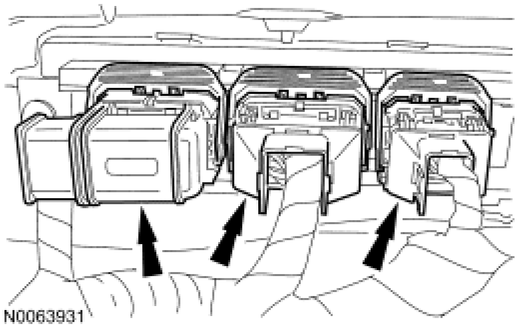


Fig. 13: Identifying PCM Electrical Connectors & Wiring Harness
Courtesy of FORD MOTOR CO.

8. Remove the pressure line-to-power steering pump banjo bolt and disconnect the pressure line from the pump.
   - Discard the 2 seals.
   - To install, tighten to 48 Nm (35 lb-ft).
9. To install, reverse removal procedure.
   - Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** .

POWER STEERING FLUID COOLER

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

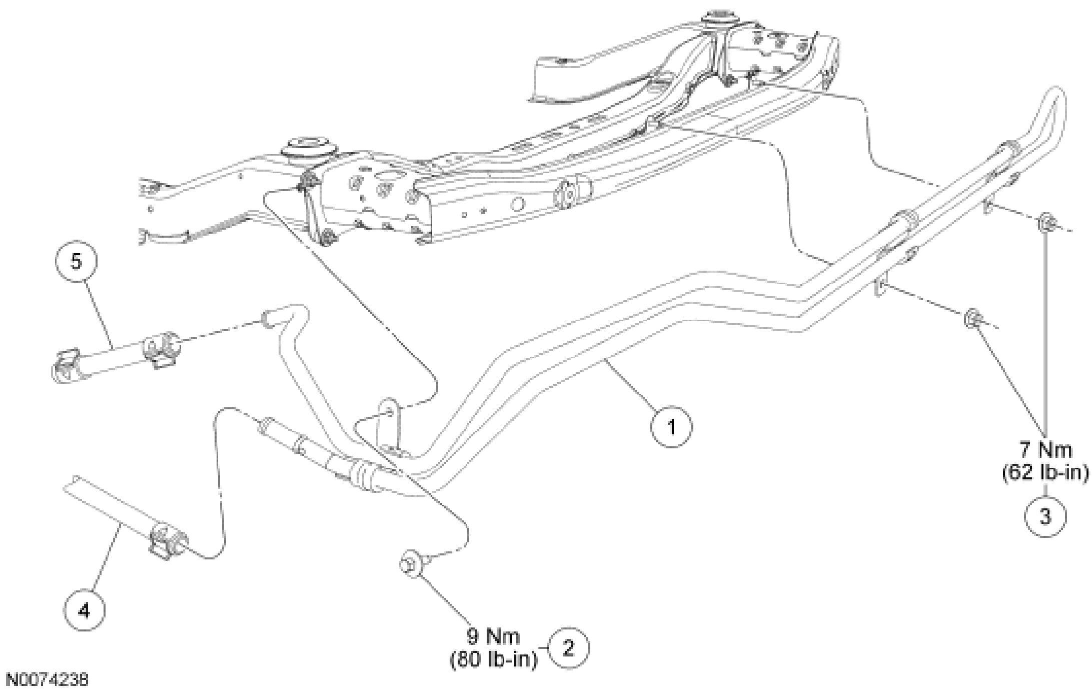


Fig. 14: Exploded View Of Power Steering Fluid Cooler With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3D746	Power steering fluid cooler
2	W711788	Power steering fluid cooler-to-subframe bolt
3	W707142	Power steering fluid cooler nuts (2 required)
4	3A713B	Return hose
5	3A713C	Return hose

REMOVAL AND INSTALLATION

CAUTION: While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

1. Using a suitable suction device, remove the power steering fluid from the reservoir.
2. Remove the front bumper cover. For additional information, refer to **BUMPERS** .
3. Release the clamps and disconnect the 2 return hoses from the power steering fluid cooler.
4. Remove the power steering fluid cooler-to-subframe bolt.
   - To install, tighten to 9 Nm (80 lb-in).
5. Remove the 2 power steering fluid cooler nuts.

- To install, tighten to 7 Nm (62 lb-in).

6. To install, reverse the removal procedure.
    - Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** .

STEERING GEAR

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

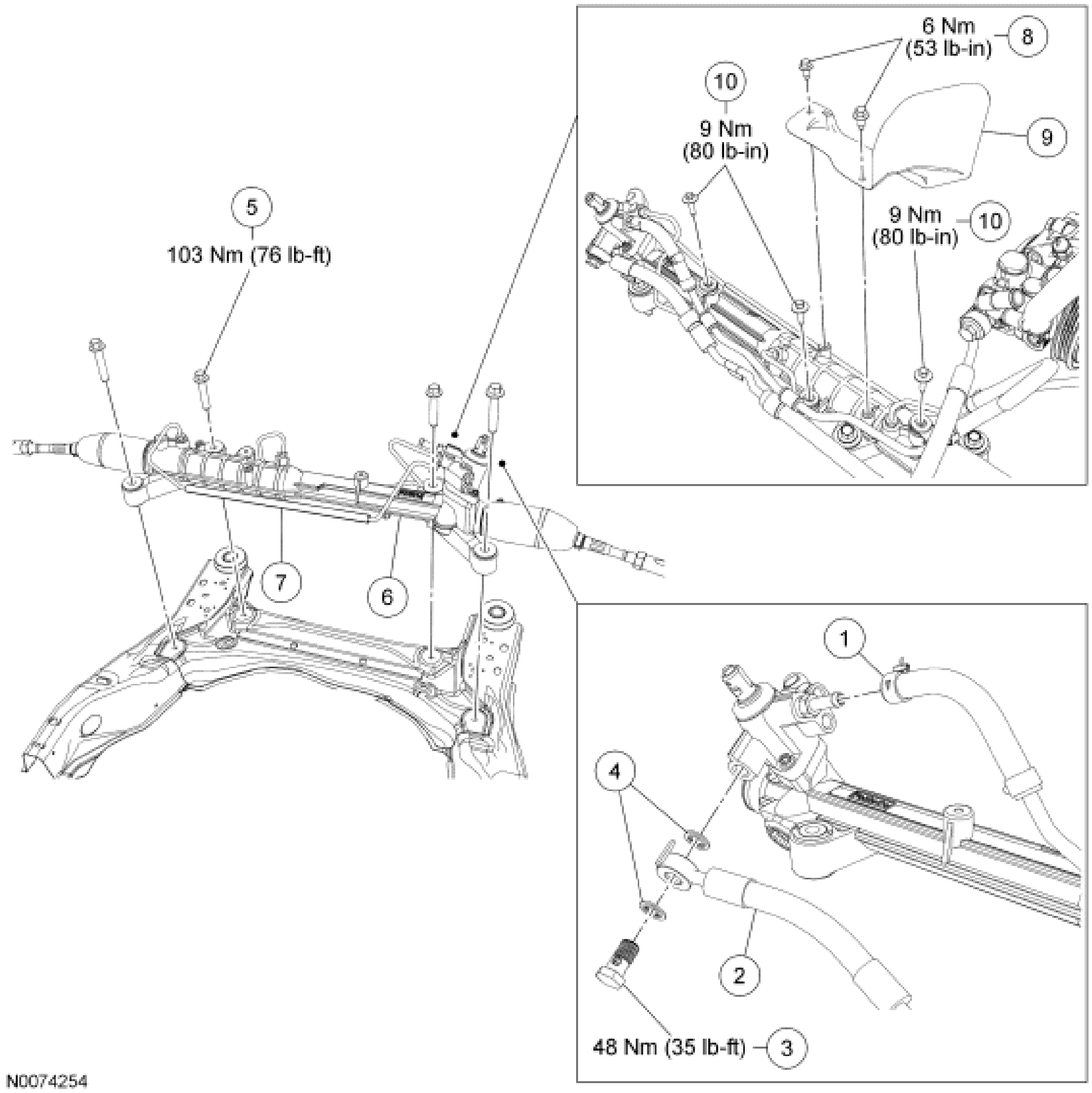


Fig. 15: Exploded View Of Steering Gear With Torque Specifications

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3C750	Return hose clamp (also part of kit 3A719)
2	3A719	Pressure line kit
3	3N623	Pressure line-to-steering gear banjo bolt (also part of kit 3A719)
4	3N626	Pressure line seals (2 required) (also part of kit 3A719)
5	W713071	Steering gear mounting bolt (4 required)
6	3504	Steering gear
7	3C569	Steering gear turn tube heat wrap
8	W500210	Steering gear heat shield bolts (2 required)
9	3F570	Steering gear heat shield
10	W711787	Pressure line bracket-to-steering gear bolts (3 required)

REMOVAL

CAUTION: When repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

1. Remove the stabilizer bar. For additional information, refer to **FRONT SUSPENSION** .
2. Remove the pressure line-to-steering gear banjo bolt.
   - Discard the 2 seals.
3. Release the clamp and disconnect the return hose from the steering gear.
4. Remove the 2 bolts and the steering gear heat shield.
5. Remove the 3 pressure line bracket-to-steering gear bolts.
6. Remove and discard the 4 steering gear bolts.
   - Remove the steering gear.

INSTALLATION

NOTE: When installing a new steering gear, install a new steering gear turn tube heat wrap.

1. Position the steering gear and tighten the 4 steering gear bolts to 103 Nm (76 lb-ft) in the sequence shown.

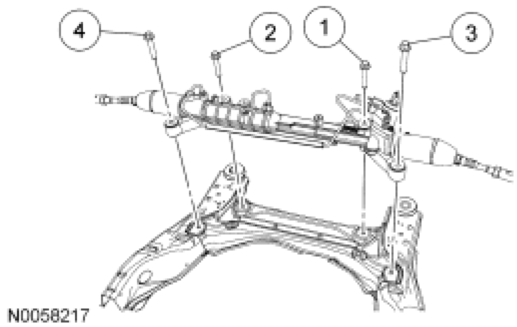


Fig. 16: Identifying Steering Gear Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

CAUTION: New seals must be installed any time the pressure line is disconnected from the power steering pump and/or the steering gear or a fluid leak may occur.

2. Install the pressure line-to-steering gear banjo bolt.
   - Tighten to 48 Nm (35 lb-ft).
3. Install the 3 pressure line bracket-to-steering gear bolts.
   - Tighten to 9 Nm (80 lb-in).
4. Release the clamp and connect the return hose to the steering gear.
5. Install the steering gear heat shield and the 2 bolts.
   - Tighten to 6 Nm (53 lb-in).
6. Install the stabilizer bar. For additional information, refer to **FRONT SUSPENSION** .
7. Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** .

STEERING GEAR TO FLUID COOLER RETURN HOSE

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

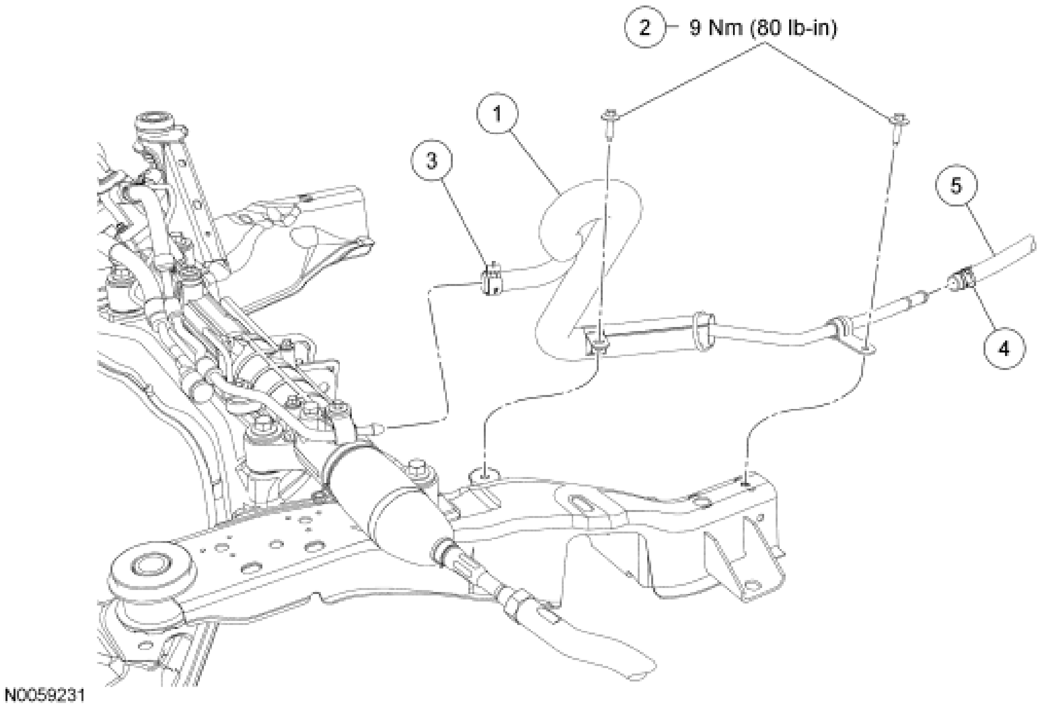


Fig. 17: Exploded View Of Steering Gear To Fluid Cooler Return Hose With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3A713A	Steering gear-to-fluid cooler return hose
2	W711787	Return hose bracket-to-subframe bolts (2 required)
3	3C750	Clamp
4	3C750	Clamp
5	3A713C	Return hose

REMOVAL AND INSTALLATION

CAUTION: While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** .
2. Using a suitable suction device, remove the power steering fluid from the fluid reservoir.
3. Remove the RH fender splash shield. For additional information, refer to **FRONT END BODY PANELS** .
4. Release the clamp and disconnect the return hose from the steering gear-to-fluid cooler return hose.
5. Release the clamp and disconnect the steering gear-to-fluid cooler return hose from the return line at the

steering gear.

6. Remove the 2 return hose bracket-to-subframe bolts.
    - To install, tighten to 9 Nm (80 lb-in).
7. To install, reverse the removal procedure.
    - Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** .

TIE ROD - INNER

NOTE: Left side shown, right side similar.

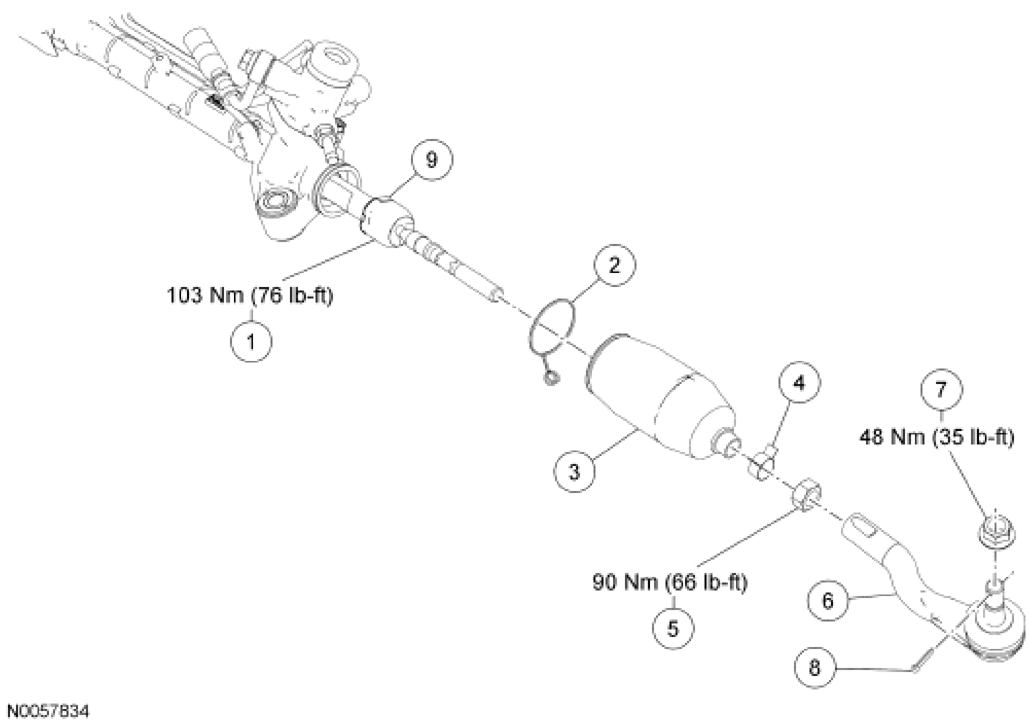


Fig. 18: Exploded View Of Inner Tie Rod With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3280	Inner tie rod
2	3C650C	Inner bellows boot clamp
3	3K661	Bellows boot
4	3C650	Outer bellows boot clamp
5	-	Tie-rod jam nut
6	3A130	Outer tie-rod end
7	6E5C	Outer tie-rod end nut
8	3K176	Cotter pin

9	32132	Lock-washer

REMOVAL AND INSTALLATION

1. Remove the steering gear. For additional information, refer to **Steering Gear**.
2. Mark the pinion shaft and the steering gear housing for correct reference during installation.

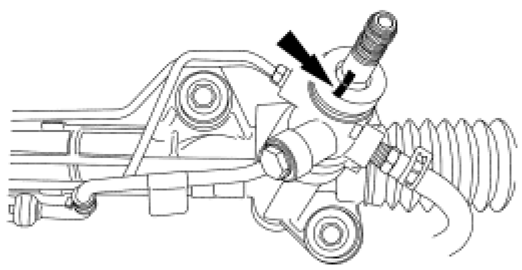


Fig. 19: Locating Pinion Shaft And Steering Gear Mark
Courtesy of FORD MOTOR CO.

CAUTION: Position the steering gear in a soft-jaw vise or damage to the steering gear may occur.

3. Loosen the tie-rod jam nut.
   - To install, tighten to 90 Nm (66 lb-ft).
4. Remove the outer tie-rod end and the tie-rod jam nut.
   - To install, tighten to 48 Nm (35 lb-ft).

NOTE: It is necessary to remove both bellows boots when removing the RH inner tie rod.

5. Remove the 4 bellows clamps and the 2 steering gear bellows boots.
6. Using a suitable wrench, hold the piston shaft.
7. Using a suitable wrench, remove the inner tie rod.
   - To install, tighten to 103 Nm (76 lb-ft).

NOTE: Using a suitable wrench, hold the piston shaft while tightening the inner tie rod.

NOTE: The new lock washer must be crimped after tightening the inner tie rod.

8. To install, reverse the removal procedure.
   - Thoroughly clean and inspect all the parts to be reused. Install new parts as necessary.

2008 DRIVELINE/AXLES

Rear Drive Axle/Differential - Edge & MKX

SPECIFICATIONS

MATERIAL SPECIFICATIONS

Item	Specification	Fill Capacity
Clear Silicone Rubber TA-32	ESB-M4G92-A	-
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada); (Model 60/70 axles)	WSP-M2C197-A	1.15L (2.43 pt)
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B	-

TORQUE SPECIFICATIONS

Description	Nm	lb-ft
Differential housing cover bolts	23	17
Differential housing-to-front insulator bracket bolts	90	66
Filler plug	29	21
Front insulator bracket-to-subframe bolts	90	66
Pinion nut	244	180
Rear driveshaft U-joint flange bolts	70	52
Side insulator bracket-to-rear axle differential bolts	90	66

DESCRIPTION AND OPERATION

REAR DRIVE AXLE AND DIFFERENTIAL

The rear drive unit (RDU) consists of the following components:

- Dished circular flange
- Full-time fluid drive coupling
- Aluminium housing with steel housing cover
- Matched ring and pinion
- Conventional open differential
- Rubber bushing isolated mounting points
- Cover mounted axle vent

- Silicone sealant rather than a gasket for the housing cover

The rear axle drive pinion receives power from the engine through the transaxle, power transfer unit (PTU), driveshaft and active torque coupling, and is engaged on demand. The pinion gear rotates the differential ring gear, which is bolted to the differential case outer flange. Inside the differential case, 2 differential pinion gears are mounted on a differential pinion shaft, which is pinned to the case. These differential pinion gears are engaged with the splined differential side gears. The halfshafts are held in the differential side gears by a retainer circlip that is located on the inboard constant velocity (CV) joint stub shaft. When each halfshaft is installed, the driveshaft bearing retainer circlip engages a step in the differential side gear. There are no stub shaft bearings in the differential housing. As the differential case turns, it rotates the halfshafts and rear wheels. When it is necessary for one wheel and halfshaft to rotate faster than the other, the faster turning differential side gear causes the differential pinion gears to roll on the slower turning differential side gear. This allows differential action between the 2 halfshafts. The active torque coupling is installed new as an assembly with the rear axle. The pinion seal and the differential halfshaft seals are the only serviced components of the rear drive axle. If other components of the rear drive axle are worn or damaged, the assembly must be installed new.

DIAGNOSTIC TESTS

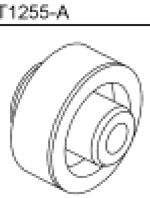
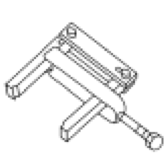
REAR DRIVE AXLE AND DIFFERENTIAL

Refer to **DRIVELINE SYSTEM - GENERAL INFORMATION** article.

IN-VEHICLE SERVICING

STUB SHAFT SEAL

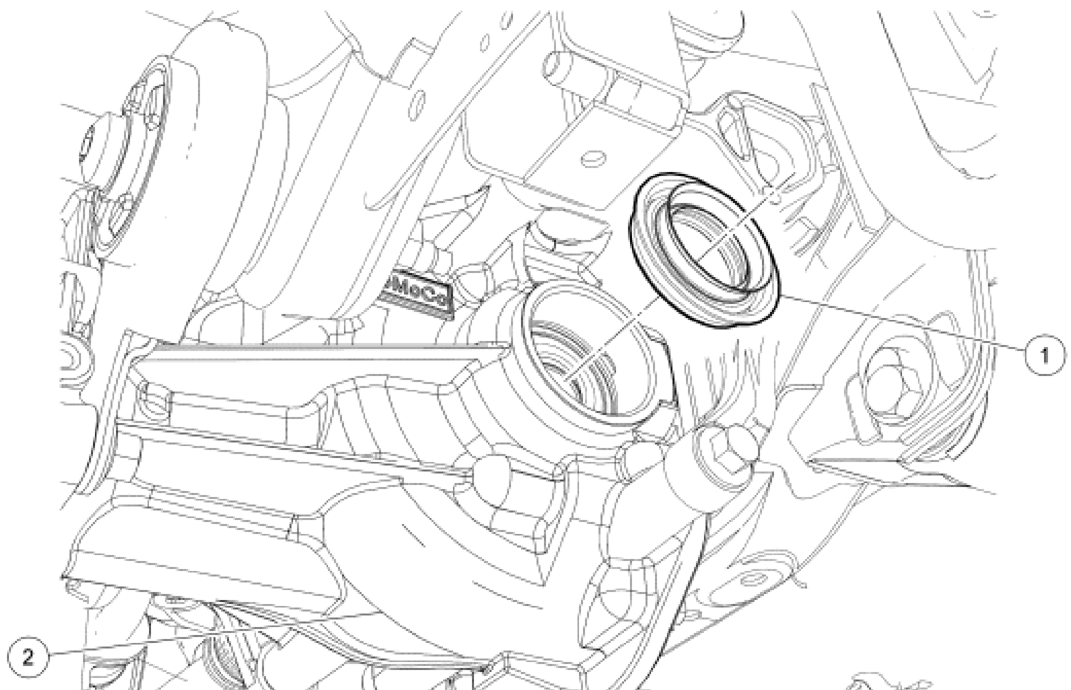
Special Tools

Illustration	Tool Name	Tool Number
 ST1255-A	Adapter for 303-224 (Handle)	205-153 (T80T-4000-W)
 ST1786-A	Installer, Front Axle Oil Seal	205-350 (T95T-3010-A)
 ST1846-A	Remover, Torque Converter Fluid Seal	307-309 (T94P-77001-BH)

 ST1185-A	Slide Hammer	100-001 (T50T-100-A)

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B



N0072245

Fig. 1: Exploded View Of Stub Shaft Seal
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	4B416	Stub shaft seal
2	4010	Differential housing

REMOVAL

NOTE: The rear drive unit (RDU) does not have stub shaft pilot bearings. It has stub shaft seals only.

1. Remove the halfshaft assembly. For additional information, refer to **REAR DRIVE HALFSHAFTS**

article.

2. Using the special tools, remove the stub shaft seal.

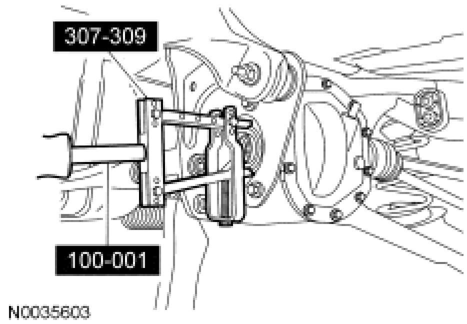


Fig. 2: Removing Stub Shaft Seal
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: Lubricate the new stub shaft seal with grease.

1. Using the special tools, install the stub shaft pilot bearing housing seal.

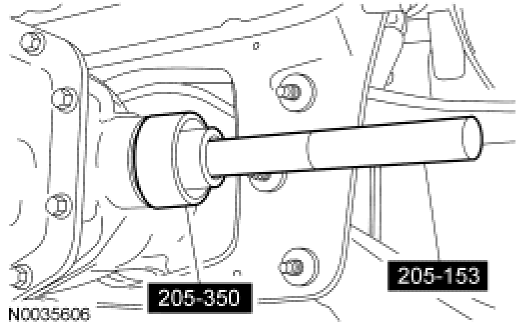


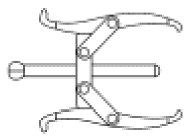
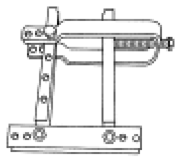
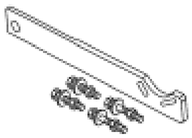
Fig. 3: Installing Stub Shaft Pilot Bearing Housing Seal
Courtesy of FORD MOTOR CO.

2. Install the halfshaft assembly. For additional information, refer to **REAR DRIVE HALFSHAFTS** article.

DRIVE PINION SEAL

Special Tools

Illustration	Tool Name	Tool Number
	2-Jaw Puller	205-D072 (D97L-4221-A) or equivalent

 ST1321-A		
 ST1758-A	Converter Seal Remover	307-309 (T94P-77001-BH)
 ST1257-A	Holding Fixture, Drive Pinion Flange	205-126 (T78P-4851-A)
 ST1957-A	Pinion Seal Replacer	205-133 (T79P-4676-A)
 ST1185-A	Slide Hammer	100-001 (T50T-100-A)

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

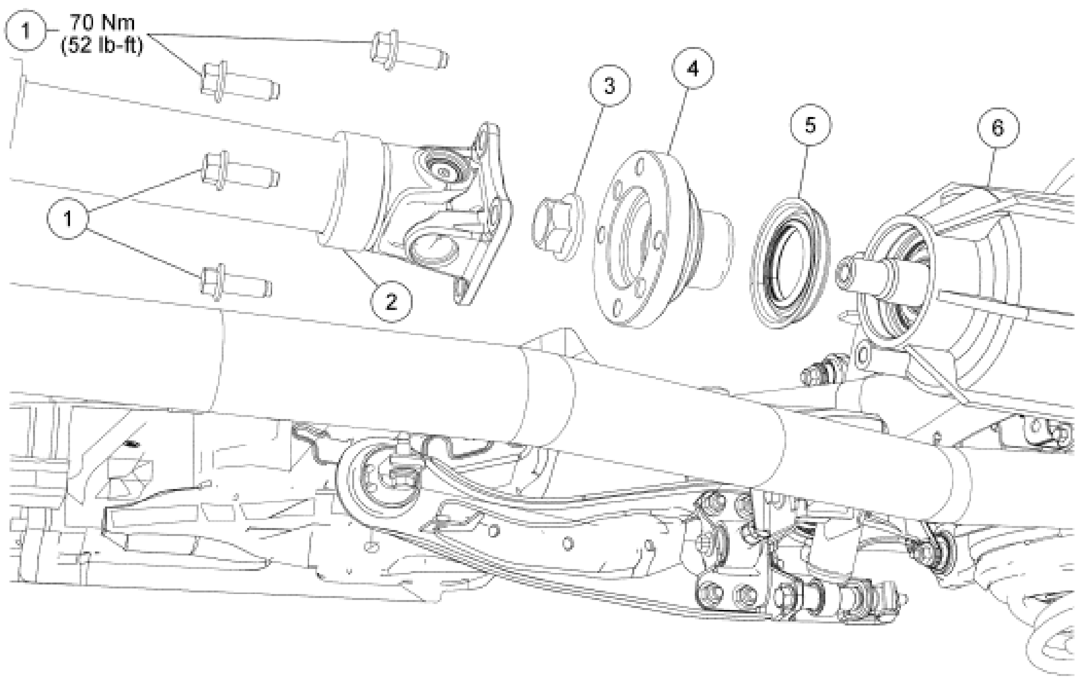


Fig. 4: Exploded View Of Drive Pinion Seal With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W711918-S	Rear driveshaft flange-to-pinion flange bolts (4 required)
2	4K357	Driveshaft
3	4320	Drive pinion nut
4	4858	Drive pinion flange
5	4676	Drive pinion seal
6	49924	Coupler housing

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove and discard the 4 rear driveshaft U-joint flange bolts.
   - Support the driveshaft.

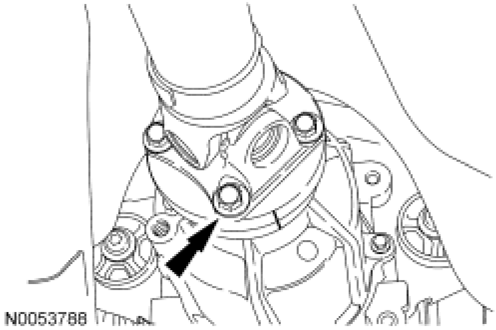


Fig. 5: Locating Rear Driveshaft Universal Joint Flange Bolts
Courtesy of FORD MOTOR CO.

3. Using the special tool, hold the pinion flange and remove and discard the nut.

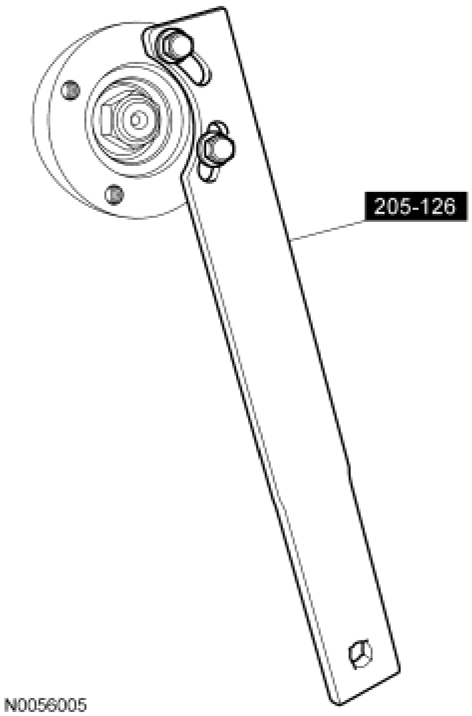


Fig. 6: Identifying Special Tool (205-126)
Courtesy of FORD MOTOR CO.

4. Index-mark the location of the pinion to the yoke.

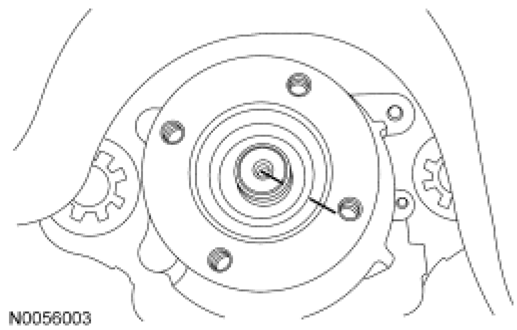


Fig. 7: Identifying Index-Mark On Pinion Of Yoke
Courtesy of FORD MOTOR CO.

5. Using the special tool, remove the pinion flange.

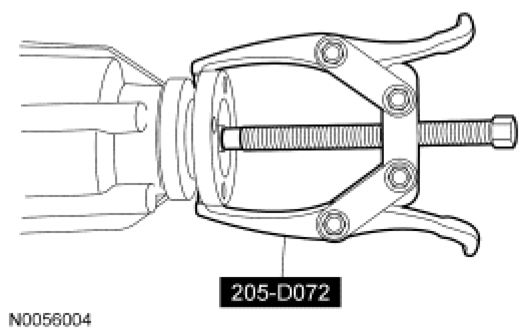


Fig. 8: Identifying Special Tool (205-D072)
Courtesy of FORD MOTOR CO.

6. Using the special tools, remove and discard the drive pinion seal.

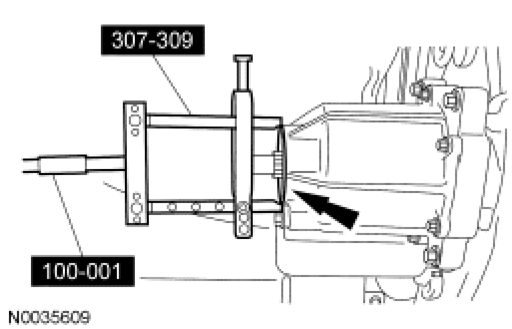


Fig. 9: Removing Seal
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: **Make sure that the mating surface is clean before installing the new seal.**

1. Using the special tool, install the drive pinion seal.

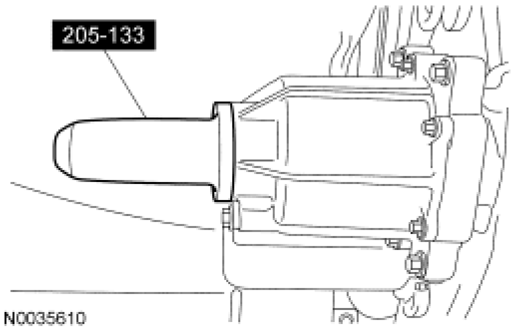


Fig. 10: Installing Seal
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the pinion flange splines with grease.

2. Line up the index marks and position the pinion flange.

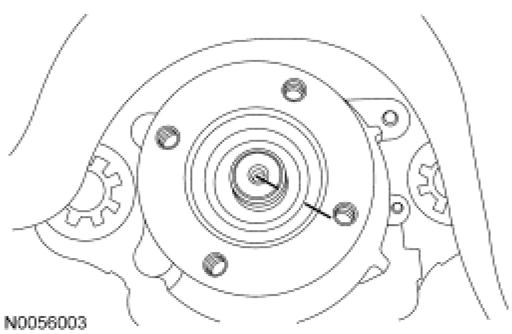


Fig. 11: Identifying Index-Mark On Pinion Of Yoke
Courtesy of FORD MOTOR CO.

3. Using the special tool, install the new pinion nut.
   - Tighten to 244 Nm (180 lb-ft).

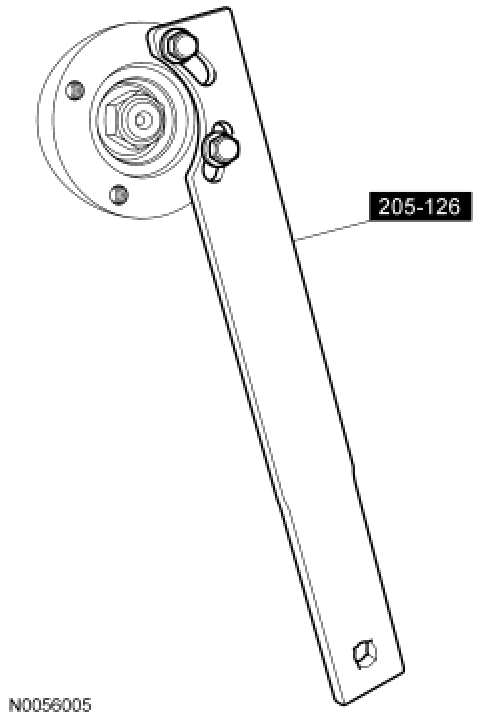


Fig. 12: Identifying Special Tool (205-126)
Courtesy of FORD MOTOR CO.

4. Line up the index marks and install the rear driveshaft U-joint flange with 4 new bolts.
   - Tighten to 70 Nm (52 lb-ft).

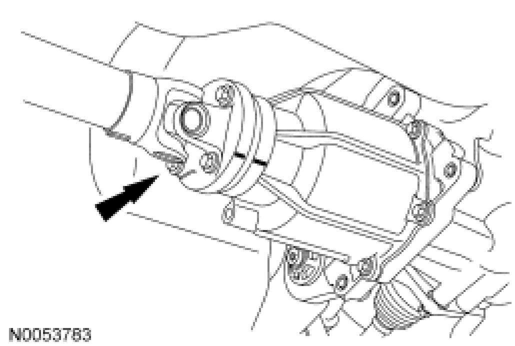


Fig. 13: Locating U-Joint Flange Bolts
Courtesy of FORD MOTOR CO.

DIFFERENTIAL HOUSING COVER

Material

Item	Specification
Clear Silicone Rubber TA-32	ESB-M4G92-A

Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A

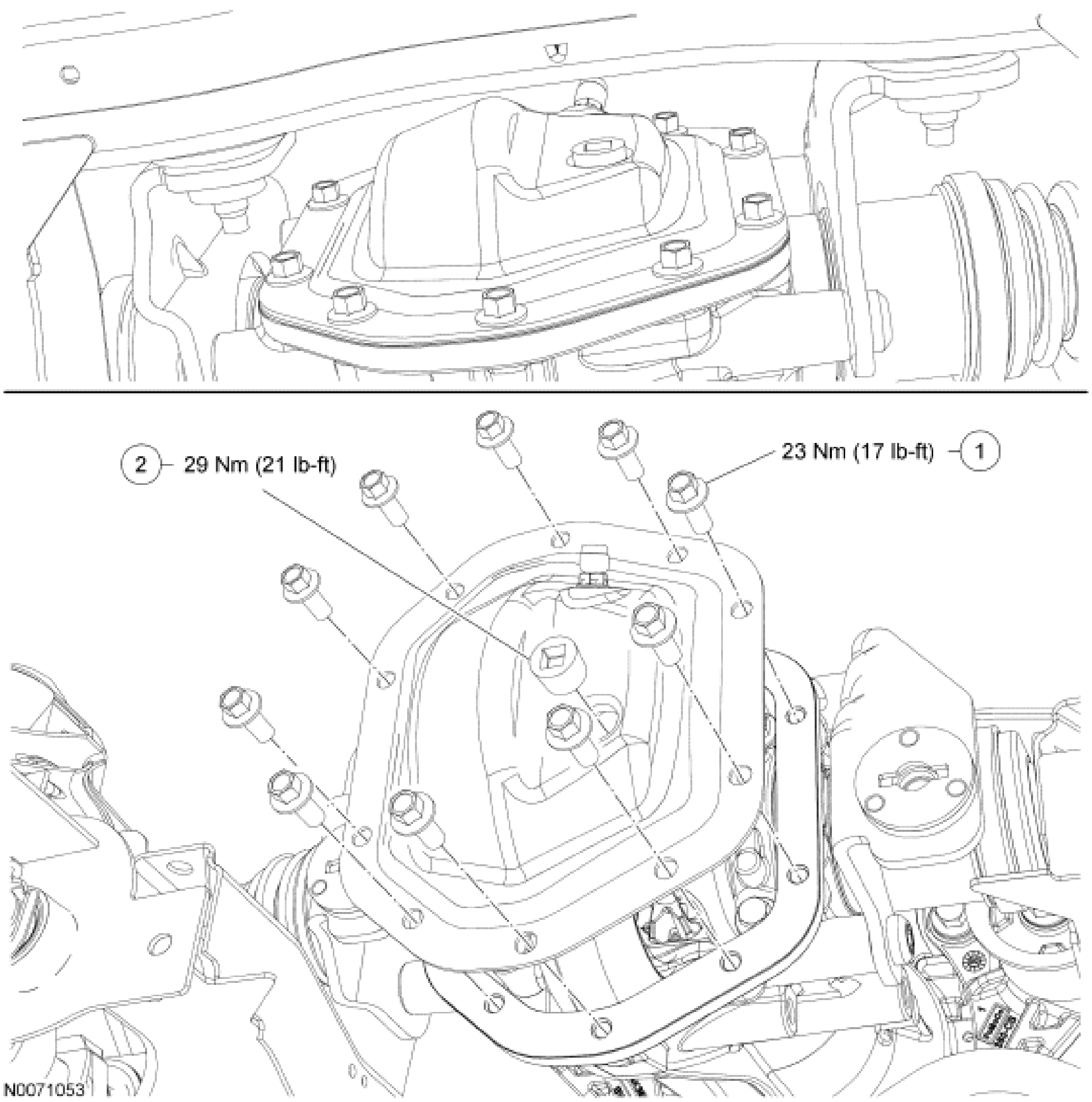


Fig. 14: Exploded View Of Differential Housing Cover Bolts With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W505262-S439	Differential cover bolt (10 required)
2	4N282	Differential fill plug

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

2. Remove the 10 bolts and the rear differential housing cover.
    - Drain the differential fluid from the housing.

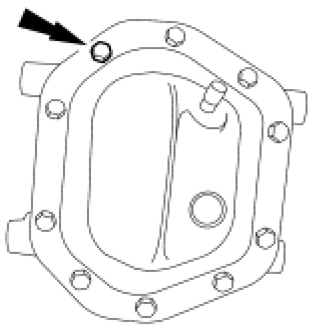


Fig. 15: Locating Rear Differential Housing Cover Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

CAUTION: Make sure the machined surfaces on the rear axle housing and the differential housing cover are clean and free of oil before installing the new silicone sealant. The inside of the rear axle must be covered when cleaning the machined surface to prevent damage to the component.

NOTE: Make sure the differential vent located on the rear cover is free of obstruction.

1. Clean the gasket mating surfaces of the differential housing and the differential housing cover.

NOTE: The differential housing cover must be installed within 15 minutes of application of the silicone, or new sealant must be applied. If possible, allow one hour before filling with lubricant to make sure the silicone sealant has correctly cured.

2. Apply a new continuous bead of clear silicone rubber as shown in the illustration.

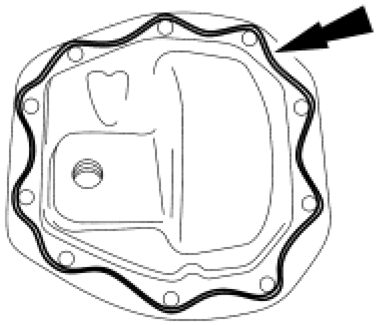


Fig. 16: Applying Sealant
Courtesy of FORD MOTOR CO.

3. Install the differential housing cover and the 10 bolts.
   - Tighten to 23 Nm (17 lb-ft).
4. Remove the filler plug, fill the rear axle with 1.15L (2.43 pt) of rear axle lubricant, 3-5 mm (0.118-0.196 in) below the bottom of the filler hole and install the filler plug.
   - Tighten to 29 Nm (21 lb-ft).

REMOVAL AND INSTALLATION

AXLE ASSEMBLY

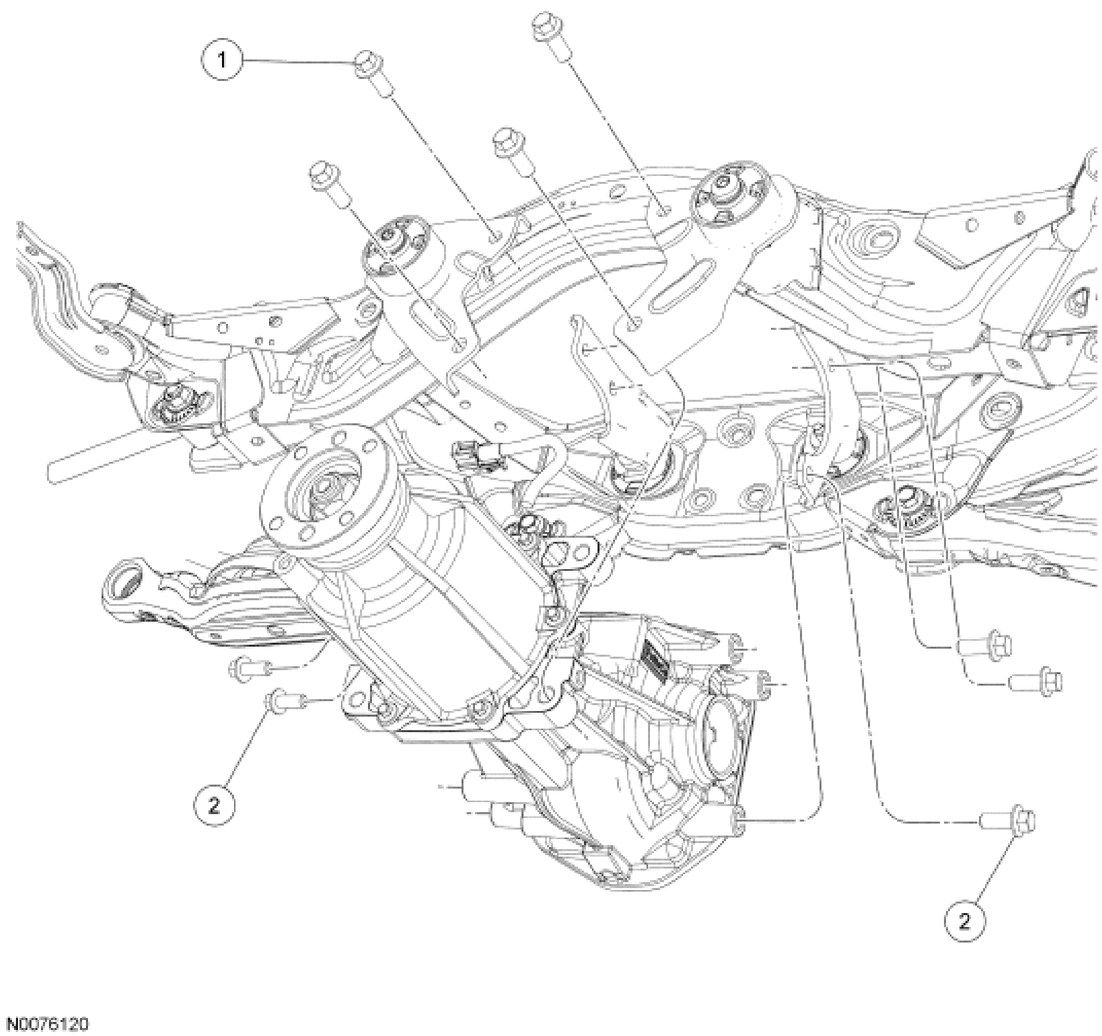


Fig. 17: Exploded View Of Axle Assembly

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W506540-S	Differential housing-to-front insulator bracket bolt (4 required)
2	W500043-S	Side insulator bracket-to-rear axle housing bolts (5 required)

REMOVAL AND INSTALLATION

1. Remove the driveshaft. For additional information, refer to **DRIVESHAFT** article.
2. Remove the rear halfshafts. For additional information, refer to **REAR DRIVE HALFSHAFTS** article.
3. Remove the rear stabilizer bar and link. For additional information, refer to **REAR SUSPENSION** article.
4. Position a suitable transmission hydraulic jack to the axle housing. Securely strap the jack to the housing.

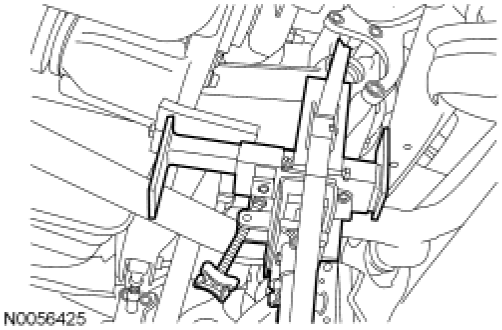


Fig. 18: Positioning Suitable Transmission Hydraulic Jack To Axle Housing
Courtesy of FORD MOTOR CO.

5. Disconnect the active torque coupling electrical connector at the front of the crossmember.
6. Remove the 4 differential housing-to-front insulator bracket bolts.
   - To install, tighten to 90 Nm (66 lb-ft).

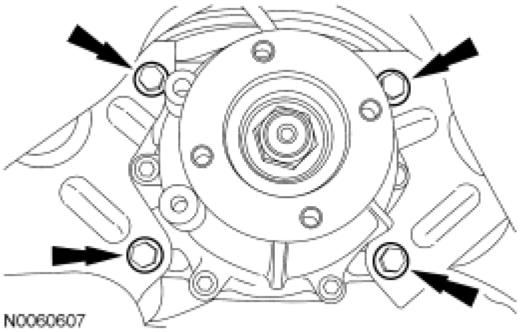


Fig. 19: Locating Differential Housing-To-Front Insulator Bracket Bolts
Courtesy of FORD MOTOR CO.

7. Loosen the LH front insulator bracket-to-subframe bolt, and rotate the bracket aside.
    - To install, tighten to 90 Nm (66 lb-ft).
8. Loosen the RH front insulator bracket-to-subframe bolt and the bracket, and rotate the bracket aside.
    - To install, tighten to 90 Nm (66 lb-ft).
9. Remove the 2 RH side insulator bracket-to-rear axle differential bolts and the axle assembly.
    - To install, tighten to 90 Nm (66 lb-ft).

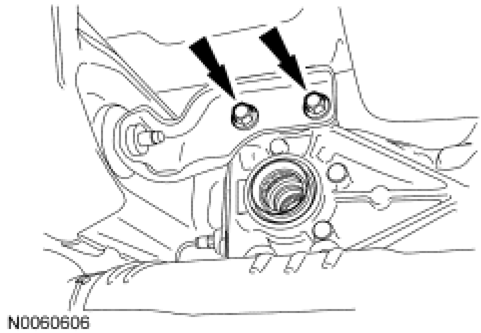


Fig. 20: Locating RH Side Insulator Bracket-To-Rear Axle Differential Bolts
Courtesy of FORD MOTOR CO.

10. Remove the 3 LH side insulator or bracket-to-rear axle differential bolts.
    - To install, tighten to 90 Nm (66 lb-ft).

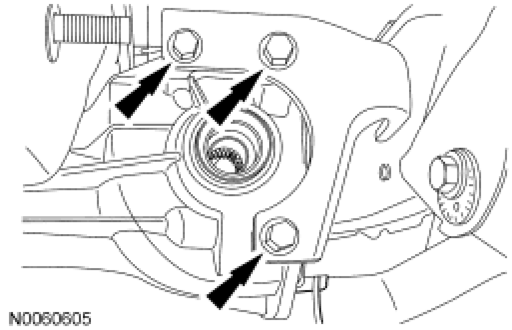


Fig. 21: Locating LH Side Insulator Or Bracket-To-Rear Axle Differential Bolts
Courtesy of FORD MOTOR CO.

11. Lower the rear axle assembly.
12. To install, reverse the removal procedure.

2008 BRAKES

Rear Disc Brake - Edge & MKX

SPECIFICATIONS

MATERIAL SPECIFICATIONS

Item	Specification	Fill Capacity
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1	803-821 ml (1.70-1.74 pt)
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A	-
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-	-

GENERAL SPECIFICATIONS

Item	Specification
Brake Disc	
Minimum brake disc thickness	16 mm (0.629 in)
Brake Pad	
Maximum brake pad taper wear (in any direction)	3.0 mm (0.118 in)
Minimum brake pad thickness	3.0 mm (0.118 in)

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Bleeder screw	8	-	71
Brake caliper anchor plate bolts	90	66	-
Brake caliper flow bolt	25	18	-
Brake caliper guide pin bolts	26	19	-
Brake caliper support plate dust boot shield bolts	10	-	89
Brake flexible hose bracket bolt	15	11	-
Brake tube fitting	17	13	-
Parking brake cable-to-support plate bolts	23	17	-
Parking brake shoe return spring bracket bolt	5	-	44

DESCRIPTION AND OPERATION

REAR DISC BRAKE

The rear disc brake system consists of the following components:

- Brake caliper anchor plate
- Brake caliper
- Brake disc
- Brake disc shield
- Brake flexible hose
- Brake pads

When mechanical force is applied by the driver to the brake pedal, the force is converted into hydraulic pressure by the master cylinder. The hydraulic force is directed to the disc brake calipers and transferred to the brake pads. The brake pads are then forced against the brake friction surfaces by the brake caliper pistons. The friction of the brake pads on the brake disc causes the slowing or stopping of wheel rotation and the vehicle.

DIAGNOSTIC TESTS

REAR DISC BRAKE

Refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

BRAKE PADS

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

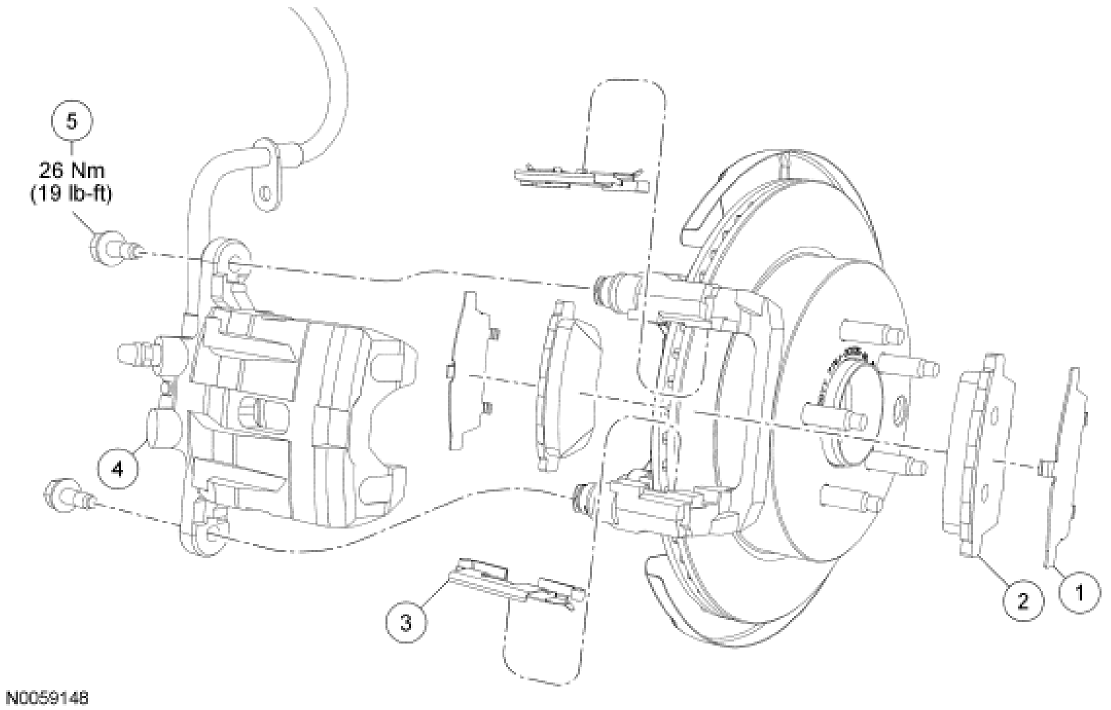


Fig. 1: Exploded View Of Brake Pads With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Brake pad shim (2 required) (part of 2200)
2	-	Brake pad (2 required) (part of 2200)
3	-	Brake pad slide clip (2 required) (part of 2200)
4	2552 RH/ 2553 LH	Brake caliper
5	-	Brake caliper guide pin bolt (2 required) (part of 2B296)

REMOVAL

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure**

to follow these instructions may result in serious personal injury.

WARNING: **Always install new brake shoes or pads at both ends of an axle to reduce the possibility of brakes pulling vehicle to one side. Failure to follow this instruction may result in uneven braking and serious personal injury.**

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Check the brake fluid level in the brake master cylinder reservoir.
   - If required, remove the fluid until the brake master cylinder reservoir is 1/2 full.
2. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

CAUTION: Do not pry in the caliper sight hole to retract the pistons, as this can damage the pistons and boots.

CAUTION: Do not allow the brake caliper to hang from the brake hose or damage to the hose can occur.

3. Remove the 2 brake caliper guide pin bolts and position the caliper aside.
   - Support the caliper using mechanic's wire.

NOTE: Install new brake pads if they are worn past the specified thickness. Refer to GENERAL SPECIFICATIONS .

4. Remove the 2 brake pads, shims and slide clips.
   - Inspect the brake pads and shims for wear, damage or contamination.
   - Discard the slide clips.

INSTALLATION

CAUTION: Protect the caliper pistons and boots when pushing the caliper piston into the caliper piston bores or damage to components may occur.

NOTE: Make sure the caliper piston boot is clean and free of foreign material.

1. If installing new brake pads, using a suitable tool and a worn brake pad, compress the disc brake caliper pistons into the caliper.

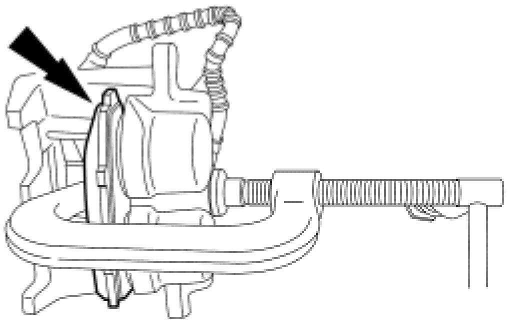


Fig. 2: Compressing Brake Caliper Pistons Into Caliper
Courtesy of FORD MOTOR CO.

2. Install the 2 brake pads, shims and new slide clips to the brake caliper anchor plate.

CAUTION: Make sure that the caliper guide pin boots are fully seated or damage to the caliper guide pin boots can occur.

NOTE: Make sure that the brake caliper hose is not twisted during caliper installation.

3. Position the brake caliper on the anchor plate and install the 2 guide pin bolts.
   - Tighten to 26 Nm (19 lb-ft).
4. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
5. Fill the brake master cylinder reservoir with clean, specified brake fluid.
   - Apply brakes several times to verify correct brake operation.

BRAKE CALIPER

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

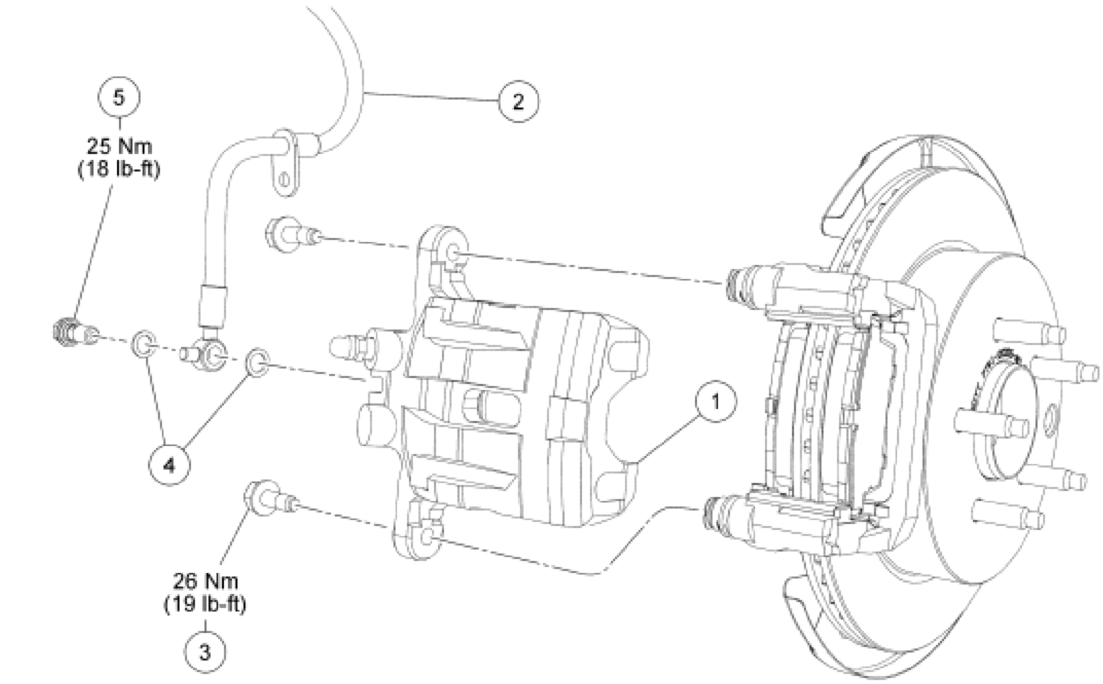


Fig. 3: Exploded View Of Brake Caliper With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2552 RH/ 2553 LH	Brake caliper
2	2282	Brake hose
3	-	Brake caliper guide pin bolt (2 required) (part of 2B296)
4	W711748	Copper washers (2 required)
5	2M085	Brake caliper flow bolt

REMOVAL

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
2. Remove the brake caliper flow bolt and position the brake hose aside.
   - Discard the 2 copper washers.
3. Remove the 2 brake caliper guide bolts and the brake caliper.
   - If a leaking or damaged caliper piston boot is found, install a new disc brake caliper.

INSTALLATION

CAUTION: Make sure that the caliper guide pin boots are fully seated or damage to the caliper guide pin boots can occur.

NOTE: Make sure that the brake caliper hose is not twisted during caliper installation.

1. Position the brake caliper onto the anchor plate and brake pads.
2. Install the 2 brake caliper guide pin bolts.
   - To install, tighten to 26 Nm (19 lb-ft).
3. Using 2 new copper washers, position the brake hose and install the brake caliper flow bolt.
   - Tighten to 25 Nm (18 lb-ft).
4. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
5. Bleed the brake system. For additional information, refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.

BRAKE CALIPER ANCHOR PLATE

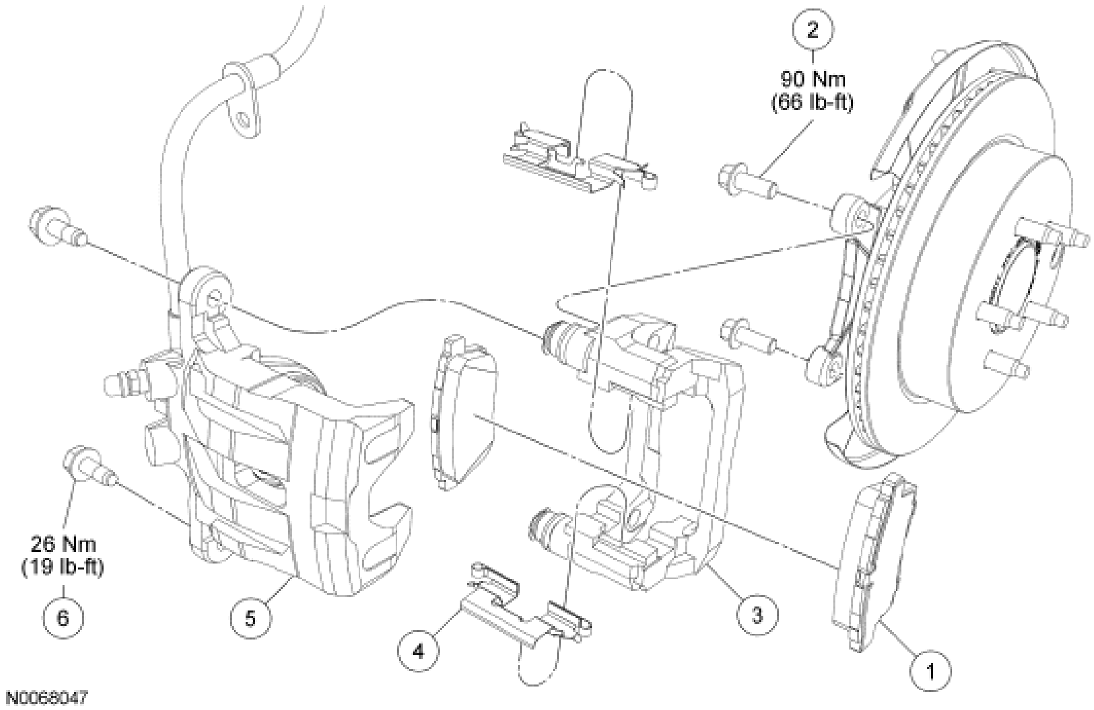


Fig. 4: Exploded View Of Brake Caliper Anchor Plate With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2200	Brake pad (2 required)
2	W711240	Brake caliper anchor plate bolt (2 required)
3	-	Brake caliper anchor plate
4	-	Brake pad slide clip (2 required) (part of 2200)
5	2552 RH/ 2553 LH	Brake caliper
6	-	Brake caliper guide pin bolt (2 required) (part of 2B296)

REMOVAL AND INSTALLATION

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

CAUTION: Do not pry in the caliper sight hole to retract the pistons, as this can damage the pistons and boots.

CAUTION: Do not allow the brake caliper to hang from the brake hose or damage to the hose can occur.

2. Remove the 2 brake caliper guide pin bolts and position the caliper aside.
    - Support the caliper using mechanic's wire.
    - To install, tighten to 26 Nm (19 lb-ft).
3. Remove the 2 brake pads, shims and slide clips. Inspect the brake pads for wear or contamination.
4. Remove the 2 brake caliper anchor plate bolts and the anchor plate.
    - To install, tighten to 90 Nm (66 lb-ft).

NOTE: Make sure that the brake caliper hose is not twisted during caliper installation.

5. To install, reverse the removal procedure.
    - Apply brakes several times to verify correct brake operation.

BRAKE DISC

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-

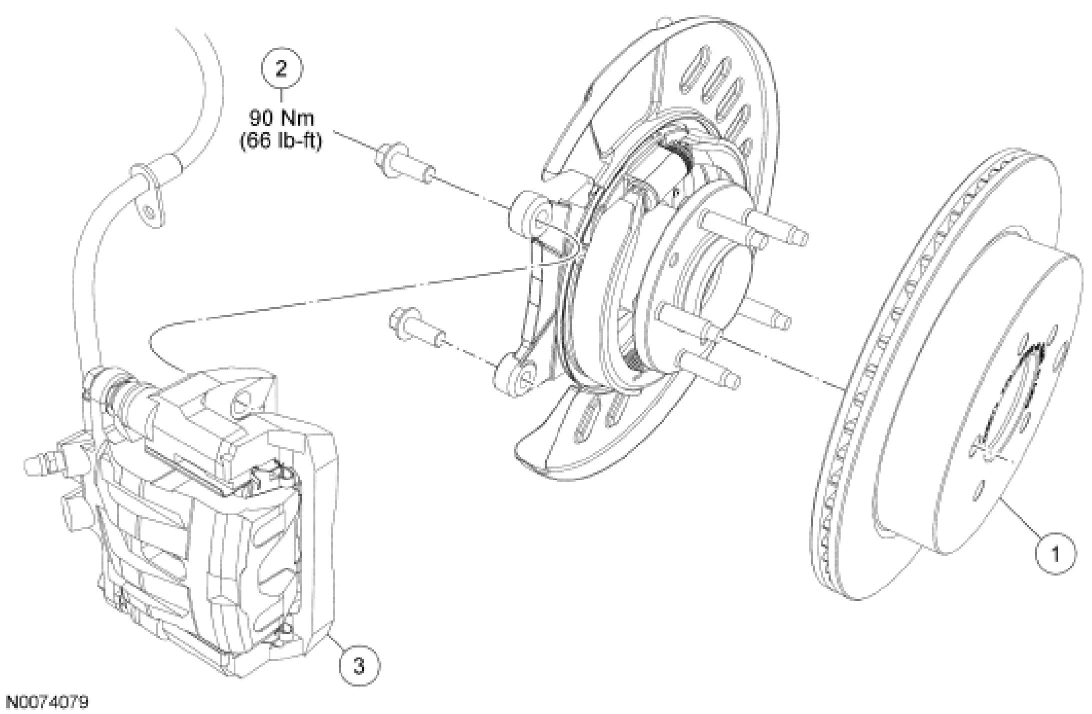


Fig. 5: Identifying Brake Disc With Torque Specifications

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2C026	Brake disc
2	W711240	Brake caliper anchor plate bolt (2 required)
3	-	Brake caliper and anchor plate assembly

REMOVAL

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

CAUTION: Do not allow the brake caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.

2. Remove the 2 brake caliper anchor plate bolts and position the brake caliper and anchor plate assembly aside.
   - Support the brake caliper and anchor plate assembly using mechanic's wire.
3. Remove the brake disc.

INSTALLATION

1. Clean and dry the brake disc-to-hub mounting surface and apply a thin coat of anti-seize lubricant where indicated.

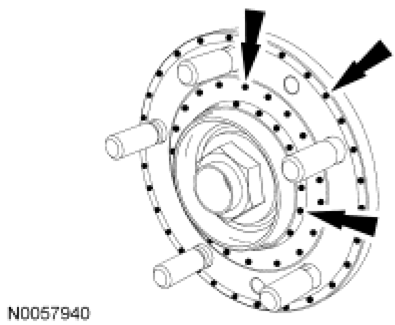


Fig. 6: Locating Brake Disc Screws
Courtesy of FORD MOTOR CO.

2. Install the brake disc onto the wheel hub.
3. Position the brake caliper and anchor plate assembly and install the 2 brake caliper anchor plate bolts.
   - Tighten to 90 Nm (66 lb-ft).
4. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
   - Apply brakes several times to verify correct brake operation.

BRAKE DISC SHIELD

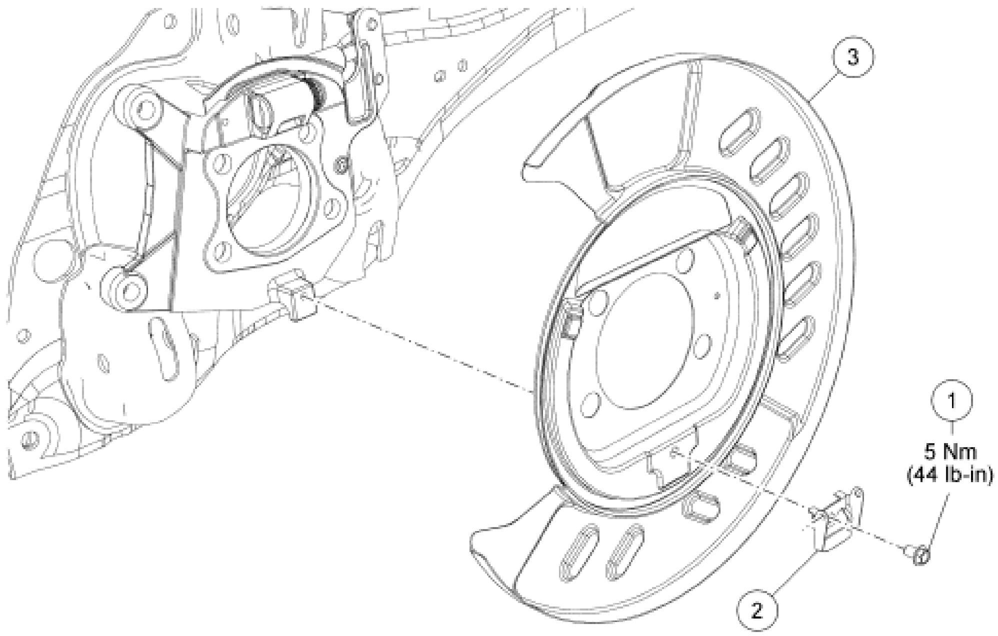


Fig. 7: Exploded View Of Brake Disc Shield With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W302607	Parking brake shoe return spring bracket bolt
2	2068	Parking brake shoe return spring bracket
3	2K045 RH/ 2K046 LH	Brake disc shield

REMOVAL AND INSTALLATION

1. Remove the wheel hub. For additional information, refer to **REAR SUSPENSION** article.
2. Remove the parking brake shoe return spring bracket bolt and bracket.
    - To install, tighten to 5 Nm (44 lb-in).
3. Remove the brake disc shield.
4. To install, reverse the removal procedure.

BRAKE CALIPER SUPPORT PLATE

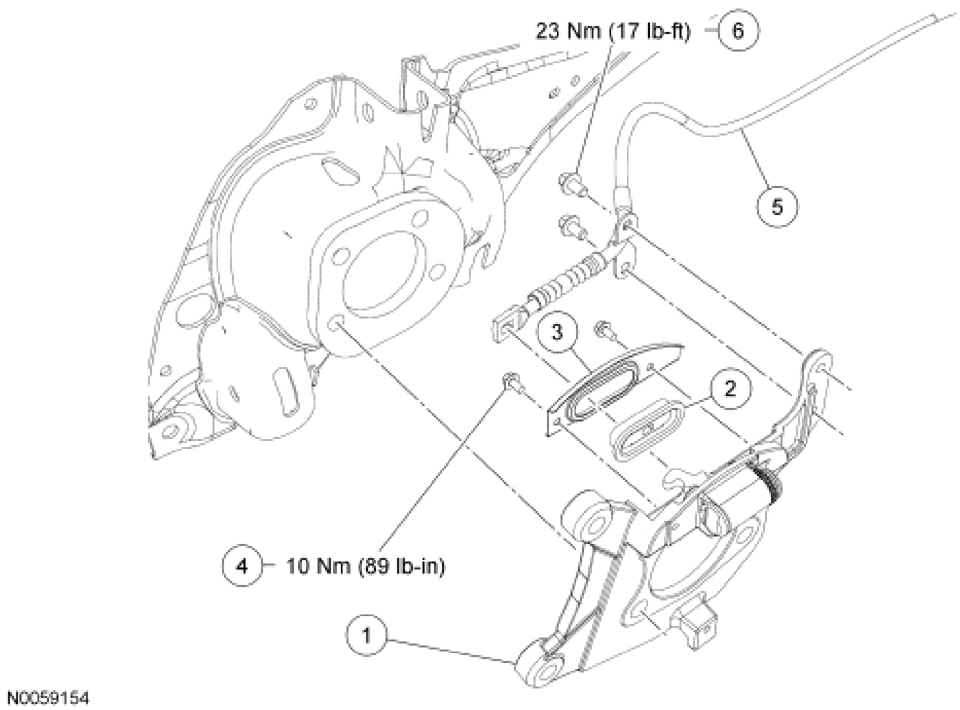


Fig. 8: Exploded View Of Brake Caliper Support Plate With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2C220	Brake caliper support plate
2	2092	Dust boot
3	-	Dust boot shield (part of 2C220)
4	W302608	Dust boot shield bolt (2 required)
5	2A635 LH/ 2A604 RH	Rear parking brake cable
6	W500021	Parking brake cable-to-support plate bolt (2 required)

REMOVAL AND INSTALLATION

1. Remove the brake disc shield. For additional information, refer to **Brake Disc Shield**.
2. Remove the 2 parking brake cable-to-support plate bolts, disconnect the parking brake cable from the lever and position the cable aside.
   - To install, tighten to 23 Nm (17 lb-ft).
3. Remove the 2 dust boot shield bolts and the dust shield.
   - To install, tighten to 10 Nm (89 lb-in).
4. Remove the dust boot.
5. To install, reverse the removal procedure.

BRAKE FLEXIBLE HOSE

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

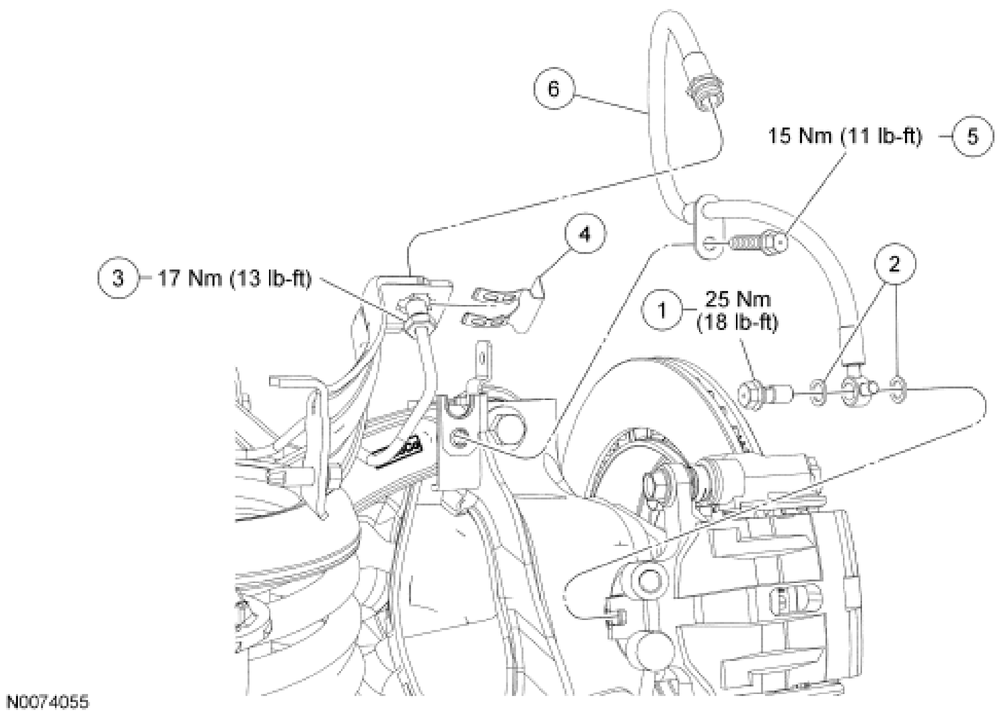


Fig. 9: Identifying Brake Flexible Hose With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2K573	Brake caliper flow bolt
2	W711784	Copper washers (2 required)
3	-	Brake tube fitting (part of 2265 RH/2C287 LH)
4	2B223	Brake flexible hose retaining clip
5	W500022	Brake flexible hose bracket bolt
6	2282	Brake flexible hose

REMOVAL AND INSTALLATION

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal**

injury.

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
2. Remove the brake caliper flow bolt and discard the 2 copper washers.
    - To install, tighten to 25 Nm (18 lb-ft).
3. Disconnect the brake tube fitting from the brake flexible hose.
    - To install, tighten to 17 Nm (13 lb-ft).
4. Remove the brake flexible hose retaining clip.
5. Remove the brake hose bracket bolt and the brake hose.
    - To install, tighten to 15 Nm (11 lb-ft).
6. To install, reverse the removal procedure.
    - Bleed the brake caliper. For additional information, refer to **BRAKE SYSTEM - GENERAL INFORMATION** article for component bleeding.

2008 SUSPENSION

Rear Suspension - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	N.m	lb. ft.	lb-in
Brake caliper anchor plate bolt	55	41	-
Brake hose bracket bolt	7	-	62
Halfshaft nut (inner)	275	203	-
Halfshaft nut (outer)	175	129	-
Lower arm cam adjuster nut	150	111	-
Lower arm outboard bolt (1)	-	-	-
Parking brake cable bolt	18	13	-
Shock absorber lower nut	80	59	-
Shock absorber upper nut	25	18	-
Stabilizer bar bracket nut	55	41	-
Stabilizer bar link upper and lower nut	35	26	-
Subframe nut	90	66	-
Subframe bushing brace bolt	25	18	-
Toe link inboard nut	200	148	-
Toe link outboard bolt	150	111	-
Upper arm inboard bolt	150	111	-
Upper arm outboard bolt	150	111	-
Wheel bearing and wheel hub bolt	133	98	-
Wheel knuckle bracket bolt	150	111	-
Wheel knuckle bracket-to-frame bolts	47	35	-
Wheel speed sensor bolt	7	-	62
(1) Refer to procedure.			

DESCRIPTION AND OPERATION

REAR SUSPENSION

The rear suspension consists of the following components:

- Coil springs
- Lower arms
- Shock absorbers
- Stabilizer bar

- Stabilizer bar bushings
- Stabilizer bar links
- Toe links
- Upper arms
- Wheel bearing and wheel hub assemblies
- Wheel knuckles
- Wheel studs

The rear suspension utilizes an independent design. This suspension system allows the wheels to react to road imperfections independent of each other. This independent action offers improved isolation from the effects of jounce and rebound.

DIAGNOSTIC TESTS

REAR SUSPENSION

Refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

WHEEL BEARING AND WHEEL HUB

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
	Front Hub Remover	205-D070 (D93P-1175-B) or equivalent

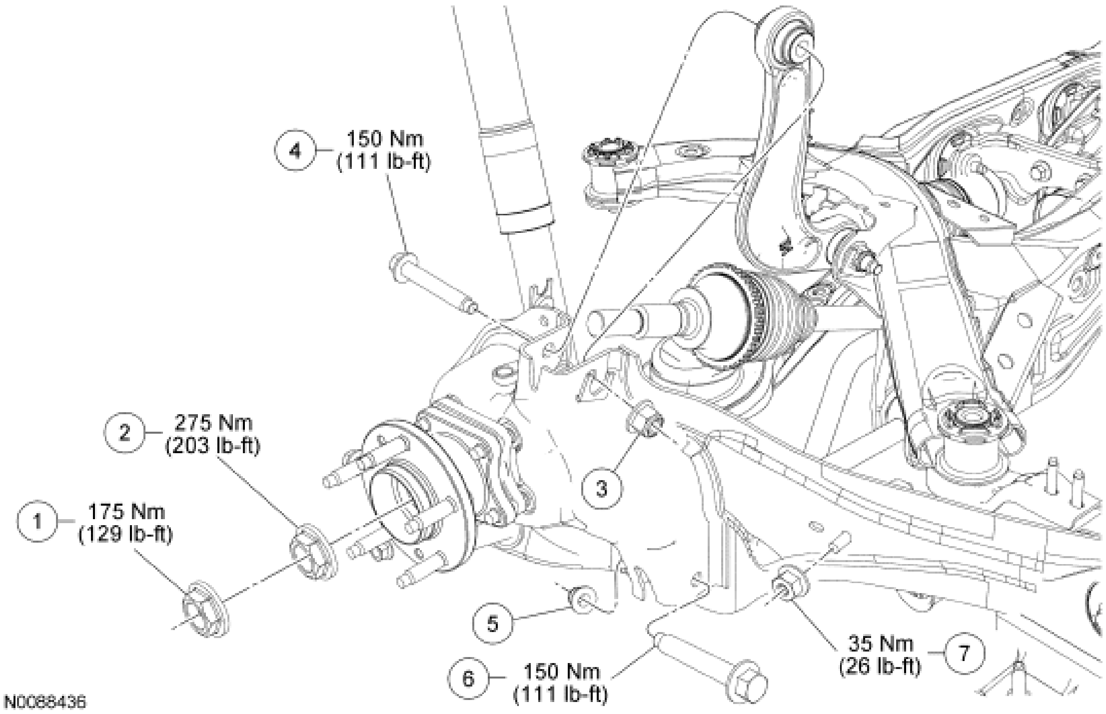


Fig. 1: All Wheel Drive (AWD) Vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W712435	Halfshaft nut (outer)
2	W712435	Halfshaft nut (inner)
3	W520516	Toe link outboard nut
4	W500766	Toe link outboard bolt
5	W520516	Lower arm outboard nut
6	W5000766	Lower arm outboard bolt
7	W520414	Stabilizer bar link upper nut

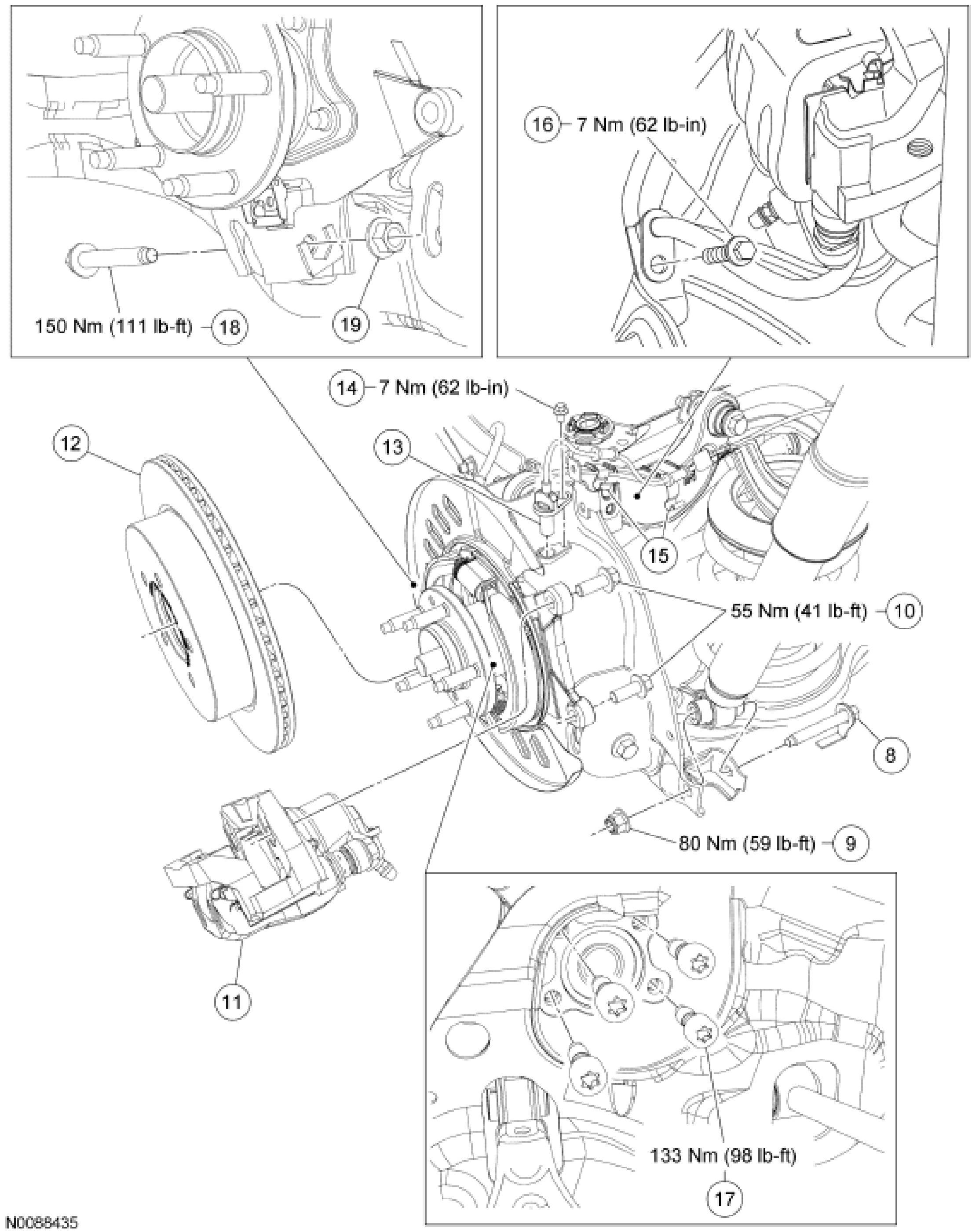


Fig. 2: All Wheel Drive (AWD) Vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
8	W712459	Shock absorber lower flag bolt
9	W520214	Shock absorber lower nut

10	W711241	Brake caliper anchor plate bolts (2 required)
11	-	Brake caliper and anchor plate assembly
12	2C203	Brake disc
13	2C190	Wheel speed sensor
14	W500010	Wheel speed sensor bolt
15	-	Wheel speed sensor harness clips (part of 2C190) (2 required)
16	W500022	Brake hose bracket bolt
17	W712754	Wheel bearing and wheel hub bolt (4 required)
18	W500766	Toe link outboard bolt
19	W520516	Toe link outboard nut

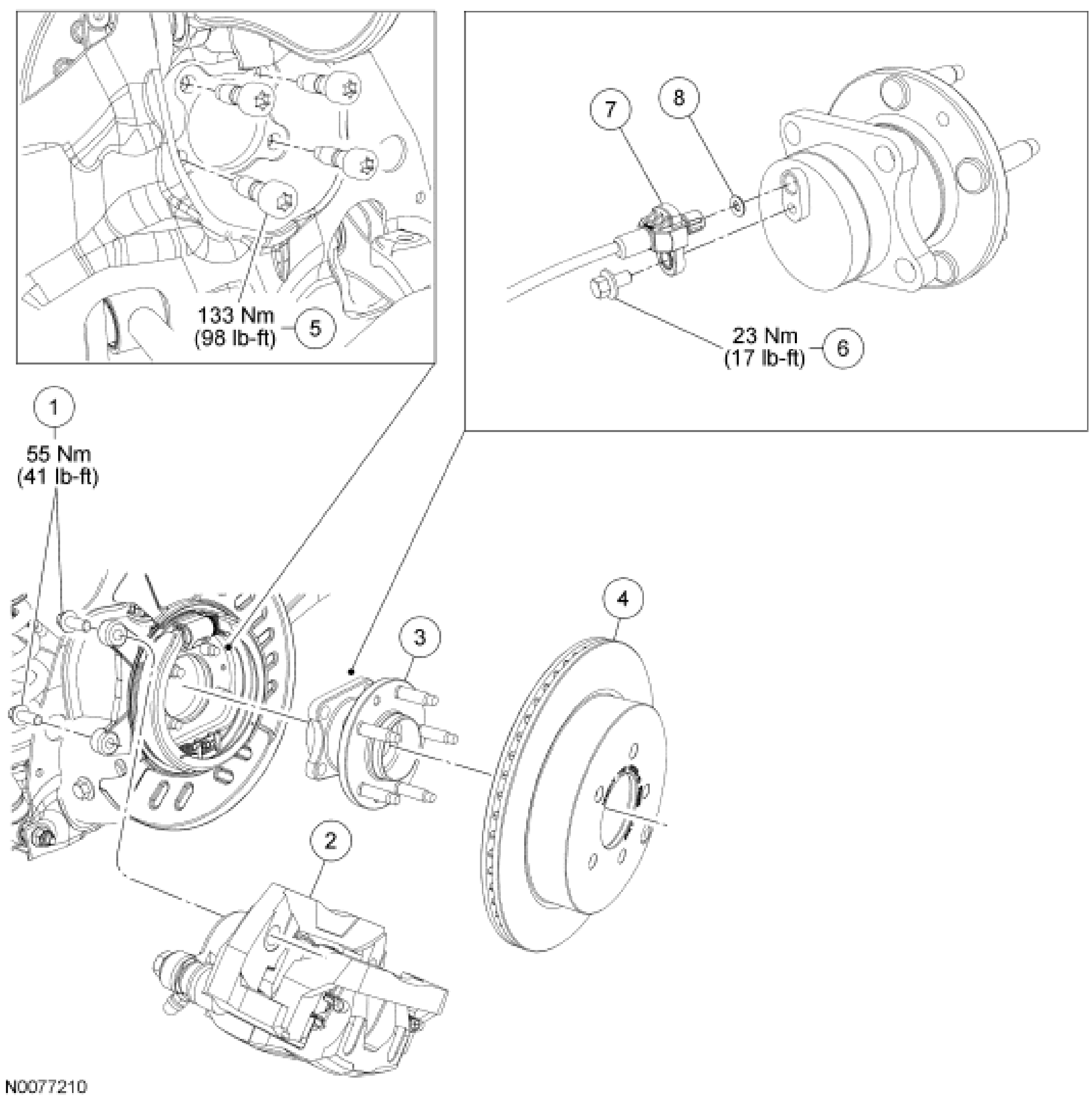


Fig. 3: Front Wheel Drive (FWD) Vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W711240	Brake caliper anchor plate bolts (2 required)
2	-	Brake caliper and anchor plate assembly
3	2C299	Wheel hub and bearing assembly
4	2C203	Brake disc
5	W712754	Wheel bearing and wheel hub bolt (4 required)
6	W500222	Wheel speed sensor bolt
7	2C186 RH/ 2C187 LH	Wheel speed sensor
8	-	O-ring (part of 2C186 RH/ 2C187 LH)

REMOVAL

All vehicles

NOTE: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure correct retention of these parts.

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

   NOTE: Do not allow the brake caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.

2. Remove the 2 anchor plate bolts and position the brake caliper and anchor plate assembly aside.
   - Support the brake caliper and anchor plate assembly using mechanic's wire.
3. Remove the brake disc.

   All wheel drive (AWD) vehicles

   NOTE: Do not discard the inner nut at this time.

4. Remove the outer and inner halfshaft nuts.
   - Discard the outer nut.
5. Using the Front Hub Remover, separate the halfshaft from the hub and bearing assembly.

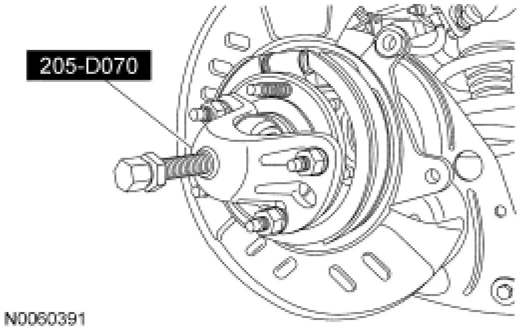


Fig. 4: Separating Halfshaft From Hub & Bearing Assembly Using Special Tool (205-D070)
Courtesy of FORD MOTOR CO.

6. Remove the brake hose bracket bolt.
7. Remove the wheel speed sensor bolt and detach the sensor from the wheel knuckle.
8. Unclip the wheel speed sensor harness from the upper arm and position the wheel speed sensor assembly aside.
9. Remove and discard the upper arm outboard bolt and nut.
    - Separate the upper arm from the wheel knuckle.
10. Position a suitable screw type jack stand under the lower arm.
11. Remove and discard the shock absorber lower bolt and nut.
12. Remove and discard the stabilizer bar link upper nut.
13. Remove and discard the toe link outboard bolt and nut.
14. With the wheel knuckle supported by the screw type jack stand, remove and discard the toe link outboard bolt and nut.
15. Position the half shaft up through the wheel knuckle opening.

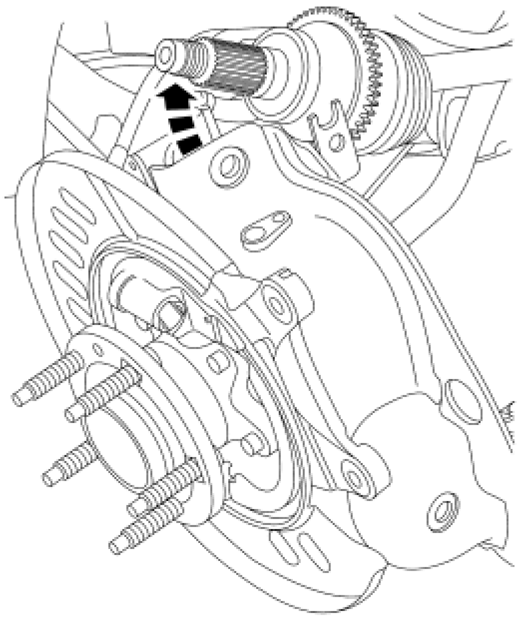


Fig. 5: Positioning Halfshaft Through Wheel Knuckle Opening & Secure Halfshaft Aside
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

16. Remove the wheel speed sensor bolt and detach the sensor from the wheel bearing and wheel hub.

All vehicles

17. Remove the 4 bolts and the wheel bearing and wheel hub.
    - Discard the bolts.

INSTALLATION

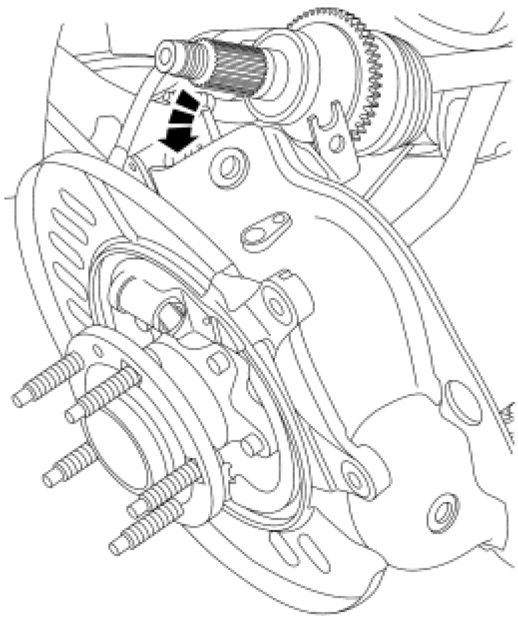
All vehicles

NOTE: **Before tightening the upper arm and lower arm bolts, use a jackstand to raise the rear suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in the removal procedure (curb height).**

1. Position the wheel bearing and wheel hub and install 4 new bolts.
    - Tighten to 133 N.m (98 lb. ft.).

AWD vehicles

2. Position the half shaft through the wheel knuckle and into the wheel bearing and wheel hub.



N0074222

Fig. 6: Positioning Halfshaft Into Wheel Bearing & Hub
Courtesy of FORD MOTOR CO.

3. Position the wheel knuckle onto the toe link and lower arm.
4. Loosely install the new toe link outboard bolt and nut.
5. Loosely install the new lower arm outboard bolt and nut.
6. Loosely install the new shock absorber lower bolt and nut.
7. Using the jack, raise the suspension and install the upper arm outboard bolt and nut.
   - Tighten the bolt to 150 N.m (111 lb. ft.).
8. Tighten the toe link outboard bolt to 150 N.m (111 lb. ft.).
9. Tighten the lower arm outboard bolt to 150 N.m (111 lb. ft.).
10. Tighten the shock absorber lower nut to 150 N.m (111 lb. ft.).
11. Position the stabilizer bar link and install the new upper link nut.
    - Tighten the nut to 35 N.m (26 lb. ft.).
12. Install the brake hose bracket bolt.
    - Tighten the bolt to 7 N.m (62 lb. ft.).
13. Position the wheel speed sensor and install the bolts.
    - Tighten the bolt to 7 N.m (62 lb. ft.).
    - Clip the 2 wheel speed sensor harness retainers to the upper arm.

FWD vehicles

14. Attach the wheel speed sensor to the wheel bearing and wheel hub and install the bolt.
    - Tighten to 23 N.m (17 lb. ft.).

All vehicles

15. Install the brake disc.
16. Position the brake caliper and anchor plate assembly and install the 2 bolts.
    - Tighten to 55 N.m (41 lb. ft.).

AWD vehicles

NOTE: Do not tighten the rear halfshaft nut with the vehicle on the ground. The nut must be tightened to specification before the vehicle is lowered to the ground. Wheel bearing damage will occur if the wheel bearing is loaded with the weight of the vehicle applied.

NOTE: Apply the brake to keep the halfshaft from rotating.

17. Position the halfshaft in the hub and use the previously removed halfshaft nut to seat the halfshaft.
    - Tighten to 275 N.m (203 lb. ft.).
    - Remove and discard the nut.

NOTE: Install and tighten the new halfshaft nut to specification within five minutes of starting it on the threads. Always install a new halfshaft nut after loosening or when not tightening within the specified time or damage to the components may occur.

18. Install a new inner halfshaft nut.
    - Tighten to 275 N.m (203 lb. ft.).
19. Install a new outer halfshaft nut.
    - Tighten to 175 N.m (129 lb. ft.).

All vehicles

20. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

WHEEL STUDS

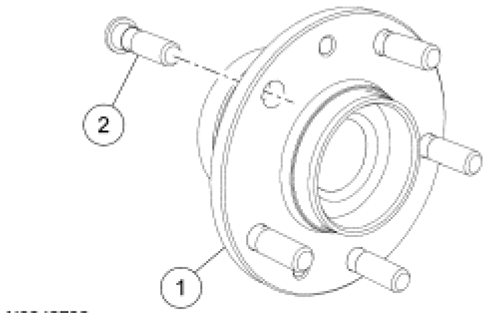


Fig. 7: Exploded View Of Wheel Studs
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2C299	Wheel bearing and wheel hub assembly
2	1107	Wheel stud

REMOVAL

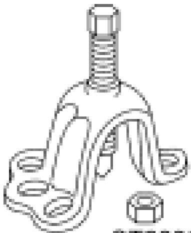
1. Remove the wheel bearing and wheel hub. For additional information, refer to **WHEEL BEARING AND WHEEL HUB**.
2. Using a suitable press, remove the wheel stud from the wheel hub.
    - Discard the wheel stud.

INSTALLATION

1. Position the new wheel stud in the wheel hub, aligning the serrations in the wheel hub flange made by the original wheel stud.
2. Using a suitable press, install the wheel stud.
3. Install the wheel bearing and wheel hub. For additional information, refer to **WHEEL BEARING AND WHEEL HUB**.

WHEEL KNUCKLE

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST2330-A	Front Hub Remover	205-D070 (D93P-1175-B) or equivalent

NOTE: **All wheel drive (AWD) shown in illustration, front wheel drive (FWD) similar.**

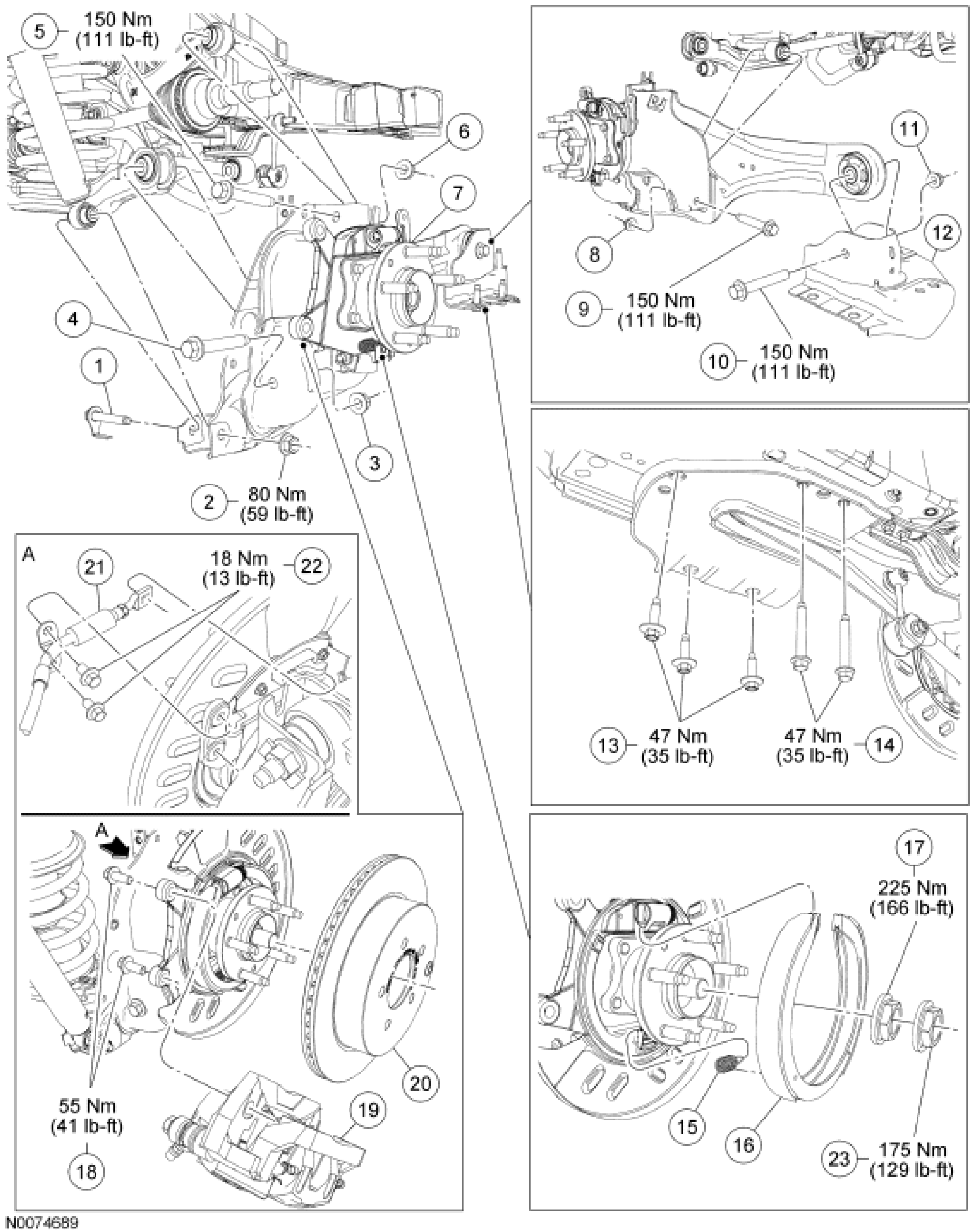


Fig. 8: Identifying Wheel Knuckle Components With Torque Specifications (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W712459	Shock absorber lower flag bolt
2	W520214	Shock absorber lower nut

3	W520516	Lower arm outboard nut
4	W500766	Lower arm outboard bolt
5	W500766	Upper arm outboard bolt
6	W520516	Upper arm outboard nut
7	5A995 LH/ 5A994 RH	Wheel knuckle
8	W520516	Toe link outboard nut
9	W500766	Toe link outboard bolt
10	W500568	Wheel knuckle bracket bolt
11	W520516	Wheel knuckle bracket nut
12	5A757 RH/ 5A758 LH	Wheel knuckle arm bracket
13	W713905	Wheel knuckle bracket-to-frame bolts (3 required)
14	W500724	Wheel knuckle bracket-to-frame bolts (2 required)
15	-	Parking brake spring
16	-	Parking brake shoe
17	W712435	Inner halfshaft nut
18	W711241	Brake anchor plate bolts (2 required)
19	-	Brake caliper and anchor plate assembly
20	2C203	Brake disc
21	2A635	Parking brake cable
22	W500021	Parking brake cable rear bracket bolts (2 required)
23	W712435	Outer halfshaft nut

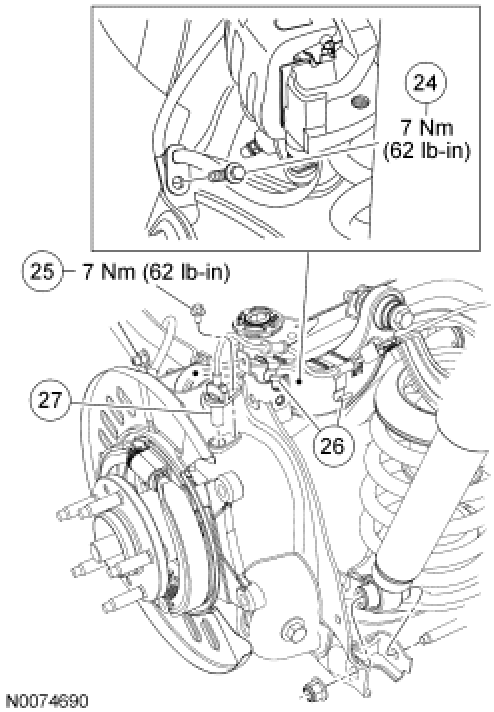


Fig. 9: Identifying Wheel Knuckle Components With Torque Specifications (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
24	-	Wheel speed sensor bolt (part of 2C190)
25	2C190	Wheel speed sensor
26	-	Wheel speed sensor harness clips
27	W500010	Wheel speed sensor bolt

REMOVAL

All vehicles

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure correct retention of these parts.

CAUTION: Suspension bushing fasteners must be tightened with the weight of the vehicle resting on the wheel and tires or incorrect clamp load and bushing damage may occur.

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

CAUTION: Do not allow the brake caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.

2. Remove the 2 anchor plate bolts and position the brake caliper and anchor plate assembly aside.
    - Support the brake caliper and anchor plate assembly using mechanic's wire.
3. Remove the brake disc.
4. Disconnect the parking brake shoe retaining spring and remove the spring and brake shoe assembly.
5. Remove the 2 bolts and disconnect the parking brake cable.
6. Remove the nut and disconnect the stabilizer bar link and parking brake cable bracket from the wheel knuckle.
    - Discard the nut.
7. Remove the bolt, unclip the 2 retainers and position aside the wheel speed sensor.
8. Remove the brake hose bracket bolt.

All wheel drive (AWD) vehicles

9. Remove and discard the outer and inner halfshaft nuts.
10. Using the special tool, separate the halfshaft from the wheel bearing and wheel hub.

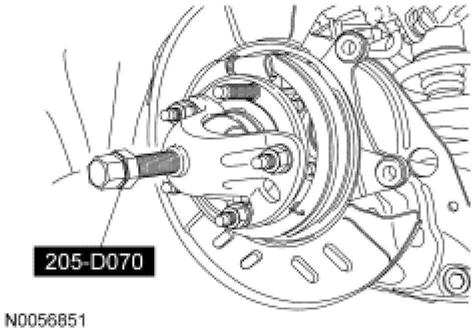


Fig. 10: Separating Halfshaft From Hub & Bearing Using Special Tool (205-D070)
Courtesy of FORD MOTOR CO.

All vehicles

11. Position a suitable jackstand under the lower arm.

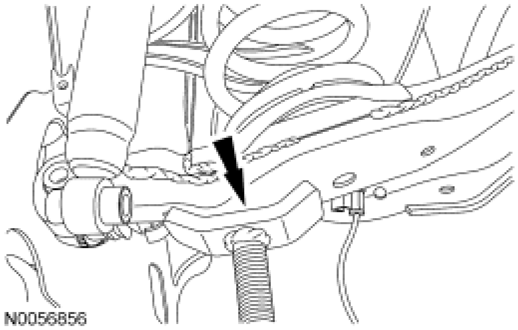


Fig. 11: Positioning Suitable Jackstand Under Lower Arm
Courtesy of FORD MOTOR CO.

12. Remove and discard the lower shock bolt and nut.
13. Remove and discard the upper arm outboard bolt and nut.
14. Remove and discard the lower arm outboard bolt and nut.
15. Remove and discard the toe link outboard bolt and nut.

AWD vehicles

16. Position the halfshaft through the wheel knuckle opening and secure the halfshaft aside.

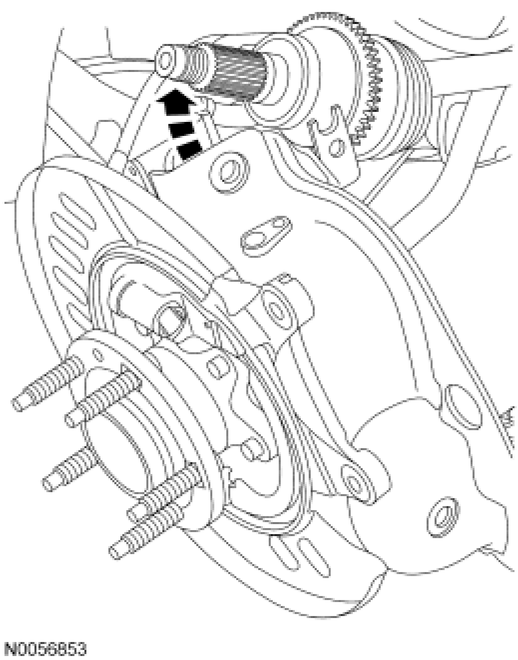


Fig. 12: Positioning Halfshaft Through Wheel Knuckle Opening & Secure Halfshaft Aside
Courtesy of FORD MOTOR CO.

All vehicles

17. Remove the 5 wheel knuckle bracket-to-frame bolts and the wheel knuckle.
    - Discard the bolts.
18. Remove and discard the wheel knuckle bracket bolt nut.

INSTALLATION

All vehicles

CAUTION: Suspension bushing fasteners must be tightened with the weight of the vehicle resting on the wheel and tires or incorrect clamp load and bushing damage may occur.

1. Install the wheel knuckle bracket bolt and nut.
    - Tighten the bolt to 150 N.m (111 lb. ft.).
2. Position the wheel knuckle and install the 5 wheel knuckle bracket-to-frame bolts.
    - Tighten the bolts to 47 N.m (35 lb. ft.).

AWD vehicles

3. Position the halfshaft into the wheel bearing and hub.

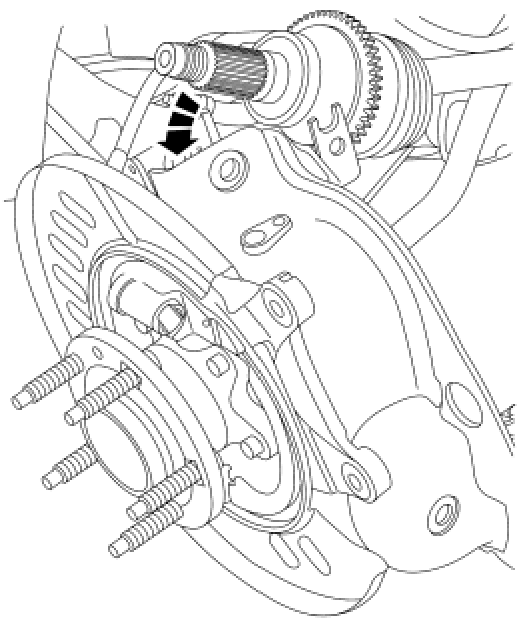


Fig. 13: Positioning Halfshaft Into Wheel Bearing & Hub
Courtesy of FORD MOTOR CO.

All vehicles

4. Position the wheel knuckle onto the toe link and lower arm.

NOTE: Do not tighten the lower arm outboard bolt at this time.

5. Loosely install the lower arm outboard bolt.

NOTE: Do not tighten the toe link outboard bolt at this time.

6. Loosely install the toe link outboard bolt.

NOTE: Do not tighten the shock absorber lower bolt at this time.

7. Loosely install the shock absorber lower bolt.
8. Using the jack, raise the suspension and install the upper arm outboard bolt and nut.
9. If installing a new wheel knuckle, tighten the lower outboard bolt in the following sequence.
    1. Tighten the bolt to 150 N.m (111 lb. ft.).
    2. Loosen the bolt 180 degrees.
    3. Tighten the bolt to 80 N.m (59 lb. ft.).
    4. Tighten the bolt an additional 90 degrees.
10. If installing the original wheel knuckle, tighten the lower arm outboard bolt to 80 N.m (59 lb. ft.).
    - Tighten the bolt an additional 90 degrees.
11. Tighten the toe link outboard bolt to 150 N.m (111 lb. ft.).
12. Tighten the shock absorber lower nut to 80 N.m (59 lb. ft.).

AWD vehicles

13. Using a suitable installation tool, install the halfshaft into the wheel hub.
14. Install the inner halfshaft nut.
    - Tighten to 275 N.m (203 lb. ft.).
15. Install the outer halfshaft nut.
    - Tighten to 175 N.m (129 lb. ft.).

All vehicles

16. Install the brake hose bracket bolt.
    - Tighten to 7 N.m (62 lb-in).
17. Position the wheel speed sensor, clip the 2 retainers to the upper arm and install the bolt.
    - Tighten to 7 N.m (62 lb-in).

NOTE: The parking brake cable bracket is fastened to the wheel knuckle with the same bolt as the stabilizer bar link.

18. Connect the parking brake cable bracket and the stabilizer bar link to the wheel knuckle.
    - Tighten the bolt to 35 N.m (26 lb. ft.).
19. Connect the parking brake cable and install the 2 bolts.
    - Tighten to 18 N.m (13 lb. ft.).
20. Install the parking brake shoe and retaining spring.
21. Install the brake disc.
22. Position the brake caliper and anchor plate assembly and install the anchor plate bolts.
    - Tighten to 55 N.m (41 lb. ft.).
23. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

LOWER ARM

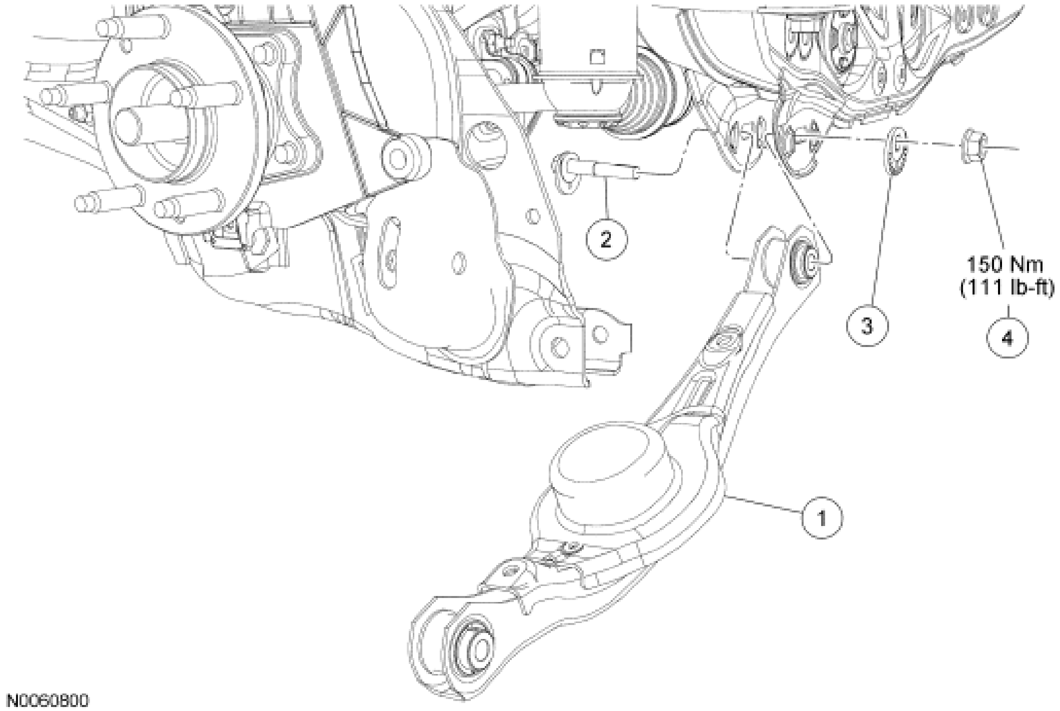


Fig. 14: Exploded View Of Lower Arm With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5A648	Lower arm
2	5K978	Lower arm cam bolt
3	5K751	Lower arm cam adjuster
4	W711798	Lower arm cam nut

REMOVAL AND INSTALLATION

1. Remove the spring. For additional information, refer to **SPRING**.
2. Remove the cam adjuster nut, cam adjuster and cam bolt.
   - Discard the cam bolt and nut.
   - To install, tighten to 150 N.m (111 lb. ft.).
3. To install, reverse the removal procedure.

UPPER ARM

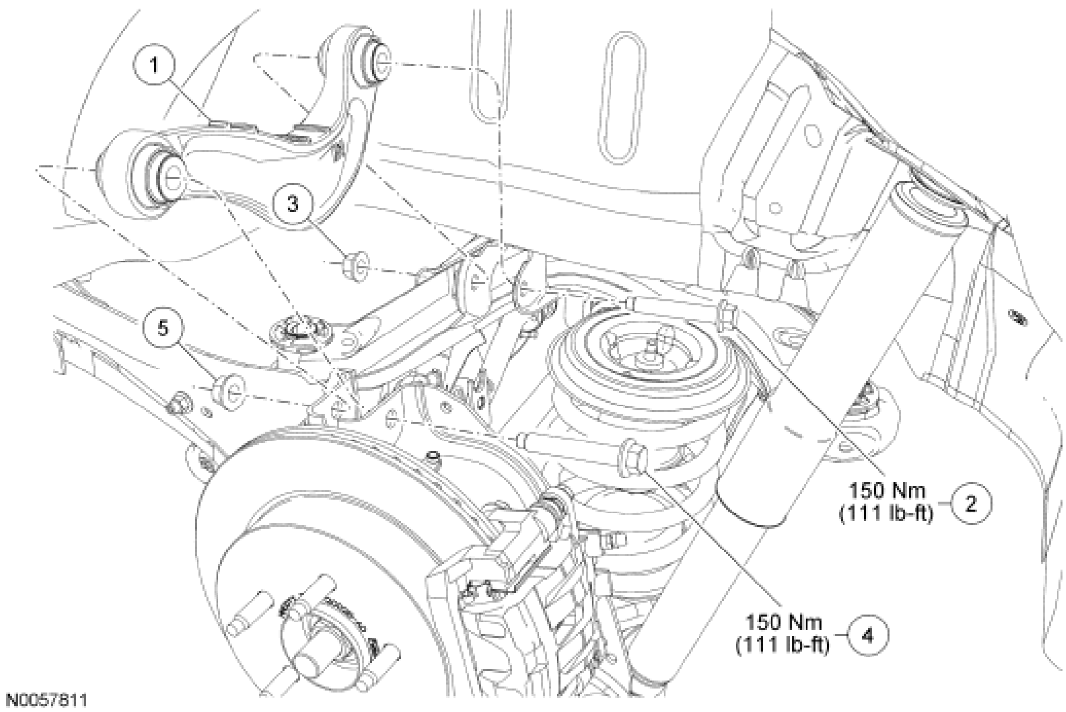


Fig. 15: Exploded View Of Upper Arm With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5500	Upper arm
2	W500766	Upper arm inboard bolt
3	W520516	Upper arm inboard nut
4	W500766	Upper arm outboard bolt
5	W520516	Upper arm outboard nut

REMOVAL

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service

expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure correct retention of these parts.

CAUTION: Suspension bushing fasteners must be tightened with the weight of the vehicle resting on the wheel and tires or incorrect clamp load and bushing damage may occur.

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
2. Position a suitable jackstand under the lower arm and raise the suspension.
3. Remove and discard the upper arm outboard bolt and nut.
4. Carefully lower the lower arm and remove the jack.
5. Position the jackstand under the subframe.

NOTE: The upper arm inboard bolt cannot be removed without first lowering the subframe.

6. Remove and discard the 2 subframe bushing brace bolts.

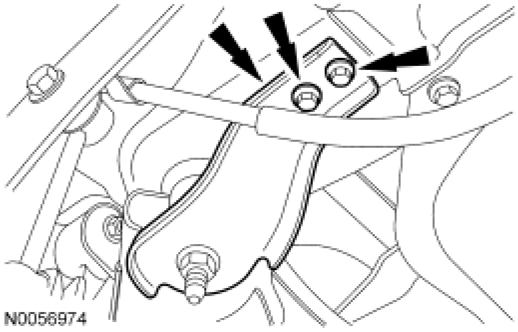


Fig. 16: Locating Subframe Bushing Brace Bolts
Courtesy of FORD MOTOR CO.

7. Remove the subframe forward nut.

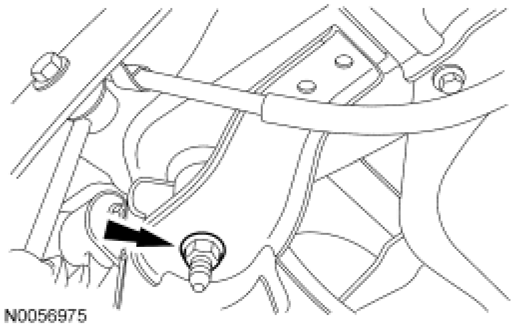


Fig. 17: Locating Subframe Forward Nut
Courtesy of FORD MOTOR CO.

NOTE: The upper arm inboard bolt cannot be removed without first lowering the subframe.

NOTE: The rear springs are under pressure. The jack must be lowered slowly while relieving the spring pressure.

8. Remove the subframe rearward nut and lower the jack.

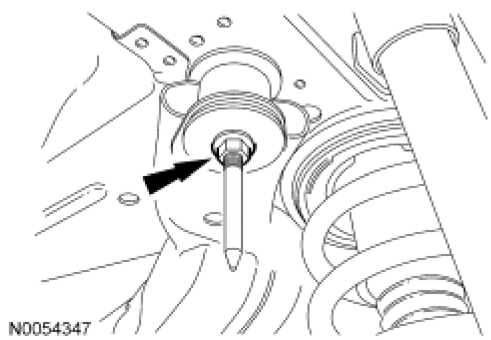


Fig. 18: Locating Subframe Rearward Nut
Courtesy of FORD MOTOR CO.

9. Remove and discard the upper arm inboard bolt and nut and remove the upper arm.

INSTALLATION

NOTE: Do not tighten the bolt at this time.

1. Position the upper arm and loosely install the upper arm inboard bolt and nut.
2. Raise the jack and install the subframe rearward nut.
   - Tighten to 90 N.m (66 lb. ft.).
3. Install the subframe forward nut.
   - Tighten to 90 N.m (66 lb. ft.).
4. Install the 2 subframe bushing brace bolts.
   - Tighten to 25 N.m (18 lb. ft.).
5. Reposition the jack under the lower arm and raise the jack.

NOTE: Do not tighten the bolt at this time.

6. Loosely install the upper arm outboard bolt and nut.
7. Remove the jack.

8. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
9. With the weight of the vehicle on the wheel and tire, tighten the upper arm outboard bolt to 150 N.m (111 lb. ft.).
10. With the weight of the vehicle on the wheel and tire, tighten the upper arm inboard bolt to 150 N.m (111 lb. ft.).

TOE LINK

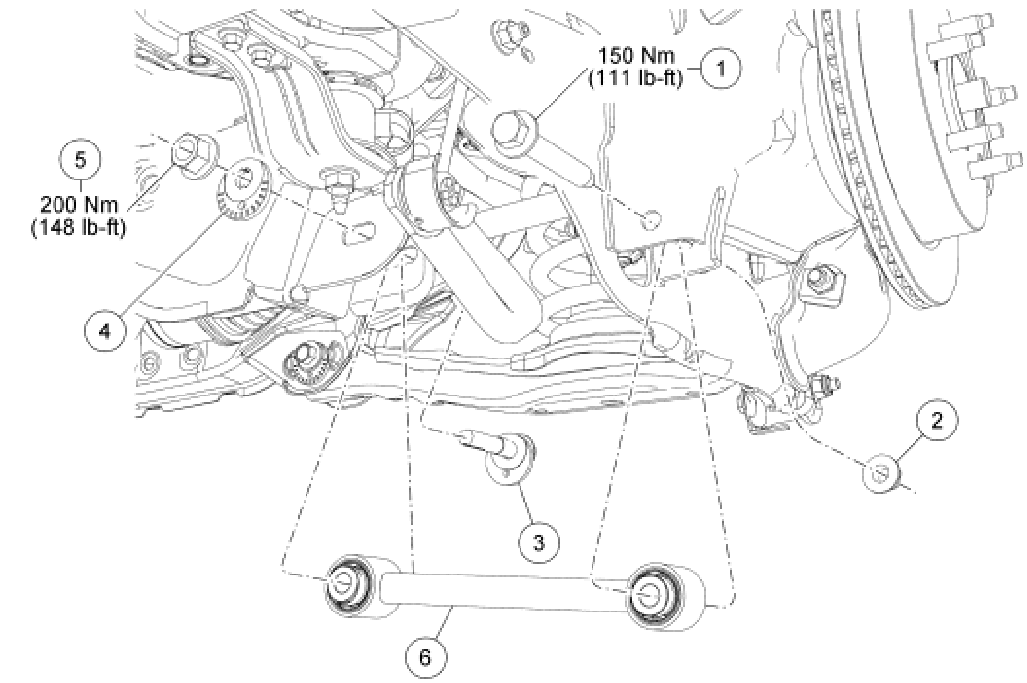


Fig. 19: Exploded View Of Toe Link With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W500766	Toe link outboard bolt
2	W520516	Toe link outboard nut
3	5K978	Toe link inboard cam bolt
4	5K751	Toe link adjuster cam
5	W711798	Toe link inboard nut
6	5500	Toe link

REMOVAL

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or

equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure correct retention of these parts.

CAUTION: Suspension bushing fasteners must be tightened with the weight of the vehicle resting on the wheel and tires or incorrect clamp load and bushing damage may occur.

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
2. Remove and discard the toe link inboard nut, cam adjuster and cam bolt.
3. Remove and discard the toe link outboard bolt and nut then remove the toe link.

INSTALLATION

NOTE: Do not tighten the bolt at this time.

1. Position the toe link and loosely install the toe link outboard bolt and nut.

NOTE: Do not tighten the bolt at this time.

2. Loosely install the toe link inboard bolt and nut.
3. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
4. With the weight of the vehicle on the wheel and tire, tighten the toe link outboard bolt to 150 N.m (111 lb. ft.).
5. With the weight of the vehicle on the wheel and tire, tighten the toe link inboard nut to 200 N.m (148 lb. ft.).

STABILIZER BAR AND LINK

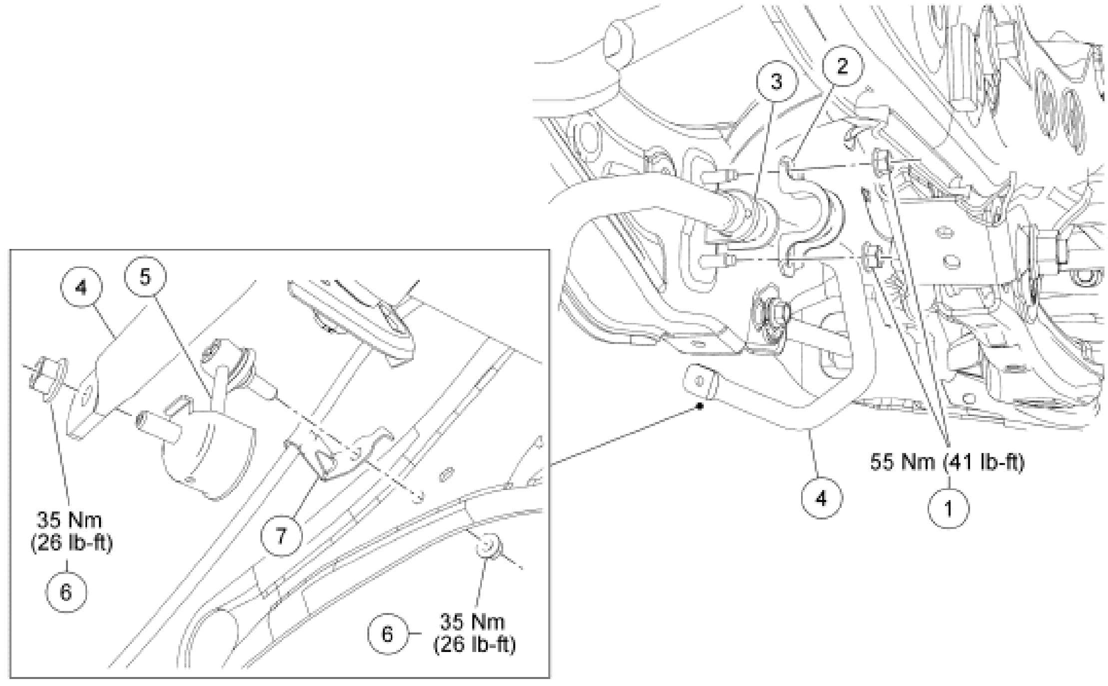


Fig. 20: Exploded View Of Stabilizer Bar & Link With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W520414	Stabilizer bar bracket nuts (4 required)
2	5B493	Stabilizer bar bracket (2 required)
3	-	Stabilizer bar bushing (part of 5B493) (2 required)
4	5A772	Stabilizer bar
5	5A486	Stabilizer bar link
6	W520414	Stabilizer bar link nut (4 required)
7	-	Parking brake cable (part of 2A635)

REMOVAL AND INSTALLATION

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure correct retention of these parts.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

2. Remove and discard the stabilizer bar link upper nuts.
    - To install, tighten to 35 N.m (26 lb. ft.).
3. Remove and discard the stabilizer bar link lower nuts and remove the stabilizer bar links.
    - To install, tighten to 35 N.m (26 lb. ft.).
4. Remove and discard the stabilizer bar bracket nuts and remove the stabilizer bar brackets and the stabilizer bar.
    - To install, tighten to 55 N.m (41 lb. ft.).
5. Inspect the stabilizer bar bushings and install a new bushing(s), if necessary.
6. To install, reverse the removal procedure.

SPRING

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
	Front Hub Remover	205-D070 (D93P-1175-B) or equivalent

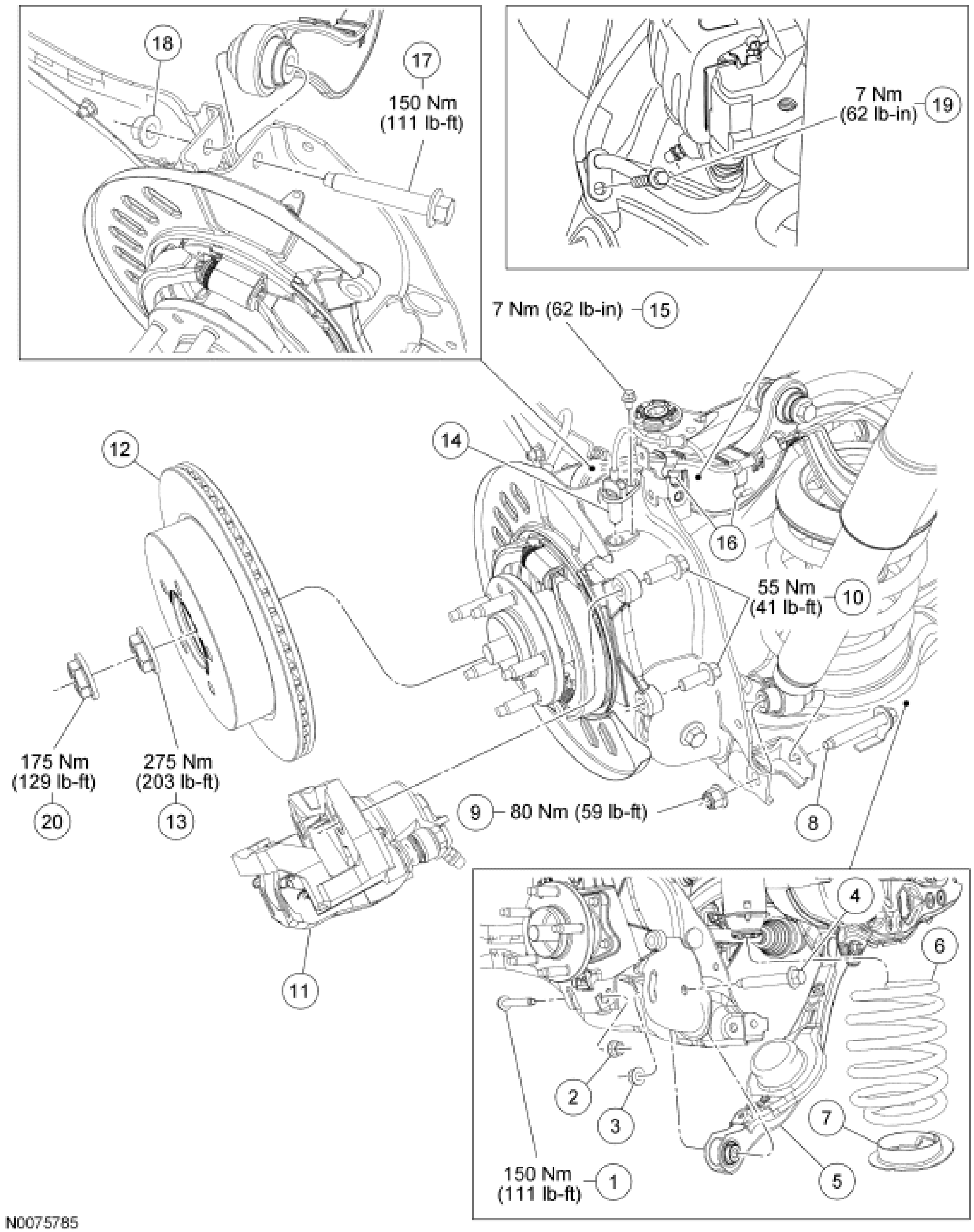


Fig. 21: Exploded View Of Spring With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W500766	Toe link outboard bolt
2	W520516	Toe link outboard nut

3	W520516	Lower arm outboard nut
4	W500766	Lower arm outboard bolt
5	5A648	Lower arm
6	-	Spring
7	-	Spring lower seat
8	W712459	Shock absorber lower flag bolt
9	W520214	Shock absorber lower nut
10	W711241	Brake caliper anchor plate bolts (2 required)
11	-	Brake caliper and anchor plate assembly
12	2C203	Brake disc
13	W712435	Inner halfshaft nut
14	2C190	Wheel speed sensor
15	W500010	Wheel speed sensor bolt
16	-	Wheel speed sensor harness clips (2 required)
17	W500766	Upper arm outboard bolt
18	W520516	Upper arm outboard nut
19	-	Wheel speed sensor bolt (part of 2C190)
20	W712435	Outer halfshaft nut

REMOVAL

All vehicles

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

CAUTION: Suspension bushing fasteners must be tightened with the weight of the vehicle resting on the wheel and tires or incorrect clamp load and bushing damage may occur.

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

CAUTION: Do not allow the brake caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.

2. Remove the 2 anchor plate bolts and position the brake caliper and anchor plate assembly aside.

- Support the brake caliper and anchor plate assembly using mechanic's wire.

3. Remove the brake disc.
4. Remove the nut and disconnect the stabilizer bar link and parking brake cable bracket from the wheel knuckle.
    - Discard the nut.
5. Remove the bolt, unclip the 2 retainers from the upper arm and position aside the wheel speed sensor.
6. Remove the brake hose bracket bolt and position the hose aside.

All wheel drive (AWD) vehicles

7. Remove and discard the outer and inner halfshaft nuts.
8. Using the special tool, separate the halfshaft from the hub and bearing.

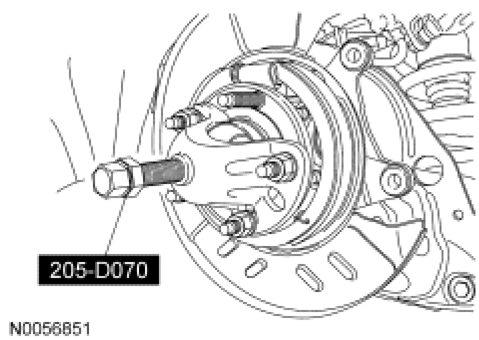


Fig. 22: Separating Halfshaft From Hub & Bearing Using Special Tool (205-D070)
Courtesy of FORD MOTOR CO.

All vehicles

9. Position a suitable jackstand under the lower arm.
10. Remove and discard the shock absorber lower nut and flag bolt.
11. Remove and discard the upper arm outboard bolt and nut.
12. Remove and discard the toe link outboard bolt and nut.
13. Remove and discard the lower arm outboard bolt and nut.

AWD vehicles

14. Position the halfshaft through the wheel knuckle opening and secure the halfshaft aside.

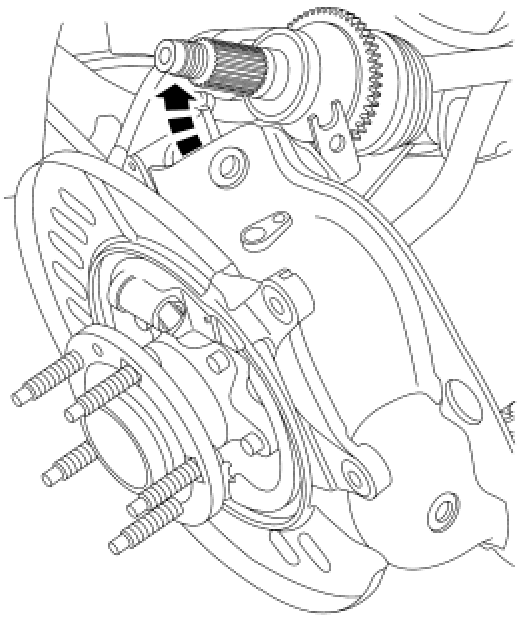


Fig. 23: Positioning Halfshaft Through Wheel Knuckle Opening & Secure Halfshaft Aside
Courtesy of FORD MOTOR CO.

All vehicles

WARNING: **The coil spring is under extreme load. Care must be taken at all times when removing or installing a loaded spring. Failure to follow this instruction may result in serious personal injury.**

15. Pull outward on the wheel knuckle while lowering the jackstand and remove the spring.
    - Inspect the spring upper and lower seats, remove and discard seats as necessary.

INSTALLATION

All vehicles

1. If removed, position a new lower seat into the lower arm with the recess in the seat aligned with the projection on the lower arm.

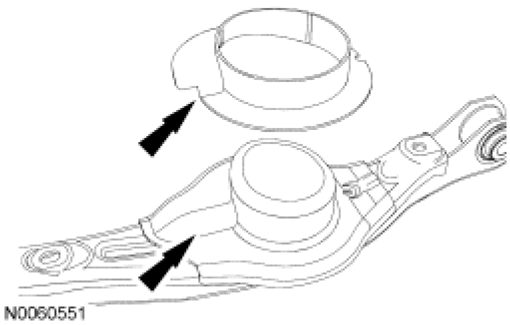


Fig. 24: Positioning Lower Seat Into Lower Arm With Recess In Seat Aligned With Projection On Lower Arm
Courtesy of FORD MOTOR CO.

2. On installation, position the spring onto the lower arm with the end of the spring 0-10 mm (0-0.39 in) from the step on the spring seat.

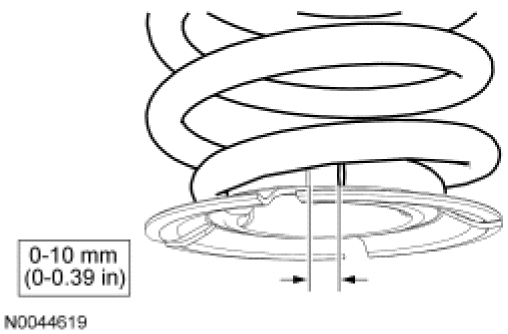


Fig. 25: Positioning Spring Onto Lower Arm With End Of Spring
Courtesy of FORD MOTOR CO.

WARNING: **The coil spring is under extreme load. Care must be taken at all times when removing or installing a loaded spring. Failure to follow this instruction may result in serious personal injury.**

3. Pull outward on the wheel knuckle and install the spring.

All wheel drive (AWD) vehicles

4. Position the halfshaft into the wheel knuckle opening.

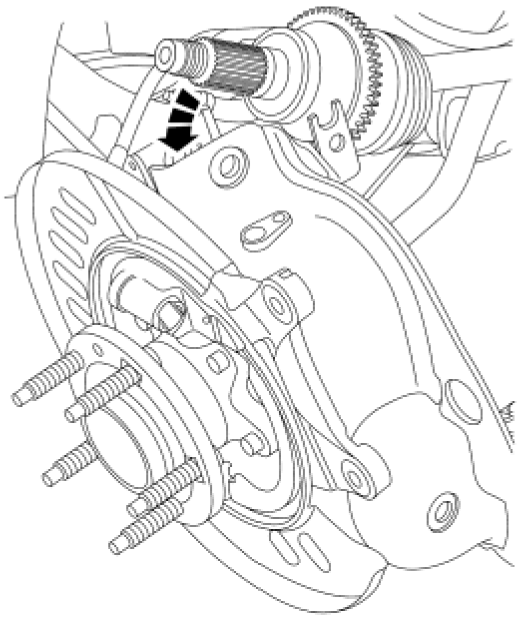


Fig. 26: Positioning Halfshaft Into Wheel Bearing & Hub
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: Do not tighten the bolt at this time.

5. Raise the jackstand and loosely install the lower arm outboard bolt and nut.

NOTE: Do not tighten the bolt at this time.

6. Position the toe link and loosely install the toe link outboard bolt and nut.

NOTE: Do not tighten the bolt at this time.

7. Position the upper arm and loosely install the upper arm outboard bolt and nut.

NOTE: Do not tighten the bolt at this time.

8. Loosely install the lower shock nut and flag bolt.
9. Lower and remove the jackstand.

AWD vehicles

10. Using a suitable installation tool, install the halfshaft into the wheel hub.
11. Install the inner halfshaft nut.
    - Tighten to 275 N.m (203 lb. ft.).
12. Install the outer halfshaft nut.
    - Tighten to 175 N.m (129 lb. ft.).

All vehicles

13. Install the brake hose bracket bolt.
    - Tighten to 7 N.m (62 lb-in).
14. Position the wheel speed sensor, clip the 2 retainers to the upper arm and install the wheel speed sensor and bolt.
    - Tighten the bolt to 7 N.m (62 lb-in).
15. Connect the parking brake cable bracket and stabilizer bar link to the wheel knuckle and install the nut.
    - Tighten the nut to 35 N.m (26 lb. ft.).
16. Install the brake disc.
17. Position the brake caliper and anchor plate assembly and install the 2 anchor plate bolts.
    - Tighten to 55 N.m (41 lb. ft.).
18. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
19. With the weight of the vehicle on the wheel and tire, tighten the lower shock nut to 80 N.m (59 lb. ft.).
20. With the weight of the vehicle on the wheel and tire, tighten the upper arm outboard bolt to 150 N.m (111 lb. ft.).
21. With the weight of the vehicle on the wheel and tire, tighten the toe link outboard bolt to 150 N.m (111 lb. ft.).
22. With the weight of the vehicle on the wheel and tire, tighten the lower arm outboard bolt in the following sequence.
    1. Tighten to 80 N.m (59 lb. ft.).
    2. Tighten an additional 90 degrees.
23. Check and if necessary, align the vehicle. For additional information, refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

SHOCK ABSORBER

REMOVAL

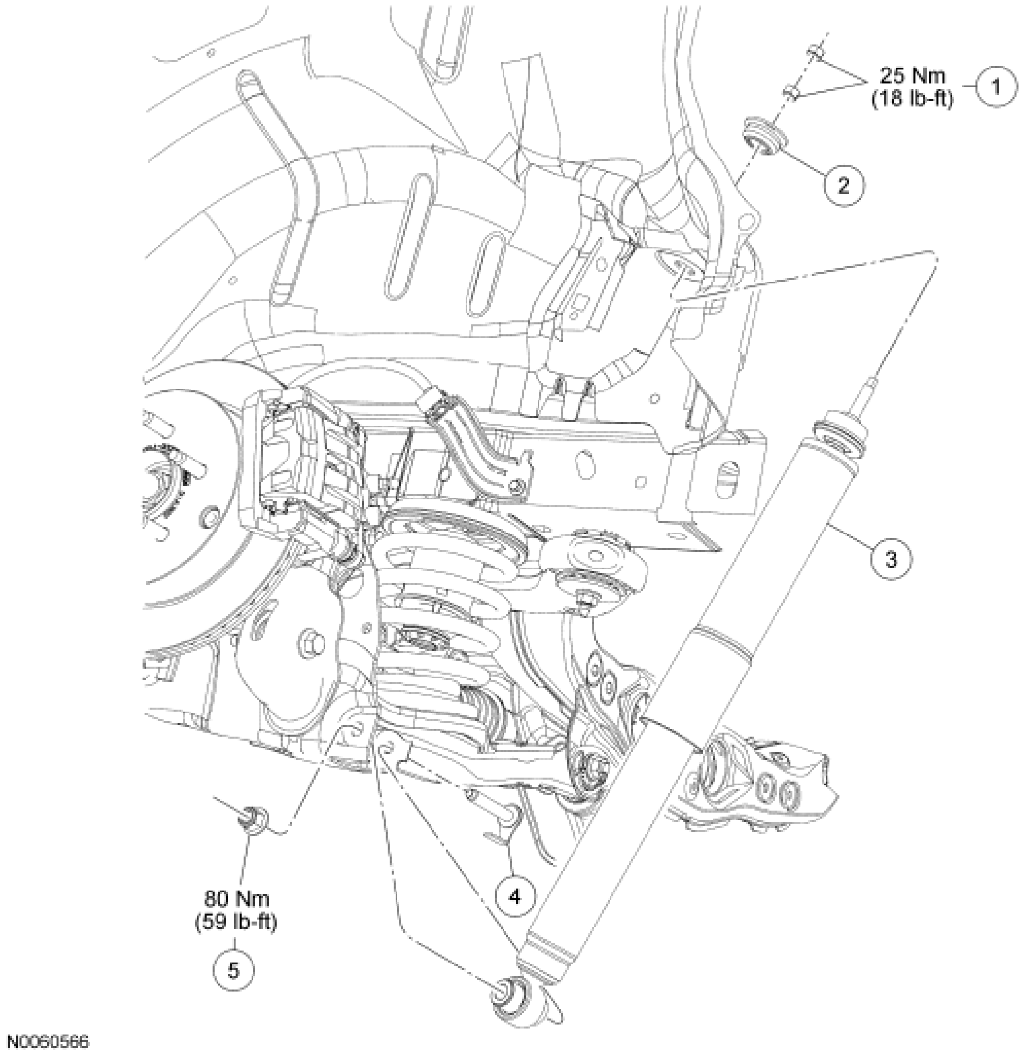


Fig. 27: Exploded View Of Shock Absorber With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W520504	Shock absorber upper nuts (2 required)
2	18080	Shock absorber
3	18017	Shock absorber upper bushing
4	W712459	Shock absorber lower flag bolt
5	W520214	Shock absorber lower nut

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part

of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure correct retention of these parts.

CAUTION: Suspension bushing fasteners must be tightened with the weight of the vehicle resting on the wheel and tires or incorrect clamp load and bushing damage may occur.

NOTE: The new shock absorber is shipped with a strap securing it in the compressed position.

1. Remove the quarter trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove and discard the shock absorber upper nuts.
3. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
4. Position a suitable jackstand under the lower arm.
5. Remove the shock absorber lower bolt, flag nut and shock absorber.
    - Discard the bolt and flag nut.

INSTALLATION

NOTE: Do not tighten the bolt at this time.

1. Position the shock absorber and loosely install the shock absorber lower bolt and flag nut.
2. Remove the jackstand.
3. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
4. With the weight of the vehicle on the wheel and tire, tighten the shock absorber lower bolt to 80 N.m (59 lb. ft.).
5. Install the shock absorber upper nuts.
    - Tighten to 25 N.m (18 lb. ft.).
6. Install the quarter trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

2008 ACCESSORIES & BODY, CAB

Seating - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Front Seat			
Cushion frame-to-seat track bolt	23	17	-
Fold-flat or power recliner-to-backrest frame bolt	50	37	-
Manual seat track front occupant classification sensor (OCS) weight sensor bolt protection bracket screw	5	-	44
Manual seat track rear OCS weight sensor bolt protection bracket screw	2	-	18
OCS weight sensor bolt nut	33	24	-
Power seat track front cross brace nut	20	15	-
Power seat track inboard OCS weight sensor bolt protection bracket screw	2	-	18
Power seat track outboard OCS weight sensor bolt protection bracket screw	6	-	53
Recliner motor bolt	8	-	71
Recliner-to-seat track bolt	50	37	-
Safety belt buckle-to-seat track bolt/nut	40	30	-
Safety belt retractor belt anchor nut	47	35	-
Seat track-to-floor bolt[a]	-	-	-
Side air bag module bolt	23	17	-
Rear Seat			
40 percent seat backrest assembly-to-floor nuts[a]	-	-	-
40 percent seat kneeling assembly-to-floor bolt[a]	-	-	-
40 percent seat kneeling assembly-to-floor nut[a]	-	-	-
60 percent seat backrest assembly-to-floor nut[a]	-	-	-
60 percent seat kneeling assembly-to-floor bolt[a]	-	-	-
60 percent seat kneeling assembly-to-floor nut[a]	-	-	-
60 percent seat rear tie-down-to-floor nut[a]	-	-	-
Armrest bolt	25	18	-
Cushion frame pivot bracket bolt	25	18	-
Kneeling assembly-to-cushion frame bolt	25	18	-
Safety belt buckle bolt (40 and 60 percent seat)	65	48	-
Safety belt retractor belt and buckle anchor bolt (60 percent seat)	65	48	-
Safety belt retractor nut	50	37	-

[a] Refer to appropriate procedure.

DESCRIPTION AND OPERATION

SEATS

Front Seats

The front seats can be equipped with the following systems:

- Two-way manual seat track
- Four-way manual seat track
- Six-way power seat track
- Manual recline
- Power recline
- Backrest, without fold-flat
- Backrest with fold-flat (optional, passenger only)
- Heated seats
- Heated/cooled climate controlled seats
- Memory driver seat
- Manual lumbar
- Power lumbar
- Adjustable head restraints
- Seat side air bags (standard)
- Occupant classification sensor (OCS) system on passenger seat

Driver Seat Module (DSM) - Memory Seat

The power driver seat and power exterior rear view mirrors are controlled by the driver seat module (DSM) only when the vehicle is equipped with the programmable/recall memory option. The DSM is located on the driver seat track.

For information on programming memory positions or recalling a stored memory position, refer to **Memory Position Programming**.

Memory Recall - Remote Keyless Entry (RKE)

When the vehicle is equipped with a memory driver seat, the remote keyless entry (RKE) can be used with a key that includes an integrated keyhead transmitter (IKT). A personality or memory position for the driver seat and exterior rear view mirrors can be assigned to an IKT. Up to 2 personalities can be assigned, 1 per IKT. If the remote memory has been activated and that IKT has been assigned a personality, pushing the button to unlock the vehicle doors will recall the memory seat and exterior rear view mirror positions.

For information on diagnosing a RKE concern or associating an IKT to a memory position, refer to **HANDLES, LOCKS, LATCHES & ENTRY SYSTEMS** article.

Easy Entry/Easy Exit

The driver power seat easy entry/exit feature can be enabled/disabled using a scan tool. When enabled, the feature becomes a user accessible item on the message center allowing the user to turn the feature on and off. Refer to the Owner's Literature or **INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES** article for information on the message center.

Heated Seats

This system allows independent seat electrical heating of each front seat on demand.

The components of the system are:

- the seat heater mats located on the seat cushion and backrest.
- the heated seat module located on the passenger power seat track and cushion frame on manual seat track.
- the heated seat switches, located on the HVAC module.
- temperature sensors, located in the seat cushion heater mats.

A new heater mat will come assembled on a new foam pad.

Climate Controlled Seats

The climate controlled seat system is able to heat and cool the front seats. Each climate controlled seat is operated by push-buttons on the HVAC module located on the instrument panel. Each front seat temperature is then monitored and controlled by the dual climate control seat module (DCSM) located on the front passenger seat track.

The dual climate controlled seat system contains the following components:

- HVAC module
- DCSM
- Thermo-electric device (TED) and blower assembly within each front seat cushion and backrest
- Air filter (attached to each TED and blower assembly)
- Cushion TED adapter attached to the cushion frame
- Cushion and backrest manifolds
- Cushion and backrest foam pads
- Cushion and backrest trim covers

Manual Lumbar

The front seat manual lumbar is adjusted by a handle mounted on the side of the seat cushion side shield.

Power Lumbar

The driver seat can have an electromechanical backrest pad adjuster. The lumbar switch adjustment is on the side of the seat cushion side shield and is part of the seat control switch.

Manual Recline

The manual recline can be adjusted by a handle mounted on the outboard side of the cushion side shield.

Front Seats Without Backrest Fold Flat

Manual recliners on seats that do not fold-flat are only serviceable by installing a new backrest frame assembly.

Passenger Seats With Backrest Fold Flat

Front passenger seats can come with a backrest that folds flat, when optioned with manual recline. The recliners on this backrest will recline the backrest back or fold the backrest forward. Pull up on the recliner handle allowing the backrest to recline forward. When the backrest reclines fully forward, if the recliner handle is held up, the backrest can continue to fold forward until it reaches the fold-flat position. Manual recliners on seats that fold flat are serviced separately from the backrest frame assembly.

Power Recline

The front seats can come with an electromechanical backrest adjuster. The backrest adjustment switch is located on the side of the seat cushion side shield and is part of the seat control switch.

Power recliners are serviced separately from the backrest frame assembly. The recliner motor can also be serviced separately.

Seat Side Air Bags

The driver and passenger seat side air bags are attached to the seat backrest frame. If a seat side air bag deployment has occurred or for more information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Occupant Classification Sensor (OCS) System

The occupant classification sensor (OCS) system is standard equipment on all front passenger seats. For diagnosing or servicing the OCS system, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Rear Seats

WARNING: **Synchronize the seat recliners following the steps in the seat removal and installation procedure any time the seat is removed for service. The following actions may result in the loss of recliner synchronization that cannot be corrected and may cause the seat back to fail in a crash:**

- **Dropping the seat**

- **Sitting on the seat when removed**
- **Applying any load to the seat when removed**
- **Removing or loosening any recliner fasteners except for the safety belt buckle bolt**

Install a new seat back frame assembly if the seat recliners cannot be synchronized. Failure to follow these instructions may result in serious personal injury to the vehicle occupant(s) in a crash.

The rear seats are a 60/40 split folding/reclining backrest design. The recliner release handle will allow the backrest to recline as well as fold the backrest forward. When the backrest is folded forward, the front legs of the seat will fold down (kneel) creating a level load floor with the luggage area. The 60 percent seat has a fold down armrest with cup holders. The armrest latches to a striker in the backrest frame.

The rear seats can be equipped with the following systems:

- Power fold down backrests
- Heated seats

When the rear seats are removed from the vehicle, the inboard and outboard recliners must be synchronized before installing the seat back into the vehicle. If the recliners are not synchronized, carry out the synchronization steps in **Seat - Rear, 40 Percent** or **Seat - Rear, 60 Percent**. The recliners must not be moved from this synchronized position until all the seat-to-floor retainers are tightened to specification. Synchronizing the recliners may require the recliners to be released. Care must be used when working with the recliners as they are spring loaded and release with high force.

The 60 percent and 40 percent seat backrest frame assemblies include the backrest frame, anchor brackets and recliners (inboard and outboard). These parts must be serviced as an assembly. To prevent loss of recliner synchronization, recliner binding or backrest latch/release failure, the recliner bolts must never be loosened or removed, except for the safety belt buckle bolt. The backrest frame assemblies are assembled on a fixture not available for service.

The safety belt buckle bolt is the only bolt on either 40 or 60 percent seat recliner that may be removed for service. To service the safety belt buckle, refer to **SAFETY BELT SYSTEM** article.

Power Fold Down Backrest

NOTE: The smart junction box (SJB) may also be identified as the generic electronic module (GEM).

The optional power fold down backrest, in addition to functioning with the manual recline handle, has a convenient power fold seat control switch mounted in the LH rear quarter trim panel rear hatch area. When the switch is pushed, left or right, an electromechanical motor releases that seat's recliners, through a cable attachment, and a spring load folds the backrest down and kneels the front legs. The seat backrest must then be manually lifted upright to the seating position with the recliners locked in place.

Heated Seats

This system allows independent seat electrical heating of each rear outboard seat on demand.

The components of the system are:

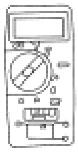
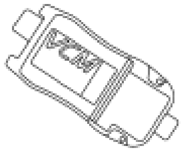
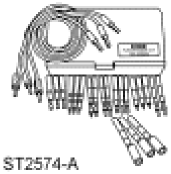
- the seat heater mats located on the seat cushion and backrest.
- the heated seat module located under the 60 percent seat.
- the heated seat switches, located in the LH and RH rear doors.
- temperature sensors, located in the seat cushion heater mats.

A new heater mat will come assembled on a new foam pad.

DIAGNOSTIC TESTS

SEATS

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	Fluke 73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	Software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

High-Speed Controller Area Network (HS-CAN) and Medium-Speed Controller Area Network (MS-CAN)

This vehicle utilizes 2 communication systems called high-speed controller area network (HS-CAN) and medium-speed controller area network (MS-CAN). The memory seat and climate controlled seat communicate over the MS-CAN. When diagnosing the memory seat or climate controlled seat, use a Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool with the latest software update with the capability of communicating over the MS-CAN bus.

Principles of Operation

Driver and Passenger Power Seats Without Memory

The driver and front passenger power seat motors are hardwired to the seat control switches on each respective seat. The circuits are normally at ground through the seat control switch. Each individual seat track, recliner (if equipped) and lumbar (if equipped) motor circuit is switched to voltage when the specific adjustment position is selected.

Power Driver Seat With Memory

NOTE:	**Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.**

NOTE:	**A memory recall in progress does not prohibit the initiation of another memory recall; the most recently requested memory recall will be executed.**

The memory driver seat feature allows the driver to program a personalized seat position that can be recalled using the memory switch or a remote keyless entry (RKE) transmitter (if associated). There are 2 memory settings possible. The power exterior mirror (if equipped) positions are also stored and recalled with the power driver seat positions.

For information on programming memory positions or recalling a stored memory position, refer to **Memory Position Programming**. For information on RKE transmitter programming, refer to **HANDLES, LOCKS, LATCHES & ENTRY SYSTEMS** article.

The driver seat module (DSM) is located under the driver seat. To install a new DSM, refer to **MULTIFUNCTION ELECTRONIC MODULES** article. Programmable module installation (PMI) must be carried out when installing a new DSM. Refer to **MODULE CONFIGURATION** article.

The driver seat control switch provides voltage to the DSM when activated. The neutral position of each driver seat control switch position is a ground state through the seat control switch contacts. A voltage input causes the DSM to power the appropriate motor until the input is removed. Ground is the normal state of the motor circuits through the DSM and is not switched to control the motors. The DSM internally switches the appropriate circuit from ground to voltage for operating the motors.

As the seat is adjusted, the DSM constantly monitors the motor position sensors to record the current seat position. The DSM will remove voltage from the motor upon termination of the seat control switch input or if the DSM does not see movement from the motor by monitoring the position sensor.

The DSM communicates DTC and other information using the medium-speed controller area network (MS-CAN) communication bus. It should be noted for diagnostics that because CAN bus communication is more robust and reliable than other methods, it may be possible to have limited module communication with one of the CAN bus circuits disconnected or shorted to ground. Refer to **MODULE COMMUNICATIONS NETWORK** article for information concerning MS-CAN bus communication.

This service information only diagnoses concerns specific to the memory driver seat. To diagnose an exterior mirror concern, refer to **REAR VIEW MIRRORS** article.

Easy Entry/Exit Feature

The easy entry/exit feature moves the driver seat backwards about 50.8 mm (2 in) when the ignition key is removed from the ignition switch. The DSM receives a key out command over the MS-CAN communication network and powers the driver seat rearward. This function will not operate if the seat is less than the 50.8 mm (2 in) travel distance to the end of the track or the function has been disabled. The DSM will also cancel this operation if a valid input command is received from the driver seat control switch, memory SET switch or exterior mirror control switch.

The DSM will record the current driver seat positions before powering the seat for an easy exit operation. This recorded position will be used to return the driver seat to this position on the easy entry operation. During easy entry operation, the seat is returned to the position previous to the easy exit operation.

The easy entry/exit feature can be enabled/disabled using a scan tool. When enabled, the feature becomes a user accessible item on the message center allowing the user to turn the feature on and off. Refer to the Owner's Literature or **INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES** article for information on the message center.

Remote Keyless Entry (RKE) Transmitter

NOTE: A memory recall in progress does not prohibit the initiation of another memory recall; the most recently requested memory recall will be executed.

A remote keyless entry (RKE) transmitter can be used to recall previously set memory positions but must first be associated to that memory position. The transmitter associated with personality 1 is capable of recalling memory position 1 only. Similarly, the associated personality 2 transmitter can recall only memory position 2.

Memory recall occurs when the unlock switch is depressed on the RKE transmitter if it has been associated with a memory position. The second depression of the unlock switch, which unlocks passenger doors, does not initiate a memory recall.

For information on diagnosing a RKE concern or associating a RKE transmitter to a memory position, refer to **HANDLES, LOCKS, LATCHES & ENTRY SYSTEMS** article.

Driver Seat Module (DSM) Hard Stop/Soft Stop

A hard stop occurs when one of the memory seat track axes or backrest recline physically reach the end of travel and can go no further. A soft stop occurs when the seat stops before physically reaching the end of travel. The hard stop is set by seat design and cannot be changed or adjusted. The soft stop is set by the DSM. The seat track axes are forward/rearward, front up/down and rear up/down. The backrest axis is recline forward/backward. To prevent unnecessary stress on the seat and motors, the DSM will set soft stop positions, 2 for each moving axis. The DSM will use a preset distance from the hard stop to determine where the soft stop will occur. When an axis reaches the hard stop and the switch is held for approximately one second, the DSM establishes the soft stop for that axis in that direction.

Setting the Soft Stop

NOTE: **If a new DSM or driver seat track has been installed, all driver seat track soft stops must be reset.**

Use the following procedure once a new seat track or DSM has been installed.

During the setting procedure, if the seat track stops before the end of travel has been reached, the DSM has stopped at a previously set soft stop. To set the new soft stop, release the seat control switch and press again in the same direction until the seat track stops.

1. Turn the ignition key to the ON position.
2. Press the seat control switch horizontal button forward until the seat track stops.
3. Keep the horizontal button pressed forward for one second after the seat track reaches its forward end of travel. The horizontal forward soft stop has been set, release the switch button.
4. Repeat steps 2 and 3 for all seat track axis in both directions.

Heated Seats - Front

Vehicles equipped with front heated seats are equipped with a single-heated seat module to control both front heated seats. The heated seat module is located under the front passenger seat. The HVAC module includes both driver and passenger heated seat control buttons and indicators. The heated seat system will function independently of the vehicle's climate control system. A momentary ground signal is transmitted to the heated seat module when a heated seat switch button on the HVAC module is depressed and ignition switched voltage is supplied. Upon receiving each control signal to an input circuit, the heated seat module will decrease one setting (the sequence is hi, low, OFF, hi, etc.). When a heated seat is set to hi, both LED indicators above that heated seat's control button will illuminate. When a heated seat is set to low, only one LED indicator above that switch will illuminate. When activated, the heated seat module supplies voltage to the selected seat's heater circuit. Each seat's cushion heater mat and backrest heater mat is connected in a series circuit to the heated seat module and powered by the output circuit for that seat and ground. The heated seat module monitors inputs from a temperature sensor, located in each seat's cushion heater mat and maintains seat temperature by regulating current flow to the heater circuits. The heated seat module will remain ON until the heated seat switch button is depressed to cycle the heated seat module OFF or the ignition switch is set to OFF.

If a fault is detected by the heated seat module, the module will stop supplying voltage to that individual left or right seat and switch indicator, that the fault was detected on. The faults detected will be: a heater supply circuit short to battery, ground or open; sensor circuit short to battery or open; heated seat switch stuck closed to ground. To reset the module, cycle the ignition switch OFF and then ON. After the heated seat module has been reset, the module will return to an OFF state. The heated seat module does not report DTCs and does not communicate on any of the controller area networks (CANs).

Heated Seats - Rear

Vehicles equipped with rear heated seats are equipped with a single-heated seat module to control both rear heated seats. The heated seat module is located under the rear 60 percent seat. The left and right rear heated seat switches, with indicators, are located in the respective second row door trim panels. A momentary ground signal is transmitted to the heated seat module when a heated seat switch button is depressed and ignition switched voltage is supplied. Upon receiving each control signal to an input circuit, the heated seat module will decrease one setting (the sequence is hi, low, OFF, hi, etc.). When a heated seat is set to hi, both LED indicators on the heated seat switch will illuminate. When a heated seat is set to low, only one LED indicator will illuminate. When activated, the heated seat module supplies voltage to the selected seat's heater circuit. Each seat's cushion heater mat and backrest heater mat is connected in a series circuit to the heated seat module and powered by the output circuit for that seat and ground. The heated seat module monitors inputs from a temperature sensor, located in each seat's cushion heater mat and maintains seat temperature by regulating current flow to the heater circuits. The heated seat module will remain ON until the heated seat switch button is depressed to cycle the heated seat module OFF or the ignition switch is set to OFF.

If a fault is detected by the heated seat module, the module will stop supplying voltage to that individual left or right seat and switch indicator, that the fault was detected on. The faults detected will be: a heater supply circuit short to battery, ground or open; sensor circuit short to battery or open; heated seat switch stuck closed to ground or heated seat switch low and high inputs shorted together. To reset the module, cycle the ignition switch OFF and then ON. After the heated seat module has been reset, the module will return to an OFF state. The heated seat module does not report DTCs and does not communicate on any of the controller area networks (CANs).

Climate Controlled Seat System

NOTE: Avoid applying voltage directly to a thermo-electric device (TED) for testing its operation. Doing so may cause damage to the TED or shorten its usable life.

NOTE: When installing a new dual climate controlled seat module (DCSM), it is necessary to carry out programmable module installation (PMI). Refer to MODULE CONFIGURATION article.

Both the driver and front passenger climate controlled seats are independently controlled electronically by the DCSM mounted under the front passenger seat. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage on 2 fused circuits from the battery junction box (BJB). If one of the voltage circuits to the DCSM is lost, both seats will remain operational because the circuits are internally connected in the DCSM. If the system shuts down due to a DTC fault, cycling the ignition to off and then on again will reset the DCSM to function until the DTC resets.

Both climate controlled seats operate independently. If a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

The 4 switches (identified with seat icons) on the HVAC module activate each seat system setting and illuminate LEDs above each switch to indicate the operating mode, 3 LEDs for HIGH, 2 LEDs for MEDIUM or 1 LED for LOW. The push-buttons with the blue seat icon operate the seat cooling mode and the push-buttons with the red seat icon operate the seat heating mode.

Each driver and front passenger seat cushion and backrest is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air depending on the control switch settings. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC seat switch settings.

The temperature differences between the individual heated and cooled settings is minimal. For example, it is difficult to distinguish between LOW cool and MEDIUM cool settings. Measuring seat temperature at different settings is possible by monitoring the DCSM PIDs using the scan tool.

The HVAC module communicates climate controlled seat commands to the DCSM using the medium-speed controller area network (MS-CAN) communication bus. The MS-CAN bus is connected to the data link connector (DLC) for diagnostic use. No direct connection exists between the DCSM and HVAC for the climate controlled seat switches. The climate controlled seats can be commanded using the scan tool to verify both module communication on the MS-CAN bus and operation of the DCSM. This method may be useful for isolating a control switch concern. It should also be noted that because CAN bus communication is more robust and reliable than other methods, it may be possible to have limited module communication with one of the CAN bus circuits disconnected or shorted to ground. Refer to **MODULE COMMUNICATIONS NETWORK** article for additional information concerning CAN bus communication.

Heating Characteristics

- In heat mode, the TED circuits of a given seat are wired in parallel internally in the DCSM.
- The climate controlled seat system draws approximately 24 amperes, with both seats heating, until reaching the set point and then the system operates at a reduced amperage to maintain the climate setting.
- In heat mode, the TED can add up to 40°C-60°C (72°F-108°F) to the ambient inlet air temperature as it passes over the TED.
- The system control settings are based on the 3 LEDs above each seat heat switch button on the HVAC.
- In the LOW setting, the DCSM is set to maintain TED temperature at approximately 46°C (115°F) (not at seat surface).
- In the HIGH setting, the DCSM is set to maintain TED temperature at 65°C (149°F) (not at seat surface).
- When heating, the DCSM will vary the speed of the fans and the TED duty cycle in order to reach and maintain the temperature determined by the switch setting (closed loop operation). Refer to the following table for heating mode temperatures.
- Seat heating has a maximum operating duration of 15 minutes.

Climate Controlled Seat Heat State	Initial Temperature	Final Temperature
HIGH	90°C (194°F)	65°C (149°F)
MED	80°C (176°F)	60°C (140°F)
LOW	75°C (167°F)	46°C (115°F)

Cooling Characteristics

- In cool mode, the TED circuits of a given seat are wired in series internally in the DCSM.
- The climate controlled seat system draws approximately 7 amps when in cool mode on high setting.
- In cool mode, the TED can remove up to 8°C (14°F) from the ambient inlet air temperature as it passes

over the TED.

- The system control settings are based on the 3 LEDs above each seat cool switch button on the HVAC.
- When cooling, the DCSM maintains constant speed of the fans and constant TED supply voltage (duty cycle) in open loop cool mode. Refer to the following table for cooling mode temperatures.
- Seat cooling has a maximum operating duration of 30 minutes.

Climate Controlled Seat Cool State	TED Voltage	TED Supply Duty Cycle
HIGH	Vbat	100%
MED	Vbat	75%
LOW	Vbat	50%

The climate controlled seat system is deactivated by one of the following actions:

- Selecting the HVAC module climate control seat switch setting to manual OFF.
- Turning the vehicle OFF.

If the temperature at one of the TEDs falls below 5°C (41°F), the DCSM will shut down the TEDs and initiate system recovery mode. If the temperature continues to drop below 2°C (36°F), the DCSM will shut down the affected seat operation.

Climate Controlled Seat System Recovery Mode

NOTE: **The presence of overtemperature faults (DTCs B2729, B2730, B272A and B272B) can be induced by incorrect operation of the climate controlled seat system after an initial heat setting has been attained. If a heat setting is repeatedly turned OFF and ON in an attempt to increase the seat temperature or repeatedly toggled between heat and cool modes, an overtemperature condition can result and the DTCs will be set.**

If the temperature at one of the TEDs rises above 110°C (230°F) in the heat mode or 65°C (149°F) in the cool mode for more than 4 seconds, the DCSM will record an overtemperature DTC, remove voltage from the TEDs and go into recovery mode (blower only) for 30 seconds to cool down the TEDs. The same will occur if a temperature difference of 60°C (108°F) or greater is seen between the backrest and cushion TEDs on either front seat. The DCSM will continue to monitor the TEDs while in recovery mode. If the temperature of the TEDs does not drop to 105°C (221°F) in the heat mode or 60°C (140°F) in the cool mode after 30 seconds, the system will continue to cool the TEDs in recovery mode for up to 5 minutes. If the TEDs cool down at anytime after 30 seconds, but before 5 minutes (checked at 4 second intervals), the system will operate as normal. An overtemperature DTC will still be recorded even if the system recovers and is operating normally. Recovery mode is more likely to occur during extreme cabin temperatures with significant seat back sunload. If the system does not recover within 30 seconds in heat mode or within 5 minutes in cool mode, the DCSM will disable that seat (fault mode) and remain off until the ignition is cycled. Also, if the DCSM detects temperature differential fault twice during the same ignition cycle, it will shut down. When a fault causes a shutdown, the climate controlled seat indicators will turn off for the affected seat and that seat will not be operational until the next key cycle.

Second Row Power-Fold Seat

NOTE: The smart junction box (SJB) may also be identified as the generic electronic module (GEM).

For the second row power-fold seat to operate, voltage is supplied by the SJB to the power-fold seat relay, enabling the seats to then be moved by pressing the second row power-fold seat switch. The second row power-fold seat operates only when the vehicle is in PARK and the liftgate glass or liftgate door is open.

The power-fold seat relay will be provided voltage on the coil side from the SJB for 30 minutes when the transmission selector is in PARK, and the liftgate, or liftgate glass, is open. The voltage will be disabled 30 minutes after turning the vehicle OFF. If the relay is disabled after 30 minutes, it can be enabled by opening any door, pressing the unlock key on the key fob, pressing any keyless keypad button or turning the ignition key.

The second row power-fold seat actuators release a locking mechanism allowing the seat backrest to fold down onto the seat cushion.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical and electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
	• Battery junction box (BJB) fuse(s): ○ 7 (30A) (rear heated seats) ○ 16 (30A) (climate controlled seats or front heated seats) ○ 27 (10A) (second row power-fold seats) ○ 60 (30A) (driver power seat or driver memory seat) ○ 61 (30A) (passenger power seat) • Smart junction box (SJB) fuse(s): ○ 5 (10A) (second

• Switch(es) • Seat tracks obstructed or damaged • Seat backrest obstructed • Lumbar assembly damaged • Recliner or latch assembly damaged (backrest frame) • Thermo-electric device (TED) assembly filter dirty (cushion or backrest) • Second row power-fold actuator and cable	row power-fold seats) ○ 12 (7.5A) (driver memory seat) ○ 35 (10A) (front/rear heated seats) • Wiring harness • Loose or corroded connections • Seat control switch(es) • Power seat motor (seat track) • Power recliner motor • Power lumbar motor • Memory SET switch • Driver seat module (DSM) • Seat cushion heater mat • Seat backrest heater mat • Heated seat module • Heated seat switch • TED assembly (cushion or backrest) • HVAC module • Dual climate controlled seat module (DCSM) • Second row power-fold actuator • Second row power-fold relay • Second row power-fold switch

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is with the power seat (non-memory seat) or heated seat and the cause is not visually evident, verify the symptom and Go to **Symptom Chart**.

NOTE: **Make sure to use the latest scan tool software release.**

5. If the concern is with the memory seat or climate controlled seat and the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

6. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
7. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
8. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
9. Clear the continuous DTCs and carry out the self-test diagnostics for the driver seat module (DSM) or dual climate controlled seat module (DCSM).
10. If the DTCs retrieved are related to the concern, go to **Driver Seat Module (DSM) DTC Chart**, go to **Dual Climate Controlled Seat Module (DCSM) DTC Chart** or go to **Smart Junction Box (SJB) DTC Chart**. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
11. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

Driver Seat Module (DSM) DTC Chart

DRIVER SEAT MODULE (DSM) DTC CHART

DTC	Description	Retrieved	Action
B1342	ECU is Faulted	On-Demand and Continuous	INSTALL a new driver seat module (DSM) and CARRY OUT programmable module installation (PMI). REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.
B1530	Memory SET Switch Circuit Short to Ground	On-Demand and Continuous	For MKX, go to **Pinpoint Test K**. For Edge, go to **Pinpoint Test M**.
B1534	Memory 1 Switch Circuit Short to Ground	On-Demand and Continuous	For MKX, go to **Pinpoint Test K**. For Edge, go to **Pinpoint Test M**.
B1538	Memory 2 Switch Circuit Short to Ground	On-Demand and Continuous	For MKX, go to **Pinpoint Test K**. For Edge, go to **Pinpoint Test M**.

B1663	Seat Driver Front Up/Down Motor Stalled	On-Demand	If the motor does not operate, for MKX, go to **Pinpoint Test J**, for Edge, go to **Pinpoint Test L**. If the motor operates, for MKX, go to **Pinpoint Test K**, for Edge, go to **Pinpoint Test M**.
B1664	Seat Driver Rear Up/Down Motor Stalled	On-Demand	If the motor does not operate, for MKX, go to **Pinpoint Test J**, for Edge, go to **Pinpoint Test L**. If the motor operates, for MKX, go to **Pinpoint Test K**, for Edge, go to **Pinpoint Test M**.
B1665	Seat Driver Forward/Backward Motor Stalled	On-Demand	If the motor does not operate, for MKX, go to **Pinpoint Test J**, for Edge, go to **Pinpoint Test L**. If the motor operates, for MKX, go to **Pinpoint Test K**, for Edge, go to **Pinpoint Test M**.
B1666	Seat Driver Recline Motor Stalled	On-Demand	If the motor does not operate, go to **Pinpoint Test J**. If the motor operates, go to **Pinpoint Test K**.
B1703	Seat Driver Recline Forward Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J**.
B1707	Seat Driver Recline Rearward Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J**.
B1711	Seat Driver Front Up Switch Circuit Short to Battery	On-Demand and Continuous	For MKX, go to **Pinpoint Test J**. For Edge, go to **Pinpoint Test L**.
B1715	Seat Driver Front Down Switch Circuit Short to Battery	On-Demand and Continuous	For MKX, go to **Pinpoint Test J**. For Edge, go to **Pinpoint Test L**.
B1719	Seat Driver Forward Switch Circuit Short to Battery	On-Demand and Continuous	For MKX, go to **Pinpoint Test J**. For Edge, go to **Pinpoint Test L**.
B1723	Seat Driver Rearward Switch Circuit Short to Battery	On-Demand and Continuous	For MKX, go to **Pinpoint Test J**. For Edge, go to **Pinpoint Test L**.
B1727	Seat Driver Rear Up Switch Circuit Short to Battery	On-Demand and Continuous	For MKX, go to **Pinpoint Test J**. For Edge, go to **Pinpoint Test L**.
B1731	Seat Driver Rear Down Switch Circuit Short to Battery	On-Demand and Continuous	For MKX, go to **Pinpoint Test J**. For Edge, go to **Pinpoint Test L**.
B1952	Seat Rear Up/Down Position Feedback Circuit Short to Battery	On-Demand and Continuous	For MKX, go to **Pinpoint Test K**. For Edge, go to **Pinpoint Test M**.
B1953	Seat Rear Up/Down Position Feedback Circuit Short to Ground	On-Demand and Continuous	For MKX, go to **Pinpoint Test K**. For Edge, go to **Pinpoint Test M**.
B1956	Seat Front Up/Down Position Feedback Circuit Short to Battery	On-Demand and Continuous	For MKX, go to **Pinpoint Test K**. For Edge, go to **Pinpoint Test M**.
B1957	Seat Front Up/Down Position Feedback Circuit Short to	On-Demand and	For MKX, go to **Pinpoint Test K**. For

	Ground	Continuous	Edge, go to **Pinpoint Test M**.
B1960	Seat Recline Forward/Backward Position Feedback Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test K**.
B1961	Seat Recline Forward/Backward Position Feedback Circuit Short to Ground	On-Demand and Continuous	Go to **Pinpoint Test K**.
B1964	Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Battery	On-Demand and Continuous	For MKX, go to **Pinpoint Test K**. For Edge, go to **Pinpoint Test M**.
B1965	Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Ground	On-Demand and Continuous	For MKX, go to **Pinpoint Test K**. For Edge, go to **Pinpoint Test M**.
B2084	Memory SET Indicator Short to Ground	On-Demand and Continuous	Go to **Pinpoint Test n**
B2143	Non Volatile Memory Failure (EEPROM)	Continuous	REPEAT the self-test. CLEAR the DTCs. If the DTC resets, INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test.
B2477	Module Configuration Failure	Continuous	**NOTE:** **This DTC indicates PMI has not been done to a newly installed module or configuration data has been lost. Presence of this DTC alone does not prevent basic seat operation from the seat control switch.** CARRY OUT PMI on the DSM. REFER to **MODULE CONFIGURATION** article. REPEAT the self-test. If PMI is successful, the DTC will not be present.
U0140	Lost Communication With Body Control Module (GEM)	Continuous	CLEAR the DTC. REPEAT the self-test. If the DTC is retrieved again, REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the medium-speed communication area network (MS-CAN) concern.
			CLEAR the DTC. REPEAT the self-

U0155	Lost Communication With Instrument Panel Cluster Control Module	Continuous	test. If the DTC is retrieved again, REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the MS-CAN concern.
U2050	No Application Present	Continuous	INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test.
All Other DTCs	-	-	REFER to the Master DTC Chart in **MULTIFUNCTION ELECTRONIC MODULES** article.

Dual Climate Controlled Seat Module (DCSM) DTC Chart

DUAL CLIMATE CONTROLLED SEAT MODULE (DCSM) DTC CHART

DTC	Description	Retrieved	Action
B103B	Thermoelectric Driver Overcurrent Low	On-Demand and Continuous	Go to **Pinpoint Test AE**.
B103C	Thermoelectric Driver Open Load	On-Demand and Continuous	Go to **Pinpoint Test AF**.
B103D	Blower Driver Overtemperature	On-Demand and Continuous	Go to **Pinpoint Test AG**.
B1111	Driver Thermoelectric Device Control Overtemperature Fault	On-Demand and Continuous	Go to **Pinpoint Test AE**.
B1113	Passenger Thermoelectric Device Control Overtemperature Fault	On-Demand and Continuous	Go to **Pinpoint Test AH**.
B111B	Passenger Thermoelectric Driver Overcurrent Low	On-Demand and Continuous	Go to **Pinpoint Test AH**.
B111C	Passenger Thermoelectric Driver Open Load	On-Demand and Continuous	Go to **Pinpoint Test AI**.
B111D	Passenger Blower Driver Overtemperature	On-Demand and Continuous	Go to **Pinpoint Test AJ**.
B1342	ECU is Faulted	On-Demand and Continuous	INSTALL a new dual climate controlled seat module (DCSM) and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**.
			DEPOWER the supplemental restraint system (SRS). REFER to **SUPPLEMENTAL RESTRAINT**

			SYSTEM article. DISCONNECT passenger seat side air bag module C327. DISCONNECT DCSM C3036c and passenger cushion thermo-electric device (TED) C3328. CONNECT the battery ground cable. With the ignition switch ON, MEASURE the voltage between C3036c-3, circuit VHS23 (BN/BU), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. CARRY OUT the self-test. CLEAR the DTC. CONNECT passenger seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B19A1	Passenger Seat Cushion Blower Speed Short to Battery	On-Demand and Continuous	(see above)
B19A2	Passenger Seat Back Blower Speed Short to Battery	On-Demand and Continuous	DEPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT passenger seat side air bag module C327. DISCONNECT DCSM C3036c and passenger backrest TED C3326. CONNECT the battery ground cable. With the ignition switch ON, MEASURE the voltage between C3036c-4, circuit VHS21 (BU/WH), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. CARRY OUT the self-test. CLEAR the DTC. CONNECT passenger seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
			DEPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT driver seat side air bag module C328

			and passenger side air bag module C327. DISCONNECT DCSM C3036c and driver cushion TED C3327. CONNECT the battery ground cable. With the ignition switch ON, MEASURE the voltage between C3036c-11, circuit VHS18 (BN/GN), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. CARRY OUT the self-test. CLEAR the DTC. CONNECT driver seat side air bag module C328 and passenger seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B19A3	Driver Seat Cushion Blower Speed Short to Battery	On-Demand and Continuous	
B19A4	Driver Seat Back Blower Speed Short to Battery	On-Demand and Continuous	DEPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT driver seat side air bag module C328 and passenger seat side air bag module C327. DISCONNECT DCSM C3036c and driver backrest TED C3322. CONNECT the battery ground cable. With the ignition switch ON, MEASURE the voltage between C3036c-12, circuit VHS16 (BU/GN), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. CARRY OUT the self-test. CLEAR the DTC. CONNECT driver seat side air bag module C328 and passenger seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
			DEPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT

			passenger seat side air bag module C327. DISCONNECT DCSM C3036c and passenger cushion TED C3328. CONNECT the battery ground cable. MEASURE the resistance between C3036c-3, circuit VHS23 (BN/BU), harness side and ground. REPAIR the short to ground as needed. If OK, INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. CARRY OUT the self-test. CLEAR the DTC. CONNECT passenger seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B19A5	Passenger Seat Cushion Blower Speed Short to Ground	On-Demand and Continuous	
B19A6	Passenger Seat Back Blower Speed Short to Ground	On-Demand and Continuous	DEPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT passenger seat side air bag module C327. DISCONNECT DCSM C3036c and passenger backrest TED C3326. CONNECT the battery ground cable. MEASURE the resistance between C3036c-4, circuit VHS21 (BU/WH), harness side and ground. REPAIR the short to ground as needed. If OK, INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. CARRY OUT the self-test. CLEAR the DTC. CONNECT passenger seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
			DEPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT driver seat side air bag module C328 and passenger seat side air bag module C327. DISCONNECT DCSM C3036c and driver cushion TED C3327.

B19A7	Driver Seat Cushion Blower Speed Short to Ground	On-Demand and Continuous	CONNECT the battery ground cable. MEASURE the resistance between C3036c-11, circuit VHS18 (BN/GN), harness side and ground. REPAIR the short to ground as needed. If OK, INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. CARRY OUT the self-test. CLEAR the DTC. CONNECT driver seat side air bag module C328 and passenger seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B19A8	Driver Seat Back Blower Speed Short to Ground	On-Demand and Continuous	DEPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT driver seat side air bag module C328 and passenger seat side air bag module C327. DISCONNECT DCSM C3036c and driver backrest TED C3322. CONNECT the battery ground cable. MEASURE the resistance between C3036c-12, circuit VHS16 (BU/GN), harness side and ground. REPAIR the short to ground as needed. If OK, INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. CARRY OUT the self-test. CLEAR the DTC. CONNECT driver seat side air bag module C328 and passenger seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B2477	Module Configuration Failure	On-Demand and Continuous	**NOTE:** **This DTC indicates PMI has not been done to a newly installed module or configuration data has been lost.** CARRY OUT PMI on the DCSM. REFER to **MODULE CONFIGURATION** article. REPEAT the self-test. If PMI is successful, the

			DTC will not be present.
B2729	Cushion Over-Temp Detected (Driver)	On-Demand and Continuous	Go to **Pinpoint Test AK**.
B272A	Passenger Cushion Over-Temp Detected	On-Demand and Continuous	Go to **Pinpoint Test AL**.
B272B	Passenger Back Over-Temp Detected	On-Demand and Continuous	Go to **Pinpoint Test AM**.
B272C	Driver Differential Temperature Fault	On-Demand and Continuous	If on-demand, go to **Pinpoint Test AN**. If continuous only, and the system is operating, CHECK the TED cooling performance on the affected seat and VERIFY the system is operating correctly. REFER to **Component Test** - Thermo-Electric Device (TED) Cooling Performance. If a concern is found, CHECK the affected seat cushion or backrest for correct installation of the climate controlled seat components (TED, manifold, air ducts and foam pad). CHECK for airflow restrictions (TED inlets and outlets, TED-to-manifold connections, filters and ducts) and REPAIR as needed. If OK, CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. The DTC may have been set by extreme cabin temperatures or excessive sun-load on the seat causing the system to enter recovery mode. Occupant size and weight characteristics can also be a factor. If a concern cannot be found or duplicated, RETURN the vehicle to the customer.
			If on-demand, go to **Pinpoint Test AO**. If continuous only, and the system is operating, CHECK the TED cooling performance on the affected seat and VERIFY the system is operating correctly. REFER to **Component Test** - Thermo-Electric Device (TED) Cooling Performance. If a concern is found, CHECK the affected seat cushion or backrest for correct installation of the climate controlled seat components (TED, manifold, air ducts and foam pad). CHECK for

B272D	Passenger Differential Temperature Fault	On-Demand and Continuous	airflow restrictions (TED inlets and outlets, TED-to-manifold connections, filters and ducts) and REPAIR as needed. If OK, CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. The DTC may have been set by extreme cabin temperatures or excessive sun-load on the seat causing the system to enter recovery mode. Occupant size and weight characteristics can also be a factor. If a concern cannot be found or duplicated, RETURN the vehicle to the customer.
B272E	Driver Ignition Run/Blower Circuit Short to Ground (this DTC sets for an open or short to voltage)	On-Demand and Continuous	Go to **Pinpoint Test AP**.
B272F	Passenger Ignition Run/Blower Circuit Short to Ground (this DTC sets for an open or short to voltage)	On-Demand and Continuous	Go to **Pinpoint Test AQ**.
B2730	Back Over-Temp Detected (Driver)	On-Demand and Continuous	Go to **Pinpoint Test AR**.
U2050	No Application Present	Continuous	INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test.
All Other DTCs	-	On-Demand and Continuous	REFER to the Master DTC Chart in **MULTIFUNCTION ELECTRONIC MODULES** article.

Smart Junction Box (SJB) DTC Chart

NOTE: **The smart junction box (SJB) may also be identified as the generic electronic module (GEM).**

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Retrieved	Action
B2794	Third Row Power Fold Circuit Failure (applies to second row seat)	On-Demand	Go to **Pinpoint Test AQ**.
B2A2D	Third Row Power Fold Circuit Short to Ground (applies to second row	Continuous	Go to **Pinpoint Test AQ**.

	seat)		
All Other DTCs	-	-	REFER to the Master DTC Chart in **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the driver seat module (DSM)	• Fuse • Circuitry • DSM	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• No communication with the dual climate controlled seat module (DCSM)	• Fuse • Circuitry • DCSM	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The power seat is inoperative - driver, without power recliner	• Fuse • Circuitry • Front seat control switch	• Go to **Pinpoint Test A**.
• The power seat is inoperative - passenger, with power recline	• Fuse • Circuitry • Front seat control switch	• Go to **Pinpoint Test B**.
• The power seat is inoperative - passenger, without power recline	• Fuse • Circuitry • Front seat control switch	• Go to **Pinpoint Test C**.
• The power seat moves but is loose	• Fastening hardware • Seat track	• Go to **Pinpoint Test D**.
• The power seat moves but is noisy	• Seat track	• Go to **Pinpoint Test E**.
• The power seat does not make full travel	• Seat track obstructed • Seat track	• Go to **Pinpoint Test F**.
• The power seat does not move horizontally/vertically - driver	• Circuitry • Front seat motors • Front seat control switch	• Go to **Pinpoint Test G**.

• The power seat does not move horizontally/vertically/recline - passenger	• Circuitry • Front seat motors • Front seat control switch	• Go to **Pinpoint Test H**.
• The power seat does not move horizontally/vertically - passenger	• Circuitry • Front seat motors • Front seat control switch	• Go to **Pinpoint Test I**.
• The memory seat is inoperative/does not operate correctly - does not operate horizontally/vertically/recline, MKX	• Fuse • Circuitry • Seat control switch • Memory seat track • Memory recline motor • DSM	• Go to **Pinpoint Test J**.
• The memory seat does not operate correctly - does not operate using the memory SET switch, MKX	• Circuitry • Memory SET switch • Memory seat track • DSM	• Go to **Pinpoint Test K**.
• The memory seat is inoperative/does not operate correctly - does not operate horizontally/vertically, Edge	• Fuse • Circuitry • Seat control switch • Memory seat track • DSM	• Go to **Pinpoint Test L**.
• The memory seat does not operate correctly - does not operate using the memory SET switch, Edge	• Circuitry • Memory SET switch • Memory seat track • DSM	• Go to **Pinpoint Test M**.
• The memory seat does not operate correctly - the seat moves in one-second intervals	• Circuitry • DSM	• REFER to the **Driver Seat Module (DSM) DTC Chart**.
• The memory seat does not operate correctly - the seat does not move to the correct memory position	• Circuitry • Memory SET switch • DSM • Seat track	• REFER to the **Driver Seat Module (DSM) DTC Chart**.

• The memory seat does not operate correctly - does not operate using the remote transmitter	• Remote keyless entry (RKE) integrated keyhead transmitter (IKT) is not correctly associated to a memory position • Circuitry • IKT • DSM • Smart junction box (SJB)	• VERIFY the RKE transmitter is operating correctly and is associated to a memory position. REFER to Owner's Literature or **HANDLES, LOCKS, LATCHES & ENTRY SYSTEMS** article for information on associating a RKE transmitter. RUN the DSM self-test and REFER to the **Driver Seat Module (DSM) DTC Chart** to diagnose any DTCs retrieved.
• The memory SET switch indicator is inoperative/always on	• Circuitry • Memory SET switch • DSM	• Go to **Pinpoint Test N**.
• Easy exit/easy entry is inoperative/does not operate correctly	• Circuitry • Key in ignition switch • Instrument cluster (IC) module • DSM	• Go to **Pinpoint Test O**.
• The power lumbar is inoperative - driver	• Circuitry • Seat control switch • Power lumbar motor assembly	• Go to **Pinpoint Test P**.
• The power lumbar is inoperative - passenger	• Circuitry • Seat control switch • Power lumbar motor assembly	• Go to **Pinpoint Test Q**.
• The heated seats are inoperative - front	• Fuse • Circuitry • Heated seat module	• Go to **Pinpoint Test R**.
	• Fuse • Circuitry • HVAC module (heated seat switch)	

• The heated seat is inoperative/does not operate correctly - driver	• Seat cushion heater mat • Seat backrest heater mat • Heated seat module	• Go to **Pinpoint Test S**.
• The heated seat is inoperative/does not operate correctly - front passenger	• Fuse • Circuitry • HVAC module (heated seat switch) • Seat cushion heater mat • Seat backrest heater mat • Heated seat module	• Go to **Pinpoint Test T**.
• The heated seat is inoperative - driver seat does heat but the heated seat indicator does not illuminate when pressed	• Wiring, terminals or connectors • HVAC module (heated seat switch) • Heated seat module	• Go to **Pinpoint Test U**.
• The heated seat is inoperative - front passenger seat does heat but the heated seat indicator does not illuminate when pressed	• Wiring, terminals or connectors • HVAC module (heated seat switch) • Heated seat module	• Go to **Pinpoint Test V**.
• The front fold-flat seat backrest does not operate correctly - the recliners do not lock in place, release or are not synchronized	• Fold-flat recliner cable • RH fold-flat recliner • LH fold-flat recliner	• RELEASE the fold-flat recliner cable locking clip, allowing the cable to self-adjust. POSITION the backrest upright, locking the recliners in place. APPLY force to the backrest, verifying the recliners are locked in place. LOCK the locking clip back in place. If concern remains, CHECK

		cable and recliners for correct operation and install new as necessary.
• The heated seats are inoperative - rear	• Fuse • Circuitry • Heated seat module	• Go to **Pinpoint Test W**.
• The heated seat is inoperative/does not operate correctly - left rear	• Circuitry • Heated seat switch • Seat cushion heater mat • Seat backrest heater mat • Heated seat module	• Go to **Pinpoint Test X**.
• The heated seat is inoperative/does not operate correctly - right rear	• Circuitry • Heated seat switch • Seat cushion heater mat • Seat backrest heater mat • Heated seat module	• Go to **Pinpoint Test Y**.
• The heated seat is inoperative - left rear seat does heat but the heated seat indicator does not illuminate when pressed	• Wiring, terminals or connectors • Heated seat switch • Heated seat module	• Go to **Pinpoint Test Z**.
• The heated seat is inoperative - left rear seat does heat but the heated seat indicator is on all the time	• Wiring, terminals or connectors • Heated seat module	• Go to **Pinpoint Test AA**.
• The heated seat is inoperative - right rear seat does heat but the heated seat indicator does not illuminate when pressed	• Wiring, terminals or connectors • Heated seat switch • Heated seat module	• Go to **Pinpoint Test AB**.
• The heated seat is inoperative - right rear seat does heat but the heated	• Wiring, terminals or connectors • Heated seat	• Go to **Pinpoint Test AC**.

seat indicator is on all the time	module	
• All climate controlled seats are inoperative	• Fuse • Circuitry • Medium-speed controller area network (MS-CAN) communication fault • DCSM • HVAC module	• VERIFY battery junction box (BJB) fuse 16 (30A) is OK. If OK, CARRY OUT the network test using a scan tool and VERIFY network communication of the HVAC module and DCSM. REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose a module communication or network concern. If OK, CARRY OUT the DCSM on-demand self test and RETRIEVE any DTCs. If any DTC is present, REFER to the **Dual Climate Controlled Seat Module (DCSM) DTC Chart**. CHECK the climate control system for correct operation. REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION & DIAGNOSTICS** article for diagnosis of the HVAC or climate control system. If OK, INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**.
• A single climate controlled seat is inoperative - switch indicators may or may not illuminate	• Circuitry • HVAC module • DCSM	**NOTE:** **If a fault occurs setting a DTC specific to only one climate controlled seat, the DCSM will disable only the affected seat outputs and allow the other seat to remain operational. CHECK for DTCs specific to the affected climate controlled seat and if a DTC is present, REFER to the Dual Climate Controlled Seat Module (DCSM) DTC Chart.**

		• Go to **Pinpoint Test AD**.
• A single climate controlled seat does not operate correctly - poor or intermittent cooling/heating	• Excessive sun-load or extreme cabin temperatures • Incorrectly installed thermo-electric device (TED) or manifold • Airflow blockage • TED • DCSM	• CARRY OUT the DCSM on-demand self test and retrieve any DTCs. If any DTC is present, REFER to the **Dual Climate Controlled Seat Module (DCSM) DTC Chart**. If no DTC is present, CHECK the affected seat cushion or backrest for correct installation of the climate controlled seat components (TED, manifold air duct and foam pad) and REPAIR as needed. If OK, CHECK for airflow restrictions (TED inlets and outlets, TED-to-manifold connections, filters and ducts) and REPAIR as needed. CHECK the TED cooling performance on the affected seat and VERIFY the system is operating correctly. REFER to **Component Test** - Thermo-Electric Device (TED) Cooling Performance. RETEST the system for normal operation.
• A single climate controlled seat does not operate correctly - exhibits poor airflow or performance	• Incorrectly installed TED or manifold • Airflow blockage • Disconnected air duct	• CARRY OUT the DCSM on-demand self test and retrieve any DTCs. If any DTC is present, REFER to the **Dual Climate Controlled Seat Module (DCSM) DTC Chart**. If no DTC is present, CHECK the affected seat cushion or backrest for correct installation of the climate controlled seat components (TED, manifold air duct and foam pad) and REPAIR as needed. If OK, CHECK for airflow restrictions (TED inlets and

		outlets, TED-to-manifold connections, filters and ducts) and REPAIR as needed. RETEST the system for normal operation.
• The power seat is inoperative/does not operate correctly - both rear, power fold	• Fuse • Circuitry • Power-fold relay • Power-fold switch • SJB	• Go to **Pinpoint Test AS**.
• The power seat is inoperative/does not operate correctly - left rear, power fold	• Circuitry • Power-fold relay • Power-fold switch • Power-fold actuator	• Go to **Pinpoint Test AT**.
• The power seat is inoperative/does not operate correctly - right rear, power fold	• Circuitry • Power-fold relay • Power-fold switch • Power-fold actuator	• Go to **Pinpoint Test AU**.
• The second row seat recliner does not operate correctly	• Seat recliner not synchronized • Seat recliner damaged • Seat recliner cable	• CHECK for correct seat recliner synchronization. REFER to **Seat - Rear, 40 Percent** or **Seat - Rear, 60 Percent**. If recliner synchronization is OK, INSTALL new parts as necessary.

Pinpoint Tests

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

NOTE: Electronic modules are sensitive to electrostatic discharge. If exposed to these charges, damage can result.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Use the correct probe adapter(s) when taking measurements. Failure to use the

correct probe adapter(s) may damage the connector.

Refer to **Inspection and Verification**, **Driver Seat Module (DSM) DTC Chart**, **Dual Climate Controlled Seat Module (DCSM) DTC Chart**, **Smart Junction Box (SJB) DTC Chart** and/or **Symptom Chart** for direction to the appropriate Pinpoint Test.

Pinpoint Test A: The Power Seat is Inoperative - Driver, Without Power Recliner

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Seats for schematic and connector information.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBB60 (GN/RD) and is supplied ground on circuit GD145 (BK/BU). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor to move the seat. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor, which moves the seat in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). If a new seat track motor needs to be installed, it is necessary to install an entire power seat track.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Seat control switch

PINPOINT TEST A: THE POWER SEAT IS INOPERATIVE - DRIVER, WITHOUT POWER RECLINER

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

A1 CHECK CIRCUIT SBB60 (GN/RD) FOR VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Driver Seat Control Switch C352

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may**

result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

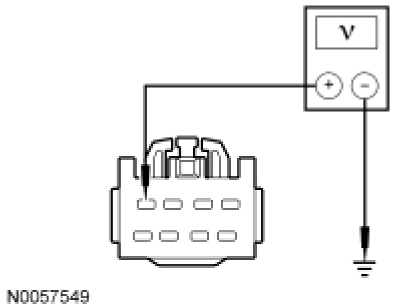


Fig. 1: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat control switch C352-4, circuit SBB60 (GN/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to A2.

  NO : VERIFY battery junction box (BJB) fuse 60 (30A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

A2 CHECK CIRCUIT GD145 (BK/BU) FOR AN OPEN

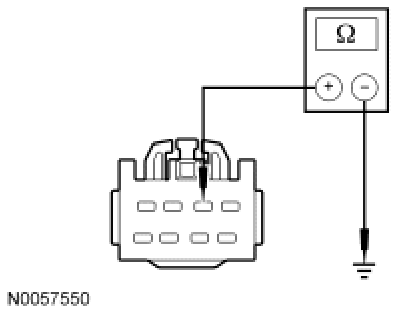


Fig. 2: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C352-2, circuit GD145 (BK/BU), harness side and ground.

- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test B: The Power Seat is Inoperative - Passenger, With Power Recline

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Seats for schematic and connector information.

Normal Operation

The passenger seat control switch is powered by battery voltage on circuit SBB61 (GY/RD) and is supplied ground on circuit GD145 (BK/BU). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor or power recliner motor to move the seat or backrest. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor or power recliner motor, which moves the seat or backrest in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). There is an additional motor in the power recliner mechanism to move the seat backrest forward and rearward. If a new seat track motor needs to be installed, it is necessary to install an entire power seat track. The power recline motor is serviced separately.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Seat control switch

PINPOINT TEST B: THE POWER SEAT IS INOPERATIVE - PASSENGER, WITH POWER RECLINE

NOTE:	**The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**
NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

B1 CHECK CIRCUIT SBB61 (GY/RD) FOR VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: Passenger Seat Control Switch C3026

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

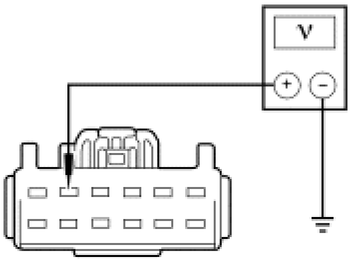


Fig. 3: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger seat control switch C3026-5, circuit SBB61 (GY/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to B2.

  NO : VERIFY battery junction box (BJB) fuse 61 (30A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

B2 CHECK CIRCUIT GD145 (BK/BU) FOR AN OPEN

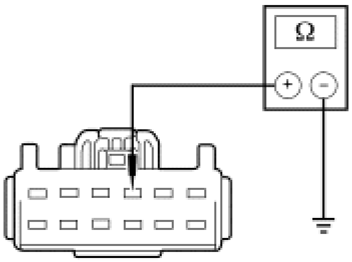


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Fig. 4: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C3026-3, circuit GD145 (BK/BU), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new passenger seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test C: The Power Seat is Inoperative - Passenger, Without Power Recline

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Seats for schematic and connector information.

Normal Operation

The passenger seat control switch is powered by battery voltage on circuit SBB61 (GY/RD) and is supplied ground on circuit GD145 (BK/BU). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor to move the seat. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor, which moves the seat in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). If a new seat track motor needs to be installed, it is necessary to install an entire power seat track. The power recline motor is serviced separately.

This pinpoint test is intended to diagnose the following:

- Fuse

- Wiring, terminals or connectors
- Seat control switch

PINPOINT TEST C: THE POWER SEAT IS INOPERATIVE - PASSENGER, WITHOUT POWER RECLINE

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

C1 CHECK CIRCUIT SBB61 (GY/RD) FOR VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: Passenger Seat Control Switch C355

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

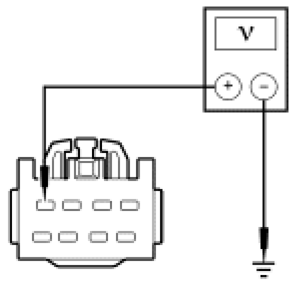


Fig. 5: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger seat control switch C355-4, circuit SBB61 (GY/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to C2.

  NO : VERIFY battery junction box (BJB) fuse 61 (30A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

C2 CHECK CIRCUIT GD145 (BK/BU) FOR AN OPEN

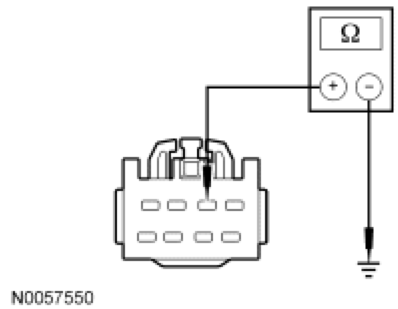


Fig. 6: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C355-2, circuit GD145 (BK/BU), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test D: The Power Seat Moves But is Loose

Normal Operation

The power seat movement should be smooth and the seat cushion should not rock during or after operation.

This pinpoint test is intended to diagnose the following:

- Loose fastening hardware

- Seat track component

PINPOINT TEST D: THE POWER SEAT MOVES BUT IS LOOSE

D1 CHECK THE FASTENING HARDWARE

- Inspect for loose fastening hardware on the affected seat.
- **Is the fastening hardware loose?**

  YES : TIGHTEN all fastening hardware to specification. TEST the system for normal operation.

  NO : IDENTIFY the cause and REPAIR as necessary. TEST the system for normal operation.

Pinpoint Test E: The Power Seat Moves But is Noisy

Normal Operation

The power seat should move quietly during operation. Some noise is acceptable.

This pinpoint test is intended to diagnose the following:

- Misaligned seat track
- Seat track component
- Object obstructing seat movement

PINPOINT TEST E: THE POWER SEAT MOVES BUT IS NOISY

E1 CHECK THE TRACK ALIGNMENT

- Check the alignment of the track to the floor and the track to the seat.
- **Is the track out of alignment?**

  YES : ALIGN the track to the seat and the floor. TEST the system for normal operation.

  NO : IDENTIFY the cause and REPAIR as necessary. TEST the system for normal operation.

Pinpoint Test F: The Power Seat Does Not Make Full Travel

Normal Operation

The power seat should travel fully horizontal (forward/rearward) and vertical (front up/down and rear up/down).

This pinpoint test is intended to diagnose the following:

- Obstruction in the seat track
- Seat track component

PINPOINT TEST F: THE POWER SEAT DOES NOT MAKE FULL TRAVEL

F1 CHECK FOR AN OBSTRUCTION IN THE SEAT TRACK

- Remove the affected seat. Refer to **Seat - Front**

- **Are there any obstructions in the seat track?**

  YES : REMOVE the obstruction(s) from the track(s).

  INSTALL the seat. REFER to **Seat - Front**. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

  NO : IDENTIFY the cause and REPAIR as necessary.

  INSTALL the seat. REFER to **Seat - Front**. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

Pinpoint Test G: The Power Seat Does Not Move Horizontally/Vertically - Driver

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Seats for schematic and connector information.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBB60 (GN/RD) and is supplied ground on circuit GD145 (BK/BU). When pressed, the seat control switch supplies voltage and ground to a power seat track motor to move the seat. When pressed in the opposite direction, the seat control switch reverses the polarity to the same power seat track motor, which moves the seat in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). If a new seat track motor needs to be installed, it is necessary to install an entire power seat track.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Seat control switch
- Seat track motor (seat track)

PINPOINT TEST G: THE POWER SEAT DOES NOT MOVE HORIZONTALLY/VERTICALLY - DRIVER

NOTE:	**The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**
NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

G1 CHECK THE HORIZONTAL MOTOR FOR CORRECT OPERATION

- Operate the driver seat forward and rearward.
- **Will the seat move horizontally?**

  YES : Go to G5.

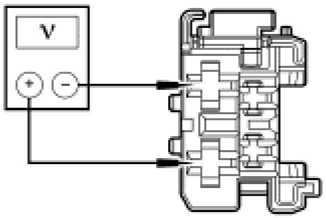
  NO : Go to G2.

G2 CHECK VOLTAGE TO THE DRIVER SEAT HORIZONTAL MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Driver Seat Horizontal Motor C362

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.



N0057525

Fig. 7: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat horizontal motor C362-1, circuit CPS28 (GN), harness side and C362-2, circuit CPS23 (GN/VT), harness side, while pushing the driver seat control switch forward and rearward.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to G3.

G3 CHECK HORIZONTAL MOTOR CIRCUIT CPS28 (GN) FOR AN OPEN

- Disconnect: Driver Seat Control Switch C352

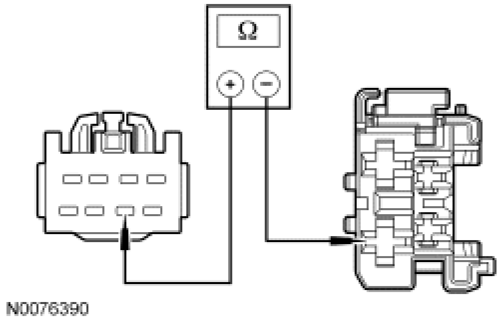


Fig. 8: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C352-6, circuit CPS28 (GN), harness side and driver seat horizontal motor C362-1, circuit CPS28 (GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to G4.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

G4 CHECK HORIZONTAL MOTOR CIRCUIT CPS23 (GN/VT) FOR AN OPEN

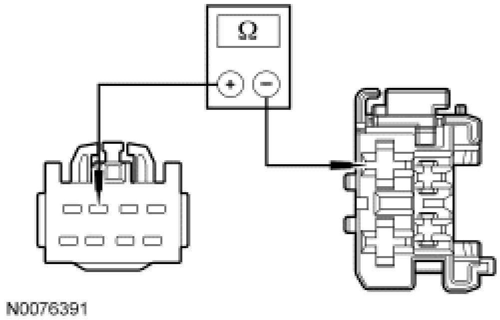


Fig. 9: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C352-3, circuit CPS23 (GN/VT), harness side and driver seat horizontal motor C362-2, circuit CPS23 (GN/VT), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

G5 DETERMINE THE SEAT HEIGHT ADJUST FAILURE

- Operate the seat front and rear height adjustments.
- **Does the seat front and rear height adjust up and down?**

  YES : If only the front height adjust motor operates, go to G6.

  If only the rear height adjust motor operates, go to G9.

  NO : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

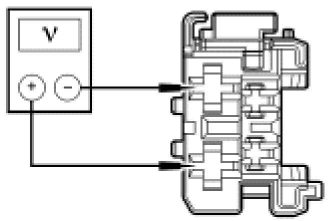
  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

G6 CHECK VOLTAGE TO THE REAR HEIGHT MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Driver Seat Rear Height Motor C363

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.



N0057525

Fig. 10: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat rear height motor C363-2, circuit CPS26 (YE/BU), harness side and C363-1, circuit CPS27 (BU/BN), harness side, while depressing the rear height adjust switch up and down.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. TEST the system for normal operation.

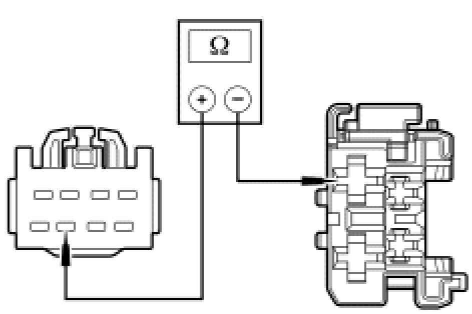
  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to G7.

G7 CHECK CIRCUIT CPS26 (YE/BU) FOR AN OPEN

- Disconnect: Driver Seat Control Switch C352



N0076392

Fig. 11: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C352-7, circuit CPS26 (YE/BU), harness side and driver seat rear height motor C363-2, circuit CPS26 (YE/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to G8.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

G8 CHECK CIRCUIT CPS27 (BU/BN) FOR AN OPEN

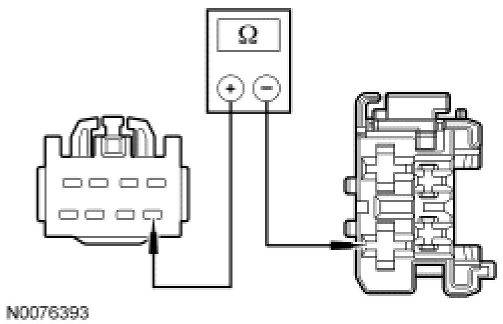


Fig. 12: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C352-5, circuit CPS27 (BU/BN), harness side and driver seat rear height motor C363-1, circuit CPS27 (BU/BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

G9 CHECK VOLTAGE TO THE DRIVER SEAT FRONT HEIGHT MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Driver Seat Front Height Motor C382

WARNING: **Make sure no one is in the vehicle and there is nothing**

blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

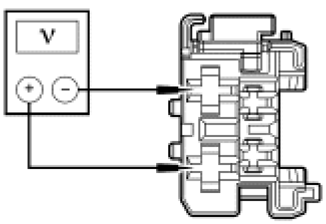


Fig. 13: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat front height motor C382-1, circuit CPS25 (WH/VT), harness side and C382-2, circuit CPS24 (GY), while depressing the front height adjust switch up and down.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to G10.

G10 CHECK CIRCUIT CPS24 (GY) FOR AN OPEN

- Disconnect: Driver Seat Control Switch C352

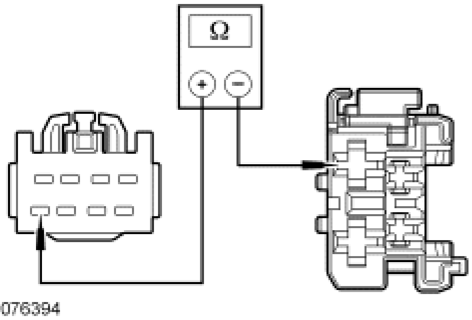


Fig. 14: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C352-8, circuit CPS24 (GY), harness side and driver seat front height motor C382-2, circuit CPS24 (GY), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to G11.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

G11 CHECK CIRCUIT CPS25 (WH/VT) FOR AN OPEN

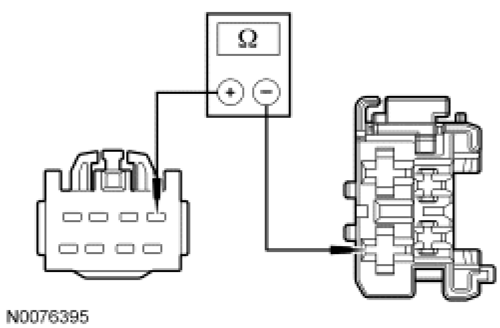


Fig. 15: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C352-1, circuit CPS25 (WH/VT) harness side, and driver seat front height motor C382-1, circuit CPS25 (WH/VT), harness side.
- **Is the resistance less than 5 ohms?**

YES : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test H: The Power Seat Does Not Move Horizontally/Vertically/Recline - Passenger

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Seats for schematic and connector information.

Normal Operation

The passenger seat control switch is powered by battery voltage on circuit SBB61 (GY/RD) and is supplied ground on circuit GD145 (BK/BU). When pressed, the seat control switch supplies voltage and ground to a power seat track motor or power recliner motor to move the seat or backrest. When pressed in the opposite direction, the seat control switch reverses the polarity to the same power seat track motor or power recliner motor, which moves the seat or backrest in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). There is an additional motor in the power recliner mechanism to move the seat backrest forward and rearward. If a new seat track motor needs to be installed, it is necessary to install an entire power seat track. The power recline motor is serviced separately.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Seat control switch
- Seat track motor (seat track)
- Power recliner motor

PINPOINT TEST H: THE POWER SEAT DOES NOT MOVE HORIZONTALLY/VERTICALLY/RECLINE - PASSENGER

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

H1 CHECK THE HORIZONTAL MOTOR FOR CORRECT OPERATION

- Operate the passenger seat forward and rearward.
- **Will the seat move horizontally?**

YES : Go to H2.

NO : Go to H3.

H2 CHECK THE RECLINER MOTOR FOR CORRECT OPERATION

- Recline the passenger backrest forward and rearward.
- **Will the seat backrest recline forward and rearward?**

YES : Go to H6.

NO : Go to H13.

H3 CHECK VOLTAGE TO THE PASSENGER SEAT HORIZONTAL MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in

the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: Passenger Seat Horizontal Motor C332

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

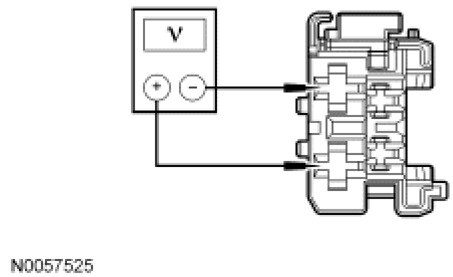


Fig. 16: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger seat horizontal motor C332-1, circuit CPS38 (GN/BU), harness side and C332-2, circuit CPS33 (WH), harness side, while pushing the passenger seat control switch forward and rearward.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to H4.

H4 CHECK CIRCUIT CPS38 (GN/BU) FOR AN OPEN

- Disconnect: Passenger Seat Control Switch C3026

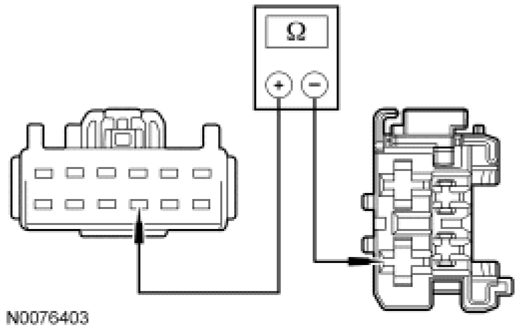


Fig. 17: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C3026-9, circuit CPS38 (GN/BU), harness side and passenger seat horizontal motor C332-1, circuit CPS38 (GN/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to H5.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

H5 CHECK CIRCUIT CPS33 (WH) FOR AN OPEN

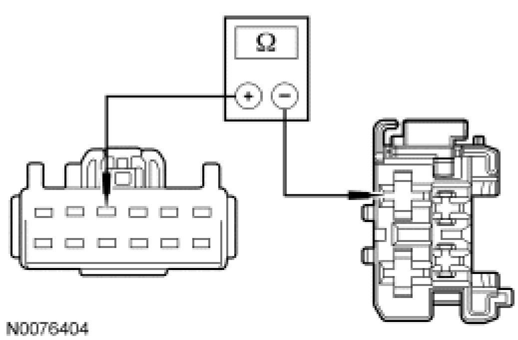


Fig. 18: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C3026-4, circuit CPS33 (WH), harness side and passenger seat horizontal motor C332-2, circuit CPS33 (WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

H6 DETERMINE THE SEAT HEIGHT ADJUST FAILURE

- Operate the seat front and rear height adjustments.
- **Does the seat front and rear height adjust up and down?**

  YES : If only the front height adjust motor operates, go to H7.

  If only the rear height adjust motor operates, go to H10.

  NO : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

H7 CHECK VOLTAGE TO THE PASSENGER SEAT REAR HEIGHT MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: Passenger Seat Rear Height Motor C3075

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

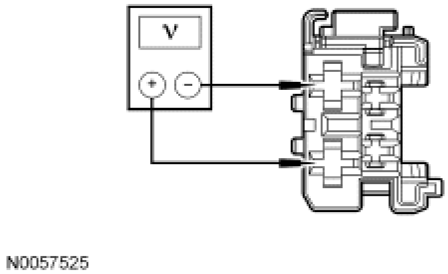


Fig. 19: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger seat rear height motor C3075-2, circuit CPS36 (YE/GY), harness side and C3075-1, circuit CPS37 (WH/BU), harness side, while depressing the rear height adjust switch up and down.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to H8.

H8 CHECK CIRCUIT CPS36 (YE/GY) FOR AN OPEN

- Disconnect: Passenger Seat Control Switch C3026

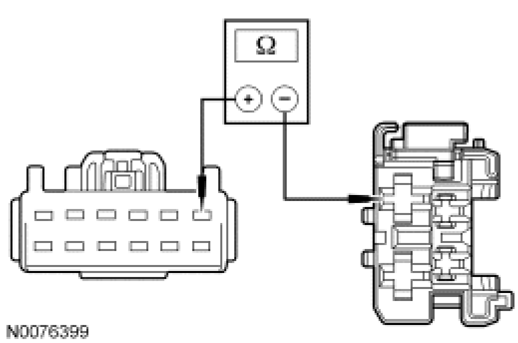


Fig. 20: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C3026-1, circuit CPS36 (YE/GY), harness side and passenger seat rear height motor C3075-2, circuit CPS36 (YE/GY), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to H9.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

H9 CHECK CIRCUIT CPS37 (WH/BU) FOR AN OPEN

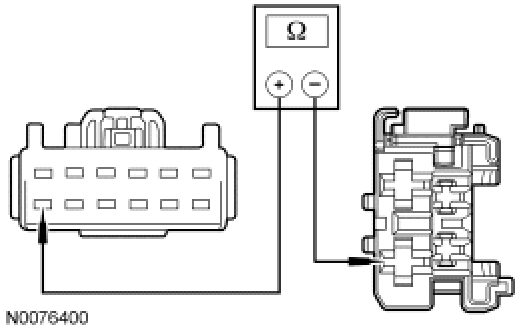


Fig. 21: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C3026-12, circuit CPS37 (WH/BU), harness side and passenger seat rear height motor C3075-1, circuit CPS37 (WH/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

H10 CHECK VOLTAGE TO THE PASSENGER SEAT FRONT HEIGHT MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: Passenger Seat Front Height Motor C3074

WARNING: Make sure no one is in the vehicle and there is nothing

blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

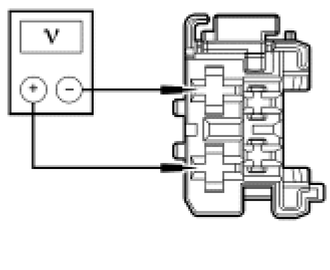


Fig. 22: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger seat front height motor C3074-1, circuit CPS35 (VT/GN), harness side and C3074-2, circuit CPS34 (GY/BU), while depressing the front height adjust switch up and down.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to H11.

H11 CHECK CIRCUIT CPS34 (GY/BU) FOR AN OPEN

- Disconnect: Passenger Seat Control Switch C3026

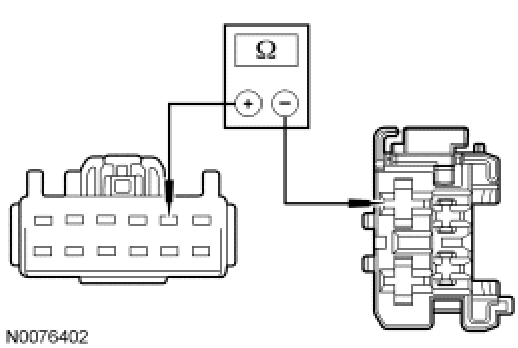


Fig. 23: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C3026-2, circuit CPS34 (GY/BU), harness side and passenger seat front height motor C3074-2, circuit CPS34 (GY/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to H12.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

H12 CHECK CIRCUIT CPS35 (VT/GN) FOR AN OPEN

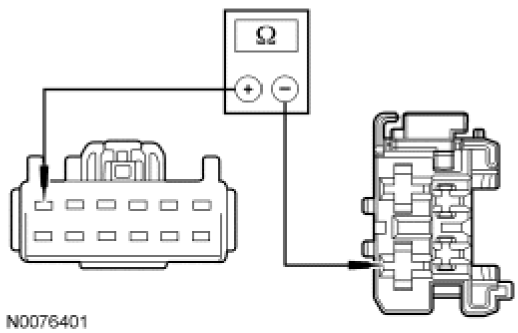


Fig. 24: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C3026-6, circuit CPS35 (VT/GN) harness side, and passenger seat front height motor C3074-1, circuit CPS35 (VT/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

H13 CHECK VOLTAGE TO THE PASSENGER SEAT RECLINER MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: Passenger Seat Recliner Motor C338

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

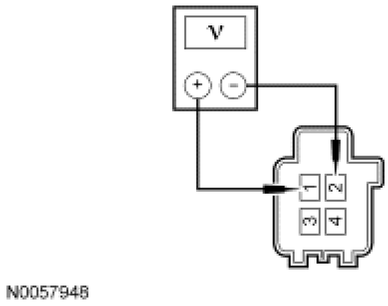


Fig. 25: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger seat recliner motor C338-2, circuit CPS39 (GY/YE), harness side and C338-1, circuit CPS40 (VT/GY), while pushing the recline switch forward and rearward.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new seat recliner motor. REFER to **Seat Recliner Motor**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to H14.

H14 CHECK CIRCUIT CPS39 (GY/YE) FOR AN OPEN

- Disconnect: Passenger Seat Control Switch C3026

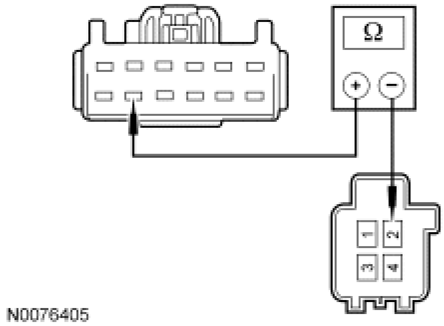


Fig. 26: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C3026-11, circuit CPS39 (GY/YE), harness side and passenger seat recliner motor C338-2, circuit CPS39 (GY/YE), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to H15.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

H15 CHECK CIRCUIT CPS40 (VT/GY) FOR AN OPEN

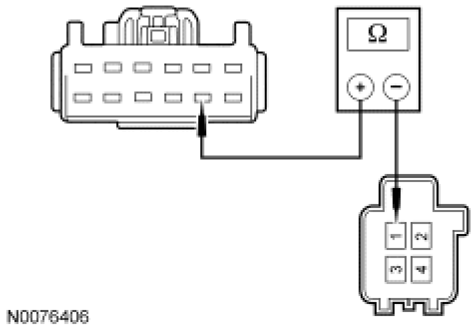


Fig. 27: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C3026-8, circuit CPS40 (VT/GY) harness side, and passenger seat recliner motor C338-1, circuit CPS40 (VT/GY), harness side.
- **Is the resistance less than 5 ohms between the passenger seat recliner motor and the passenger seat control switch?**

  YES : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test I: The Power Seat Does Not Move Horizontally/Vertically - Passenger

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Seats for schematic and connector information.

Normal Operation

The passenger seat control switch is powered by battery voltage on circuit SBB61 (GY/RD) and is supplied ground on circuit GD145 (BK/BU). When pressed, the seat control switch supplies voltage and ground to a power seat track motor. When pressed in the opposite direction, the seat control switch reverses the polarity to the same power seat track motor, which moves the seat in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). If a new seat track motor needs to be installed, it is necessary to install an entire power seat track.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Seat control switch
- Seat track motor (seat track)

PINPOINT TEST I: THE POWER SEAT DOES NOT MOVE HORIZONTALLY/VERTICALLY - PASSENGER

NOTE:	**The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

I1 CHECK THE HORIZONTAL MOTOR FOR CORRECT OPERATION

- Operate the passenger seat forward and rearward.
- **Will the seat move horizontally?**

  YES : Go to I5.

  NO : Go to I2.

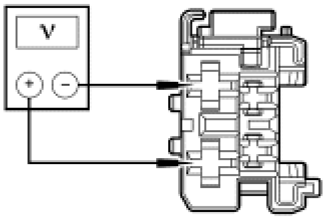
I2 CHECK VOLTAGE TO THE PASSENGER SEAT HORIZONTAL MOTOR

- Key in OFF position.

- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: Passenger Seat Horizontal Motor C332

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.



N0057525

Fig. 28: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger seat horizontal motor C332-1, circuit CPS38 (GN/BU), harness side and C332-2, circuit CPS33 (WH), harness side, while pushing the passenger seat control switch forward and rearward.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to I3.

I3 CHECK CIRCUIT CPS38 (GN/BU) FOR AN OPEN

- Disconnect: Passenger Seat Control Switch C355

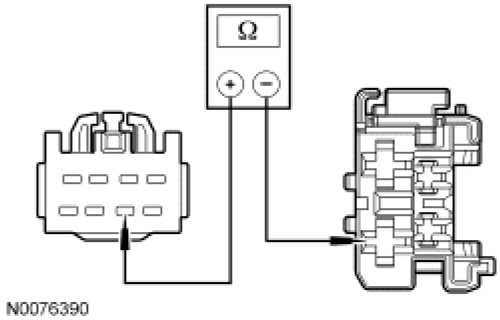


Fig. 29: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C355-6, circuit CPS38 (GN/BU), harness side and passenger seat horizontal motor C332-1, circuit CPS38 (GN/BU), harness side?
- **Is the resistance less than 5 ohms between the passenger seat horizontal motor and the passenger seat control switch?**

  YES : Go to I4.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

I4 CHECK CIRCUIT CPS33 (WH) FOR AN OPEN

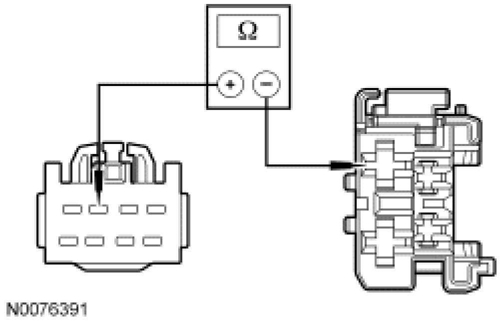


Fig. 30: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C355-3, circuit CPS33 (WH), harness side and passenger seat horizontal motor C332-2, circuit CPS33 (WH), harness side?
- **Is the resistance less than 5 ohms between the passenger seat horizontal motor and the passenger seat control switch?**

  YES : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

I5 DETERMINE THE SEAT HEIGHT ADJUST FAILURE

- Operate the seat front and rear height adjustments.
- **Does the seat front and rear height adjust up and down?**

  YES : If only the front height adjust motor operates, go to I6.

  If only the rear height adjust motor operates, go to I9.

  NO : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

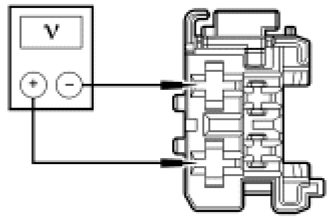
  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

I6 CHECK VOLTAGE TO THE PASSENGER SEAT REAR HEIGHT MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: Passenger Seat Rear Height Motor C3075

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.



N0057525

Fig. 31: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger seat rear height motor C3075-2, circuit CPS36 (YE/GY), harness side and C3075-1, circuit CPS37 (WH/BU), harness side, while depressing the rear height adjust switch up and down.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. TEST the system for normal operation.

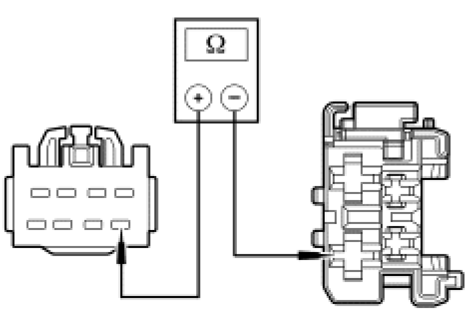
  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to I7.

I7 CHECK CIRCUIT CPS36 (YE/GY) FOR AN OPEN

- Disconnect: Passenger Seat Control Switch C355



N0076393

Fig. 32: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C355-5, circuit CPS36 (YE/GY), harness side and passenger seat rear height motor C3075-2, circuit CPS36 (YE/GY), harness side.
- **Is the resistance less than 5 ohms between the passenger seat rear height motor and the passenger seat control switch?**

YES : Go to I8.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

I8 CHECK CIRCUIT CPS37 (WH/BU) FOR AN OPEN

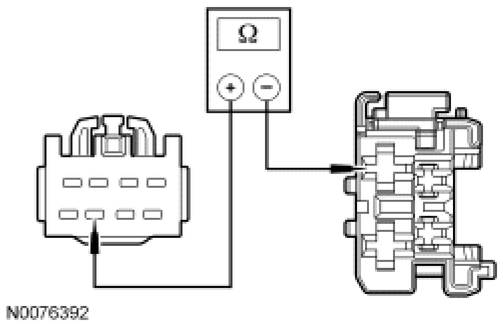


Fig. 33: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C355-7, circuit CPS37 (WH/BU), harness side and passenger seat rear height motor C3075-1, circuit CPS37 (WH/BU), harness side.
- **Is the resistance less than 5 ohms between the passenger seat rear height motor and the passenger seat control switch?**

  YES : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

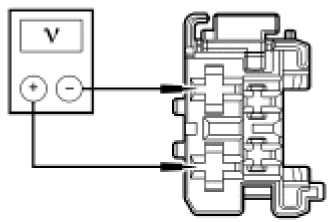
  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

I9 CHECK VOLTAGE TO THE PASSENGER SEAT FRONT HEIGHT MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: Passenger Seat Front Height Motor C3074

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.



N0057525

Fig. 34: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger seat front height motor C3074-1, circuit CPS35 (VT/GN), harness side and C3074-2, circuit CPS34 (GY/BU), while depressing the front height adjust switch up and down.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to I10.

I10 CHECK CIRCUIT CPS34 (GY/BU) FOR AN OPEN

- Disconnect: Passenger Seat Control Switch C355

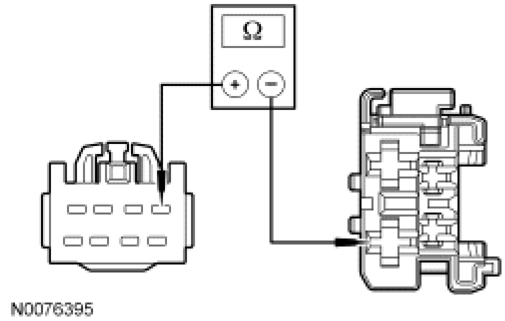


Fig. 35: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C355-1, circuit CPS34 (GY/BU), harness side and passenger seat front height motor C3074-2, circuit CPS34 (GY/BU), harness side.
- **Is the resistance less than 5 ohms between the passenger seat front height motor and the passenger seat control switch?**

  YES : Go to I11.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

I11 CHECK CIRCUIT CPS35 (VT/GN) FOR AN OPEN

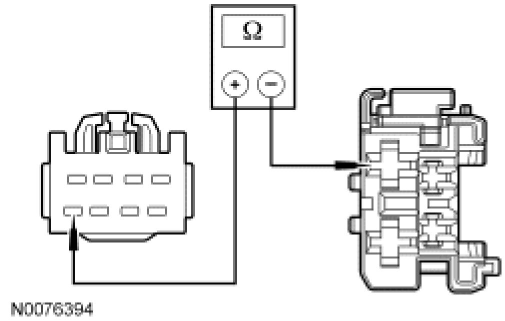


Fig. 36: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C355-8, circuit CPS35 (VT/GN) harness side, and passenger seat front height motor C3074-1, circuit CPS35 (VT/GN), harness side.
- **Is the resistance less than 5 ohms between the passenger seat front height motor and the passenger seat control switch?**

  YES : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test J: The Memory Seat is Inoperative/Does Not Operate Correctly - Does Not Operate Horizontally/Vertically/Recline, MKX

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Memory Seats for schematic and connector information.

Refer to appropriate COMPONENT TESTING article.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBP12 (GN/RD) and is supplied ground on circuit GD133 (BK). When pressed, the seat control switch supplies the voltage and ground to the applicable driver seat module (DSM) inputs. The DSM then supplies voltage and ground to the appropriate power seat track motor or power recline motor, based on the inputs received from the seat control switch. When pressed in the opposite direction, the seat control switch reverses the polarity to the DSM inputs, and the DSM likewise reverses polarity of the appropriate power seat track motor or power recliner motor circuits causing the seat or backrest to move in the opposite direction. There are 3 power seat track motors that combine to move the seat horizontally (forward/rearward) and vertically (front up/down and rear up/down). The seat backrest power recliner uses a single motor to move the seat backrest forward and rearward.

Battery voltage is supplied to DSM circuit SBB60 (GN/RD) and SBP12 (GN/RD). Ground is supplied to DSM circuit GD145 (BK/BU).

Each motor in the memory power seat track and power recliner contains a Hall-effect position sensor. The DSM supplies a signal supply circuit to each position sensor and a shared reference signal return circuit. Each position sensor sends a signal voltage back to the DSM used to monitor the position of the power seat and seat backrest. The DSM uses this information to return the seat to a stored pre-programmed position when pressing the memory SET switch or a remote entry transmitter. Refer to **Principles of Operation** or the Owner's Literature for information on programming the DSM for storing memory seat positions.

The following pinpoint test diagnoses a memory seat that does not operate in one or more directions when using the seat control switch. If the memory seat moves in all directions using the seat control switch, go to **Pinpoint Test K**.

DTC Description	Fault Trigger Conditions
• B1342 - ECU is Faulted	If a programming error is detected,

	the DTC is set.
• B1663 - Seat Driver Front Up/Down Motor Stalled • B1664 - Seat Driver Rear Up/Down Motor Stalled • B1665 - Seat Driver Forward/Backward Motor Stalled	During self-test, the driver seat module (DSM) attempts to operate the appropriate seat track motor and uses the motor's position sensor to monitor movement. If no motor movement is sensed, the DTC is set. The DSM will retry motor operation on the next activation of the seat control switch. If no movement continues to be monitored after 250 milliseconds, the DSM disables the output.
• B1666 - Seat Driver Recline Motor Stalled	During self-test, the DSM attempts to operate the recliner motor and uses the recliner motor position sensor to monitor movement. If no motor movement is sensed, the DTC is set. The DSM will retry motor operation on the next activation of the seat control switch. If no motor movement is still monitored after 250 milliseconds, the DSM disables the output.
• B1703 - Seat Driver Recline Forward Switch Circuit Short to Battery • B1707 - Seat Driver Recline Rearward Switch Circuit Short to Battery	If voltage is sensed on the switch input circuit during the DSM self-test, the DTC is set. If voltage is sensed on the input circuit for greater than 2 minutes, the DTC is set as continuous. With the DTC set, any input signal on the circuit is ignored.
• B1711 - Seat Driver Front Up Switch Circuit Short to Battery • B1715 - Seat Driver Front Down Switch Circuit Short to Battery	If voltage is sensed on the switch input circuit during the DSM self-test, the DTC is set. If voltage is sensed on the input circuit for greater than 2 minutes, the DTC is set as continuous. With the DTC set, any input signal on the circuit is ignored.
• B1719 - Seat Driver Forward Switch Circuit Short to Battery • B1723 - Seat Driver Rearward Switch Circuit Short to Battery	If voltage is sensed on the switch input circuit during the DSM self-test, the DTC is set. If voltage is sensed on the input circuit for greater than 2 minutes, the DTC is set as continuous. With the DTC set, any input signal on the circuit is

	ignored.
• B1727 - Seat Driver Rear Up Switch Circuit Short to Battery • B1731 - Seat Driver Rear Down Switch Circuit Short to Battery	If voltage is sensed on the switch input circuit during the DSM self-test, the DTC is set. If voltage is sensed on the input circuit for greater than 2 minutes, the DTC is set as continuous. With the DTC set, any input signal on the circuit is ignored.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Seat control switch
- Missing controller area network (CAN) status information (CAN communication message):
  - ignition switch status
  - gear selector position
- Memory power seat track
- Memory power recliner motor
- DSM

PINPOINT TEST J: THE MEMORY SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - DOES NOT OPERATE HORIZONTALLY/VERTICALLY/RECLINE, MKX

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

NOTE: **Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.**

J1 CHECK DSM GEAR SELECTED (TRANSGEAR) PID STATES

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/Driver Seat Module (DSM) PID: TRANSGEAR
- Operate the transmission gear selector in all positions while monitoring the following DSM PID TRANSGEAR states:

- D6_Park
- REV
- NTRL
- DRIVE5
- DRIVE1

- **Do the PID states agree with the selected positions?**

  YES : Go to J2.

  NO : To diagnose a transmission gear selector (PRNDL) status concern, REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article.

J2 CHECK DSM IGNITION SWITCH STATUS (IGN_SW) PID STATES

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM PID: IGN_SW
- Cycle the ignition switch in all positions while monitoring the following DSM IGN_SW PID states:
  - Off
  - Accessory
  - Run
  - Start
- **Do the PID states agree with the selected positions?**

  YES : Go to J3.

  NO : To diagnose an ignition switch status concern, REFER to **STEERING COLUMN SWITCHES** article.

J3 RETRIEVE DSM DTCs

- Operate the memory seat and memory mirrors in all directions through the full range of travel.
- Place the memory seat and memory mirrors in central travel positions.
- Enter the following diagnostic mode on the diagnostic tool: Self Test/DSM/Retrieve DTCs
- **Are any DSM DTCs retrieved?**

  YES : If DTCs B1663, B1664, B1665 and B1666 are all retrieved, go to J12.

  If DTC B1663, go to J22.

  If DTC B1664, go to J25.

  If DTC B1665, go to J28.

  If DTC B1666, go to J31.

  If DTC B1703, go to J5.

  If DTC B1707, go to J5.

  If DTC B1711, go to J5.

If DTC B1715, go to J5.

If DTC B1719, go to J5.

If DTC B1723, go to J5.

If DTC B1727, go to J5.

If DTC B1731, go to J5.

If DTC 1342, INSTALL a new DSM and CARRY OUT programmable module installation (PMI). REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

For any other DSM DTCs, REFER to the Driver Seat Module (DSM) DTC Chart in **MULTIFUNCTION ELECTRONIC MODULES** article.

NO : Go to J4.

J4 MONITOR THE DSM PIDs AND CHECK FOR CORRECT MEMORY SEAT SWITCH INPUTS

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM PIDs
  - Driver Power Seat Front Up/Down Switch (SFNT_SW)
  - Driver Power Seat Forward/Backward Switch (SFWD_SW)
  - Driver Power Seat Recline Switch Status (SRCL_SW)
  - Driver Power Seat Rear Up/Down Switch (SREARSW)
- Monitor DSM seat switch PIDs while activating the seat switch in all positions.
- **Do the PID states agree with the switch positions?**

  YES : Go to J11.

  NO : VERIFY smart junction box (SJB) fuse 12 (7.5A) is OK. If SJB fuse 12 (7.5A) fails while operating the seat control switch, DISCONNECT driver seat control switch C3016 and Go to J9.

  If OK, go to J5.

J5 CHECK THE SEAT CONTROL SWITCH

- Key in OFF position.
- Disconnect: Seat Control Switch C3016
- Check the seat control switch. Refer to appropriate COMPONENT TESTING article.
- **Is the seat control switch OK?**

  YES : Go to J6.

  NO : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J6 CHECK CIRCUIT SBP12 (GN/RD) FOR VOLTAGE TO THE SEAT CONTROL SWITCH

- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328

WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Measure the voltage between seat control switch C3016-5, circuit SBP12 (GN/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to J7.

NO : VERIFY SJB fuse 12 (7.5A) is OK, If OK, REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J7 CHECK CIRCUIT GD133 (BK) FOR AN OPEN

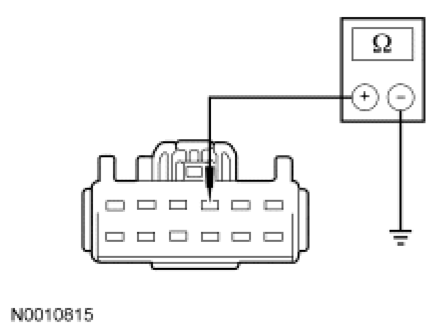


Fig. 37: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between seat control switch C3016-3, circuit GD133 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : Go to J8.

NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J8 CHECK SEAT CONTROL SWITCH TO DSM CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect: DSM C3299b
- Key in ON position.

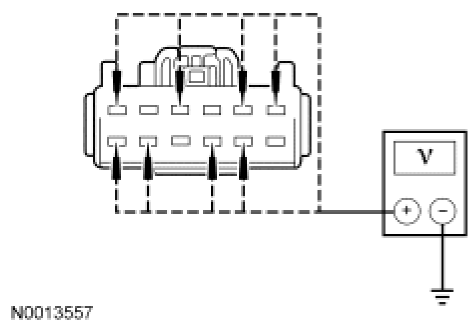


Fig. 38: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the following seat control switch C3016 pins, harness side and ground:

Connector - Pin	Circuit
C3016-1	CPS27 (BU/BN)
C3016-2	CPS25 (WH/VT)
C3016-4	CPS23 (GN/VT)
C3016-6	CPS24 (GY)
C3016-8	CPS30 (VT/BN)
C3016-9	CPS28 (GN)
C3016-11	CPS29 (WH/BN)
C3016-12	CPS26 (YE/BU)

- **Is voltage present on a circuit?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J9.

J9 CHECK SEAT CONTROL SWITCH TO DSM CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Seat Control Switch C3016

WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

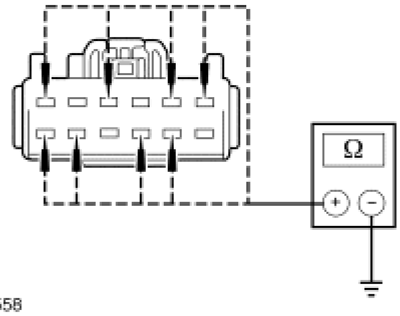


Fig. 39: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the following seat control switch C3016 pins, harness side and ground:

Connector - Pin	Circuit
C3016-1	CPS27 (BU/BN)
C3016-2	CPS25

	(WH/VT)
C3016-4	CPS23 (GN/VT)
C3016-6	CPS24 (GY)
C3016-8	CPS30 (VT/BN)
C3016-9	CPS28 (GN)
C3016-11	CPS29 (WH/BN)
C3016-12	CPS26 (YE/BU)

- **Are the resistances greater than 10,000 ohms?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J10.

J10 CHECK SEAT CONTROL SWITCH TO DSM CIRCUITS FOR AN OPEN

- Disconnect: DSM C3299b

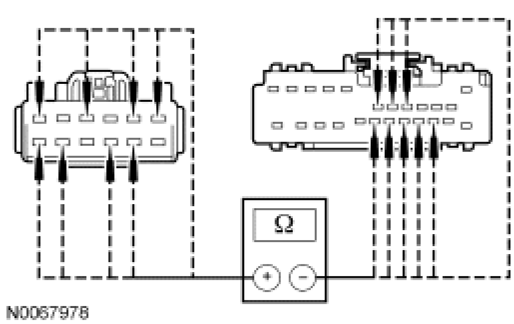


Fig. 40: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the following seat control switch C3016 pins, harness side and DSM C3299b pins, harness side:

Seat Control Switch Connector	Circuit	DSM Connector - Pin

- Pin		
C3016-1	CPS27 (BU/BN)	C3299b-17
C3016-2	CPS25 (WH/VT)	C3299b-18
C3016-4	CPS23 (GN/VT)	C3299b-16
C3016-6	CPS24 (GY)	C3299b-6
C3016-8	CPS30 (VT/BN)	C3299b-7
C3016-9	CPS28 (GN)	C3299b-15
C3016-11	CPS29 (WH/BN)	C3299b-19
C3016-12	CPS26 (YE/BU)	C3299b-5

- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J11 CHECK THE DSM FOR CORRECT OUTPUTS USING A SCAN TOOL AND DSM ACTIVE COMMANDS

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM PIDs
  - Front Motor Up (FRONT_UP)
  - Front Motor Down (FRONT_DWN)
  - Rear Motor Up (REAR_UP)
  - Rear Motor Down (REAR_DWN)
  - Horizontal Motor Forward (HORZ_FWD)
  - Horizontal Motor Backward (HORZ_BWD)
  - Recline Motor Forward (RECL_FWD)
  - Recline Motor Backward (RECL_BWD)

- Toggle the DSM active commands ON and OFF while monitoring the seat movement.
- **Does the driver seat operate correctly?**

  YES : INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

  NO : If no seat movement, go to J12.

  If no front vertical seat movement, go to J22.

  If no rear vertical seat movement, go to J25.

  If no horizontal seat movement, go to J28.

  If no recline seat movement, go to J31.

J12 CHECK DSM CIRCUIT SBB60 (GN/RD) FOR VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: DSM C3299a

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

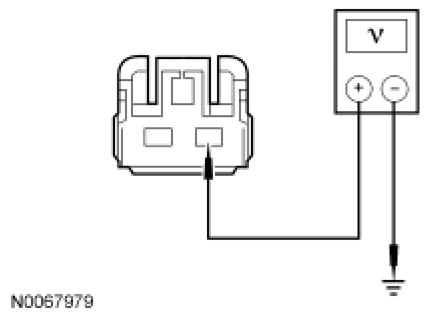


Fig. 41: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DSM C3299a-1, circuit SBB60 (GN/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to J13.

NO : VERIFY battery junction box (BJB) fuse 60 (30A) is OK. If OK, REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J13 CHECK CIRCUITS GD145 (BK/BU) AND GD133 (BK) FOR AN OPEN

- Disconnect: DSM C3299c

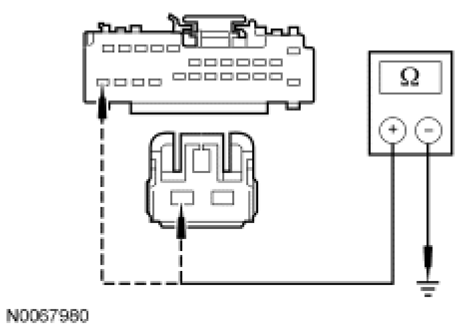


Fig. 42: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299a-2, circuit GD145 (BK/BU), harness side and ground; and between DSM C3299b-24, circuit GD133 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : Go to J14.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J14 CHECK CIRCUITS CPS03 (VT/GY) AND CPS02 (GY/YE) FOR A SHORT TO GROUND

- Disconnect: DSM C3299b

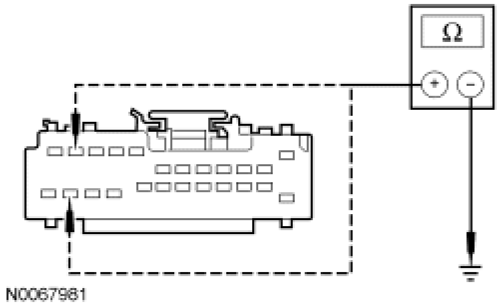


Fig. 43: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-23, circuit CPS03 (VT/GY), harness side and ground; and between DSM C3299b-11, circuit CPS02 (GY/YE), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to J16.

  NO : Go to J15.

J15 CHECK FRONT HEIGHT POWER SEAT MOTOR CIRCUITS CPS03 (VT/GY) AND CPS02 (GY/YE) FOR A SHORT TO GROUND

- Disconnect: Front Height Power Seat Motor C382

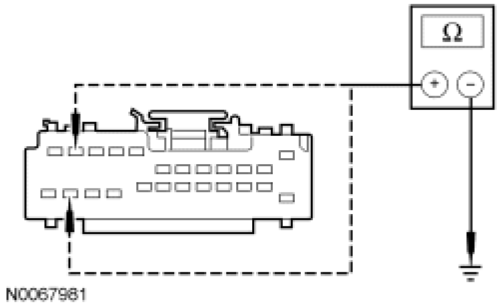


Fig. 44: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-23 circuit CPS03 (VT/GY), harness side and ground; and between DSM C3299b-11, circuit CPS02 (GY/YE), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J16 CHECK CIRCUITS CPS05 (BU/WH) AND CPS04 (YE/OG) FOR A SHORT TO GROUND

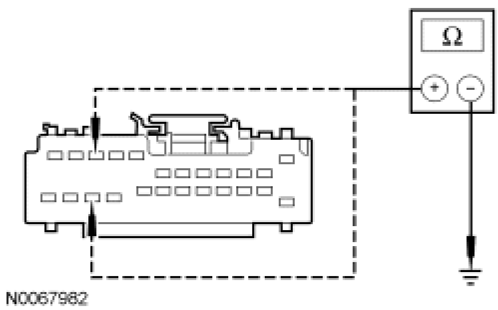


Fig. 45: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-22, circuit CPS05 (BU/WH), harness side and ground; and between DSM C3299b-10, circuit CPS04 (YE/OG), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to J18.

  NO : Go to J17.

J17 CHECK THE REAR HEIGHT POWER SEAT MOTOR CIRCUITS CPS05 (BU/WH) AND CPS04 (YE/OG) FOR A SHORT TO GROUND

- Disconnect: Rear Height Power Seat Motor C363

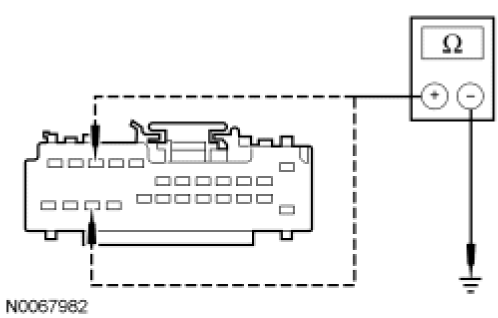


Fig. 46: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-22, circuit CPS05 (BU/WH), harness side and ground; and between DSM C3299b-10, circuit CPS04 (YE/OG), harness side and ground.

- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J18 CHECK CIRCUITS CPS06 (GN/WH) AND CPS01 (GN/BU) FOR A SHORT TO GROUND

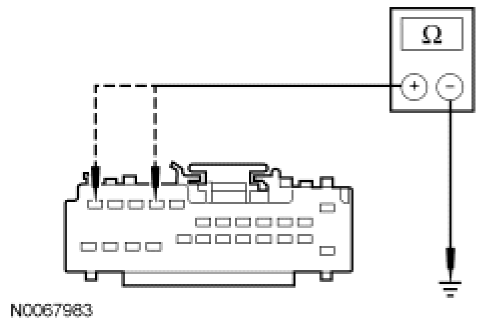


Fig. 47: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-9, circuit CPS06 (GN/WH), harness side and ground; and between DSM C3299b-12, circuit CPS01 (GN/BU), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to J20.

  NO : Go to J19.

J19 CHECK THE HORIZONTAL POWER SEAT MOTOR CIRCUITS CPS06 (GN/WH) AND CPS01 (GN/BU) FOR A SHORT TO GROUND

- Disconnect: Horizontal Power Seat Motor C362

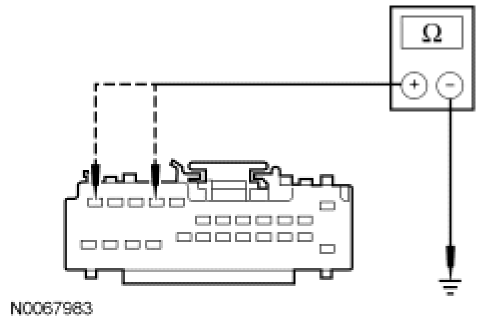


Fig. 48: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-9, circuit CPS06 (GN/WH), harness side and ground; and between DSM C3299b-12, circuit CPS01 (GN/BU), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J20 CHECK CIRCUITS CPS07 (GY/BN) AND CPS08 (VT/OG) FOR A SHORT TO GROUND

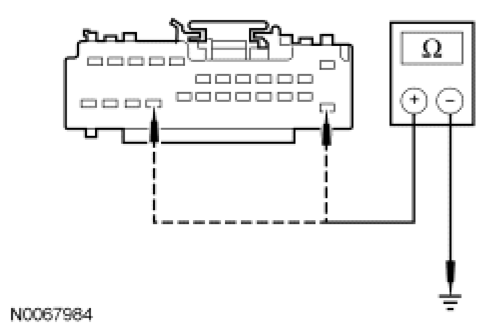


Fig. 49: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-13, circuit CPS07 (GY/BN), harness side and ground; and between DSM C3299b-21, circuit CPS08 (VT/OG), harness side and ground.

- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J21.

J21 CHECK THE DRIVER POWER SEAT RECLINER MOTOR CIRCUITS CPS07 (GY/BN) AND CPS08 (VT/OG) FOR A SHORT TO GROUND

- Disconnect: Driver Power Seat Recliner Motor C368

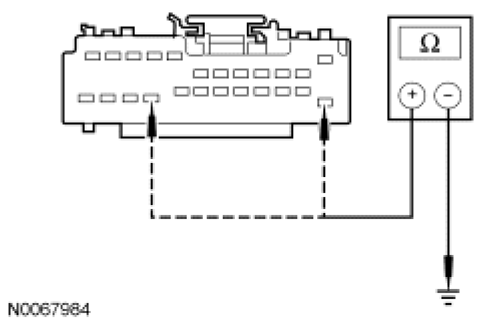


Fig. 50: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-13, circuit CPS07 (GY/BN), harness side and ground; and between DSM C3299b-21, circuit CPS08 (VT/OG), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new seat recliner motor. REFER to **Seat Recliner Motor**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J22 CHECK THE FRONT HEIGHT POWER SEAT MOTOR FOR CORRECT OPERATION

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in

the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Front Height Power Seat Motor C382

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM PIDs
    - Front Motor Up (FRONT_UP)
    - Front Motor Down (FRONT_DWN)

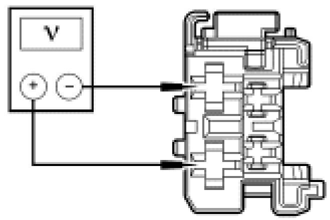


Fig. 51: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between front height power seat motor C382-2, circuit CPS02 (GY/YE) and C382-1, circuit CPS03 (VT/GY), harness side while toggling DSM active commands front motor up and front motor down, ON and OFF.
- **Is the voltage greater than 10 volts when command ON in both directions and no voltage present when commanded OFF?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J23.

J23 CHECK CIRCUITS CPS03 (VT/GY) AND CPS02 (GY/YE) FOR A SHORT TO VOLTAGE

- Key in OFF position.

- Disconnect: DSM C3299b
- Key in ON position.

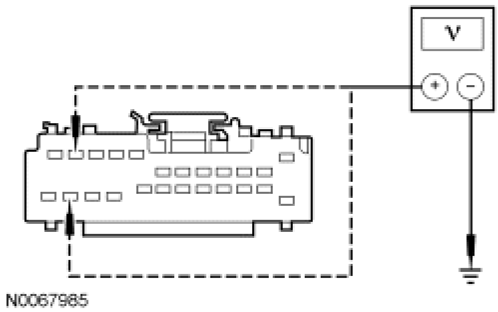


Fig. 52: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DSM C3299b-23, circuit CPS03 (VT/GY), harness side and ground; and between DSM C3299b-11, circuit CPS02 (GY/YE), harness side and ground.
- **Is voltage present on a circuit?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J24.

J24 CHECK CIRCUITS CPS03 (VT/GY) AND CPS02 (GY/YE) FOR AN OPEN

- Key in OFF position.

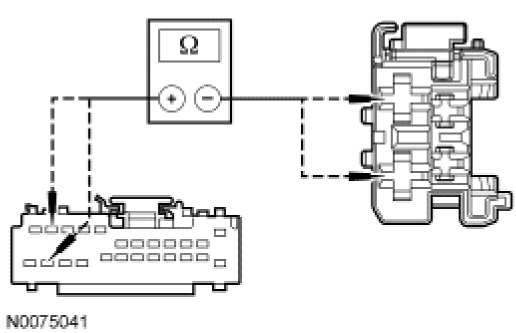


Fig. 53: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-11, circuit CPS02 (GY/YE), harness side and front height power seat motor C382-2, circuit CPS02 (GY/YE), harness side; and between DSM C3299b-23, circuit CPS03 (VT/GY), harness side and front height power seat motor C382-1, circuit CPS03 (VT/GY), harness side.

- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J25 CHECK THE REAR HEIGHT MOTOR FOR CORRECT OPERATION

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Rear Height Power Seat Motor C363

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM PIDs
  - Rear Motor Up (REAR_UP)
  - Rear Motor Down (REAR_DWN)

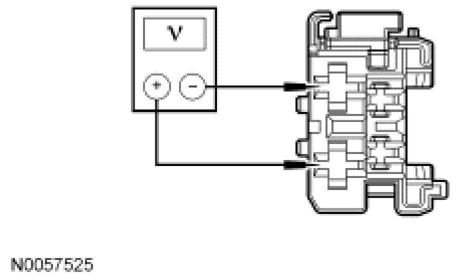


Fig. 54: Measuring Voltage

Courtesy of FORD MOTOR CO.

- Measure the voltage between rear height power seat motor C363-2, circuit CPS04 (YE/OG), harness side and C363-1, circuit CPS05 (BU/WH), harness side while toggling DSM active commands rear motor up and rear motor down, ON and OFF.
- **Is the voltage greater than 10 volts when commanded ON in both directions and no voltage present when commanded OFF?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J26.

J26 CHECK CIRCUITS CPS05 (BU/WH) AND CPS04 (YE/OG) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DSM C3299b
- Key in ON position.

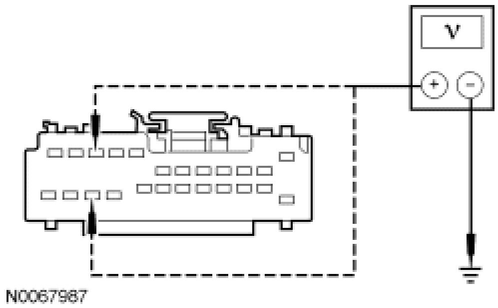


Fig. 55: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DSM C3299b-22, circuit CPS05 (BU/WH), harness side and ground; and between DSM C3299b-10, circuit CPS04 (YE/OG), harness side and ground.
- **Is voltage present on a circuit?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J27.

J27 CHECK CIRCUITS CPS05 (BU/WH) AND CPS04 (YE/OG) FOR AN OPEN

- Key in OFF position.

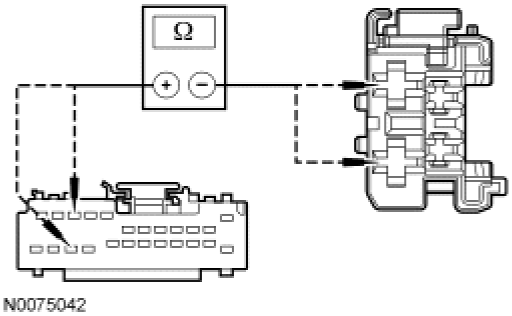


Fig. 56: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-22, circuit CPS05 (BU/WH), harness side and rear height power seat motor C363-1, circuit CPS05 (BU/WH), harness side; and between DSM C3299b-10, circuit CPS04 (YE/OG), harness side and rear height power seat motor C363-2, circuit CPS04 (YE/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J28 CHECK THE HORIZONTAL MOTOR FOR CORRECT OPERATION

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Horizontal Power Seat Motor C362

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM PIDs
  - Horizontal Motor Forward (HORZ_FWD)
  - Horizontal Motor Backward (HORZ_BWD)

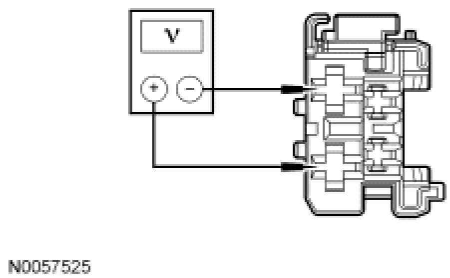


Fig. 57: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between horizontal power seat motor C362-2, circuit CPS01 (GN/BU) and C362-1, circuit CPS06 (GN/WH), harness side while toggling DSM active commands horizontal motor forward and horizontal motor backward, ON and OFF.
- **Is the voltage greater than 10 volts when command ON in both directions and no voltage present when commanded OFF?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J29.

J29 CHECK CIRCUITS CPS01 (GN/BU) AND CPS06 (GN/WH) FOR A SHORT TO VOLTAGE

- Disconnect: DSM C3299b
- Key in ON position.

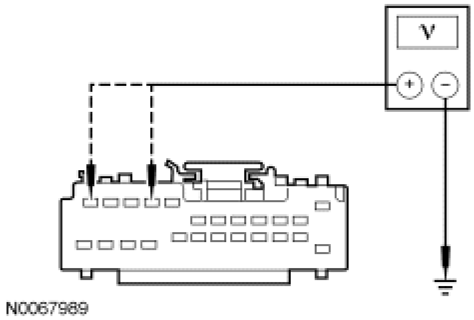


Fig. 58: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DSM C3299b-9, circuit CPS06 (GN/WH), harness side and ground; and between DSM C3299b-12, circuit CPS01 (GN/BU), harness side and ground.
- **Is voltage present on a circuit?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J30.

J30 CHECK CIRCUITS CPS01 (GN/BU) AND CPS06 (GN/WH) FOR AN OPEN

- Key in OFF position.

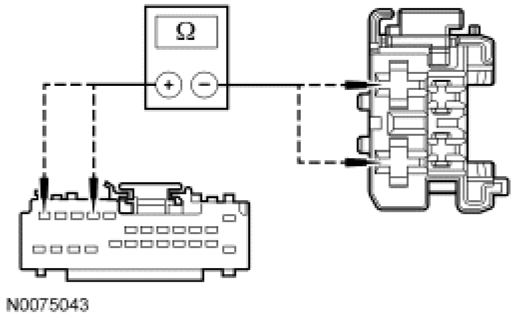


Fig. 59: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-9, circuit CPS06 (GN/WH), harness side and horizontal power seat motor C362-1, circuit CPS06 (GN/WH), harness side; and between DSM C3299b-12, circuit CPS01 (GN/BU), harness side and horizontal power seat motor C362-2, circuit CPS01 (GN/BU), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J31 CHECK THE DRIVER SEAT POWER RECLINER MOTOR FOR CORRECT OPERATION

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Driver Seat Power Recliner Motor C368

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM PIDs
  - Recline Motor Forward (RECL_FWD)
  - Recline Motor Backward (RECL_BWD)

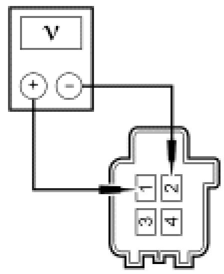


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Fig. 60: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat power recliner motor C368-1, circuit CPS08 (VT/OG) and C368-2, circuit CPS07 (GY/BN), harness side while toggling DSM active commands recline motor forward and recline motor backward, ON and OFF.

- **Is the voltage greater than 10 volts when command ON in both directions and no voltage present when commanded OFF?**

  YES : INSTALL a new seat recliner motor. REFER to **Seat Recliner Motor**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J32.

J32 CHECK CIRCUITS CPS07 (GY/BN) AND CPS08 (VT/OG) FOR A SHORT TO VOLTAGE

- Disconnect: DSM C3299b

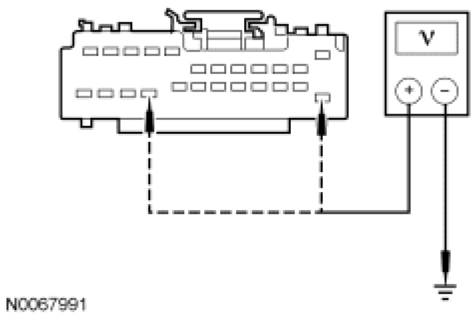

Fig. 61: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DSM C3299b-13, circuit CPS07 (GY/BN), harness side and ground; and between DSM C3299b-21, circuit CPS08 (VT/OG), harness side and ground.
- **Is voltage present on a circuit?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J33.

J33 CHECK CIRCUITS CPS07 (GY/BN) AND CPS08 (VT/OG) FOR AN OPEN

- Key in OFF position.

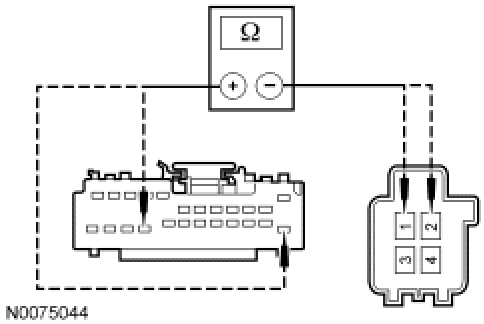

Fig. 62: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-13, circuit CPS07 (GY/BN), harness side and recliner power seat motor C368-2, circuit CPS07 (GY/BN), harness side; and between DSM C3299b-21, circuit CPS08 (VT/OG), harness side and recliner power seat motor C368-1, circuit CPS08 (VT/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test K: The Memory Seat Does Not Operate Correctly - Does Not Operate Using the Memory SET Switch, MKX

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Memory Seats for schematic and connector information.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBP12 (GN/RD) and is supplied ground on circuit GD133 (BK). When pressed, the seat control switch supplies the voltage and ground to the applicable driver seat module (DSM) inputs. The DSM then supplies voltage and ground to the appropriate power seat track motor or power recline motor, based on the inputs received from the seat control switch. When pressed in the opposite direction, the seat control switch reverses the polarity to the DSM inputs, and the DSM likewise reverses polarity of the appropriate power seat track motor or power recliner motor circuits causing the seat or backrest to move in the opposite direction. There are 3 power seat track motors that combine to move the seat horizontally (forward/rearward) and vertically (front up/down and rear up/down). The seat backrest power recliner uses a single motor to move the seat backrest forward and rearward.

Battery voltage is supplied to DSM circuit SBB60 (GN/RD) and SBP12 (GN/RD). Ground is supplied to DSM circuit GD145 (BK/BU).

Each motor in the memory power seat track and power recliner contains a Hall-effect position sensor. The DSM supplies a signal supply circuit to each position sensor and a shared reference signal return circuit. Each position sensor sends a signal voltage back to the DSM used to monitor the position of the power seat and seat backrest. The DSM uses this information to return the seat to a stored pre-programmed position when pressing the memory SET switch or a remote entry transmitter. Refer to **Principles of Operation** or the Owner's Literature for information on programming the DSM for storing memory seat positions.

The following pinpoint test diagnoses a memory seat that does not operate correctly using the memory SET switch. If the memory seat does not move in all directions using the seat control switch, go to **Pinpoint Test J**.

DTC Description	Fault Trigger Conditions
• B1342 - ECU is Faulted	If a programming error is detected, the DTC is set.
• B1530 - Memory SET Switch Circuit Short to Ground • B1534 - Memory 1 Switch Circuit Short to Ground • B1538 - Memory 2 Switch Circuit Short to Ground	If any activity is sensed on the switch input circuit during the DSM self-test, the DTC is set. If activity is sensed on the input circuit for greater than 2 minutes, the DTC is set as continuous. With the DTC set, any input signal on the circuit is ignored.
• B1663 - Seat Driver Front Up/Down Motor Stalled • B1664 - Seat Driver Rear Up/Down Motor Stalled • B1665 - Seat Driver Forward/Backward Motor Stalled	During self-test, the DSM attempts to operate the appropriate seat track motor and uses the motor's position sensor to monitor movement. If no motor movement is sensed, the DTC is set. The DSM will retry motor operation on the next activation of the seat control switch. If no movement continues to be monitored after 250 milliseconds, the DSM disables the output.
• B1666 - Seat Driver Recline Motor Stalled	During self-test, the DSM attempts to operate the recliner motor and uses the recliner motor position sensor to monitor movement. If no motor movement is sensed, the DTC is set. The DSM will retry motor operation on the next activation of the seat control switch. If no motor movement is still monitored after 250 milliseconds, the DSM disables

	the output.
• B1952 - Seat Rear Up/Down Position Feedback Circuit Short to Battery • B1956 - Seat Front Up/Down Position Feedback Circuit Short to Battery • B1960 - Seat Recline Forward/Backward Position Feedback Circuit Short to Battery • B1964 - Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Battery	If a short to voltage condition is present on the affected motor's position sensor (Hall-effect) feedback circuit, the DTC is set. After a DTC is set, a memory recall is not possible but the seat control switch can operate the associated motor in one second increments.
• B1953 - Seat Rear Up/Down Position Feedback Circuit Short to Ground • B1957 - Seat Front Up/Down Position Feedback Circuit Short to Ground • B1961 - Seat Recline Forward/Backward Position Feedback Circuit Short to Ground • B1965 - Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Ground	If a short to ground condition is present on the affected motor's position sensor (Hall-effect) feedback circuit, the DTC is set. After a DTC is set, a memory recall is not possible but the seat control switch can operate the associated motor in one second increments.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Faulty memory SET switch
- Missing controller area network (CAN) status information (CAN communication message):
  - ignition switch status
  - gear selector position
- Remote entry transmitter
- Memory power seat track
- Memory recliner motor
- DSM

PINPOINT TEST K: THE MEMORY SEAT DOES NOT OPERATE CORRECTLY - DOES NOT OPERATE USING THE MEMORY SET SWITCH, MKX

NOTE:	**The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**
NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

NOTE: Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.

K1 CHECK DSM GEAR SELECTED (TRANSGEAR) PID STATES

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/Driver Seat Module (DSM) PID: TRANSGEAR
- Operate the transmission gear selector in all positions while monitoring the following DSM PID TRANSGEAR states:
  - D6_Park
  - REV
  - NTRL
  - DRIVE5
  - DRIVE1
- **Do the PID states agree with the selected positions?**

  YES : Go to K2.

  NO : To diagnose a transmission gear selector (PRNDL) status concern, REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article.

K2 CHECK DSM IGNITION SWITCH STATUS (IGN_SW) PID STATES

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/Driver Seat Module (DSM) PID: IGN_SW
- Cycle the ignition switch in all positions while monitoring the following DSM IGN_SW PID states:
  - Off
  - Accessory
  - Run
  - Start
- **Do the PID states agree with the selected positions?**

  YES : Go to K3.

  NO : To diagnose an ignition switch status concern, REFER to **STEERING COLUMN SWITCHES** article.

K3 RETRIEVE DSM DTCs

- Operate the memory seat and memory mirrors in all directions through the full range of travel.
- Place the memory seat and memory mirrors in central travel positions.
- Enter the following diagnostic mode on the diagnostic tool: Driver Seat Module (DSM) Self-Test/Retrieve DTCs
- **Are any DSM DTCs retrieved?**

  YES : If DTCs B1952, B1956, B1960 and B1964 are all retrieved, go to K10.

If DTCs B1953, B1957, B1961 and B1965 are all retrieved, go to K10.

If DTC B1530, go to K5.

If DTC B1534, go to K5.

If DTC B1538, go to K5.

If DTC B1663, go to K11.

If DTC B1664, go to K14.

If DTC B1665, go to K17.

If DTC B1666, go to K20.

If DTC B1952, go to K14.

If DTC B1953, go to K14.

If DTC B1956, go to K11.

If DTC B1957, go to K11.

If DTC B1960, go to K20.

If DTC B1961, go to K20.

If DTC B1964, go to K17.

If DTC B1965, go to K17.

If DTC 1342, INSTALL a new DSM and CARRY OUT programmable module installation (PMI). REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

For any other DSM DTCs, REFER to the **Driver Seat Module (DSM) DTC Chart**.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : Go to K4.

K4 MONITOR THE DSM PIDs AND CHECK THE DSM FOR CORRECT MEMORY SET SWITCH INPUTS

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM PIDs

- Memory 1 recall switch status (MEM_1)
- Memory 2 recall switch status (MEM_2)
- Memory set switch status (MEM_S)

- Monitor the DSM PIDs while activating the memory SET switch, recall 1 and recall 2 buttons.
- **Do the PID states agree with the switch button positions?**

  YES : Go to K10.

  NO : Go to K5.

K5 CHECK THE MEMORY SET SWITCH

- Key in OFF position.
- Disconnect: Memory SET Switch C503

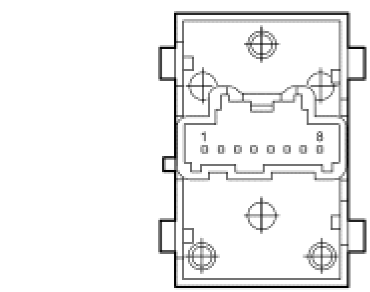

Fig. 63: Identifying Memory Set Switch Terminals
Courtesy of FORD MOTOR CO.

- Use the following table and illustration to check the memory SET switch. Measure the resistance between the memory SET switch pins, component side, while pressing the indicated switch buttons and compare the results to the table.

Switch Button	Pins	Ohms
Memory SET 1	7 and 2	Less than 7
Memory SET 2	7 and 6	Less than 7
Memory SET	7 and 5	Less than 7

NOTE: Refer to multi-meter user's manual for testing diodes.

- Use the following table and preceding illustration. Using the diode testing meter function, connect the meter leads to the memory SET switch pins, component side. Measure the voltages and compare the results to the table, to check the switch LED indicator.

Positive Lead	Negative Lead	Volts
Pin 1	Pin 7	Greater than 0.3
Pin 7	Pin 1	OL

- **Is the memory SET switch OK?**

  YES : Go to K6.

  NO : INSTALL a new memory SET switch. REFER to **Memory Set Switch**. REPEAT the self-test. CLEAR the DTCs.

K6 CHECK CIRCUIT GD133 (BK) TO THE MEMORY SET SWITCH FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

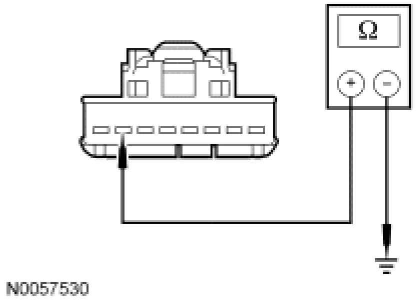

Fig. 64: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between memory SET switch C503-7, circuit GD133 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : Go to K7.

NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

K7 CHECK CIRCUITS CPS14 (GY/VT), CPS15 (VT/WH) AND CPS16 (YE) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DSM C3299c
- Key in ON position.

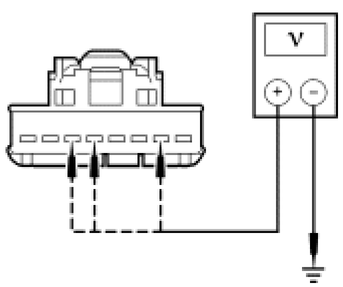

Fig. 65: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the following memory SET switch C503 pins, harness side and ground:

Connector - Pin	Circuit
C503-2	CPS15 (VT/WH)
C503-5	CPS14 (GY/VT)
C503-6	CPS16 (YE)

- **Is voltage present on any circuit?**

YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : Go to K8.

K8 CHECK CIRCUITS CPS14 (GY/VT), CPS15 (VT/WH) AND CPS16 (YE) FOR A SHORT TO GROUND

- Key in OFF position.

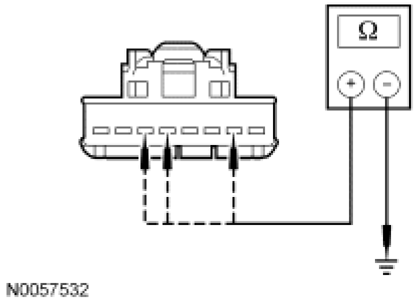

Fig. 66: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the resistance between the following memory SET switch C503 pins, harness side and ground:

Connector - Pin	Circuit
C503-2	CPS15 (VT/WH)
C503-5	CPS14 (GY/VT)
C503-6	CPS16 (YE)

- **Are the resistances greater than 10,000 ohms?**

YES : Go to K9.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

K9 CHECK CIRCUITS CPS14 (GY/VT), CPS15 (VT/WH) AND CPS16 (YE) FOR AN OPEN

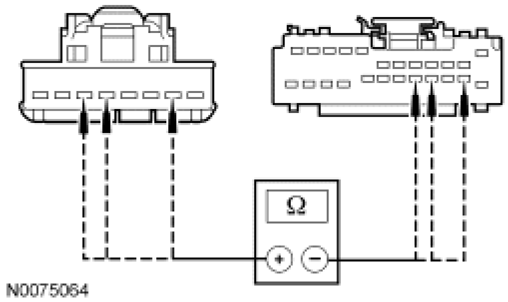

Fig. 67: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the following memory SET switch C503 pins and DSM C3299c pins:

Memory SET Switch C503 - Pin	Circuit	DSM C3299c - Pin
C503-2	CPS15 (VT/WH)	C3299c-16
C503-5	CPS14 (GY/VT)	C3299c-14
C503-6	CPS16 (YE)	C3299c-17

- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

K10 MONITOR THE DSM PIDs

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM PIDs
  - Driver Mirror Left/Right Sensor Pinpoint (DMIR_H)

- Driver Mirror Up/Down Sensor Pinpoint (DMIR_V)
- Pedal sensor (PEDLFWD)
- Passenger Power Mirror Horizontal Sense (PMIR_H)
- Passenger Power Mirror Vertical Sense (PMIR_V)
- Driver Power Seat Front Up/Down Sense (SFNT_MT)
- Driver Power Seat Forward/Backward Sense (SFWD_MT)
- Driver Power Seat Recline Sense (SRCL_MT)
- Driver Power Seat Rear Up/Down Sense (SREARMT)

- Operate the memory seat and memory mirrors in all directions through the full range of travel while monitoring the PIDs.
- **Does each PID indicate the sensor is operational throughout each associated motor's full range of travel?**

  YES : INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If the front height PID indicates not sensed, go to K11.

  If the rear height PID indicates not sensed, go to K14.

  If the horizontal PID indicates not sensed, go to K17.

  If the recline PID indicates not sensed, go to K20.

  For a memory mirror sensor concern, REFER to **REAR VIEW MIRRORS** article.

  For a memory adjustable pedal sensor concern, REFER to **BRAKE SYSTEM - GENERAL INFORMATION** article.

K11 CHECK CIRCUITS RPS13 (GN/OG) AND VPS10 (BU/GN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: DSM C3299b
- Disconnect: Driver Seat Front Height Motor C382

WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the

battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.

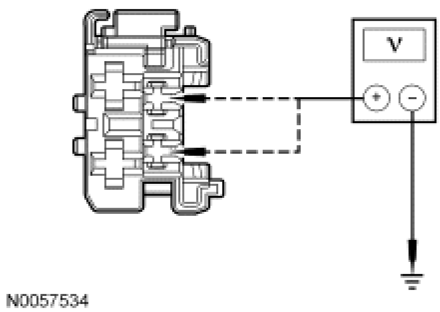

Fig. 68: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat front height motor C382-3, circuit RPS13 (GN/OG), harness side and ground; and between driver seat front height motor C382-4, circuit VPS10 (BU/GN), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to K12.

K12 CHECK CIRCUITS RPS13 (GN/OG) AND VPS10 (BU/GN) FOR A SHORT TO GROUND

- Key in OFF position.

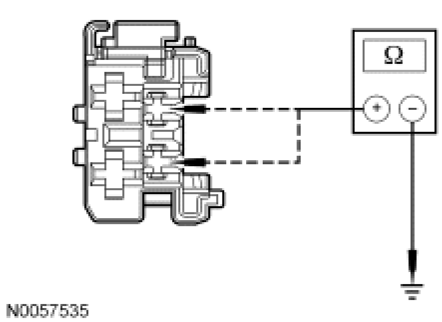

Fig. 69: Measuring Resistance

Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat front height motor C382-3, circuit RPS13 (GN/OG), harness side and ground; and between driver seat front height motor 382-4, circuit VPS10 (BU/GN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to K13.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

K13 CHECK CIRCUITS RPS13 (GN/OG) AND VPS10 (BU/GN) FOR AN OPEN

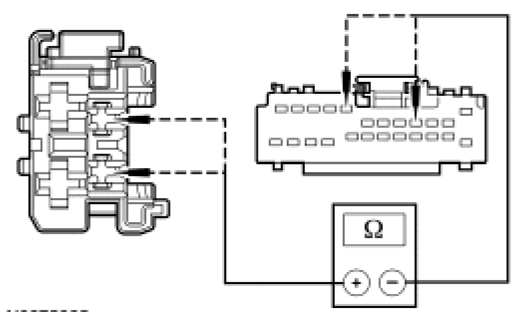

Fig. 70: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat front height motor C382-3, circuit RPS13 (GN/OG), harness side and DSM C3299b-8, circuit RPS13 (GN/OG), harness side; and between driver seat front height motor C382-4, circuit VPS10 (BU/GN), harness side and DSM C3299b-4, circuit VPS10 (BU/GN), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

K14 CHECK CIRCUITS RPS13 (GN/OG) AND VPS11 (GN/BN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: DSM C3299b
- Disconnect: Driver Seat Rear Height Motor C363

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.

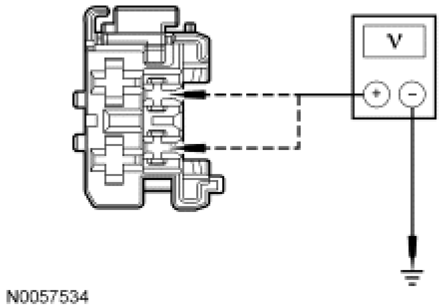

Fig. 71: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat rear height motor C363-3, circuit RPS13 (GN/OG), harness side and ground; and between driver seat rear height motor C363-4, circuit VPS11 (GN/BN), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to K15.

K15 CHECK CIRCUITS RPS13 (GN/OG) AND VPS11 (GN/BN) FOR A SHORT TO GROUND

- Key in OFF position.

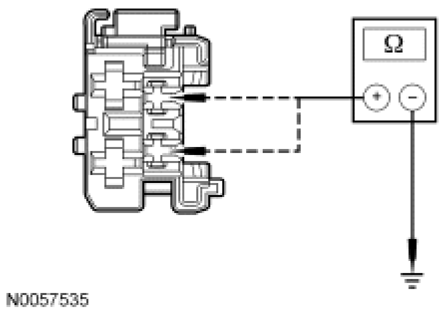

Fig. 72: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat rear height motor C363-3, circuit RPS13 (GN/OG), harness side and ground; and between driver seat rear height motor C363-4, circuit VPS11 (GN/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to K16.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

K16 CHECK CIRCUITS RPS13 (GN/OG) AND VPS11 (GN/BN) FOR AN OPEN

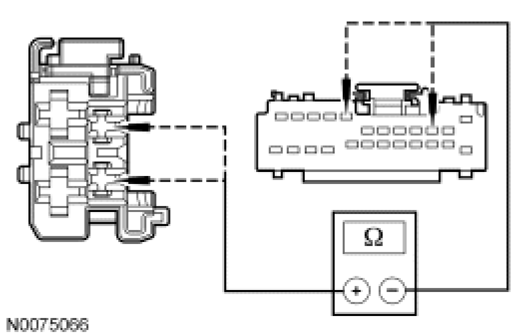

Fig. 73: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat rear height motor C363-3, circuit RPS13 (GN/OG), harness side and DSM C3299b-8, circuit RPS13 (GN/OG), harness side; and between driver seat rear height motor C363-4, circuit VPS11 (GN/BN), harness side and DSM C3299b-3, circuit VPS11 (GN/BN), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the circuit(s) in question. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

K17 CHECK CIRCUITS RPS13 (GN/OG) AND VPS09 (BN/BU) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: DSM C3299b
- Disconnect: Driver Seat Horizontal Motor C362

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.

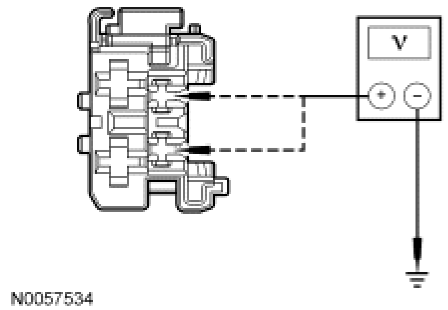

Fig. 74: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat horizontal motor C362-3, circuit RPS13 (GN/OG), harness side and ground; and between driver seat horizontal motor C362-4, circuit VPS09 (BN/BU), harness side and ground.
- **Is any voltage present?**

YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : Go to K18.

K18 CHECK CIRCUITS RPS13 (GN/OG) AND VPS09 (BN/BU) FOR A SHORT TO GROUND

- Key in OFF position.

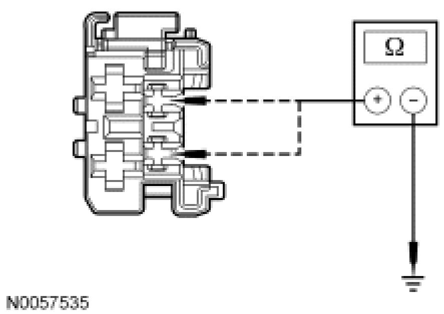

Fig. 75: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat horizontal motor C362-3, circuit RPS13 (GN/OG), harness side and ground; and between driver seat horizontal motor C362-4, circuit VPS09 (BN/BU), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to K19.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

K19 CHECK CIRCUITS RPS13 (GN/OG) AND VPS09 (BN/BU) FOR AN OPEN

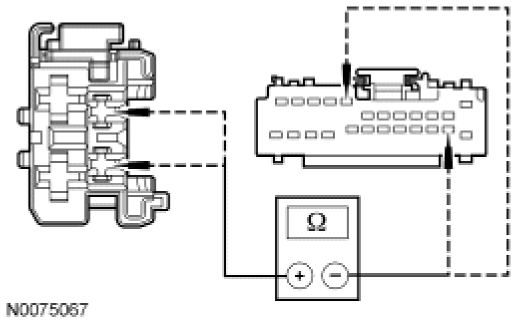

Fig. 76: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat horizontal motor C362-3, circuit RPS13 (GN/OG), harness side and DSM C3299b-8, circuit RPS13 (GN/OG), harness side; and between driver seat horizontal motor C362-4, circuit VPS09 (BN/BU), harness side and DSM C3299b-14, circuit VPS09 (BN/BU), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

K20 CHECK CIRCUITS RPS13 (GN/OG) AND VPS12 (GY/OG) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: DSM C3299b
- Disconnect: Driver Seat Recliner Motor C368

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.

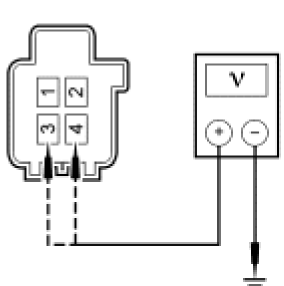

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Fig. 77: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat recliner motor C368-3, circuit RPS13 (GN/OG), harness side and ground; and between driver seat recliner motor C368-4, circuit VPS12 (GY/OG), harness side and ground.
- **Is voltage present on either circuit?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to K21.

K21 CHECK CIRCUITS RPS13 (GN/OG) AND VPS12 (GY/OG) FOR A SHORT TO GROUND

- Key in OFF position.

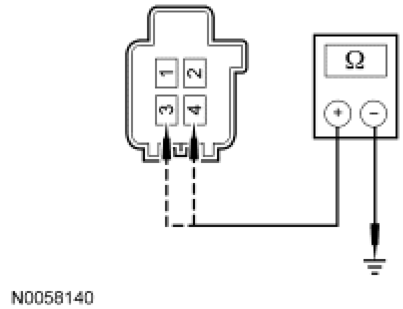

Fig. 78: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat recliner motor C368-3, circuit RPS13 (GN/OG), harness side and ground; and between driver seat recliner motor C368-4, circuit VPS12 (GY/OG), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to K22.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

K22 CHECK CIRCUITS RPS13 (GN/OG) AND VPS12 (GY/OG) FOR AN OPEN

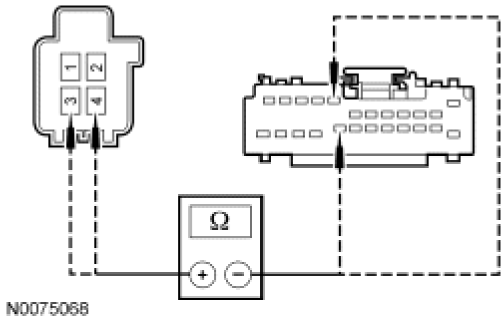

Fig. 79: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat recliner motor C368-3, circuit RPS13 (GN/OG), harness side and DSM C3299b-8, circuit RPS13 (GN/OG), harness side; and between driver seat recliner motor C368-4, circuit VPS12 (GY/OG), harness side and DSM C3299b-20, circuit VPS12 (GY/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new seat recliner motor. REFER to **Seat Recliner Motor**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test L: The Memory Seat is Inoperative/Does Not Operate Correctly - Does Not Operate Horizontally/Vertically, Edge

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Memory Seats for schematic and connector information.

Refer to appropriate COMPONENT TESTING article.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBP12 (GN/RD) and is supplied ground on circuit GD133 (BK). When pressed, the seat control switch supplies the voltage and ground to the applicable driver seat module (DSM) inputs. The DSM then supplies voltage and ground to the appropriate power seat track motor based on the inputs received from the seat control switch. When pressed in the opposite direction, the seat control switch reverses the polarity to the DSM inputs, and the DSM likewise reverses polarity of the appropriate power seat track motor circuits causing the seat to move in the opposite direction. There are 3 power seat track motors that combine to move the seat horizontally (forward/rearward) and vertically (front up/down and rear up/down).

Battery voltage is also supplied to DSM circuit SBB60 (GN/RD) and is supplied ground to DSM circuit GD145 (BK/BU).

Each motor in the memory power seat track contains a Hall-effect position sensor. The DSM supplies a signal supply circuit to each position sensor and a shared reference signal return circuit. Each position sensor sends a signal voltage back to the DSM used to monitor the position of the power seat. The DSM uses this information to return the seat to a stored pre-programmed position when pressing the memory SET switch or a remote entry transmitter. Refer to **Principles of Operation** or the Owner's Literature for information on programming the DSM for storing memory seat positions.

The following pinpoint test diagnoses a memory seat that does not operate in one or more directions when using the seat control switch. If the memory seat moves in all directions using the seat control switch, go to **Pinpoint Test M**.

DTC Description	Fault Trigger Conditions
• B1342 - ECU is Faulted	If a programming error is detected, the DTC is set.
• B1663 - Seat Driver Front Up/Down Motor Stalled • B1664 - Seat Driver Rear Up/Down Motor Stalled • B1665 - Seat Driver Forward/Backward Motor Stalled	During self-test, the driver seat module (DSM) attempts to operate all seat track motors and uses the motor's position sensor to monitor movement. If no motor movement is sensed, the DTC is set. The DSM will retry motor operation on the next activation of the seat control switch. If no movement continues to be monitored after 250 milliseconds, the DSM disables the output.
• B1711 - Seat Driver Front Up Switch Circuit Short to Battery • B1715 - Seat Driver Front Down Switch Circuit Short to Battery	If voltage is sensed on the switch input circuit during the DSM self-test, the DTC is set. If voltage is sensed on the input circuit for greater than 2 minutes, the DTC is set as continuous. With the DTC set, any input signal on the circuit is ignored.
• B1719 - Seat Driver Forward Switch Circuit Short to Battery • B1723 - Seat Driver Rearward Switch Circuit Short to Battery	If voltage is sensed on the switch input circuit during the DSM self-test, the DTC is set. If voltage is sensed on the input circuit for greater than 2 minutes, the DTC is set as continuous. With the DTC set, any input signal on the circuit is

	ignored.
• B1727 - Seat Driver Rear Up Switch Circuit Short to Battery • B1731 - Seat Driver Rear Down Switch Circuit Short to Battery	If voltage is sensed on the switch input circuit during the DSM self-test, the DTC is set. If voltage is sensed on the input circuit for greater than 2 minutes, the DTC is set as continuous. With the DTC set, any input signal on the circuit is ignored.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Seat control switch
- Missing controller area network (CAN) status information (CAN communication message):
  - ignition switch status
  - gear selector position
- Memory power seat track
- DSM

PINPOINT TEST L: THE MEMORY SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - DOES NOT OPERATE HORIZONTALLY/VERTICALLY, EDGE

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

NOTE: **Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.**

L1 CHECK DSM GEAR SELECTED (TRANSGEAR) PID STATES

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/Driver Seat Module (DSM) PID: TRANSGEAR
- Operate the transmission gear selector in all positions while monitoring the following DSM PID TRANSGEAR states:
  - D6_Park

- REV
- NTRL
- DRIVE5
- DRIVE1

- **Do the PID states agree with the selected positions?**

  YES : Go to L2.

  NO : To diagnose a transmission gear selector (PRNDL) status concern, REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article.

L2 CHECK DSM IGNITION SWITCH STATUS (IGN_SW) PID STATES

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM PID: IGN_SW
- Cycle the ignition switch in all positions while monitoring the following DSM IGN_SW PID states:
  - Off
  - Accessory
  - Run
  - Start
- **Do the PID states agree with the selected positions?**

  YES : Go to L3.

  NO : To diagnose an ignition switch status concern, REFER to **STEERING COLUMN SWITCHES** article.

L3 CHECK IGNITION SWITCH STATUS, TRANSMISSION GEAR SELECTOR STATUS AND RETRIEVE DTCs

- Operate the memory seat and memory mirrors in all directions through the full range of travel.
- Place the memory seat and memory mirrors in central travel positions.
- Enter the following diagnostic mode on the diagnostic tool: Self-Test/DSM/Retrieve DTCs
- **Are any DSM DTCs retrieved?**

  YES : If DTCs B1663, B1664 and B1665 are all retrieved, go to L12.

  If DTC B1663, go to L20.

  If DTC B1664, go to L23.

  If DTC B1665, go to L26.

  If DTC B1711, go to L5.

  If DTC B1715, go to L5.

  If DTC B1719, go to L5.

  If DTC B1723, go to L5.

If DTC B1727, go to L5.

If DTC B1731, go to L5.

If DTC 1342, INSTALL a new DSM and CARRY OUT programmable module installation (PMI). REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

For any other DSM DTCs, REFER to the Driver Seat Module (DSM) DTC Chart.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : Go to L4.

L4 MONITOR THE DSM PIDs AND CHECK FOR CORRECT MEMORY SEAT SWITCH INPUTS

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM PIDs
  - Driver Power Seat Front Up/Down Switch (SFNT_SW)
  - Driver Power Seat Forward/Backward Switch (SFWD_SW)
  - Driver Power Seat Rear Up/Down Switch (SREARSW)
- Monitor DSM seat switch PIDs while activating the seat switch in all positions.
- **Do the PID states agree with the switch positions?**

  YES : Go to L11.

  NO : VERIFY smart junction box (SJB) fuse 12 (7.5A) is OK. If SJB fuse 12 (7.5A) fails while operating the seat control switch, DISCONNECT the seat control switch C352 and Go to L9.

  If OK, go to L5.

L5 CHECK THE SEAT CONTROL SWITCH

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Seat Control Switch C352

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

- Check the seat control switch. Refer to appropriate COMPONENT TESTING article.
- **Is the seat control switch OK?**

  YES : Go to L6.

  NO : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

L6 CHECK CIRCUIT SBP12 (GN/RD) FOR VOLTAGE TO THE SEAT CONTROL SWITCH

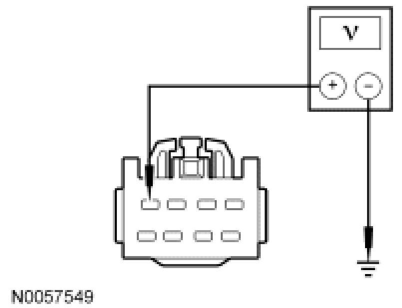

Fig. 80: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between seat control switch C352-4, circuit SBP12 (GN/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to L7.

  NO : VERIFY SJB fuse 12 (7.5A) is OK, If OK, REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

L7 CHECK CIRCUIT GD133 (BK) FOR AN OPEN

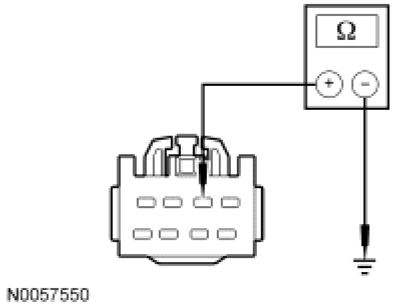

Fig. 81: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between seat control switch C352-2, circuit GD133 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

 YES : Go to L8.

 NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

 DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

 REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

L8 CHECK SEAT CONTROL SWITCH TO DRIVER SEAT MODULE CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect: DSM C3299b
- Key in ON position.

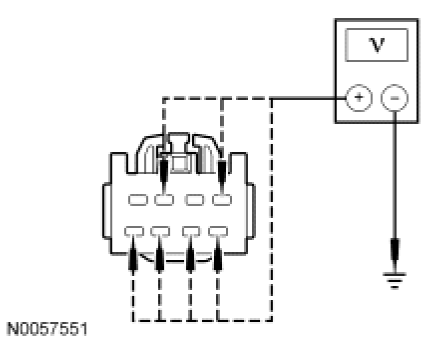

Fig. 82: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the following seat control switch C352 pins, harness side and ground:

Connector - Pin	Circuit

C352-5	CPS27 (BU/BN)
C352-7	CPS26 (YE/BU)
C352-3	CPS23 (GN/VT)
C352-6	CPS28 (GN)
C352-1	CPS25 (WH/VT)
C352-8	CPS24 (GY)

- **Is voltage present on a circuit?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to L9.

L9 CHECK SEAT CONTROL SWITCH TO DRIVER SEAT MODULE CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Seat Control Switch C352
- Disconnect: DSM C3299b

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

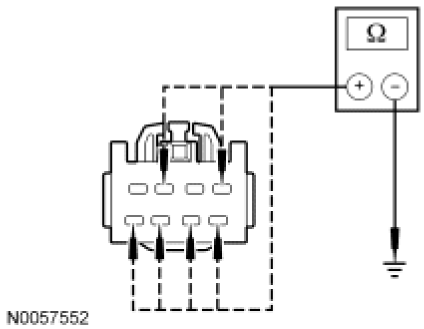

Fig. 83: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the following seat control switch C352 pins, harness side and ground:

Connector - Pin	Circuit
C352-5	CPS27 (BU/BN)
C352-7	CPS26 (YE/BU)
C352-3	CPS23 (GN/VT)
C352-6	CPS28 (GN)
C352-1	CPS25 (WH/VT)
C352-8	CPS24 (GY)

- **Are the resistances greater than 10,000 ohms?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to L10.

L10 CHECK SEAT CONTROL SWITCH TO DRIVER SEAT MODULE CIRCUITS FOR AN OPEN

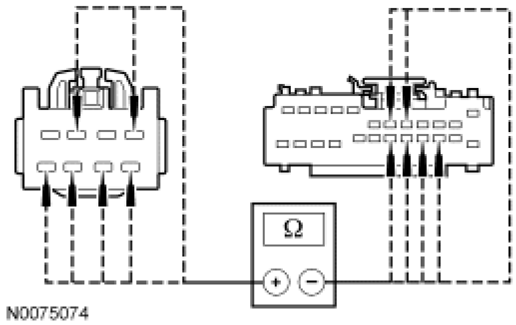

Fig. 84: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the following seat control switch C352 pins, harness side and DSM C3299b pins, harness side:

Seat Control Switch Connector - Pin	Circuit	DSM Connector - Pin
C352-5	CPS27 (BU/BN)	C3299b-17
C352-7	CPS26 (YE/BU)	C3299b-5
C352-3	CPS23 (GN/VT)	C3299b-16
C352-6	CPS28 (GN)	C3299b-15
C352-1	CPS25 (WH/VT)	C3299b-18
C352-8	CPS24 (GY)	C3299b-6

- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

L11 CHECK THE DSM FOR CORRECT OUTPUTS USING A SCAN TOOL AND DSM ACTIVE COMMANDS

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM PIDs
  - Front Motor Up (FRONT_UP)
  - Front Motor Down (FRONT_DWN)
  - Rear Motor Up (REAR_UP)
  - Rear Motor Down (REAR_DWN)
  - Horizontal Motor Forward (HORZ_FWD)
  - Horizontal Motor Backward (HORZ_BWD)
- Toggle the DSM active commands ON and OFF while monitoring the seat movement.
- **Does the driver seat operate correctly?**

  YES : INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If no seat movement, go to L12.

  If no front vertical seat movement, go to L20.

  If no rear vertical seat movement, go to L23.

  If no horizontal seat movement, go to L26.

L12 CHECK DSM CIRCUIT SBB60 (GN/RD) FOR VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: DSM C3299a

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

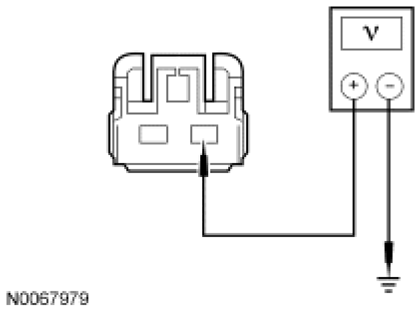

Fig. 85: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DSM C3299a-1, circuit SBB60 (GN/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to L13.

  NO : VERIFY battery junction box (BJB) fuse 60 (30A) is OK. If OK, REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

L13 CHECK CIRCUITS GD145 (BK/BU) AND GD133 (BK) FOR AN OPEN

- Disconnect: DSM C3299c

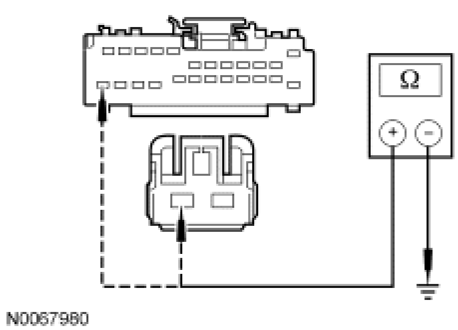

Fig. 86: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299a-2, circuit GD145 (BK/BU), harness side and ground; and between DSM C3299b-24, circuit GD133 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to L14.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

L14 CHECK CIRCUITS CPS03 (VT/GY) AND CPS02 (GY/YE) FOR A SHORT TO GROUND

- Disconnect: DSM C3299b

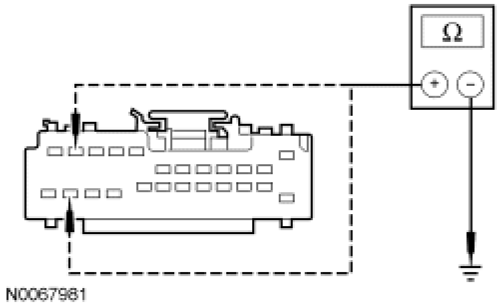

Fig. 87: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-23, circuit CPS03 (VT/GY), harness side and ground; and between DSM C3299b-11, circuit CPS02 (GY/YE), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to L16.

  NO : Go to L15.

L15 CHECK FRONT HEIGHT POWER SEAT MOTOR CIRCUITS CPS03 (VT/GY) AND CPS02 (GY/YE) FOR A SHORT TO GROUND

- Disconnect: Front Height Power Seat Motor C382

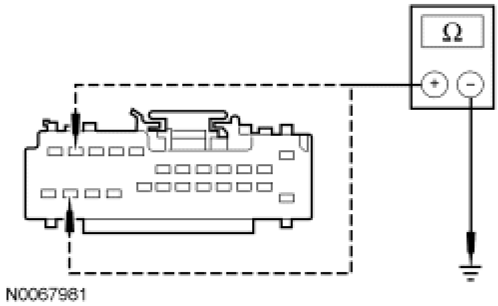

Fig. 88: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-23 circuit CPS03 (VT/GY), harness side and ground; and between DSM C3299b-11, circuit CPS02 (GY/YE), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

L16 CHECK CIRCUITS CPS05 (BU/WH) AND CPS04 (YE/OG) FOR A SHORT TO GROUND

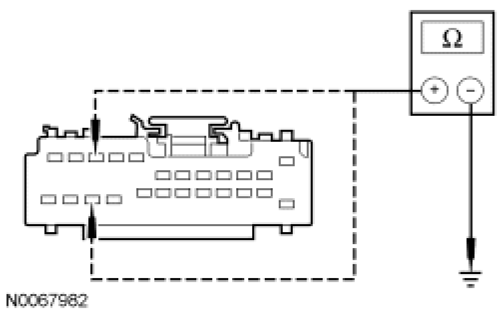

Fig. 89: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-22, circuit CPS05 (BU/WH), harness side and ground; and between DSM C3299b-10, circuit CPS04 (YE/OG), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to L18.

  NO : Go to L17.

L17 CHECK THE REAR HEIGHT POWER SEAT MOTOR CIRCUITS CPS05 (BU/WH) AND CPS04 (YE/OG) FOR A SHORT TO GROUND

- Disconnect: Rear Height Power Seat Motor C363

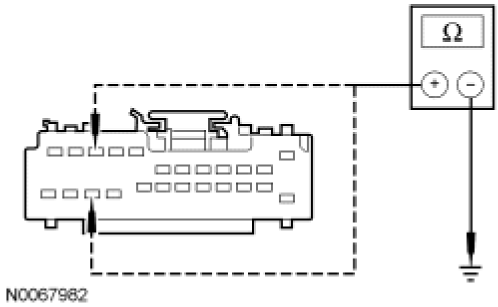

Fig. 90: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-22, circuit CPS05 (BU/WH), harness side and ground; and between DSM C3299b-10, circuit CPS04 (YE/OG), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

L18 CHECK CIRCUITS CPS06 (GN/WH) AND CPS01 (GN/BU) FOR A SHORT TO GROUND

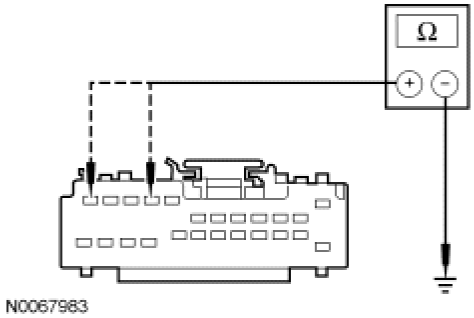

Fig. 91: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-9, circuit CPS06 (GN/WH), harness side and ground; and between DSM C3299b-12, circuit CPS01 (GN/BU), harness side and ground.

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to L20.

  NO : Go to L19.

L19 CHECK THE HORIZONTAL POWER SEAT MOTOR CIRCUITS CPS06 (GN/WH) AND CPS01 (GN/BU) FOR A SHORT TO GROUND

- Disconnect: Horizontal Power Seat Motor C362

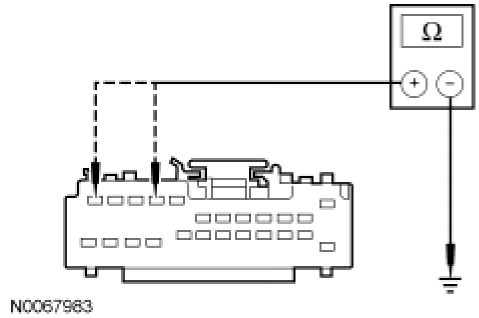

Fig. 92: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-9, circuit CPS06 (GN/WH), harness side and ground; and between DSM C3299b-12, circuit CPS01 (GN/BU), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

L20 CHECK THE FRONT HEIGHT POWER SEAT MOTOR FOR CORRECT OPERATION

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Front Height Power Seat Motor C382

WARNING: **Make sure no one is in the vehicle and there is nothing**

blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM PIDs
  - Front Motor Up (FRONT_UP)
  - Front Motor Down (FRONT_DWN)

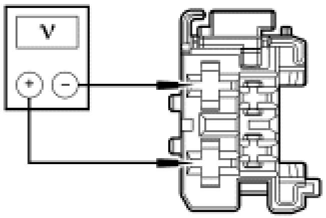

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Fig. 93: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between front height power seat motor C382-2, circuit CPS02 (GY/YE) and C382-1, circuit CPS03 (VT/GY), harness side while toggling DSM active commands front motor up and front motor down, ON and OFF.
- **Is the voltage greater than 10 volts when commanded ON in both directions and no voltage present when commanded OFF?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to L21.

L21 CHECK CIRCUITS CPS03 (VT/GY) AND CPS02 (GY/YE) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DSM C3299b
- Key in ON position.

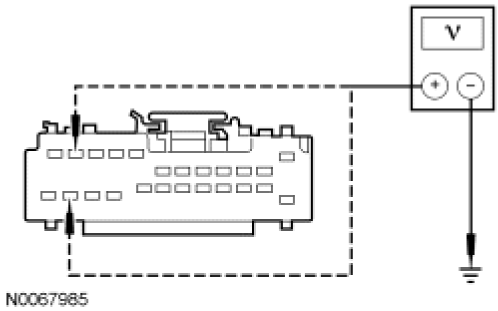


Fig. 94: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DSM C3299b-23, circuit CPS03 (VT/GY), harness side and ground; and between DSM C3299b-11, circuit CPS02 (GY/YE), harness side and ground.
- **Is voltage present on a circuit?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to L22.

L22 CHECK CIRCUITS CPS03 (VT/GY) AND CPS02 (GY/YE) FOR AN OPEN

- Key in OFF position.

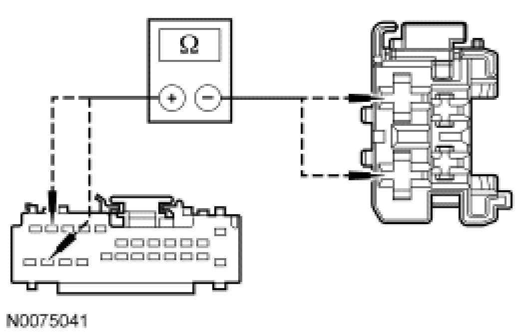


Fig. 95: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-11, circuit CPS02 (GY/YE), harness side and front height power seat motor C382-2, circuit CPS02 (GY/YE), harness side; and between DSM C3299b-23, circuit CPS03 (VT/GY), harness side and front height power seat motor C382-1, circuit CPS03 (VT/GY), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

L23 CHECK THE REAR HEIGHT MOTOR FOR CORRECT OPERATION

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Rear Height Power Seat Motor C363

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM PIDs
  - Rear Motor Up (REAR_UP)
  - Rear Motor Down (REAR_DWN)

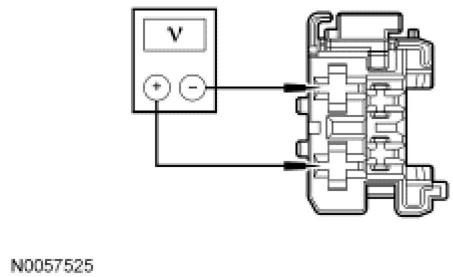


Fig. 96: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between rear height power seat motor C363-2, circuit CPS04 (YE/OG), harness side and C363-1, circuit CPS05 (BU/WH), harness side while toggling DSM active commands rear motor up and rear motor down, ON and OFF.

- **Is the voltage greater than 10 volts when command ON in both directions and no voltage present when commanded OFF?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to L24.

L24 CHECK CIRCUITS CPS05 (BU/WH) AND CPS04 (YE/OG) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DSM C3299b
- Key in ON position.

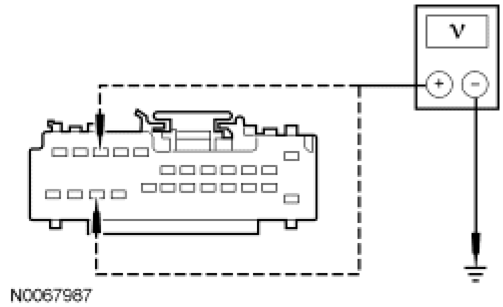


Fig. 97: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DSM C3299b-22, circuit CPS05 (BU/WH), harness side and ground; and between DSM C3299b-10, circuit CPS04 (YE/OG), harness side and ground.
- **Is voltage present on a circuit?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to L25.

L25 CHECK CIRCUITS CPS05 (BU/WH) AND CPS04 (YE/OG) FOR AN OPEN

- Key in OFF position.

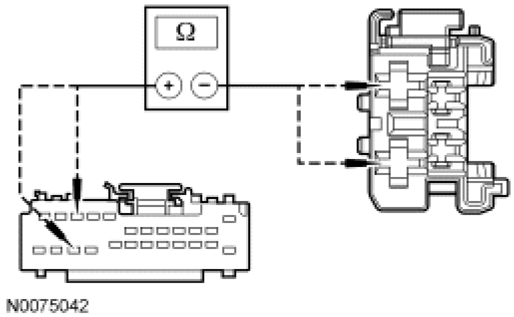


Fig. 98: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-22, circuit CPS05 (BU/WH), harness side and rear height power seat motor C363-1, circuit CPS05 (BU/WH), harness side; and between DSM C3299b-10, circuit CPS04 (YE/OG), harness side and rear height power seat motor C363-2, circuit CPS04 (YE/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

L26 CHECK THE HORIZONTAL MOTOR FOR CORRECT OPERATION

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Horizontal Power Seat Motor C362

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM PIDs
  - Horizontal Motor Forward (HORZ_FWD)
  - Horizontal Motor Backward (HORZ_BWD)

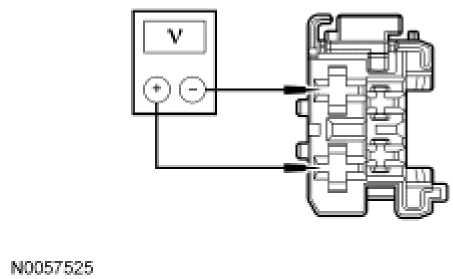


Fig. 99: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between horizontal power seat motor C362-2, circuit CPS01 (GN/BU) and C362-1, circuit CPS06 (GN/WH), harness side while toggling DSM active commands horizontal motor forward and horizontal motor backward, ON and OFF.
- **Is the voltage greater than 10 volts when commanded ON in both directions and no voltage present when commanded OFF?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to L27.

L27 CHECK CIRCUITS CPS01 (GN/BU) AND CPS06 (GN/WH) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DSM C3299b
- Key in ON position.

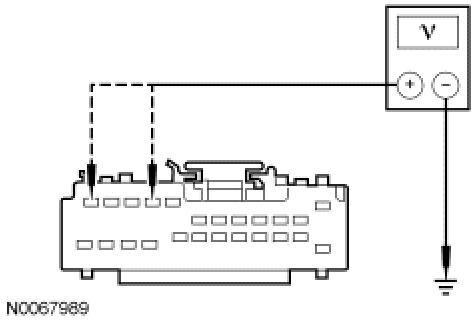


Fig. 100: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DSM C3299b-9, circuit CPS06 (GN/WH), harness side and ground; and between DSM C3299b-12, circuit CPS01 (GN/BU), harness side and ground.
- **Is voltage present on a circuit?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to L28.

L28 CHECK CIRCUITS CPS01 (GN/BU) AND CPS06 (GN/WH) FOR AN OPEN

- Key in OFF position.

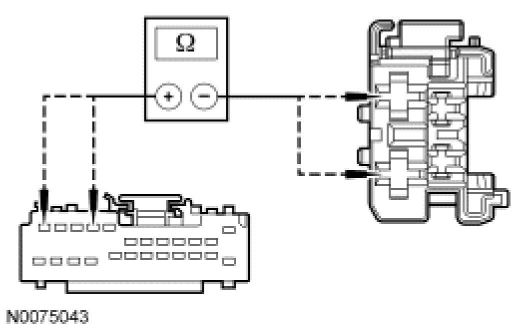


Fig. 101: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-9, circuit CPS06 (GN/WH), harness side and horizontal power seat motor C362-1, circuit CPS06 (GN/WH), harness side; and between DSM C3299b-12, circuit CPS01 (GN/BU), harness side and horizontal power seat motor C362-2, circuit CPS01 (GN/BU), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test M: The Memory Seat Does Not Operate Correctly - Does Not Operate Using the Memory SET Switch, Edge

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Memory Seats for schematic and connector information.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBP12 (GN/RD) and is supplied ground on circuit GD133 (BK). When pressed, the seat control switch supplies the voltage and ground to the applicable driver seat module (DSM) inputs. The DSM then supplies voltage and ground to the appropriate power seat track motor based on the inputs received from the seat control switch. When pressed in the opposite direction, the seat control switch reverses the polarity to the DSM inputs, and the DSM likewise reverses polarity of the appropriate power seat track motor or power recliner motor circuits causing the seat or backrest to move in the opposite direction. There are 3 power seat track motors that combine to move the seat horizontally (forward/rearward) and vertically (front up/down and rear up/down).

Battery voltage is supplied to DSM circuit SBB60 (GN/RD) and SBP12 (GN/RD). Ground is supplied to DSM circuit GD145 (BK/BU).

Each motor in the memory power seat track contains a Hall-effect position sensor. The DSM supplies a signal supply circuit to each position sensor and a shared reference signal return circuit. Each position sensor sends a signal voltage back to the DSM used to monitor the position of the power seat. The DSM uses this information to return the seat to a stored pre-programmed position when pressing the memory SET switch or a remote entry transmitter. Refer to **Principles of Operation** or the Owner's Literature for additional information on programming the DSM for storing memory seat positions.

The following pinpoint test diagnoses a memory seat that does not operate correctly using the memory SET switch. If the memory seat does not move in all directions using the seat control switch, go to **Pinpoint Test L**.

DTC Description	Fault Trigger Conditions
• B1342 - ECU is Faulted	If a programming error is detected, the DTC is set.
• B1530 - Memory SET Switch Circuit Short to Ground • B1534 - Memory 1 Switch Circuit Short to Ground	If any activity is sensed on the switch input circuit during the DSM self-test, the DTC is set. If activity is

• B1538 - Memory 2 Switch Circuit Short to Ground	sensed on the input circuit for greater than 2 minutes, the DTC is set as continuous. With the DTC set, any input signal on the circuit is ignored.
• B1663 - Seat Driver Front Up/Down Motor Stalled • B1664 - Seat Driver Rear Up/Down Motor Stalled • B1665 - Seat Driver Forward/Backward Motor Stalled	During self-test, the DSM attempts to operate the appropriate seat track motor and uses the motor's position sensor to monitor movement. If no motor movement is sensed, the DTC is set. The DSM will retry motor operation on the next activation of the seat control switch. If no movement continues to be monitored after 250 milliseconds, the DSM disables the output.
• B1952 - Seat Rear Up/Down Position Feedback Circuit Short to Battery • B1956 - Seat Front Up/Down Position Feedback Circuit Short to Battery • B1964 - Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Battery	If a short to voltage condition is present on the affected motor's position sensor (Hall-effect) feedback circuit, the DTC is set. After a DTC is set, a memory recall is not possible but the seat control switch can operate the associated motor in one second increments.
• B1953 - Seat Rear Up/Down Position Feedback Circuit Short to Ground • B1957 - Seat Front Up/Down Position Feedback Circuit Short to Ground • B1965 - Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Ground	If a short to ground condition is present on the affected motor's position sensor (Hall-effect) feedback circuit, the DTC is set. After a DTC is set, a memory recall is not possible but the seat control switch can operate the associated motor in one second increments.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Faulty memory SET switch
- Missing controller area network (CAN) status information (CAN communication message):
  - ignition switch status
  - gear selector position
- Remote entry transmitter
- Memory power seat track
- DSM

PINPOINT TEST M: THE MEMORY SEAT DOES NOT OPERATE CORRECTLY - DOES NOT OPERATE USING THE MEMORY SET SWITCH, EDGE

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

NOTE: **Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.**

M1 CHECK DSM GEAR SELECTED (TRANSGEAR) PID STATES

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/Driver Seat Module (DSM) PID: TRANSGEAR
- Operate the transmission gear selector in all positions while monitoring the following DSM PID TRANSGEAR states:
  - D6_Park
  - REV
  - NTRL
  - DRIVE5
  - DRIVE1
- **Do the PID states agree with the selected positions?**

  YES : Go to M2.

  NO : To diagnose a transmission gear selector (PRNDL) status concern, REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article.

M2 CHECK DSM IGNITION SWITCH STATUS (IGN_SW) PID STATES

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/Driver Seat Module (DSM) PID: IGN_SW
- Cycle the ignition switch in all positions while monitoring the following DSM IGN_SW PID states:
  - Off
  - Accessory
  - Run
  - Start
- **Do the PID states agree with the selected positions?**

  YES : Go to M3.

  NO : To diagnose an ignition switch status concern, REFER to **STEERING COLUMN SWITCHES** article.

M3 RETRIEVE THE DSM DTCs

- Using the switches, operate the memory seat and memory mirrors in all directions through the full range of travel.
- Place the memory seat and memory mirrors in central travel positions.
- Enter the following diagnostic mode on the diagnostic tool: Self Test/Driver Seat Module (DSM)/Retrieve DTCs
- **Are any DSM DTCs retrieved?**

  YES : If DTCs B1952, B1956 and B1964 are all retrieved, go to M10.

  If DTCs B1953, B1957 and B1965 are all retrieved, go to M10.

  If DTC B1530, go to M5.

  If DTC B1534, go to M5.

  If DTC B1538, go to M5.

  If DTC B1663, go to M11.

  If DTC B1664, go to M14.

  If DTC B1665, go to M17.

  If DTC B1952, go to M14.

  If DTC B1953, go to M14.

  If DTC B1956, go to M11.

  If DTC B1957, go to M11.

  If DTC B1964, go to M17.

  If DTC B1965, go to M17.

  If DTC 1342, INSTALL a new DSM and CARRY OUT programmable module installation (PMI). REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

  For any other DSM DTCs, REFER to the Driver Seat Module (DSM) DTC Chart.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : Go to M4.

M4 MONITOR THE DSM PIDs AND CHECK THE DSM FOR CORRECT MEMORY SET SWITCH INPUTS

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM PIDs
  - Memory 1 recall switch status (MEM_1)
  - Memory 2 recall switch status (MEM_2)
  - Memory set switch status (MEM_S)
- Monitor the DSM PIDs while activating the memory SET switch, recall 1 and recall 2 buttons.
- **Do the PID states agree with the switch button positions?**

  YES : Go to M11.

  NO : Go to M5.

M5 CHECK THE MEMORY SET SWITCH

- Key in OFF position.
- Disconnect: Memory SET Switch C503

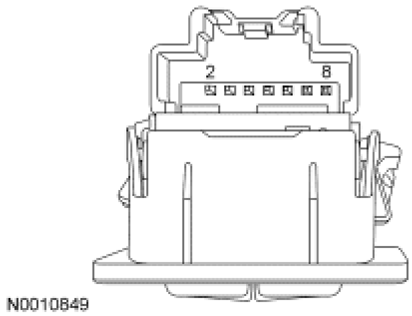


Fig. 102: Identifying Memory SET Switch Terminals
Courtesy of FORD MOTOR CO.

- Use the following table and illustration to check the memory SET switch. Measure the resistance between the memory SET switch pins, component side, while pressing the indicated switch buttons and compare the results to the table.

Switch Button	Pins	Ohms
Memory SET 1	7 and 2	Less than 7
Memory SET 2	3 and 2	Less than 7
Memory SET	4 and 2	Less than 7

NOTE: Refer to multi-meter user's manual for testing diodes.

- Use the following table and preceding illustration. Using the diode testing meter function, connect the meter leads to the memory SET switch pins, component side. Measure the voltages and compare the results to the table, to check the switch LED indicator.

Positive Lead	Negative Lead	Volts
Pin 8	Pin 2	Greater than 0.3
Pin 2	Pin 8	OL

- **Is the memory SET switch OK?**

  YES : Go to M6.

  NO : INSTALL a new memory SET switch. REFER to **Memory Set Switch**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

M6 CHECK GROUND CIRCUIT GD133 (BK) TO THE MEMORY SET SWITCH

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

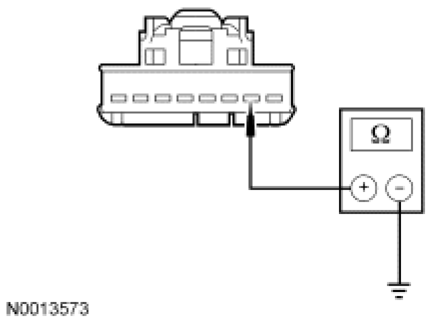


Fig. 103: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between memory SET switch C503-2, circuit GD133 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to M7.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

M7 CHECK CIRCUITS CPS14 (GY/VT), CPS15 (VT/WH) AND CPS16 (YE) FOR A SHORT TO VOLTAGE

- Disconnect: DSM C3299c
- Key in ON position.

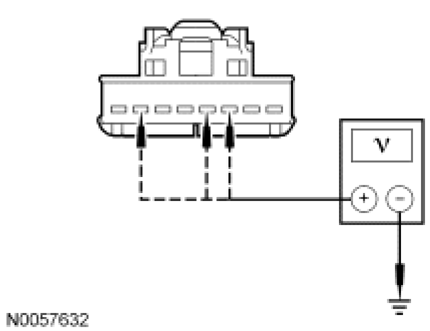


Fig. 104: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the following memory SET switch C503 pins, harness side and ground:

Connector - Pin	Circuit

C503-3	CPS16 (YE)
C503-4	CPS14 (GY/VT)
C503-7	CPS15 (VT/WH)

- **Is voltage present on a circuit?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to M8.

M8 CHECK CIRCUITS CPS14 (GY/VT), CPS15 (VT/WH) AND CPS16 (YE) FOR A SHORT TO GROUND

- Key in OFF position.

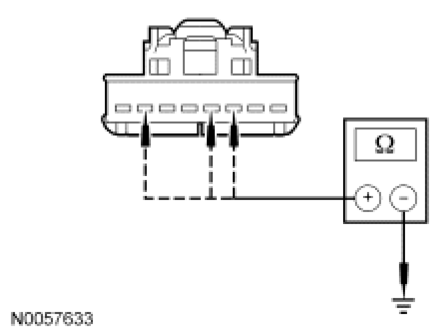


Fig. 105: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the following memory SET switch C503 pins, harness side and ground:

Connector - Pin	Circuit
C503-3	CPS16 (YE)
C503-4	CPS14 (GY/VT)
C503-7	CPS15 (VT/WH)

- **Are the resistances greater than 10,000 ohms?**

YES : Go to M9.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

M9 CHECK CIRCUITS CPS14 (GY/VT), CPS15 (VT/WH) AND CPS16 (YE) FOR AN OPEN

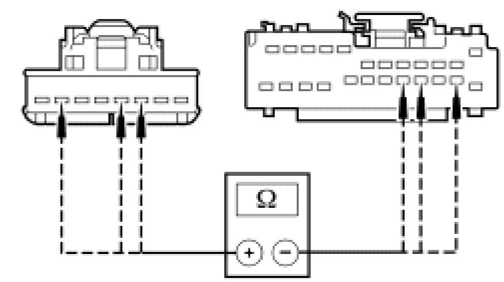


Fig. 106: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the following memory SET switch C503 pins and DSM C3299c pins:

Memory SET Switch C503 - Pin	Circuit	DSM C3299c - Pin
C503-3	CPS16 (YE)	C3299c-17
C503-4	CPS14 (GY/VT)	C3299c-14
C503-7	CPS15 (VT/WH)	C3299c-16

- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

M10 MONITOR THE DSM PIDs

- Place the seat in a central position, using the seat control switch.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM PIDs
  - Driver Mirror Left/Right Sensor Pinpoint (DMIR_H)
  - Driver Mirror Up/Down Sensor Pinpoint (DMIR_V)
  - Pedal sensor (PEDLFWD)
  - Passenger Power Mirror Horizontal Sense (PMIR_H)
  - Passenger Power Mirror Vertical Sense (PMIR_V)
  - Driver Power Seat Front Up/Down Sense (SFNT_MT)
  - Driver Power Seat Forward/Backward Sense (SFWD_MT)
  - Driver Power Seat Rear Up/Down Sense (SREARMT)
- Using the switches, operate the memory seat and memory mirrors in all directions through the full range of travel while monitoring the PIDs.
- **Does each PID indicate the sensor is operational throughout each associated motor's full range of travel?**

  YES : INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If the front height PID indicates not sensed, go to M11.

  If the rear height PID indicates not sensed, go to M14.

  If the horizontal PID indicates not sensed, go to M17.

M11 CHECK CIRCUITS RPS13 (GN/OG) AND VPS10 (BU/GN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: DSM C3299b
- Disconnect: Driver Seat Front Height Motor C382

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in OFF position.
- Key in ON position.

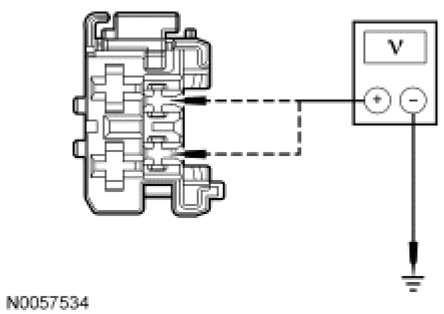


Fig. 107: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat front height motor C382-3, circuit RPS13 (GN/OG), harness side and ground; and between driver seat front height motor C382-4, circuit VPS10 (BU/GN), harness side and ground.
- **Is voltage present on a circuit?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to M12.

M12 CHECK CIRCUITS RPS13 (GN/OG) AND VPS10 (BU/GN) FOR A SHORT TO GROUND

- Key in OFF position.

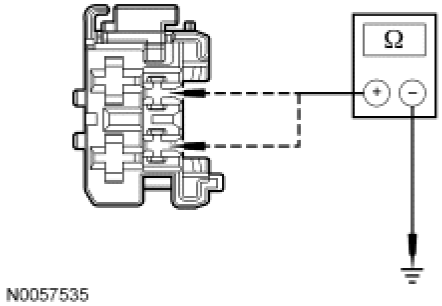


Fig. 108: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat front height motor C382-3, circuit RPS13 (GN/OG), harness side and ground; and between driver seat front height motor 382-4, circuit VPS10 (BU/GN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to M13.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

M13 CHECK CIRCUITS RPS13 (GN/OG) AND VPS10 (BU/GN) FOR AN OPEN

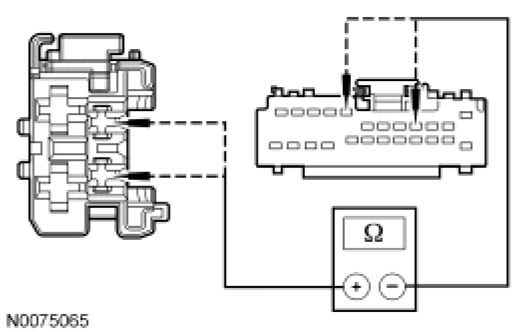


Fig. 109: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat front height motor C382-3, circuit RPS13 (GN/OG), harness side and DSM C3299b-8, circuit RPS13 (GN/OG), harness side; and between driver seat front height motor C382-4, circuit VPS10 (BU/GN), harness side and DSM C3299b-4, circuit VPS10 (BU/GN), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

M14 CHECK CIRCUITS RPS13 (GN/OG) AND VPS11 (GN/BN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: DSM C3299b
- Disconnect: Driver Seat Rear Height Motor C363

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.

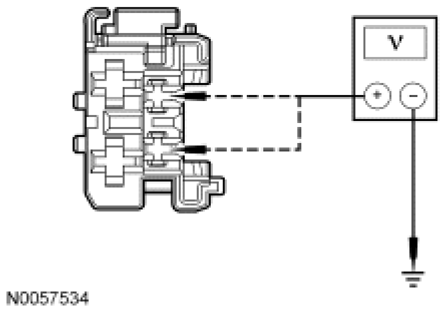


Fig. 110: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat rear height motor C363-3, circuit RPS13 (GN/OG), harness side and ground; and between driver seat rear height motor C363-4, circuit VPS11 (GN/BN), harness side and ground.
- **Is voltage present on a circuit?**

YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : Go to M15.

M15 CHECK CIRCUITS RPS13 (GN/OG) AND VPS11 (GN/BN) FOR A SHORT TO GROUND

- Key in OFF position.

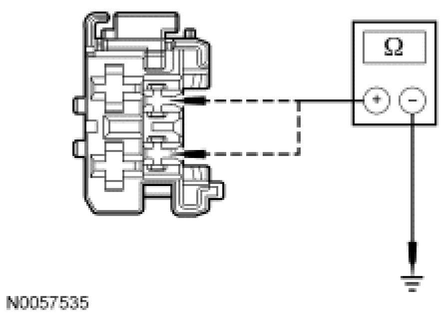


Fig. 111: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat rear height motor C363-3, circuit RPS13 (GN/OG), harness side and ground; and between driver seat rear height motor C363-4, circuit VPS11 (GN/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

YES : Go to M16.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

M16 CHECK CIRCUITS RPS13 (GN/OG) AND VPS11 (GN/BN) FOR AN OPEN

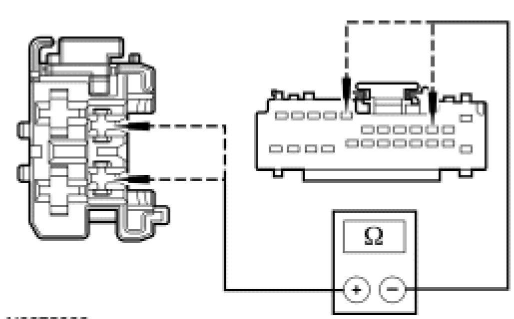


Fig. 112: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat rear height motor C363-3, circuit RPS13 (GN/OG), harness side and DSM C3299b-8, circuit RPS13 (GN/OG), harness side; and between driver seat rear height motor C363-4, circuit VPS11 (GN/BN), harness side and DSM C3299b-3, circuit VPS11 (GN/BN), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit(s) in question. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

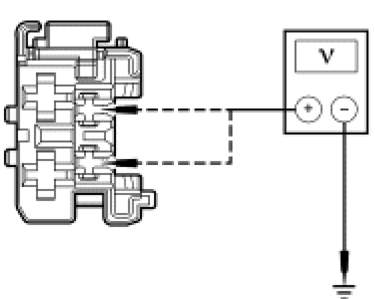
  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

M17 CHECK CIRCUITS RPS13 (GN/OG) AND VPS09 (BN/BU) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: DSM C3299b
- Disconnect: Driver Seat Horizontal Motor C362

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.



N0057534

Fig. 113: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat horizontal motor C362-3, circuit RPS13 (GN/OG), harness side and ground; and between driver seat horizontal motor C362-4, circuit VPS09 (BN/BU), harness side and ground.
- **Is voltage present on a circuit?**

YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : Go to M18.

M18 CHECK CIRCUITS RPS13 (GN/OG) AND VPS09 (BN/BU) FOR A SHORT TO GROUND

- Key in OFF position.

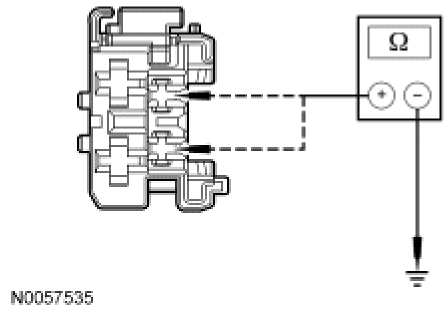


Fig. 114: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat horizontal motor C362-3, circuit RPS13 (GN/OG), harness side and ground; and between driver seat horizontal motor C362-4, circuit VPS09 (BN/BU), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

YES : Go to M19.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

M19 CHECK CIRCUITS RPS13 (GN/OG) AND VPS09 (BN/BU) FOR AN OPEN

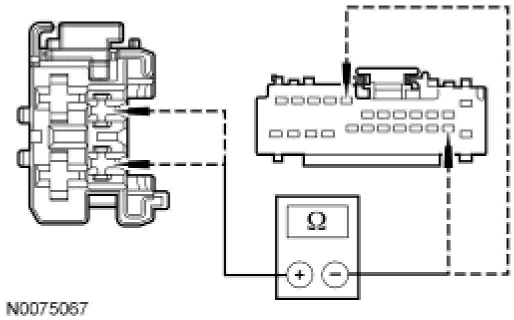


Fig. 115: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat horizontal motor C362-3, circuit RPS13 (GN/OG), harness side and DSM C3299b-8, circuit RPS13 (GN/OG), harness side; and between driver seat horizontal motor C362-4, circuit VPS09 (BN/BU), harness side and DSM C3299b-14, circuit VPS09 (BN/BU), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test N: The Memory SET Switch Indicator is Inoperative/Always On

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Memory Seats for schematic and connector information.

Normal Operation

The memory SET switch indicator is provided voltage, for approximately 5 seconds, from the driver seat module (DSM) on circuit CPS55 (YE) after the SET switch has been pressed. Ground is supplied at circuit GD133 (BK). The indicator will turn off after memory switch 1 or memory switch 2 have been pressed or 5 seconds have elapsed.

- DTC B2084 Memory SET Indicator Short to Ground - If a short to ground or open condition is present on the memory SET switch indicator output circuit, the DTC is set.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Memory SET switch
- DSM

PINPOINT TEST N: THE MEMORY SET SWITCH INDICATOR IS INOPERATIVE/ALWAYS ON

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

NOTE: **Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.**

N1 RETRIEVE THE DTCs

- Connect the diagnostic tool.
- Enter the following diagnostic mode on the diagnostic tool: Self Test/Driver Seat Module (DSM)/Retrieve DTCs

  NOTE: **During the self-test, document when the memory SET switch LED illuminates and turns off.**

- **Is DTC B2084 present, does memory SET switch LED fail to illuminate when SET button is pushed or does the memory SET switch LED fail to illuminate during the Self Test?**

  YES : If DTC B2084 is present or if the memory SET switch LED fails to illuminate during the Self Test, go to N2.

  NO : If the memory SET switch LED is on all the time, go to N6.

N2 CHECK CIRCUIT CPS55 (YE) FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Memory SET Switch C503
- Disconnect: DSM C3299c

  WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

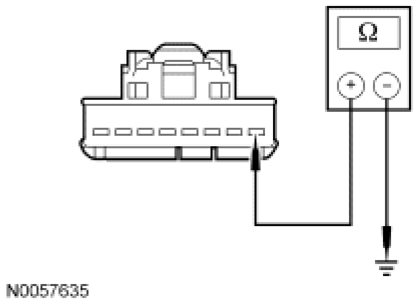


Fig. 116: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **For MKX vehicles,** measure the resistance between memory SET switch C503-1, circuit CPS55 (YE), harness side and ground.

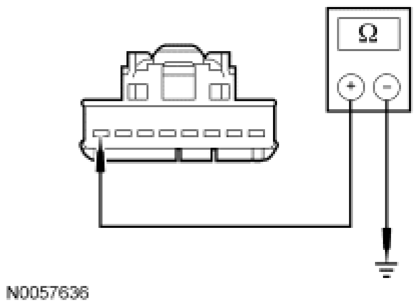


Fig. 117: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **For Edge vehicles,** measure the resistance between memory SET switch C503-8, circuit CPS55 (YE), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to N3.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

N3 CHECK CIRCUIT CPS55 (YE) FOR AN OPEN

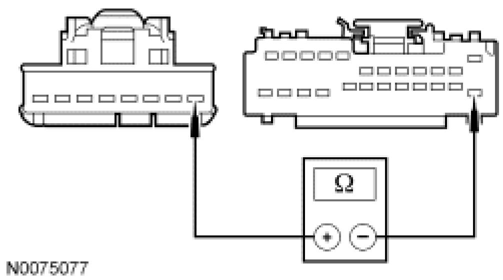


Fig. 118: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **For MKX vehicles,** measure the resistance between memory SET switch C503-1, circuit CPS55 (YE), harness side and DSM C3299c-13, circuit CPS55 (YE) harness side.

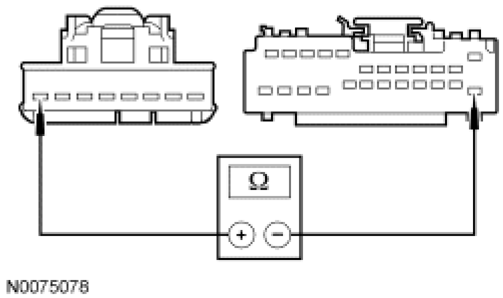


Fig. 119: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **For Edge vehicles,** measure the resistance between memory SET switch C503-8, circuit CPS55 (YE), harness side and DSM C3299c-13, circuit CPS55 (YE) harness side.
- **Is the resistances less than 5 ohms?**

  YES : Go to N4.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

N4 CHECK GROUND CIRCUIT GD133 (BK) TO THE MEMORY SET SWITCH

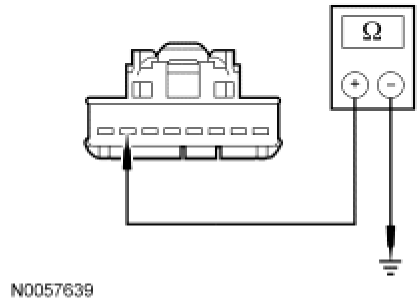


Fig. 120: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **For MKX vehicles,** measure the resistance between memory SET switch C503-7, circuit GD133 (BK), harness side and ground.

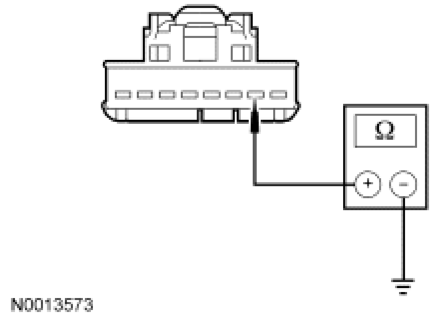


Fig. 121: Measuring Resistance
Courtesy of FORD MOTOR CO.

- **For Edge vehicles,** measure the resistance between memory SET switch C503-2, circuit GD133 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to N5.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

N5 CHECK CIRCUIT CPS55 (YE) FOR VOLTAGE

- Connect: DSM C3299c
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/Driver Seat Module (DSM) PID: Memory Recall Indicator LED (LED_STATE)

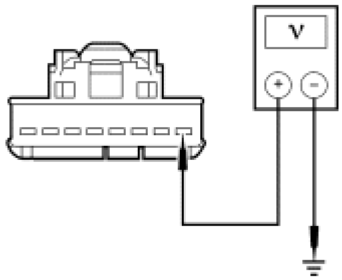


Fig. 122: Measuring Voltage
Courtesy of FORD MOTOR CO.

- **For MKX vehicles,** measure the voltage between memory SET switch C503-1, circuit CPS55 (YE) harness side and ground while commanding the memory SET switch LED ON and OFF.

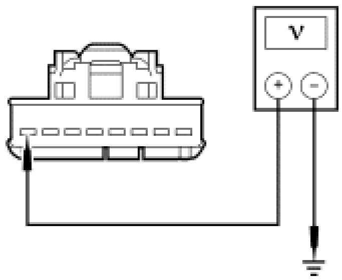


Fig. 123: Measuring Voltage
Courtesy of FORD MOTOR CO.

- **For Edge vehicles,** measure the voltage between memory SET switch C503-8, circuit CPS55 (YE) harness side and ground while commanding the memory SET switch LED ON and OFF.
- **Is voltage present when the command is ON and no voltage present when command is OFF?**

  YES : INSTALL a new memory SET switch. REFER to **Memory Set Switch**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new DSM and CARRY OUT programmable module installation (PMI). REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

N6 CHECK CIRCUIT CPS55 (YE) FOR VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Memory SET Switch C503

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

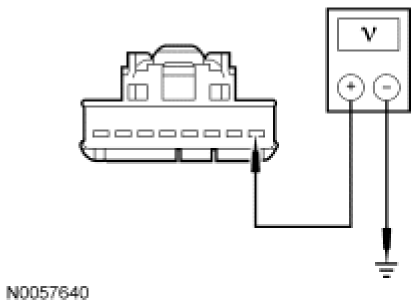


Fig. 124: Measuring Voltage
Courtesy of FORD MOTOR CO.

- **For MKX vehicles,** measure the voltage between memory SET switch C503-1, circuit CPS55 (YE) harness side and ground.

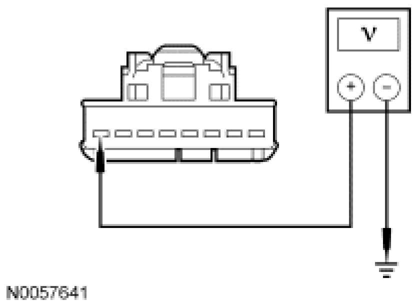


Fig. 125: Measuring Voltage
Courtesy of FORD MOTOR CO.

- **For Edge vehicles,** measure the voltage between memory SET switch C503-8, circuit CPS55 (YE) harness side and ground.

- **Is voltage greater than 0.2 volt?**

  YES : Go to N7.

  NO : INSTALL a new memory SET switch. REFER to **Memory Set Switch**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

N7 CHECK CIRCUIT CPS55 (YE) FOR SHORT TO VOLTAGE

- Disconnect: DSM C3299c

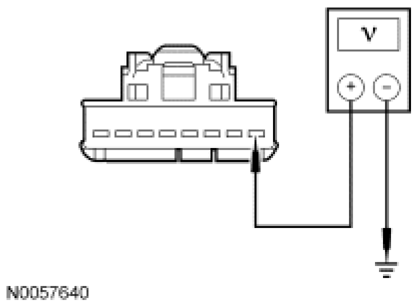


Fig. 126: Measuring Voltage
Courtesy of FORD MOTOR CO.

- **For MKX vehicles,** measure the voltage between memory SET switch C503-1, circuit CPS55 (YE), harness side and ground.

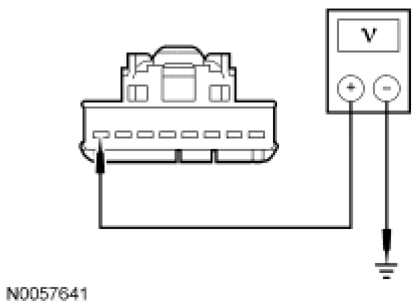


Fig. 127: Measuring Voltage
Courtesy of FORD MOTOR CO.

- **For Edge vehicles,** measure the voltage between memory SET switch C503-8, circuit CPS55 (YE), harness side and ground.
- **Is voltage greater than 0.2 volt?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test O: Easy Exit/Easy Entry is Inoperative/Does Not Operate Correctly

Normal Operation

The driver seat module (DSM) receives a key out command from the smart junction box (SJB) and a transmission range selection of park from the PCM, both coming over the medium-speed controller area network (MS-CAN) communication network and powers the memory driver seat rearward about 2 inches. When the ignition key is inserted, the memory driver seat goes back to its last known position.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Easy exit/easy entry not enabled
- Key-in-ignition warning switch
- Driver seat module (DSM)
- Missing controller area network (CAN) status information (CAN communication message):
  - ignition switch status
  - gear selector position

PINPOINT TEST O: EASY EXIT/EASY ENTRY IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTE:	**Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.**
NOTE:	**The transmission gear selector must be in park for the easy entry/exit feature to function.**
NOTE:	**Make sure all memory seat DTC and symptom based faults are corrected before proceeding with easy entry/exit diagnosis. Verify the PID(s) states agree with the ignition switch and transmission gear selector in all positions before proceeding with easy entry/exit diagnosis.**

O1 CHECK THE DRIVER POWER SEAT OPERATION

- Key in ON position.
- Check the message center to verify the easy entry/exit feature is enabled.
  - The easy entry/exit feature can be enabled/disabled using a scan tool in module programming. When enabled, the feature becomes a user accessible item on the message center allowing the user to turn the feature on and off. Refer to the Owner's Literature or **INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES** article for information on the message center.
- Using the seat control switch, verify the driver power seat operates fully forward and rearward.

NOTE: **During the Self-Test, each memory motor will be requested to move for one second. If a motor is near the end of travel, that position sensor feedback will not change as expected for one second resulting in a false DTC.**

- Place the memory seat and memory mirrors in central travel positions.
- Connect the diagnostic tool.
- Enter the following diagnostic mode on the diagnostic tool: Self Test/Driver Seat Module (DSM)/Retrieve DTCs
- **Are any DSM DTCs retrieved?**

  YES : REFER to the **Driver Seat Module (DSM) DTC Chart**.

  NO : If disabled, ENABLE the easy entry/exit feature with the message center. REFER to the Owner's Literature - Driver Controls for easy entry/exit feature enable/disable instructions. TEST the system for normal operation. If OK, INSTRUCT the customer on correct system operation.

  If easy entry/exit is enabled and the seat does not move horizontally from the seat control switch, go to **Pinpoint Test J** for MKX vehicles or Go to **Pinpoint Test L** for Edge vehicles.

  Otherwise, go to O2.

O2 CHECK DSM GEAR SELECTED (TRANSGEAR) PID STATES

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/Driver Seat Module (DSM) PID: TRANSGEAR
- Operate the transmission gear selector in all positions while monitoring the following DSM PID TRANSGEAR states:
  - D6_Park
  - REV
  - NTRL
  - DRIVE5
  - DRIVE1
- **Do the PID states agree with the selected positions?**

YES : Go to O3.

NO : To diagnose a transmission gear selector (PRNDL) status concern, REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article.

O3 CHECK THE GENERIC ELECTRONIC MODULE (GEM/SJB) FOR CORRECT IGNITION SWITCH POSITION (IGN_SW) STATES

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/GEM/SJB PID: IGN_SW
- Insert and remove the ignition key into the ignition lock cylinder while monitoring the following DSM PID IGN_SW states:
  - Key In
  - KEY OUT
- Monitor the DSM ignition switch position PID with the ignition key in and with the key removed.
- **Do the DSM PID states agree?**

YES : INSTALL a new DSM and CARRY OUT programmable module installation (PMI). REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. CLEAR the DTCs.

NO : To diagnose the key-in-ignition warning switch fault, REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES** article.

Pinpoint Test P: The Power Lumbar is Inoperative - Driver

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Memory Seats for schematic and connector information.

Normal Operation

The seat control switch is powered by battery voltage on circuit SBP12 (GN/RD) and is supplied ground on circuit GD133 (BK). When the lumbar knob on the seat control switch is pressed, voltage and ground are supplied to the power lumbar motor. When pressing the lumbar knob in the opposite direction, the seat control switch reverses the polarity to the power lumbar motor, which moves the lumbar mechanism in the opposite direction.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Seat control switch
- Power lumbar motor assembly

PINPOINT TEST P: THE POWER LUMBAR IS INOPERATIVE - DRIVER

NOTE:	**The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**
NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of**

faults before releasing the vehicle to the customer.

P1 CHECK CIRCUIT SBP12 (GN/RD) FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Seat Control Switch C3016

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Measure the voltage between seat control switch C3016-5, circuit SBP12 (GN/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to P2.

  NO : VERIFY smart junction box (SJB) fuse 12 (7.5A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

P2 CHECK CIRCUIT GD133 (BK) FOR AN OPEN

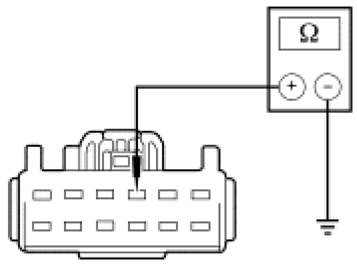


Fig. 128: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between seat control switch C3016-3, circuit GD133 (BK), harness side and ground.

- **Is the resistance less than 5 ohms?**

  YES : Go to P3.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

P3 CHECK THE LUMBAR MOTOR

- Connect: Seat Control Switch C3016
- Disconnect: Power Lumbar Motor C3215

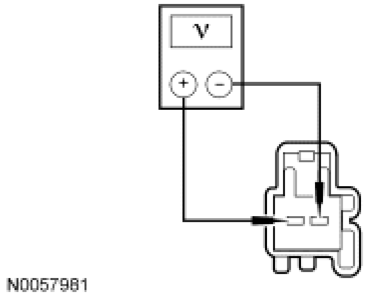


Fig. 129: Measuring Voltage
Courtesy of FORD MOTOR CO.

- While operating the seat control switch in both directions, measure the voltage between power lumbar motor C3215-1, circuit CPS18 (BN/GN), harness side and power lumbar motor C3215-2, circuit CPS19 (GY/VT), harness side.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new power lumbar assembly. REFER to **Lumbar Assembly - Power**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to P4.

P4 CHECK CIRCUIT CPS19 (GY/VT) AND CIRCUIT CPS18 (BN/GN) FOR A SHORT TO GROUND

- Disconnect: Seat Control Switch C3016

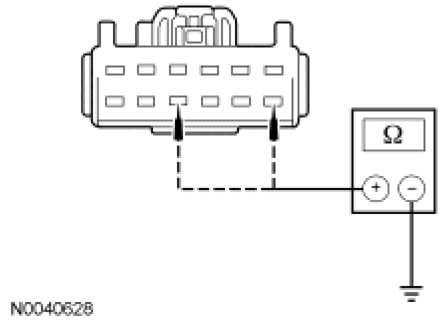


Fig. 130: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between seat control switch C3016-10, circuit CPS18 (BN/GN), harness side and ground; and between seat control switch C3016-7, circuit CPS19 (GY/VT), harness side and ground.
- **Are the resistances greater than 10,000 ohms.**

YES : Go to P5.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

P5 CHECK CIRCUIT CPS19 (GY/VT) AND CPS18 (BN/GN) FOR AN OPEN

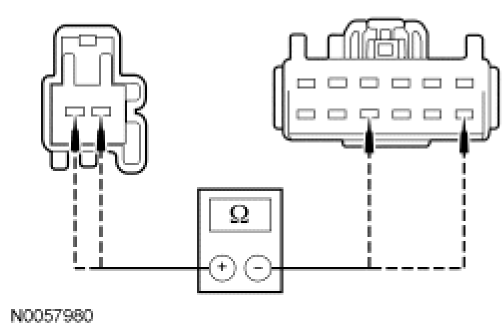


Fig. 131: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between seat control switch C3016-10, circuit CPS18 (BN/GN), harness side and power lumbar motor C3215-1, circuit CPS18 (BN/GN), harness side; and between seat control switch C3016-7, circuit CPS19 (GY/VT), harness side and power lumbar motor C3215-2, circuit CPS19 (GY/VT), harness side.
- **Are the resistances less than 5 ohms?**

YES : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test Q: The Power Lumbar is Inoperative - Passenger

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Seats for schematic and connector information.

Normal Operation

The seat control switch is powered by battery voltage on circuit SBB61 (GY/RD) and is supplied ground on circuit GD145 (BK/BU). When the lumbar knob on the seat control switch is pressed, voltage and ground are supplied to the power lumbar motor. When pressing the lumbar knob in the opposite direction, the seat control switch reverses the polarity to the power lumbar motor, which moves the lumbar mechanism in the opposite direction.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Lumbar control switch
- Power lumbar motor assembly

PINPOINT TEST Q: THE POWER LUMBAR IS INOPERATIVE - PASSENGER

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

Q1 CHECK CIRCUIT SBB61 (GY/RD) FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the**

battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Disconnect: Seat Control Switch C3026
- Measure the voltage between seat control switch C3026-5 , circuit SBB61 (GY/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to Q2.

  NO : VERIFY battery junction box (BJB) fuse 61 (30A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Q2 CHECK CIRCUIT GD145 (BK/BU) FOR AN OPEN

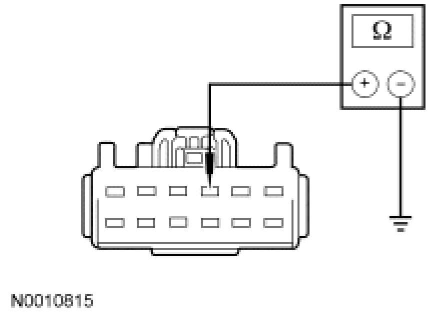


Fig. 132: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between seat control switch C3026-3, circuit GD145 (BK/BU), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to Q3.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Q3 CHECK THE LUMBAR MOTOR

- Connect: Seat Control Switch C3026

- Disconnect: Power Lumbar Motor C3216

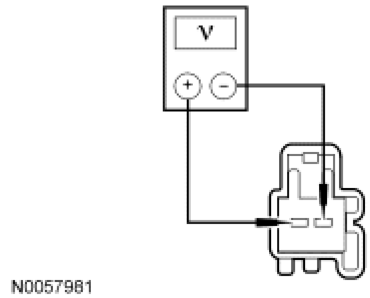


Fig. 133: Measuring Voltage
Courtesy of FORD MOTOR CO.

- While operating the seat control switch in both directions, measure the voltage between power lumbar motor C3216-1, circuit CPS20 (VT), harness side and power lumbar motor C3216-2, circuit CPS21 (WH/OG), harness side.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new power lumbar assembly. REFER to **Lumbar Assembly - Power**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to Q4.

Q4 CHECK CIRCUIT CPS20 (VT) AND CIRCUIT CPS21 (WH/OG) FOR A SHORT TO GROUND

- Disconnect: Seat Control Switch C3026

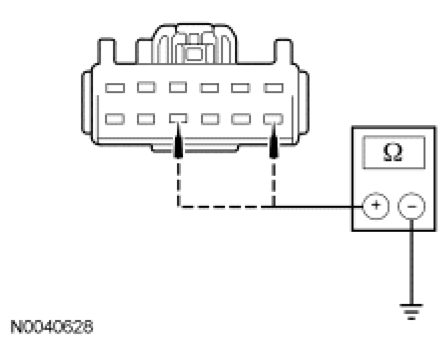


Fig. 134: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between seat control switch C3026-10, circuit CPS20 (VT), harness side and ground; and between seat control switch C3026-7, circuit CPS21 (WH/OG), harness side and ground.

- **Are the resistances greater than 10,000 ohms.**

  YES : Go to Q5.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Q5 CHECK CIRCUIT CPS20 (VT) AND CIRCUIT CPS21 (WH/OG) FOR AN OPEN

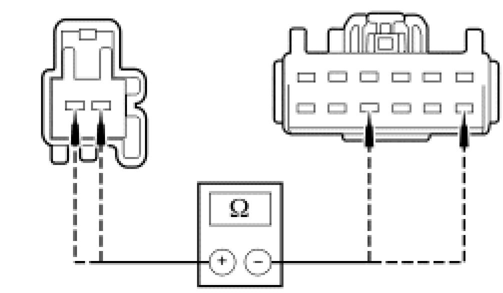


Fig. 135: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between seat control switch C3026-10, circuit CPS20 (VT), harness side and power lumbar motor C3216-1, circuit CPS20 (VT), harness side; and between seat control switch C3026-7, circuit CPS21 (WH/OG), harness side and power lumbar motor C3216-2, circuit CPS21 (WH/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new seat control switch. REFER to **Seat Control Switch - Front**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test R: The Heated Seats are Inoperative - Front

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and

connector information.

Normal Operation

The heated seat module receives ignition voltage on circuit CBP35 (YE/GY), battery voltage on circuit SBB16 (VT/RD) and is supplied ground on circuit GD133 (BK). When ignition switched voltage is supplied and the driver or passenger heated seat button on the HVAC module is pressed, a momentary ground signal is sent to the heated seat module to command the system ON or OFF. Upon receiving a signal, the heated seat module will decrease one setting (the sequence is hi, lo, OFF, hi, etc.). The heated seat module supplies voltage to the cushion and backrest heater mats, which are connected in series and operate together. A separate ground to the heater mats is provided on the backrest heater mat. Temperature is maintained by the heated seat module using a sensor contained within the cushion heater mat. The heated seat module supplies a reference voltage to the temperature sensor and monitors the return signal from the temperature sensor for controlling current flow to the heater mats. The heated seat module is designed to remain ON, heating the seat and maintaining temperature until switched OFF from the HVAC module or the ignition switch is turned OFF.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Heated seat module

PINPOINT TEST R: THE HEATED SEATS ARE INOPERATIVE - FRONT

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

R1 CHECK THE VOLTAGE TO THE HEATED SEAT MODULE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: Heated Seat Module C329

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

- Key in ON position.

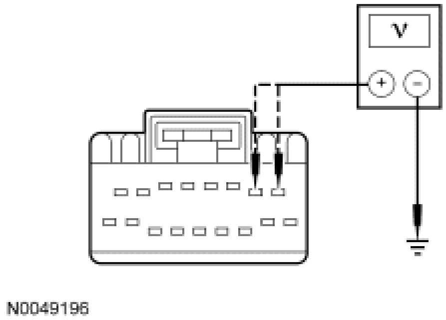


Fig. 136: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C329-2, circuit CBP35 (YE/GY), harness side and ground; and between heated seat module C329-1, circuit SBB16 (VT/RD), harness side and ground.
- **Are the voltages greater than 10 volts?**

  YES : Go to R2.

  NO : VERIFY battery junction box (BJB) fuse 16 (30A) and smart junction box (SJB) fuse 35 (10A) are OK. If OK, REPAIR the affected circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

R2 CHECK THE HEATED SEAT MODULE GROUND

- Key in OFF position.

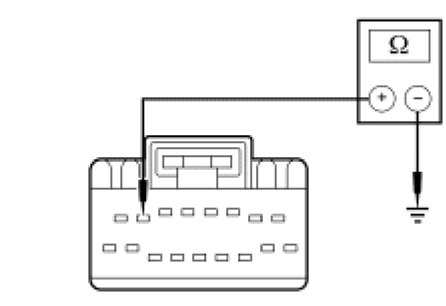


Fig. 137: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C329-7, circuit GD133 (BK), harness side and

ground.

- **Is the resistance less than 5 ohms?**

  YES : Go to R3.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

R3 CHECK THE SENSOR RETURN CIRCUIT FOR SHORT TO VOLTAGE

- Key in ON position.

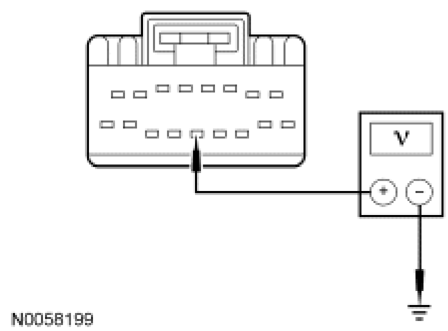


Fig. 138: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C329-13, circuit RHS05 (YE/VT), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to R4.

R4 CHECK THE SENSOR RETURN CIRCUIT FOR SHORT TO GROUND

- Key in OFF position.

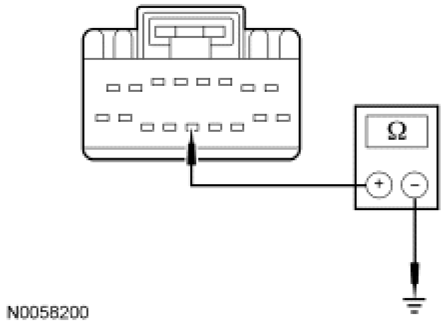


Fig. 139: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C329-13, circuit RHS05 (YE/VT), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to R5.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

R5 CHECK THE SENSOR RETURN CIRCUIT FOR AN OPEN

- Disconnect: Passenger Heated Seat C3284

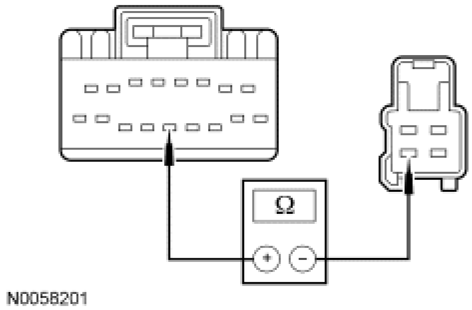


Fig. 140: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C329-13, circuit RHS05 (YE/VT), harness side and passenger heated seat C3284-3, circuit RHS05 (YE/VT), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to R6.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

R6 CHECK THE HEATED SEAT GROUND

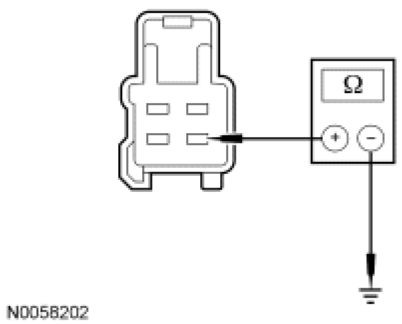


Fig. 141: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat C3284-4, circuit GD145 (BK/BU), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : INSTALL a new heated seat module. REFER to **Heated Seat Module - Front**. TEST the system for normal operation.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test S: The Heated Seat is Inoperative/Does Not Operate Correctly - Driver

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

The heated seat module receives ignition voltage on circuit CBP35 (YE/GY), battery voltage on circuit SBB16 (VT/RD) and is supplied ground on circuit GD133 (BK). When ignition switched voltage is supplied and the driver heated seat button on the HVAC module is pressed, a momentary ground signal is sent to the heated seat module on circuit CHS29 (WH/BU) to command the system ON or OFF. Upon receiving a signal, the heated seat module will decrease one setting (the sequence is hi, lo, OFF, hi, etc.). The heated seat module supplies voltage to the cushion and backrest heater mats on circuit CHS02 (YE/BU). Ground to the heater mats is provided on circuit GD145 (BK/BU). The cushion and backrest heater mats are connected in series and operate together. Temperature is maintained by the heated seat module using a sensor contained within the cushion heater mat. The heated seat module supplies a reference voltage to the temperature sensor on circuit RHS05 (YE/VT) and monitors the signal from the temperature sensor on circuit VHS26 (VT) for controlling current flow to the heater mats. The heated seat module is designed to remain ON, heating the seat and maintaining temperature until switched OFF from the HVAC module or the ignition switch is turned OFF.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Heater mat
- Heated seat module
- HVAC module

PINPOINT TEST S: THE HEATED SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - DRIVER

NOTE:	**The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

S1 CHECK CIRCUIT SBB16 (VT/RD) FOR VOLTAGE TO THE HEATED SEAT MODULE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: Heated Seat Module C329

WARNING:	**Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the**

battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

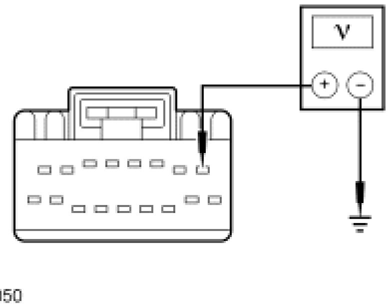


Fig. 142: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C329-1, circuit SBB16 (VT/RD) harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to S2.

  NO : VERIFY battery junction box (BJB) fuse 16 (30A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S2 CHECK CIRCUIT CHS02 (YE/BU) FOR AN OPEN OR SHORT TO GROUND

- Disconnect: Driver Cushion Heater Mat C3283

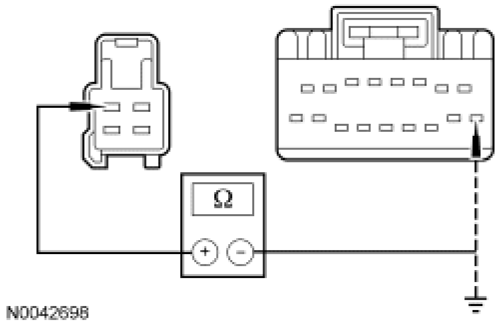


Fig. 143: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat cushion heater mat C3283-1, circuit CHS02 (YE/BU), harness side and ground; and between C3283-1, circuit CHS02 (YE/BU), harness side and heated seat module C329-9, circuit CHS02 (YE/BU) harness side.
- **Is the resistance greater than 10,000 ohms between the driver seat cushion heater mat and ground; and less than 5 ohms between the driver seat cushion heater mat and the heated seat module?**

  YES : Go to S3.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S3 CHECK CIRCUIT VHS26 (VT) FOR AN OPEN OR SHORT TO GROUND

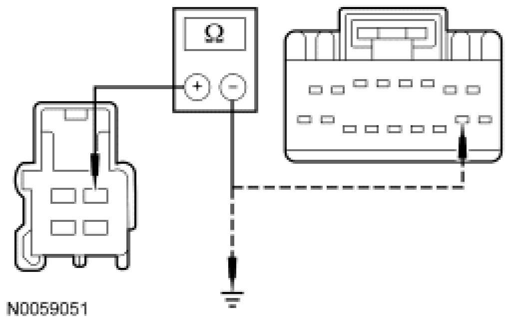


Fig. 144: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat cushion heater mat C3283-2, circuit VHS26 (VT), harness side and ground; and between C3283-2, circuit VHS26 (VT), harness side and heated seat module C329-10, circuit VHS26 (VT) harness side.

- **Is the resistance greater than 10,000 ohms between the driver seat cushion heater mat and ground and less than 5 ohms between the driver seat cushion heater mat and the heated seat module?**

  YES : Go to S4.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S4 CHECK CIRCUIT RHS05 (YE/VT) FOR AN OPEN OR SHORT TO GROUND

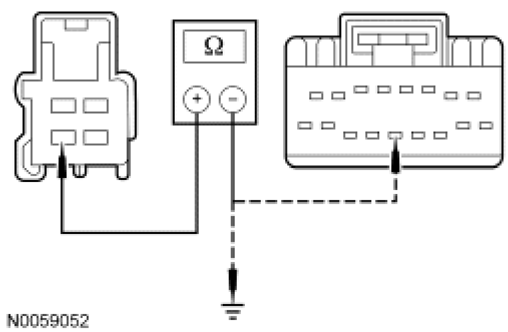


Fig. 145: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat cushion heater mat C3283-3, circuit RHS05 (YE/VT), harness side and ground; and between C3283-3, circuit RHS05 (YE/VT), harness side and heated seat module C329-13, circuit RHS05 (YE/VT) harness side.
- **Is the resistance greater than 10,000 ohms between the driver seat cushion heater mat and ground and less than 5 ohms between the driver seat cushion heater mat and the heated seat module?**

  YES : Go to S5.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S5 CHECK CIRCUITS CHS02 (YE/BU), VHS26 (VT) AND RHS05 (YE/VT) FOR SHORT TO VOLTAGE

- Key in ON position.

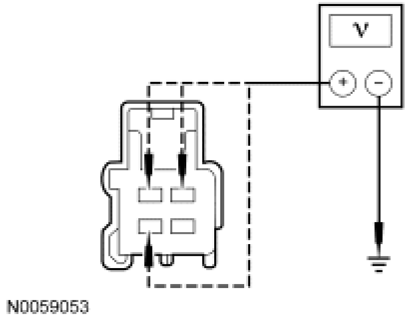


Fig. 146: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the following driver seat cushion heater mat C3283 pins, harness side and ground:

Connector - Pin	Circuit
C3283-1	CHS02 (YE/BU)
C3283-2	VHS26 (VT)
C3283-3	RHS05 (YE/VT)

- **Is the voltage less than 0.2 volt?**

  YES : Go to S6.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S6 CHECK CIRCUIT GD145 (BK/BU) FOR AN OPEN

- Key in OFF position.

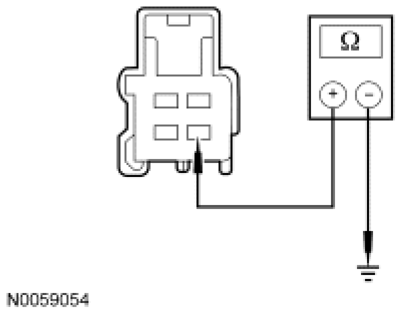


Fig. 147: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat cushion heater mat C3283-4, circuit GD145 (BK/BU), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to S7.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S7 CHECK CUSHION AND BACKREST HEATER MAT AND SENSOR FOR SHORT TO VOLTAGE

- Key in ON position.

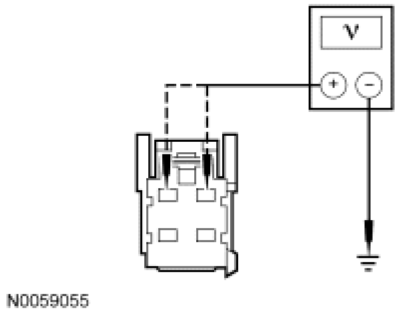


Fig. 148: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat cushion heater mat C3283 pin 1, component side and ground; and between driver seat cushion heater mat C3283 pin 2, component side and ground.

- **Is the voltage less than 0.2 volt?**

  YES : Go to S8.

  NO : REPAIR the circuit. INSTALL a new affected cushion or backrest heater mat. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S8 CHECK CUSHION HEATED SEAT MAT FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Disconnect: Driver Seat Cushion Heater Mat to Driver Seat Backrest Heater Mat Connector

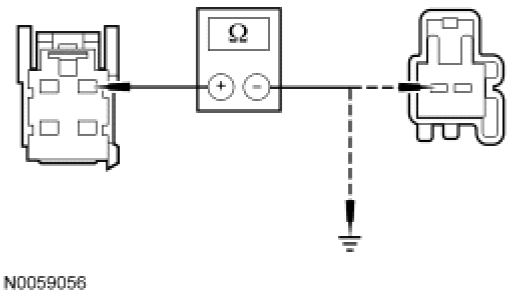


Fig. 149: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat cushion heater mat C3283 pin 1, component side and ground; and between driver seat cushion heater mat C3283 pin 1, component side and driver seat cushion heater mat to driver seat backrest heater mat connector pin 1, cushion side.
- **Is the resistance greater than 10,000 ohms between the driver seat cushion heater mat and ground; and between 1.4 and 2.2 ohms between the driver seat cushion heater mat to driver seat backrest heater mat?**

  YES : Go to S9.

  NO : INSTALL a new cushion heater mat. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S9 CHECK BACKREST HEATED SEAT MAT FOR AN OPEN OR SHORT TO GROUND

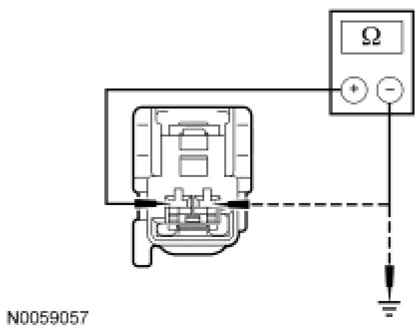


Fig. 150: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat backrest heater mat connector pin 2, component side and ground; and between driver seat backrest heater mat connector pin 1 and pin 2, component side.
- **Is the resistance greater than 10,000 ohms between the driver seat backrest heater mat and ground; and between 1.4 and 2.2 ohms between the driver seat backrest heater mat pins?**

  YES : Go to S10.

  NO : INSTALL a new cushion heater mat. TEST the system for normal operation.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S10 CHECK CIRCUIT BETWEEN BACKREST AND CUSHION HEATER MAT

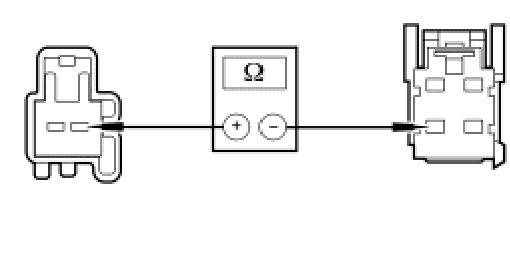


Fig. 151: Measuring Resistance

Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat cushion heater mat C3283 pin 4, component side and driver seat cushion heater mat to driver seat backrest heater mat connector pin 2, cushion side.
- **Is the resistance less than 5 ohms?**

  YES : Go to S11.

  NO : INSTALL a new seat cushion heater mat. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S11 CHECK THE HEATED SEAT TEMPERATURE SENSOR AND CIRCUITS FOR AN OPEN OR SHORT TO GROUND

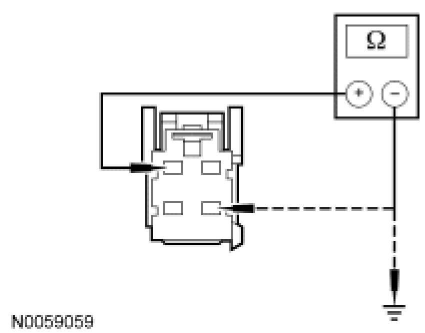


Fig. 152: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat cushion heater mat C3283 pin 2 and pin 3, component side; and between driver seat cushion heater mat C3283 pin 2, component side and ground.
- **Is the resistance less than 375,000 ohms and greater than 50 ohms between driver seat cushion heater mat pins; and greater than 10,000 ohms between driver seat cushion heater mat and ground?**

  YES : Go to S12.

  NO : INSTALL a new seat cushion heater mat. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S12 CHECK CIRCUIT CHS29 (WH/BU) FOR A SHORT TO VOLTAGE

- Disconnect: HVAC Module C228b
- Key in ON position.

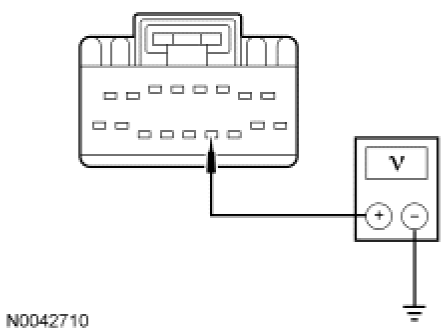


Fig. 153: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C329-12, circuit CHS29 (WH/BU), harness side and ground.
- **Is the voltage less than 0.2 volt?**

YES : Go to S13.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S13 CHECK CIRCUIT CHS29 (WH/BU) FOR A SHORT TO GROUND

- Key in OFF position.

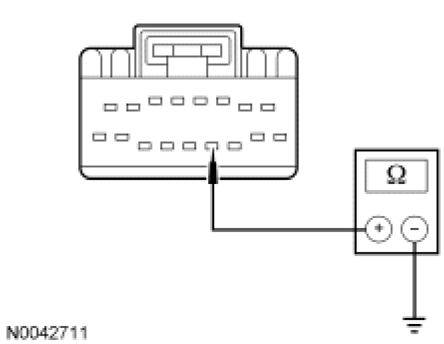


Fig. 154: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C329-12, circuit CHS29 (WH/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

YES : Go to S14.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S14 CHECK CIRCUIT CHS29 (WH/BU) FOR AN OPEN

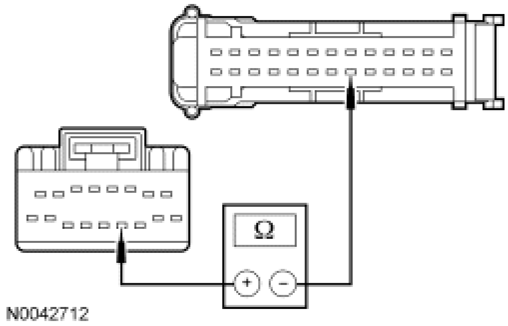


Fig. 155: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C329-12, circuit CHS29 (WH/BU), harness side and HVAC module C228b-6, circuit CHS29 (WH/BU), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to S15.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S15 CHECK THE HVAC MODULE OUTPUT

- Connect: HVAC Module C228b
- Connect: Heated Seat Module C329
- Key in ON position.

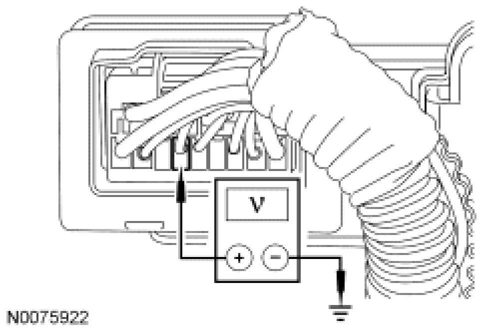


Fig. 156: Measuring Voltage
Courtesy of FORD MOTOR CO.

NOTE:	**The following measurement must be taken by back-probing the heated seat module C329.**

NOTE:	**The voltage on circuit CHS29 (WH/BU) should drop momentarily when the driver heated seat control button is pressed.**

- Measure the voltage between heated seat module C329-12, circuit CHS29 (WH/BU), harness side and ground by back-probing heated seat module connector. Press the driver heated seat control button on the HVAC module and note the voltage.
- **Is the voltage greater than 10 volts before pressing the driver heated seat control button, then momentarily drops when the heated seat control button is pressed?**

YES : INSTALL a new heated seat module. REFER to **Heated Seat Module - Front**. TEST the system for normal operation.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : If the voltage is greater than 10 volts but did not drop when the driver heated seat button was pressed, INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

If the voltage is less than 10 volts, INSTALL a new heated seat module. REFER to **Heated Seat**

Module - Front. TEST the system for normal operation.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test T: The Heated Seat is Inoperative/Does Not Operate Correctly - Front Passenger

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

The heated seat module receives ignition voltage on circuit CBP35 (YE/GY), battery voltage on circuit SBB16 (VT/RD) and is supplied ground on circuit GD133 (BK). When ignition switched voltage is supplied and the driver heated seat button on the HVAC module is pressed, a momentary ground signal is sent to the heated seat module on circuit CHS30 (GY/YE) to command the system ON or OFF. Upon receiving a signal, the heated seat module will decrease one setting (the sequence is hi, lo, OFF, hi, etc.). The heated seat module supplies voltage to the cushion and backrest heater mats on circuit CHS07 (GY/BU). Ground to the heater mats is provided on circuit GD145 (BK/BU). The cushion and backrest heater mats are connected in series and operate together. Temperature is maintained by the heated seat module using a sensor contained within the cushion heater mat. The heated seat module supplies a reference voltage to the temperature sensor on circuit RHS05 (YE/VT) and monitors the signal from the temperature sensor on circuit VHS27 (WH/OG) for controlling current flow to the heater mats. The heated seat module is designed to remain ON, heating the seat and maintaining temperature until switched OFF from the HVAC module or the ignition switch is turned OFF.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Heater mat
- Heated seat module
- HVAC module

PINPOINT TEST T: THE HEATED SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - PASSENGER

T1 CHECK CIRCUIT SBB16 (VT/RD) FOR VOLTAGE TO THE HEATED SEAT MODULE

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and**

free of faults before releasing the vehicle to the customer.

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: Heated Seat Module C329

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

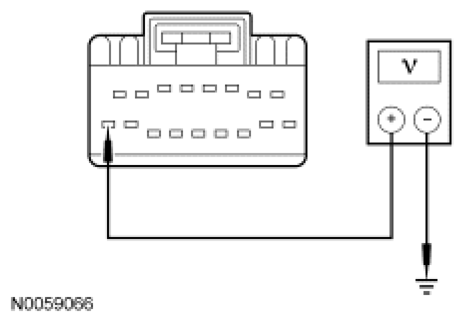


Fig. 157: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C329-17, circuit SBB16 (VT/RD) harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to T2.

  NO : VERIFY battery junction box (BJB) fuse 16 (30A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

T2 CHECK CIRCUIT CHS07 (GY/BU) FOR AN OPEN OR SHORT TO GROUND

- Disconnect: Passenger Cushion Heater Mat C3284

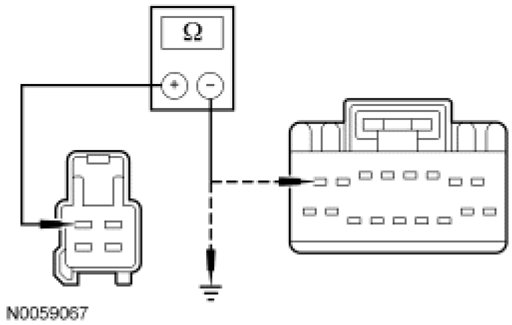


Fig. 158: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat cushion heater mat C3284-1, circuit CHS07 (GY/BU), harness side and ground; and between C3284-1, circuit CHS07 (GY/BU), harness side and heated seat module C329-8, circuit CHS07 (GY/BU) harness side.
- **Is the resistance greater than 10,000 ohms between the passenger seat cushion heater mat and ground; and less than 5 ohms between the passenger seat cushion heater mat and the heated seat module?**

  YES : Go to T3.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

T3 CHECK CIRCUIT VHS27 (WH/OG) FOR AN OPEN OR SHORT TO GROUND

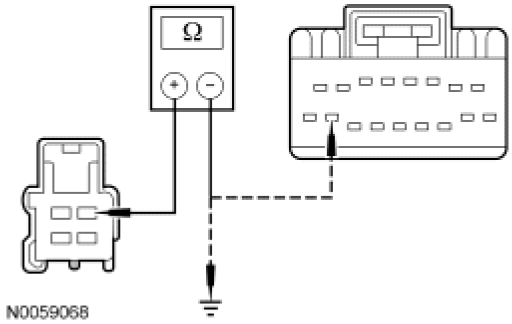


Fig. 159: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat cushion heater mat C3284-2, circuit VHS27 (WH/OG), harness side and ground; and between C3284-2, circuit VHS27 (WH/OG), harness side and heated seat module C329-16, circuit VHS27 (WH/OG) harness side.

- **Is the resistance greater than 10,000 ohms between the passenger seat cushion heater mat and ground; and less than 5 ohms between the passenger seat cushion heater mat and the heated seat module?**

  YES : Go to T4.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

T4 CHECK CIRCUIT RHS05 (YE/VT) FOR AN OPEN OR SHORT TO GROUND

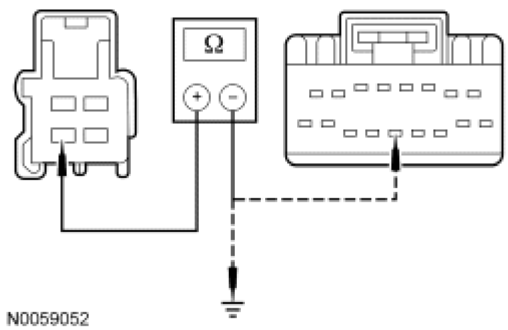


Fig. 160: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat cushion heater mat C3284-3, circuit RHS05 (YE/VT), harness side and ground; and between C3284-3, circuit RHS05 (YE/VT), harness side and heated seat module C329-13, circuit RHS05 (YE/VT) harness side.
- **Is the resistance greater than 10,000 ohms between the passenger seat cushion heater mat and ground; and less than 5 ohms between the passenger seat cushion heater mat and the heated seat module?**

  YES : Go to T5.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

T5 CHECK CIRCUITS CHS07 (GY/BU), VHS27 (WH/OG) AND RHS05 (YE/VT) FOR SHORT TO VOLTAGE

- Key in ON position.

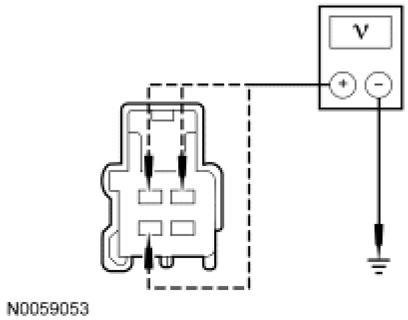


Fig. 161: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the following passenger seat cushion heater mat C3284 pins, harness side and ground:

Connector - Pin	Circuit
C3284-1	CHS07 (GY/BU)
C3284-2	VHS27 (WH/OG)
C3284-3	RHS05 (YE/VT)

- **Is the voltage less than 0.2 volt?**

  YES : Go to T6.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

T6 CHECK CIRCUIT GD145 (BK/BU) FOR AN OPEN

- Key in OFF position.

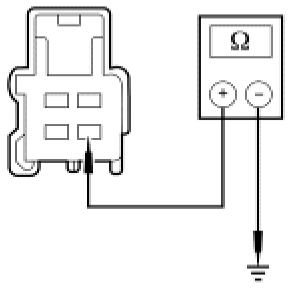


Fig. 162: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat cushion heater mat C3284-4, circuit GD145 (BK/BU), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to T7.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

T7 CHECK CUSHION AND BACKREST HEATER MAT AND SENSOR FOR SHORT TO VOLTAGE

- Key in ON position.

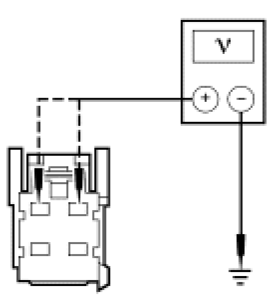


Fig. 163: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger seat cushion heater mat C3284 pin 1, component side and ground; and between passenger seat cushion heater mat C3284 pin 2, component side and ground.
- **Is the voltage less than 0.2 volt?**

  YES : Go to T8.

NO : REPAIR the circuit. INSTALL a new affected cushion or backrest heater mat. TEST the system for normal operation.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

T8 CHECK CUSHION HEATED SEAT MAT FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Disconnect: Passenger Seat Cushion Heater Mat to Passenger Seat Backrest Heater Mat Connector

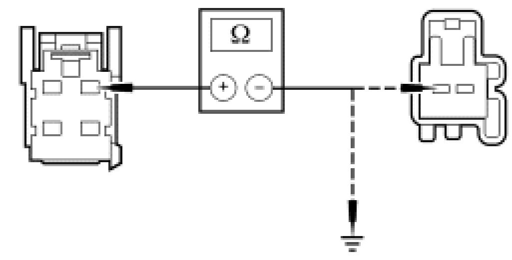


Fig. 164: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat cushion heater mat C3284 pin 1, component side and ground; and between passenger seat cushion heater mat C3284 pin 1, component side and passenger seat cushion heater mat to passenger seat backrest heater mat connector pin 1, cushion side.
- **Is the resistance greater than 10,000 ohms between the passenger seat cushion heater mat and ground; and between 1.4 and 2.2 ohms between the passenger seat cushion heater mat and passenger seat cushion heater mat to passenger seat backrest heater mat?**

YES : Go to T9.

NO : INSTALL a new cushion heater mat. TEST the system for normal operation.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

T9 CHECK BACKREST HEATED SEAT MAT FOR AN OPEN OR SHORT TO GROUND

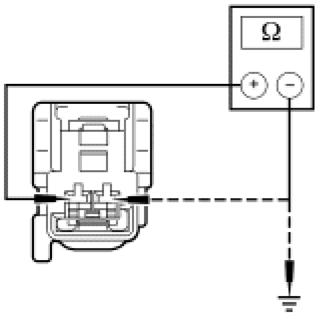


Fig. 165: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat backrest heater mat connector pin 2, component side and ground; and between passenger seat backrest heater mat connector pin 1 and pin 2, component side.
- **Is the resistance greater than 10,000 ohms between the passenger seat backrest heater mat and ground; and between 1.4 and 2.2 ohms between the passenger seat backrest heater mat pins?**

  YES : Go to T10.

  NO : INSTALL a new cushion heater mat. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

T10 CHECK CIRCUIT BETWEEN BACKREST AND CUSHION HEATER MAT

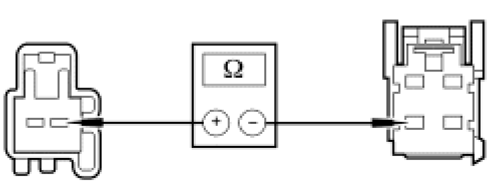


Fig. 166: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat cushion heater mat C3284 pin 4, component side and passenger seat cushion heater mat to passenger seat backrest heater mat connector pin 2, cushion side.

- **Is the resistance less than 5 ohms?**

  YES : Go to T11.

  NO : INSTALL a new seat cushion heater mat. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

T11 CHECK THE HEATED SEAT TEMPERATURE SENSOR AND CIRCUITS FOR AN OPEN OR SHORT TO GROUND

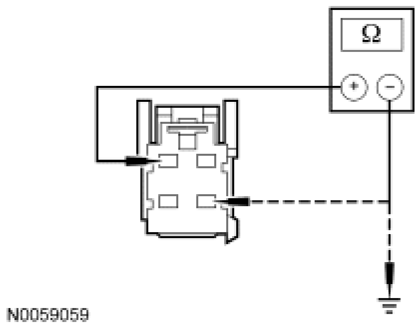


Fig. 167: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat cushion heater mat C3284 pin 2 and pin 3, component side; and between passenger seat cushion heater mat C3284 pin 2, component side and ground.
- **Is the resistance less than 375,000 ohms and greater than 50 ohms between passenger seat cushion heater mat pins; and greater than 10,000 ohms between passenger seat cushion heater mat and ground?**

  YES : Go to T12.

  NO : INSTALL a new seat cushion heater mat. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

T12 CHECK CIRCUIT CHS30 (GY/YE) FOR A SHORT TO VOLTAGE

- Disconnect: HVAC Module C228b
- Key in ON position.

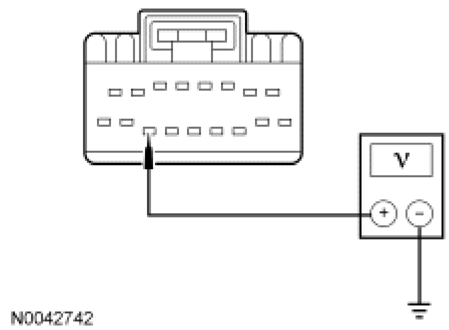


Fig. 168: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C329-15, circuit CHS30 (GY/YE), harness side and ground.
- **Is the voltage less than 0.2 volt?**

YES : Go to T13.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

T13 CHECK CIRCUIT CHS30 (GY/YE) FOR A SHORT TO GROUND

- Key in OFF position.

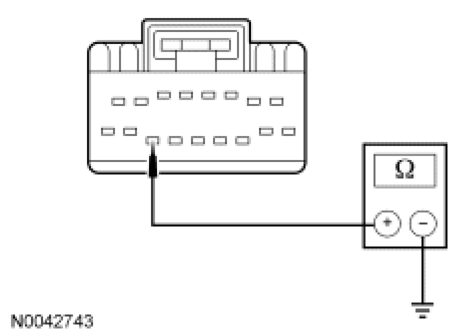


Fig. 169: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C329-15, circuit CHS30 (GY/YE), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

YES : Go to T14.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

T14 CHECK CIRCUIT CHS30 (GY/YE) FOR AN OPEN

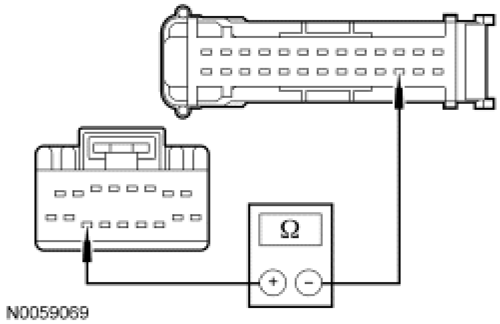


Fig. 170: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C329-15, circuit CHS30 (GY/YE), harness side and HVAC module C228b-3, circuit CHS30 (GY/YE), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to T15.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

T15 CHECK THE HVAC MODULE OUTPUT

- Connect: HVAC Module C228b
- Connect: Heated Seat Module C329
- Key in ON position.

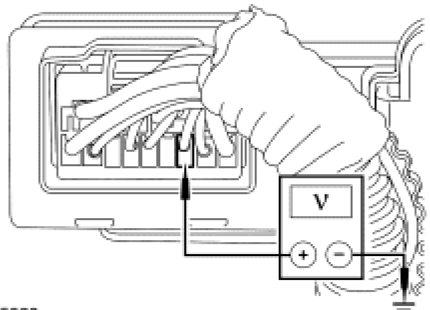


Fig. 171: Measuring Voltage
Courtesy of FORD MOTOR CO.

NOTE:	**The following measurement must be taken by back-probing the heated seat module C329.**

NOTE:	**The voltage on circuit CHS30 (GY/YE) should drop momentarily when the passenger heated seat control button is pressed.**

- Measure the voltage between passenger heated seat module C329-15, circuit CHS30 (GY/YE), harness side and ground by back-probing heated seat module connector. Press the passenger heated seat control button on the HVAC module and note the voltage.
- **Is the voltage greater than 10 volts before pressing the passenger heated seat control button, then momentarily drops when the heated seat control button is pressed?**

  YES : INSTALL a new heated seat module. REFER to **Heated Seat Module - Front**. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If the voltage is greater than 10 volts but did not drop when the passenger heated seat button was pressed, INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  If the voltage is less than 10 volts, INSTALL a new heated seat module. REFER to **Heated Seat Module - Front**. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test U: The Heated Seat is Inoperative - Driver Seat Does Heat But the Heated Seat Indicator Does Not Illuminate When Pressed

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Upon receiving a signal from the HVAC module, the heated seat module will decrease one setting (the sequence is hi, lo, OFF, hi, etc.). When the driver heated seat is set to hi, both LED indicators above the driver heated seat control button will illuminate. When the driver heated seat is set to lo, only the left LED on the driver heated seat indicator will illuminate. When the driver heated seat is set to OFF, neither driver heated seat LED will illuminate.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Heated seat module
- HVAC module

PINPOINT TEST U: THE HEATED SEAT IS INOPERATIVE - DRIVER SEAT DOES HEAT BUT THE HEATED SEAT INDICATOR DOES NOT ILLUMINATE WHEN PRESSED

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

U1 CHECK CIRCUITS CHS04 (YE/GY) AND CHS13 (VT/BN) FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: HVAC Module C228b
- Disconnect: Heated Seat Module C329

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

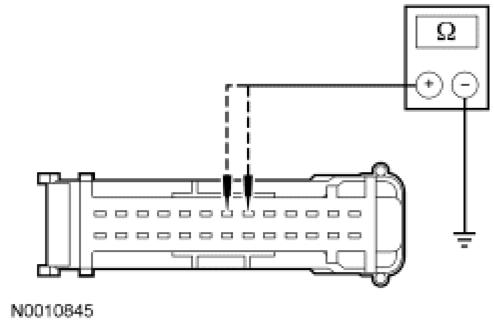


Fig. 172: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module C228b-7, circuit CHS04 (YE/GY), harness side and ground; and between HVAC module C228b-8, circuit CHS13 (VT/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to U2.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

U2 CHECK CIRCUITS CHS04 (YE/GY) AND CHS13 (VT/BN) FOR AN OPEN

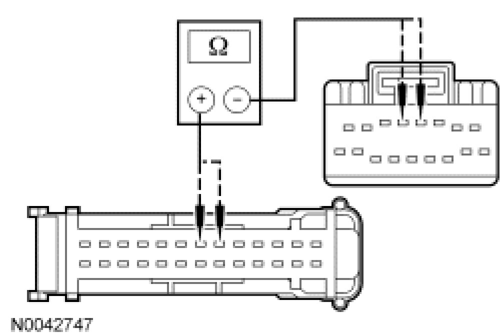


Fig. 173: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module C228b-7, circuit CHS04 (YE/GY), harness side and heated seat module C329-5, circuit CHS04 (YE/GY), harness side; and between HVAC module C228b-8, circuit CHS13 (VT/BN), harness side and heated seat module C329-4, circuit CHS13 (VT/BN), harness side.
- **Are the resistances less than 5 ohms?**

YES : Go to U3.

NO : REPAIR the affected circuit. TEST the system for normal operation.

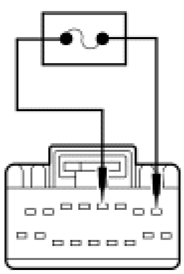
DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

U3 CHECK THE HEATED SEAT MODULE HI INDICATOR ON THE HVAC MODULE

- Connect: HVAC Module C228b
- Key in ON position.



N0042749

Fig. 174: Checking Heated Seat Module HI Indicator On EATC Module
Courtesy of FORD MOTOR CO.

- Connect a fused jumper lead between heated seat module C329-4, circuit CHS13 (VT/BN), harness side and C329-1, circuit SBB16 (VT/RD), harness side.
- **Does the right driver heated seat indicator LED illuminate on the HVAC module?**

YES : Go to U4.

NO : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

U4 CHECK THE HEATED SEAT MODULE LOW INDICATOR ON THE HVAC MODULE

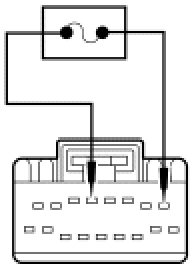

N0042750

Fig. 175: Checking Heated Seat Module Low Indicator On EATC Module
Courtesy of FORD MOTOR CO.

- Connect a fused jumper lead between heated seat module C329-5, circuit CHS04 (YE/GY), harness side and C329-1, circuit SBB16 (VT/RD), harness side.
- **Does the left driver heated seat indicator LED illuminate on the HVAC module?**

  YES : INSTALL a new heated seat module. REFER to **Heated Seat Module - Front**. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test V: The Heated Seat is Inoperative - Front Passenger Seat Does Heat But the Heated Seat Indicator Does Not Illuminate When Pressed

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Upon receiving a signal from the HVAC module, the heated seat module will decrease one setting (the sequence is hi, lo, OFF, hi, etc.). When the passenger heated seat is set to hi, both LED indicators above the passenger heated seat control button will illuminate. When the passenger heated seat is set to lo, only the left LED on the passenger heated seat indicator will illuminate. When the passenger heated seat is set to OFF, neither passenger heated seat LED will illuminate.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Heated seat module
- HVAC module

PINPOINT TEST V: THE HEATED SEAT IS INOPERATIVE - FRONT PASSENGER SEAT DOES HEAT BUT THE HEATED SEAT INDICATOR DOES NOT ILLUMINATE WHEN PRESSED

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

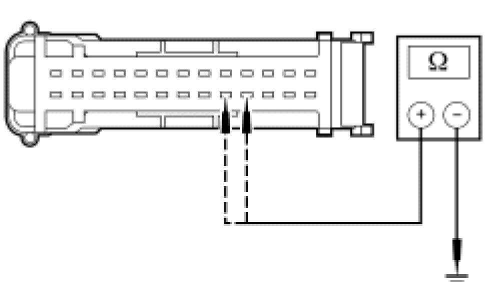
NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

V1 CHECK CIRCUITS CHS09 (GY) AND CHS14 (GN) FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: HVAC Module C228b
- Disconnect: Heated Seat Module C329

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.



N0059077

Fig. 176: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module C228b-4, circuit CHS09 (GY), harness side and ground; and between HVAC module C228b-5, circuit CHS14 (GN), harness side and ground.

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to V2.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

V2 CHECK CIRCUITS CHS09 (GY) AND CHS14 (GN) FOR AN OPEN

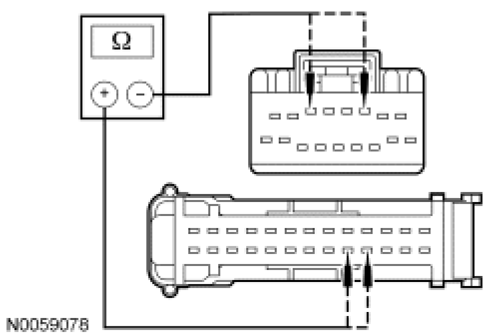


Fig. 177: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module C228b-4, circuit CHS09 (GY), harness side and heated seat module C329-3, circuit CHS09 (GY), harness side; and between HVAC module C228b-5, circuit CHS14 (GN), harness side and heated seat module C329-6, circuit CHS14 (GN), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to V3.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

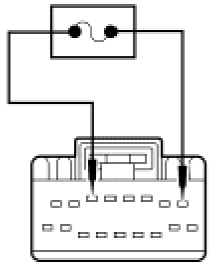
  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

V3 CHECK THE HEATED SEAT MODULE HI INDICATOR ON THE HVAC MODULE

- Connect: HVAC Module C228b
- Key in ON position.



N0042754

Fig. 178: Checking Heated Seat Module HI Indicator On EATC Module
Courtesy of FORD MOTOR CO.

- Connect a fused jumper lead between heated seat module C329-6, circuit CHS14 (GN), harness side and C329-1, circuit SBB16 (VT/RD), harness side.
- **Does the right passenger heated seat indicator LED illuminate on the HVAC module?**

  YES : Go to V4.

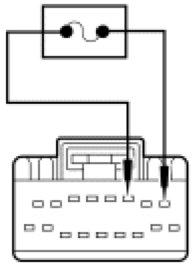
  NO : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

V4 CHECK THE HEATED SEAT MODULE LOW INDICATOR ON THE HVAC MODULE



N0042755

Fig. 179: Checking Heated Seat Module Low Indicator On EATC Module
Courtesy of FORD MOTOR CO.

- Connect a fused jumper lead between passenger heated seat module C329-3, circuit CHS09 (GY), harness side and C329-1, circuit SBB16 (VT/RD), harness side.
- **Does the left passenger heated seat indicator LED illuminate on the HVAC module?**

  YES : INSTALL a new heated seat module. REFER to **Heated Seat Module - Front**. TEST the system for normal operation.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test W: The Heated Seats are Inoperative - Rear

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

The heated seat module receives battery voltage on circuit SBB07 (WH/RD) and ignition voltage on circuit CBP35 (YE/GY), and is supplied ground on circuit GD133 (BK). When the left rear heated seat control switch is pressed with the ignition switch in RUN or START, a ground is supplied on circuit CHS46 (YE/GN) to command the system ON or OFF in hi heat mode or circuit CHS47 (VT/GN) to command the system ON or OFF in low heat mode. When the right rear heated seat control switch is pressed with the ignition switch in RUN or START, a ground is supplied on circuit CHS50 (BU/GY) to command the system ON or OFF in hi heat mode or circuit CHS51 (YE/GY) to command the system ON or OFF in low heat mode. When commanded ON, voltage is supplied to the heated seat switch from the heated seat module on either circuit CHS48 (YE) (left rear) or CHS52 (BU) (right rear) (hi heat mode); or circuit CHS49 (VT) (left rear) or CHS53 (WH/BN) (right rear) (low heat mode) illuminating the switch indicator. The heated seat module also supplies voltage to the cushion and backrest heater mats on circuit CHS39 (GN/BU) (left rear) or CHS43 (GY/BU) (right rear) and ground to the heater mats on circuit GD126 (BK/WH) (left rear) or GD151 (BK/GN) (right rear). The cushion and backrest heater mats are connected in series and operate together. Temperature is maintained by the heated seat module using a sensor contained within the cushion heater mat. The heated seat module monitors the temperature sensors on circuit VHS42 (GN) (left rear) or VHS45 (GY/BN) (right rear) for adjusting the current flow to the heater mats and uses a ground supplied on circuit RHS41 (GN/BN). The heated seat module is designed to remain ON, heating the seat and maintaining temperature until switched OFF or the ignition voltage is switched OFF.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Heated seat module

PINPOINT TEST W: THE HEATED SEATS ARE INOPERATIVE - REAR

W1 CHECK THE VOLTAGE TO THE HEATED SEAT MODULE

- Disconnect: Heated Seat Module C3162
- Key in ON position.

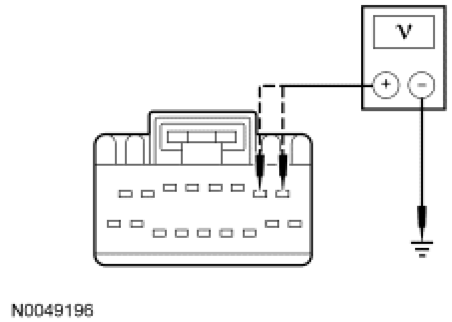


Fig. 180: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C3162-2, circuit CBP35 (YE/GY), harness side and ground; and between heated seat module C3162-1, circuit SBB07 (WH/RD), harness side and ground.
- **Are the voltages greater than 10 volts?**

  YES : Go to W2.

  NO : VERIFY battery junction box (BJB) fuse 7 (30A) and smart junction box (SJB) fuse 35 (10A) are OK. If OK, REPAIR the affected circuit. TEST the system for normal operation.

W2 CHECK THE HEATED SEAT MODULE GROUND

- Key in OFF position.

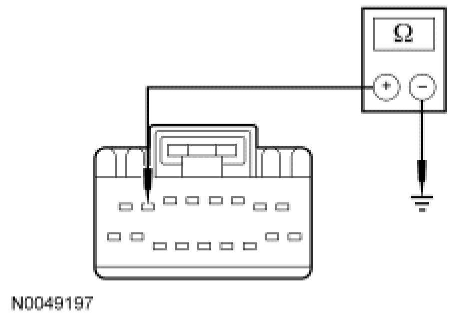


Fig. 181: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C3162-7, circuit GD133 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : Go to W3.

NO : REPAIR the circuit. TEST the system for normal operation.

W3 CHECK THE SENSOR RETURN CIRCUIT FOR SHORT TO VOLTAGE

- Key in ON position.

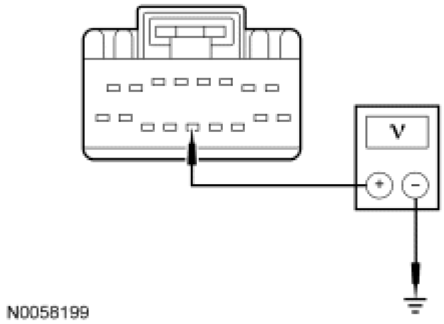


Fig. 182: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C3162-13, circuit RHS41 (GN/BN), harness side and ground.
- **Is voltage greater than 0.2 volt?**

YES : REPAIR the circuit. TEST the system for normal operation.

NO : Go to W4.

W4 CHECK THE SENSOR RETURN CIRCUIT FOR SHORT TO GROUND

- Key in OFF position.

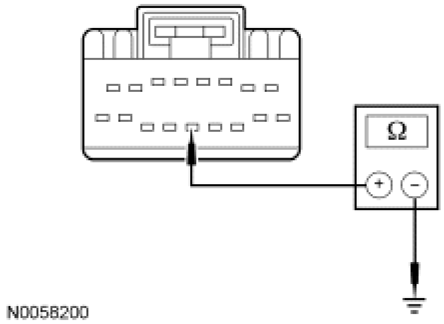


Fig. 183: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C3162-13, circuit RHS41 (GN/BN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

YES : Go to W5.

NO : REPAIR the circuit. TEST the system for normal operation.

W5 CHECK THE SENSOR RETURN CIRCUIT FOR AN OPEN

- Disconnect: Right Rear Heated Seat C3169

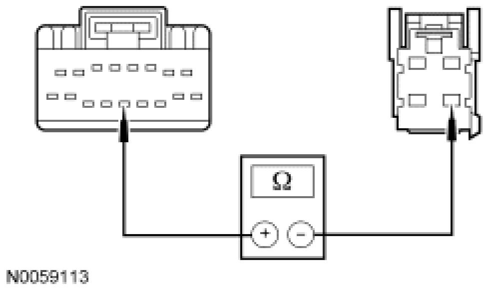


Fig. 184: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C3162-13, circuit RHS41 (GN/BN), harness side and right rear heated seat C3169-3, circuit RHS41 (GN/BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new heated seat module. REFER to **Heated Seat Module - Rear Seat**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test X: The Heated Seat is Inoperative/Does Not Operate Correctly - Left Rear

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

The heated seat module receives battery voltage on circuit CBP35 (YE/GY) and ignition voltage on circuit SBB07 (WH/RD), and is supplied ground on circuit GD133 (BK). When the left rear heated seat control switch is pressed with the ignition switch in RUN or START, a ground is supplied on circuit CHS46 (YE/GN) to command the system ON or OFF in hi heat mode or circuit CHS47 (VT/GN) to command the system ON or OFF in low heat mode. When commanded ON, voltage is supplied to the heated seat switch from the heated seat module on either circuit CHS48 (YE) (hi heat mode) or circuit CHS49 (VT) (low heat mode) illuminating the switch indicator. The heated seat module also supplies voltage to the cushion and backrest heater mats on circuit CHS39 (GN/BU) and ground to the heater mats on circuit GD126 (BK/WH). The cushion and backrest heater mats are connected in series and operate together. Temperature is maintained by the heated seat module using a sensor contained within the cushion heater mat. The heated seat module monitors the temperature sensor on circuit VHS42 (GN) for adjusting the current flow to the heater mats and uses a ground supplied on circuit RHS41 (GN/BN). The heated seat module is designed to remain ON, heating the seat and maintaining temperature until switched OFF or the ignition voltage is switched OFF.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Heater mat
- Heated seat module
- Heated seat switch

PINPOINT TEST X: THE HEATED SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - LEFT REAR

X1 CHECK CIRCUIT SBB07 (WH/RD) FOR VOLTAGE TO THE HEATED SEAT MODULE

- Disconnect: Heated Seat Module C3162

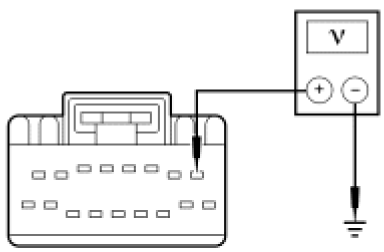


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Fig. 185: Measuring Voltage
Courtesy of FORD MOTOR CO.

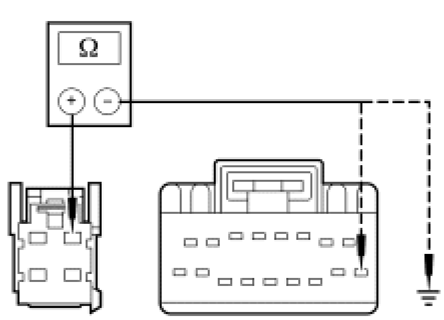
- Measure the voltage between heated seat module C3162-1, circuit SBB07 (WH/RD) harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to X2.

NO : REPAIR the circuit. TEST the system for normal operation.

X2 CHECK CIRCUIT CHS39 (GN/BU) FOR AN OPEN OR SHORT TO GROUND

- Disconnect: Left Rear Cushion Heater Mat C3167



N0059282

Fig. 186: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between left rear seat cushion heater mat C3167-1, circuit CHS39 (GN/BU), harness side and ground; and between C3167-1, circuit CHS39 (GN/BU), harness side and heated seat module C3162-9, circuit CHS39 (GN/BU) harness side.

- **Is the resistance greater than 10,000 ohms between the left rear seat cushion heater mat and ground; and less than 5 ohms between the left rear seat cushion heater mat and the heated seat module?**

  YES : Go to X3.

  NO : REPAIR the circuit. TEST the system for normal operation.

X3 CHECK CIRCUIT VHS42 (GN) FOR AN OPEN OR SHORT TO GROUND

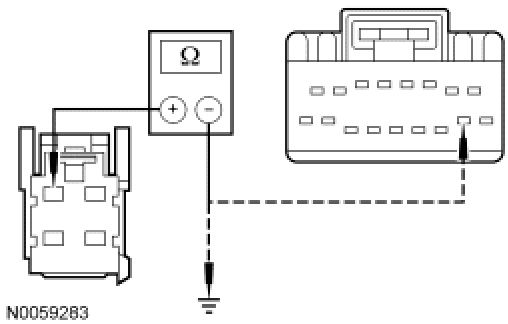


Fig. 187: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between left rear seat cushion heater mat C3167-2, circuit VHS42 (GN), harness side and ground; and between C3167-2, circuit VHS42 (GN), harness side and heated seat module C3162-10, circuit VHS42 (GN) harness side.
- **Is the resistance greater than 10,000 ohms between the left rear seat cushion heater mat and ground and less than 5 ohms between the left rear seat cushion heater mat and the heated seat module?**

  YES : Go to X4.

  NO : REPAIR the circuit. TEST the system for normal operation.

X4 CHECK CIRCUIT RHS41 (GN/BN) FOR AN OPEN OR SHORT TO GROUND

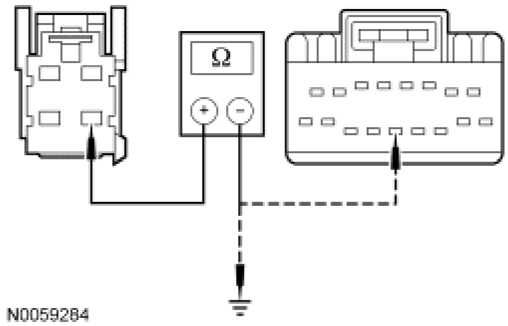


Fig. 188: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between left rear seat cushion heater mat C3167-3, circuit RHS41 (GN/BN), harness side and ground; and between C3167-3, circuit RHS41 (GN/BN), harness side and heated seat module C3162-13, circuit RHS41 (GN/BN) harness side.
- **Is the resistance greater than 10,000 ohms between the left rear seat cushion heater mat and ground and less than 5 ohms between the left rear seat cushion heater mat and the heated seat module?**

  YES : Go to X5.

  NO : REPAIR the circuit. TEST the system for normal operation.

X5 CHECK CIRCUITS CHS39 (GN/BU), VHS42 (GN) AND RHS41 (GN/BN) FOR SHORT TO VOLTAGE

- Key in ON position.

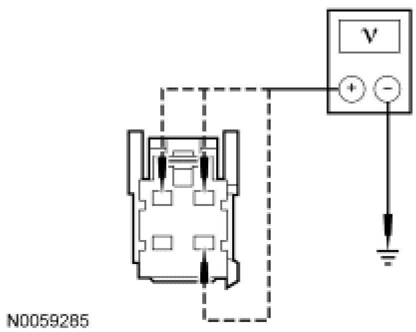


Fig. 189: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the following left rear seat cushion heater mat C3167 pins, harness side and ground:

Connector - Pin	Circuit
C3167-1	CHS39 (GN/BU)
C3167-2	VHS42 (GN)
C3167-3	RHS41 (GN/BN)

- **Are the voltages less than 0.2 volt?**

  YES : Go to X6.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

X6 CHECK CIRCUIT GD126 (BK/WH) FOR AN OPEN

- Key in OFF position.

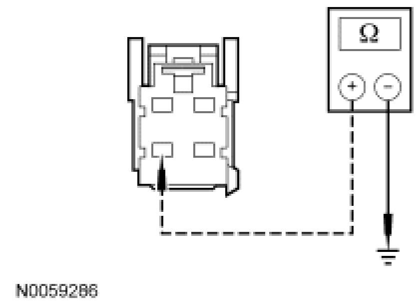


Fig. 190: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between left rear seat cushion heater mat C3167-4, circuit GD126 (BK/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to X7.

  NO : REPAIR the circuit. TEST the system for normal operation.

X7 CHECK CUSHION AND BACKREST HEATER MAT AND SENSOR FOR SHORT TO VOLTAGE

- Key in ON position.

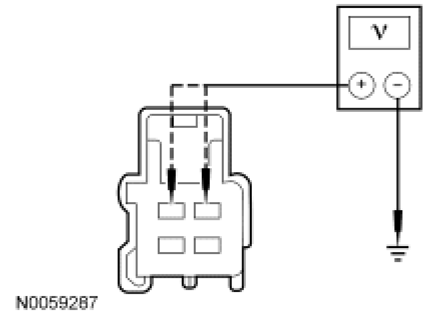


Fig. 191: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between left rear seat cushion heater mat C3167 pin 1, component side and ground; and between left rear seat cushion heater mat C3167 pin 2, component side and ground.
- **Are the voltages less than 0.2 volt?**

  YES : Go to X8.

  NO : REPAIR the circuit. INSTALL a new affected cushion or backrest heater mat. TEST the system for normal operation.

X8 CHECK CUSHION HEATED SEAT MAT FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Disconnect: Left Rear Seat Cushion Heater Mat to Left Rear Seat Backrest Heater Mat Connector

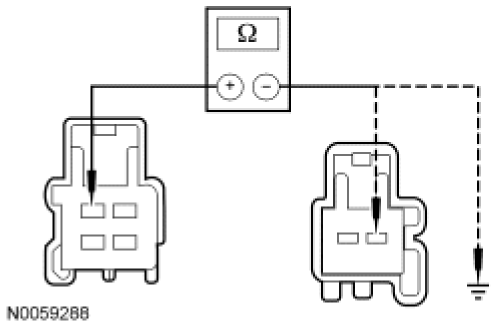


Fig. 192: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between left rear seat cushion heater mat C3167 pin 1, component side and ground; and between left rear seat cushion heater mat C3167 pin 1, component side and left rear seat cushion heater mat to left rear seat backrest heater mat connector pin 1, cushion side.
- **Is the resistance greater than 10,000 ohms between the left rear seat cushion heater mat and ground; and between 1.6 and 2.2 ohms between the left rear seat cushion heater mat and left rear seat backrest heater mat?**

  YES : Go to X9.

  NO : INSTALL a new cushion heater mat. TEST the system for normal operation.

X9 CHECK BACKREST HEATED SEAT MAT FOR AN OPEN OR SHORT TO GROUND

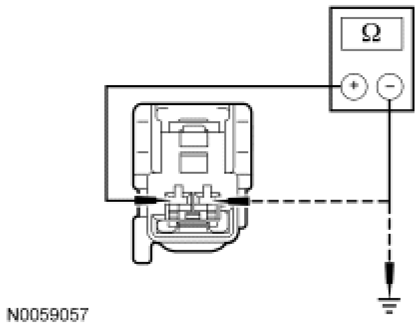


Fig. 193: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between left rear seat backrest heater mat connector pin 2, component side and ground; and between left rear seat backrest heater mat connector pin 1 and pin 2, component side.
- **Is the resistance greater than 10,000 ohms between the left rear seat backrest heater mat and ground; and between 1.6 and 2.2 ohms between the left rear seat backrest heater mat pins?**

  YES : Go to X10.

  NO : INSTALL a new cushion heater mat. TEST the system for normal operation.

X10 CHECK CIRCUIT BETWEEN BACKREST AND CUSHION HEATER MAT

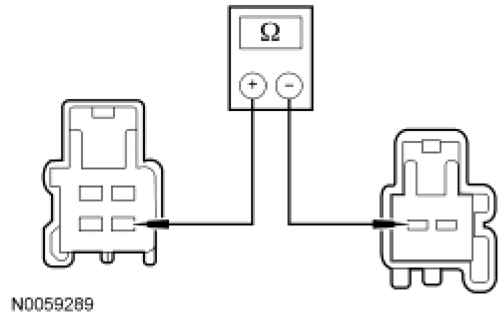


Fig. 194: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between left rear seat cushion heater mat C3167 pin 4, component side and left rear seat cushion heater mat to left rear seat backrest heater mat connector pin 2, cushion side.
- **Is the resistance less than 5 ohms?**

  YES : Go to X11.

  NO : INSTALL a new cushion heater mat. TEST the system for normal operation.

X11 CHECK THE HEATED SEAT TEMPERATURE SENSOR AND CIRCUITS FOR AN OPEN OR SHORT TO GROUND

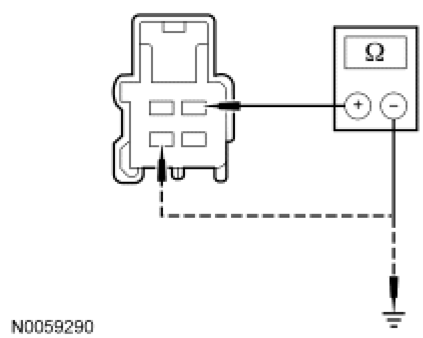


Fig. 195: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between left rear seat cushion heater mat C3167 pin 2 and pin 3, component side; and between left rear seat cushion heater mat C3167 pin 2, component side and ground.
- **Is the resistance less than 300,000 ohms and greater than 50 ohms between left rear seat cushion heater mat pins; and greater than 10,000 ohms between left rear seat cushion heater mat and ground?**

  YES : Go to X12.

  NO : INSTALL a new cushion heater mat. TEST the system for normal operation.

X12 CHECK CIRCUITS CHS46 (YE/GN) AND CHS47 (VT/GN) FOR A SHORT TO VOLTAGE

- Disconnect: Left Rear Heated Seat Switch C722
- Key in ON position.

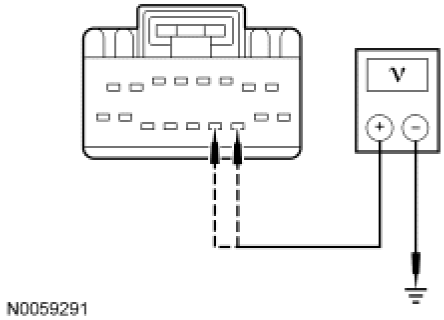


Fig. 196: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C3162-11, circuit CHS46 (YE/GN), harness side and ground; and between heated seat module C3162-12, circuit CHS47 (VT/GN), harness side and ground.
- **Are the voltages less than 0.2 volt?**

  YES : Go to X13.

  NO : REPAIR the circuit. TEST the system for normal operation.

X13 CHECK CIRCUITS CHS46 (YE/GN) AND CHS47 (VT/GN) FOR A SHORT TO GROUND

- Key in OFF position.

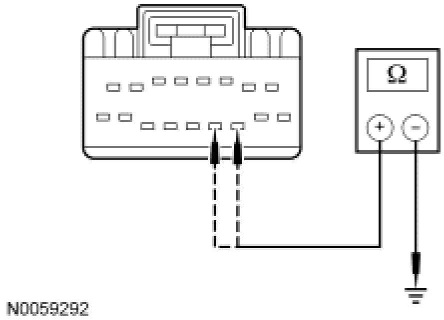


Fig. 197: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C3162-11, circuit CHS46 (YE/GN), harness side and ground; and between heated seat module C3162-12, circuit CHS47 (VT/GN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to X14.

  NO : REPAIR the circuit. TEST the system for normal operation.

X14 CHECK BETWEEN CIRCUITS CHS46 (YE/GN) AND CHS47 (VT/GN) FOR A SHORT

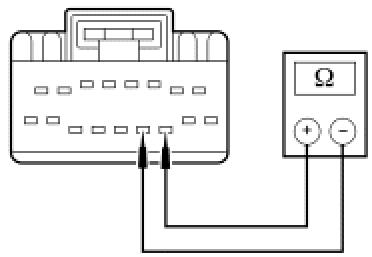


Fig. 198: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C3162-11, circuit CHS46 (YE/GN), harness side and heated seat module C3162-12, circuit CHS47 (VT/GN), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to X15.

  NO : REPAIR the circuits. TEST the system for normal operation.

X15 CHECK CIRCUITS CHS46 (YE/GN) AND CHS47 (VT/GN) FOR AN OPEN

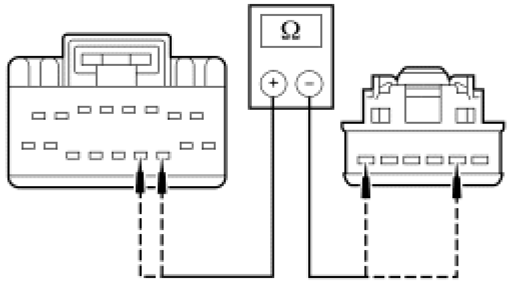


Fig. 199: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C3162-11, circuit CHS46 (YE/GN), harness side and left rear heated seat switch C722-6, circuit CHS46 (YE/GN), harness side; and between heated seat module C3162-12, circuit CHS47 (VT/GN), harness side and left rear heated seat switch C722-2, circuit CHS47 (VT/GN), harness side
- **Are the resistances less than 5 ohms?**

  YES : Go to X16.

  NO : REPAIR the circuit. TEST the system for normal operation.

X16 CHECK HEATED SEAT SWITCH GROUND CIRCUIT GD126 (BK/WH)

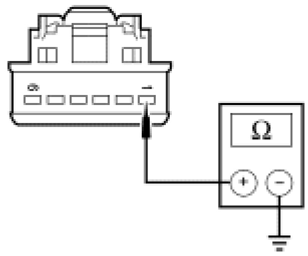


Fig. 200: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between left rear heated seat switch C722-1, circuit GD126 (BK/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to X17.

  NO : REPAIR the circuit. TEST the system for normal operation.

X17 CHECK THE RIGHT REAR HEATED SEAT SWITCH

- Connect the right rear heated seat switch to the left rear heated seat switch connector.
- Key in ON position.
- Check the left rear heated seat operation.
- **Does the left rear heated seat operate correctly?**

  YES : INSTALL a new heated seat switch. REFER to **Heated Seat Switch - Rear Seat**. TEST the system for normal operation.

  NO : INSTALL a new heated seat module. REFER to **Heated Seat Module - Rear Seat**. TEST the system for normal operation.

Pinpoint Test Y: The Heated Seat is Inoperative/Does Not Operate Correctly - Right Rear

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

The heated seat module receives battery voltage on circuit CBP35 (YE/GY) and ignition voltage on circuit SBB07 (WH/RD), and is supplied ground on circuit GD133 (BK). When the right rear heated seat control switch is pressed with the ignition switch in RUN or START, a ground is supplied on circuit CHS50 (BU/GY) to command the system ON or OFF in hi heat mode or circuit CHS51 (YE/GY) to command the system ON or OFF in low heat mode. When commanded ON, voltage is supplied to the heated seat switch from the heated seat module on either circuit CHS52 (BU) (hi heat mode) or circuit CHS53 (WH/BN) (low heat mode) illuminating the switch indicator. The heated seat module also supplies voltage to the cushion and backrest heater mats on circuit CHS43 (GY/BU) and ground to the heater mats on circuit GD151 (BK/GN). The cushion and backrest heater mats are connected in series and operate together. Temperature is maintained by the heated seat module using a sensor contained within the cushion heater mat. The heated seat module monitors the temperature sensor on circuit VHS45 (GY/BN) for adjusting the current flow to the heater mats and uses a ground supplied on circuit RHS41 (GN/BN). The heated seat module is designed to remain ON, heating the seat and maintaining temperature until switched OFF or the ignition voltage is switched OFF.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Heater mat
- Heated seat module
- Heated seat switch

PINPOINT TEST Y: THE HEATED SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - RIGHT REAR

Y1 CHECK CIRCUIT SBB07 (WH/RD) FOR VOLTAGE TO THE HEATED SEAT MODULE

- Disconnect: Heated Seat Module C3162

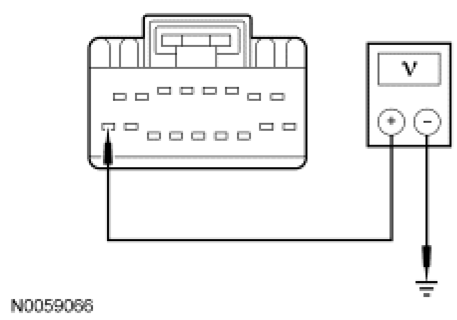


Fig. 201: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C3162-17, circuit SBB07 (WH/RD) harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to Y2.

  NO : REPAIR the circuit. TEST the system for normal operation.

Y2 CHECK CIRCUIT CHS43 (GY/BU) FOR AN OPEN OR SHORT TO GROUND

- Disconnect: Right Rear Cushion Heater Mat C3169

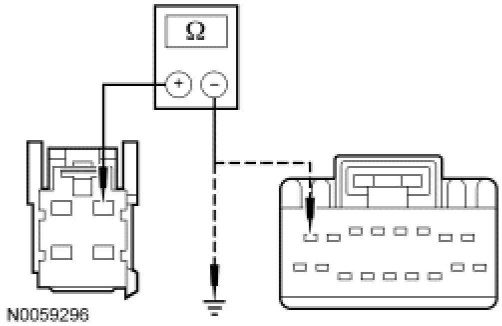


Fig. 202: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between right rear seat cushion heater mat C3169-1, circuit CHS43 (GY/BU), harness side and ground; and between C3169-1, circuit CHS43 (GY/BU), harness side and heated seat module C3162-8, circuit CHS43 (GY/BU) harness side.
- **Is the resistance greater than 10,000 ohms between the right rear seat cushion heater mat and ground; and less than 5 ohms between the right rear seat cushion heater mat and the heated seat module?**

  YES : Go to Y3.

  NO : REPAIR the circuit. TEST the system for normal operation.

Y3 CHECK CIRCUIT VHS45 (GY/BN) FOR AN OPEN OR SHORT TO GROUND

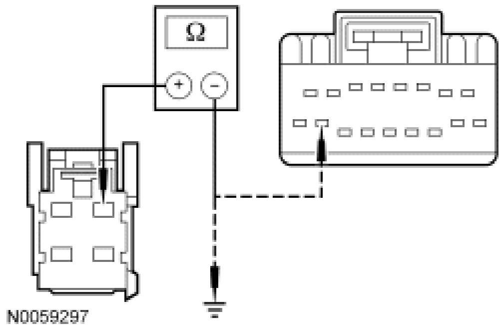


Fig. 203: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between right rear seat cushion heater mat C3169-2, circuit VHS45 (GY/BN), harness side and ground; and between C3169-2, circuit VHS45 (GY/BN), harness side and heated seat module C3162-16, circuit VHS45 (GY/BN) harness side.
- **Is the resistance greater than 10,000 ohms between the right rear seat cushion heater mat and ground and less than 5 ohms between the right rear seat cushion heater mat and the heated seat module?**

  YES : Go to Y4.

  NO : REPAIR the circuit. TEST the system for normal operation.

Y4 CHECK CIRCUIT RHS41 (GN/BN) FOR AN OPEN OR SHORT TO GROUND

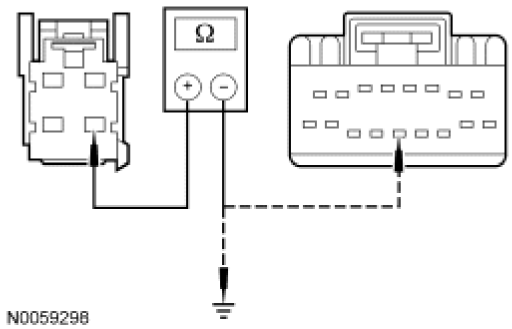


Fig. 204: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between right rear seat cushion heater mat C3169-3, circuit RHS41 (GN/BN), harness side and ground; and between C3169-3, circuit RHS41 (GN/BN), harness side and heated seat module C3162-13, circuit RHS41 (GN/BN) harness side.
- **Is the resistance greater than 10,000 ohms between the right rear seat cushion heater mat and ground and less than 5 ohms between the right rear seat cushion heater mat and the heated seat module?**

  YES : Go to Y5.

  NO : REPAIR the circuit. TEST the system for normal operation.

Y5 CHECK CIRCUITS CHS43 (GY/BU), VHS45 (GY/BN) AND RHS41 (GN/BN) FOR SHORT TO VOLTAGE

- Key in ON position.

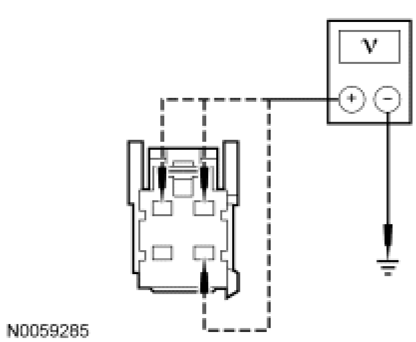


Fig. 205: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the following left rear seat cushion heater mat C3169 pins, harness side and ground:

Connector - Pin	Circuit
C3169-1	CHS43 (GY/BU)

C3169-2	VHS45 (GY/BN)
C3169-3	RHS41 (GN/BN)

- **Are the voltages less than 0.2 volt?**

  YES : Go to Y6.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

Y6 CHECK CIRCUIT GD151 (BK/GN) FOR AN OPEN

- Key in OFF position.

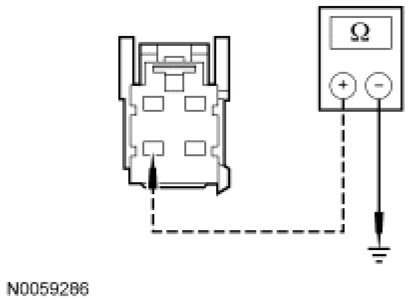


Fig. 206: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between right rear seat cushion heater mat C3169-4, circuit GD151 (BK/GN), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to Y7.

  NO : REPAIR the circuit. TEST the system for normal operation.

Y7 CHECK CUSHION AND BACKREST HEATER MAT AND SENSOR FOR SHORT TO VOLTAGE

- Key in ON position.

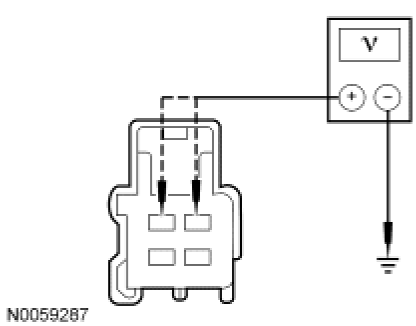


Fig. 207: Measuring Voltage

Courtesy of FORD MOTOR CO.

- Measure the voltage between right rear seat cushion heater mat C3169 pin 1, component side and ground; and between right rear seat cushion heater mat C3169 pin 2, component side and ground.
- **Are the voltages less than 0.2 volt?**

  YES : Go to Y8.

  NO : REPAIR the circuit. INSTALL a new affected cushion or backrest heater mat. TEST the system for normal operation.

Y8 CHECK CUSHION HEATED SEAT MAT FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Disconnect: Right Rear Seat Cushion Heater Mat to Right Rear Seat Backrest Heater Mat Connector

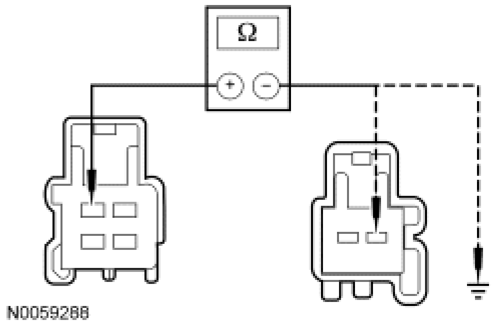


Fig. 208: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between right rear seat cushion heater mat C3169 pin 1, component side and ground; and between right rear seat cushion heater mat C3169 pin 1, component side and right rear seat cushion heater mat to right rear seat backrest heater mat connector pin 1, cushion side.
- **Is the resistance greater than 10,000 ohms between the right rear seat cushion heater mat and ground; and between 1.6 and 2.2 ohms between the right rear seat cushion heater mat and right rear seat backrest heater mat?**

  YES : Go to Y9.

  NO : INSTALL a new cushion heater mat. TEST the system for normal operation.

Y9 CHECK BACKREST HEATED SEAT MAT FOR AN OPEN OR SHORT TO GROUND

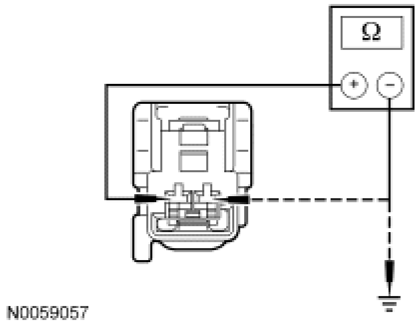


Fig. 209: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between right rear seat backrest heater mat connector pin 2, component side and ground; and between right rear seat backrest heater mat connector pin 1 and pin 2, component side.
- **Is the resistance greater than 10,000 ohms between the right rear seat backrest heater mat and ground; and between 1.6 and 2.2 ohms between the right rear seat backrest heater mat pins?**

  YES : Go to Y10.

  NO : INSTALL a new cushion heater mat. TEST the system for normal operation.

Y10 CHECK CIRCUIT BETWEEN BACKREST AND CUSHION HEATER MAT

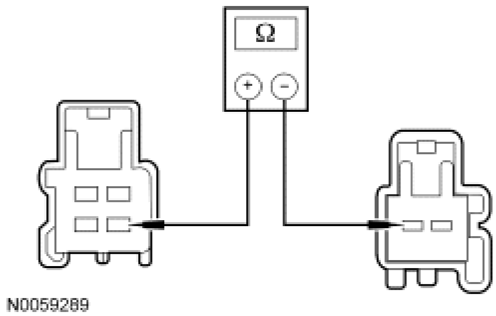


Fig. 210: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between right rear seat cushion heater mat C3169 pin 4, component side and right rear seat cushion heater mat to right rear seat backrest heater mat connector pin 2, cushion side.
- **Is the resistance less than 5 ohms?**

  YES : Go to Y11.

  NO : INSTALL a new cushion heater mat. TEST the system for normal operation.

Y11 CHECK THE HEATED SEAT TEMPERATURE SENSOR AND CIRCUITS FOR AN OPEN OR SHORT TO GROUND

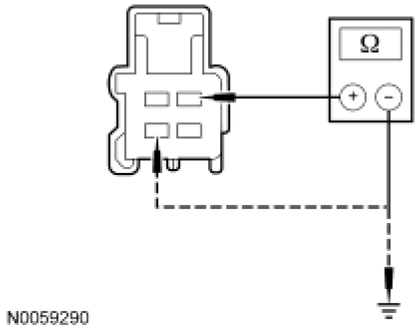


Fig. 211: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between right rear seat cushion heater mat C3169 pin 2 and pin 3, component side; and between right rear seat cushion heater mat C3169 pin 2, component side and ground.
- **Is the resistance less than 300,000 ohms and greater than 50 ohms between right rear seat cushion heater mat pins; and greater than 10,000 ohms between right rear seat cushion heater mat and ground?**

  YES : Go to Y12.

  NO : INSTALL a new cushion heater mat. TEST the system for normal operation.

Y12 CHECK CIRCUITS CHS50 (BU/GY) AND CHS51 (YE/GY) FOR A SHORT TO VOLTAGE

- Disconnect: Right Rear Heated Seat Switch C822
- Key in ON position.

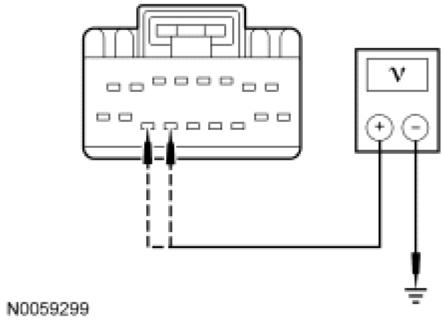


Fig. 212: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C3162-14, circuit CHS50 (BU/GY), harness side and ground; and between heated seat module C3162-15, circuit CHS51 (YE/GY), harness side and ground.
- **Are the voltages less than 0.2 volt?**

  YES : Go to Y13.

  NO : REPAIR the circuit. TEST the system for normal operation.

Y13 CHECK CIRCUITS CHS50 (BU/GY) AND CHS51 (YE/GY) FOR A SHORT TO GROUND

- Key in OFF position.

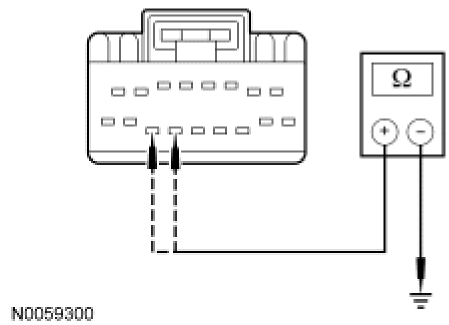


Fig. 213: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C3162-14, circuit CHS50 (BU/GY), harness side and ground; and between heated seat module C3162-15, circuit CHS51 (YE/GY), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to Y14.

  NO : REPAIR the circuit. TEST the system for normal operation.

Y14 CHECK BETWEEN CIRCUITS CHS50 (BU/GY) AND CHS51 (YE/GY) FOR A SHORT

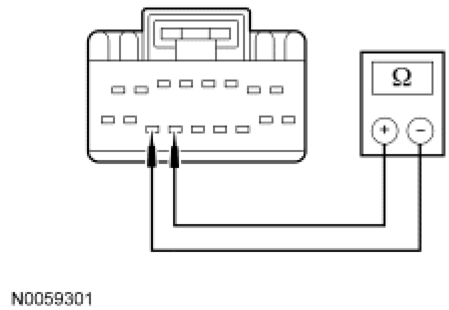


Fig. 214: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C3162-14, circuit CHS50 (BU/GY), harness side and heated seat module C3162-15, circuit CHS51 (YE/GY), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to Y15.

  NO : REPAIR the circuits. TEST the system for normal operation.

Y15 CHECK CIRCUITS CHS50 (BU/GY) AND CHS51 (YE/GY) FOR AN OPEN

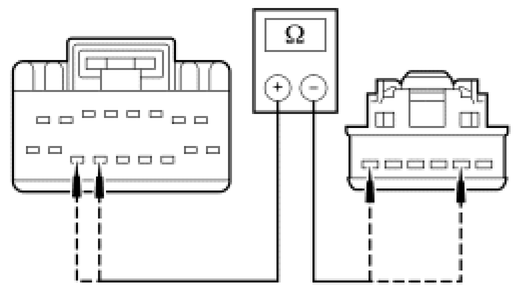


Fig. 215: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C3162-14, circuit CHS50 (BU/GY), harness side and right rear heated seat switch C822-6, circuit CHS50 (BU/GY), harness side; and between heated seat module C3162-15, circuit CHS51 (YE/GY), harness side and right rear heated seat switch C822-2, circuit CHS51 (YE/GY), harness side
- **Are the resistances less than 5 ohms?**

  YES : Go to Y16.

  NO : REPAIR the circuit. TEST the system for normal operation.

Y16 CHECK HEATED SEAT SWITCH GROUND CIRCUIT GD145 (BK/BU)

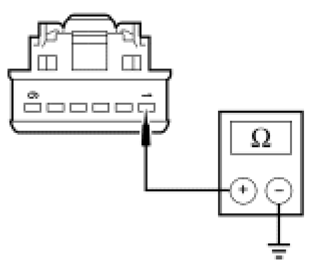


Fig. 216: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between right rear heated seat switch C822-1, circuit GD145 (BK/BU), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to Y17.

  NO : REPAIR the circuit. TEST the system for normal operation.

Y17 CHECK THE RIGHT REAR HEATED SEAT SWITCH

- Connect the left rear heated seat switch to the right rear heated seat switch connector.
- Key in ON position.
- Check the right rear heated seat operation.

- **Does the right rear heated seat operate correctly?**

  YES : INSTALL a new heated seat switch. REFER to **Heated Seat Switch - Rear Seat**. TEST the system for normal operation.

  NO : INSTALL a new heated seat module. REFER to **Heated Seat Module - Rear Seat**. TEST the system for normal operation.

Pinpoint Test Z: The Heated Seat is Inoperative - Left Rear Seat Does Heat But the Heated Seat Indicator Does Not Illuminate When Pressed

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Pressing the left rear heated seat switch once in either the hi or low mode will command ON the left rear heated seat. Voltage is then supplied to the left rear heated seat switch from the heated seat module on either circuit CHS48 (YE) (hi heat mode) or circuit CHS49 (VT) (low heat mode) illuminating the switch indicator. Pressing the left rear heated seat switch again in the mode that is currently on will set the left rear heated seat to OFF and also turn that LED OFF.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Heated seat module
- Heated seat switch

PINPOINT TEST Z: THE HEATED SEAT IS INOPERATIVE - LEFT REAR SEAT DOES HEAT BUT THE HEATED SEAT INDICATOR DOES NOT ILLUMINATE WHEN PRESSED

Z1 CHECK CIRCUITS CHS49 (VT) AND CHS48 (YE) FOR A SHORT TO GROUND

- Disconnect: Left Rear Heated Seat Switch C722
- Disconnect: Heated Seat Module C3162

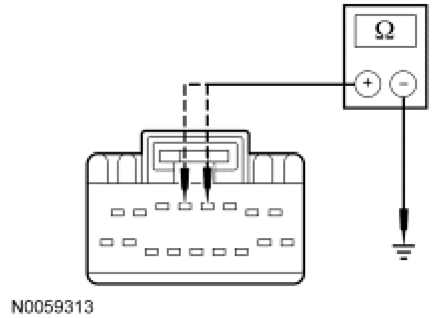


Fig. 217: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C3162-5, circuit CHS49 (VT), harness side and ground; and between heated seat module C3162-4, circuit CHS48 (YE), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to Z2.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

Z2 CHECK CIRCUITS CHS49 (VT) AND CHS48 (YE) FOR AN OPEN

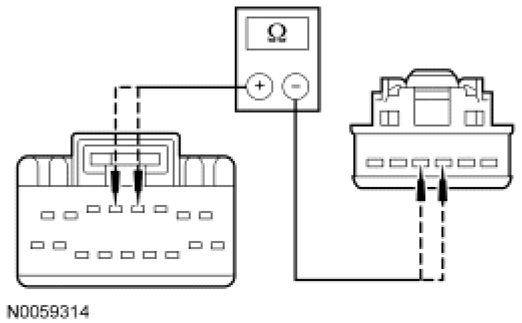


Fig. 218: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between left rear heated seat switch C722-3, circuit CHS49 (VT), harness side and heated seat module C3162-5, circuit CHS49 (VT), harness side; and between left rear heated seat switch C722-4, circuit CHS48 (YE), harness side and heated seat module C3162-4, circuit CHS48 (YE), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to Z3.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

Z3 CHECK THE HEATED SEAT HI INDICATOR

- Connect: Left Rear Heated Seat Switch C722
- Key in ON position.

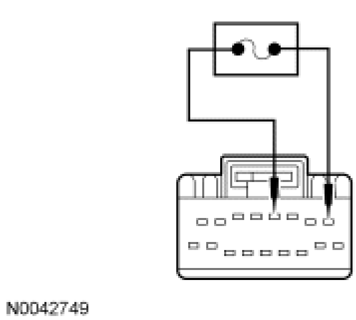


Fig. 219: Checking Heated Seat Module HI Indicator On EATC Module
Courtesy of FORD MOTOR CO.

- Connect a fused jumper lead between heated seat module C3162-4, circuit CHS48 (YE), harness side and C3162-1, circuit SBB07 (WH/RD), harness side.
- **Does the hi indicator LED illuminate on the left rear heated seat switch?**

  YES : Go to Z4.

  NO : INSTALL a new rear heated seat switch. REFER to **Heated Seat Switch - Rear Seat**. TEST the system for normal operation.

Z4 CHECK THE HEATED SEAT LOW INDICATOR

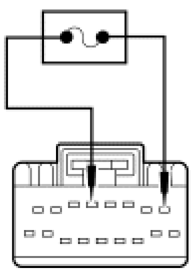


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Fig. 220: Checking Heated Seat Module Low Indicator On EATC Module
Courtesy of FORD MOTOR CO.

- Connect a fused jumper lead between heated seat module C3162-5, circuit CHS49 (VT), harness side and C3162-1, circuit SBB07 (WH/RD), harness side.
- **Does the low indicator LED illuminate on the left rear heated seat switch?**

  YES : INSTALL a new heated seat module. REFER to **Heated Seat Module - Rear Seat**. TEST the system for normal operation.

  NO : INSTALL a new rear heated seat switch. REFER to **Heated Seat Switch - Rear Seat**. TEST the system for normal operation.

Pinpoint Test AA: The Heated Seat is Inoperative - Left Rear Seat Does Heat But the Heated Seat Indicator is On All the Time

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Pressing the left rear heated seat switch once in either the hi or low mode will command ON the left rear heated seat. Voltage is then supplied to the left rear heated seat switch from the heated seat module on either circuit CHS48 (YE) (hi heat mode) or circuit CHS49 (VT) (low heat mode) illuminating the switch indicator. Pressing the left rear heated seat switch again in the mode that is currently on will set the left rear heated seat to OFF and also turn that LED OFF.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

- Heated seat module

PINPOINT TEST AA: THE HEATED SEAT IS INOPERATIVE - LEFT REAR SEAT DOES HEAT BUT THE HEATED SEAT INDICATOR IS ON ALL THE TIME

AA1 CHECK CIRCUITS CHS49 (VT) AND CHS48 (YE) FOR A SHORT TO VOLTAGE

- Disconnect: Heated Seat Module C3162
- **Did the affected hi or low indicator LED turn off when the heated seat module was disconnected?**

  YES : INSTALL a new heated seat module. REFER to **Heated Seat Module - Rear Seat**. TEST the system for normal operation.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

Pinpoint Test AB: The Heated Seat is Inoperative - Right Rear Seat Does Heat But the Heated Seat Indicator Does Not Illuminate When Pressed

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Pressing the right rear heated seat switch once in either the hi or low mode will command ON the left rear heated seat. Voltage is then supplied to the left rear heated seat switch from the heated seat module on either circuit CHS52 (BU) (hi heat mode) or circuit CHS53 (WH/BN) (low heat mode) illuminating the switch indicator. Pressing the right rear heated seat switch again in the mode that is currently on will set the right rear heated seat to OFF and also turn that LED OFF.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Heated seat module
- Heated seat switch

PINPOINT TEST AB: THE HEATED SEAT IS INOPERATIVE - RIGHT REAR SEAT DOES HEAT BUT THE HEATED SEAT INDICATOR DOES NOT ILLUMINATE WHEN PRESSED

AB1 CHECK CIRCUITS CHS53 (WH/BN) AND CHS52 (BU) FOR A SHORT TO GROUND

- Disconnect: Right Rear Heated Seat Switch C822
- Disconnect: Heated Seat Module C3162

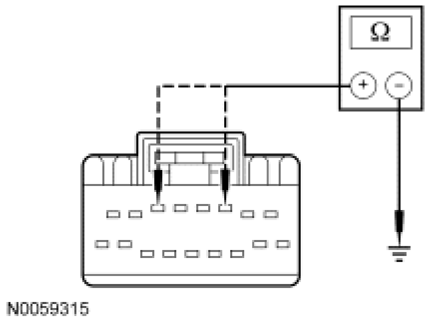

Fig. 221: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C3162-3, circuit CHS53 (WH/BN), harness side and ground; and between heated seat module C3162-6, circuit CHS52 (BU), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to AB2.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

AB2 CHECK CIRCUITS CHS53 (WH/BN) AND CHS52 (BU) FOR AN OPEN

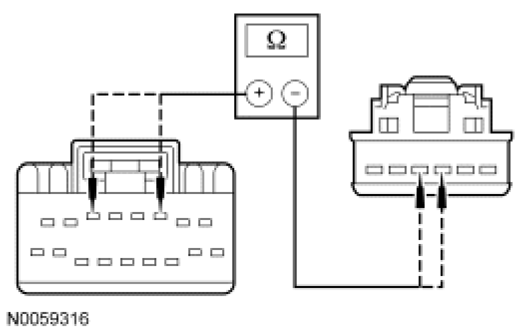

Fig. 222: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between right rear heated seat switch C822-3, circuit CHS53 (WH/BN), harness side and heated seat module C3162-3, circuit CHS53 (WH/BN), harness side; and between right rear heated seat switch C822-4, circuit CHS52 (BU), harness side and heated seat module C3162-6, circuit CHS52 (BU), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to AB3.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

AB3 CHECK THE HEATED SEAT HI INDICATOR

- Connect: Right Rear Heated Seat Switch C822
- Key in ON position.

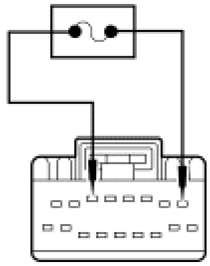

Fig. 223: Checking Heated Seat Module HI Indicator On EATC Module
Courtesy of FORD MOTOR CO.

- Connect a fused jumper lead between heated seat module C3162-6, circuit CHS52 (BU), harness side and C3162-1, circuit SBB07 (WH/RD), harness side.
- **Does the hi indicator LED illuminate on the right rear heated seat switch?**

  YES : Go to AB4.

  NO : INSTALL a new rear heated seat switch. REFER to **Heated Seat Switch - Rear Seat**. TEST the system for normal operation.

AB4 CHECK THE HEATED SEAT LOW INDICATOR

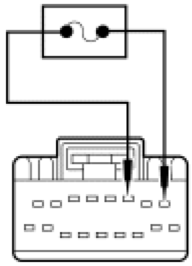

Fig. 224: Checking Heated Seat Module Low Indicator On EATC Module
Courtesy of FORD MOTOR CO.

- Connect a fused jumper lead between heated seat module C3162-3, circuit CHS53 (WH/BN), harness side and C3162-17, circuit SBB07 (WH/RD), harness side.
- **Does the low indicator LED illuminate on the right rear heated seat switch?**

  YES : INSTALL a new heated seat module. REFER to **Heated Seat Module - Rear Seat**. TEST the system for normal operation.

  NO : INSTALL a new rear heated seat switch. REFER to **Heated Seat Switch - Rear Seat**. TEST the system for normal operation.

Pinpoint Test AC: The Heated Seat is Inoperative - Right Rear Seat Does Heat But the Heated Seat Indicator is On All the Time

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Pressing the right rear heated seat switch once in either the hi or low mode will command ON the left rear heated seat. Voltage is then supplied to the left rear heated seat switch from the heated seat module on either circuit CHS52 (BU) (hi heat mode) or circuit CHS53 (WH/BN) (low heat mode) illuminating the switch indicator. Pressing the right rear heated seat switch again in the mode that is currently on will set the right rear heated seat to OFF and also turn that LED OFF.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Heated seat module

PINPOINT TEST AC: THE HEATED SEAT IS INOPERATIVE - RIGHT REAR SEAT DOES HEAT BUT THE HEATED SEAT INDICATOR IS ON ALL THE TIME

AC1 CHECK CIRCUITS CHS53 (WH/BN) AND CHS52 (BU) FOR A SHORT TO VOLTAGE

- Disconnect: Heated Seat Module C3162
- **Did the affected hi or low indicator LED turn off when the heated seat module was disconnected?**

  YES : INSTALL a new heated seat module. REFER to **Heated Seat Module - Rear Seat**. TEST the system for normal operation.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

Pinpoint Test AD: A Single Climate Controlled Seat is Inoperative - Switch Indicators May or May Not Illuminate

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 16 (30A) supplying battery voltage on circuit SBB16 (VT/RD) into DCSM C3036a pins E and F. If voltage is disconnected from either pin E or F of DCSM C3036a with the connection remaining on the other circuit, both seats will remain operational because the circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the DSCM and the other will remain operational.

Each driver and front passenger seat cushion and backrest are equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Medium-speed controller area network (MS-CAN) fault
- HVAC module
- DCSM

PINPOINT TEST AD: A SINGLE CLIMATE CONTROLLED SEAT IS INOPERATIVE - SWITCH INDICATORS MAY OR MAY NOT ILLUMINATE

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

AD1 CHECK OPERATION OF BOTH CLIMATE CONTROLLED SEATS AND VERIFY THE SYMPTOM

- Check the operation of both climate controlled seats and verify the symptom.
- **Is only a single climate controlled seat inoperative?**

  YES : Go to AD2.

  NO : If both seats are inoperative, go to **Symptom Chart**.

AD2 CHECK FOR DCSM AND HVAC DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test/DCSM/Retrieve DTCs
- Enter the following diagnostic mode on the diagnostic tool: Self Test/HVAC module/Retrieve DTCs
- **Were any DTCs retrieved during the on-demand self tests?**

  YES : For DCSM DTCs, go to the **Dual Climate Controlled Seat Module (DCSM) DTC Chart**.

  For HVAC DTCs, REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION & DIAGNOSTICS** article to diagnose the HVAC module fault.

  NO : Go to AD3.

AD3 CHECK OPERATION OF THE DCSM USING PIDs

NOTE: The purpose of this step is to verify the DCSM is able to receive and process inbound command messages from the communication bus and demonstrate if the DCSM is operational. This indicates the HVAC module may not be sending the commands correctly.

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DCSM

Driver Seat

- Seat cushion thermal electric device temperature (CSHTEMP)
- Seat back thermal electric device temperature (BK_TEMP)
- Climate-controlled seat heat command (TED_HEAT_D)

Front Passenger Seat

- Passenger Cushion Thermal Electric Device (TED) Temperature (PCSHTMP)
- Passenger Back TED Temperature (PBKTMP)
- Passenger TED Heat Mode (TED_HEAT_P)

NOTE: The DCSM active commands TED_HEAT_D (driver seat) and TED_HEAT_P (passenger seat) are limited to 15 seconds in the ON state.

- Operate the affected climate controlled seat using the active command while monitoring the appropriate PIDs for that seat.
  - When the command is in process the TED temperature PIDs on the affected seat should momentarily increase. If no temperature increase is noted, remove the cushion blower filter and repeat the active command while physically monitoring the cushion blower for fan movement.
- **Do the PID states or cushion blower movement indicate climate controlled seat operation when using the active command?**

  YES : Go to AD4.

  NO : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

AD4 USE THE HVAC SWITCH AND MONITOR THE DCSM PID FOR A RESPONSE

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DCSM
  - Driver State Seat Mode (DCCSMOD) (driver seat)
  - Passenger State Seat Mode (PCCSMOD) (passenger seat)
- Key in START position.

NOTE: Operation of the climate controlled seats repeatedly ON and OFF or repeatedly switching between heat and cool modes may cause DCSM DTCs to set, disabling one or both seat system and may require DTCs to be cleared before seat operation may continue. It is recommended to allow time between modes for seat temperatures to return toward ambient temperatures before continuing.

- Attempt to operate the affected climate controlled seat in all modes using the appropriate switch on the HVAC while monitoring the DCSM PID DCCSMOD (driver seat) or PCCSMOD (passenger seat).

- **Do all the PID states match the climate controlled seat settings selected on the HVAC module?**

  YES : If the fault is intermittent, CHECK for causes of the intermittent fault. INSPECT the connectors, terminals and wiring. ATTEMPT to recreate the fault by flexing the wire harness and operating the system. CHECK the electrical connectors for corrosion, poor pin contact or pushed-out pins. REPAIR any intermittent concerns found and TIGHTEN any loose DCSM connector pins. REPEAT the self-test. CLEAR the DTCs.

  NO : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. REPEAT the self-test. CLEAR the DTCs.

Pinpoint Test AE: DTC B103B/B1111 - Thermo-electric Driver Overcurrent Low/Driver Thermo-electric Device Control Overtemperature Fault

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 16 (30A) supplying battery voltage on circuit SBB16 (VT/RD) into DCSM C3036a pins E and F. If voltage is disconnected from either pin E or F of DCSM C3036a with the connection remaining on the other circuit, both seats will remain operational because the circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the DCSM and the other will remain operational.

Each driver and front passenger seat cushion and backrest are equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B103B Thermo-electric Driver Overcurrent Low - If DCSM outputs to the driver seat backrest or cushion TED (circuit pins G, H, J or K at the DCSM connector) or any components within these circuit loops are shorted to ground or a TED resistance of less than 0.9 ohm is sensed, the DCSM will shut down the driver seat system and set this DTC.
- DTC B1111 Driver Thermo-electric Device Control Overtemperature Fault - If the DCSM TED driver integrated circuit temperature exceeds 175°C (347°F), the DCSM will shut down the driver seat system and set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- TED assembly
- DCSM

PINPOINT TEST AE: DTC B103B/B1111 - THERMO-ELECTRIC DRIVER OVERCURRENT LOW/DRIVER THERMO-ELECTRIC DEVICE CONTROL OVERTEMPERATURE FAULT

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

AE1 CHECK THE TED CIRCUITS FOR SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036a

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Measure the resistance between the following DCSM C3036a pins, harness side and ground.

Connector-Pin	Circuit
C3036a-G	CHS02 (YE/BU)
C3036a-H	RHS02 (BU/OG)
C3036a-J	CHS01 (GY/VT)
C3036a-K	RHS01 (WH/VT)

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to AE2.

NO : If the resistances of C3036a-G, circuit CHS02 (YE/BU) and/or C3036a-H, circuit RHS02 (BU/OG) to ground were **not** greater than 10,000 ohms to ground, go to AE6.

If resistances of C3036a-J, circuit CHS01 (GY/VT) and/or C3036a-K, circuit RHS01 (WH/VT) to ground were **not** greater than 10,000 ohms to ground, go to AE7.

AE2 CHECK THE TED CIRCUITS FOR SHORT TO VOLTAGE

- Key in ON position.
- Measure the voltage between the following DCSM C3036a pins, harness side and ground.

Connector-Pin	Circuit
C3036a-G	CHS02 (YE/BU)
C3036a-H	RHS02 (BU/OG)
C3036a-J	CHS01 (GY/VT)
C3036a-K	RHS01 (WH/VT)

- **Are the voltages less than one volt?**

  YES : Go to AE3.

  NO : If the voltages measured at C3036a-G and/or C3036a-H were **not** less than one volt, go to AE8.

  If voltages measured at C3036a-J and/or C3036a-K were **not** less than one volt, go to AE9.

AE3 CHECK THE TED RESISTANCE

- Key in OFF position.

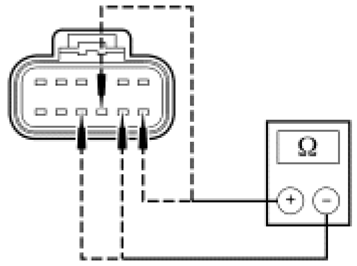

Fig. 225: Measuring Voltage
Courtesy of FORD MOTOR CO.

NOTE: Make sure the thermo-electric devices (TEDs) are at room temperature and there is no air blowing across the TEDs. Do not handle a TED when measuring resistance. These conditions can cause incorrect readings and lead to incorrect identification of components that are not faulty.

- Measure the resistance between DCSM C3036a-G, circuit CHS02 (YE/BU), harness side and DCSM C3036a-H, circuit RHS02 (BU/OG), harness side; and between DCSM C3036a-J, circuit CHS01 (GY/VT), harness side and C3036a-K, circuit RHS01 (WH/VT), harness side and ground.
- **Are the resistances between 0.9 and 10 ohms?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If the resistance between DCSM C3036a-G and C3036a-H was **not** between 0.9 and 10 ohms, go to AE5.

  If the resistance between DCSM C3036a-J and C3036a-K was **not** between 0.9 and 10 ohms, go to AE4.

AE4 CHECK THE RESISTANCE OF THE BACKREST TED

- Disconnect: Backrest TED C3322

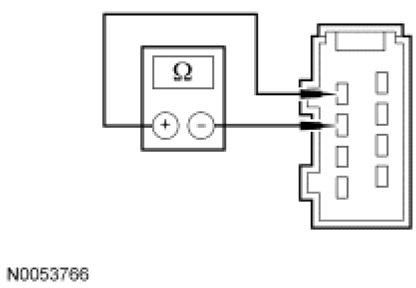

Fig. 226: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED C3322 pin 1 and pin 3, component side.
- **Is the resistance between 0.9 and 10 ohms?**

YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AE5 CHECK THE RESISTANCE OF THE CUSHION TED

- Disconnect: Cushion TED C3327

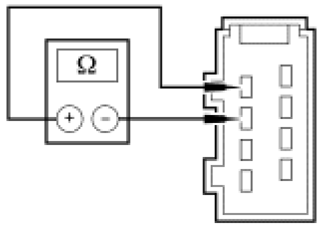

Fig. 227: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between cushion TED C3327 pin 1 and pin 3, component side.
- **Is the resistance between 0.9 and 10 ohms?**

YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AE6 CHECK THE CUSHION TED CIRCUITS FOR SHORT TO GROUND

- Disconnect: Cushion TED C3327

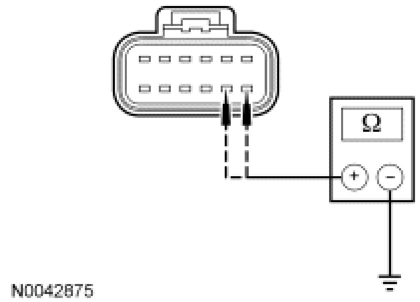

Fig. 228: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036a-G, circuit CHS02 (YE/BU), harness side and ground and between C3036a-H, circuit RHS02 (BU/OG), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

YES : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AE7 CHECK THE BACKREST TED CIRCUITS FOR SHORT TO GROUND

- Disconnect: Backrest TED C3322

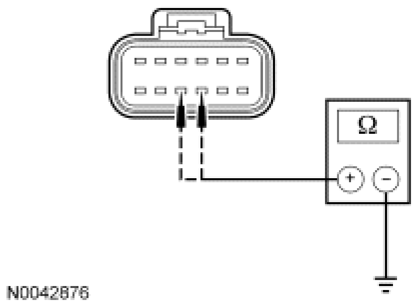

Fig. 229: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036a-J, circuit CHS01 (GY/VT), harness side and ground and between C3036a-K, circuit RHS01 (WH/VT), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

YES : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AE8 CHECK THE CUSHION TED CIRCUITS FOR SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Cushion TED C3327
- Key in ON position.

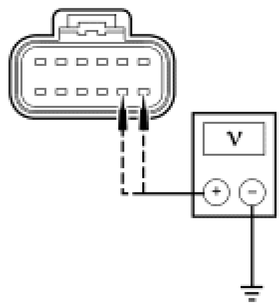

Fig. 230: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036a-G, circuit CHS02 (YE/BU), harness side and ground and between C3036a-H, circuit RHS02 (BU/OG), harness side and ground.
- **Are the voltages less than 1 volt?**

YES : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AE9 CHECK THE BACKREST TED CIRCUITS FOR SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Backrest TED C3322

- Key in ON position.

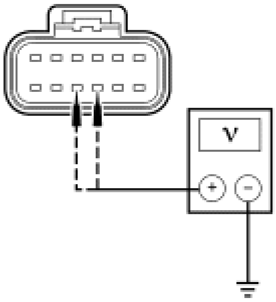

Fig. 231: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036a-J, circuit CHS01 (GY/VT), harness side and ground and between C3036a-K, circuit RHS01 (WH/VT), harness side and ground.
- **Are the voltages less than one volt?**

  YES : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AF: DTC B103C - Thermo-electric Driver Open Load

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 16 (30A) supplying battery voltage on circuit SBB16 (VT/RD) into DCSM C3036a pins E and F. If voltage is disconnected from either pin E or F of DCSM C3036a with the connection remaining on the other circuit, both seats will remain operational because the circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the DCSM and the other will remain operational.

Each driver and front passenger seat cushion and backrest are equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B103C Thermo-electric Driver Open Load - If DCSM outputs to the driver seat backrest or cushion TED (circuit pins G, H, J or K at the DCSM connector) or any components within these circuit loops are open, disconnected or a TED resistance greater than 90K ohms is sensed, the DCSM continues normal operation and sets this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- TED assembly
- DCSM

PINPOINT TEST AF: DTC B103C - THERMO-ELECTRIC DRIVER OPEN LOAD

NOTE:	**The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

AF1 CHECK THE TED CIRCUITS FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036a
- Disconnect: Cushion TED C3327

- Disconnect: Backrest TED C3322

WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Measure the resistance of the following circuits.

DCSM Connector-Pin	Circuit	TED Connector-Pin
C3036a-G	CHS02 (YE/BU)	C3327-1
C3036a-H	RHS02 (BU/OG)	C3327-3
C3036a-J	CHS01 (GY/VT)	C3322-1
C3036a-K	RHS01 (WH/VT)	C3322-3

- **Are the resistances less than 5 ohms?**

  YES : Go to AF2.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AF2 CHECK THE TED CIRCUITS FOR SHORT TO VOLTAGE

- Key in ON position.
- Measure the voltage between the following DCSM C3036a pins, harness side and ground.

Connector-Pin	Circuit
C3036a-G	CHS02 (YE/BU)

C3036a-H	RHS02 (BU/OG)
C3036a-J	CHS01 (GY/VT)
C3036a-K	RHS01 (WH/VT)

- **Is voltage present on any circuit?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to AF3.

AF3 CHECK RESISTANCE OF THE TEDs

- Key in OFF position.

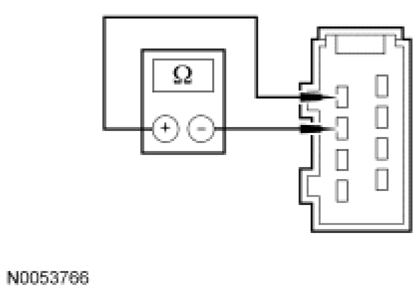

Fig. 232: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED C3322 pin 1 and pin 3, component side and between cushion TED C3327 pin 1 and pin 3, component side.
- **Are the resistances between 0.9 and 10 ohms?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : If the resistance of the backrest TED was **not** between 0.9 and 10 ohms, INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

If the resistance of the cushion TED was **not** between 0.9 and 10 ohms, INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AG: DTC B103D - Blower Driver Overtemperature

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 16 (30A) supplying battery voltage on circuit SBB16 (VT/RD) into DCSM C3036a pins E and F. If voltage is disconnected from either pin E or F of DCSM C3036a with the connection remaining on the other circuit, both seats will remain operational because the circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the DCSM and the other will remain operational.

Each driver and front passenger seat cushion and backrest are equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B103D Blower Driver Overtemperature - If the DCSM outputs to the driver seat blower or any components within these circuit loops are shorted to ground or cause an excessive current draw, the

DCSM will overheat, shut down the driver seat system and set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- TED assembly
- DCSM

PINPOINT TEST AG: DTC B103D - BLOWER DRIVER OVERTEMPERATURE

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

AG1 CHECK THE BLOWER CIRCUIT FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036c
- Disconnect: Cushion TED C3327
- Disconnect: Backrest TED C3322

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

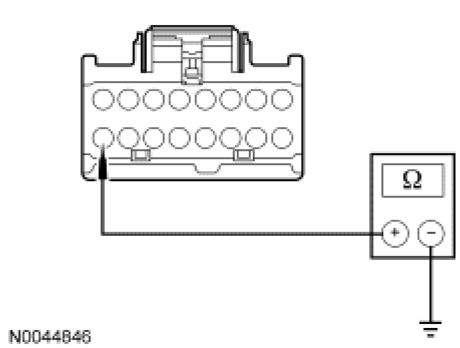

Fig. 233: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-16, circuit CHS03 (GN/BN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AG2.

  NO : REPAIR the affected circuit. REPEAT the self-test.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AG2 CHECK THE BLOWER CIRCUITS FOR A SHORT

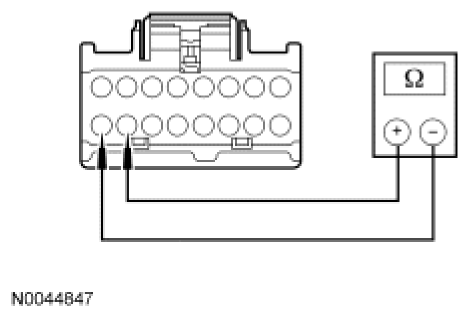

Fig. 234: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-15, circuit RHS03 (GY/OG), harness side and C3036c-16, circuit CHS03 (GN/BN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AG3.

  NO : REPAIR the affected circuits. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AG3 CHECK THE BLOWER RESISTANCE

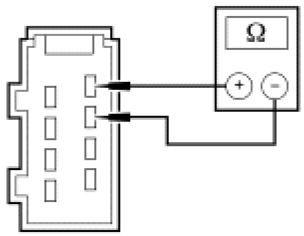

Fig. 235: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.

- Measure the resistance between cushion TED C3327 pin 2 and pin 4, component side and between backrest TED C3322 pin 2 and pin 4, component side.
- **Are the resistances between 6,000 ohms and 9,000 ohms?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If the resistance of the cushion TED was **not** between 6,000 and 9,000 ohms, INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  If the resistance of the backrest TED was **not** between 6,000 and 9,000 ohms, INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AH: DTC B1113/B111B - Passenger Thermo-electric Device Control Overtemperature Fault/Passenger Thermo-electric Driver Overcurrent Low

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 16 (30A) supplying battery voltage on circuit SBB16 (VT/RD) into DCSM C3036a pins E and F. If voltage is disconnected from either pin E or F of DCSM C3036a with the connection remaining on the other circuit, both seats will remain operational because the circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the DCSM and the other will remain operational.

Each driver and front passenger seat cushion and backrest are equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B1113 Passenger Thermo-electric Device Control Overtemperature Fault - If the DCSM TED driver integrated circuit temperature exceeds 175°C (347°F), the DCSM will shut down the passenger seat system and set this DTC.
- DTC B111B Passenger Thermo-electric Driver Overcurrent Low - If DCSM outputs to the passenger seat backrest or cushion TED (circuit pins A, B, C or D at the DCSM connector) or any components within these circuit loops are shorted to ground or a TED resistance of less than 0.9 ohms is sensed, the DCSM will shut down the passenger seat system and set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- TED assembly
- DCSM

PINPOINT TEST AH: DTC B1113/B111B - PASSENGER THERMO-ELECTRIC DEVICE CONTROL OVERTEMPERATURE FAULT/PASSENGER THERMO-ELECTRIC DRIVER OVERCURRENT LOW

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

AH1 CHECK THE TED CIRCUITS FOR SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036a

WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Measure the resistance between the following DCSM C3036a pins, harness side and ground.

Connector-Pin	Circuit
C3036a-A	CHS07 (GY/BU)
C3036a-B	RHS07 (BU)
C3036a-C	CHS06 (BU/BN)
C3036a-D	RHS06 (WH)

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to AH2.

  NO : If the resistances of C3036a-A and/or C3036a-B to ground were **not** greater than 10,000 ohms to ground, go to AH6.

  If resistances of C3036a-C and/or C3036a-D to ground were **not** greater than 10,000 ohms to ground, go to AH7.

AH2 CHECK THE TED CIRCUITS FOR A SHORT TO VOLTAGE

- Key in ON position.

- Measure the voltage between the following DCSM C3036a pins, harness side and ground.

Connector-Pin	Circuit
C3036a-A	CHS07 (GY/BU)
C3036a-B	RHS07 (BU)
C3036a-C	CHS06 (BU/BN)
C3036a-D	RHS06 (WH)

- **Are the voltages less than one volt?**

  YES : Go to AH3.

  NO : If the voltages measured at C3036a-A and/or C3036a-B were **not** less than 1 volt, go to AH8.

  If voltages measured at C3036a-C and/or C3036a-D were **not** less than 1 volt, go to AH9.

AH3 CHECK THE TED RESISTANCE

- Key in OFF position.

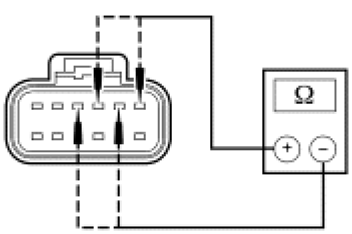

Fig. 236: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: Make sure the TEDs are at room temperature and there is no air blowing across the TEDs. Do not handle a TED when measuring resistance. These conditions can cause incorrect readings and lead to incorrect identification of components that are not faulty.

- Measure the resistance between DCSM C3036a-A, circuit CHS07 (GY/BU), harness side and DCSM C3036a-B, circuit RHS07 (BU), harness side; and between DCSM C3036a-C, circuit CHS06 (BU/BN), harness side and C3036a-D, circuit RHS06 (WH), harness die and ground.
- **Are the resistances between 0.9 and 10 ohms?**

YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : If the resistance between DCSM C3036a-A and C3036a-B was **not** between 0.9 and 10 ohms, go to AH5.

If the resistance between DCSM C3036a-C and C3036a-D was **not** between 0.9 and 10 ohms, go to AH4.

AH4 CHECK THE RESISTANCE OF THE BACKREST TED

- Disconnect: Backrest TED C3326

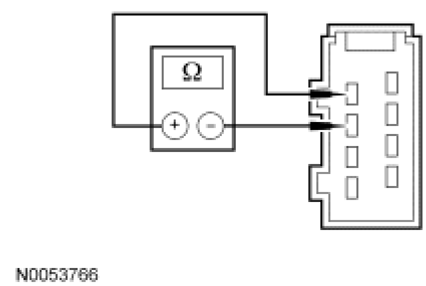

Fig. 237: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED C3326 pin 1 and pin 3, component side.
- **Is the resistance between 0.9 and 10 ohms?**

YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AH5 CHECK THE RESISTANCE OF THE CUSHION TED

- Disconnect: Cushion TED C3328

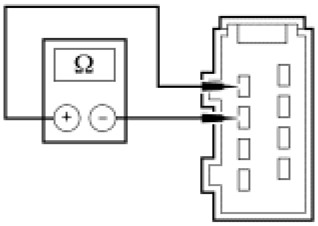

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Fig. 238: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between cushion TED C3328 pin 1 and pin 3, component side.
- **Is the resistance between 0.9 and 10 ohms?**

YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AH6 CHECK THE CUSHION TED CIRCUITS FOR SHORT TO GROUND

- Disconnect: Cushion TED C3328

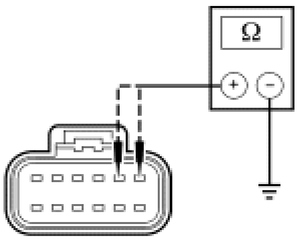

Fig. 239: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036a-A, circuit CHS07 (GY/BU), harness side and ground and between C3036a-B, circuit RHS07 (BU), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AH7 CHECK THE BACKREST TED CIRCUITS FOR SHORT TO GROUND

- Disconnect: Backrest TED C3326

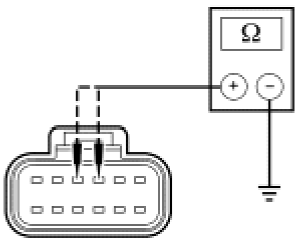

Fig. 240: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036a-C, circuit CHS06 (BU/BN), harness side and ground and between C3036a-D, circuit RHS06 (WH), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AH8 CHECK THE CUSHION TED CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Cushion TED C3328
- Key in ON position.

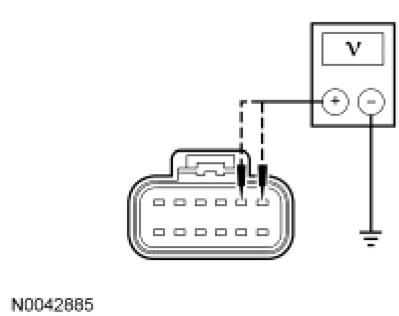

Fig. 241: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036a-A, circuit CHS07 (GY/BU), harness side and ground and between C3036a-B, circuit RHS07 (BU), harness side and ground.
- **Are the voltages less than one volt?**

  YES : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**.

REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AH9 CHECK THE BACKREST TED CIRCUITS FOR SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Backrest TED C3326
- Key in ON position.

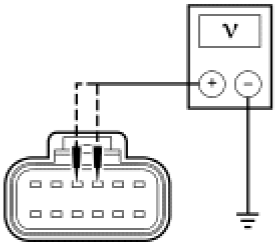

Fig. 242: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036a-C, circuit CHS06 (BU/BN), harness side and ground and between C3036a-D, circuit RHS06 (WH), harness side and ground.
- **Are the voltages less than one volt?**

  YES : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AI: DTC B111C - Passenger Thermo-electric Driver Open Load

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 16 (30A) supplying battery voltage on circuit SBB16 (VT/RD) into DCSM C3036a pins E and F. If voltage is disconnected from either pin E or F of DCSM C3036a with the connection remaining on the other circuit, both seats will remain operational because the circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the DCSM and the other will remain operational.

Each driver and front passenger seat cushion and backrest are equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B111C Passenger Thermo-electic Driver Open Load - If DCSM outputs to the passenger seat backrest or cushion TED (circuit pins A, B, C or D at the DCSM connector) or any components within these circuit loops are open, disconnected or a TED resistance greater than 90K ohms is sensed, the DCSM continues normal operation and sets this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- TED assembly
- DCSM

PINPOINT TEST AI: DTC B111C - PASSENGER THERMO-ELECTRIC DRIVER OPEN LOAD

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

AI1 CHECK THE TED CIRCUITS FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036a
- Disconnect: Cushion TED C3328
- Disconnect: Backrest TED C3326

WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Measure the resistance of the following circuits.

DCSM Connector-Pin	Circuit	TED Connector-Pin
C3036a-A	CHS07 (GY/BU)	C3328-1
C3036a-B	RHS07 (BU)	C3328-3
C3036a-C	CHS06 (BU/BN)	C3326-1
C3036a-D	RHS06 (WH)	C3326-3

- **Are the resistances less than 5 ohms?**

  YES : Go to AI2.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AI2 CHECK THE TED CIRCUITS FOR SHORT TO VOLTAGE

- Key in ON position.
- Measure the voltage between the following DCSM C3036a pins, harness side and ground.

Connector-Pin	Circuit
C3036a-A	CHS07 (GY/BU)
C3036a-B	RHS07 (BU)
C3036a-C	CHS06 (BU/BN)
C3036a-D	RHS06 (WH)

- **Is voltage present on any circuit?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to AI3.

AI3 CHECK RESISTANCE OF THE TEDs

- Key in OFF position.

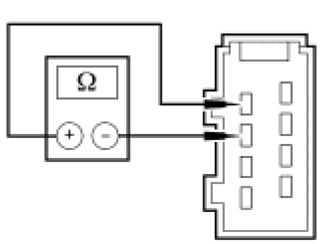

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Fig. 243: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED C3326 pin 1 and pin 3, component side and between cushion TED C3328 pin 1 and pin 3, component side.

- **Are the resistances between 0.9 and 10 ohms?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If the resistance of the backrest TED was **not** between 0.9 and 10 ohms, INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  If the resistance of the cushion TED was **not** between 0.9 and 10 ohms, INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AJ: DTC B111D - Passenger Blower Driver Overtemperature

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 16 (30A) supplying battery voltage on circuit SBB16 (VT/RD) into DCSM C3036a pins E and F. If voltage is disconnected from either pin E or F of DCSM C3036a with the connection remaining on the other circuit, both seats will remain operational because the circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the DSCM and the other will remain operational.

Each driver and front passenger seat cushion and backrest are equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B111D Passenger Blower Driver Overtemperature - If the DCSM outputs to the passenger seat blower or any components within these circuit loops are shorted to ground or cause an excessive current draw, the DCSM will overheat, shut down the passenger seat system and set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- TED assembly
- DCSM

PINPOINT TEST AJ: DTC B111D - PASSENGER BLOWER DRIVER OVERTEMPERATURE

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

AJ1 CHECK THE BLOWER CIRCUIT FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036c
- Disconnect: Cushion TED C3328
- Disconnect: Backrest TED C3326

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

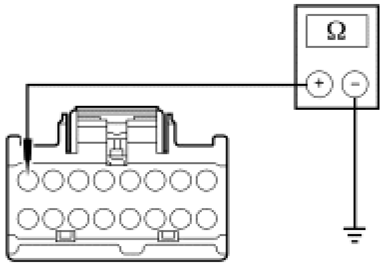

Fig. 244: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-8, circuit CHS08 (BN/YE), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

YES : Go to AJ2.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AJ2 CHECK BLOWER CIRCUIT RHS08 (VT/WH) FOR A SHORT TO BLOWER CIRCUIT CHS08 (BN/YE)

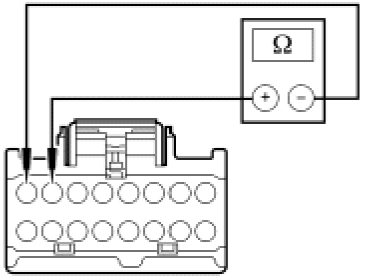

Fig. 245: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-7, circuit RHS08 (VT/WH), harness side and C3036c-8, circuit CHS08 (BN/YE), harness side.
- **Is the resistance greater than 10,000 ohms?**

YES : Go to AJ3.

NO : REPAIR the circuits. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AJ3 CHECK THE BLOWER RESISTANCE

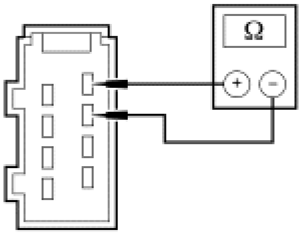

Fig. 246: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between cushion TED C3328 pin 2 and pin 4, component side and between backrest TED C3326 pin 2 and pin 4, component side.
- **Are the resistances between 6,000 ohms and 9,000 ohms?**

YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : If the resistance of the cushion TED was **not** between 6,000 and 9,000 ohms, INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

If the resistance of the backrest TED was **not** between 6,000 and 9,000 ohms, INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AK: DTC B2729 - Driver Cushion Over-Temp Detected

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 16 (30A) supplying battery voltage on circuit SBB16 (VT/RD) into DCSM C3036a pins E and F. If voltage is disconnected from either pin E or F of DCSM C3036a with the connection remaining on the other circuit, both seats will remain operational because the circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the DCSM and the other will remain operational.

Each driver and front passenger seat cushion and backrest are equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B2729 Cushion Over-Temp Detected - In the heating mode, if the driver seat cushion TED temperature exceeds 85°C (185°F) for more than 4 seconds, the TED is disconnected or the duct is blocked, the DCSM will shut down the driver seat system and set this DTC.
- DTC B2729 Cushion Over-Temp Detected - In the cooling mode, if the driver seat cushion TED temperature exceeds 70°C (158°F) for more than 4 seconds, the TED is disconnected or the duct is blocked, the DCSM will shut down the driver seat system and set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Restricted cushion TED filter
- Crushed or restricted cushion foam pad
- Crushed or restricted climate controlled seat manifold
- Cushion TED assembly
- DCSM

PINPOINT TEST AK: DTC B2729 - DRIVER CUSHION OVER-TEMP DETECTED

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

AK1 CHECK THE DCSM FOR DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test/DCSM/Retrieve DTCs
- **Was DTC B2729 retrieved during the self-test?**

  YES : Go to AK2.

  NO : Go to AK4.

AK2 CHECK THE TED THERMISTOR CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036b
- Disconnect: Cushion TED C3327

WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

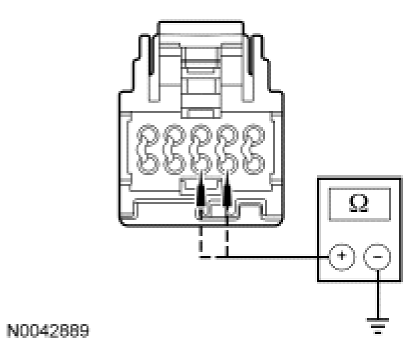

Fig. 247: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036b-7, circuit VHS26 (VT), harness side and ground and between DCSM C3036b-8, circuit RHS05 (YE/VT), harness side and ground.

- **Are the resistances greater than 10,000 ohms?**
  YES : Go to AK3.
  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AK3 CHECK THE TED THERMISTOR

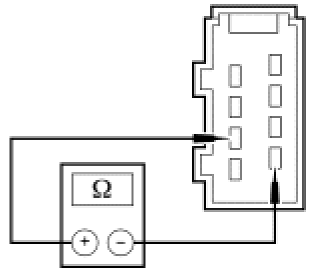

Fig. 248: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between cushion TED C3327 pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AK4 CONFIRM THE FAULT

- Verify with the customer that the concern is the seat shuts OFF in heat mode.

NOTE: **A crushed seat cushion foam pad or a crushed climate controlled seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on the seat to recreate the fault.**

- Attempt to recreate the fault. Start the vehicle and set the driver seat to HIGH heat for at least 15 minutes.
- **Is the customer concern with the seat shutting OFF in heat mode or was the fault recreated?**

  YES : Go to AK5.

  NO : Fault not present. Fault may have been set due to a past failure or incorrect use of the climate controlled seat system by repeated switching between heat and cool modes. REPEAT the self-test. CLEAR the DTCs.

AK5 CHECK OPERATION OF THE SEAT

- With the engine running, set both front seats to HIGH cool (3 LEDs illuminated on HVAC module).
- Compare the airflow from the driver seat cushion and compare it to the airflow from the passenger seat cushion.
- **Is the airflow exhausting from the driver seat cushion comparable to the airflow exhausting from the passenger seat cushion?**

  YES : Go to AK14.

NO : Go to AK6.

AK6 CHECK THE CUSHION BLOWER FOR AN OBSTRUCTION OR RESTRICTED FILTER

- Key in OFF position.
- Inspect the blower of the cushion TED assembly for an obstruction or for a restricted filter.
- **Is the blower obstructed or the filter restricted?**

  YES : REMOVE the obstruction or INSTALL a new filter. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to AK7.

AK7 CHECK THE CUSHION FAN OPERATION

- Key in ON position.
- With the engine running, set both front seats to HIGH cool (3 LEDs illuminated on HVAC module).
- Inspect the cushion blower for operation.
- **Does the cushion blower operate?**

  YES : Go to AK14.

  NO : Go to AK8.

AK8 CHECK THE BLOWER SPEED CONTROL CIRCUIT FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036c
- Disconnect: Cushion TED C3327

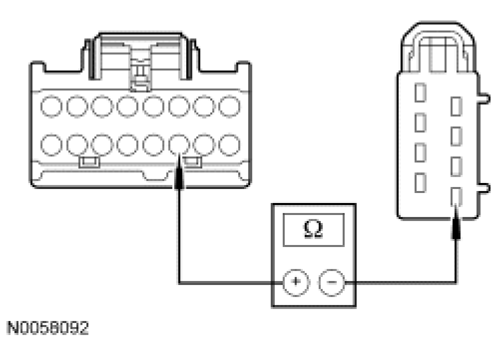

Fig. 249: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3265c-11, circuit VHS18 (BN/GN), harness side and cushion TED C3327-7, circuit VHS18 (BN/GN), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to AK9.

NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AK9 CHECK BLOWER CIRCUIT RHS03 (GY/OG) FOR A SHORT TO VOLTAGE

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.

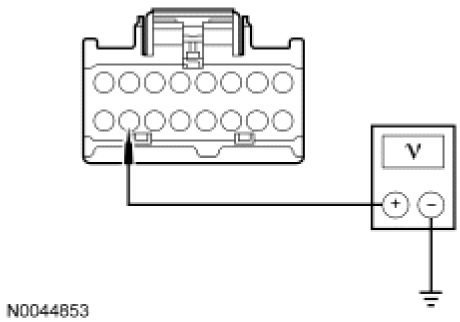

Fig. 250: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036c-15, circuit RHS03 (GY/OG), harness side and ground.
- **Is voltage greater than one volt?**

YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : Go to AK10.

AK10 CHECK BLOWER CIRCUIT CHS03 (GN/BN) FOR A SHORT TO GROUND

- Key in OFF position.

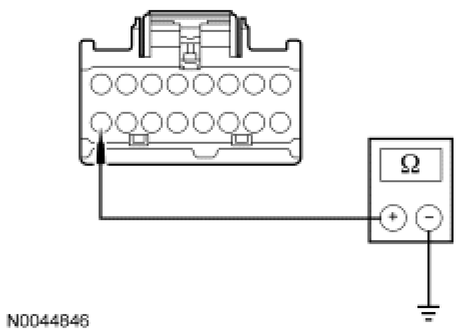

Fig. 251: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-16, circuit CHS03 (GN/BN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AK11.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AK11 CHECK BLOWER CIRCUITS RHS03 (GY/OG) AND CHS03 (GN/BN) FOR AN OPEN

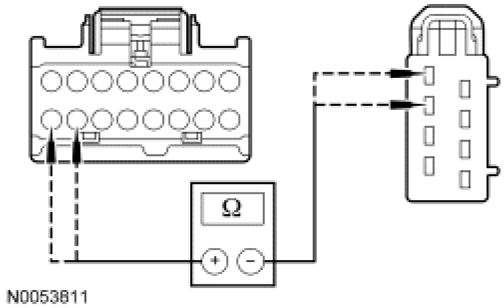

Fig. 252: Measuring Resistance

Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-16, circuit CHS03 (GN/BN), harness side and cushion TED C3327-2, circuit CHS03 (GN/BN), harness side; and between DCSM C3036c-15, circuit RHS03 (GY/OG), harness side and cushion TED C3327-4, circuit RHS03 (GY/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to AK12.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AK12 CHECK THE BLOWER RESISTANCE

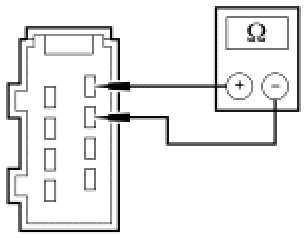

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Fig. 253: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between cushion TED C3327 pin 2 and pin 4, component side.
- **Is the resistance between 6,000 ohms and 9,000 ohms?**

  YES : Go to AK13.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AK13 CHECK THE BLOWER SPEED CONTROL RESISTANCE

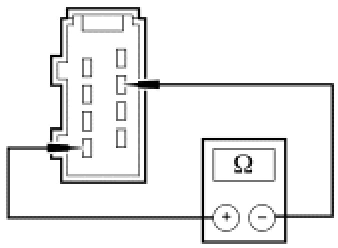


Fig. 254: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between cushion TED C3327 pin 7 and pin 4, component side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : Go to AK14.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AK14 CHECK THE TED INSTALLATION AND FOR CRUSHED SEAT CUSHION

- Key in OFF position.
- Remove the seat. Refer to **Seat - Front**.
- Remove the seat cushion trim cover. Refer to **Seat Cushion Cover - Front**.
- Inspect the seat cushion for the following:

- Is the TED correctly installed?
- Is the seat cushion foam pad crushed or restricted?
- Is the climate controlled seat manifold crushed or restricted?

- **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**

  YES : CONNECT the battery ground cable.

  INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : CORRECTLY install the cushion TED or INSTALL a new seat cushion foam pad and/or climate controlled seat manifold. INSTALL the driver seat. CONNECT the battery ground cable. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AL: DTC B272A - Passenger Cushion Over-Temp Detected

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 16 (30A) supplying battery voltage on circuit SBB16 (VT/RD) into DCSM C3036a pins E and F. If voltage is disconnected from either pin E or F of DCSM C3036a with the connection remaining on the other circuit, both seats will remain operational because the circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the DCSM and the other will remain operational.

Each driver and front passenger seat cushion and backrest are equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B272A Passenger Cushion Over-Temp Detected - In the cooling mode, if the passenger seat cushion TED temperature exceeds 70°C (158°F) for more than 4 seconds, the TED is disconnected or the duct is blocked, the DCSM will shut down the passenger seat system and set this DTC.
- DTC B272A Passenger Cushion Over-Temp Detected - In the heating mode, if the passenger seat cushion TED temperature exceeds 85°C (185°F) for more than 4 seconds, the TED is disconnected or the duct is blocked, the DCSM will shut down the passenger seat system and set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Restricted cushion TED filter
- Crushed or restricted cushion foam pad
- Crushed or restricted climate controlled seat manifold
- Cushion TED assembly
- DCSM

PINPOINT TEST AL: DTC B272A - PASSENGER CUSHION OVER-TEMP DETECTED

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

AL1 CHECK THE DCSM FOR DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test/DCSM/Retrieve DTCs
- **Was DTC B272A retrieved during the self-test?**

  YES : Go to AL2.

  NO : Go to AL4.

AL2 CHECK THE TED THERMISTOR CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036b

- Disconnect: Cushion TED C3328

> **WARNING:** **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

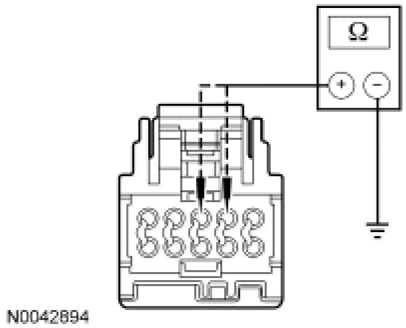


Fig. 255: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036b-2, circuit VHS27 (WH/OG), harness side and ground and between DCSM C3036b-3, circuit RHS10 (BU/OG), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to AL3.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AL3 CHECK THE TED THERMISTOR

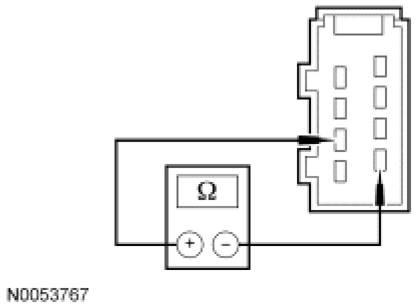


Fig. 256: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between cushion TED C3328 pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AL4 CONFIRM THE FAULT

- Verify with the customer that the concern is the seat shuts OFF in heat mode.

NOTE: A crushed seat cushion foam pad or a crushed climate controlled seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on the seat to recreate the fault.

- Attempt to recreate the fault. Start the vehicle and set the passenger seat to HIGH heat for at least 15 minutes.
- **Is the customer concern with the seat shutting OFF in heat mode or was the fault recreated?**

  YES : Go to AL5.

  NO : Fault not present. Fault may have been set due to a past failure or incorrect use of the climate controlled seat system by repeated switching between heat and cool modes. REPEAT the self-test. CLEAR the DTCs.

AL5 CHECK OPERATION OF THE SEAT

- Key in ON position.
- With the engine running, set both front seats to HIGH cool (3 LEDs illuminated on HVAC module).
- Compare the airflow from the passenger seat cushion and compare it to the airflow from the driver seat cushion.
- **Is the airflow exhausting from the passenger seat cushion comparable to the airflow exhausting from the driver seat cushion?**

  YES : Go to AL14.

  NO : Go to AL6.

AL6 CHECK THE CUSHION BLOWER FOR AN OBSTRUCTION OR RESTRICTED FILTER

- Key in OFF position.
- Inspect the blower of the cushion TED assembly for an obstruction or for a restricted filter.
- **Is the blower obstructed or the filter restricted?**

  YES : REMOVE the obstruction or INSTALL a new filter. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to AL7.

AL7 CHECK THE CUSHION FAN OPERATION

- Key in ON position.
- With the engine running, set both front seats to HIGH cool (3 LEDs illuminated on HVAC module).
- Inspect the cushion blower for operation.
- **Does the cushion blower operate?**

  YES : Go to AL14.

NO : Go to AL8.

AL8 CHECK THE BLOWER SPEED CONTROL CIRCUIT FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036c
- Disconnect: Cushion TED C3328

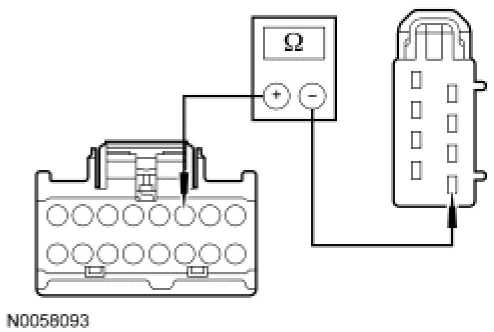


Fig. 257: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-3, circuit VHS23 (BN/BU), harness side and cushion TED C3328-7, circuit VHS23 (BN/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to AL9.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AL9 CHECK THE BLOWER CIRCUIT RHS08 (VT/WH) FOR A SHORT TO VOLTAGE

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.

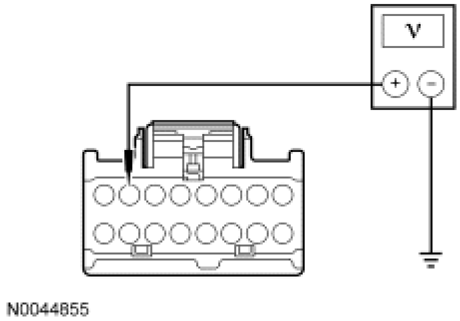


Fig. 258: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036c-7, circuit RHS08 (VT/WH), harness side and ground.
- **Is voltage greater than one volt?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to AL10.

AL10 CHECK BLOWER CIRCUIT CHS08 (BN/YE) FOR A SHORT TO GROUND

- Key in OFF position.

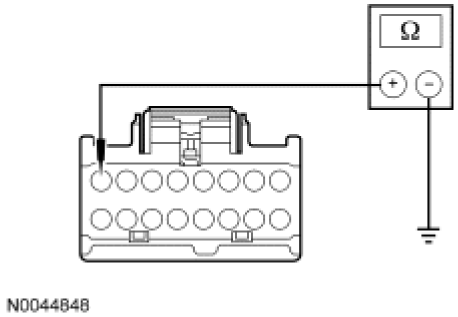


Fig. 259: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-8, circuit CHS08 (BN/YE), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AL11.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AL11 CHECK BLOWER CIRCUITS CHS08 (BN/YE) AND RHS08 (VT/WH) FOR AN OPEN

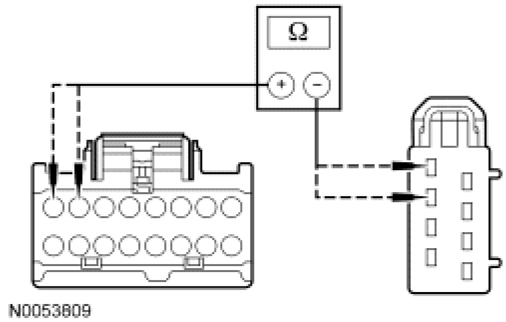


Fig. 260: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-8, circuit CHS08 (BN/YE), harness side and cushion TED C3328-2, circuit CHS08 (BN/YE), harness side; and between DCSM C3036c-7, circuit RHS08 (VT/WH), harness side and cushion TED C3328-4, circuit RHS08 (VT/WH), harness side.
- **Are the resistances less than 5 ohms?**

YES : Go to AL12.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AL12 CHECK THE BLOWER RESISTANCE

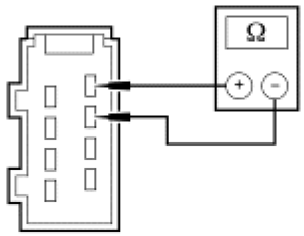


Fig. 261: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.

- Measure the resistance between cushion TED C3328 pin 2 and pin 4, component side.
- **Is the resistance between 6,000 ohms and 9,000 ohms?**

YES : Go to AL13.

NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AL13 CHECK THE BLOWER SPEED CONTROL RESISTANCE

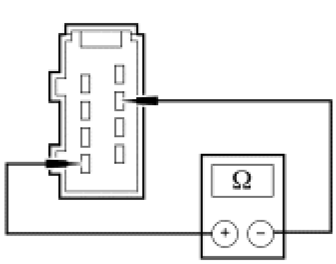


Fig. 262: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: The ohmmeter must be connected with the positive lead to pin 7 and

the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.

- Measure the resistance between cushion TED C3328 pin 7 and pin 4, component side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : Go to AL14.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AL14 CHECK THE TED INSTALLATION AND FOR CRUSHED SEAT CUSHION

- Key in OFF position.
- Remove the seat. Refer to **Seat - Front**.
- Remove the seat cushion trim cover. Refer to **Seat Cushion Cover - Front**.
- Inspect the seat cushion for the following:
  - Is the TED correctly installed?
  - Is the seat cushion foam pad crushed or restricted?
  - Is the climate controlled seat manifold crushed or restricted?
- **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**

  YES : CONNECT the battery ground cable.

  INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : CORRECTLY install the cushion TED or INSTALL a new seat cushion foam pad and/or climate controlled seat manifold. INSTALL the passenger seat. CONNECT the battery ground cable. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AM: DTC B272B - Passenger Back Over-Temp Detected

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 16 (30A) supplying battery voltage on circuit SBB16 (VT/RD) into DCSM C3036a pins E and F. If voltage is disconnected from either pin E or F of DCSM C3036a with the connection remaining on the other circuit, both seats will remain operational because the circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the DCSM and the other will remain operational.

Each driver and front passenger seat cushion and backrest are equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B272B Passenger Back Over-Temp Detected - In the cooling mode, if the passenger seat backrest TED temperature exceeds 70°C (158°F) for more than 4 seconds, the TED is disconnected or the duct is blocked, the DCSM will shut down the passenger seat system and set this DTC.
- DTC B272B Passenger Back Over-Temp Detected - In the heating mode, if the passenger seat backrest TED temperature exceeds 85°C (185°F) for more than 4 seconds, the TED is disconnected or the duct is blocked, the DCSM will shut down the passenger seat system and set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Restricted backrest TED filter
- Crushed or restricted backrest foam pad
- Crushed or restricted climate controlled seat manifold
- Backrest TED assembly
- DCSM

PINPOINT TEST AM: DTC B272B - PASSENGER BACK OVER-TEMP DETECTED

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

AM1 CHECK THE DCSM FOR DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test/DCSM/Retrieve DTCs
- **Was DTC B272B retrieved during the self-test?**

  YES : Go to AM2.

  NO : Go to AM4.

AM2 CHECK THE TED THERMISTOR CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036b
- Disconnect: Backrest TED C3326

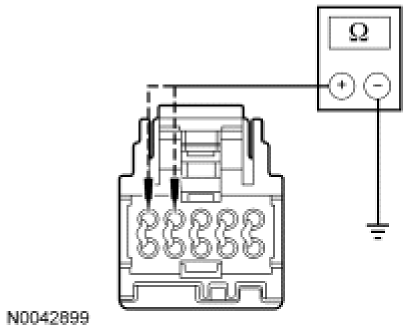


Fig. 263: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036b-4, circuit VHS36 (YE/BU), harness side and ground and between DCSM C3036b-5, circuit RHS20 (GN/BU), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to AM3.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AM3 CHECK THE TED THERMISTOR

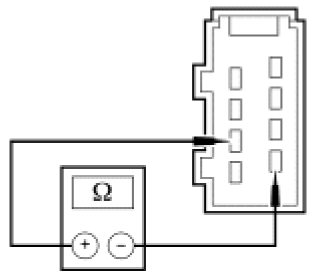


Fig. 264: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED C3326 pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : REPAIR the affected open circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AM4 CONFIRM THE FAULT

- Verify with the customer that the concern is the seat shuts OFF in heat mode.

NOTE: A crushed seat backrest foam pad or a crushed climate controlled seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on the seat to recreate the fault.

- Attempt to recreate the fault. Start the vehicle and set the front passenger seat to HIGH heat for at least 15 minutes.
- **Is the customer concern with the seat shutting OFF in heat mode or was the fault recreated?**

  YES : Go to AM5.

  NO : Fault not present. Fault may have been set due to a past failure or incorrect use of the climate controlled seat system by repeated switching between heat and cool modes. REPEAT the self-test. CLEAR the DTCs.

AM5 CHECK OPERATION OF THE SEAT

- Key in ON position.
- With the engine running, set both front seats to HIGH cool (3 LEDs illuminated on HVAC module).
- Compare the airflow from the front passenger seat backrest and compare it to the airflow from the driver seat backrest.
- **Is the airflow exhausting from the front passenger seat backrest comparable to the airflow exhausting from the driver seat backrest?**

  YES : Go to AM14.

  NO : Go to AM6.

AM6 CHECK THE BACKREST BLOWER FOR AN OBSTRUCTION OR RESTRICTED FILTER

- Key in OFF position.
- Inspect the blower of the backrest TED assembly for an obstruction or for a restricted filter.
- **Is the blower obstructed or the filter restricted?**

  YES : REMOVE the obstruction or INSTALL a new filter. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to AM7.

AM7 CHECK THE BACKREST FAN OPERATION

- Key in ON position.
- With the engine running, set both front seats to HIGH cool (3 LEDs illuminated on HVAC module).

- Inspect the backrest blower for operation.
- **Does the backrest blower operate?**

  YES : Go to AM14.

  NO : Go to AM8.

AM8 CHECK THE BLOWER SPEED CONTROL CIRCUIT FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036c
- Disconnect: Backrest TED C3326

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

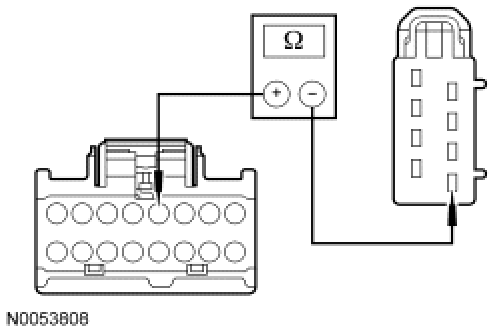


Fig. 265: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-4, circuit VHS21 (BU/WH), harness side and backrest TED C3326-7, circuit VHS21 (BU/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to AM9.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AM9 CHECK THE BLOWER CIRCUIT RHS08 (VT/WH) FOR A SHORT TO VOLTAGE

- Key in ON position.

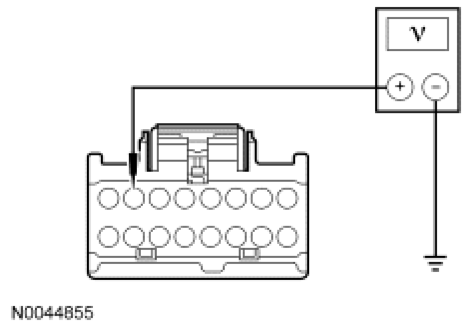


Fig. 266: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036c-7, circuit RHS08 (VT/WH), harness side and ground.
- **Is voltage greater than one volt?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to AM10.

AM10 CHECK THE BLOWER CIRCUIT CHS08 (BN/YE) FOR A SHORT TO GROUND

- Key in OFF position.

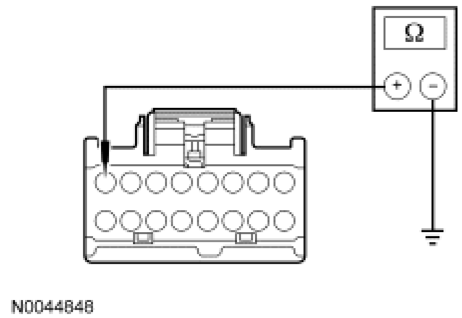


Fig. 267: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-8, circuit CHS08 (BN/YE), harness side and

ground.

- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AM11.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AM11 CHECK THE BLOWER CIRCUITS RHS08 (VT/WH) AND CHS08 (BN/YE) FOR AN OPEN

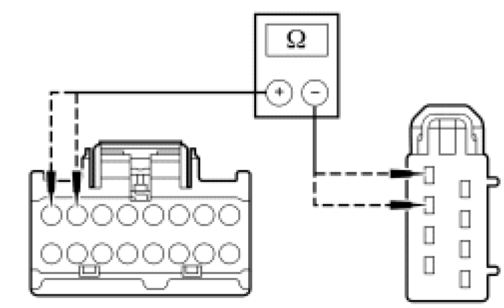


Fig. 268: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-8, circuit CHS08 (BN/YE), harness side and backrest TED C3326-2, circuit CHS08 (BN/YE), harness side; and between DCSM C3036c-7, circuit RHS08 (VT/WH), harness side and backrest TED C3326-4, circuit RHS08 (VT/WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to AM12.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AM12 CHECK THE BLOWER RESISTANCE

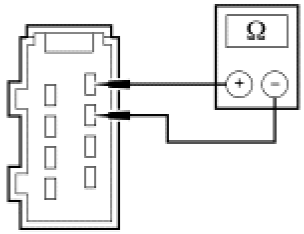


Fig. 269: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between backrest TED C3326 pin 2 and pin 4, component side.
- **Is the resistance between 6,000 ohms and 9,000 ohms?**

YES : Go to AM13.

NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AM13 CHECK THE BLOWER SPEED CONTROL RESISTANCE

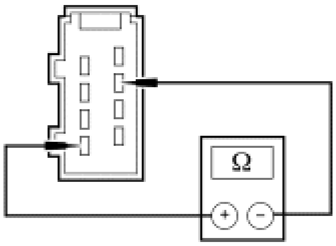


Fig. 270: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to pin 7 and**

the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.

- Measure the resistance between backrest TED C3326 pin 7 and pin 4, component side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : Go to AM14.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AM14 CHECK THE TED INSTALLATION AND FOR CRUSHED SEAT BACKREST

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Remove the seat. Refer to **Seat - Front**.
- Remove the seat backrest trim cover. Refer to **Seat Backrest Cover - Front, Without Fold Flat**.
- Inspect the seat backrest for the following:
  - Is the TED correctly installed?
  - Is the seat backrest foam pad crushed or restricted?
  - Is the climate controlled seat manifold crushed or restricted?
- **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**

  YES : CONNECT the battery ground cable.

  INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : CORRECTLY install the backrest TED or INSTALL a new seat backrest foam pad and/or climate controlled seat manifold. CONNECT the battery ground cable. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AN: DTC B272C - Driver Differential Temperature Fault

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 16 (30A) supplying battery voltage on circuit SBB16 (VT/RD) into DCSM C3036a pins E and F. If voltage is disconnected from either pin E or F of DCSM C3036a with the connection remaining on the other circuit, both seats will remain operational because the circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the DCSM and the other will remain operational.

Each driver and front passenger seat cushion and backrest are equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

A differential fault occurs when the cushion and backrest TEDs on the seat are reporting temperatures to the DCSM with a difference between them of 60°C (108°F) or greater. This can result from an air flow restriction or a circuit fault of either TED. If a TED and manifold is clear of obstruction and is operational, the other TED and circuitry on the seat should be checked. It is important to note that a TED with a higher temperature may be operating correctly and not be the area of concern. The other TED may be indicating a much lower temperature, causing the DTC to set.

- DTC B272C Driver Differential Temperature Fault - If there is a temperature differential between the driver backrest and cushion TED of 60°C (108°F) or more for more than 4 seconds, the TED is disconnected or the duct is blocked, this DTC will set. When this happens the first time in a key cycle, the DCSM puts the driver seat system into recovery mode (see principles of operation). If the system is able to recover, it will function normally. If the system is able to recover and it occurs a second time in the same key cycle, the DCSM will shut down the driver seat system.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

- Restricted cushion or backrest TED filter
- Crushed or restricted cushion or backrest foam pad
- Crushed or restricted cushion or backrest climate controlled seat manifold
- Cushion or backrest TED assembly
- DCSM

PINPOINT TEST AN: DTC B272C - DRIVER DIFFERENTIAL TEMPERATURE FAULT

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

AN1 CHECK THE DCSM FOR DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test/DCSM/Retrieve DTCs
- **Was DTC B2729 or B2730 retrieved in the self-test as an on-demand or a continuous DTC?**

  YES : For DTC B2729, go to **Pinpoint Test AK**. For DTC B2730, go to **Pinpoint Test AP**.

  NO : Go to AN2.

AN2 MONITOR THE DCSM TED TEMPERATURE PIDs

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DCSM PIDs
  - Passenger Cushion Thermal Electric Device (TED) Temperature (PCSHTMP)
  - Passenger Back TED Temperature (PBKTMP)
  - Seat cushion thermal electric device temperature (CSHTEMP)
  - Seat back thermal electric device temperature (BK_TEMP)

NOTE: **Make sure the temperature of the climate controlled seats has stabilized before monitoring the PIDs. Not allowing stabilization can cause incorrect readings and lead to incorrect identification of components that are not faulty.**

- Monitor the TED temperature PIDs with the climate controlled seats OFF. Compare the PID values of the driver seat to those of the front passenger seat. This can help identify if there is a concern with the driver seat cushion or backrest PID readings.
- **Are both driver seat TED temperature PID values within 10°C (18°F) of the ambient temperature?**

  YES : Go to AN3.

  NO : If the driver seat cushion PID value varies 10°C (18°F) or more from ambient temperature, go to AN16.

  If the driver seat backrest PID value varies 10°C (18°F) or more from ambient temperature, go to

AN31.

AN3 CONFIRM THE FAULT IS IN THE SEAT CUSHION OR THE BACKREST

- Key in OFF position.
- Key in ON position.

NOTE: **A crushed seat cushion foam pad or a crushed climate controlled seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on the seat to recreate the fault.**

NOTE: **If the seat shuts down before a 15-minute heat cycle has timed-out, carry out the DCSM self test and go to the Dual Climate Controlled Seat Module (DCSM) DTC Chart to continue diagnostics.**

- After cycling the ignition switch and with the engine running, set the driver seat to high heat (3 LEDs illuminated on HVAC module). Allow the seat to heat for at least 15 minutes while monitoring the TED temperature PIDs of the driver seat. If necessary, when the seat times-out after 15 minutes, set the driver seat to high heat once again.
- **Do the driver seat cushion TED and backrest TED PIDs vary more than 60°C (108°F) from each other?**

  YES : If the driver seat cushion PID value is 60°C (108°F) hotter than the backrest PID value, go to AN5.

  If the driver seat backrest PID value is 60°C (108°F) hotter than the cushion PID value, go to AN20.

  NO : Go to AN4.

AN4 CHECK THE TEDs COOLING PERFORMANCE

- Check the TEDs cooling performance on the driver seat. Refer to **Component Test** - Thermo-Electric Device (TED) Cooling Performance.
- **Did the TEDs pass the component test?**

  YES : The DTC may have been set by extreme cabin temperatures or excessive sun-load on the seat causing the system to enter recovery mode. Occupant size and weight characteristics can also be a factor. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. If a concern cannot be found or duplicated, RETURN the vehicle to the customer.

  NO : CHECK the affected seat cushion or backrest for correct installation of the climate controlled seat components (TED, manifold, air ducts and foam pad). CHECK for airflow restrictions (TED inlets and outlets, TED-to-manifold connections, filters and ducts) and REPAIR as needed. CHECK for an intermittent wiring fault. REPAIR as needed. REPEAT the self-test. CLEAR the DTCs.

AN5 CHECK THE TED INSTALLATION AND FOR A CRUSHED SEAT CUSHION

- Key in OFF position.

- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Remove the seat. Refer to **Seat - Front**.
- Remove the seat cushion trim cover. Refer to **Seat Cushion Cover - Front**.
- Inspect the seat cushion for the following:
  - Is the cushion blower obstructed?
  - Is the blower filter restricted or plugged?
  - Is the TED correctly installed?
  - Is the seat cushion foam pad crushed or restricted?
  - Is the climate controlled seat manifold crushed or restricted?
- **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**

  YES : Go to AN6.

  NO : CORRECTLY install the cushion TED or INSTALL a new seat cushion foam pad and/or climate controlled seat manifold. CONNECT the battery ground cable. REPEAT the self-test. CLEAR the DTCs.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN6 CHECK BACKREST TED CIRCUIT RHS01 (WH/VT) FOR SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036a

NOTE: **Do not connect the seat side air bag electrical connector at this time.**

- Position the driver seat in the vehicle and connect the seat-to-floor connectors.

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.

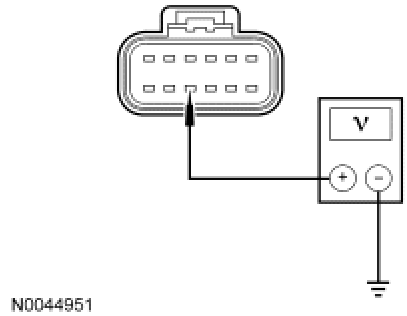


Fig. 271: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036a-K, circuit RHS01 (WH/VT), harness side and ground.
- **Is the voltage less than 0.5 volt?**

  YES : Go to AN7.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN7 CHECK BACKREST TED CIRCUIT CHS01 (GY/VT) FOR SHORT TO GROUND

- Key in OFF position.

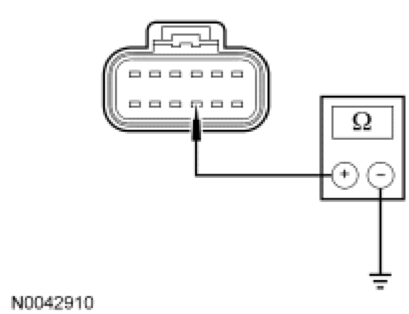


Fig. 272: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036a-J, circuit CHS01 (GY/VT), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

YES : Go to AN8.

NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN8 CHECK RESISTANCE OF THE BACKREST TED AND WIRING

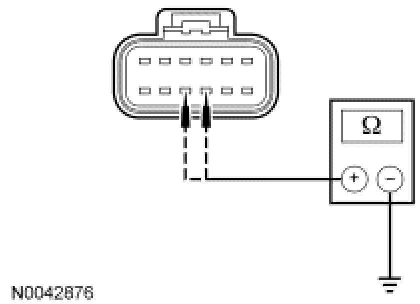


Fig. 273: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036a-J, circuit CHS01 (GY/VT), harness side and DCSM C3036a-K, circuit RHS01 (WH/VT), harness side.
- **Is the resistance between 0.9 and 10 ohms?**

YES : Go to AN10.

NO : Go to AN9.

AN9 CHECK RESISTANCE OF THE BACKREST TED

- Disconnect: Backrest TED C3322

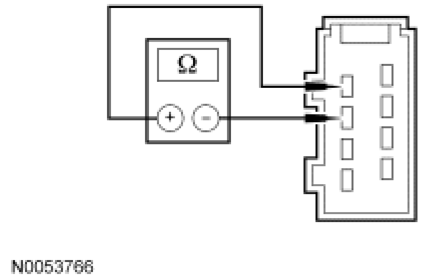


Fig. 274: Measuring Resistance

Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED C3322 pin 1 and pin 3, component side.
- **Is the resistance between 0.9 and 10 ohms?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN10 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect: DCSM C3036c
- Key in ON position.

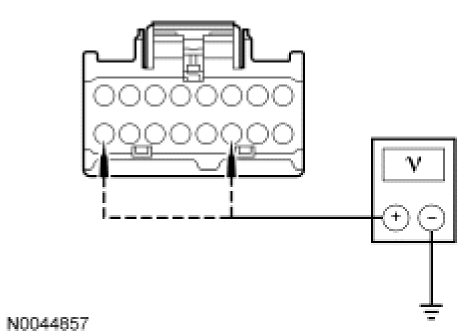


Fig. 275: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036c-16, circuit CHS03 (GN/BN), harness side and ground and between DCSM C3036c-11, circuit VHS18 (BN/GN), harness side and ground.
- **Are the voltages less than one volt?**

YES : Go to AN11.

NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN11 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.

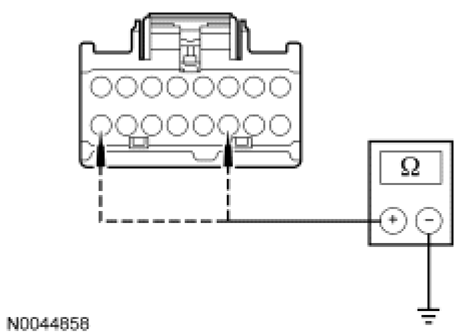


Fig. 276: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-16, circuit CHS03 (GN/BN), harness side and ground and between DCSM C3036c-11, circuit VHS18 (BN/GN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

YES : Go to AN12.

NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN12 CHECK THE BLOWER AND WIRING

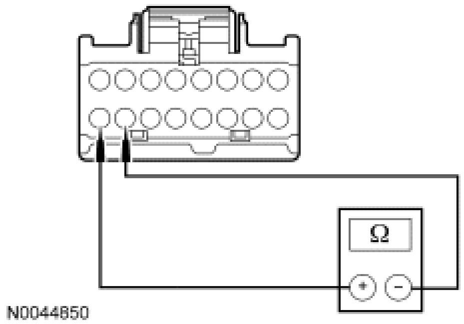


Fig. 277: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to dual climate controlled seat module (DCSM) C3036c-16, circuit CHS03 (GN/BN) and the negative lead to DCSM C3036c-15, circuit RHS03 (GY/OG) when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between DCSM C3036c-16, circuit CHS03 (GN/BN), harness side and DCSM C3036c-15, circuit RHS03 (GY/OG), harness side.
- **Is the resistance between 6,000 ohms and 9,000 ohms?**

  YES : Go to AN14.

  NO : Go to AN13.

AN13 CHECK THE BLOWER

- Disconnect: Cushion TED C3327

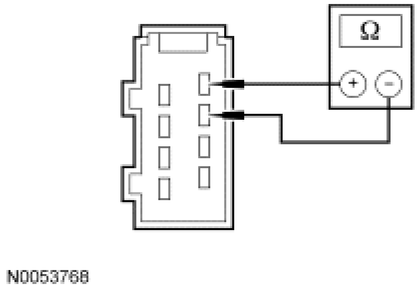


Fig. 278: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between cushion TED C3327 pin 2 and pin 4, component side.
- **Is the resistance between 6,000 ohms and 9,000 ohms?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN14 CHECK BLOWER SPEED CONTROL AND BLOWER GROUND CIRCUIT

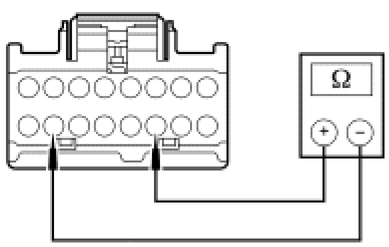


Fig. 279: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to C3036c-11, circuit VHS18 (BN/GN), harness side and the negative lead to C3036c-15, circuit RHS03 (GY/OG), harness side when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between DCSM C3036c-11, circuit VHS18 (BN/GN) harness side and DCSM C3036c-15, circuit RHS03 (GY/OG), harness side.

- **Is the resistance between 290K ohms and 420K ohms?**

  YES : Go to AN16.

  NO : Go to AN15.

AN15 CHECK THE BLOWER SPEED CONTROL

- Disconnect: Cushion TED C3327

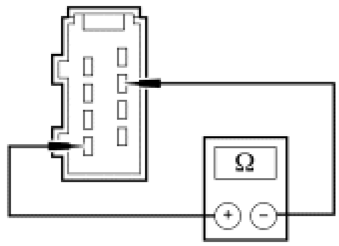


Fig. 280: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between cushion TED C3327 pin 7 and pin 4, component side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN16 CHECK THERMISTOR CIRCUIT FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036b

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.

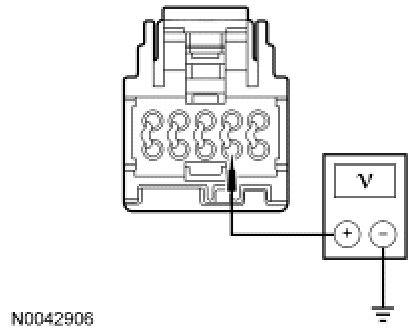


Fig. 281: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036b-7, circuit VHS26 (VT), harness side and ground.
- **Is the voltage less than 0.5 volt?**

YES : Go to AN17.

NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN17 CHECK THERMISTOR CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.

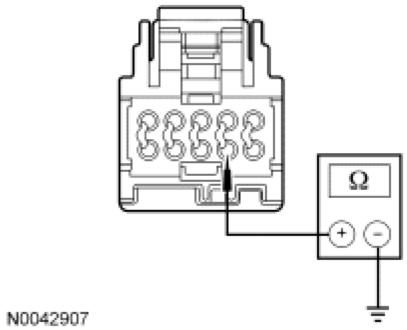


Fig. 282: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036b-7, circuit VHS26 (VT), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AN18.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN18 CHECK THE THERMISTOR AND WIRING

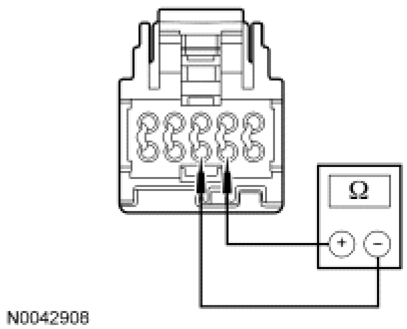


Fig. 283: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036b-7, circuit VHS26 (VT), harness side and DCSM C3036b-8, circuit RHS05 (YE/VT), harness side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to AN19.

AN19 CHECK THE THERMISTOR

- Disconnect: Cushion TED C3327

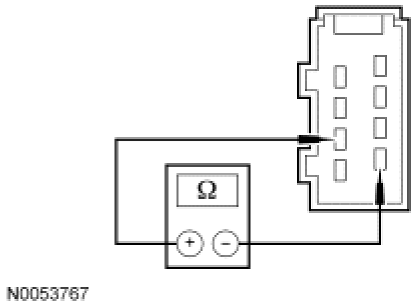


Fig. 284: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between cushion TED pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN20 CHECK THE TED INSTALLATION AND FOR A CRUSHED SEAT BACKREST

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Remove the seat. Refer to **Seat - Front**.

- Remove the seat backrest trim cover. Refer to **Seat Backrest Cover - Front, Without Fold Flat**.
- Inspect the seat backrest for the following:
  - Is the backrest blower obstructed?
  - Is the blower filter restricted or plugged?
  - Is the TED correctly installed?
  - Is the seat backrest foam pad crushed or restricted?
  - Is the climate controlled seat manifold crushed or restricted?
- **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**

  YES : Go to AN21.

  NO : CORRECTLY install the backrest TED or INSTALL a new seat backrest foam pad and/or climate controlled seat manifold. CONNECT the battery ground cable. REPEAT the self-test. CLEAR the DTCs.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN21 CHECK THE CUSHION TED CIRCUIT RHS02 (BU/OG) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036a

NOTE: Do not connect the seat side air bag electrical connector at this time.

- Position the driver seat in the vehicle and connect the seat-to-floor connectors.

WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.

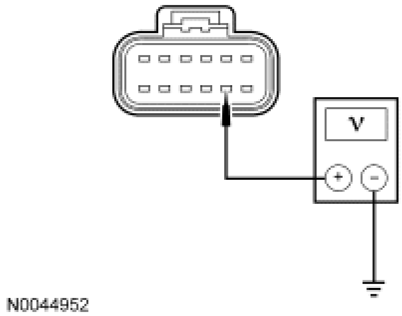


Fig. 285: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036a-H, circuit RHS02 (BU/OG), harness side and ground.
- **Is the voltage less than 0.5 volt?**

  YES : Go to AN22.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN22 CHECK CUSHION TED CIRCUIT CHS02 (YE/BU) FOR SHORT TO GROUND

- Key in OFF position.

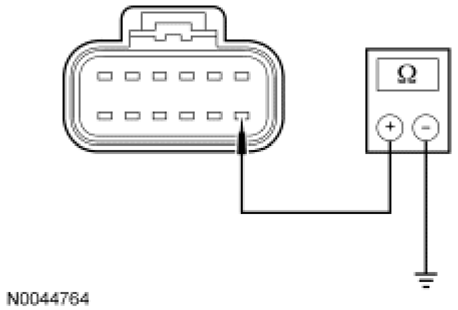


Fig. 286: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036a-G, circuit CHS02 (YE/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AN23.

NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN23 CHECK RESISTANCE OF THE CUSHION TED AND WIRING

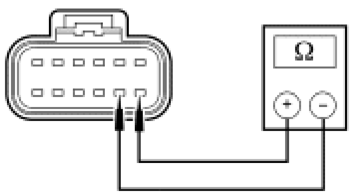


Fig. 287: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036a-G circuit CHS02 (YE/BU), harness side and DCSM C3036a-H, circuit RHS02 (BU/OG), harness side.
- **Is the resistance between 0.9 and 10 ohms?**

  YES : Go to AN25.

  NO : Go to AN24.

AN24 CHECK RESISTANCE OF THE CUSHION TED

- Disconnect: Cushion TED C3327

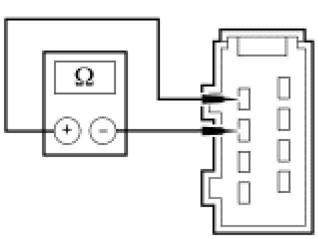


Fig. 288: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between cushion TED C3327 pin 1 and pin 3, component side.
- **Is the resistance between 0.9 and 10 ohms?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN25 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect: DCSM C3036c
- Key in ON position.

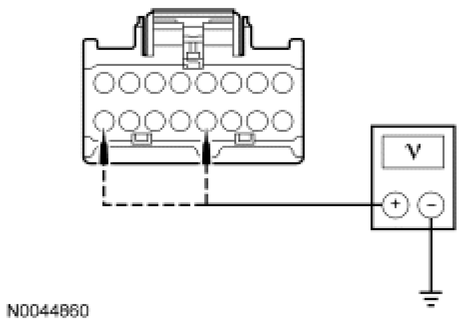


Fig. 289: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036c-16, circuit CHS03 (GN/BN), harness side and ground and between DCSM C3036c-12, circuit VHS16 (BU/GN), harness side and ground.
- **Are the voltages less than one volt?**

  YES : Go to AN26.

NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN26 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.

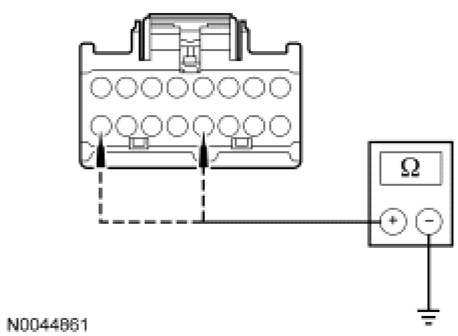


Fig. 290: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-16, circuit CHS03 (GN/BN), harness side and ground and between DCSM C3036c-12, circuit VHS16 (BU/GN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to AN27.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN27 CHECK THE BLOWER AND WIRING

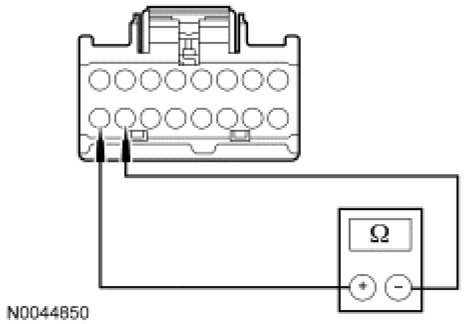


Fig. 291: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to DCSM C3036c-16, circuit CHS03 (GN/BN) and the negative lead to DCSM C3036c-15, circuit RHS03 (GY/OG) when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between DCSM C3036c-16, circuit CHS03 (GN/BN), harness side and DCSM C3036c-15, circuit RHS03 (GY/OG), harness side.
- **Is the resistance between 6,000 ohms and 9,000 ohms?**

  YES : Go to AN29.

  NO : Go to AN28.

AN28 CHECK THE BLOWER

- Disconnect: Backrest TED C3322

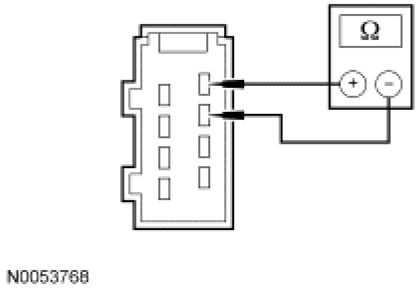


Fig. 292: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between backrest TED C3322 pin 2 and pin 4, component side.
- **Is the resistance between 6,000 ohms and 9,000 ohms?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN29 CHECK BLOWER SPEED CONTROL AND CIRCUIT

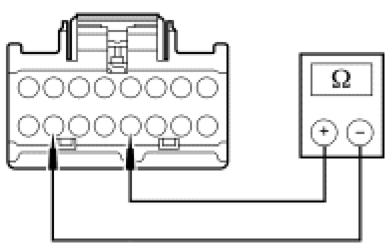


Fig. 293: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to C3036c-12, circuit VHS16 (BU/GN), harness side and the negative lead to C3036c-15, circuit RHS03 (GY/OG), harness side when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between DCSM C3036c-12, circuit VHS16 (BU/GN) harness side and DCSM C3036c-15, circuit RHS03 (GY/OG), harness side.

- **Is the resistance between 290K ohms and 420K ohms?**

  YES : Go to AN31.

  NO : Go to AN30.

AN30 CHECK THE BLOWER SPEED CONTROL

- Disconnect: Backrest TED C3322

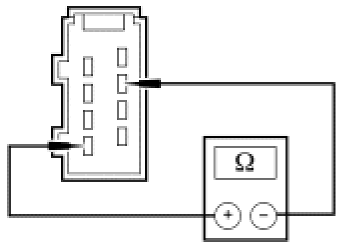


Fig. 294: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between backrest TED C3322 pin 7 and pin 4, component side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN31 CHECK THERMISTOR CIRCUIT FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036b

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.

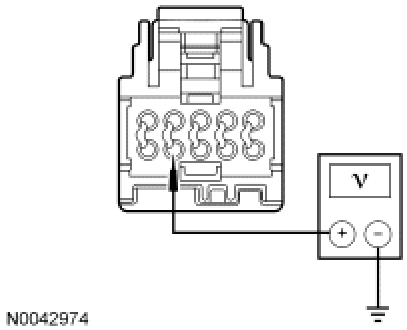


Fig. 295: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036b-9, circuit VHS35 (VT/OG), harness side and ground.
- **Is the voltage less than 0.5 volt?**

YES : Go to AN32.

NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN32 CHECK THERMISTOR CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.

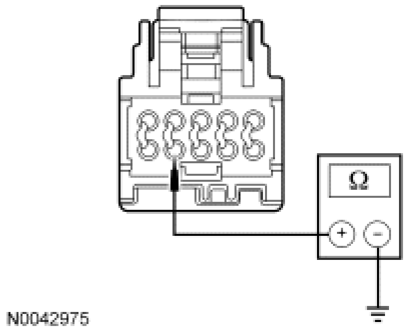


Fig. 296: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036b-9, circuit VHS35 (VT/OG), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AN33.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AN33 CHECK THE THERMISTOR AND WIRING

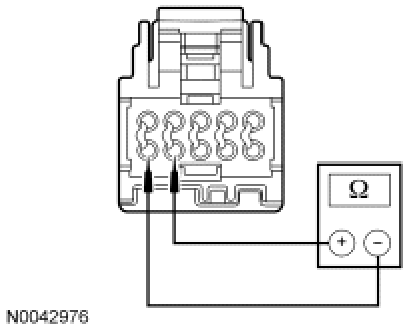


Fig. 297: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036b-9, circuit VHS35 (VT/OG), harness side and

DCSM C3036b-10, circuit RHS15 (GY/BN), harness side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to AN34.

AN34 CHECK THE THERMISTOR

- Disconnect: Backrest TED C3322

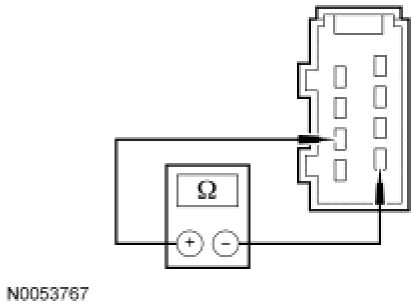


Fig. 298: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AO: DTC B272D - Passenger Differential Temperature Fault

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 16 (30A) supplying battery voltage on circuit SBB16 (VT/RD) into DCSM C3036a pins E and F. If voltage is disconnected from either pin E or F of DCSM C3036a with the connection remaining on the other circuit, both seats will remain operational because the circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the DCSM and the other will remain operational.

Each driver and front passenger seat cushion and backrest are equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

A differential fault occurs when the cushion and backrest TEDs on the seat are reporting temperatures to the DCSM with a difference between them of 60°C (108°F) or greater. This can result from an air flow restriction or a circuit fault of either TED. If a TED and manifold is clear of obstruction and is operational, the other TED and circuitry on the seat should be checked. It is important to note that a TED with a higher temperature may be operating correctly and not be the area of concern. The other TED may be indicating a much lower temperature, causing the DTC to set.

- DTC B272D Passenger Differential Temperature Fault - If there is a temperature differential between the passenger backrest and cushion TED of 60°C (108°F) or more for more than 4 seconds, the TED is disconnected or the duct is blocked, this DTC will set. When this happens the first time in a key cycle, the DCSM puts the passenger seat system into recovery mode (see principles of operation). If the system is able to recover, it will function normally. If the system is able to recover and it occurs a second time in the same key cycle, the DCSM will shut down the passenger seat system.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Restricted cushion or backrest TED filter
- Crushed or restricted cushion or backrest foam pad
- Crushed or restricted cushion or backrest climate controlled seat manifold
- Cushion or backrest TED assembly
- DCSM

PINPOINT TEST AO: DTC B272D - PASSENGER DIFFERENTIAL TEMPERATURE FAULT

NOTE:	**The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

AO1 CHECK THE DCSM FOR DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test/DCSM/Retrieve DTCs
- **Was DTC B272A or B272B retrieved in the self-test as an on-demand or a continuous DTC?**

  YES : For DTC B272A, go to **Pinpoint Test AL**. For DTC B272B, go to **Pinpoint Test AM**.

  NO : Go to AO2.

AO2 MONITOR THE DCSM TED TEMPERATURE PIDs

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DCSM PIDs
  - Passenger cushion thermal electric device (TED) temperature (PCSHTMP)
  - Passenger back TED temperature (PBKTMP)
  - Seat cushion thermal electric device temperature (CSHTEMP)
  - Seat back thermal electric device temperature (BK_TEMP)

NOTE: Make sure the temperature of the climate controlled seats has stabilized before monitoring the PIDs. Not allowing stabilization can cause incorrect readings and lead to incorrect identification of components that are not faulty.

- Monitor the TED temperature PIDs with the climate controlled seats off. Compare the PIDs of the front passenger seat to those of the driver seat, this can help identify if there is a concern with the front passenger seat cushion or backrest PID readings.
- **Are both front passenger seat TED temperature PIDs within 10°C (18°F) of the ambient temperature?**

  YES : Go to AO3.

  NO : If the front passenger seat cushion PID varies 10°C (18°F) or more from ambient temperature, go to AO16.

  If the front passenger seat backrest PID varies 10°C (18°F) or more from ambient temperature, go to AO31.

AO3 CONFIRM THE FAULT IS IN THE SEAT CUSHION OR THE BACKREST

- Key in OFF position.
- Key in ON position.

NOTE: A crushed seat cushion foam pad or a crushed climate controlled seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on the seat to recreate the fault.

NOTE: If the seat shuts down before a 15-minute heat cycle has timed-out,

carry out the DCSM self test and go to the Dual Climate Controlled Seat Module (DCSM) DTC Chart to continue diagnostics.

- After cycling the ignition switch and with the engine running, set the driver seat to high heat (3 LEDs illuminated on HVAC module). Allow the seat to heat for at least 15 minutes while monitoring the TED temperature PIDs of the driver seat. If necessary, when the seat times-out after 15 minutes, set the driver seat to high heat once again.
- **Do the driver seat cushion TED and backrest TED PIDs vary more than 60°C (108°F) from each other?**

  YES : If the front passenger seat cushion PID is 60°C (108°F) hotter than the backrest PID, go to AO5.

  If the front passenger seat backrest PID is 60°C (108°F) hotter than the cushion PID, go to AO20.

  NO : Go to AO4.

AO4 CHECK THE TED COOLING PERFORMANCE

- Check the TEDs cooling performance on the passenger seat. Refer to **Component Test** - Thermo-Electric Device (TED) Cooling Performance.
- **Did the TEDs pass the component test?**

  YES : The DTC may have been set by extreme cabin temperatures or excessive sun-load on the seat causing the system to enter recovery mode. Occupant size and weight characteristics can also be a factor. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. If a concern cannot be found or duplicated, RETURN the vehicle to the customer.

  NO : CHECK the affected seat cushion or backrest for correct installation of the climate controlled seat components (TED, manifold, air ducts and foam pad). CHECK for airflow restrictions (TED inlets and outlets, TED-to-manifold connections, filters and ducts) and REPAIR as needed. CHECK for an intermittent wiring fault. REPAIR as needed. REPEAT the self-test. CLEAR the DTCs.

AO5 CHECK THE TED INSTALLATION AND FOR A CRUSHED SEAT CUSHION

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Remove the seat. Refer to **Seat - Front**.
- Remove the seat cushion trim cover. Refer to **Seat Cushion Cover - Front**.
- Inspect the seat cushion for the following:
  - Is the cushion blower obstructed?
  - Is the blower filter restricted or plugged?
  - Is the TED correctly installed?
  - Is the seat cushion foam pad crushed or restricted?
  - Is the climate controlled seat manifold crushed or restricted?
- **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**

YES : Go to AO6.

NO : CORRECTLY install the cushion TED or INSTALL a new seat cushion foam pad and/or climate controlled seat manifold. REPEAT the self-test. CLEAR the DTCs.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO6 CHECK THE BACKREST TED CIRCUIT RHS06 (WH) FOR SHORT TO VOLTAGE

- Disconnect: DCSM C3036a

NOTE: Do not connect the seat side air bag electrical connector at this time.

- Position the front passenger seat in the vehicle and connect the seat-to-floor connectors.

WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.

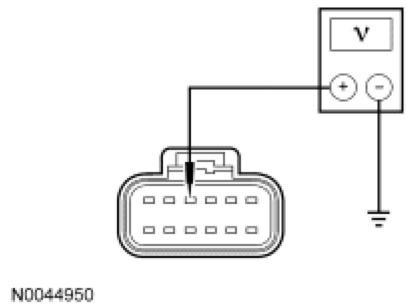


Fig. 299: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036a-D, circuit RHS06 (WH), harness side and ground.
- **Is the voltage less than 0.5 volt?**

YES : Go to AO7.

NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO7 CHECK THE BACKREST TED CIRCUIT CHS06 (BU/BN) FOR SHORT TO GROUND

- Key in OFF position.

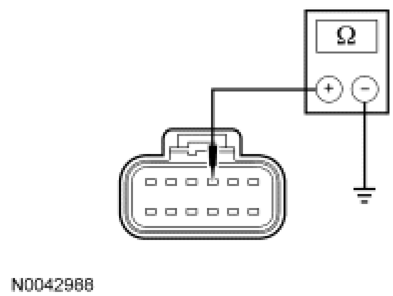


Fig. 300: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036a-C, circuit CHS06 (BU/BN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AO8.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO8 CHECK RESISTANCE OF THE BACKREST TED AND WIRING

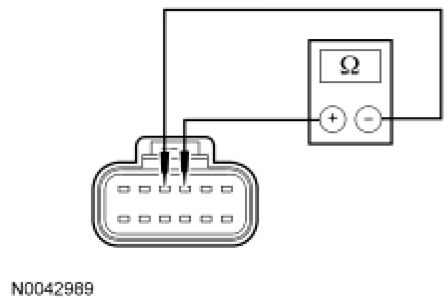


Fig. 301: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036a-C, circuit CHS06 (BU/BN), harness side and

DCSM C3036a-D, circuit RHS06 (WH), harness side.

- **Is the resistance between 0.9 and 10 ohms?**

  YES : Go to AO10.

  NO : Go to AO9.

AO9 CHECK RESISTANCE OF THE BACKREST TED

- Disconnect: Backrest TED C3326

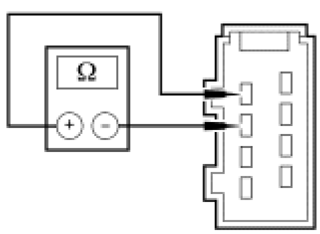


Fig. 302: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED C3326 pin 1 and pin 3, component side.
- **Is the resistance between 0.9 and 10 ohms?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO10 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect: DCSM C3036c
- Key in ON position.

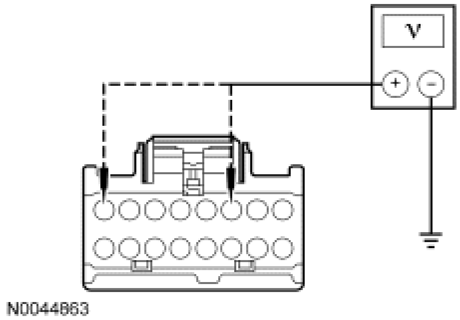


Fig. 303: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036c-8, circuit CHS08 (BN/YE), harness side and ground and between DCSM C3036c-3, circuit VHS23 (BN/BU), harness side and ground.
- **Are the voltages less than 1 volt?**

  YES : Go to AO11.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO11 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.

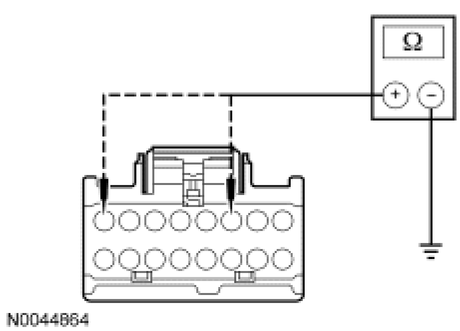


Fig. 304: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-8, circuit CHS08 (BN/YE), harness side and ground and between DCSM C3036c-3, circuit VHS23 (BN/BU), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to AO12.

NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO12 CHECK THE BLOWER AND WIRING

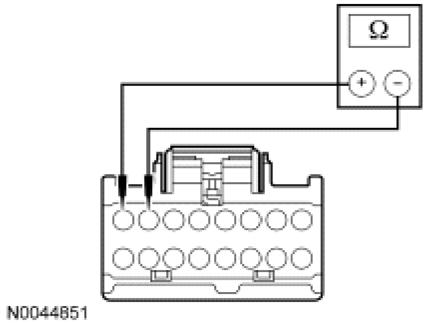


Fig. 305: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to dual climate controlled seat module (DCSM) C3036c-8, circuit CHS08 (BN/YE) and the negative lead to DCSM C3036c-7, circuit RHS08 (VT/WH) when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between DCSM C3036c-8, circuit CHS08 (BN/YE), harness side and DCSM C3036c-7, circuit RHS08 (VT/WH), harness side.
- **Is the resistance between 6,000 ohms and 9,000 ohms?**

  YES : Go to AO14.

  NO : Go to AO13.

AO13 CHECK THE BLOWER

- Disconnect: Cushion TED C3328

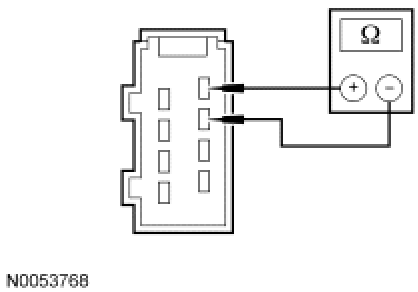


Fig. 306: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between cushion TED C3328 pin 2 and pin 4, component side.
- **Is the resistance between 6,000 ohms and 9,000 ohms?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO14 CHECK BLOWER SPEED CONTROL AND CIRCUIT

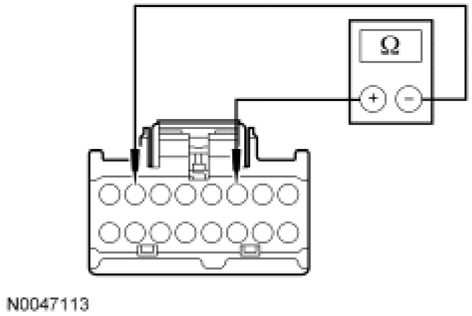


Fig. 307: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to C3036c-3, circuit VHS23 (BN/BU), harness side and the negative lead to C3036c-7, circuit RHS08 (VT/WH), harness side when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between DCSM C3036c-3, circuit VHS23 (BN/BU) harness side and DCSM C3036c-7, circuit RHS08 (VT/WH), harness side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : Go to AO16.

  NO : Go to AO15.

AO15 CHECK THE BLOWER SPEED CONTROL

- Disconnect: Cushion TED C3328

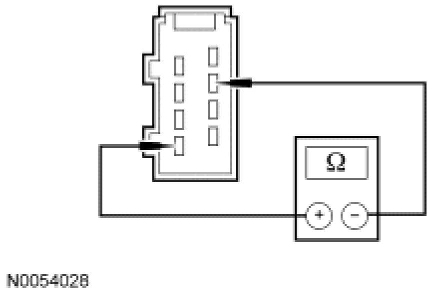


Fig. 308: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between cushion TED C3328 pin 7 and pin 4, component side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO16 CHECK THERMISTOR CIRCUIT FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036b

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.

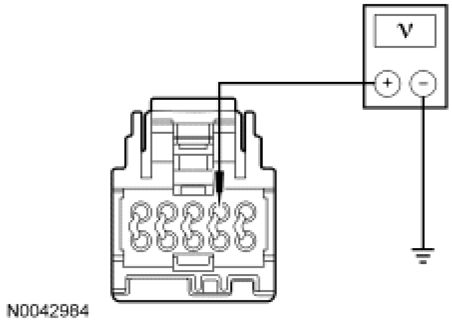


Fig. 309: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036b-2, circuit VHS27 (WH/OG), harness side and ground.
- **Is the voltage less than 0.5 volt?**

YES : Go to AO17.

NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO17 CHECK THERMISTOR CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.

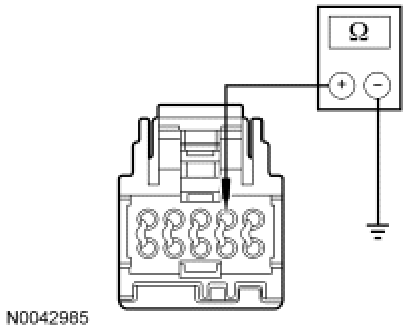


Fig. 310: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036b-2, circuit VHS27 (WH/OG), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

YES : Go to AO18.

NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO18 CHECK THE THERMISTOR AND WIRING

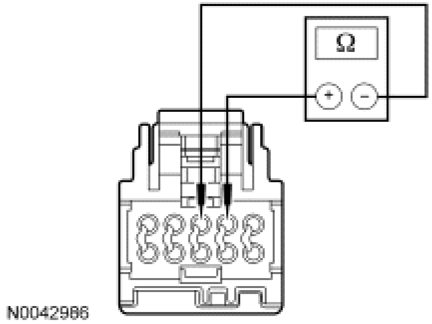


Fig. 311: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036b-2, circuit VHS27 (WH/OG), harness side and DCSM C3036b-3, circuit RHS10 (BU/OG), harness side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to AO19.

AO19 CHECK THE THERMISTOR

- Disconnect: Cushion TED C3328

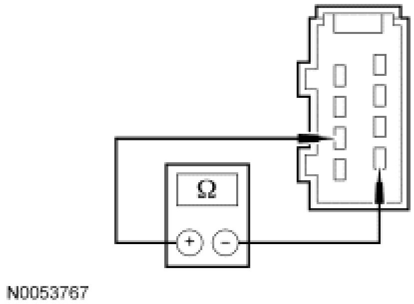


Fig. 312: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between cushion TED pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO20 CHECK THE TED INSTALLATION AND FOR A CRUSHED SEAT BACKREST

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Remove the seat. Refer to **Seat - Front**.
- Remove the seat backrest trim cover. Refer to **Seat Backrest Cover - Front, Without Fold Flat**.
- Inspect the seat backrest for the following:
  - Is the backrest blower obstructed?
  - Is the blower filter restricted or plugged?
  - Is the TED correctly installed?
  - Is the seat backrest foam pad crushed or restricted?
  - Is the climate controlled seat manifold crushed or restricted?
- **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**

  YES : Go to AO21.

  NO : CORRECTLY install the backrest TED or INSTALL a new seat backrest foam pad and/or climate controlled seat manifold. CONNECT the battery ground cable. REPEAT the self-test. CLEAR the DTCs.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO21 CHECK CUSHION TED CIRCUIT RHS07 (BU) FOR SHORT TO VOLTAGE

- Disconnect: DCSM C3036a

NOTE: **Do not connect the seat side air bag electrical connector at this time.**

- Position the front passenger seat in the vehicle and connect the seat-to-floor connectors.

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.

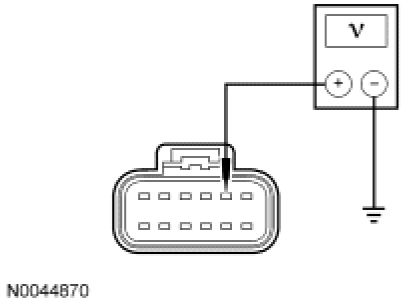


Fig. 313: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036a-B, circuit RHS07 (BU), harness side and ground.
- **Is the voltage less than 0.5 volt?**

  YES : Go to AO22.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO22 CHECK THE CUSHION TED CIRCUIT CHS07 (GY/BU) FOR SHORT TO GROUND

- Key in OFF position.

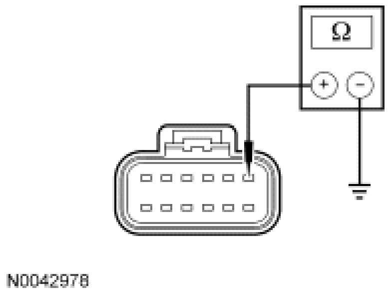


Fig. 314: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036a-A, circuit CHS07 (GY/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AO23.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO23 CHECK RESISTANCE OF THE CUSHION TED AND WIRING

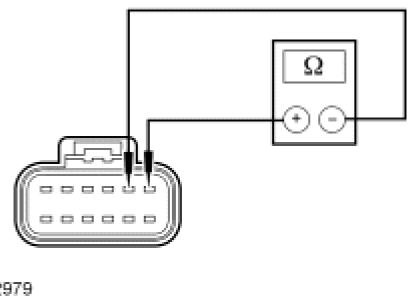


Fig. 315: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036a-A circuit CHS07 (GY/BU), harness side and DCSM C3036a-B, circuit RHS07 (BU), harness side.
- **Is the resistance between 0.9 and 10 ohms?**

  YES : Go to AO25.

  NO : Go to AO24.

AO24 CHECK RESISTANCE OF THE CUSHION TED

- Disconnect: Cushion TED C3328

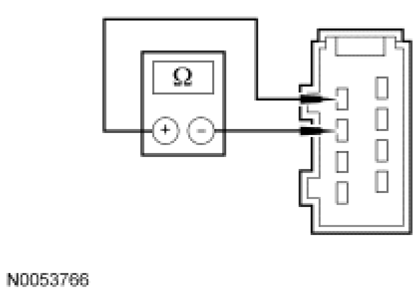


Fig. 316: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between cushion TED C3328 pin 1 and pin 3, component side.
- **Is the resistance between 0.9 and 10 ohms?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO25 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect: DCSM C3036c
- Key in ON position.

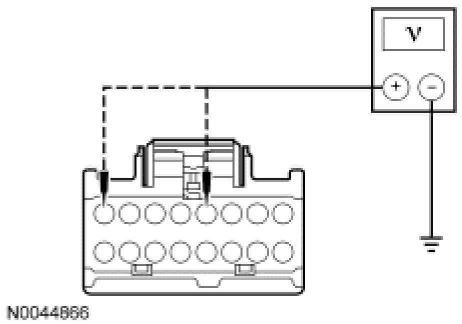


Fig. 317: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036c-8, circuit CHS08 (BN/YE), harness side and ground and between DCSM C3036c-4, circuit VHS21 (BU/WH), harness side and ground.
- **Are the voltages less than one volt?**

  YES : Go to AO26.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO26 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO

GROUND

- Key in OFF position.

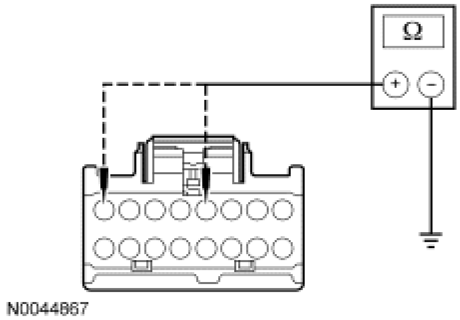


Fig. 318: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-8, circuit CHS08 (BN/YE), harness side and ground and between DCSM C3036c-4, circuit VHS21 (BU/WH), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to AO27.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO27 CHECK THE BLOWER AND WIRING

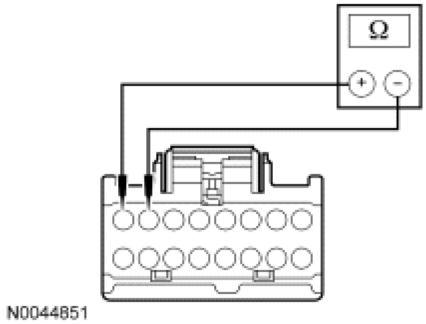


Fig. 319: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to dual climate controlled seat module (DCSM) C3036c-8, circuit CHS08 (BN/YE) and the negative lead to DCSM C3036c-7, circuit RHS08**

(VT/WH) when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.

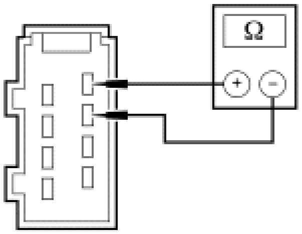
- Measure the resistance between DCSM C3036c-8, circuit CHS08 (BN/YE), harness side and DCSM C3036c-7, circuit RHS08 (VT/WH), harness side.
- **Is the resistance between 6,000 ohms and 9,000 ohms?**

  YES : Go to AO29.

  NO : Go to AO28.

AO28 CHECK THE BLOWER

- Disconnect: Backrest TED C3326



N0053768

Fig. 320: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between backrest TED C3326 pin 2 and pin 4, component side.
- **Is the resistance between 6,000 ohms and 9,000 ohms?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO29 CHECK BLOWER SPEED CONTROL AND CIRCUIT

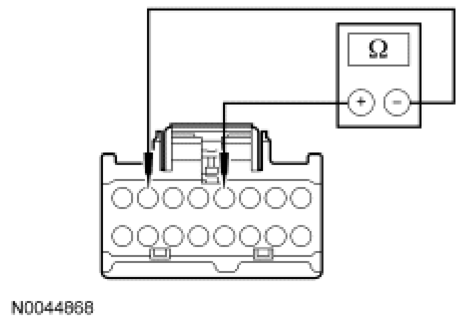


Fig. 321: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: The ohmmeter must be connected with the positive lead to C3036c-4, circuit VHS21 (BU/WH), harness side and the negative lead to C3036c-7, circuit RHS08 (VT/WH), harness side when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.

- Measure the resistance between DCSM C3036c-4, circuit VHS21 (BU/WH) harness side and DCSM C3036c-7, circuit RHS08 (VT/WH), harness side.
- **Is the resistance between 290K ohms and 420K ohms?**

YES : Go to AO31.

NO : Go to AO30.

AO30 CHECK THE BLOWER SPEED CONTROL

- Disconnect: Backrest TED C3326

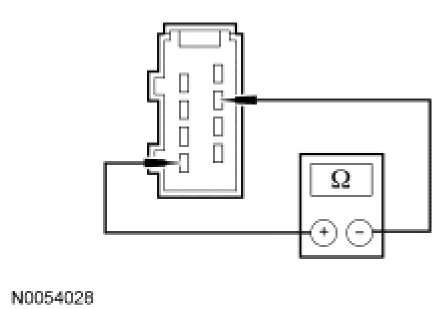


Fig. 322: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.

- Measure the resistance between backrest TED C3326 pin 7 and pin 4, component side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO31 CHECK THERMISTOR CIRCUIT FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036b

WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.

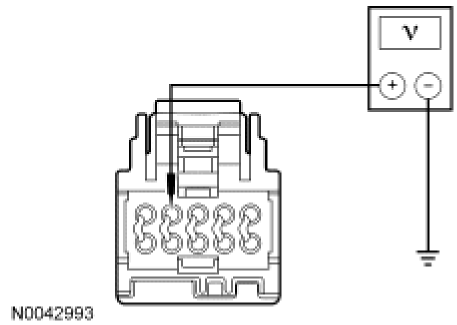


Fig. 323: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036b-4, circuit VHS36 (YE/BU), harness side and ground.
- **Is the voltage less than 0.5 volt?**

  YES : Go to AO32.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO32 CHECK THERMISTOR CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.

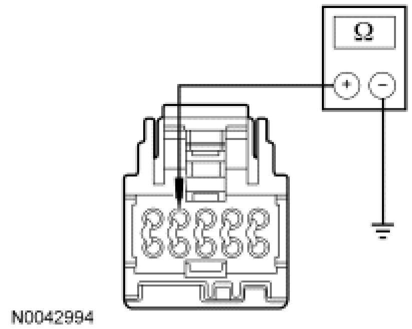


Fig. 324: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036b-4, circuit VHS36 (YE/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AO33.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AO33 CHECK THE THERMISTOR AND WIRING

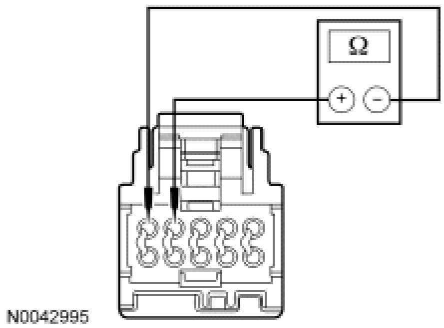


Fig. 325: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036b-4, circuit VHS36 (YE/BU), harness side and DCSM C3036b-5, circuit RHS20 (GN/BU), harness side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

YES : INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : Go to AO34.

AO34 CHECK THE THERMISTOR

- Disconnect: Backrest TED C3326

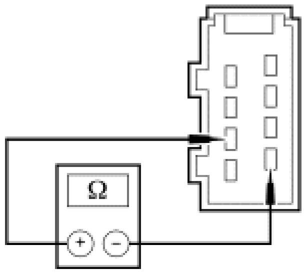


Fig. 326: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AP: DTC B272E - Driver Ignition Run/Blower Circuit Short to Ground

NOTE: This DTC sets for an open or short to voltage. See DTC setting description below.

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 16 (30A) supplying battery voltage on circuit SBB16 (VT/RD) into DCSM C3036a pins E and F. If voltage is disconnected from either pin E or F of DCSM C3036a with the connection remaining on the other circuit, both seats will remain operational because the circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the DCSM and the other will remain operational.

Each driver and front passenger seat cushion and backrest are equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B272E Driver Ignition Run/Blower Circuit Short to Ground - This DTC is set if the blower voltage or ground circuit opens to both backrest and cushion blowers or if both blower voltage circuits short to voltage. Only one blower voltage circuit needs to be open for the DTC to be set if battery voltage is less than 12 volts.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- HVAC module

- Backrest or cushion TED
- DCSM

PINPOINT TEST AP: DTC B272E - DRIVER IGNITION RUN/BLOWER CIRCUIT SHORT TO GROUND

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

AP1 CHECK DCSM CLIMATE-CONTROLLED SEAT HEAT COMMAND (TED_HEAT_D) PID

- Access the cushion and backrest TEDs and remove the filters to watch the TED fans.
- Connect the diagnostic tool.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DCSM PID TED_HEAT_D

NOTE: The DCSM active command TED_HEAT_D is limited to 15 seconds in the ON state.

- Operate the climate controlled seat using the active command while monitoring the cushion and backrest TEDs for fan movement.
- **Did both fans turn on?**

YES : CARRY OUT the network test. If DTCs are retrieved from the HVAC module, REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. If no DTCs are retrieved, CARRY OUT the HVAC Module Cold Boot Process in the Diagnosis and Testing portion of **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION & DIAGNOSTICS** article.

NO : Go to AP2.

AP2 CHECK FOR AN INTERMITTENT CONNECTION AT THE DCSM

- Key in OFF position.
- Disconnect: DCSM C3036c
- Connect: DCSM C3036c
- With the engine running and using the switches on the HVAC module, turn the driver climate controlled seat system on while monitoring the cushion and backrest fans for movement.
  - If there is fan movement, run the driver climate controlled seat system for a complete cycle in heat (15 minutes) and cool (30 minutes) until the system times out.
- **Did the climate controlled seat operate correctly?**

YES : The fault is intermittent. CHECK for causes of the intermittent fault at C3036c and REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

NO : Go to AP3.

AP3 CHECK FOR AN INTERMITTENT CONNECTION AT THE CUSHION TED

- Key in OFF position.
- Disconnect: Cushion TED C3327
- Connect: Cushion TED C3327
- With the engine running and using the switches on the HVAC module, turn the driver climate controlled seat system on while monitoring the cushion and backrest fans for movement.
  - If there is fan movement, run the driver climate controlled seat system for a complete cycle in heat (15 minutes) and cool (30 minutes) until the system times out.
- **Did the climate controlled seat operate correctly?**

  YES : The fault is intermittent. CHECK for causes of the intermittent fault at C3327 and REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to AP4.

AP4 CHECK FOR AN INTERMITTENT CONNECTION AT THE BACKREST TED

- Key in OFF position.
- Disconnect: Backrest TED C3322
- Connect: Backrest TED C3322
- With the engine running and using the switches on the HVAC module, turn the driver climate controlled seat system on while monitoring the cushion and backrest fans for movement.
  - If there is fan movement, run the driver climate controlled seat system for a complete cycle in heat (15 minutes) and cool (30 minutes) until the system times out.
- **Did the climate controlled seat operate correctly?**

  YES : The fault is intermittent. CHECK for causes of the intermittent fault at C3322 and REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to AP5.

AP5 CHECK BLOWER CIRCUIT CHS03 (GN/BN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036c
- Disconnect: Cushion TED C3327
- Disconnect: Backrest TED C3322

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.

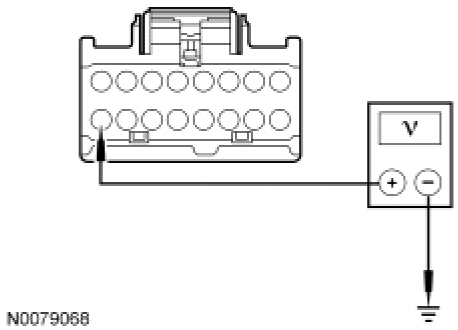


Fig. 327: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036c-16, circuit CHS03 (GN/BN), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to AP6.

AP6 CHECK CUSHION TED BLOWER CIRCUITS CHS03 (GN/BN) AND RHS03 (GY/OG) FOR AN OPEN

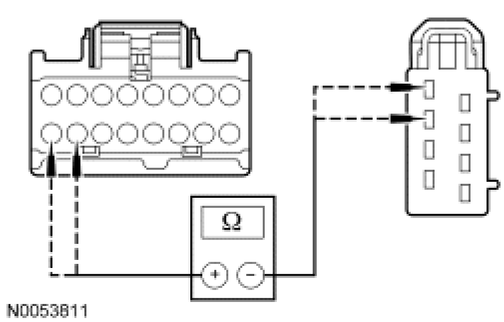


Fig. 328: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-16, circuit CHS03 (GN/BN), harness side and cushion TED C3327-2, circuit CHS03 (GN/BN), harness side; and between DCSM C3036c-15, circuit RHS03 (GY/OG), harness side and cushion TED C3327-4, circuit RHS03 (GY/OG), harness side.

- **Are the resistances less than 5 ohms?**

  YES : Go to AP7.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AP7 CHECK BACKREST TED BLOWER CIRCUITS CHS03 (GN/BN) AND RHS03 (GY/OG) FOR AN OPEN

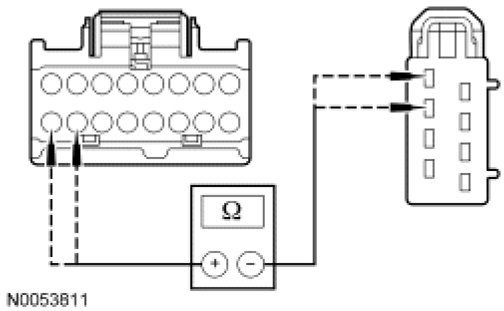


Fig. 329: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-16, circuit CHS03 (GN/BN), harness side and cushion TED C3322-2, circuit CHS03 (GN/BN), harness side; and between DCSM C3036c-15, circuit RHS03 (GY/OG), harness side and cushion TED C3322-4, circuit RHS03 (GY/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to AP8.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AP8 CHECK BLOWER RESISTANCE

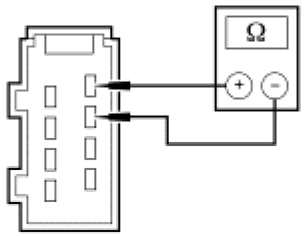


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Fig. 330: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.

- Measure the resistance between cushion TED C3327 pin 2 and pin 4, component side and between backrest TED C3322 pin 2 and pin 4, component side.
- **Are the resistances between 6,000 ohms and 9,000 ohms?**

YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328. CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : If the resistance of the cushion TED was **not** between 6,000 and 9,000 ohms, INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

If the resistance of the backrest TED was **not** between 6,000 and 9,000 ohms, INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C328. CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AQ: DTC B272F - Passenger Ignition Run/Blower Circuit Short to Ground

NOTE: This DTC sets for an open or short to voltage. See DTC setting description

below.

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 16 (30A) supplying battery voltage on circuit SBB16 (VT/RD) into DCSM C3036a pins E and F. If voltage is disconnected from either pin E or F of DCSM C3036a with the connection remaining on the other circuit, both seats will remain operational because the circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the DCSM and the other will remain operational.

Each driver and front passenger seat cushion and backrest are equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B272F Passenger Ignition Run/Blower Circuit Short to Ground - This DTC is set if the blower voltage or ground circuit opens to both backrest and cushion blowers or if both blower voltage circuits short to voltage. Only one blower voltage circuit needs to be open for the DTC to be set if battery voltage is less than 12 volts.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- HVAC module
- Backrest or cushion TED
- DCSM

PINPOINT TEST AQ: DTC B272F - PASSENGER IGNITION RUN/BLOWER CIRCUIT SHORT TO GROUND

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

AQ1 CHECK DCSM PASSENGER TED HEAT MODE (TED_HEAT_P) PID

- Access the cushion and backrest TEDs and remove the filters to watch the TED fans.
- Connect the diagnostic tool.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DCSM PID TED_HEAT_P

NOTE: The DCSM active command TED_HEAT_P is limited to 15 seconds in the ON state.

- Operate the climate controlled seat using the active command while monitoring the cushion and backrest TEDs for fan movement.
- **Did both fans turn on?**

  YES : CARRY OUT the network test. If DTCs are retrieved from the HVAC module, REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. If no DTCs are retrieved, CARRY OUT the HVAC Module Cold Boot Process in the Diagnosis and Testing portion of **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION & DIAGNOSTICS** article.

  NO : Go to AQ2.

AQ2 CHECK FOR AN INTERMITTENT CONNECTION AT THE DCSM

- Key in OFF position.
- Disconnect: DCSM C3036c
- Connect: DCSM C3036c
- With the engine running and using the switches on the HVAC module, turn the passenger climate controlled seat system on while monitoring the cushion and backrest fans for movement.
  - If there is fan movement, run the passenger climate controlled seat system for a complete cycle in heat (15 minutes) and cool (30 minutes) until the system times out.
- **Did the climate controlled seat operate correctly?**

  YES : The fault is intermittent. CHECK for causes of the intermittent fault at C3036c and REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to AQ3.

AQ3 CHECK FOR AN INTERMITTENT CONNECTION AT THE CUSHION TED

- Key in OFF position.
- Disconnect: Cushion TED C3328
- Connect: Cushion TED C3328
- With the engine running and using the switches on the HVAC module, turn the passenger climate controlled seat system on while monitoring the cushion and backrest fans for movement.
  - If there is fan movement, run the passenger climate controlled seat system for a complete cycle in heat (15 minutes) and cool (30 minutes) until the system times out.
- **Did the climate controlled seat operate correctly?**

  YES : The fault is intermittent. CHECK for causes of the intermittent fault at C3328 and REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to AQ4.

AQ4 CHECK FOR AN INTERMITTENT CONNECTION AT THE BACKREST TED

- Key in OFF position.
- Disconnect: Backrest TED C3326
- Connect: Backrest TED C3326
- With the engine running and using the switches on the HVAC module, turn the passenger climate controlled seat system on while monitoring the cushion and backrest fans for movement.
  - If there is fan movement, run the passenger climate controlled seat system for a complete cycle in heat (15 minutes) and cool (30 minutes) until the system times out.
- **Did the climate controlled seat operate correctly?**

  YES : The fault is intermittent. CHECK for causes of the intermittent fault at C3326 and REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to AQ5.

AQ5 CHECK BLOWER CIRCUIT CHS08 (BN/YE) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036c
- Disconnect: Cushion TED C3328
- Disconnect: Backrest TED C3326

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.
- Key in ON position.

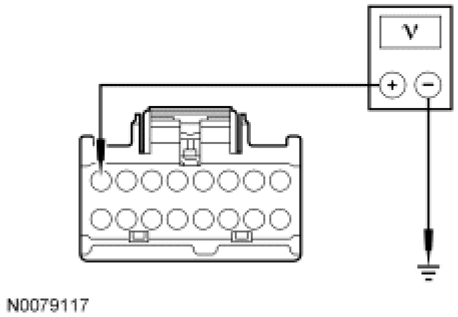

Fig. 331: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036c-8, circuit CHS08 (BN/YE), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to AQ6.

AQ6 CHECK CUSHION TED BLOWER CIRCUITS CHS08 (BN/YE) AND RHS08 (VT/WH) FOR AN OPEN

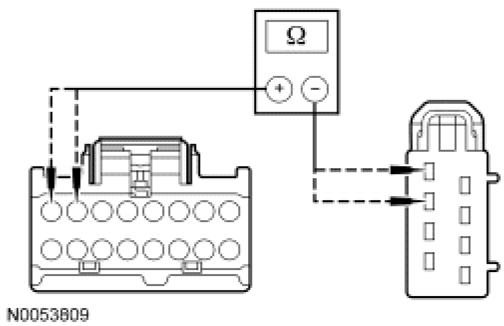

Fig. 332: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-8, circuit CHS08 (BN/YE), harness side and cushion TED C3328-2, circuit CHS08 (BN/YE), harness side; and between DCSM C3036c-7, circuit RHS08 (VT/WH), harness side and cushion TED C3328-4, circuit RHS08 (VT/WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to AQ7.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AQ7 CHECK BACKREST TED BLOWER CIRCUITS CHS08 (BN/YE) AND RHS08 (VT/WH) FOR AN OPEN

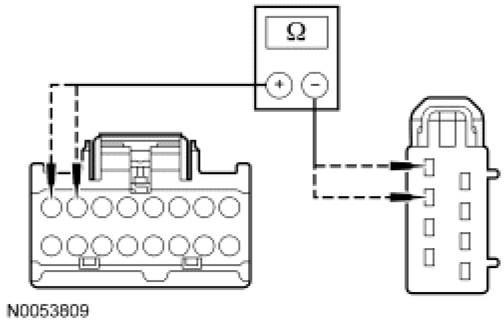

Fig. 333: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-8, circuit CHS08 (BN/YE), harness side and backrest TED C3326-2, circuit CHS08 (BN/YE), harness side; and between DCSM C3036c-7, circuit RHS08 (VT/WH), harness side and backrest TED C3326-4, circuit RHS08 (VT/WH), harness side.
- **Are the resistances less than 5 ohms?**

YES : Go to AQ8.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AQ8 CHECK BLOWER RESISTANCE

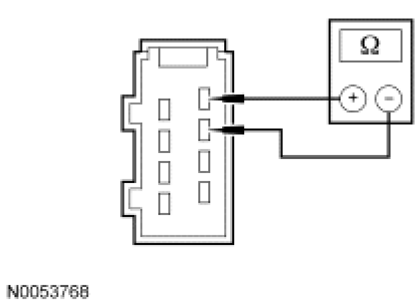

Fig. 334: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between cushion TED C3328 pin 2 and pin 4, component side and between backrest TED C3326 pin 2 and pin 4, component side.

- **Are the resistances between 6,000 ohms and 9,000 ohms?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If the resistance of the cushion TED was **not** between 6,000 and 9,000 ohms, INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  If the resistance of the backrest TED was **not** between 6,000 and 9,000 ohms, INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C327.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AR: DTC B2730 - Back Over-Temp Detected (Driver)

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 16 (30A) supplying battery voltage on circuit SBB16 (VT/RD) into DCSM C3036a pins E and F. If voltage is disconnected from either pin E or F of DCSM C3036a with the connection remaining on the other circuit, both seats will remain operational because the circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the DCSM and the other will remain operational.

Each driver and front passenger seat cushion and backrest are equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B2730 Back Over-Temp Detected (Driver) - In the cooling mode, if the driver seat backrest TED temperature exceeds 70°C (158°F) for more than 4 seconds, the TED is disconnected or the duct is blocked, the DCSM will shut down the driver seat system and set this DTC.
- DTC B2730 Back Over-Temp Detected (Driver) - In the heating mode, if the driver seat backrest TED temperature exceeds 85°C (185°F) for more than 4 seconds, the TED is disconnected or the duct is blocked, the DCSM will shut down the driver seat system and set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Restricted backrest TED filter
- Crushed or restricted backrest foam pad
- Crushed or restricted climate controlled seat manifold
- Backrest TED assembly
- DCSM

PINPOINT TEST AR: DTC B2730 - BACK OVER-TEMP DETECTED (DRIVER)

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

AR1 CHECK THE DCSM FOR DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test/DCSM/Retrieve DTCs
- **Was DTC B2730 retrieved during the self-test?**

  YES : Go to AR2.

  NO : Go to AR4.

AR2 CHECK THE TED THERMISTOR CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Passenger Seat Side Air Bag C327
- Disconnect: DCSM C3036b
- Disconnect: Backrest TED C3322

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may**

result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

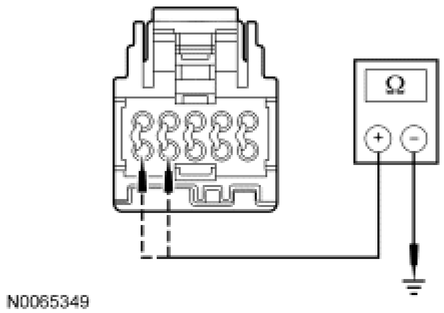

Fig. 335: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036b-9, circuit VHS35 (VT/OG), harness side and ground and between DCSM C3036b-10, circuit RHS15 (GY/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to AR3.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AR3 CHECK THE TED THERMISTOR

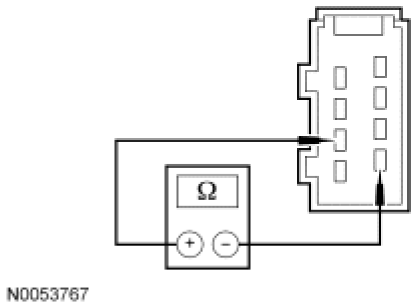

Fig. 336: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED C3322 pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : REPAIR the affected open circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AR4 CONFIRM THE FAULT

- Verify with the customer that the concern is the seat shuts OFF in heat mode.

NOTE: **A crushed seat backrest foam pad or a crushed climate controlled seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on**

the seat to recreate the fault.

- Attempt to recreate the fault. Start the vehicle and set the driver seat to HIGH heat for at least 15 minutes.
- **Is the customer concern with the seat shutting OFF in heat mode or was the fault recreated?**

  YES : Go to AR5.

  NO : Fault not present. Fault may have been set due to a past failure or incorrect use of the climate controlled seat system by repeated switching between heat and cool modes. REPEAT the self-test. CLEAR the DTCs.

AR5 CHECK OPERATION OF THE SEAT

- Key in ON position.
- With the engine running, set both front seats to HIGH cool.
- Compare the airflow from the driver seat backrest and compare it to the airflow from the passenger seat backrest.
- **Is the airflow exhausting from the driver seat backrest comparable to the airflow exhausting from the passenger seat backrest?**

  YES : Go to AR14.

  NO : Go to AR6.

AR6 CHECK THE BACKREST BLOWER FOR AN OBSTRUCTION OR RESTRICTED FILTER

- Key in OFF position.
- Inspect the blower of the backrest TED assembly for an obstruction or for a restricted filter.
- **Is the blower obstructed or the filter restricted?**

  YES : REMOVE the obstruction or INSTALL a new filter. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to AR7.

AR7 CHECK THE BACKREST FAN OPERATION

- Key in ON position.
- With the engine running, set both front seats to HIGH cool.
- Inspect the backrest blower for operation.
- **Does the backrest blower operate?**

  YES : Go to AR14.

  NO : Go to AR8.

AR8 CHECK THE BLOWER SPEED CONTROL CIRCUIT FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Driver Seat Side Air Bag C328
- Disconnect: Passenger Seat Side Air Bag C327

- Disconnect: DCSM C3036c
- Disconnect: Backrest TED C3322

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING & CABLES** article.

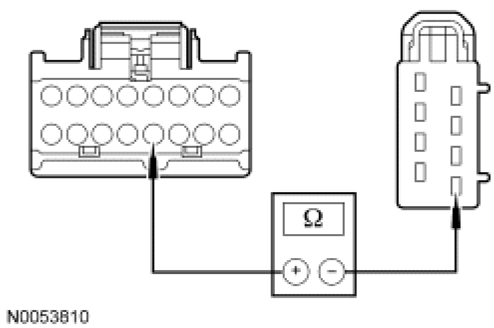

Fig. 337: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-12, circuit VHS16 (BU/GN), harness side and backrest TED C3322-7, circuit VHS16 (BU/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to AR9.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AR9 CHECK BLOWER CIRCUIT RHS03 (GY/OG) FOR A SHORT TO VOLTAGE

- Key in ON position.

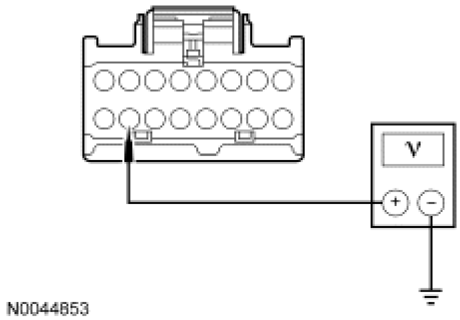

Fig. 338: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3036c-15, circuit RHS03 (GY/OG), harness side and ground.
- **Is voltage greater than one volt?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to AR10.

AR10 CHECK BLOWER CIRCUIT CHS03 (GN/BN) FOR A SHORT TO GROUND

- Key in OFF position.

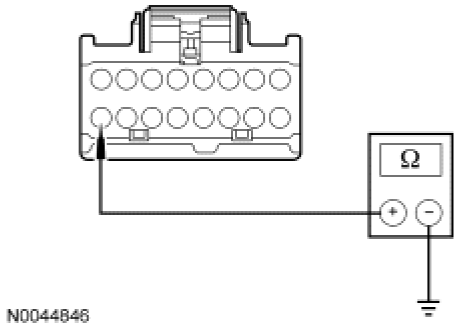

Fig. 339: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-16, circuit CHS03 (GN/BN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

YES : Go to AR11.

NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AR11 CHECK BLOWER CIRCUITS RHS03 (GY/OG) AND CHS03 (GN/BN) FOR AN OPEN

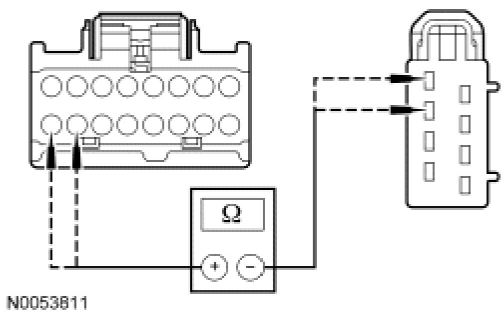

Fig. 340: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3036c-16, circuit CHS03 (GN/BN), harness side and backrest TED C3322-2, circuit CHS03 (GN/BN), harness side; and between DCSM C3036c-15, circuit RHS03 (GY/OG), harness side and backrest TED C3322-4, circuit RHS03 (GY/OG), harness side.
- **Are the resistances less than 5 ohms?**

YES : Go to AR12.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AR12 CHECK THE BLOWER RESISTANCE

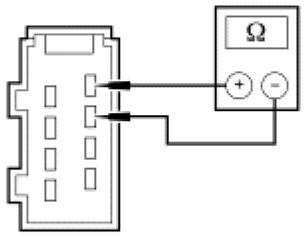

Fig. 341: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between backrest TED C3322 pin 2 and pin 4, component side.
- **Is the resistance between 6,000 ohms and 9,000 ohms?**

YES : Go to AR13.

NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AR13 CHECK THE BLOWER SPEED CONTROL RESISTANCE

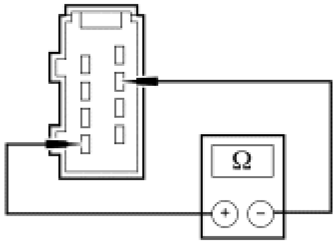

Fig. 342: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.

- Measure the resistance between backrest TED C3322 pin 7 and pin 4, component side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : Go to AR14.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable.

  CONNECT passenger seat side air bag module C327.

  CONNECT driver seat side air bag module C328.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AR14 CHECK THE TED INSTALLATION AND FOR CRUSHED SEAT BACKREST

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Remove the seat. Refer to **Seat - Front**.
- Remove the seat backrest trim cover. Refer to **Seat Backrest Cover - Front, Without Fold Flat**.
- Inspect the seat backrest for the following:
  - Is the TED correctly installed?
  - Is the seat backrest foam pad crushed or restricted?
  - Is the climate controlled seat manifold crushed or restricted?
- **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**

  YES : CONNECT the battery ground cable.

  INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : CORRECTLY install the backrest TED or INSTALL a new seat backrest foam pad and/or climate controlled seat manifold. CONNECT the battery ground cable. REPEAT the self-test. CLEAR the DTCs.

  CONNECT passenger seat side air bag module C327.

CONNECT driver seat side air bag module C328.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AS: The Power Seat is Inoperative/Does Not Operate Correctly - Both Rear, Power Fold

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Seats for schematic and connector information.

Refer to appropriate COMPONENT TESTING article.

Normal Operation

The rear seat power-fold relay is provided voltage on the coil side from the smart junction box (SJB), on pin 2, circuit CPS 48 (BU), for 30 minutes after turning the vehicle off, when the transmission selector is in PARK and the liftgate is open. Ground for the coil side of the relay is on pin 1, circuit GD120 (BK/GN). The rear seat power-fold relay switched side is supplied voltage from battery junction box (BJB) fuse 27 (10A) on relay pin 3, and is hot at all times. Pushing the double-throw switch to the appropriate rear seat release actuator, left or right, will provide voltage from relay pin 5 and allow folding of that seat. If the relay is disabled after 30 minutes, it can be enabled as long as the transmission is in PARK by opening any door, pressing the unlock key on the key fob, pressing any keyless keypad button or turning the ignition key.

- DTC B2794 Third Row Power Fold Circuit Failure - If SJB output to the left or right third row folding seat relay is open or shorted to voltage, the SJB sets this code.
- DTC B2A2D Third Row Power Fold Circuit Short To Ground - If SJB output to the left or right third row folding seat relay is shorted to ground, the SJB sets this DTC.

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- SJB
- Power-fold relay
- Rear seat control switch

PINPOINT TEST AS: THE POWER SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - BOTH REAR, POWER FOLD

NOTE: The SJB may also be identified as the generic electronic module (GEM).

AS1 CHECK FOR DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test/Generic Electronic Module (GEM/SJB)/Retrieve DTCs
- **Are any DTCs present?**

  YES : If DTC B2794 is present, go to AS2.

If DTC B2A2D is present, go to AS5.

For all other DTCs, go to **Driver Seat Module (DSM) DTC Chart**, **Dual Climate Controlled Seat Module (DCSM) DTC Chart**, **Smart Junction Box (SJB) DTC Chart** and/or refer to **MULTIFUNCTION ELECTRONIC MODULES** article.

NO : Go to AS2.

AS2 CHECK THE OPERATION OF THE POWER-FOLD REAR SEAT

NOTE: Shifting the transmission out of PARK will disable the voltage supply from the SJB to the BJB relay.

- Operate both power-fold rear seats.
- **Do both power-fold rear seats operate at all times?**

  YES : If DTC B2794 is present and the power-fold rear seats operate at all times, go to AS4.

  If both power-fold rear seats operate at all times, and no DTCs were present, go to AS3.

  NO : If DTC B2794 is present and neither power-fold rear seat operates, go to AS6.

  If no DTCs were present and neither power-fold rear seat operates, go to AS3.

AS3 CHECK TRANSMISSION GEAR SELECTOR TRANSMISSION RANGE (TR) PID STATES

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/Transmission Control Module (TCM) PID: TR
- Operate the transmission gear selector in all positions while monitoring the following TCM PID TR states:
  - Park
  - Reverse
  - Neutral
  - OverDrive
  - Low
- **Do the PID states agree with the selected positions?**

  YES : If no DTCs were present and neither power-fold rear seat works, go to AS9.

  If no DTCs were present and both power-fold rear seat work all the time, go to AS14.

  NO : To diagnose a transmission gear selector (PRNDL) status concern, REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F50** article.

AS4 CHECK CIRCUIT CPS48 (BU) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: BJB Power-Fold Relay 25

- Disconnect: SJB C2280c
- Key in ON position.

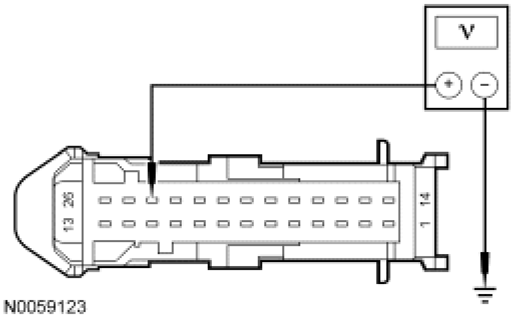

Fig. 343: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280c-24, circuit CPS48 (BU), harness side and ground.
- **Is the voltage less than 0.2 volt?**

  YES : INSTALL a new SJB. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. TEST the system for normal operation.

AS5 CHECK CIRCUIT CPS48 (BU) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280c
- Disconnect: BJB Power-Fold Relay 25

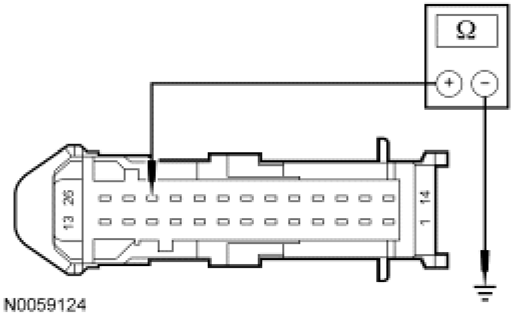

Fig. 344: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between SJB C2280c-24, circuit CPS48 (BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new SJB. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. TEST the system for normal operation.

AS6 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN

- Key in OFF position.
- Disconnect: BJB Power-Fold Relay 25

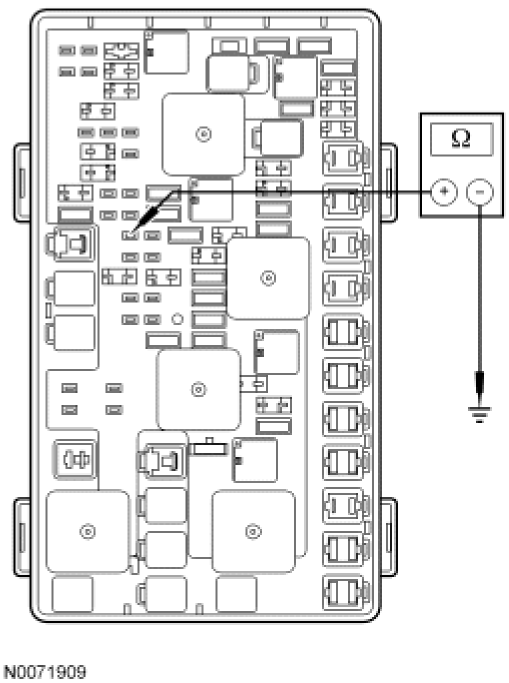

Fig. 345: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between power-fold relay cavity 1 BJB side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to AS7.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. TEST the system for normal operation.

AS7 CHECK CIRCUIT CPS48 (BU) FOR AN OPEN

- Disconnect: SJB C2280c
- Connect a jumper wire between power-fold relay 25, cavity 1 BJB side and cavity 2 BJB side.

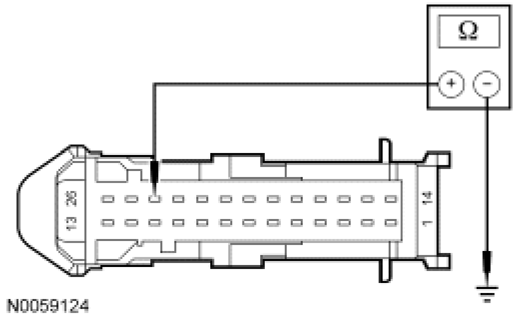

Fig. 346: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between SJB C2280c-24, circuit CPS48 (BU), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to AS8.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. TEST the system for normal operation.

AS8 CHECK THE ULTRA MICRO ISO RELAY

- Carry out the component test for ultra micro ISO relay. Refer to appropriate COMPONENT TESTING article.
- **Is the ultra micro ISO relay OK?**

  YES : INSTALL a new SJB. REPEAT the self-test. TEST the system for normal operation.

  NO : INSTALL a new ultra micro ISO relay. REPEAT the self-test. CLEAR the DTCs. TEST the system for normal operation.

AS9 CHECK CIRCUIT CPS48 (BU) FOR VOLTAGE

- Make sure the transmission is in PARK.
- Activate the power-fold rear seats by carrying out one of the following within 30 minutes of checking circuit CPS48 (BU) for voltage.
  - Open 1 of the 4 doors, rear hatch or rear hatch glass
  - Turn the ignition switch to accessory or run
  - Press a keyless entry key pad button
  - Press a remote keyless entry (RKE) button
- Disconnect: BJB Power-Fold Relay 25

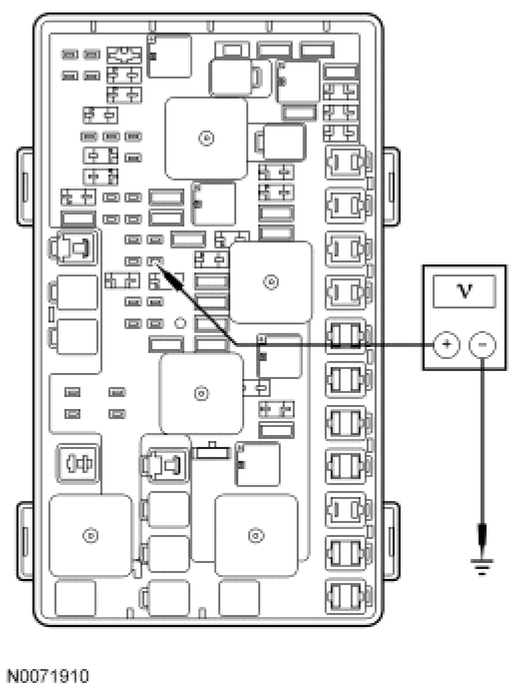

Fig. 347: Measuring Voltage
Courtesy of FORD MOTOR CO.

- With the SJB power-fold rear seat relay circuit CPS48 (BU) activated, measure the voltage at BJB power-fold relay 25 cavity 2 BJB side and ground.
- **Is the voltage greater than 10 volt?**

  YES : Go to AS10.

  NO : INSTALL a new SJB. REPEAT the self-test. TEST the system for normal operation.

AS10 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN

- Key in OFF position.

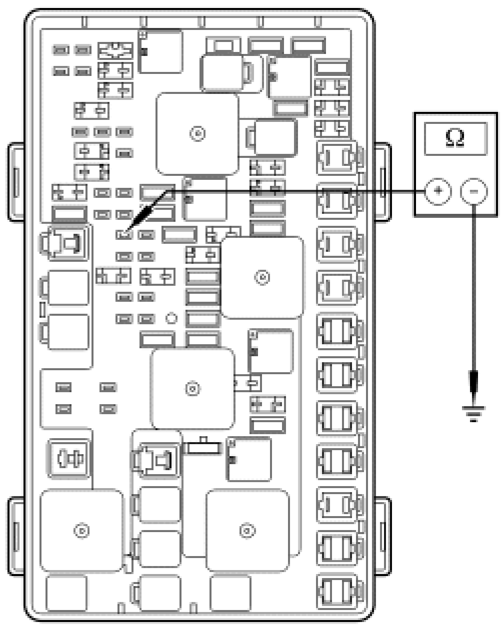

Fig. 348: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between power-fold relay cavity 1 BJB side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to AS11.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. TEST the system for normal operation.

AS11 CHECK THE ULTRA MICRO ISO RELAY

- Carry out the component test for ultra micro ISO relay. Refer to appropriate COMPONENT TESTING article.
- **Is the ultra micro ISO relay OK?**

  YES : Go to AS12.

  NO : INSTALL a new ultra micro ISO relay. REPEAT the self-test. CLEAR the DTCs. TEST the system for normal operation.

AS12 CHECK BJB FOR VOLTAGE

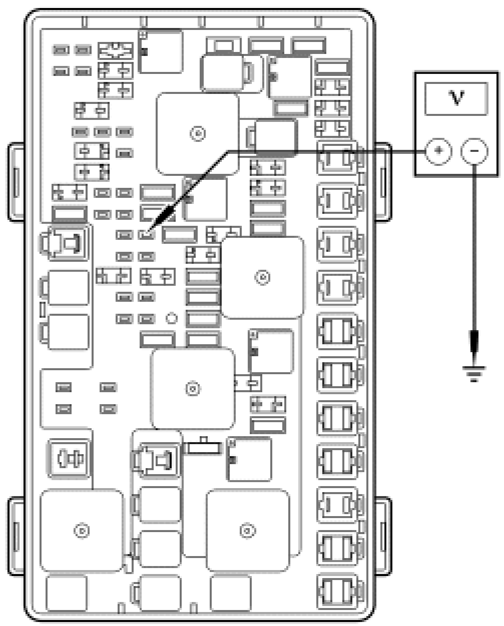

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Fig. 349: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage at power-fold relay cavity 3 BJB side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to AS13.

  NO : VERIFY BJB fuse 27 (10A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

AS13 CHECK CIRCUIT CPS58 (WH/BN) FOR AN OPEN

- Connect: BJB Power-Fold Relay 25
- Open the liftgate.

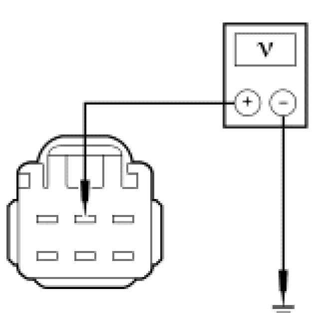

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Fig. 350: Measuring Voltage
Courtesy of FORD MOTOR CO.

NOTE: If the relay is disabled after 30 minutes, it can be enabled by opening any door, pressing the unlock key on the key fob, pressing any keyless keypad button or turning the ignition key.

- Measure the voltage between rear seat control switch C4351-2, circuit CPS58 (WH/BN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new rear seat control switch. REFER to **Seat Control Switch - Rear Seat**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

AS14 CHECK CIRCUIT CPS58 (WH/BN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: BJB Power-Fold Relay 25
- Key in ON position.
- Using the rear seat control switch, attempt to fold the rear left and right seats down.
- **Did the rear left and right seats fold down?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to AS15.

AS15 CHECK THE ULTRA MICRO ISO RELAY

- Carry out the component test for ultra micro ISO relay. Refer to appropriate COMPONENT TESTING article.
- **Is the ultra micro ISO relay OK?**

  YES : INSTALL a new SJB. TEST the system for normal operation.

  NO : INSTALL a new ultra micro ISO relay. REPEAT the self-test. CLEAR the DTCs. TEST the system for normal operation.

Pinpoint Test AT: The Power Seat is Inoperative/Does Not Operate Correctly - Left Rear, Power Fold

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Seats for schematic and connector information.

Normal Operation

The rear seat power-fold relay is provided voltage on the coil side from the smart junction box (SJB), on pin 2, circuit CPS 48 (BU), for 30 minutes after turning the vehicle off, when the transmission selector is in PARK and the liftgate is open. Ground for the coil side of the relay is on pin 1, circuit GD120 (BK/GN). The rear seat power-fold relay switched side is supplied voltage from battery junction box (BJB) fuse 27 (10A) on relay pin 3, and is hot at all times. Pushing the double-throw switch to the appropriate rear seat release actuator, left or right, will provide voltage from relay pin 5 and allow folding of that seat. If the relay is disabled after 30 minutes, it can be enabled as long as the transmission is in PARK by opening any door, pressing the unlock key on the key fob, pressing any keyless keypad button or turning the ignition key.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Rear seat control switch
- Left power-fold seat actuator
- Power-fold relay

PINPOINT TEST AT: THE POWER SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - LEFT REAR, POWER FOLD

AT1 CHECK LH SEAT OPERATION

- Key in ON position.
- Select NEUTRAL.
- Press the rear seat control switch to release the left side backrest.
- **Does the LH seat operate all the time?**

  YES : Go to AT2.

  NO : Go to AT3.

AT2 CHECK CIRCUIT CPS58 (WH/BN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: BJB Power-Fold Relay 25
- Disconnect: Rear Seat Control Switch C4351
- Key in ON position.

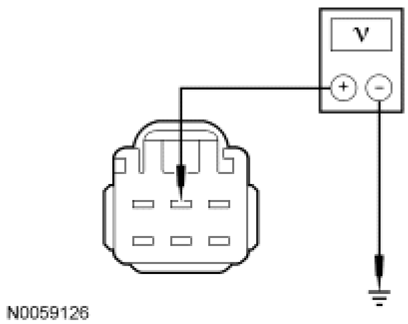


Fig. 351: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between rear seat control switch C4351-2, circuit CPS58 (WH/BN), harness side and ground.
- **Is the voltage greater than 0.2 volt?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : INSTALL a new power-fold relay. TEST the system for normal operation.

AT3 CHECK THE REAR SEAT CONTROL SWITCH

- Select PARK.
- Key in OFF position.

- Gain access to the rear seat control switch C4351.
- Back probe for voltage between rear seat control switch C4351-1, circuit CPS56 (GN/BN), harness side and ground.

NOTE: If the relay is disabled after 30 minutes, it can be enabled by opening any door, pressing the unlock key on the key fob, pressing any keyless keypad button or turning the ignition key.

- While back probing for voltage, press the rear seat control switch to release the left side backrest.
- **Is the voltage greater than 10 volts when rear seat control switch is depressed?**

  YES : Go to AT4.

  NO : INSTALL a new rear seat control switch. REFER to **Seat Control Switch - Rear Seat**. TEST the system for normal operation.

AT4 CHECK CIRCUIT CPS56 (GN/BN) FOR AN OPEN

- Disconnect: Left Power-Fold Actuator C3317

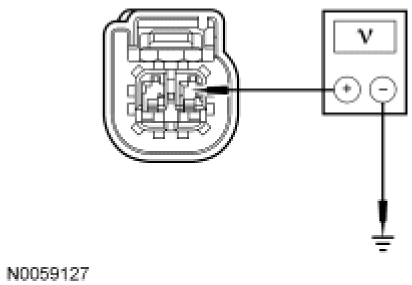


Fig. 352: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between left power-fold actuator C3317-1, circuit CPS56 (GN/BN), harness side and ground while pressing the rear seat control switch to release the left side backrest.
- **Is the voltage greater than 10 volts when rear seat control switch is depressed?**

  YES : Go to AT5.

  NO : REPAIR the circuit. TEST the system for normal operation.

AT5 CHECK CIRCUIT GD126 (BK/WH) FOR AN OPEN

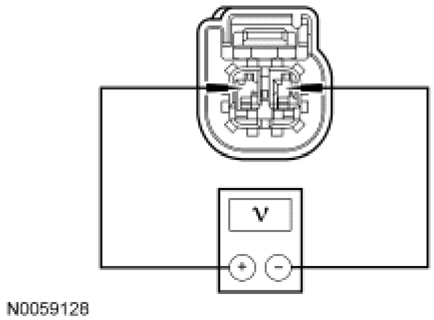


Fig. 353: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between left power-fold actuator C3317-1, circuit CPS56 (GN/BN), harness side and C3317-2, circuit GD126 (BK/WH), harness side while pressing the rear seat control switch to release the left side backrest.
- **Is the voltage greater than 10 volts when rear seat control switch is depressed?**

  YES : INSTALL a new left power-fold actuator. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test AU: The Power Seat is Inoperative/Does Not Operate Correctly - Right Rear, Power Fold

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Seats for schematic and connector information.

Normal Operation

The rear seat power-fold relay is provided voltage on the coil side from the smart junction box (SJB), on pin 2, circuit CPS 48 (BU), for 30 minutes after turning the vehicle off, when the transmission selector is in PARK and the liftgate is open. Ground for the coil side of the relay is on pin 1, circuit GD120 (BK/GN). The rear seat power-fold relay switched side is supplied voltage from battery junction box (BJB) fuse 27 (10A) on relay pin 3, and is hot at all times. Pushing the double-throw switch to the appropriate rear seat release actuator, left or right, will provide voltage from relay pin 5 and allow folding of that seat. If the relay is disabled after 30 minutes, it can be enabled as long as the transmission is in PARK by opening any door, pressing the unlock key on the key fob, pressing any keyless keypad button or turning the ignition key.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Rear seat control switch
- Right power-fold seat actuator
- Power-fold relay

PINPOINT TEST AU: THE POWER SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - RIGHT REAR, POWER FOLD

AU1 CHECK RH SEAT OPERATION

- Key in ON position.
- Select NEUTRAL.
- Press the rear seat control switch to release the right side backrest.
- **Does the RH seat operate all the time?**

  YES : Go to AU2.

  NO : Go to AU3.

AU2 CHECK CIRCUIT CPS58 (WH/BN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: BJB Power-Fold Relay 25
- Disconnect: Rear Seat Control Switch C4351
- Key in ON position.

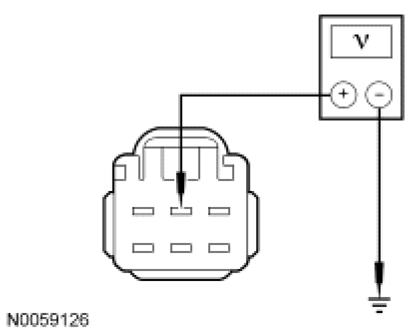


Fig. 354: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between rear seat control switch C4351-2, circuit CPS58 (WH/BN), harness side to ground.
- **Is the voltage greater than 0.2 volt?**

  YES : REPAIR circuit CPS58 (WH/BN). TEST the system for normal operation.

  NO : INSTALL a new power-fold relay. TEST the system for normal operation.

AU3 CHECK THE REAR SEAT CONTROL SWITCH

- Select PARK.
- Key in OFF position.
- Gain access to the rear seat control switch C4351.
- Back probe for voltage between rear seat control switch C4351-5, circuit CPS57 (GY/BN), harness side and ground.

NOTE: **If the relay is disabled after 30 minutes, it can be enabled by opening any door, pressing the unlock key on the key fob, pressing any keyless keypad button or turning the ignition key.**

- While back probing for voltage, press the rear seat control switch to release the right side backrest.
- **Is the voltage greater than 10 volts when rear seat control switch is depressed?**

  YES : Go to AU4.

  NO : INSTALL a new rear seat control switch. REFER to **Seat Control Switch - Rear Seat**. TEST the system for normal operation.

AU4 CHECK CIRCUIT CPS57 (GY/BN) FOR AN OPEN

- Disconnect: Right Power-Fold Actuator C3334

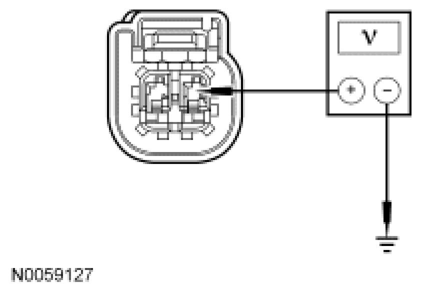


Fig. 355: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between right power-fold actuator C3334-1, circuit CPS57 (GY/BN), harness side and ground while pressing the rear seat control switch to release the right side backrest.
- **Is the voltage greater than 10 volts when rear seat control switch is depressed?**

  YES : Go to AU5.

  NO : REPAIR circuit CPS57 (GY/BN). TEST the system for normal operation.

AU5 CHECK CIRCUIT GD151 (BK/GN) FOR AN OPEN

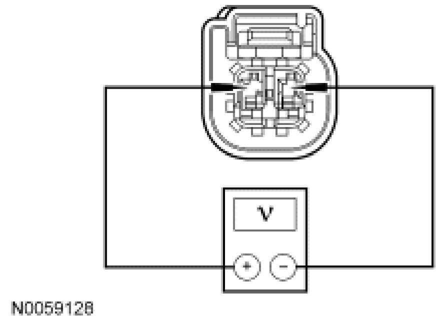


Fig. 356: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between right power-fold actuator C3334-1, circuit CPS57 (GY/BN), harness side and C3334-2, circuit GD151 (BK/GN), harness side while pressing the rear seat control switch to release the right side backrest.

- **Is the voltage greater than 10 volts when rear seat control switch is depressed?**
  YES : INSTALL a new right power-fold actuator. TEST the system for normal operation.
  NO : REPAIR the circuit GD151 (BK/GN). TEST the system for normal operation.

Component Test

Component Testing - Thermo-Electric Device (TED) Cooling Performance

NOTE: This test is intended to check the cooling mode performance of an operational climate controlled seat backrest or cushion thermo-electric device (TED) and verify it is cooling inlet air at the TED (ambient cabin air) between 6-8°C (10-14° F).

NOTE: Make sure the vehicle is out of direct sunlight and is in an area with a stable air temperature when testing the climate controlled seat system.

NOTE: For correct temperature measurements, the seat being tested should be occupied.

1. Enter DataLogger and monitor the following DCSM PIDs:
   - CSHTEMP (Cushion Thermal Electric Device [TED] Temperature)
   - BK_TEMP (Back Thermal Electric Device [TED] Temperature)
   - PCSHTMP (Passenger Cushion Thermal Electric Device [TED] Temperature)
   - PBKTMP (Passenger Back Thermal Electric Device [TED] Temperature)
   - DCCSMOD (Driver Climate Controlled System State)
   - PCCSMOD (Passenger Climate Controlled System State)
2. Any initial PID value of greater than 205°C (401°F) or less than 2°C (36°F) indicates a system hardware failure. Do not proceed with this test. Go to **Symptom Chart** or **Dual Climate Controlled Seat Module (DCSM) DTC Chart** for diagnosis.

   NOTE: Typical backrest and cushion TED shown in illustration, others similar.

3. Gain access to the seat backrest and cushion TEDs and use a suitable thermo-couple temperature measuring device to monitor the air inlet temperature.
   - Access the backrest TED.
     - Release the backrest trim cover J-clips at the sides and bottom.
     - Pull out at the bottom and detach the 2 lower hard back panel pin-type retainers.
     - Position the backrest trim cover out of the way.
   - Place the temperature probe near each TEDs air filter.

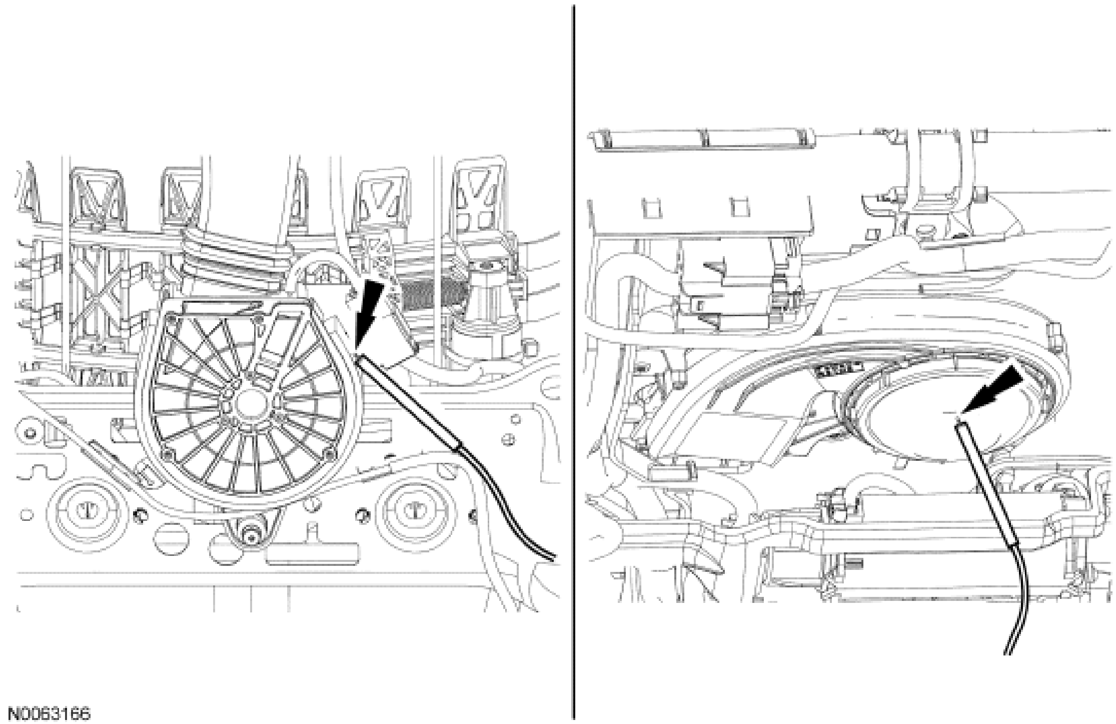


Fig. 357: Using Scan Tool To Measure Cushion TED PID Temperature
Courtesy of FORD MOTOR CO.

NOTE: The engine must be running to operate the climate controlled seat system and carry out this test.

4. Operate system in high cool mode and measure the temperature at the cushion TED filter using the thermo-couple device.
   - Obtain and record the air inlet temperature at the TED.
5. Use a scan tool to measure the cushion TED PID temperature and record the value.
   - Monitor the MODE PID and verify the system is operating. If during testing the PID value changes to Blower Only state, the system has entered into recovery mode and voltage to the TEDs is disabled. If this occurs, the seat has failed the test. Do not continue. Return to the diagnostic routine.
6. Subtract the cushion TED PID temperature from the cushion air inlet temperature and record the temperature difference value.
7. Continue to operate the system in high cool mode and use the thermo-couple device to measure the temperature at the backrest TED filter.
   - Obtain and record the air inlet temperature at the TED.
     - Secure the temperature probe at the backrest TED air filter and close the backrest trim cover before measuring.
8. Use a scan tool to measure the backrest TED PID temperature and record the value.
   - Monitor the MODE PID and verify the system is operating. If during testing the PID value changes to Blower Only state, the system has entered into recovery mode and voltage to the TEDs is

disabled. If this occurs, the seat has failed the test. Do not continue. Return to the diagnostic routine.

9. Subtract the backrest TED PID temperature from the backrest air inlet temperature and record the value.
10. Compare the cushion and backrest calculated temperature values. Both values should be between 6°-8°C (10.8°-14.4°F) and approximately equal (±1°C [±1.8°F]).
11. If the calculated temperature values are not within these specifications, check the climate controlled seat components for air duct or filter restrictions, blockages, duct or electrical disconnections and for incorrect assembly. Repair as needed. If OK, carry out the DCSM self-test and if any DTC is retrieved, go to **Dual Climate Controlled Seat Module (DCSM) DTC Chart** for diagnostic direction. Return to the diagnostic routine.

GENERAL PROCEDURES

MEMORY POSITION PROGRAMMING

Programming Memory Positions

NOTE: Memory positions can be stored at any time.

NOTE: Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.

NOTE: To program the remote keyless entry (RKE) transmitter, refer to HANDLES, LOCKS, LATCHES & ENTRY SYSTEMS article.

1. To set memory position(s) move the memory driver seat, memory exterior mirrors (if equipped), memory adjustable pedals (if equipped) and memory tilt steering column (if equipped) to the preferred position using the appropriate switch(es).

NOTE: Once the memory SET switch button is pressed, there is a 5-second time limit to input a memory position. If a memory position input is not received within the time limit, the operation is aborted and the memory SET switch LED (if equipped) is turned OFF.

NOTE: If one of the following other inputs is received during the time limit, the operation is aborted and the memory SET switch LED (if equipped) is turned OFF:

- **Driver seat control switch**
- **Memory SET switch button**
- **Adjustable pedal control switch (if equipped)**
- **Exterior mirror control switch (if equipped)**

- **Power tilt steering column switch (if equipped)**

2. Press the memory SET switch button, activating the memory SET switch LED (if equipped).
3. Within 5 seconds (before the LED goes out) (if equipped), press memory SET switch button 1 or 2.
4. Repeat Steps 1 through 3 to initiate another memory position setting.

Recalling a Stored Memory Position

NOTE: A memory recall can be initiated only if the vehicle is in PARK or NEUTRAL gear and the ignition switch is not in START. A memory recall in progress will not be affected by moving the ignition switch to START or by moving the gearshift lever out of PARK or NEUTRAL.

NOTE: Input from the driver seat control switch, memory SET switch, adjustable pedal control switch (if equipped), exterior mirror control switch (if equipped) or power tilt steering column switch (if equipped) during a memory recall will abort the memory recall.

1. The driver can recall the desired memory driver seat, memory exterior mirror (if equipped), memory adjustable pedal (if equipped) and memory tilt steering column (if equipped) positions by depressing either memory SET switch button 1 or 2. Depressing memory SET switch button 1 will initiate a recall of the positions stored for Memory 1. Depressing memory SET switch button 2 will initiate a recall of the positions stored for Memory 2.

SEAT WIRE HARNESS ROUTING - FRONT PASSENGER CUSHION

All seat tracks

1. For correct front passenger seat cushion wire harness routing, refer to the illustrations with the correct seat option content.

Manual seat track

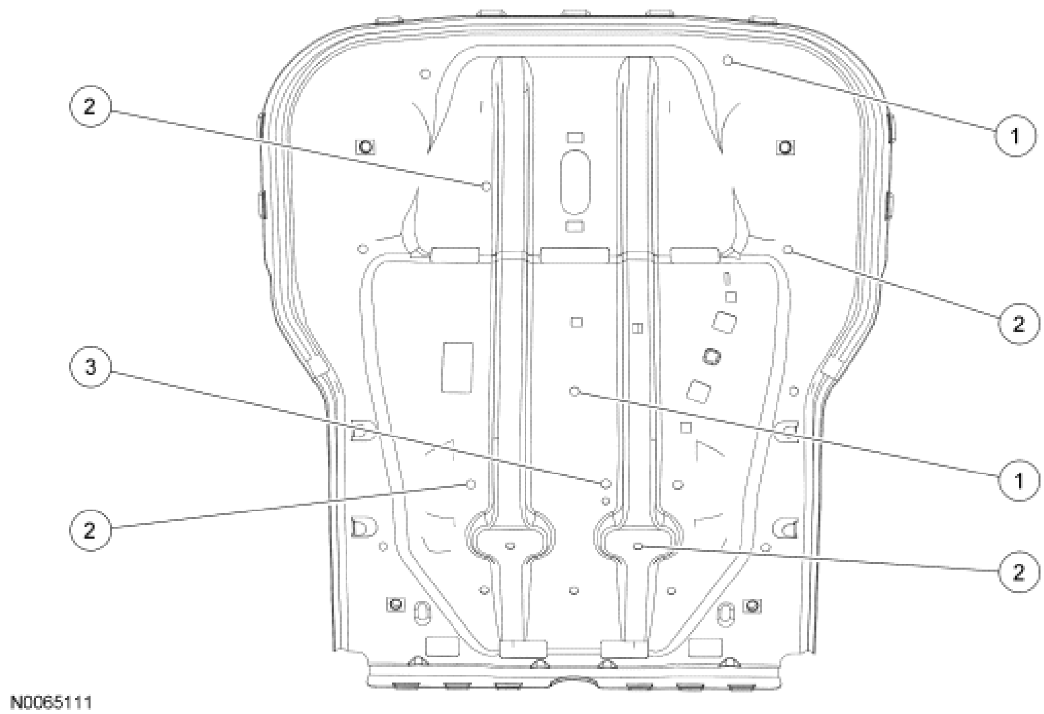


Fig. 358: Cushion Frame From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Wire harness main bundle
2	Occupant classification sensor (OCS) weight sensor bolt wire harness takeout
3	Side air bag electrical connector

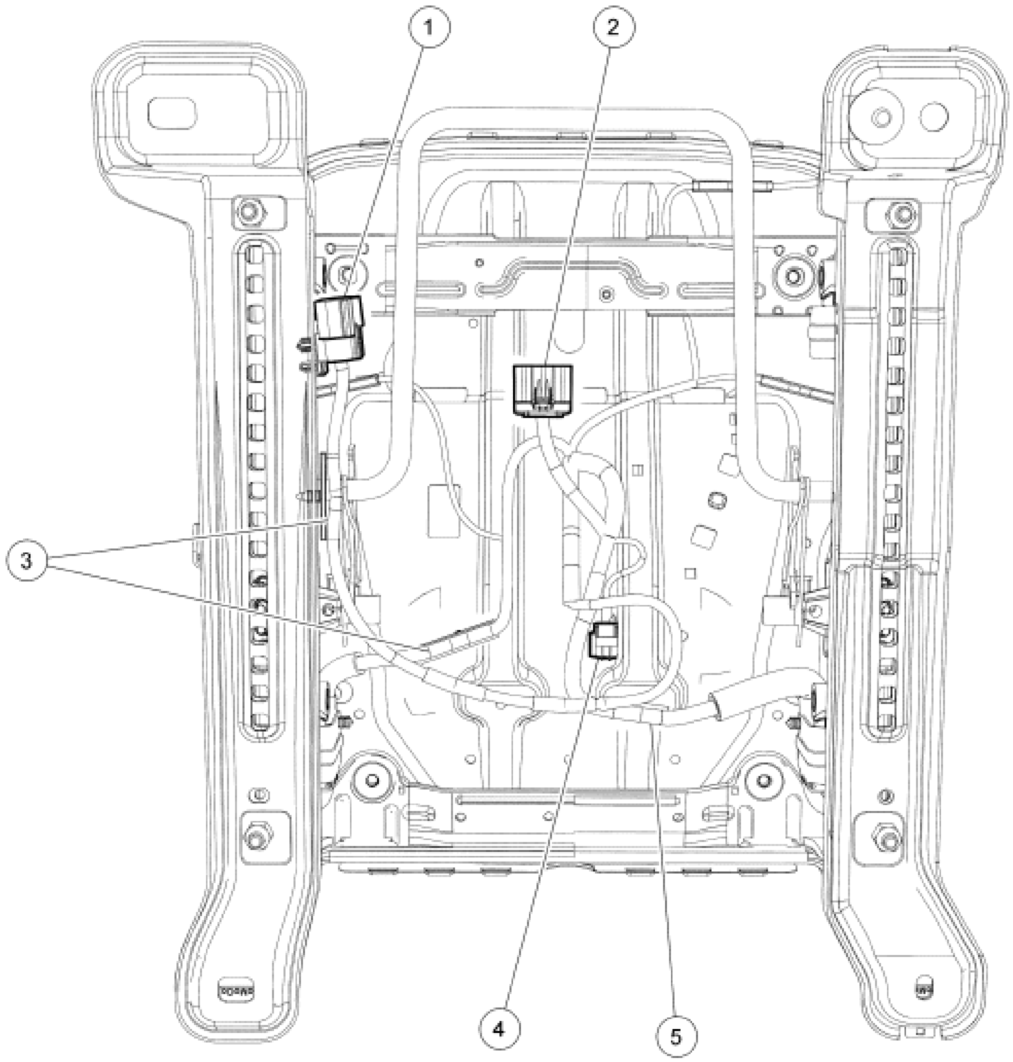


Fig. 359: Cushion Frame With Manual Seat Track Attached From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Inline electrical connector to vehicle harness electrical connector
2	Occupant classification system module (OCSM) electrical connector
3	Wire harness with gray tape
4	Side air bag electrical connector
5	Wire harness with orange tape

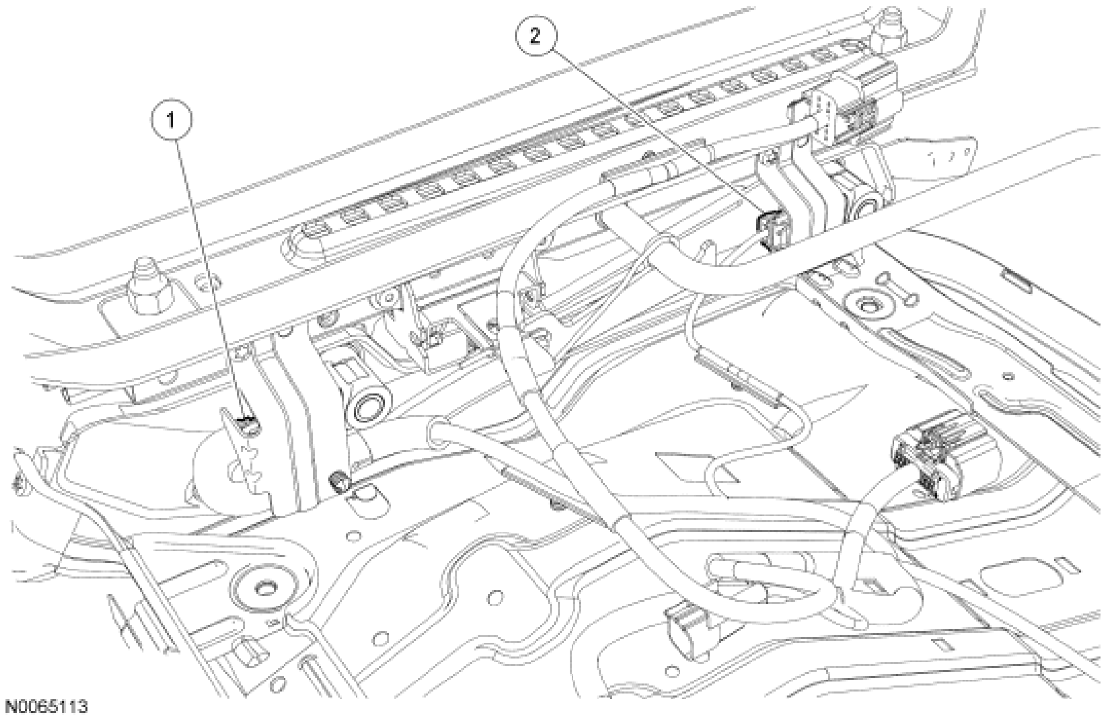


Fig. 360: Outboard Side of Cushion Frame and Manual Seat Track From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Rear outboard occupant classification sensor (OCS) weight sensor bolt electrical connector
2	Front outboard OCS weight sensor bolt electrical connector

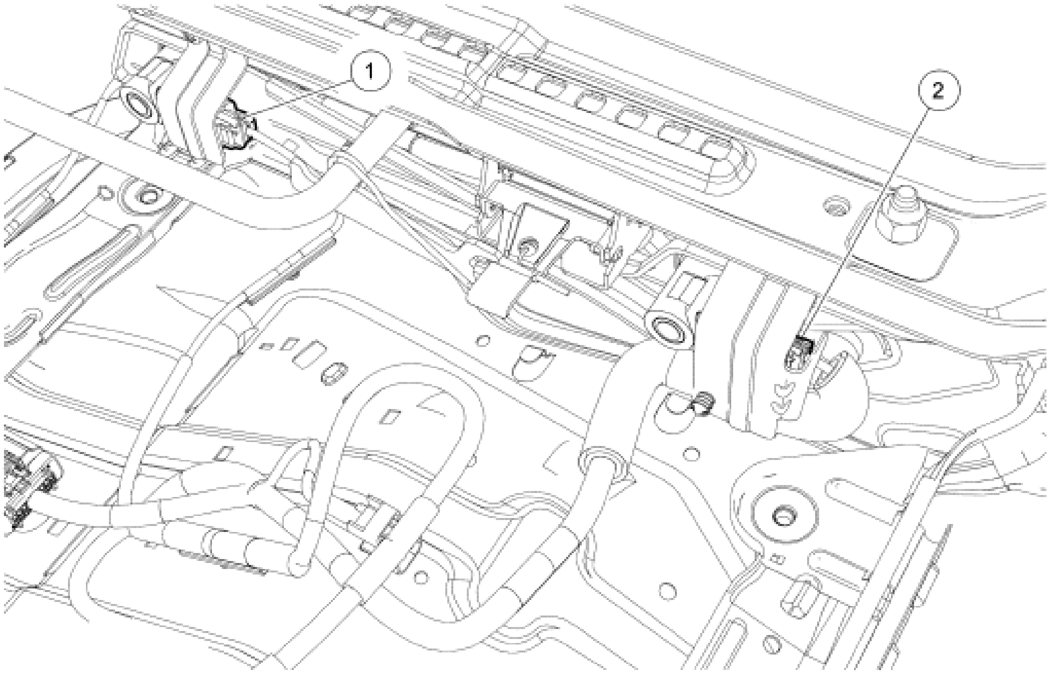


Fig. 361: Inboard Side of Cushion Frame and Manual Seat Track From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Front inboard occupant classification sensor (OCS) weight sensor bolt electrical connector
2	Rear inboard OCS weight sensor bolt electrical connector

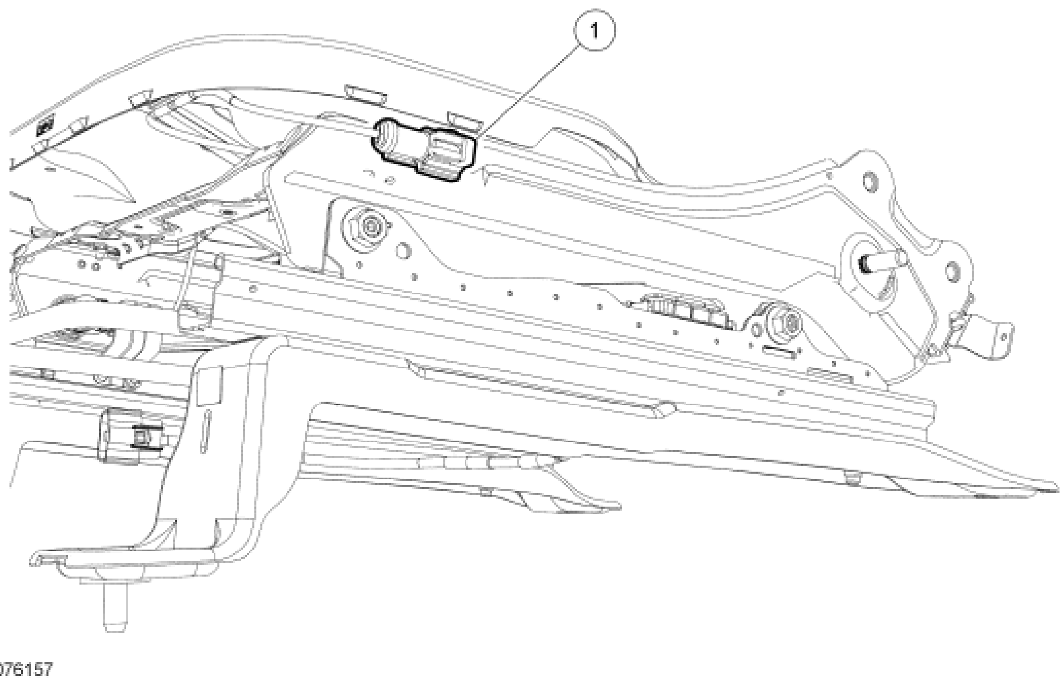


Fig. 362: Inboard Side of Cushion Frame and Manual Seat Track From Upright
Courtesy of FORD MOTOR CO.

Item	Description
1	Safety belt buckle switch electrical connector

1. Make sure the passenger seat cushion wire harness is correctly routed and attached.

Manual seat track with heat

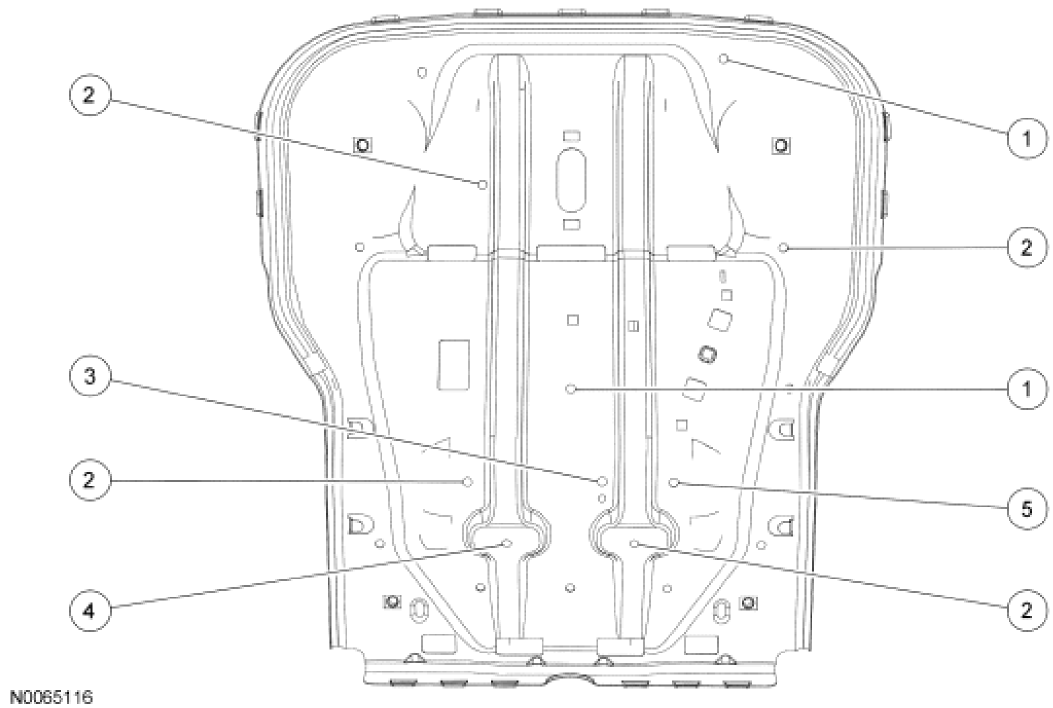


Fig. 363: Cushion Frame From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Wire harness main bundle
2	Occupant classification sensor (OCS) weight sensor bolt wire harness takeout
3	Side air bag electrical connector
4	Cushion heater mat electrical connector
5	Backrest heater mat electrical connector

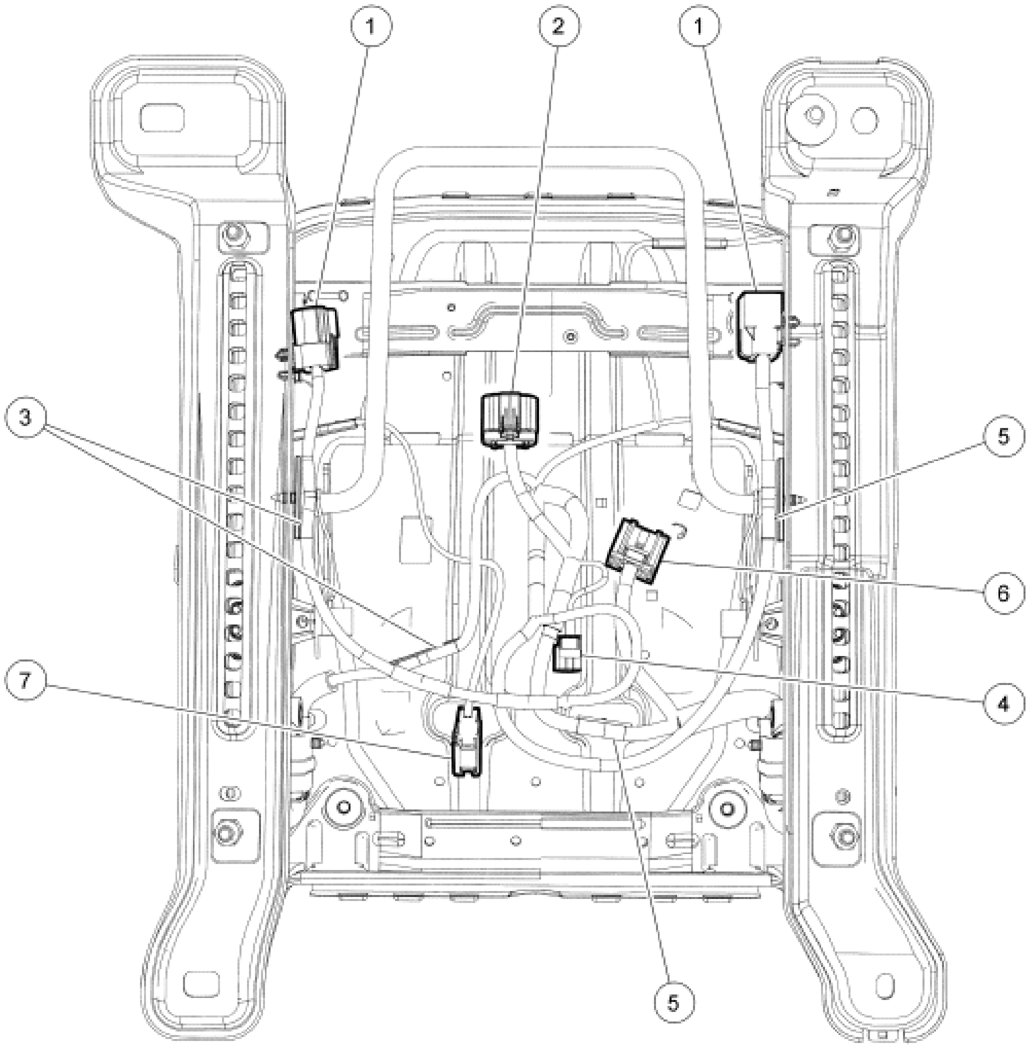


Fig. 364: Cushion Frame With Manual Seat Track Attached From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Inline electrical connector to vehicle harness electrical connector
2	Occupant classification system module (OCSM) connector
3	Wire harness with gray tape
4	Side air bag electrical connector
5	Wire harness with orange tape
6	Heated seat module electrical connector
7	Cushion heater mat electrical connector

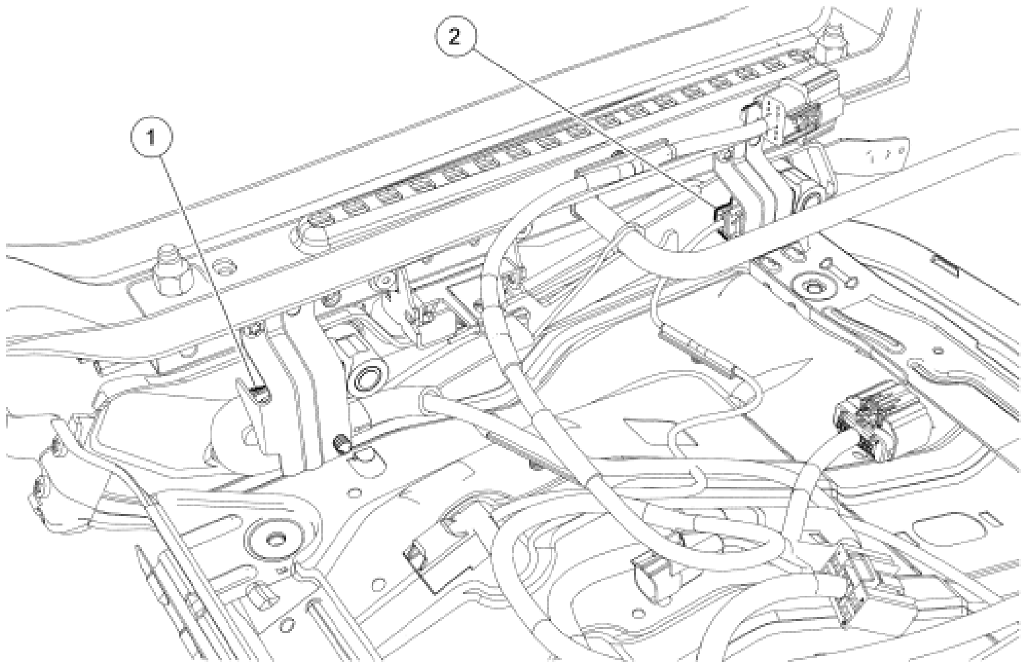


Fig. 365: Outboard Side of Cushion Frame and Manual Seat Track From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Rear outboard occupant classification sensor (OCS) weight sensor bolt electrical connector
2	Front outboard OCS weight sensor bolt electrical connector

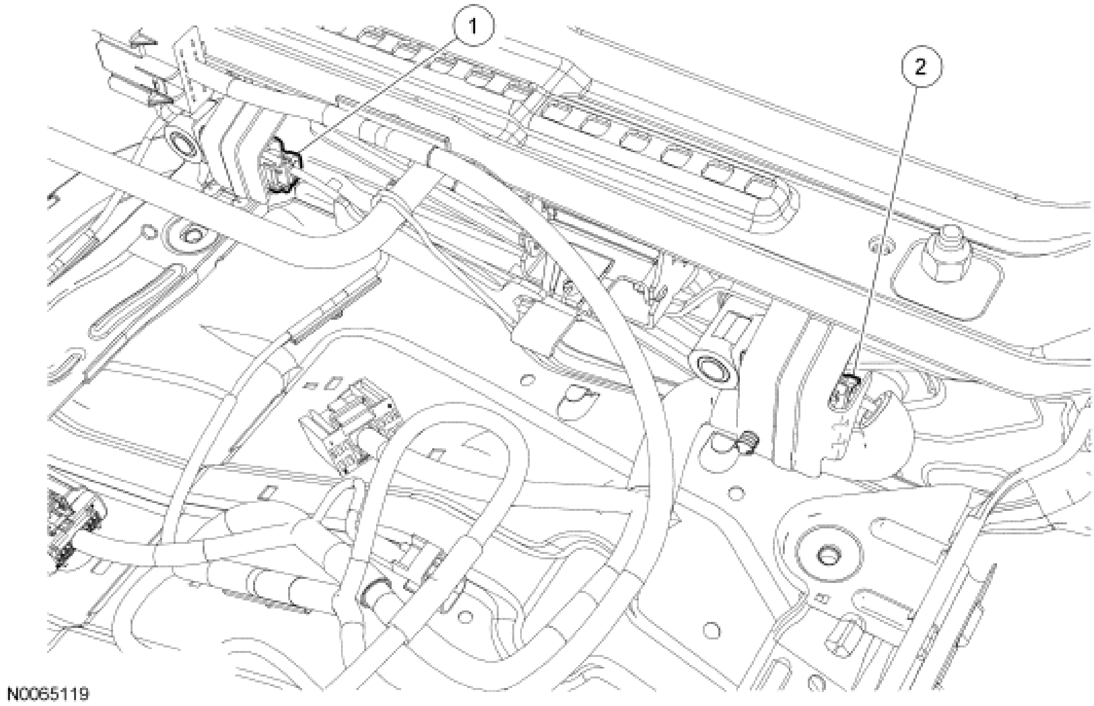


Fig. 366: Inboard Side of Cushion Frame and Manual Seat Track From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Front inboard occupant classification sensor (OCS) weight sensor bolt electrical connector
2	Rear inboard OCS weight sensor bolt electrical connector

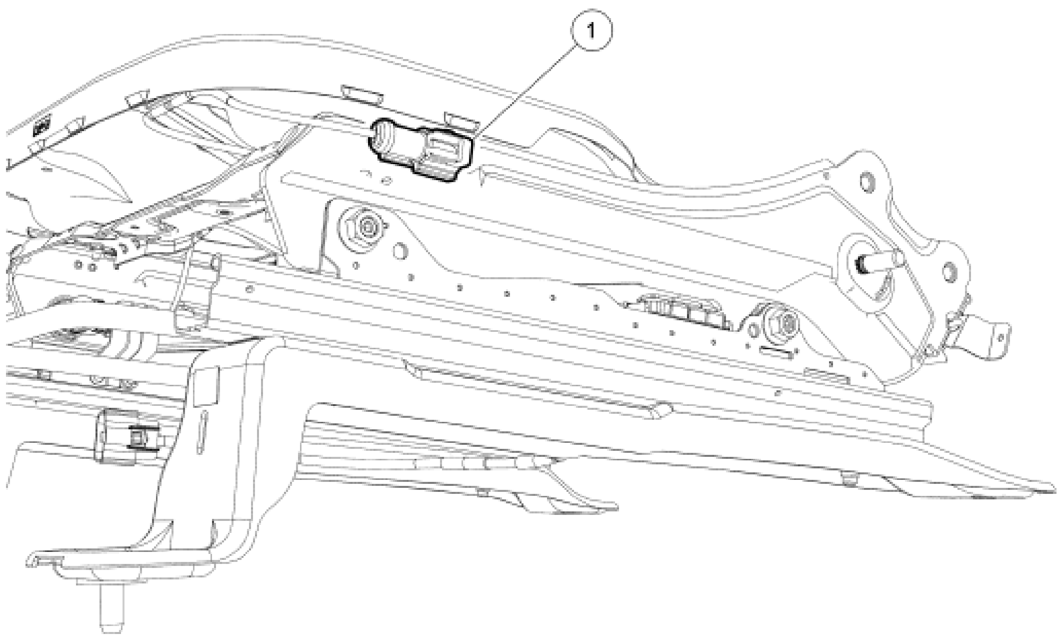


Fig. 367: Inboard Side of Cushion Frame and Manual Seat Track From Upright
Courtesy of FORD MOTOR CO.

Item	Description
1	Safety belt buckle switch electrical connector

1. Make sure the passenger seat cushion wire harness is correctly routed and attached.

Power seat track with heat

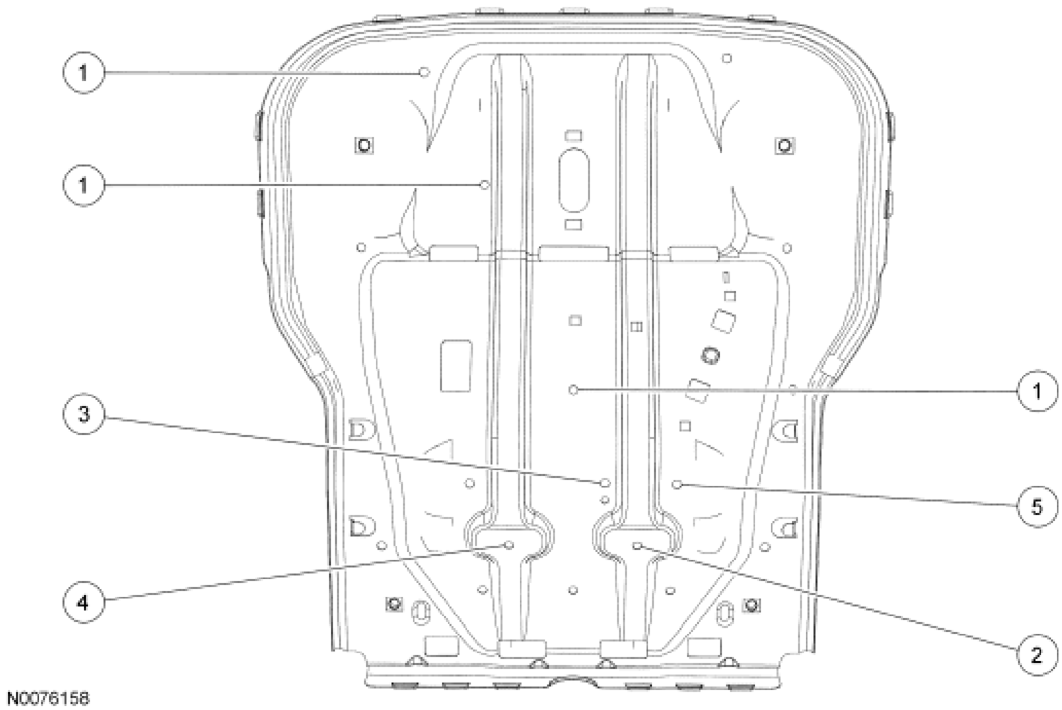


Fig. 368: Cushion Frame From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Wire harness main bundle
2	Occupant classification sensor (OCS) weight sensor bolt wire harness takeout
3	Side air bag electrical connector
4	Cushion heater mat electrical connector
5	Backrest heater mat electrical connector

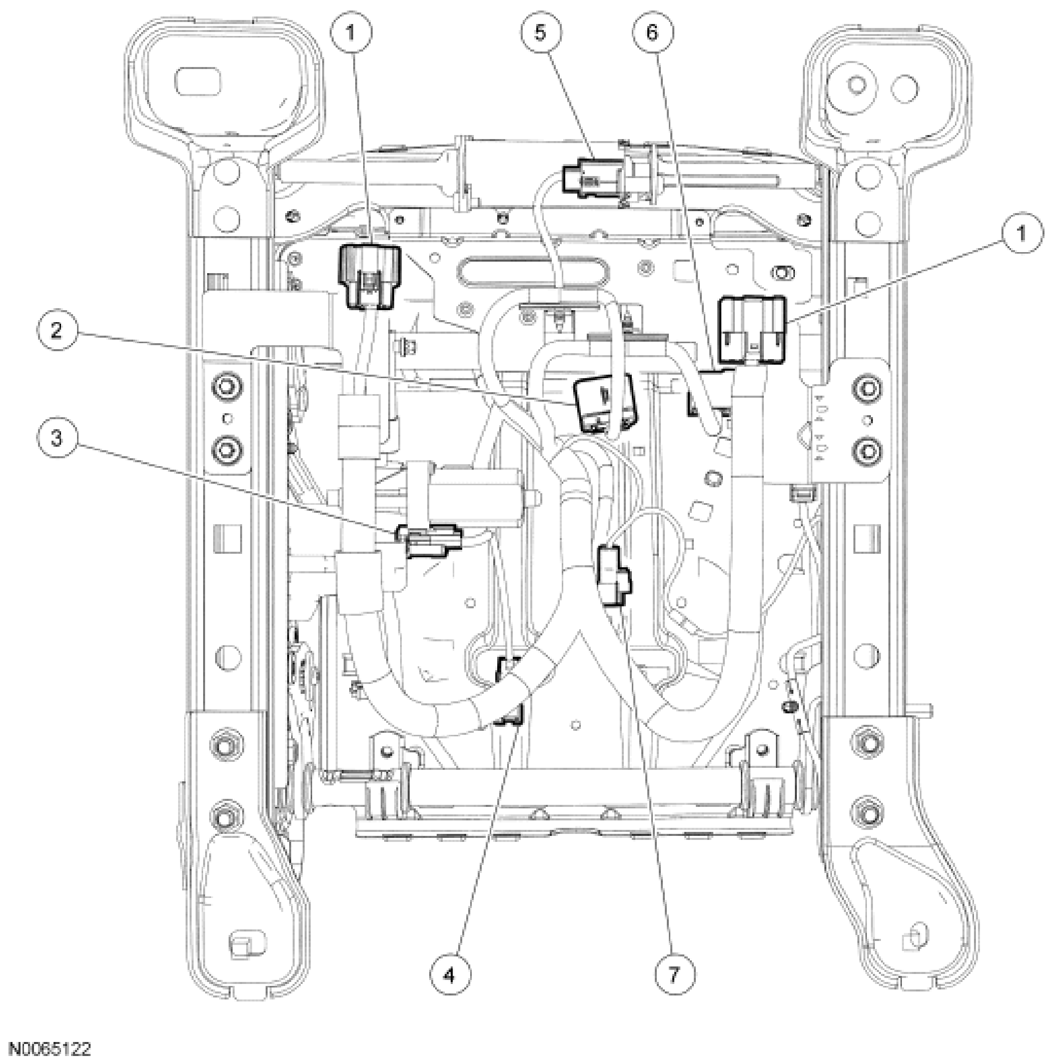


Fig. 369: Cushion Frame With Power Seat Track Attached From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Inline electrical connector to vehicle harness electrical connector
2	Occupant classification system module (OCSM) electrical connector
3	Front height motor electrical connector
4	Cushion heater mat electrical connector
5	Horizontal motor electrical connector
6	Heated seat module electrical connector
7	Side air bag electrical connector

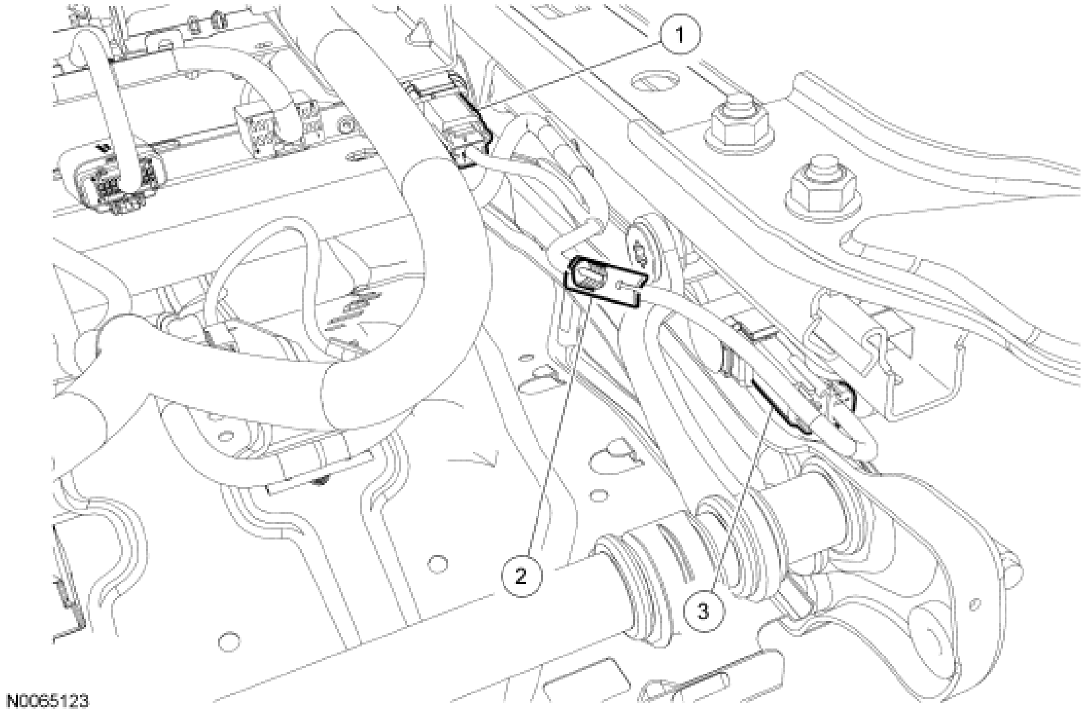


Fig. 370: Inboard Side of Cushion Frame and Power Seat Track From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Front inboard occupant classification sensor (OCS) weight sensor bolt electrical connector
2	Attaches to inboard OCS weight sensor bolt protection bracket
3	Rear inboard OCS weight sensor bolt electrical connector

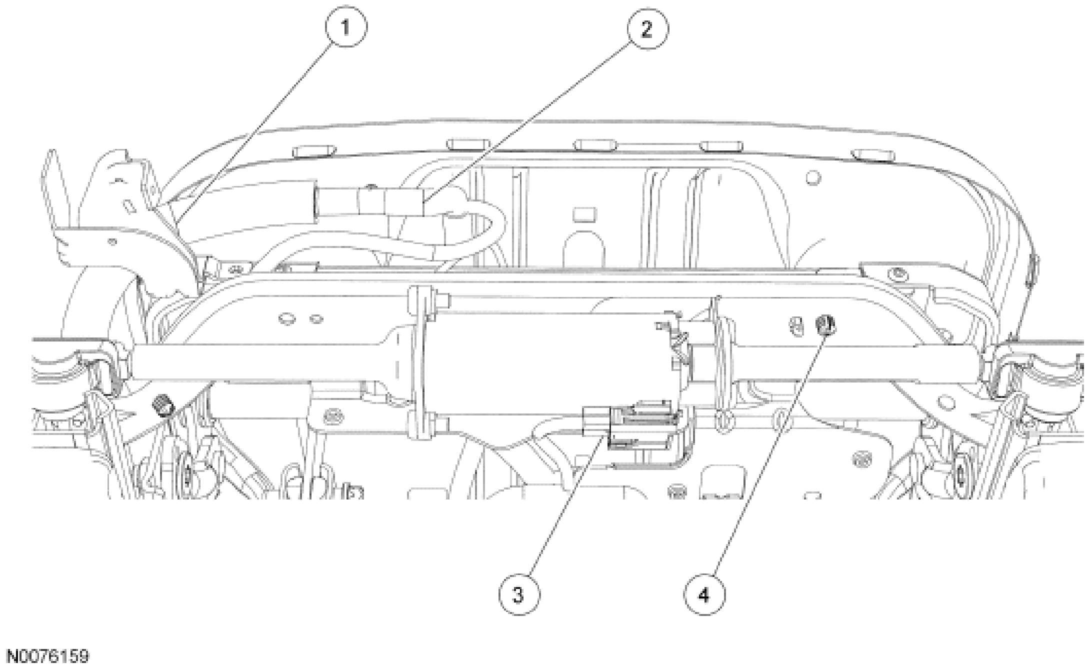


Fig. 371: Front of Cushion Frame and Power Seat Track From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Seat control switch and rear height motor takeout must be routed on top of the bracket
2	Wire harness attachment points
3	Horizontal motor electrical connector
4	Safety belt buckle switch electrical connector pin-type retainer attached in place

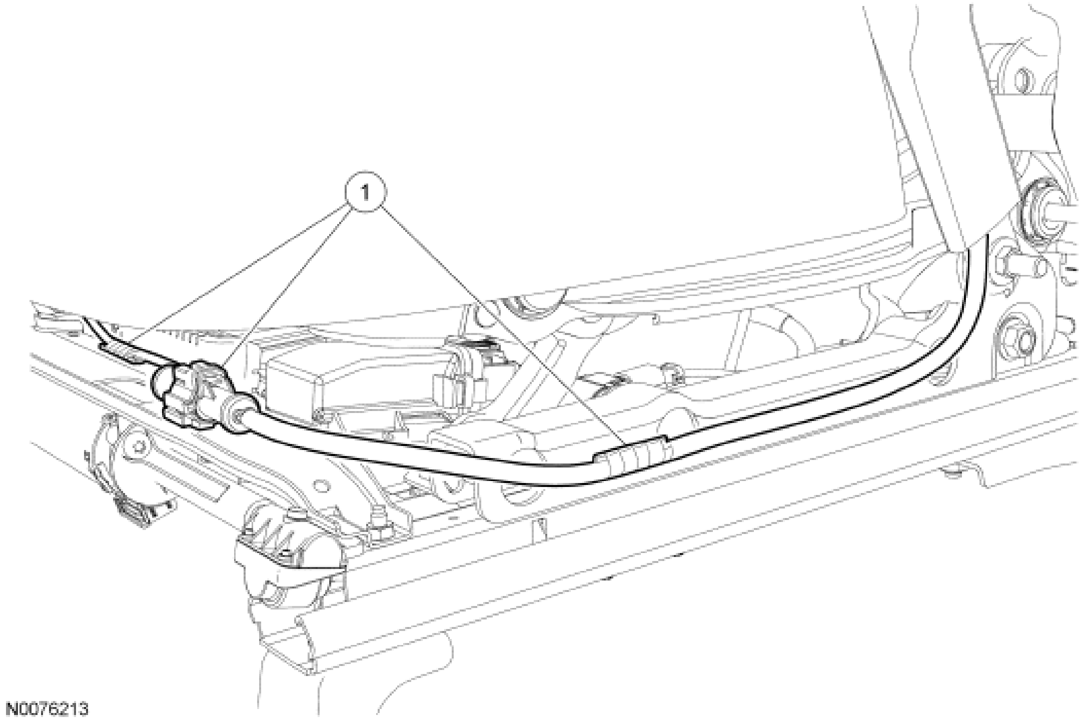


Fig. 372: Front Inboard Side of Cushion Frame and Power Seat Track From Upright
Courtesy of FORD MOTOR CO.

Item	Description
1	Safety belt buckle switch electrical connector and wire harness takeout routing attachment points

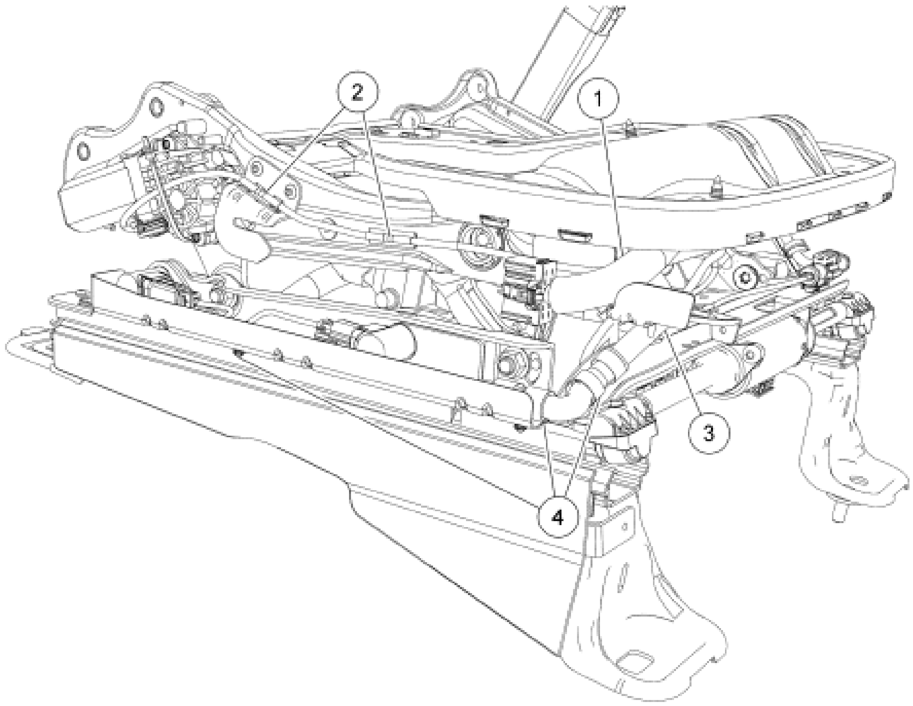


Fig. 373: Front and Outboard Side of Cushion Frame and Power Seat Track From Upright
Courtesy of FORD MOTOR CO.

Item	Description
1	Seat control switch and rear height motor takeout must be routed on top of the bracket
2	Rear height motor takeout attachment points
3	Outboard occupant classification sensor (OCS) weight sensor bolt takeout must be routed under the bracket
4	Outboard OCS weight sensor bolt takeout attachment points

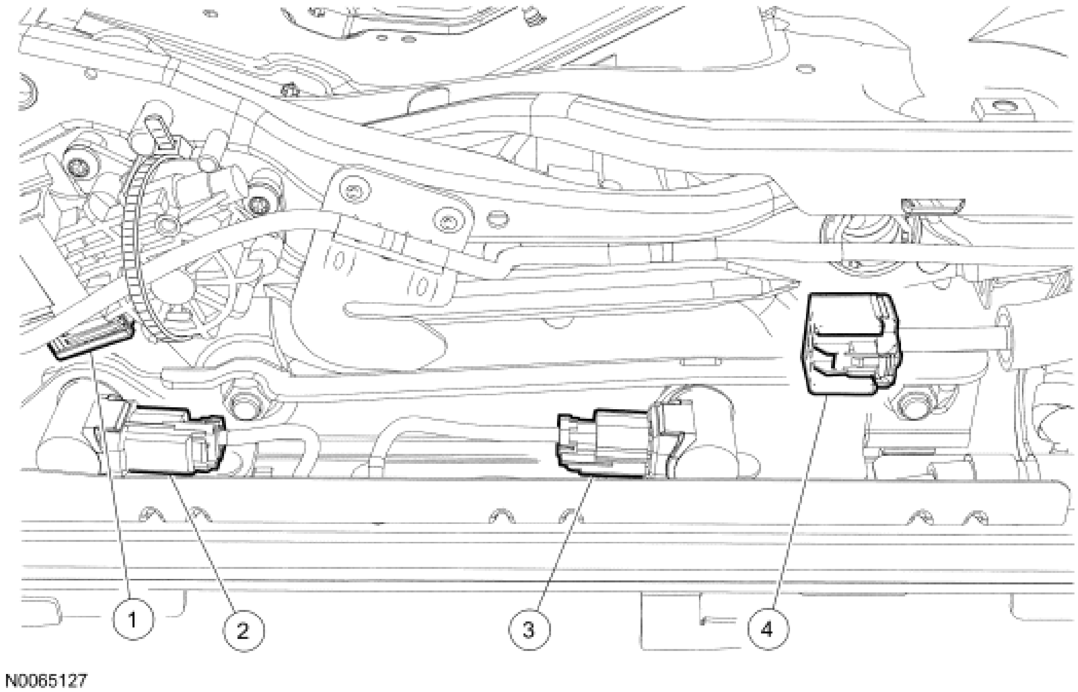


Fig. 374: Outboard of Cushion Frame and Power Seat Track From Upright
Courtesy of FORD MOTOR CO.

Item	Description
1	Rear height motor electrical connector
2	Rear outboard occupant classification sensor (OCS) weight sensor bolt electrical connector
3	Front outboard OCS weight sensor bolt electrical connector
4	Seat control switch electrical connector

1. Make sure the passenger seat cushion wire harness is correctly routed and attached.

Power seat track

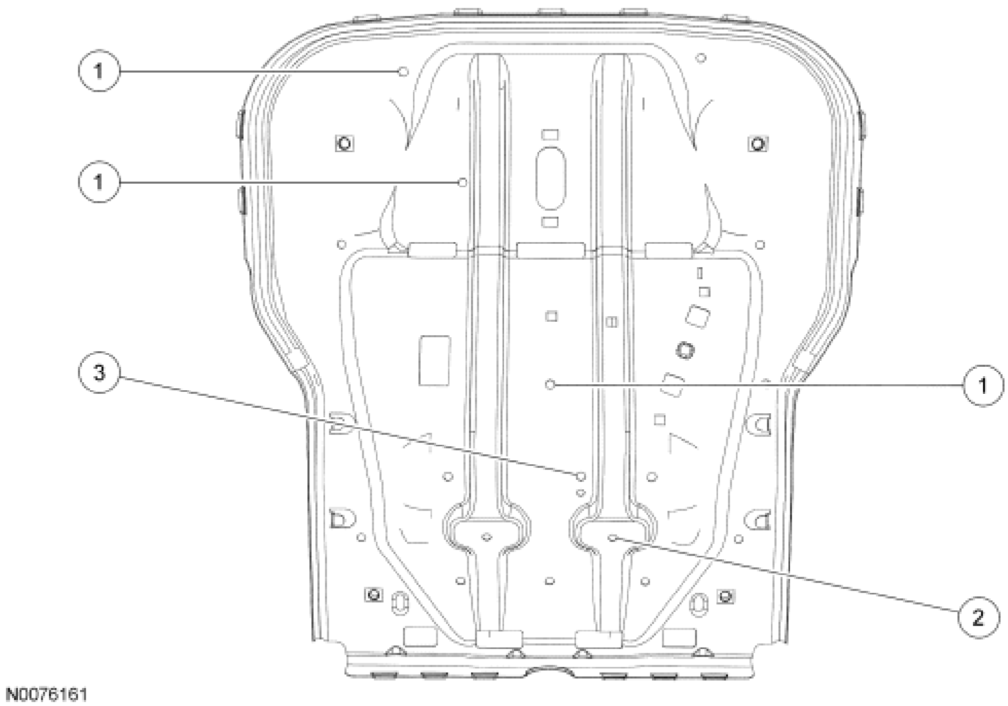


Fig. 375: Cushion Frame From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Wire harness main bundle
2	Occupant classification sensor (OCS) weight sensor bolt wire harness takeout
3	Side air bag electrical connector

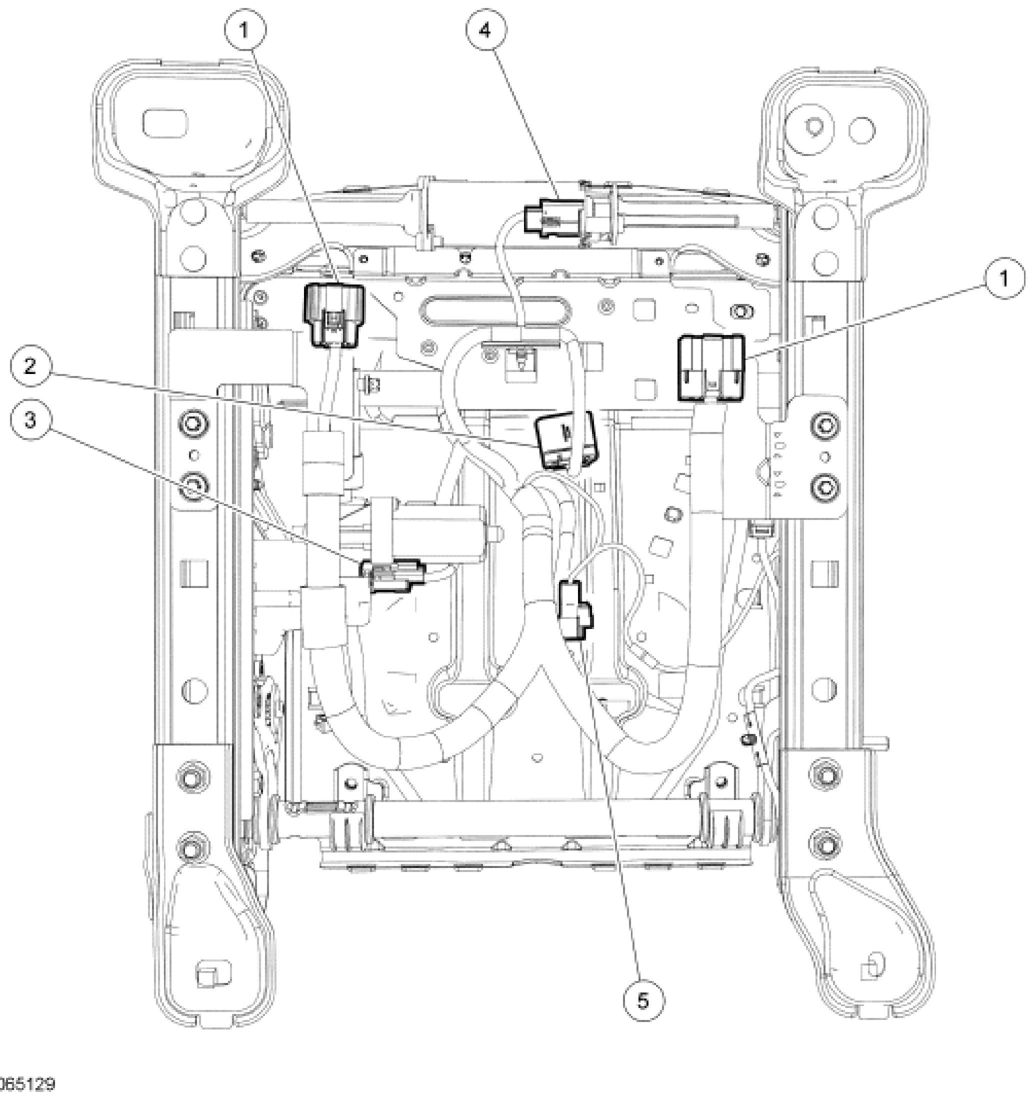


Fig. 376: Cushion Frame With Power Seat Track Attached From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Inline electrical connector to vehicle harness electrical connector
2	Occupant classification system module (OCSM) electrical connector
3	Front height motor electrical connector
4	Horizontal motor electrical connector
5	Side air bag electrical connector

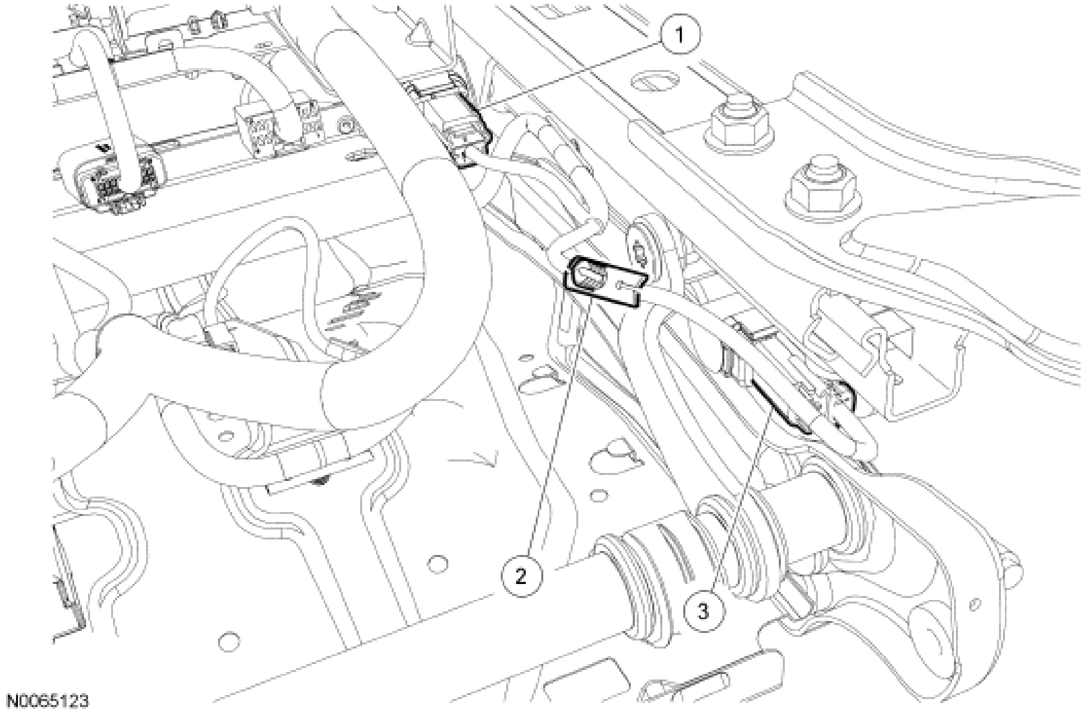


Fig. 377: Inboard Side of Cushion Frame and Power Seat Track From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Front inboard occupant classification sensor (OCS) weight sensor bolt electrical connector
2	Attaches to inboard OCS weight sensor bolt protection bracket
3	Rear inboard OCS weight sensor bolt electrical connector

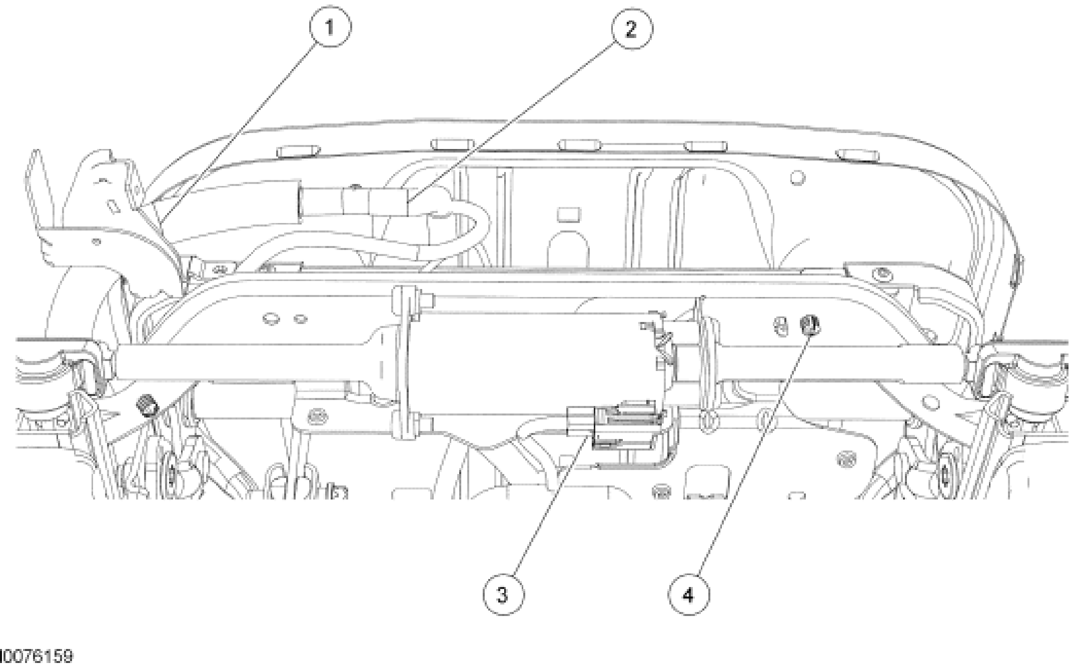


Fig. 378: Front of Cushion Frame and Power Seat Track From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Seat control switch and rear height motor takeout must be routed on top of the bracket
2	Wire harness attachment points
3	Horizontal motor electrical connector
4	Safety belt buckle switch electrical connector pin-type retainer attached in place

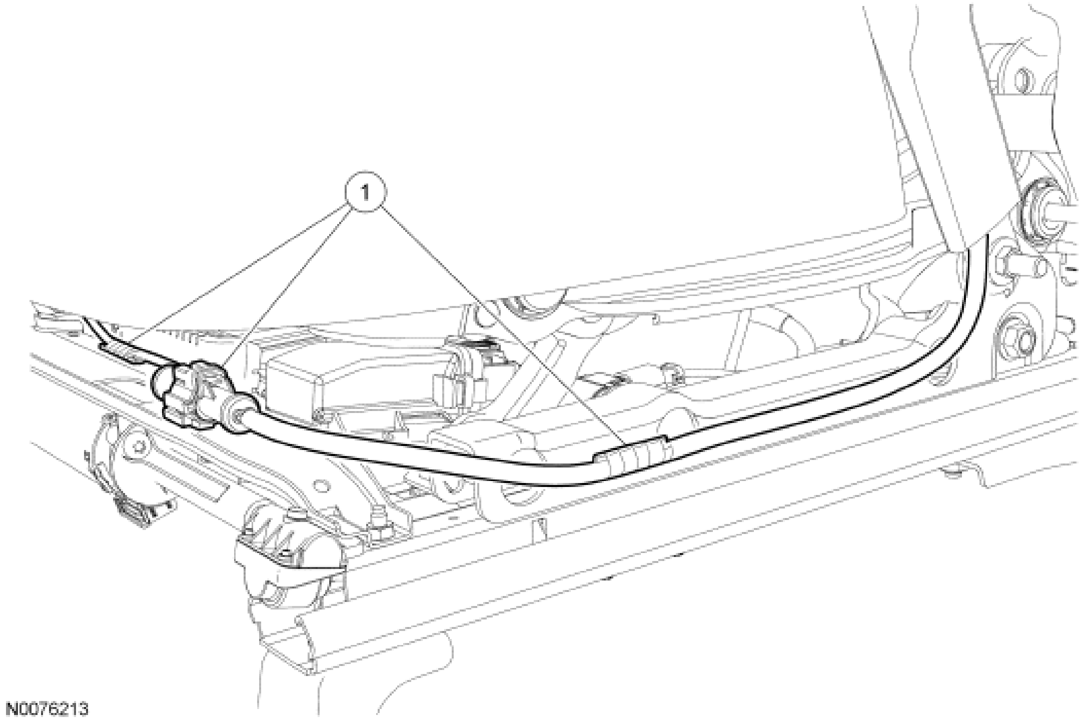


Fig. 379: Front Inboard Side of Cushion Frame and Power Seat Track From Upright
Courtesy of FORD MOTOR CO.

Item	Description
1	Safety belt buckle switch electrical connector and wire harness takeout routing attachment points

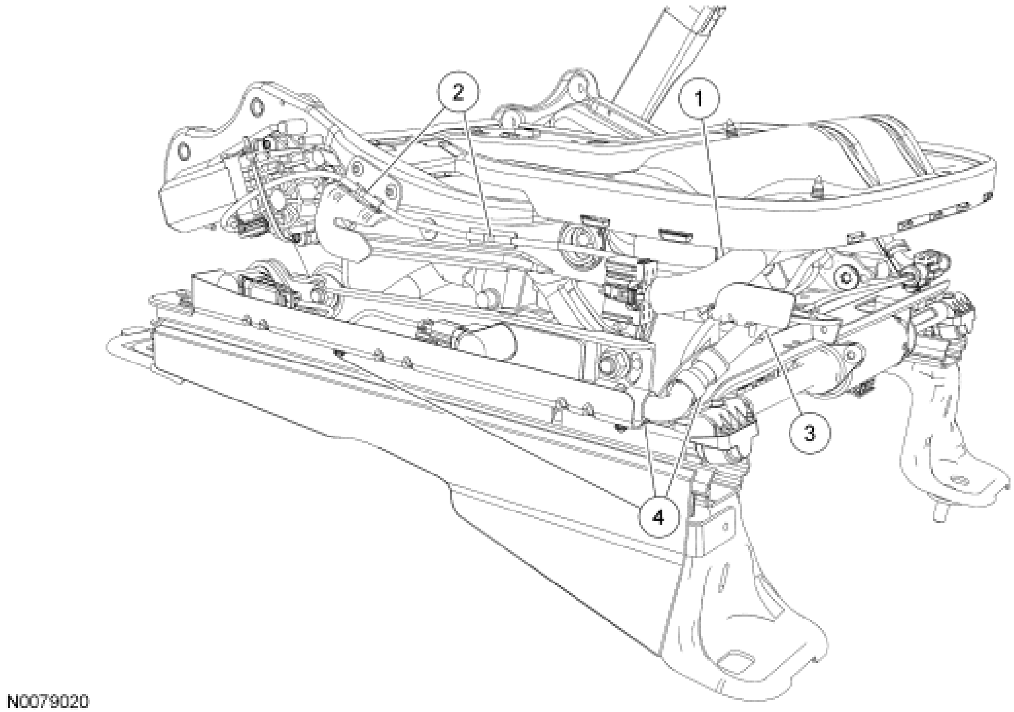


Fig. 380: Front and Outboard Side of Cushion Frame and Power Seat Track From Upright
Courtesy of FORD MOTOR CO.

Item	Description
1	Seat control switch and rear height motor takeout must be routed on top of the bracket
2	Rear height motor takeout attachment points
3	Outboard occupant classification sensor (OCS) weight sensor bolt takeout must be routed under the bracket
4	Outboard OCS weight sensor bolt takeout attachment points

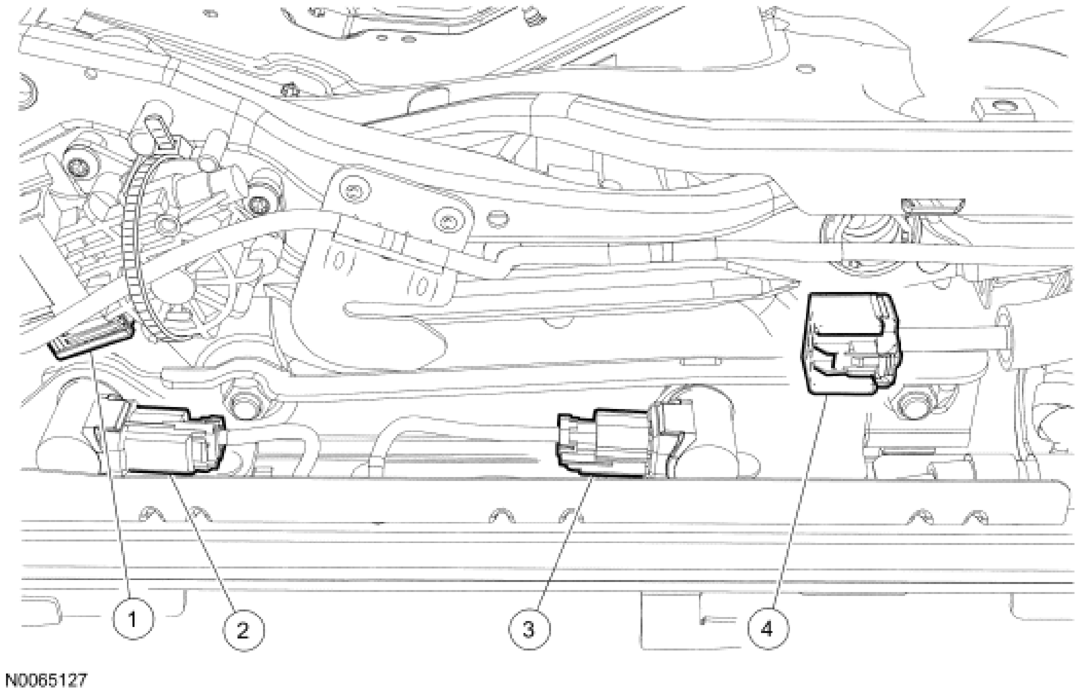


Fig. 381: Outboard of Cushion Frame and Power Seat Track From Upright
Courtesy of FORD MOTOR CO.

Item	Description
1	Rear height motor electrical connector
2	Rear outboard occupant classification sensor (OCS) weight sensor bolt electrical connector
3	Front outboard OCS weight sensor bolt electrical connector
4	Seat control switch electrical connector

1. Make sure the passenger seat cushion wire harness is correctly routed and attached.

Power seat track with power recline, power lumbar and climate control

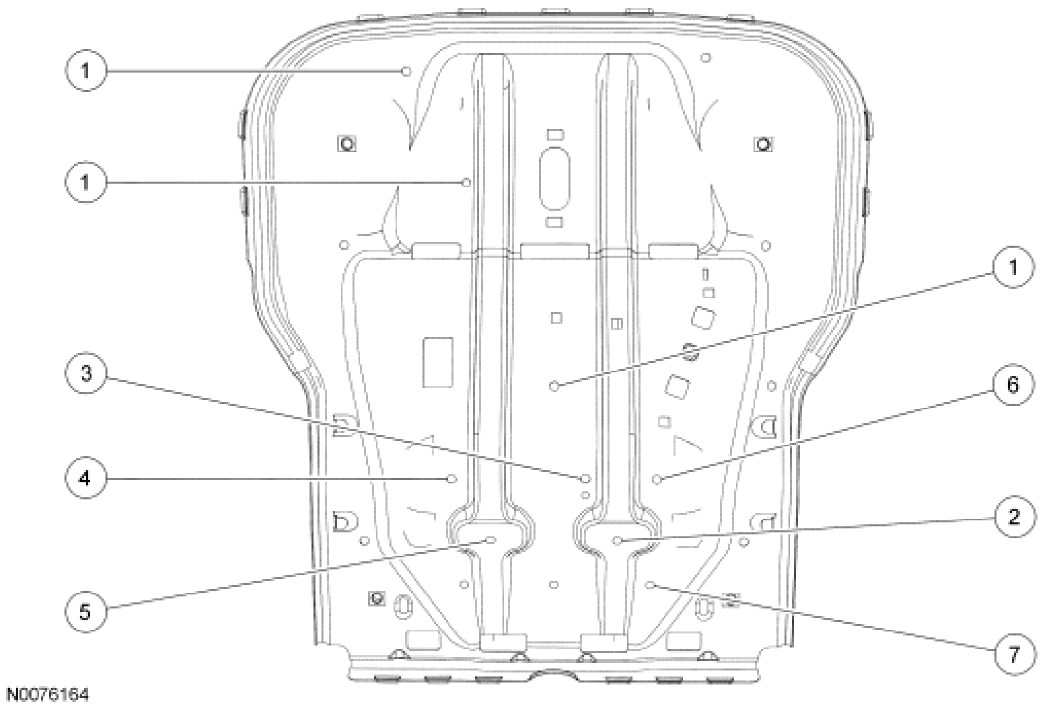


Fig. 382: Cushion Frame From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Wire harness main bundle
2	Occupant classification sensor (OCS) weight sensor bolt wire harness takeout
3	Side air bag electrical connector
4	Power recline electrical connector
5	Backrest thermo-electric device (TED) electrical connector
6	Cushion TED electrical connector
7	Power lumbar electrical connector

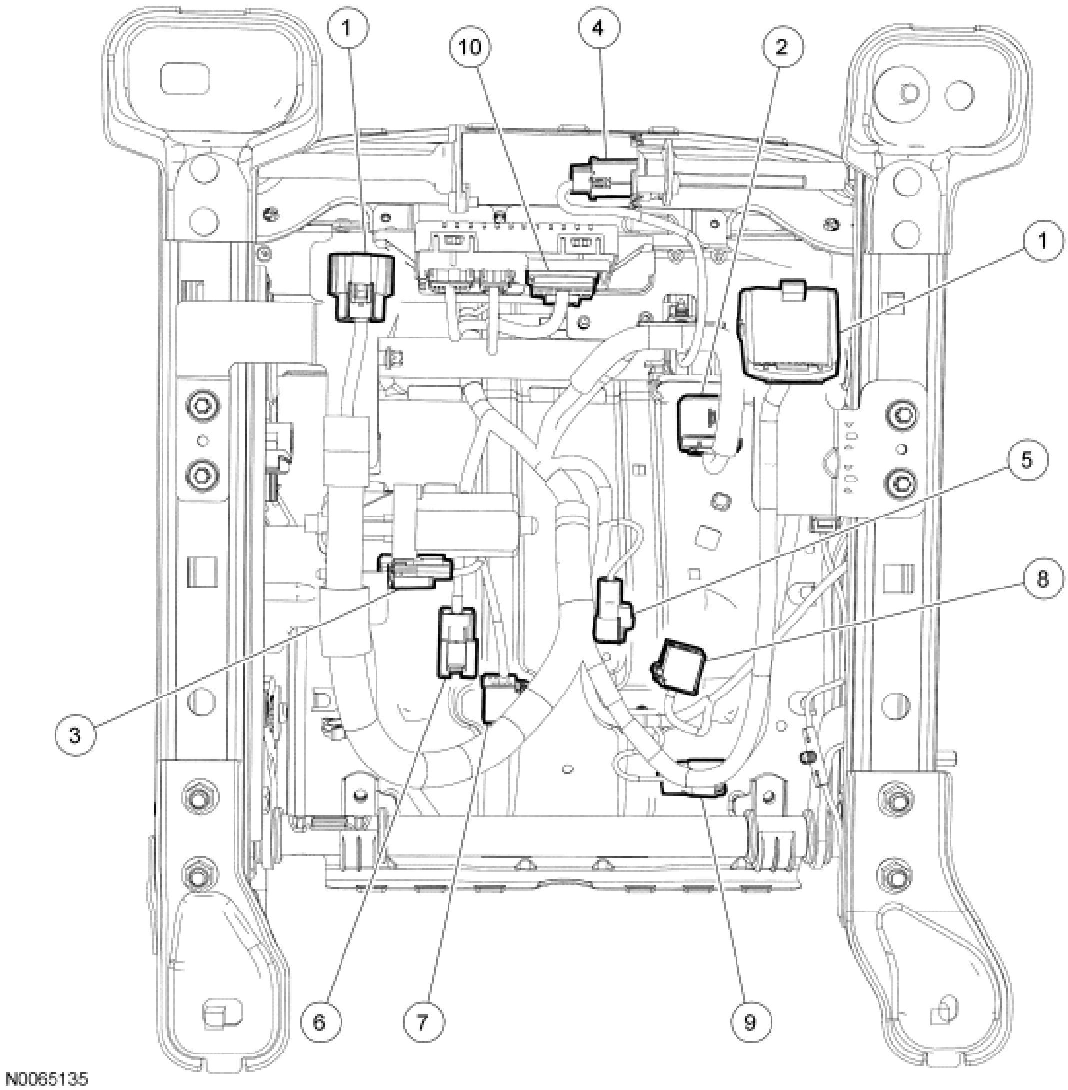


Fig. 383: Cushion Frame With Power Seat Track Attached From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Inline electrical connector-to-vehicle harness electrical connector
2	Occupant classification system module (OCSM) electrical connector
3	Front height motor electrical connector
4	Horizontal motor electrical connector
5	Side air bag electrical connector
6	Power recline electrical connector
7	Backrest thermo-electric device (TED) electrical connector
8	Cushion TED electrical connector
9	Power lumbar electrical connector
10	Dual climate controlled seat module (DCSM) and 3 electrical connectors

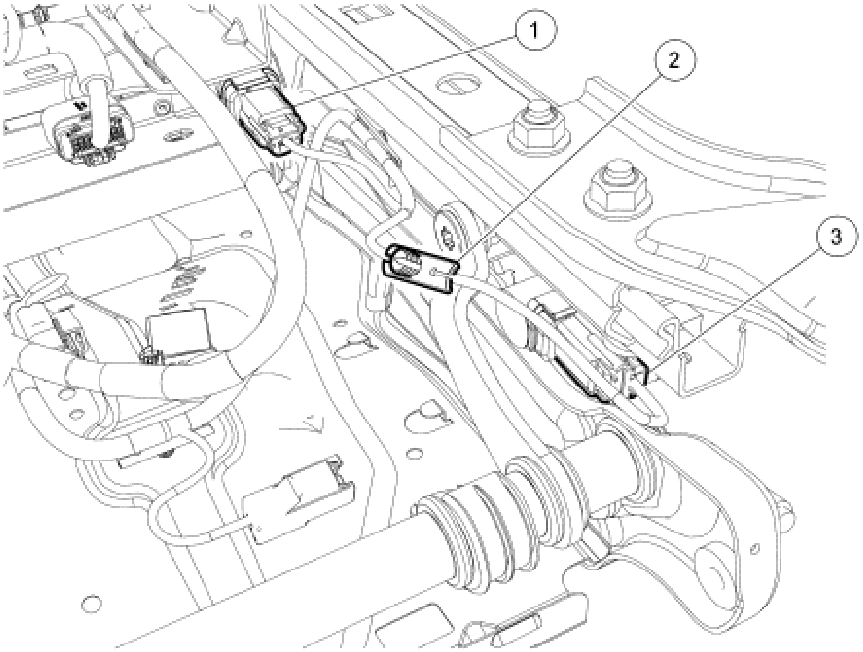


Fig. 384: Inboard Side of Cushion Frame and Power Seat Track From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Front inboard occupant classification sensor (OCS) weight sensor bolt electrical connector
2	Attaches to inboard OCS weight sensor bolt protection bracket
3	Rear inboard OCS weight sensor bolt electrical connector

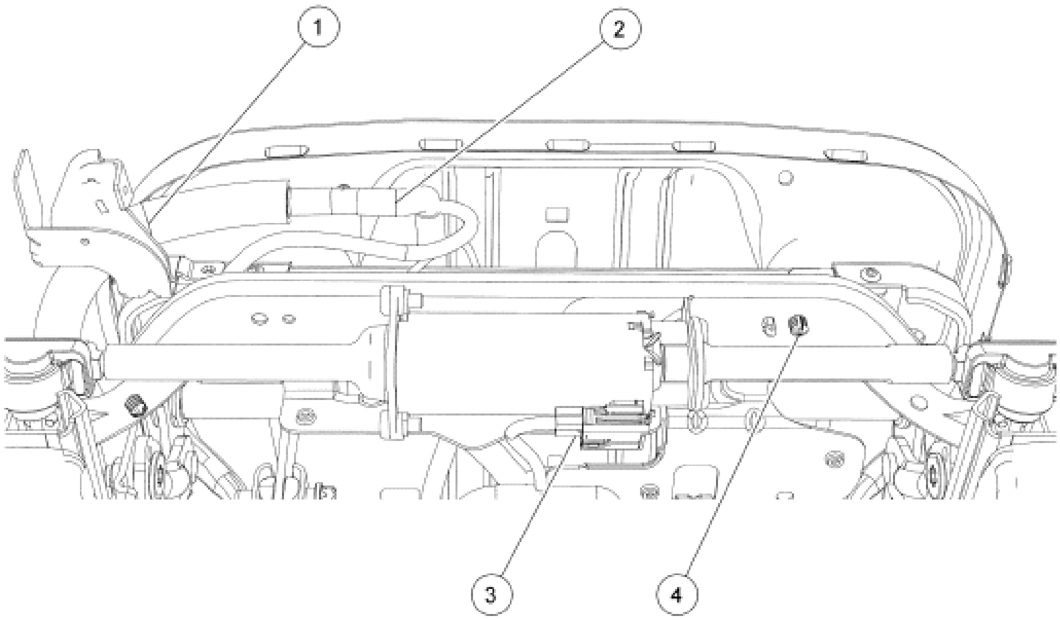


Fig. 385: Front of Cushion Frame and Power Seat Track From Underneath
Courtesy of FORD MOTOR CO.

Item	Description
1	Seat control switch and rear height motor takeout must be routed on top of the bracket
2	Wire harness attachment points
3	Horizontal motor electrical connector
4	Safety belt buckle switch electrical connector pin-type retainer attached in place

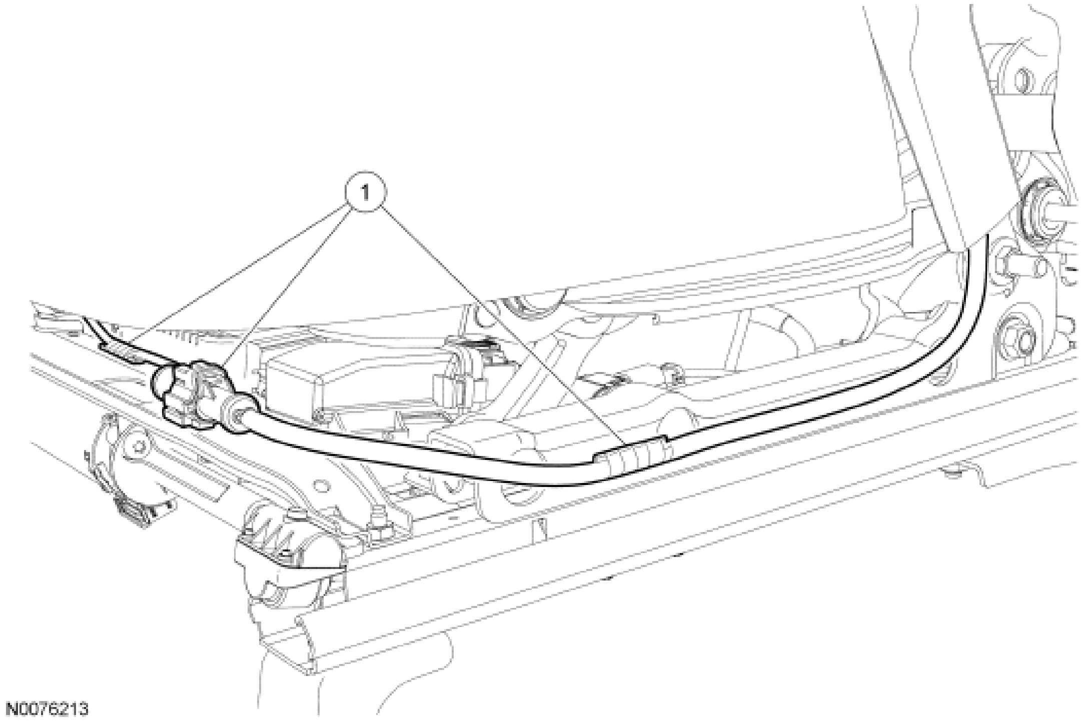


Fig. 386: Front Inboard Side of Cushion Frame and Power Seat Track From Upright
Courtesy of FORD MOTOR CO.

Item	Description
1	Safety belt buckle switch electrical connector and wire harness takeout routing attachment points

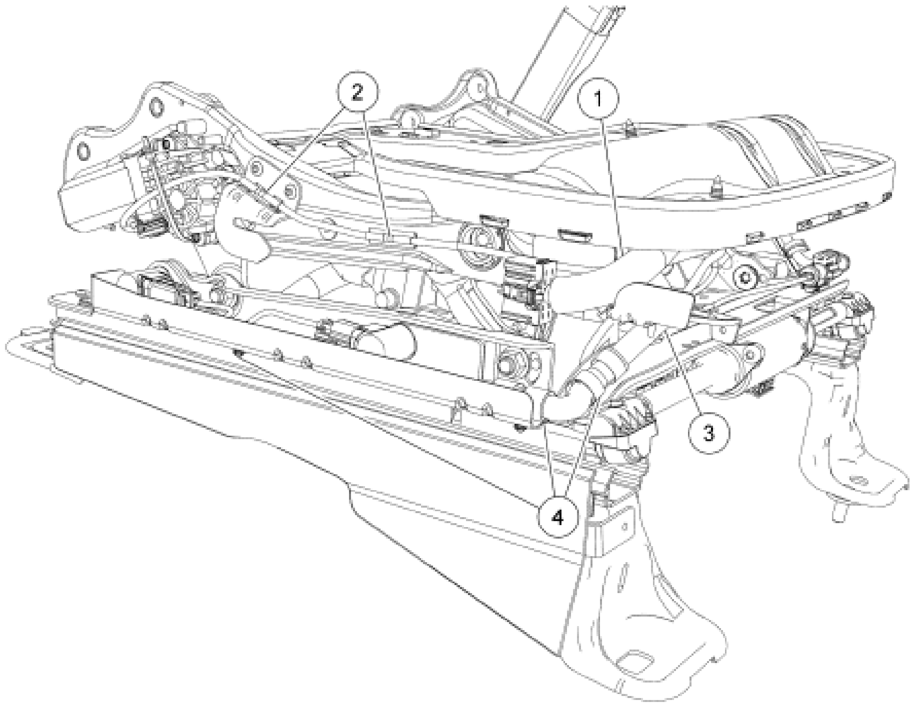


Fig. 387: Front and Outboard Side of Cushion Frame and Power Seat Track From Upright
Courtesy of FORD MOTOR CO.

Item	Description
1	Seat control switch and rear height motor takeout must be routed on top of the bracket
2	Rear height motor takeout attachment points
3	Outboard occupant classification sensor (OCS) weight sensor bolt takeout must be routed under the bracket
4	Outboard OCS weight sensor bolt takeout attachment points

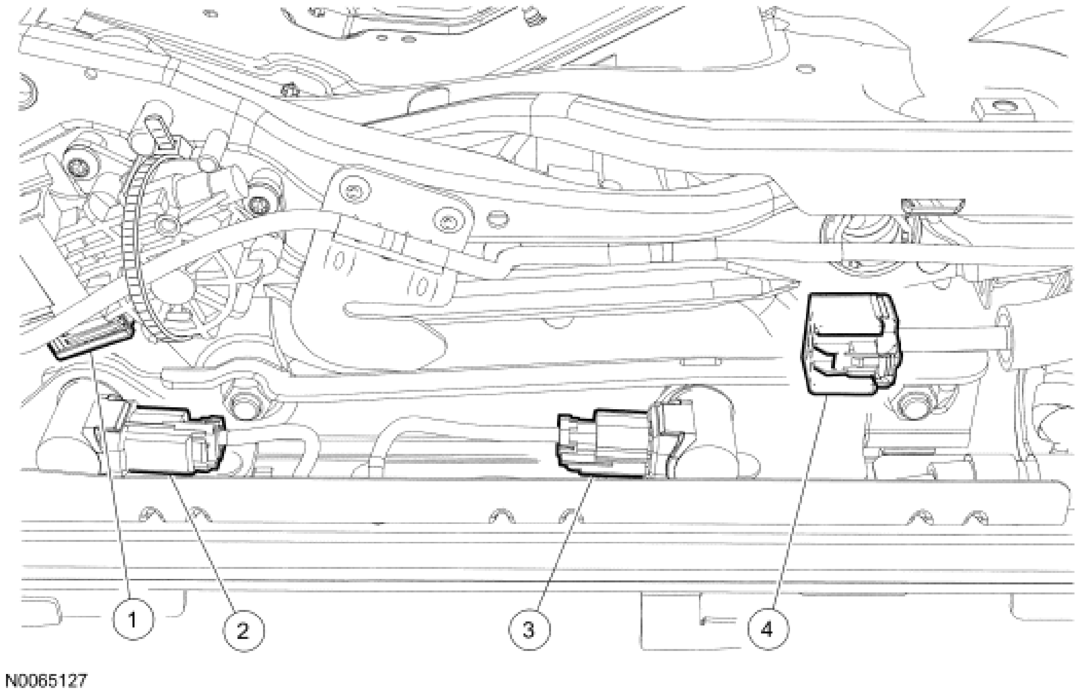


Fig. 388: Outboard of Cushion Frame and Power Seat Track From Upright
Courtesy of FORD MOTOR CO.

Item	Description
1	Rear height motor electrical connector
2	Rear outboard occupant classification sensor (OCS) weight sensor bolt electrical connector
3	Front outboard OCS weight sensor bolt electrical connector
4	Seat control switch electrical connector

1. Make sure the passenger seat cushion wire harness is correctly routed and attached.

REMOVAL AND INSTALLATION

SEAT - FRONT

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

NOTE: Driver seat shown in illustration, passenger similar.

NOTE: For seat track-to-floor bolt torque specification and torque sequence, refer to the steps in this procedure.

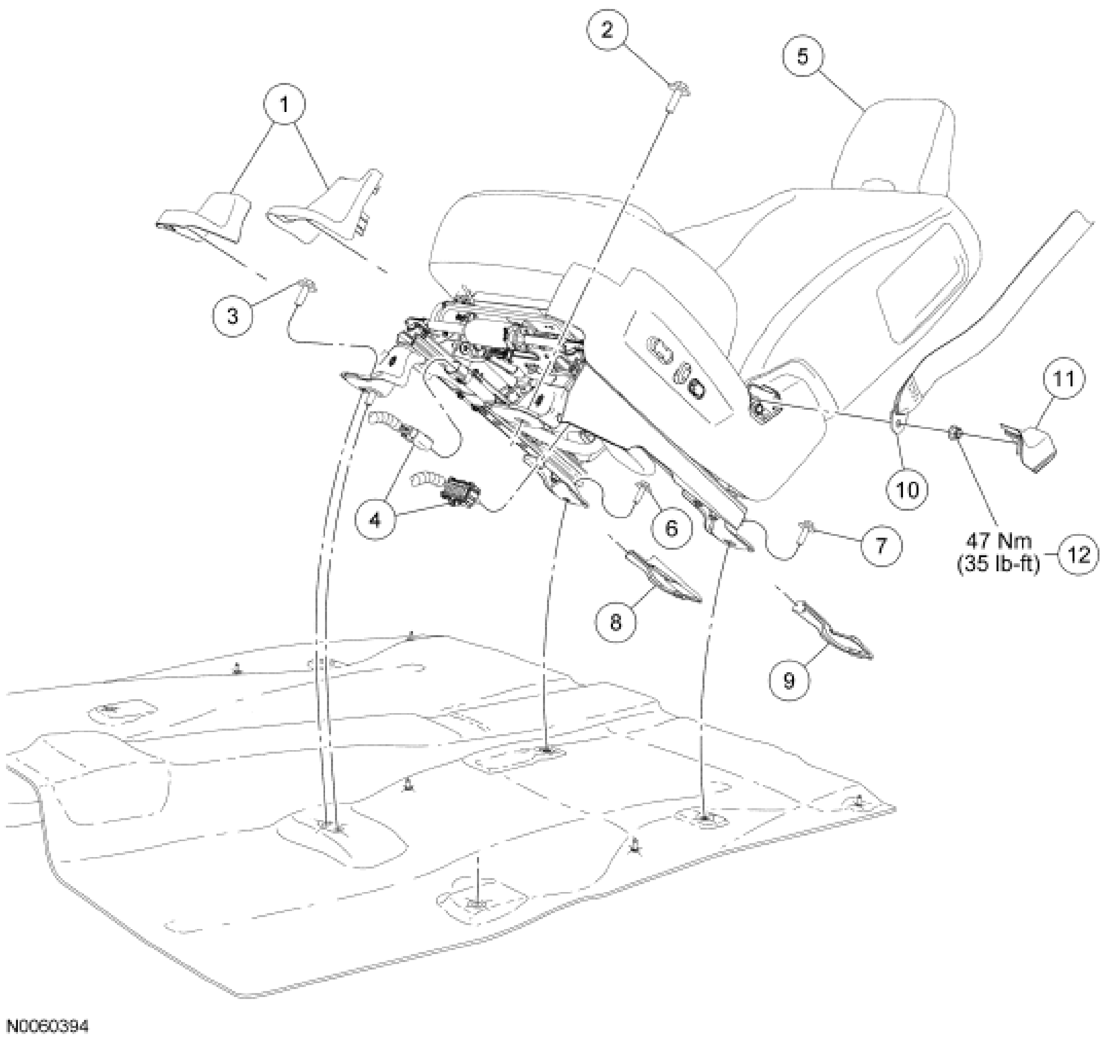


Fig. 389: Exploded View Of Front Seat Components With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	66410	Seat track-to-floor front bolt covers (2 required)
2	W712888	Seat track-to-floor front outboard bolt
3	W712888	Seat track-to-floor front inboard bolt
4	-	Electrical connectors (part of 14A005)
5	-	Front seat assembly
6	W712888	Seat track-to-floor rear inboard bolt

7	W712888	Seat track-to-floor rear outboard bolt
8	61748	Seat track-to-floor rear inboard bolt cover
9	61749	Seat track-to-floor rear outboard bolt cover
10	-	Safety belt retractor belt anchor (part of 611B08 RH/ 611B09 LH)
11	62187	Safety belt retractor belt anchor nut cover
12	-	Safety belt retractor belt anchor nut (part of 611B08 RH/ 611B09 LH)

REMOVAL

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: If servicing a power seat track, if possible, raise the front and rear to its highest point.

1. Position the seat to access all the seat track-to-floor bolts and the safety belt retractor belt anchor nut.
2. Depower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
3. Carefully pull up and out to remove the safety belt retractor belt anchor nut cover from the cushion side shield for access to the safety belt retractor belt anchor nut.
4. Remove the safety belt anchor nut and separate the safety belt anchor from the seat.
5. Pull forward and remove the 2 seat track-to-floor front bolt covers.
6. Remove the 2 seat track-to-floor rear bolt covers in the following sequence.
    1. Push the seat track-to-floor rear bolt cover forward.
    2. Lift to disengage the tab at the front of the seat track-to-floor rear bolt cover.
    3. Slide back and remove the seat track-to-floor rear bolt cover.
        - Repeat for the other side.

7. Remove the 4 seat track-to-floor bolts.
8. Tip the seat back and disconnect the seat electrical connectors.

WARNING: **Use care when handling the front passenger seat and track assembly. Dropping the assembly, placing excessive weight on or sitting on a front passenger seat that is not secured in the vehicle may result in damaged seat components. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.**

NOTE: **Use care when handling the driver seat and track assembly. Dropping the assembly or sitting on a seat not secured in the vehicle may result in damaged components.**

9. Remove the seat from the vehicle.

INSTALLATION

WARNING: **Make sure the front passenger seat is correctly installed and fastened to the vehicle. Do not force the alignment to the floorpan mounting holes. If the seat does not align to the floorpan mounting holes, repair the seat or floorpan as needed. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increase the risk of serious personal injury or death in a crash.**

All seats

1. Position the seat in the vehicle.
2. Tip the seat and connect the electrical connectors.
3. Align the front inboard seat mounting locator to the guide hole in the floor and position the seat in place.
4. Start all the seat track-to-floor bolts by hand.

NOTE: **Driver shown in illustration, passenger similar.**

5. Install the seat track-to-floor bolts.
    1. Install the seat track-to-floor front inboard bolt.
        - Tighten to 55 Nm (41 lb-ft).
    2. Install the seat track-to-floor front outboard bolt.
        - Tighten to 55 Nm (41 lb-ft).
    3. Install the seat track-to-floor rear inboard bolt.
        - Tighten to 55 Nm (41 lb-ft).

4. Install the seat track-to-floor rear outboard bolt.
    - Tighten to 55 Nm (41 lb-ft).

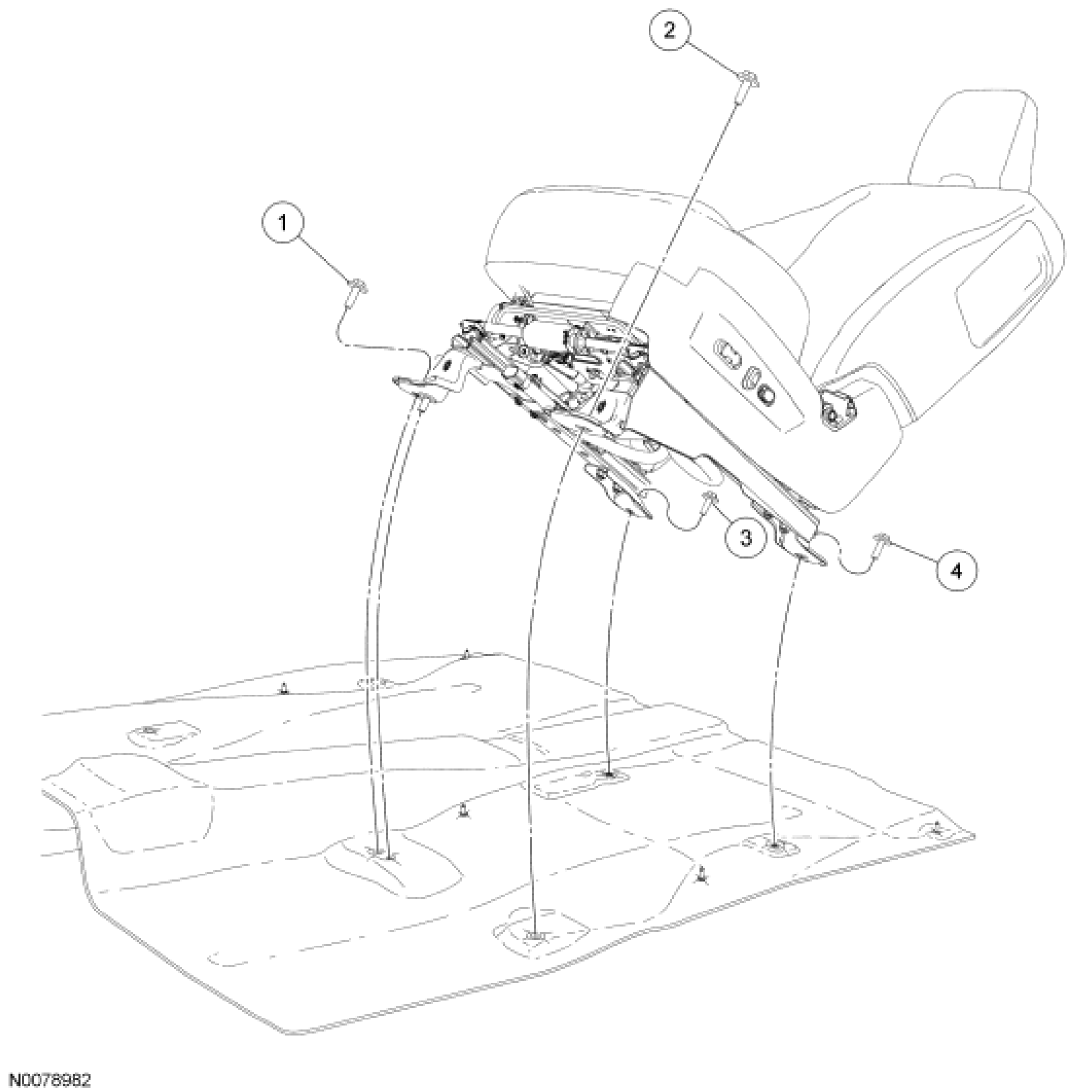


Fig. 390: Seat Track Bolts
Courtesy of FORD MOTOR CO.

6. Install the 4 seat track-to-floor front and rear bolt covers.

NOTE: **Make sure the safety belt webbing is not twisted prior to installation. Failure to follow this instruction may result in incorrect operation of the safety belt retractor.**

7. Position the safety belt retractor belt anchor onto the seat stud and install the safety belt retractor belt anchor nut.

- Tighten to 47 Nm (35 lb-ft).

8. Install the safety belt retractor belt anchor nut cover to the cushion side shield.
9. Repower the SRS. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Passenger seat with existing seat track, occupant classification system module (OCSM) and occupant classification sensor (OCS) weight sensor bolts

10. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Passenger seat with new seat track or OCSM or OCS weight sensor bolt(s)

11. Carry out the Occupant Classification Sensor (OCS) System Reset. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

All seats

12. Check the active restraint system for correct operation. For additional information, refer to safety belt system in the Diagnosis and Testing portion of **SAFETY BELT SYSTEM** article.
    - Make sure the safety belts and buckles are accessible to the occupants after installation.
    - Verify the safety belt retractor operates without excessive effort or binding.

SEAT - EXPLODED VIEW, FRONT

NOTE: **Driver backrest shown in illustration, passenger similar.**

NOTE: **Manual recliners without fold-flat backrest are serviced with the backrest frame. Power recliners without fold-flat backrest are serviced separately.**

NOTE: **A new heater mat will come assembled on a new foam pad.**

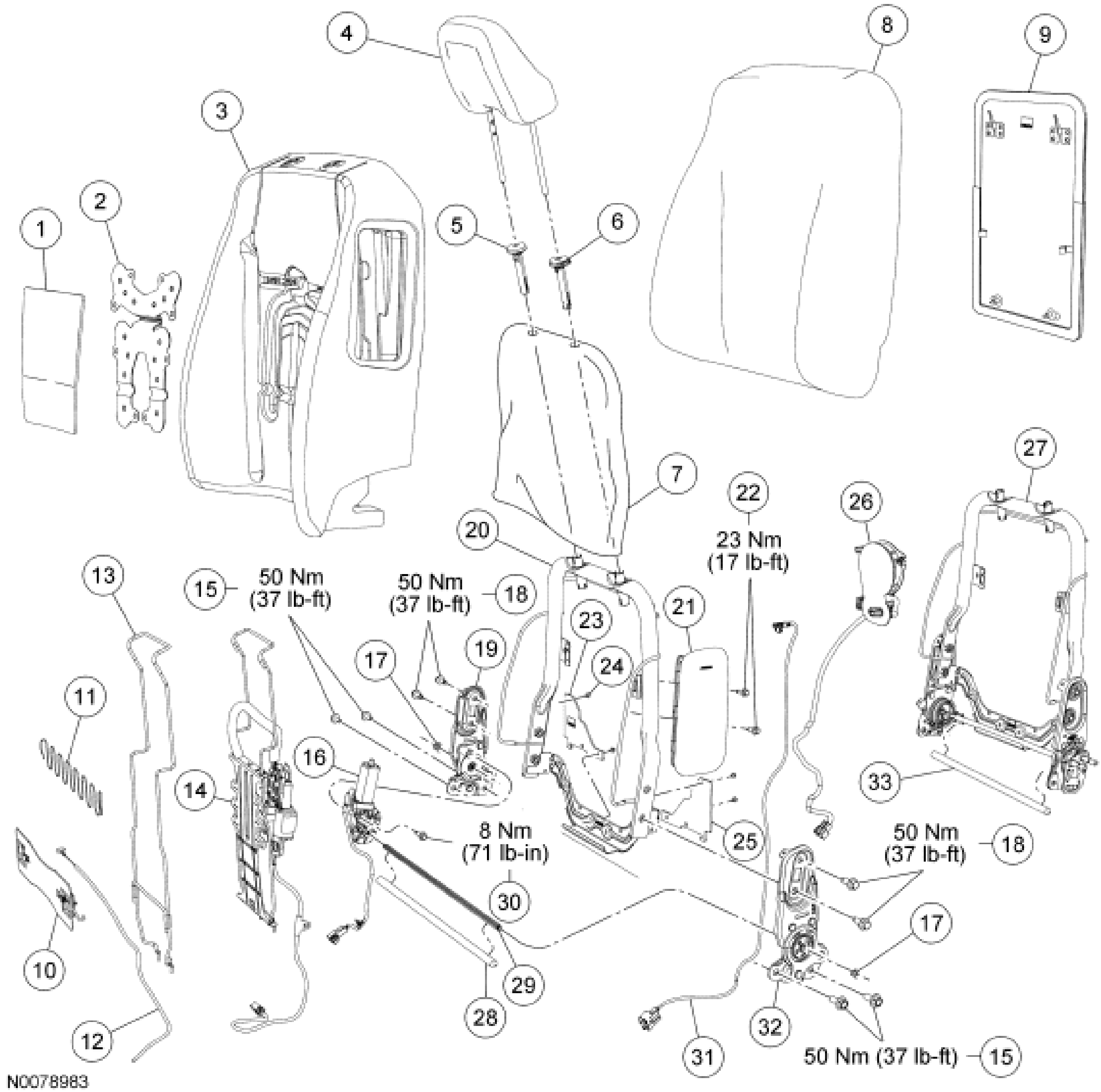


Fig. 391: Front Seat Backrest, Manual and Power Recline, Without Fold Flat
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Backrest heater mat (part of 64811) (if equipped)
2	18D507	Backrest climate control seat manifold (if equipped)
3	64811	Backrest foam pad
4	611A08	Head restraint
5	610A16	Head restraint guide, slave
6	610A16	Head restraint guide, master
7	-	Anti-squeak bag
8	64417	Backrest trim cover

9	-	Backrest trim panel
10	65500	Manual lumbar assembly (if equipped)
11	-	Upper support spring
12	-	Manual lumbar cable (part of 65500) (if equipped)
13	65500	Static lumbar
14	65500	Power lumbar assembly (if equipped)
15	W712240	Power/manual recliner-to-seat track bolts (4 required)
16	14547	Recliner motor (if equipped)
17	-	Recliner torque shaft clips (2 required) (if equipped)
18	W712240	Power recliner-to-backrest frame bolts (4 required) (if equipped)
19	62648	Inboard power recliner (if equipped)
20	61019	Backrest frame (with power recline) (if equipped)
21	611D11	Side air bag module
22	W506021	Side air bag module bolts
23	-	RH attachment panel
24	-	Screw (4 required)
25	-	LH attachment panel
26	18D507	Backrest thermo-electric device (TED) (if equipped)
27	61018	Backrest frame (with manual recline) (if equipped)
28	625A84	Power recline torque shaft cover (if equipped)
29	61726	Recliner torque shaft
30	-	Recliner motor bolt (if equipped)
31	14K155	Side air bag wire harness
32	62648	Outboard power recliner (if equipped)
33	625A84	Manual recline torque shaft cover (if equipped)

NOTE: Optional backrest on passenger seat only.

NOTE: Manual recliners with fold-flat backrest are serviced separately.

NOTE: A new heater mat will come assembled on a new foam pad.

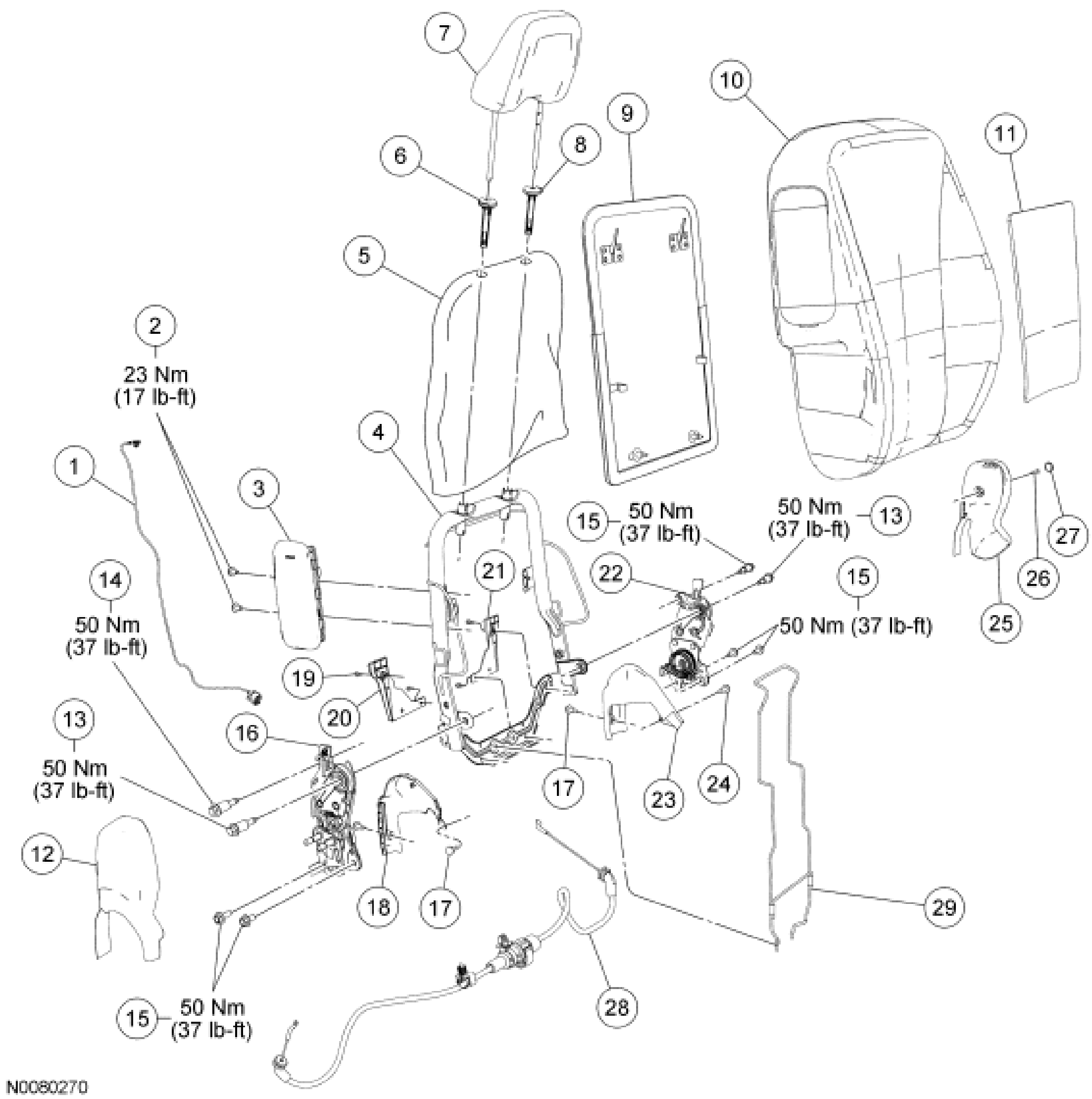


Fig. 392: Front Seat Backrest, Manual Recline With Fold Flat
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14K155	Side air bag wire harness
2	W506021	Side air bag module bolts
3	611D10	Side air bag module
4	-	Fold-flat backrest frame
5	-	Anti-squeak bag
6	610A16	Head restraint guide, slave
7	611A08	Head restraint
8	610A16	Head restraint guide, master
9	60508	Backrest trim panel
10	64810/64416	Backrest foam pad/backrest trim cover

11	-	Backrest heater mat (part of 64810) (if equipped)
12	62186	RH outer fold-flat recliner cover
13	W712059	Fold-flat recliner-to-fold-flat backrest frame front bolts (2 required)
14	W500720	Fold-flat recliner-to-fold-flat backrest frame rear bolts (2 required)
15	W712240	Fold-flat recliner-to-seat track bolts (4 required)
16	-	RH fold-flat recliner
17	62294	Inboard fold-flat recliner cover screws (3 required)
18	62186	RH inboard fold-flat recliner cover
19	-	Screw (4 required)
20	-	RH attachment panel
21	-	LH attachment panel
22	-	LH fold-flat recliner
23	62187	LH inboard fold-flat recliner cover
24	W714053	Scrivet
25	62187	LH outer fold-flat recliner cover
26	62294	LH outer fold-flat recliner cover screw
27	-	Screw cover
28	-	Fold-flat recliner cable
29	65500	Static lumbar

NOTE: Driver seat shown in illustration, passenger similar.

NOTE: A new heater mat will come assembled on a new foam pad.

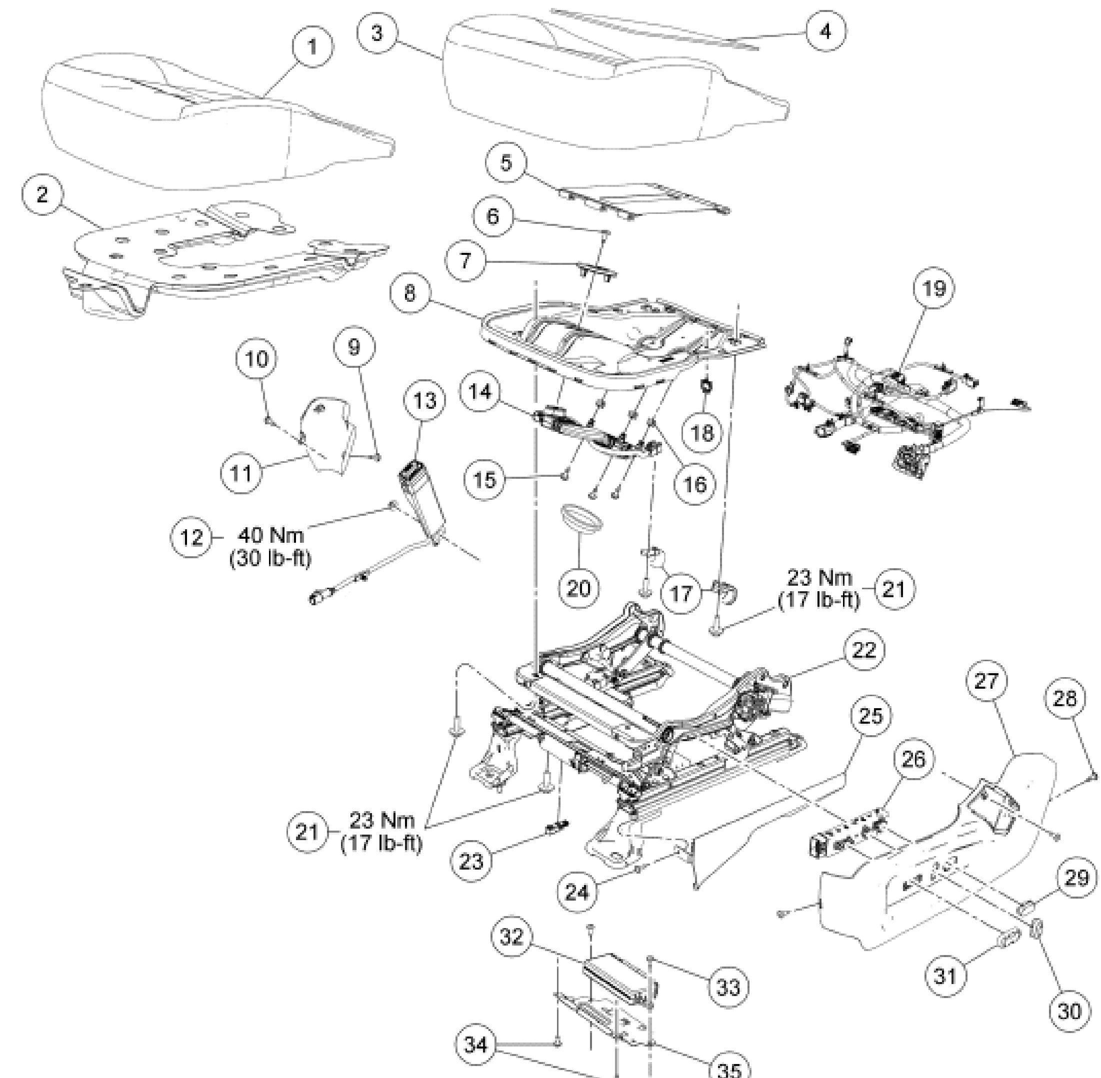


Fig. 393: Seat Cushion With Power Seat Track
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	62901	Cushion trim cover
2	18D507	Cushion climate control seat manifold (if equipped)
3	632A23	Cushion foam pad
4	-	Cushion heater mat (part of 632A23)
5	63226	Cushion support
6	-	Cushion thermo-electric device (TED)-to-climate control seat cushion adapter screw (if equipped)
7	18D507	Cushion TED adapter (if equipped)

8	63100	Cushion frame
9	62294	Recliner side shield screws
10	W714053	Scrivet
11	62187	Recliner side shield
12	-	Safety belt buckle-to-seat track nut (part of 61203)
13	61203	Safety belt buckle
14	18D507	Cushion TED (if equipped)
15	W505945	Cushion TED-to-cushion frame screw (3 required) (if equipped)
16	-	Screw grommet
17	-	Cushion frame-to-seat track rear brackets
18	-	Wire clip
19	14A699	Driver seat wire harness
20	19E880	Cushion TED filter (if equipped)
21	-	Seat track-to-cushion frame bolts (4 required)
22	61711	Power seat track assembly
23	14B416	Seat position sensor (driver only)
24	62294	Seat track cover retainer
25	62187	Seat track cover
26	14A701	Seat control switch
27	62187	Cushion side shield
28	62294	Cushion side shield retainer (3 required)
29	14711	Power lumbar switch knob (if equipped)
30	14711	Power seat recliner knob
31	14711	Seat control switch knob
32	14C708	Driver seat module (DSM) (if equipped)
33	62294	DSM-to-bracket screw (2 required) (if equipped)
34	62294	Bracket-to-seat track screws (if equipped)
35	14A301	DSM bracket (if equipped)

NOTE: A new heater mat will come assembled on a new foam pad.

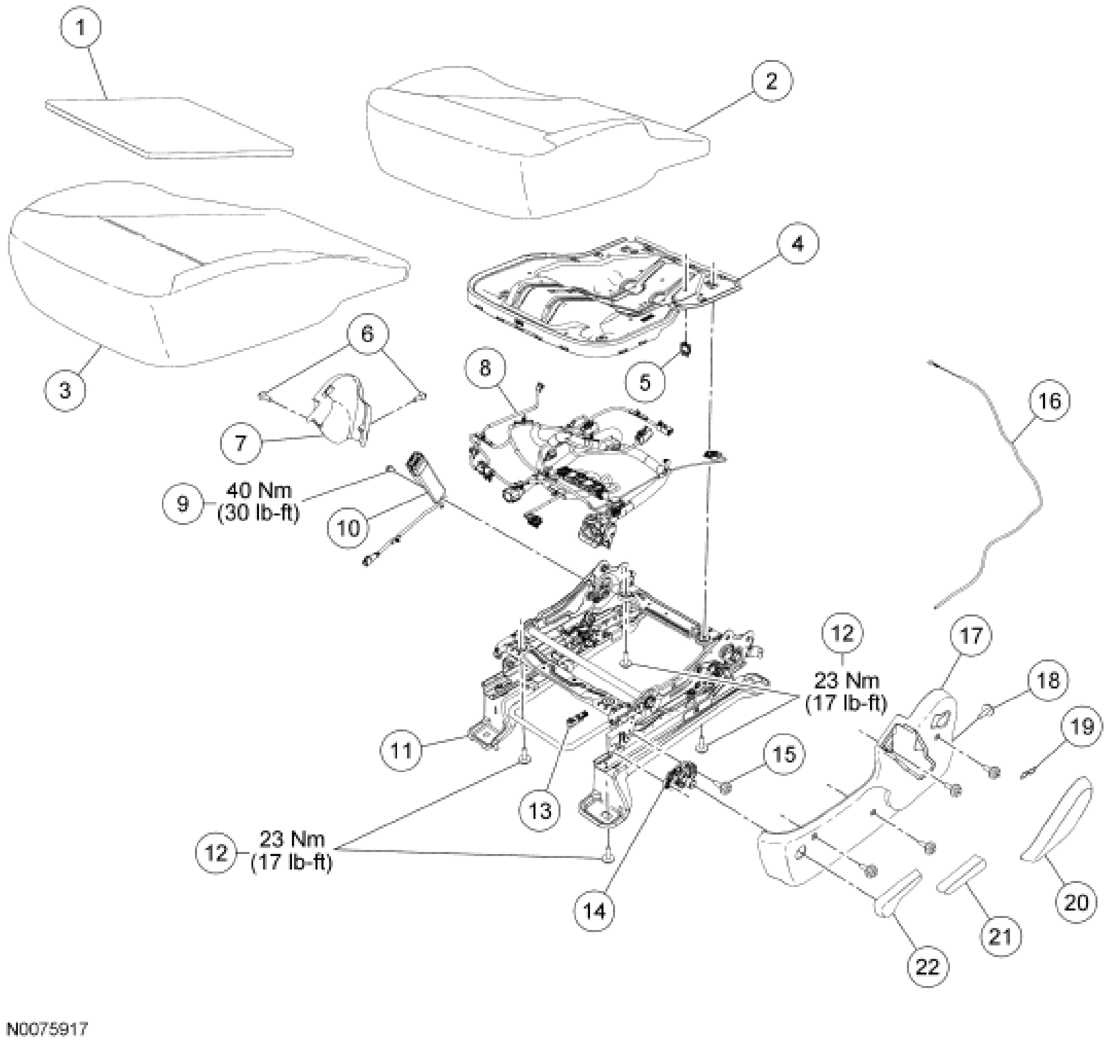


Fig. 394: Driver Seat Cushion With Manual Seat Track
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Cushion heater mat (part of 632A23) (if equipped)
2	62901	Cushion trim cover
3	632A23	Cushion foam pad
4	63100	Cushion frame
5	-	Wire clip
6	62294	Recliner side shield screws
7	-	Recliner side shield
8	14A699	Driver seat wire harness
		Safety belt buckle-to-seat track bolt (part

9	-	of 61203) (manual driver seat track only)
10	61203	Safety belt buckle
11	61711	Manual seat track assembly
12	-	Seat track-to-cushion frame bolts (4 required)
13	14B416	Seat track position sensor
14	610C01	Manual lumbar adjuster (if equipped)
15	62294	Manual lumbar adjuster-to-seat track screw (if equipped)
16	-	Manual lumbar cable (if equipped)
17	62187	Cushion side shield
18	62294	Cushion side shield retainer (4 required)
19	-	Manual recliner handle spring clip
20	61737	Manual recliner handle
21	61737	Manual height adjust handle (if equipped)
22	617B70	Manual lumbar adjust handle (if equipped)

NOTE: **A new heater mat will come assembled on a new foam pad.**

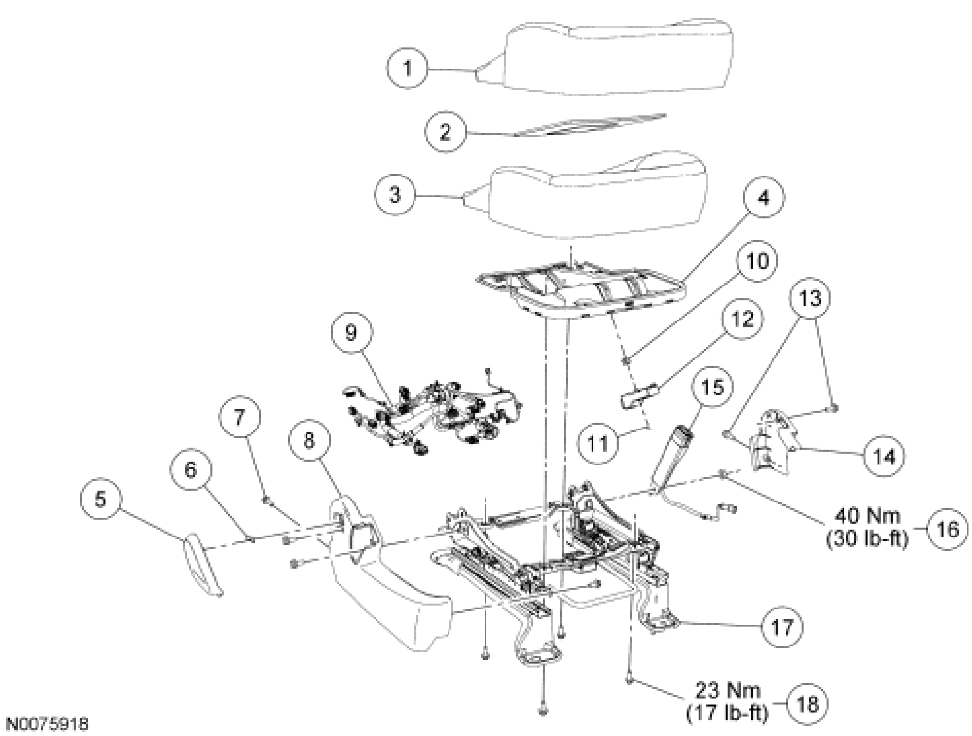


Fig. 395: Passenger Seat Cushion With Manual Seat Track
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	62900	Cushion trim cover
2	-	Cushion heater mat (part of 632A22) (if equipped)
3	632A22	Cushion foam pad
4	63100	Cushion frame
5	61736	Manual recliner handle
6	-	Manual recliner handle cover spring clip
7	62294	Cushion side shield screw (4 required)
8	62186	Cushion side shield
9	14A698	Passenger seat wire harness
10	-	Grommet
11	-	Screw
12	14C724	Heated seat module (if equipped)
13	62294	Recliner side shield screws
14	62187	Recliner side shield
15	61202	Safety belt buckle
16	W520113	Safety belt buckle nut
17	61704	Manual seat track assembly
18	-	Seat track-to-cushion frame bolts (4 required)

NOTE: **To install a new occupant classification system module (OCSM) or an occupant classification sensor (OCS) weight sensor bolt, refer to the appropriate procedure in SUPPLEMENTAL RESTRAINT SYSTEM article.**

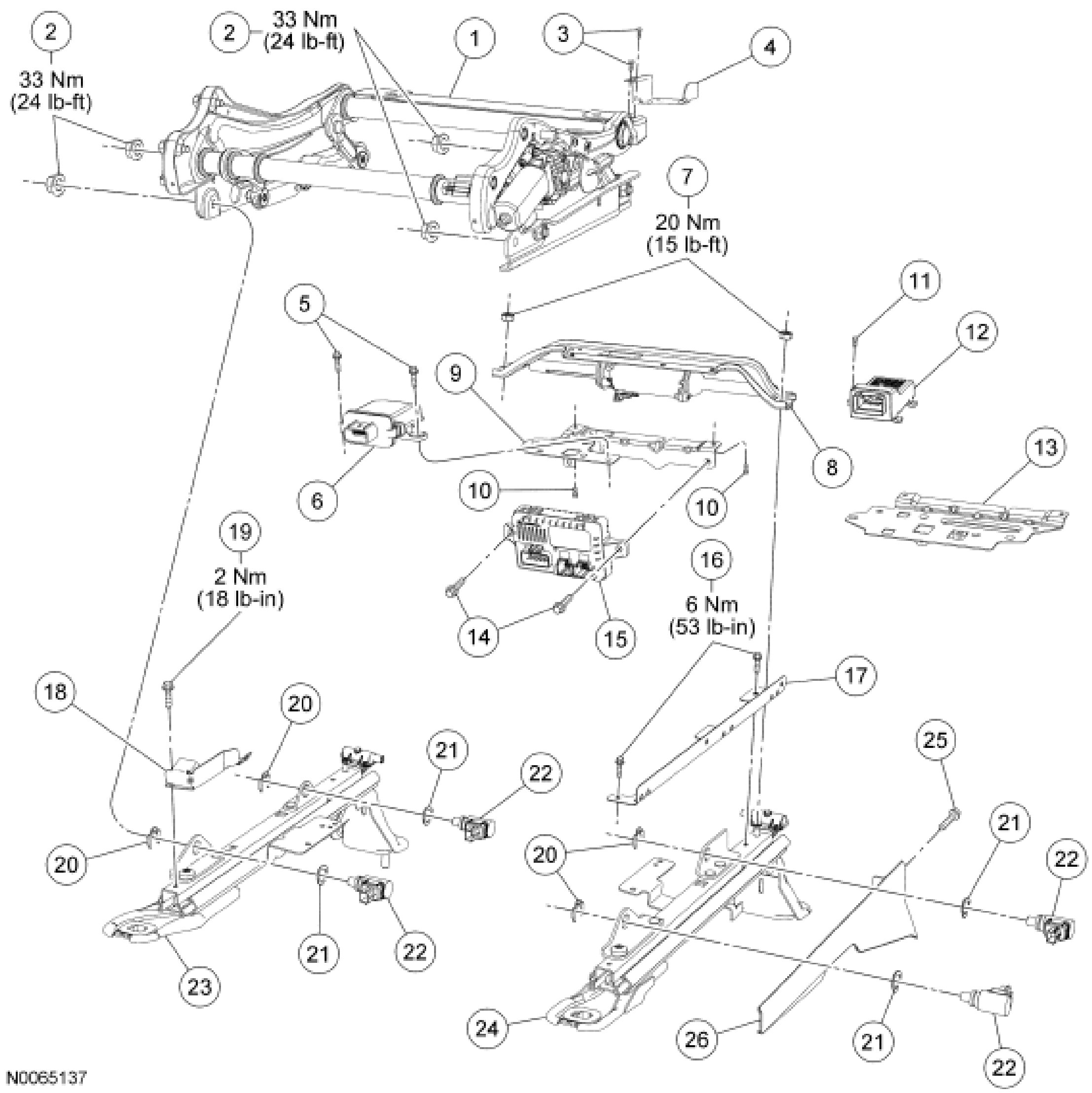


Fig. 396: Passenger Power Seat Track
Courtesy of FORD MOTOR CO.

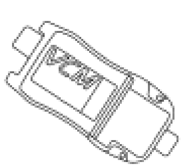
Item	Part Number	Description
1	-	Power seat track adjuster assembly (part of 61710)
2	63100	Occupant classification sensor (OCS) weight sensor bolt nuts (4 required)
3	62294	Cushion side shield bracket screws
4	14A301	Cushion side shield bracket
5	62294	Occupant classification system module (OCSM) retainers
6	14B422	OCSM
7	-	Seat track front cross brace nuts (part of

		61710)
8	-	Seat track front cross brace (part of 61710)
9	14A301	Bracket (with dual climate controlled seat module [DCSM]) (if equipped)
10	62294	Bracket screws
11	-	Heated seat module screw (if equipped)
12	14C724	Heated seat module (if equipped)
13	14A301	Bracket (with heated seat module) (if equipped)
14	62294	DCSM retainers (if equipped)
15	14C724	DCSM (if equipped)
16	62294	Outboard OCS weight sensor bolt protection bracket screws
17	-	Outboard OCS weight sensor bolt protection bracket
18	-	Inboard OCS weight sensor bolt protection bracket
19	62294	Inboard OCS weight sensor bolt protection bracket screw
20	12655	OCS weight sensor bolt retaining clips (4 required)
21	12656	OCS weight sensor bolt spring washers (4 required)
22	14B422	OCS weight sensor bolts (4 required) (part of 61710)
23	-	Inboard seat track rail (part of 61710)
24	-	Outboard seat track rail (part of 61710)
25	62294	Seat track cover retainer
26	62186	Seat track cover

1. For additional information, refer to the appropriate procedure.

SEAT BACKREST - FRONT

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the cushion side shield in the following sequence.
    1. If equipped with manual recline, release the clip and remove the manual recline handle.
    2. If equipped with manual height adjust, pull and remove the manual height adjust handle.

    NOTE: Release the tension on the manual lumbar cable before removing the manual lumbar handle.

    3. If equipped with manual lumbar, release the 2 clips on the back of the manual lumbar handle then pull and remove the manual lumbar handle.
    4. Remove the cushion side shield screw(s).
    5. If equipped with power seat track, slide the cushion side shield up in the rear to release the retainer.
    6. Slide the cushion side shield forward to disengage the retainer.
        - If equipped with manual seat tracks, remove the cushion side shield.
    7. If equipped with power seat tracks, disconnect the seat control switch electrical connector.
        - Remove the cushion side shield.
3. Remove the screw and the scrivet and the recliner side shield.

Seats with manual lumbar

4. Remove the manual lumbar cable from the manual lumbar adjuster in the following sequence.
    1. Remove the manual lumbar adjuster bracket screw.
    2. Separate the manual lumbar adjuster from the bracket.
    3. Remove the manual lumbar cable from the manual lumbar adjuster.

Passenger seat with fold-flat backrest

5. Separate the recliner cable casing and Z-fitting from the LH fold-flat recliner.

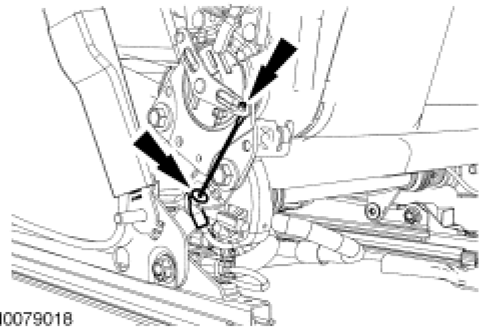


Fig. 397: Separating Recliner Cable Casing & Z-Fitting From LH Fold Flat Recliner
Courtesy of FORD MOTOR CO.

6. Separate the recliner cable casing and Z-fitting from the RH fold-flat recliner.

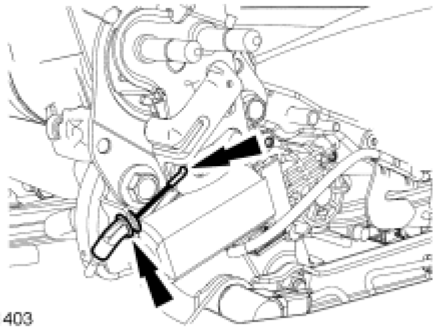


Fig. 398: Separating Recliner Cable Casing & Z-Fitting From RH Fold Flat Recliner
Courtesy of FORD MOTOR CO.

All seats

7. Disconnect the following electrical connectors, release any retainers and route out the wire harness for following components:
   - Side air bag module (if equipped).
   - Power lumbar motor (if equipped).
   - Power recline motor (if equipped).
   - Thermo-electric device (TED) (if equipped).
   - Backrest heater mat (if equipped).
8. Remove the 4 recliner-to-seat track bolts and remove the backrest assembly.
   - If equipped, route out the manual lumbar cable.

INSTALLATION

All seats

1. Position the backrest assembly to the seat track and install the 4 recliner-to-seat track bolts.
   - Route the manual lumbar cable (if equipped).
   - Tighten to 50 Nm (37 lb-ft).
2. Route the wire harnesses, connect the electrical connectors and attach the retainers for the following parts. For correct front passenger seat cushion wire harness routing, refer to **Seat Wire Harness Routing - Front Passenger Cushion**.
   - The side air bag module.
   - The power lumbar motor (if equipped).
   - The power recline motor (if equipped).
   - The TED (if equipped).
   - The backrest heater mat (if equipped).

   Passenger seat with fold-flat backrest

3. Install the Z-fitting to the RH fold-flat recliner and attach the recliner cable casing.

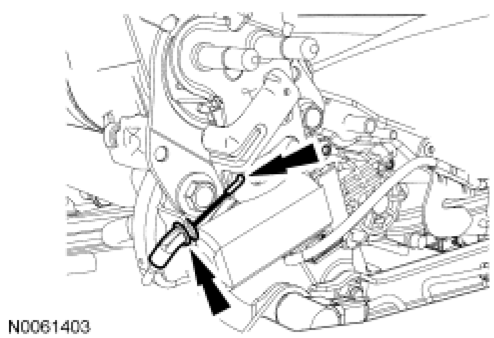


Fig. 399: Separating Recliner Cable Casing & Z-Fitting From RH Fold Flat Recliner
Courtesy of FORD MOTOR CO.

4. Install the Z-fitting to the LH fold-flat recliner and attach the recliner cable casing.

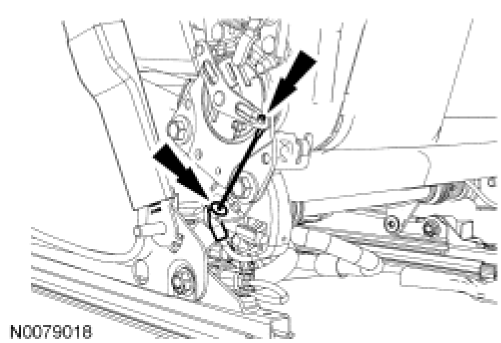


Fig. 400: Separating Recliner Cable Casing & Z-Fitting From LH Fold Flat Recliner
Courtesy of FORD MOTOR CO.

5. Adjust the fold-flat recliner cable in the following sequence.

1. Release the fold-flat recliner cable locking clip, allowing the cable to self-adjust.
2. Position the backrest upright, locking the recliners in place.
3. Apply force to the backrest, verifying the recliners are locked in place.
4. Lock the locking clip back in place.

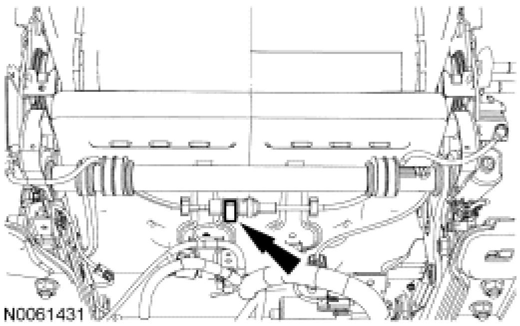


Fig. 401: Locating Fold Flat Recliner Cable Locking Clip
Courtesy of FORD MOTOR CO.

Seats with manual lumbar

6. Install the manual lumbar adjuster in the following sequence.
    1. Install the manual lumbar cable to the manual lumbar adjuster.
    2. Position the manual lumbar adjuster to the bracket.
    3. Install the manual lumbar adjuster bracket screw.

All seats

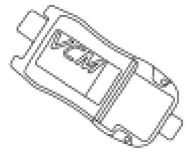
7. Position the recliner side shield and install the screw and scrivet.
8. Install the cushion side shield in the following sequence.
    1. Position the side shield to the seat and connect the seat control switch electrical connector (if equipped).
    2. Slide the cushion side shield rearward to engage the cushion side shield retainer to the seat track bracket.
    3. If equipped with power seat track, slide the cushion side shield down in the rear to engage the retainer.
    4. Install the cushion side shield screw(s).
    5. Install the manual lumbar handle (if equipped).
    6. Install the manual height adjust handle (if equipped).
    7. Position the clip on the manual recline handle and install the manual recline handle (if equipped).
9. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

Passenger seat

10. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT BACKREST COVER - FRONT, WITHOUT FOLD FLAT

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

WARNING: **Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

WARNING: **Front seat backrest trim covers installed on seats equipped with seat side air bags cannot be repaired. A new trim cover must be installed. Cleaning is permissible. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increase the risk of serious personal injury or death in a crash.**

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of**

faults before releasing the vehicle to the customer.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.

NOTE: **The seat backrest trim cover and foam pad have been removed to show the backrest trim panel retainers.**

2. Remove the backrest trim panel in the following sequence.
   1. Release the 2 pin-type retainers at the bottom of the backrest trim panel.
   2. Slide the backrest trim panel down to release the upper clips.
   3. Turn the backrest trim panel to release the middle clips and remove the backrest trim panel.

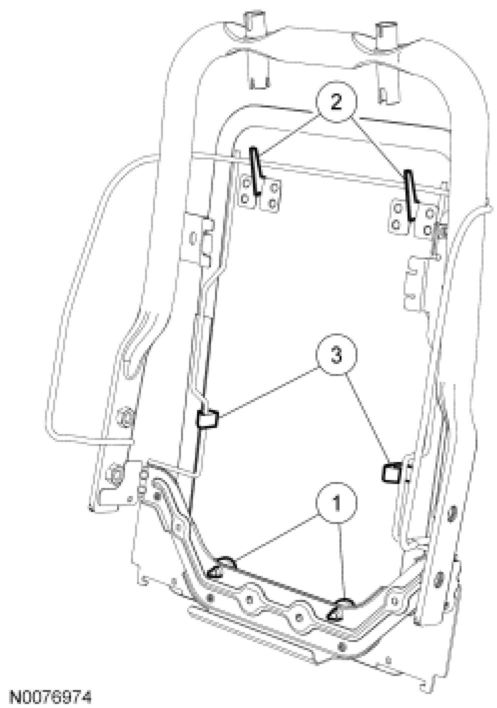


Fig. 402: Locating Pin-Type Retainers, Upper Clips & Middle Clips
Courtesy of FORD MOTOR CO.

NOTE: **Lower outer J-clips are unfastened to show inner J-clips.**

3. Release the backrest trim cover outer and inner J-clips.

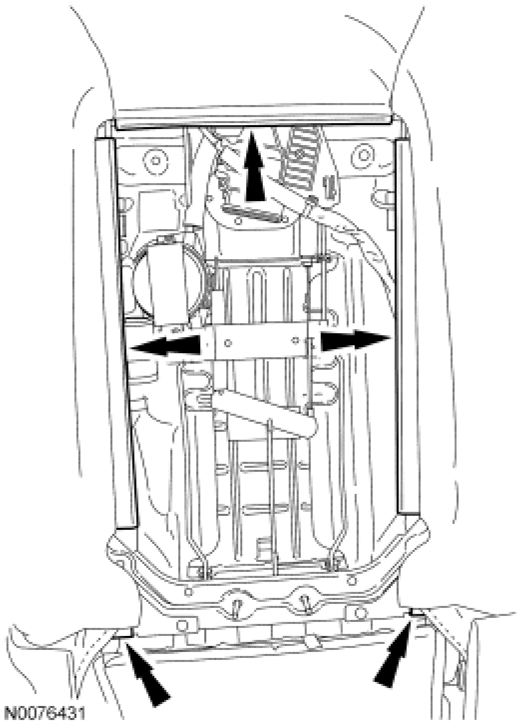


Fig. 403: Locating Inner J-Clips
Courtesy of FORD MOTOR CO.

4. Remove the head restraint.
    1. Using an appropriate tool, push in the hole, lift up on the head restraint and release one side of the head restraint.
    2. Push the release button and remove the head restraint.

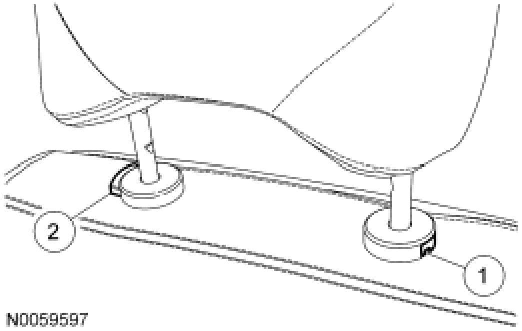


Fig. 404: Locating Release Button On Head Restraint
Courtesy of FORD MOTOR CO.

NOTE: Always install a new slave head restraint guide.

5. Pull out and remove the master and slave head restraint guides.

NOTE: When installing, make sure the side air bag module wiring harness is not pinched between the side air bag module and the backrest frame or damage to the wiring harness can occur.

NOTE: When installing the side air bag module, new bolts must be installed.

6. Through the rear of the seat, remove and discard the 2 side air bag module bolts. Then separate the side air bag module from the seat backrest.
   - To install, tighten to 23 Nm (17 lb-ft).

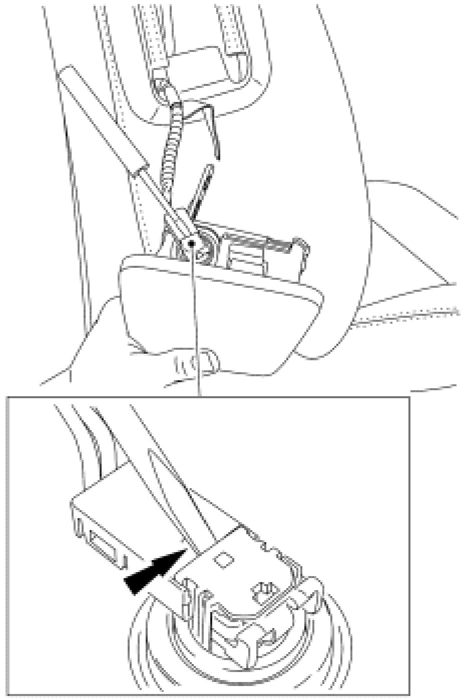
NOTE: Do not pull the side air bag module electrical connector out by the locking button. Damage to the locking button can occur.

NOTE: Do not install the side air bag module electrical connector by the locking button. Damage to the locking button can occur.

NOTE: The side air bag module electrical connector locking button must be in the released position when the connector is being installed or connector damage may occur.

NOTE: The side air bag module electrical connector is unique and cannot be reversed when connected to the side air bag module. Match the electrical connector key to the keyway in the side air bag module. Do not force the electrical connector into the side air bag module or damage can occur.

7. Using a small screwdriver as shown in illustration, lift up and release the locking button on the side air bag module electrical connector. With the locking button released, remove the electrical connector and the side air bag module.



N0056883

Fig. 405: Lifting Up & Releasing Locking Button On Side Air Bag Module Electrical Connector Using A Small Screwdriver
Courtesy of FORD MOTOR CO.

NOTE:	**Use care when separating the backrest trim cover from the hook-and-loop strips, or the hook-and-loop strips can be torn from the backrest foam pad.**

NOTE:	**A new heater mat will come assembled on a new foam pad.**

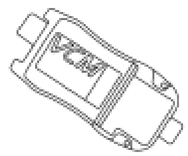
8. Remove the backrest trim cover from the backrest foam pad in the following sequence.
    1. Invert the backrest trim cover in an inside out fashion to the wire in the backrest trim cover attached to the clips in the backrest foam pad.
        - Separate the hook-and-loop strips.
    2. Separate the backrest trim cover wire from the clips in the backrest foam pad.
        - If equipped with climate controlled seats, on assembly make sure the manifold is in place before snapping the backrest trim cover wire back into the backrest foam pad clips.
    3. Remove the backrest trim cover.
        - When installing the backrest trim cover, tuck the hook-and-loop strips into the backrest foam pad trenches last to get the best trim cover appearance.
9. To install, reverse the removal procedure.
10. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

Passenger seat

11. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT BACKREST COVER - FRONT, WITH FOLD FLAT

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

WARNING: **Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

WARNING: **Front seat backrest trim covers installed on seats equipped with seat side air bags cannot be repaired. A new trim cover must be installed. Cleaning is permissible. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increase the risk of serious personal injury or death in a crash.**

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Only the front passenger seat can come equipped with optional fold-flat backrest.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the screw and the LH outer fold-flat recliner cover.
3. Remove the RH outer fold-flat recliner cover in the following sequence.
    1. Pull to release the clips.
    2. Slide up to disengage the retainer and remove.

Seats with heat

4. From under the seat, disconnect the backrest heater mat electrical connector, release any pin-type retainers and route out the wire harness.

All seats

5. From under the seat, disconnect the side air bag electrical connector, release any pin-type retainers and route out the wire harness.
6. Remove the 4 fold-flat recliner-to-fold-flat backrest frame bolts and remove the backrest.
    - To install, tighten to 50 Nm (37 lb-ft).

NOTE: The seat backrest trim cover and foam pad have been removed to show the backrest trim panel retainers.

7. Remove the backrest trim panel in the following sequence.
    1. Release the 2 pin-type retainers at the bottom of the backrest trim panel.
    2. Slide the backrest trim panel down to release the upper clips.
    3. Turn the backrest trim panel to release the middle clips and remove the backrest trim panel.

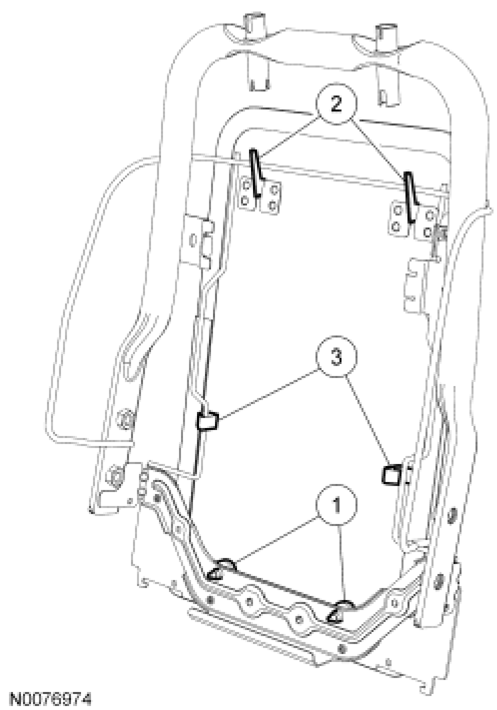


Fig. 406: Locating Pin-Type Retainers, Upper Clips & Middle Clips
Courtesy of FORD MOTOR CO.

NOTE: Lower outer J-clips are unfastened to show inner J-clips.

8. Release the backrest trim cover outer and inner J-clips.

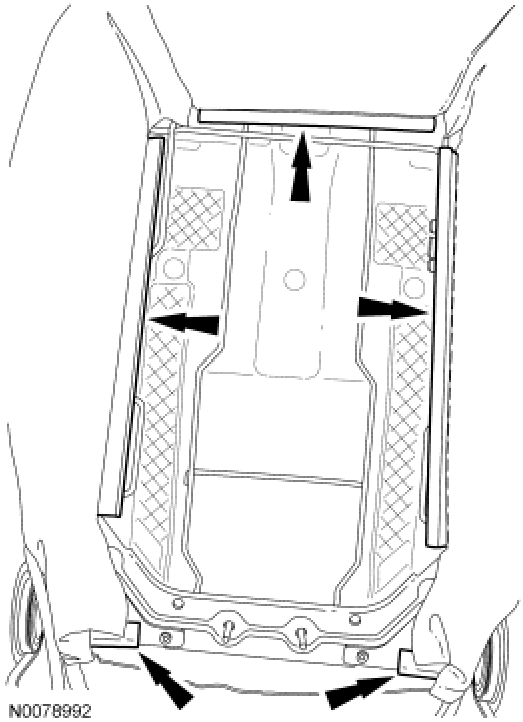


Fig. 407: Locating J-Clips
Courtesy of FORD MOTOR CO.

9. Remove the head restraint.
   1. Using an appropriate tool, push in the hole, lift up on the head restraint and release one side of the head restraint.
   2. Push the release button and remove the head restraint.

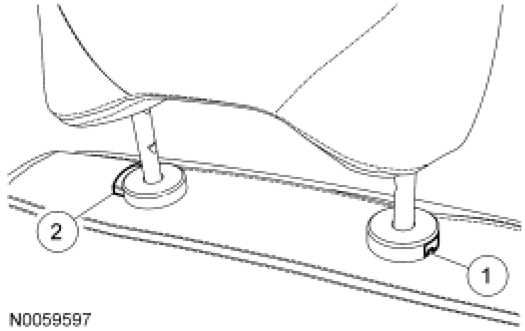


Fig. 408: Locating Release Button On Head Restraint
Courtesy of FORD MOTOR CO.

NOTE: **Always install a new slave head restraint guide.**

10. Pull out and remove the master and slave head restraint guides.

NOTE: Use care when separating the backrest trim cover from the hook-and-loop strips, or the hook-and-loop strips can be torn from the backrest foam pad.

11. Separate the backrest trim cover-to-backrest foam pad hook-and-loop strips.

NOTE: When installing, make sure the side air bag module wiring harness is not pinched between the side air bag module and the backrest frame or damage to the wiring harness can occur.

NOTE: When installing the side air bag module, new bolts must be installed.

12. Through the rear of the seat, remove and discard the 2 side air bag module bolts. Then separate the side air bag module from the seat backrest.
    - To install, tighten to 23 Nm (17 lb-ft).

NOTE: Do not pull the side air bag module electrical connector out by the locking button. Damage to the locking button can occur.

NOTE: Do not install the side air bag module electrical connector by the locking button. Damage to the locking button can occur.

NOTE: The side air bag module electrical connector locking button must be in the released position when the connector is being installed or connector damage may occur.

NOTE: The side air bag module electrical connector is unique and cannot be reversed when connected to the side air bag module. Match the electrical connector key to the keyway in the side air bag module. Do not force the electrical connector into the side air bag module or damage can occur.

13. Using a small screwdriver as shown in illustration, lift up and release the locking button on the side air bag module electrical connector. With the locking button released, remove the electrical connector and the side air bag module.

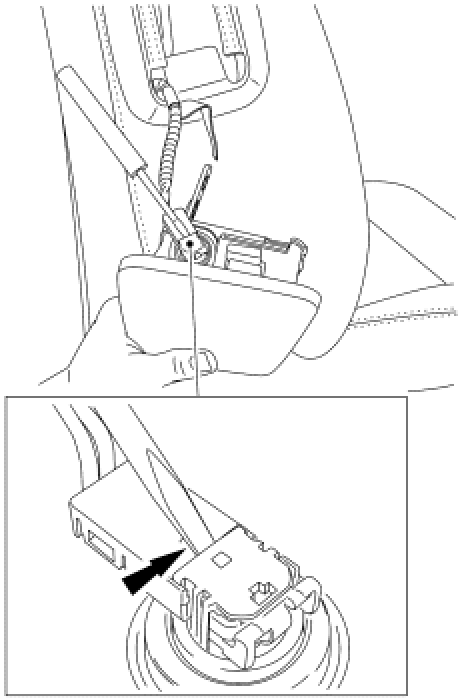

N0056883

Fig. 409: Lifting Up & Releasing Locking Button On Side Air Bag Module Electrical Connector Using A Small Screwdriver
Courtesy of FORD MOTOR CO.

NOTE: Use care when separating the backrest trim cover from the hook-and-loop strips, or the hook-and-loop strips can be torn from the backrest foam pad.

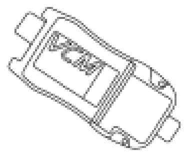
NOTE: A new heater mat will come assembled on a new foam pad.

14. Remove the backrest trim cover in the following sequence.
    1. Invert the backrest trim cover in an inside out fashion to the wire in the backrest trim cover attached to the clips in the backrest foam pad.
        - Separate the hook-and-loop strips.
    2. Separate the backrest trim cover wire from the clips in the backrest foam pad.
    3. If equipped, feed out the backrest heater mat and side air bag module wire harness from the opening in the side of the backrest trim cover.
    4. Remove the backrest trim cover.
15. To install, reverse the removal procedure.
    - For correct front passenger seat cushion wire harness routing at installation, refer to **Seat Wire Harness Routing - Front Passenger Cushion**.
16. Install the front seat. **Do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.
17. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional

information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT CUSHION - FRONT

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Release all wire harness and connector retainers to the cushion frame.

Passenger seat with fold-flat backrest

3. Separate the fold-flat recliner cable holders from the bottom of the cushion frame.

Seats with climate control

4. Disconnect the cushion thermo-electric device (TED).

Passenger seat with manual track and heat

5. Disconnect the heated seat module electrical connector and separate the pin-type retainers from the cushion frame.

Seats with heat

6. Disconnect the 2 heated seat electrical connectors and separate the pin-type retainers from the cushion frame.

   All seats

7. Remove the 4 cushion frame-to-seat track bolts and the cushion assembly.

INSTALLATION

Passenger seat with fold-flat backrest

1. Make sure the fold-flat recliner cable is routed correctly between the power seat track cross tube and cushion frame.

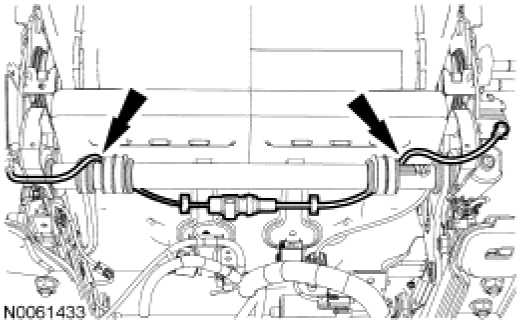


Fig. 410: Locating Fold Flat Recliner Cable
Courtesy of FORD MOTOR CO.

   All seats

2. Position the cushion assembly and install the 4 cushion frame-to-seat track bolts.
   - With power seat track, make sure the cushion frame-to-seat track rear brackets are aligned correctly with the tabs seated in the cushion frame (if equipped).
   - Tighten to 23 Nm (17 lb-ft).

   All passenger seats

3. For correct front passenger seat cushion wire harness routing, refer to **Seat Wire Harness Routing - Front Passenger Cushion**.

   Passenger seat with fold-flat backrest

4. Attach the 2 fold-flat recliner cable holders to the bottom of the cushion frame.

   Seats with heat

5. Route the heated seat wire harness, connect the 2 heated seat electrical connectors and attach the pin-type

retainers to the cushion frame.

Passenger seat with manual track and heat

6. Connect the heated seat module electrical connector and attach the pin-type retainers to the cushion frame.

Seats with climate control

7. Connect the cushion TED.

All seats

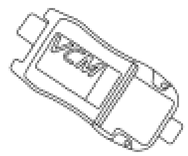
8. Attach any remaining wire harness and connector retainers to the cushion frame.
9. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

Passenger seat

10. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT CUSHION COVER - FRONT

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the front seat cushion. For additional information, refer to **Seat Cushion - Front**.

3. Release the cushion trim cover retainers from the cushion frame and remove the cushion trim cover and cushion foam pad.

NOTE: Use care when separating the cushion trim cover from the hook-and-loop strips, or the hook-and-loop strips can be torn from the cushion foam pad.

NOTE: A new heater mat will come assembled on a new foam pad.

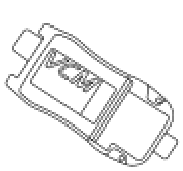
4. Remove the cushion trim cover in the following sequence.
    1. Separate the hook-and-loop strips.
    2. Separate the cushion trim cover wire retainer from the clips in the cushion foam pad.
        - For vehicles with climate controlled seats, on assembly make sure the climate controlled seat manifold is in place before snapping the cushion trim cover wire retainer back into the cushion foam pad.
    3. Remove the cushion trim cover.
5. To install, reverse the removal procedure.
6. Install the front seat cushion. For additional information, refer to **Seat Cushion - Front**.
    - For correct front passenger seat cushion wire harness routing, refer to **Seat Wire Harness Routing - Front Passenger Cushion**.
7. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

    Passenger seat

8. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT TRACK

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL

WARNING: Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of

serious personal injury or death.

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: To install a new occupant classification system module (OCSM) or an occupant classification sensor (OCS) weight sensor bolt, refer to the appropriate procedure in SUPPLEMENTAL RESTRAINT SYSTEM article.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the front seat backrest. For additional information, refer to **Seat Backrest - Front**.
3. Separate the seat wire harness main feed electrical connector(s) from the seat track brackets.
4. Disconnect the safety belt buckle switch electrical connector. Separate any retainers holding the wire harness or electrical connector to the seat track.
5. Disconnect all the seat track motor electrical connectors and separate any retainers holding the wire harness or electrical connectors to the seat track (if equipped).

Driver seat

6. Disconnect the seat track position sensor and separate any retainers holding the wire harness or electrical connectors to the seat track.
7. Disconnect the driver seat module (DSM) electrical connectors and separate any retainers holding the wire harness to the seat track (if equipped).

Passenger seat with manual seat track

NOTE: Rear inboard OCS weight sensor bolt protection bracket shown in illustration, others similar.

8. Separate the wire harness from the OCS weight sensor bolt protection brackets, remove the 4 OCS weight sensor bolt protection bracket screws and remove the 4 OCS weight sensor bolt protection brackets.

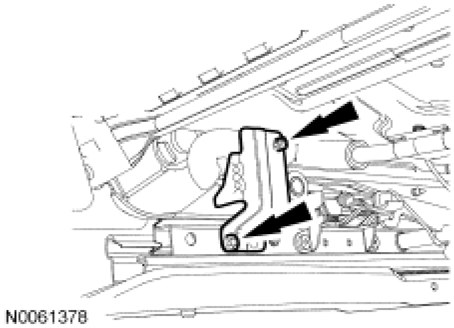


Fig. 411: Identifying OCS Weight Sensor Bolt Protection Brackets
Courtesy of FORD MOTOR CO.

Passenger seat with power seat track

9. Remove the cushion side shield in the following sequence.
    1. If equipped with manual recline, release the clip and remove the manual recline handle.

    NOTE: Release the tension on the manual lumbar cable before removing the manual lumbar handle.

    2. If equipped with manual lumbar, release the 2 clips on the back of the manual lumbar handle then pull and remove the manual lumbar handle.
    3. Remove the cushion side shield screw(s).
    4. Slide the cushion side shield up in the rear to release the retainer.
    5. Slide the cushion side shield forward to disengage the retainer.
    6. Disconnect the seat control switch electrical connector.
        - Remove the cushion side shield.
10. Separate the wire harness from the outboard OCS weight sensor bolt protection bracket, remove the 2 outboard OCS weight sensor bolt protection bracket screws and remove the outboard OCS weight sensor bolt protection bracket.
11. Separate the wire harness from the inboard OCS weight sensor bolt protection bracket, remove the inboard OCS weight sensor bolt protection bracket screw and the inboard OCS weight sensor bolt protection bracket.

Passenger seat

12. Mark the 4 OCS weight sensor bolt electrical connectors so that they can be reconnected in their same location at installation.
13. Disconnect the 4 OCS weight sensor bolt electrical connectors and detach any wire harness retainers to the seat track.
14. Disconnect the OCSM and detach any wire harness retainers to the seat track.

Passenger seat with power seat track

15. Disconnect the heated seat module electrical connector and detach any wire harness retainers to the seat track (if equipped).
16. Disconnect the dual climate controlled seat module (DCSM) electrical connectors and detach any wire harness retainers to the seat track (if equipped).

All seats

17. Separate any retainers holding the seat wire harness or electrical connectors to the seat track.
18. Remove the 4 seat track-to-cushion frame bolts and remove the seat track.

All passenger seats

19. To install a new OCSM or an OCS weight sensor bolt, refer to the appropriate procedure in **SUPPLEMENTAL RESTRAINT SYSTEM** article.

INSTALLATION

Power seat tracks

1. Position the cushion frame-to-seat track rear brackets to the power seat track rear cross tube.
   - Make sure the locator tabs of the cushion frame-to-seat track rear brackets are aligned correctly to the cushion frame.

Passenger seat with fold-flat backrest

2. Make sure the fold-flat recliner cable is routed correctly between the power seat track cross tube and cushion frame.

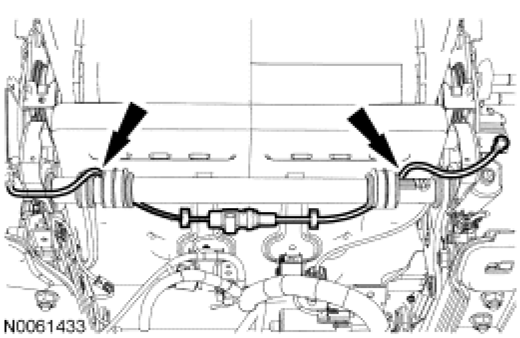


Fig. 412: Locating Fold Flat Recliner Cable
Courtesy of FORD MOTOR CO.

All seat tracks

3. Install the 4 cushion frame-to-seat track bolts.
   - Tighten to 23 Nm (17 lb-ft).

All passenger seats

4. For correct front passenger seat cushion wire harness routing, refer to **Seat Wire Harness Routing - Front Passenger Cushion**.
5. Connect the 4 OCS weight sensor bolt electrical connectors, as marked during removal and attach any retainers holding the wire harness to the seat track.
6. Connect the OCSM and attach any wire harness retainers to the seat track.

Passenger seat with power seat track

7. Position the inboard OCS weight sensor bolt protection bracket to the seat track, install the inboard OCS weight sensor bolt protection bracket screw and attach the wire harness to the inboard OCS weight sensor bolt protection bracket.
   - Tighten to 2 Nm (18 lb-in).
8. Position the outboard OCS weight sensor bolt protection bracket to the seat track, install the 2 outboard OCS weight sensor bolt protection bracket screws and attach the wire harness to the outboard OCS weight sensor bolt protection bracket.
   - Tighten to 6 Nm (53 lb-in).
9. Install the cushion side shield in the following sequence.
   1. Position the side shield to the seat and connect the seat control switch electrical connector.
   2. Slide the cushion side shield rearward to engage the cushion side shield retainer to the seat track bracket.
   3. Slide the cushion side shield down in the rear to engage the retainer.
   4. Install the cushion side shield screw(s).
   5. Install the manual lumbar handle (if equipped).
   6. Position the clip on the manual recline handle and install the manual recline handle (if equipped).
10. Connect the heated seat module electrical connector and attach any retainers holding the wire harness to the seat track (if equipped).
11. Connect the DCSM electrical connectors and attach any retainers holding the wire harness to the seat track (if equipped).

Passenger seat with manual seat track

NOTE: Rear inboard OCS weight sensor bolt protection bracket shown in illustration, others similar.

12. Position each of the 4 OCS weight sensor bolt protection brackets, install the 4 OCS weight sensor bolt protection bracket screws and attach the wire harness to the OCS weight sensor bolt protection brackets.
   - Tighten the front OCS weight sensor bolt protection brackets to 5 Nm (44 lb-in).
   - Tighten the rear OCS weight sensor bolt protection brackets to 2 Nm (18 lb-in).

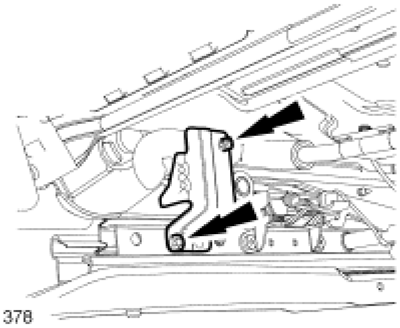


Fig. 413: Identifying OCS Weight Sensor Bolt Protection Brackets
Courtesy of FORD MOTOR CO.

Driver seat

13. Connect the DSM electrical connectors and attach any retainers holding the wire harness to the seat track (if equipped).
14. Connect the seat track position sensor and attach any retainers holding the wire harness or electrical connectors to the seat track.

All seats

15. Connect all the seat track motor electrical connectors and attach any retainers holding the wire harness or electrical connectors to the seat track (if equipped).
16. Connect the safety belt buckle switch electrical connector. Attach any retainers holding the wire harness or electrical connector to the seat track.
17. Attach the seat wire harness main feed in electrical connector(s) to the seat track brackets.
18. Install the front seat backrest. For additional information, refer to **Seat Backrest - Front**.
19. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

Passenger seat with existing seat track

20. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Passenger seat with new seat track, OCS module or OCS weight sensor bolt

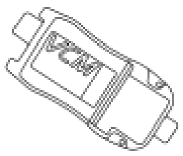
21. Carry out the Occupant Classification Sensor (OCS) System Reset. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Driver seat with memory

22. Set the memory seat soft stops. For additional information, carry out Setting the Soft Stops in the Principles of Operation portion of **Seats**.

SEAT RECLINER MOTOR

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

1. If equipped with power lumbar, release the tension on the power lumbar cable before removing the seat from the vehicle.
2. Remove the front seat. For additional information, refer to **Seat - Front**.
3. Remove the cushion side shield in the following sequence.

   NOTE: Release the tension on the manual lumbar cable before removing the manual lumbar handle.

   1. If equipped with manual lumbar, release the 2 clips on the back of the manual lumbar handle then pull and remove the manual lumbar handle.
   2. Remove the cushion side shield screw(s).
   3. Slide the cushion side shield up in the rear to release the retainer.
   4. Slide the cushion side shield forward to disengage the retainer.
   5. Disconnect the seat control switch electrical connector.
      - Remove the cushion side shield.
4. Remove the recliner side shield in the following sequence.
   1. Remove the recliner side shield screw and scrivet.
   2. Pull out and remove the recliner side shield.

NOTE: The seat backrest trim cover and foam pad have been removed to show the backrest trim panel retainers.

5. Remove the backrest trim panel in the following sequence.
    1. Release the 2 pin-type retainers at the bottom of the backrest trim panel.
    2. Slide the backrest trim panel down to release the upper clips.
    3. Turn the backrest trim panel to release the middle clips and remove the backrest trim panel.

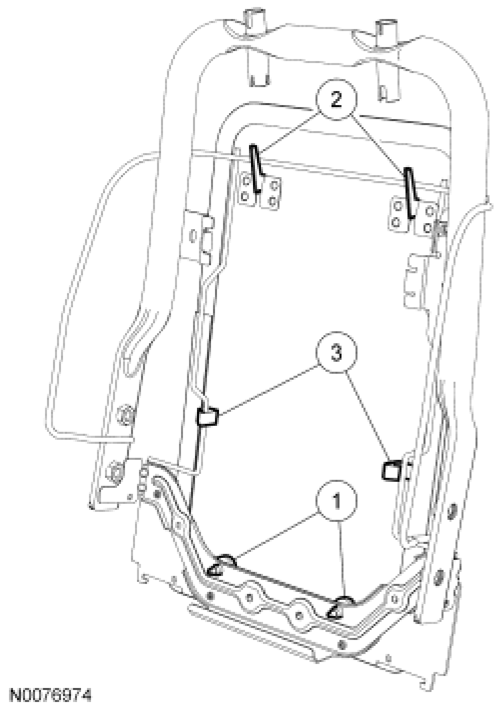


Fig. 414: Locating Pin-Type Retainers, Upper Clips & Middle Clips
Courtesy of FORD MOTOR CO.

NOTE: Lower outer J-clips are unfastened to show inner J-clips.

6. Release the backrest trim cover outer and inner J-clips attached to the backrest frame.

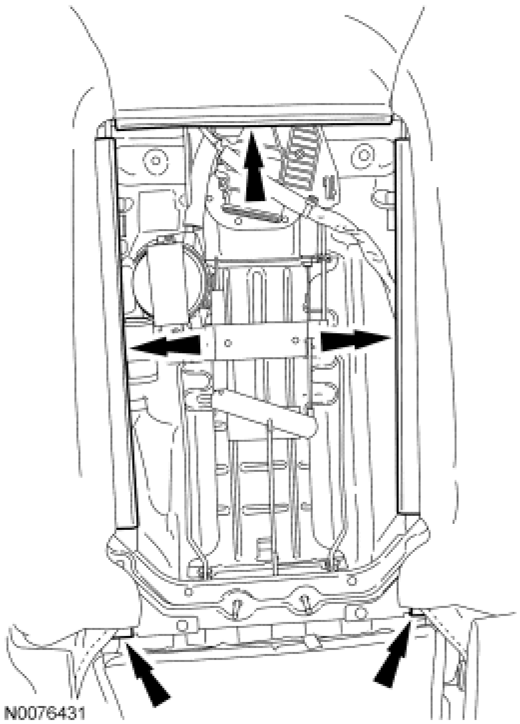


Fig. 415: Locating Inner J-Clips
Courtesy of FORD MOTOR CO.

7. Push the backrest foam pad away from the backrest frame.
8. Remove the recliner motor in the following sequence.
   1. Remove the clip from the torque shaft on the recliner motor side.
   2. Slide the torque shaft out of the recliner and recliner motor.
   3. Remove the recliner motor bolt.
      - To install, tighten to 8 Nm (71 lb-in).
   4. Disconnect and remove the recliner motor.
9. To install, reverse the removal procedure.
10. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

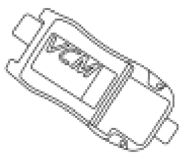
    Passenger seat only

11. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

LUMBAR ASSEMBLY - MANUAL

Special Tools

Illustration	Tool Name	Tool Number

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the cushion side shield in the following sequence.
    1. If equipped with manual recline, release the clip and remove the manual recline handle.
    2. If equipped with manual height adjust, pull and remove the manual height adjust handle.

    NOTE: Release the tension on the manual lumbar cable before removing the manual lumbar handle.

    3. Release the 2 clips on the back of the manual lumbar handle then pull and remove the manual lumbar handle.
    4. Remove the cushion side shield screw(s).
    5. If equipped with power seat track, slide the cushion side shield up in the rear to release the retainer.
    6. Slide the cushion side shield forward to disengage the retainer.
        - If equipped with manual seat tracks, remove the cushion side shield.
    7. If equipped with power seat tracks, disconnect the seat control switch electrical connector.
        - Remove the cushion side shield.
3. Remove the lumbar cable from the manual lumbar adjuster in the following sequence.
    1. Remove the manual lumbar adjuster to bracket screw.
    2. Separate the manual lumbar adjuster from the bracket.
    3. Remove the lumbar cable from the manual lumbar adjuster.

NOTE: The seat backrest trim cover and foam pad have been removed to show the backrest trim panel retainers.

4. Remove the backrest trim panel in the following sequence.

1. Release the 2 pin-type retainers at the bottom of the backrest trim panel.
2. Slide the backrest trim panel down to release the upper clips.
3. Turn the backrest trim panel to release the middle clips and remove the backrest trim panel.

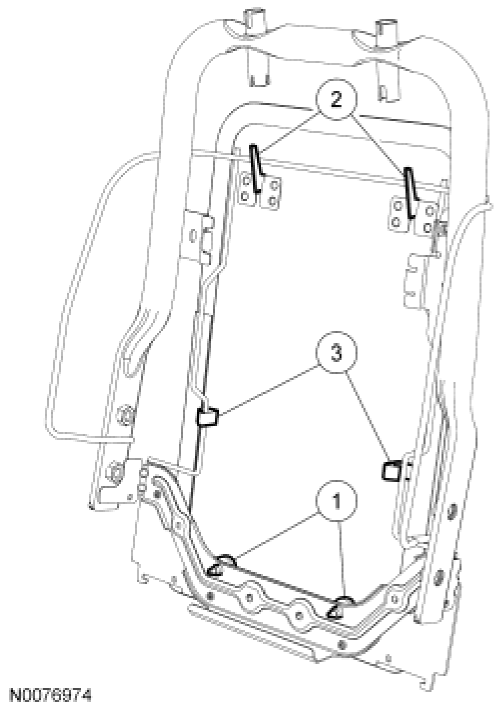


Fig. 416: Locating Pin-Type Retainers, Upper Clips & Middle Clips
Courtesy of FORD MOTOR CO.

NOTE: Lower outer J-clips are unfastened to show inner J-clips.

5. Release the backrest trim cover outer and inner J-clips attached to the backrest frame.

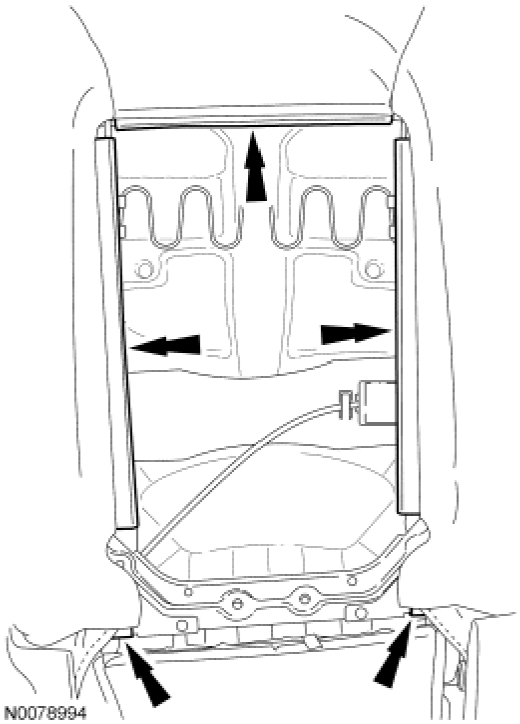


Fig. 417: Locating J-Clips
Courtesy of FORD MOTOR CO.

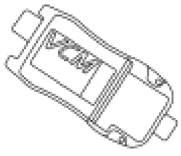
6. Release the manual lumbar hooks from the backrest frame, route out the manual lumbar cable and remove the manual lumbar assembly.
7. To install, reverse the removal procedure.
8. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

   Passenger seat

9. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

LUMBAR ASSEMBLY - POWER

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

WARNING: **Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.

    NOTE: The seat backrest trim cover and foam pad have been removed to show the backrest trim panel retainers.

2. Remove the backrest trim panel in the following sequence.
    1. Release the 2 pin-type retainers at the bottom of the backrest trim panel.
    2. Slide the backrest trim panel down to release the upper clips.
    3. Turn the backrest trim panel to release the middle clips and remove the backrest trim panel.

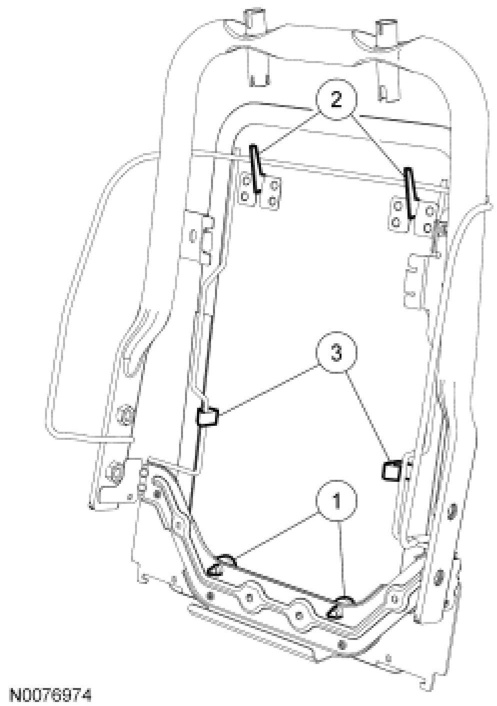


Fig. 418: Locating Pin-Type Retainers, Upper Clips & Middle Clips
Courtesy of FORD MOTOR CO.

NOTE: Lower outer J-clips are unfastened to show inner J-clips.

3. Release the backrest trim cover outer and inner J-clips attached to the backrest frame.

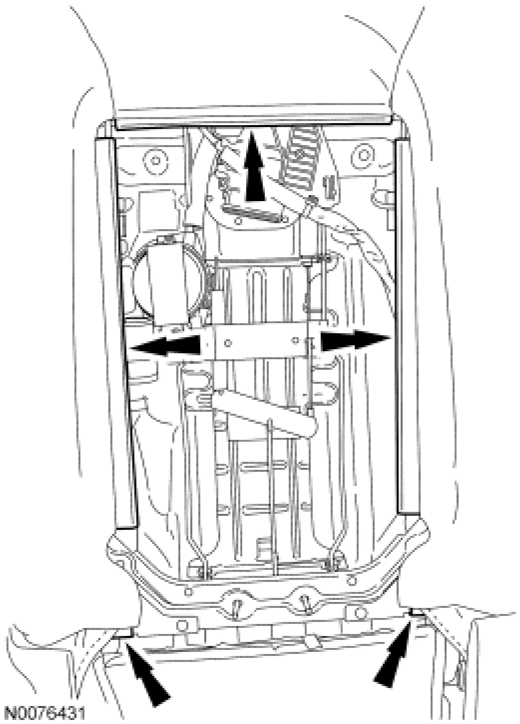


Fig. 419: Locating Inner J-Clips
Courtesy of FORD MOTOR CO.

4. Remove the head restraint.
   1. Using an appropriate tool, push in the hole, lift up on the head restraint and release one side of the head restraint.
   2. Push the release button and remove the head restraint.

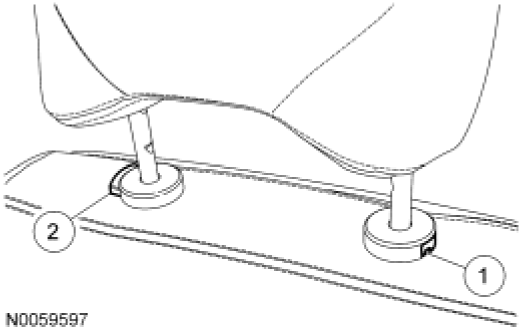


Fig. 420: Locating Release Button On Head Restraint
Courtesy of FORD MOTOR CO.

NOTE: Always install a new slave head restraint guide.

5. Pull out and remove the master and slave head restraint guides.

NOTE: **When installing, make sure the side air bag module wiring harness is not pinched between the side air bag module and the backrest frame or damage to the wiring harness can occur.**

NOTE: **When installing the side air bag module, new bolts must be installed.**

6. Through the rear of the seat, remove and discard the 2 side air bag module bolts. Then separate the side air bag module from the seat backrest.
   - To install, tighten to 23 Nm (17 lb-ft).

NOTE: **Do not pull the side air bag module electrical connector out by the locking button. Damage to the locking button can occur.**

NOTE: **Do not install the side air bag module electrical connector by the locking button. Damage to the locking button can occur.**

NOTE: **The side air bag module electrical connector locking button must be in the released position when the connector is being installed or connector damage may occur.**

NOTE: **The side air bag module electrical connector is unique and cannot be reversed when connected to the side air bag module. Match the electrical connector key to the keyway in the side air bag module. Do not force the electrical connector into the side air bag module or damage can occur.**

7. Using a small screwdriver as shown in illustration, lift up and release the locking button on the side air bag module electrical connector. With the locking button released, remove the electrical connector and the side air bag module.

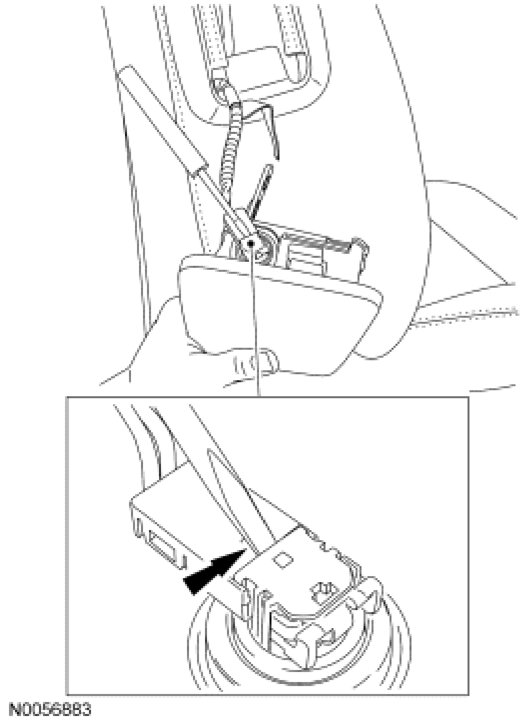


Fig. 421: Lifting Up & Releasing Locking Button On Side Air Bag Module Electrical Connector Using A Small Screwdriver
Courtesy of FORD MOTOR CO.

8. Separate the backrest frame from the backrest foam pad.

   Seats with climate control

9. Remove the screw, release the 3 clips, disconnect the electrical connector and remove the backrest thermo-electric device (TED).

   All seats

10. Remove the power lumbar assembly in the following sequence.
    1. Disconnect the power lumbar motor.
    2. Release the power lumbar assembly clip at the top of the backrest frame.
    3. Slide the lumbar wire frame up and out at the bottom of the backrest frame.
    4. Remove the power lumbar assembly.
11. To install, reverse the removal procedure.
12. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

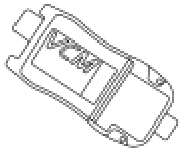
    Passenger seat

13. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional

information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT BACKREST THERMO-ELECTRIC DEVICE

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

WARNING: **Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: The backrest thermo-electric device (TED) filter is detachable from the TED assembly housing and can be replaced without TED removal.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.

    NOTE: The seat backrest trim cover and foam pad have been removed to show the backrest trim panel retainers.

2. Remove the backrest trim panel in the following sequence.
    1. Release the 2 pin-type retainers at the bottom of the backrest trim panel.
    2. Slide the backrest trim panel down to release the upper clips.
    3. Turn the backrest trim panel to release the middle clips and remove the backrest trim panel.

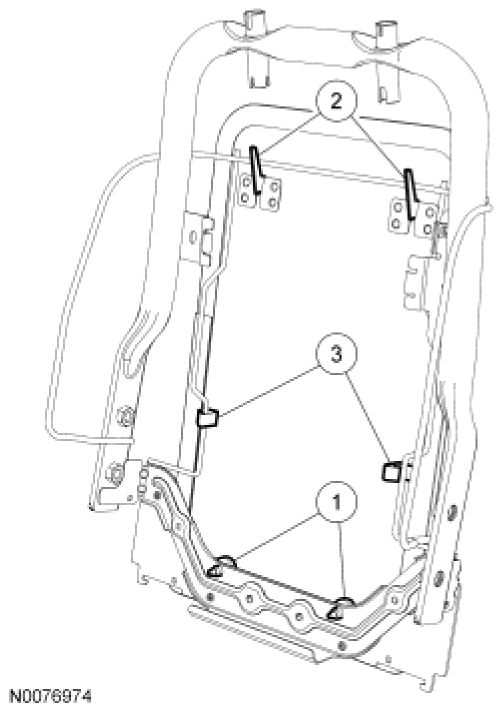


Fig. 422: Locating Pin-Type Retainers, Upper Clips & Middle Clips
Courtesy of FORD MOTOR CO.

NOTE: Lower outer J-clips are unfastened to show inner J-clips.

3. Release the backrest trim cover outer and inner J-clips attached to the backrest frame.

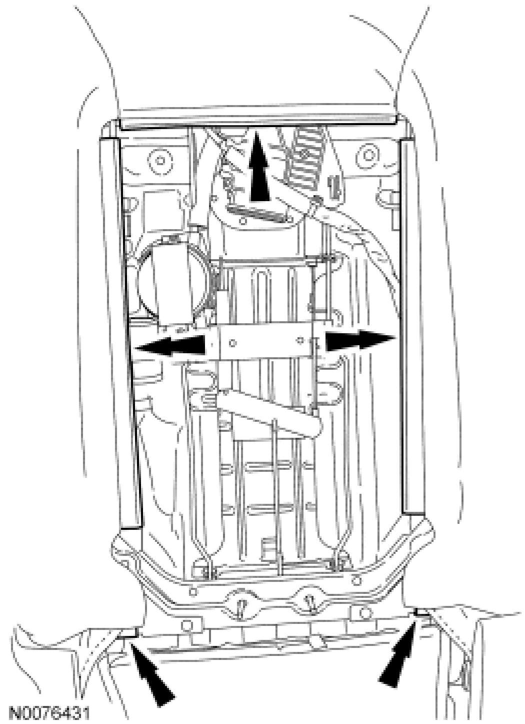


Fig. 423: Locating Inner J-Clips
Courtesy of FORD MOTOR CO.

4. Remove the head restraint.
    1. Using an appropriate tool, push in the hole, lift up on the head restraint and release one side of the head restraint.
    2. Push the release button and remove the head restraint.

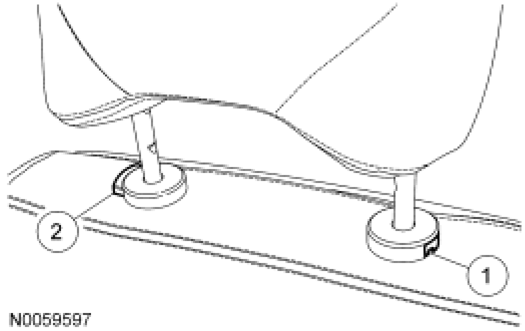


Fig. 424: Locating Release Button On Head Restraint
Courtesy of FORD MOTOR CO.

NOTE: Always install a new slave head restraint guide.

5. Pull out and remove the master and slave head restraint guides.

NOTE: When installing, make sure the side air bag module wiring harness is not pinched between the side air bag module and the backrest frame or damage to the wiring harness can occur.

NOTE: When installing the side air bag module, new bolts must be installed.

6. Through the rear of the seat remove and discard the 2 side air bag module bolts. Then separate the side air bag module from the seat backrest.
    - To install, tighten to 23 Nm (17 lb-ft).

NOTE: Do not pull the side air bag module electrical connector out by the locking button. Damage to the locking button can occur.

NOTE: Do not install the side air bag module electrical connector by the locking button. Damage to the locking button can occur.

NOTE: The side air bag module electrical connector locking button must be in the released position when the connector is being installed or connector damage may occur.

NOTE: The side air bag module electrical connector is unique and cannot be reversed when connected to the side air bag module. Match the electrical connector key to the keyway in the side air bag module. Do not force the electrical connector into the side air bag module or damage can occur.

7. Using a small screwdriver as shown in illustration, lift up and release the locking button on the side air bag module electrical connector. With the locking button released, remove the electrical connector and the side air bag module.

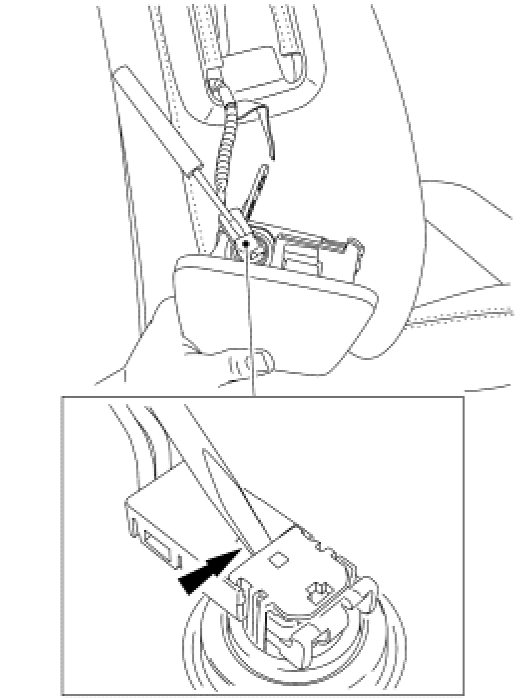


Fig. 425: Lifting Up & Releasing Locking Button On Side Air Bag Module Electrical Connector Using A Small Screwdriver
Courtesy of FORD MOTOR CO.

8. Separate the backrest frame from the backrest foam pad.
9. Release the 3 clips, disconnect the electrical connector and remove the backrest TED.
10. To install, reverse the removal procedure.
11. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

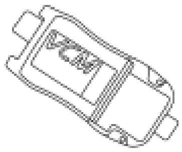
    Passenger seat

12. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT CUSHION THERMO-ELECTRIC DEVICE

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

 ST2834-A		

REMOVAL AND INSTALLATION

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: The cushion thermo-electric device (TED) filter is detachable from the TED assembly housing from underneath the seat cushion.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the front seat cushion. For additional information, refer to **Seat Cushion - Front**.
3. Release the cushion trim cover retainers from the cushion frame and remove the cushion trim cover and cushion foam pad.
4. Remove the 3 cushion thermo-electric device (TED)-to-cushion frame screws.
5. Remove the cushion TED-to-climate control seat cushion adapter screw and remove the TED.
6. To install, reverse the removal procedure.
    - For correct front passenger seat cushion wire harness routing, refer to **Seat Wire Harness Routing - Front Passenger Cushion**.
7. Install the front seat cushion assembly. For additional information, refer to **Seat Cushion - Front**.
8. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

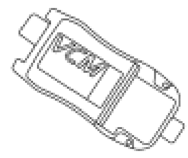
    Passenger seat

9. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

DUAL CLIMATE CONTROLLED SEAT MODULE (DCSM)

Special Tools

Illustration	Tool Name	Tool Number

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: When installing a new dual climate controlled seat module (DCSM), it is necessary to carry out programmable module installation (PMI). For additional information, refer to MODULE CONFIGURATION article.

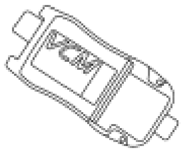
NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Before removing the DCSM, carry out the appropriate steps in the PMI procedure. For additional information, refer to **MODULE CONFIGURATION** article.
2. Remove the front passenger seat. For additional information, refer to **Seat - Front**.
3. Remove the DCSM.
   - Disconnect the 3 electrical connectors.
   - Remove the 2 screws.
   - Remove the DCSM.
4. To install, reverse the removal procedure.
5. Install the front passenger seat. **Do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.
6. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
7. Install the DCSM software data. Carry out the appropriate steps in the PMI procedure. For additional information, refer to **MODULE CONFIGURATION** article.

HEATED SEAT MODULE - FRONT

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent	

 ST2834-A	scan tool	

REMOVAL AND INSTALLATION

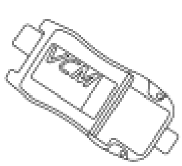
NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Position the front passenger seat to access the heated seat module.
2. Depower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
3. From under the front of the front passenger seat, remove the heated seat module.
   - Vehicles with power seat track, remove the 2 screws and lower the bracket (if equipped).
   - Disconnect the heated seat module electrical connector.
   - Remove the screw and heated seat module.
4. To install, reverse the removal procedure.
5. Repower the SRS. **Do not prove out the SRS at this time.** For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
6. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT CONTROL SWITCH - FRONT

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

1. If possible, position the seat all the way up and center the seat in the front door opening.
2. Depower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
3. Separate the safety belt retractor belt anchor from the seat in the following sequence.
    1. Carefully pull up and out to remove the safety belt retractor belt anchor nut cover from the cushion side shield.
    2. Remove the safety belt anchor nut.
        - To install, tighten to 47 Nm (35 lb-ft).
    3. Separate the safety belt retractor belt anchor from the seat.
4. Remove the seat control switch in the following sequence.
    1. Pull out and remove the seat control switch knob(s).
    2. If equipped with manual recline, release the clip and remove the manual recline handle.
    3. If equipped with manual lumbar, pull and remove the manual lumbar handle.
    4. Remove the cushion side shield screw(s).
    5. Slide the cushion side shield up in the rear to release the retainer.
    6. Slide the cushion side shield forward to disengage the retainer.
    7. Release the cushion side shield clips and separate the seat control switch.
    8. Disconnect the seat control switch electrical connector and remove the switch.
5. To install, reverse the removal procedure.
6. Repower the SRS. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

    Passenger seat

7. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

MEMORY SET SWITCH

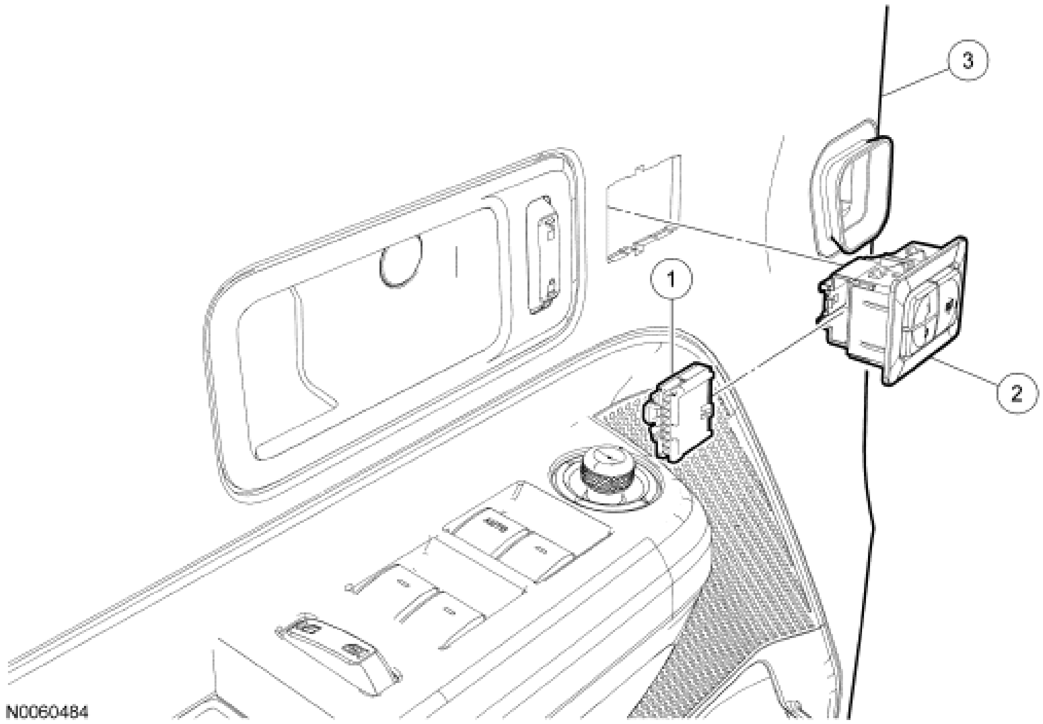


Fig. 426: Memory SET Switch, Edge
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Electrical connector (part of 14631)
2	14776	Memory SET switch
3	-	Driver door trim panel

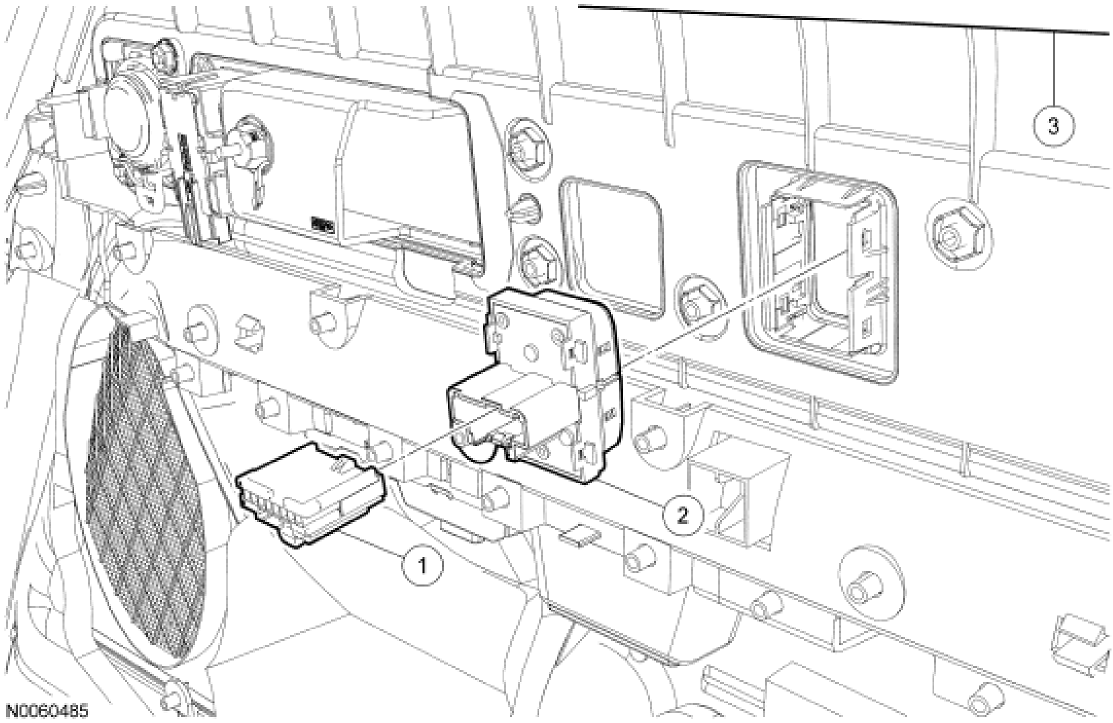


Fig. 427: Memory SET Switch, MKX
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Electrical connector (part of 14631)
2	14776	Memory SET switch
3	-	Driver door trim panel

REMOVAL AND INSTALLATION

All vehicles

1. Remove the driver door trim panel. For additional information, refer to **INTERIOR TRIM & ORNAMENTATION** article.

   Edge vehicles

2. Disconnect the electrical connector, release the 4 tabs and remove the memory SET switch through the front of the door trim panel.

   MKX vehicles

3. Disconnect the electrical connector, release the 4 tabs and remove the memory SET switch through the back of the door trim panel.

All vehicles

4. To install, reverse the removal procedure.

SEAT - REAR, 40 PERCENT

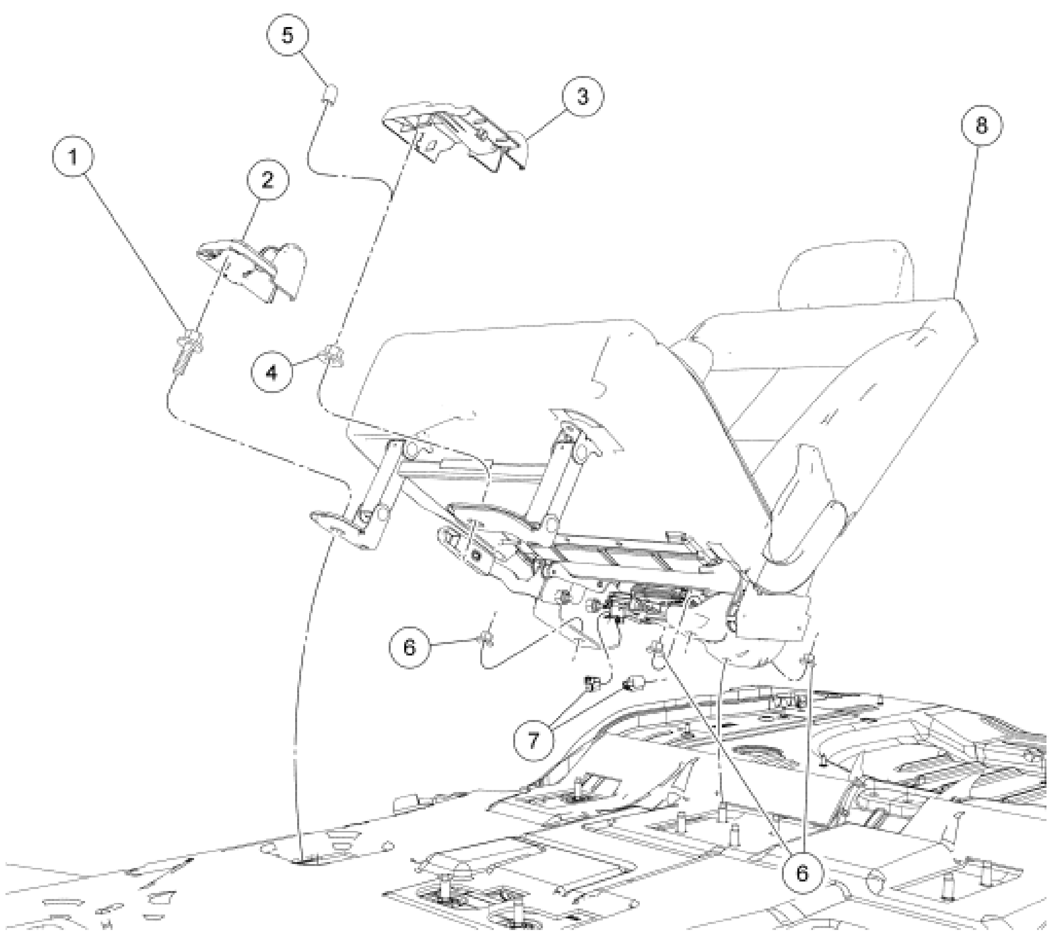


Fig. 428: Second Row 40 Percent Seat
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W712026	40 percent seat kneeling assembly-to-floor bolt
2	63386	Outboard bolt cover
3	63386	Inboard nut cover (MKX only)

4	N801995	40 percent seat kneeling assembly-to-floor nut
5	-	Rubber stud cap (Edge only)
6	N801995	40 percent seat backrest assembly anchor bracket-to-floor nuts (3 required)
7	-	Electrical connectors (if equipped) (part of 14A005)
8	-	40 percent seat

REMOVAL

WARNING: **Keep hands clear of all moving seat mechanisms when releasing the recliner lever. The recliners are spring loaded and release with high force. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Follow all seat recliner synchronization steps exactly as indicated. Always verify correct seat recliner alignment. Any misalignment may adversely affect seat back and seat retractor performance in a crash. Failure to follow these steps may result in serious personal injury to the vehicle occupant(s).**

WARNING: **Always keep the seat back in the upright position while installing the seat and when tightening all retainers to specification. Always verify correct seat recliner alignment. Correct seat recliner alignment is critical for correct seat and safety belt retractor operation in a crash. Failure to follow these instructions may result in serious personal injury to the vehicle occupant(s).**

WARNING: **Synchronize the seat recliners following the steps in the seat removal and installation procedure any time the seat is removed for service. The following actions may result in the loss of recliner synchronization that cannot be corrected and may cause the seat back to fail in a crash:**

- **Dropping the seat**
- **Sitting on the seat when removed**
- **Applying any load to the seat when removed**
- **Removing or loosening any recliner fasteners except for the safety belt buckle bolt**

Install a new seat back frame assembly if the seat recliners cannot be synchronized. Failure to follow these instructions may result in serious personal injury to the vehicle occupant(s) in a crash.

1. Position the 40 percent seat backrest in the upright position.

2. Remove the 60 percent and 40 percent seat inboard nut covers (if equipped).
3. Remove the 40 percent seat kneeling assembly rubber stud cap (if equipped).
4. Remove the 40 percent seat outboard bolt cover.
5. Remove the 40 percent seat kneeling assembly-to-floor nut and bolt.
6. Pivot the 40 percent seat cushion upward.
7. Disconnect the heated seat (if equipped) and the power-fold actuator (if equipped) electrical connectors.
8. Remove the 40 percent seat backrest assembly anchor bracket-to-floor nuts.
9. Remove the 40 percent seat.

INSTALLATION

WARNING: **Keep hands clear of all moving seat mechanisms when releasing the recliner lever. The recliners are spring loaded and release with high force. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Follow all seat recliner synchronization steps exactly as indicated. Always verify correct seat recliner alignment. Any misalignment may adversely affect seat back and seat retractor performance in a crash. Failure to follow these steps may result in serious personal injury to the vehicle occupant(s).**

WARNING: **Always keep the seat back in the upright position while installing the seat and when tightening all retainers to specification. Always verify correct seat recliner alignment. Correct seat recliner alignment is critical for correct seat and safety belt retractor operation in a crash. Failure to follow these instructions may result in serious personal injury to the vehicle occupant(s).**

WARNING: **Synchronize the seat recliners following the steps in the seat removal and installation procedure any time the seat is removed for service. The following actions may result in the loss of recliner synchronization that cannot be corrected and may cause the seat back to fail in a crash:**

- **Dropping the seat**
- **Sitting on the seat when removed**
- **Applying any load to the seat when removed**
- **Removing or loosening any recliner fasteners except for the safety belt buckle bolt**

Install a new seat back frame assembly if the seat recliners cannot be synchronized. Failure to follow these instructions may result in serious personal injury to the vehicle occupant(s) in a crash.

Check for recliner synchronization

1. The recliner arm on the outboard recliner must be aligned to the stamped index mark as shown in illustration.

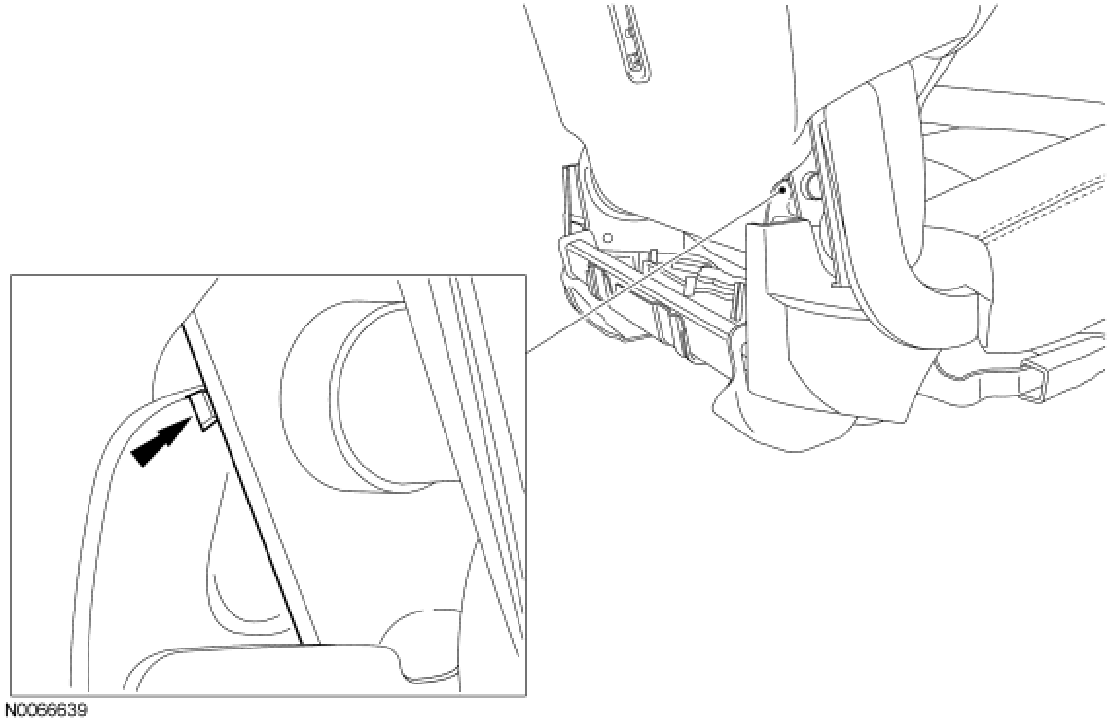


Fig. 429: Recliner Arm On Outboard Recliner Must Be Aligned To Stamped Index Mark
Courtesy of FORD MOTOR CO.

2. The recliner arm on the inboard recliner must be aligned to the stamped index mark as shown in illustration.

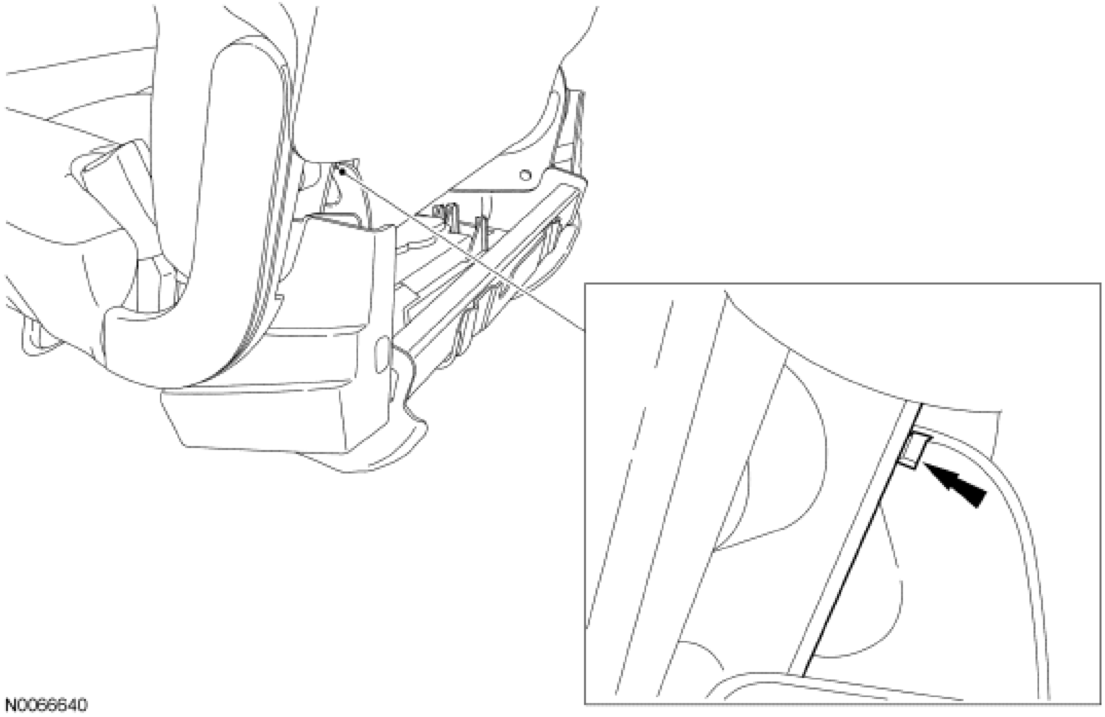


Fig. 430: Recliner Arm On Inboard Recliner Must Be Aligned To Stamped Index Mark
Courtesy of FORD MOTOR CO.

3. Make sure that the outboard and inboard recliners are aligned to the stamped index marks. This synchronizes the outboard and inboard recliners.
   - If the outboard and inboard recliner arms align to the stamped index mark on the recliners, the 40 percent seat can be installed. If the recliners are moved from this position or the recliner handle is actuated before the seat is secured in the vehicle, the recliners must be synchronized again.
   - If the outboard and inboard recliner arms do not align to the stamped index mark on the recliners, carry out the recliner synchronization steps.

Recliner synchronization

WARNING: **Follow all seat recliner synchronization steps exactly as indicated. Always verify correct seat recliner alignment. Any misalignment may adversely affect seat back and seat retractor performance in a crash. Failure to follow these steps may result in serious personal injury to the vehicle occupant(s).**

WARNING: **Keep hands clear of all moving seat mechanisms when releasing the recliner lever. The recliners are spring loaded and release with high force. Failure to follow these instructions may result in serious personal injury.**

4. Using the recliner lever, release the recliners allowing the backrest assembly anchor brackets to pivot

upward.

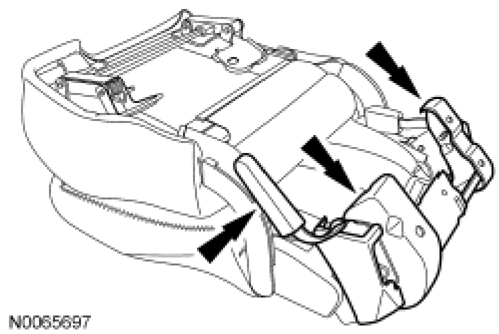


Fig. 431: Releasing Recliners Allowing Backrest Assembly Anchor Brackets To Pivot Upward Using Recliner Lever
Courtesy of FORD MOTOR CO.

NOTE: The outboard recliner (side with the recliner handle) must be pushed downward and latched in place first for correct synchronization to occur.

5. Synchronize the outboard and inboard recliners.
    1. Push downward on the outboard (side with the recliner handle) backrest assembly anchor bracket until an audible click is heard and the outboard recliner is latched in place.

        NOTE: It is possible that the inboard recliner may have latched in place when the outboard recliner was latched in place. Therefore, no audible click will be heard on the inboard side and the recliner will already be latched in place.

    2. Push downward on the inboard backrest assembly anchor bracket until an audible click is heard and the inboard recliner is latched in place.

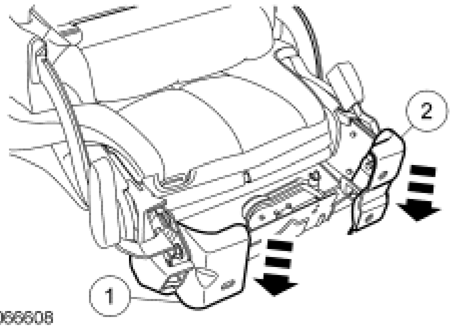


Fig. 432: Pushing Downward On Inboard Backrest Assembly Anchor Bracket Until An Audible Click Is Heard
Courtesy of FORD MOTOR CO.

6. The recliner arm on the outboard recliner must be aligned to the stamped index mark as shown in

illustration.

- If the outboard recliner arm does not align to the stamped index mark on the recliner, repeat the recliner synchronization steps.

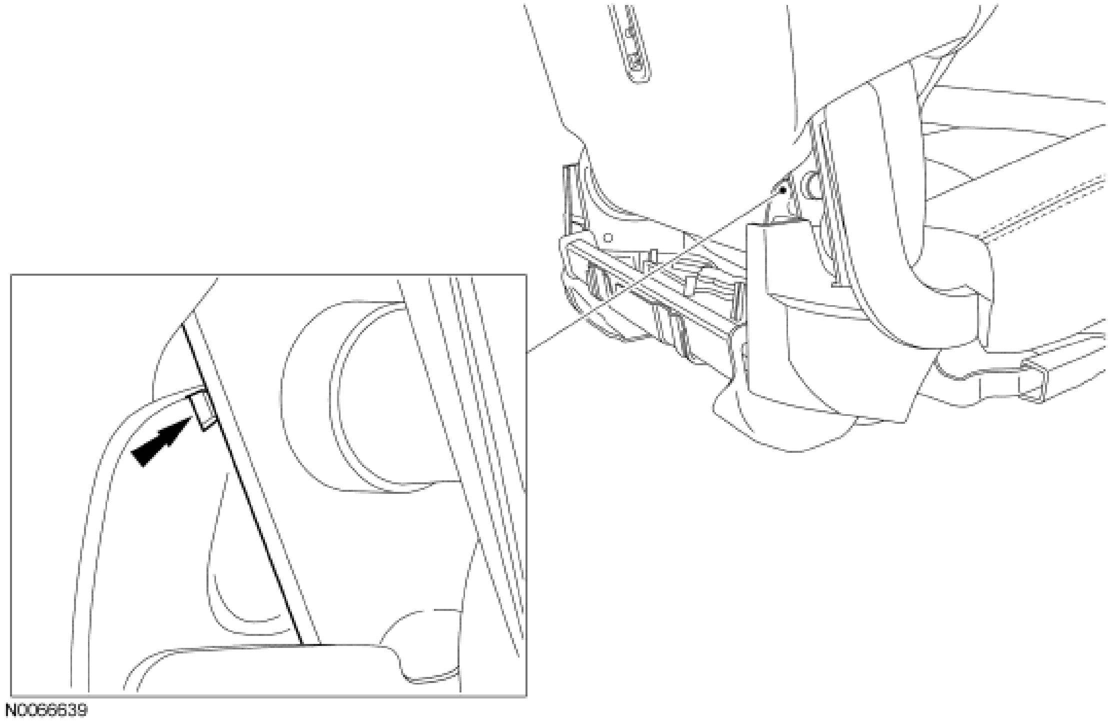


Fig. 433: Recliner Arm On Outboard Recliner Must Be Aligned To Stamped Index Mark
Courtesy of FORD MOTOR CO.

7. The recliner arm on the inboard recliner must be aligned to the stamped index mark as shown in illustration.
    - If the inboard recliner arm does not align to the stamped index mark on the recliner, repeat the recliner synchronization steps.

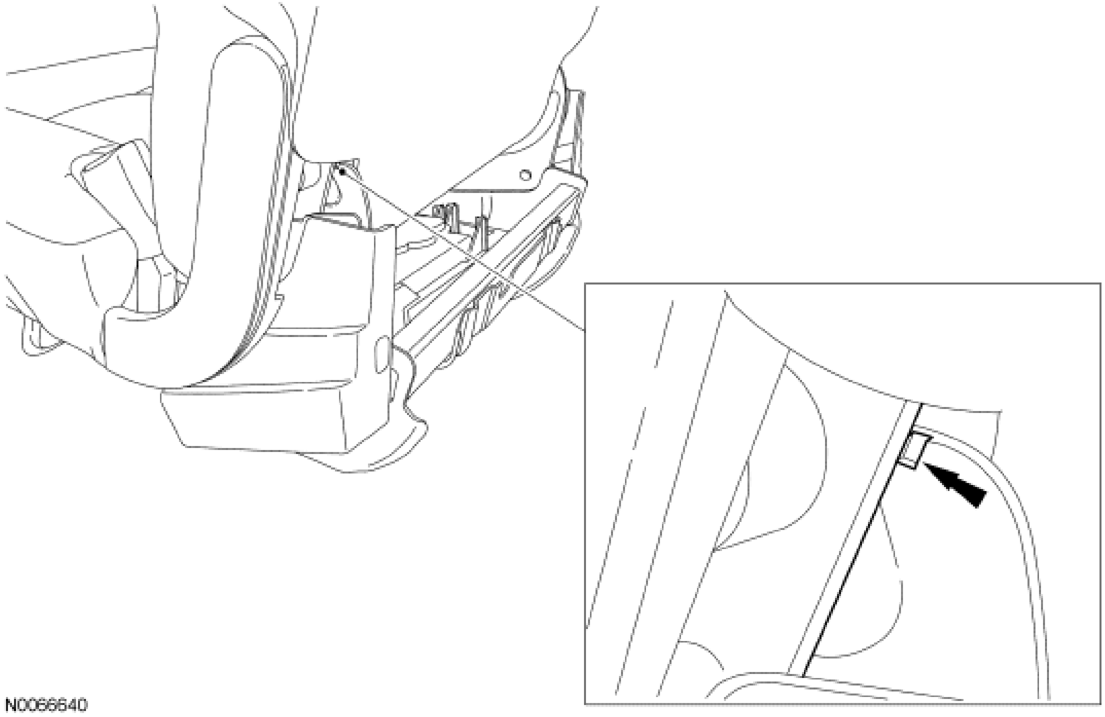


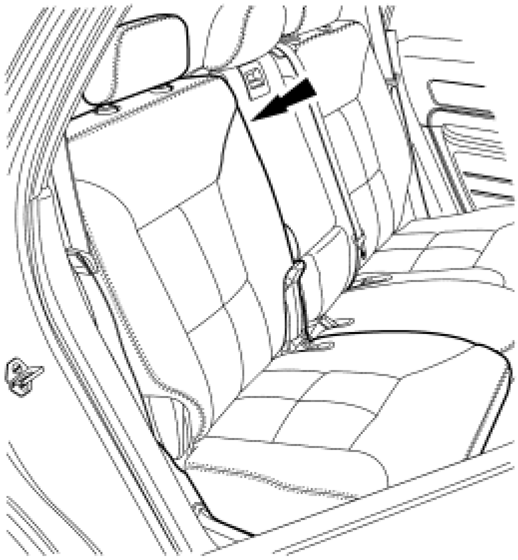
Fig. 434: Recliner Arm On Inboard Recliner Must Be Aligned To Stamped Index Mark
Courtesy of FORD MOTOR CO.

8. If the outboard and inboard recliner arms align to the stamped index mark on the recliners, proceed to the seat installation steps. If the outboard and inboard recliner arms do not align to the stamped index mark on the recliners or the recliner handle is actuated, repeat the recliner synchronization steps.

Seat installation

WARNING: **Always keep the seat back in the upright position while installing the seat and when tightening all retainers to specification. Always verify correct seat recliner alignment. Correct seat recliner alignment is critical for correct seat and safety belt retractor operation in a crash. Failure to follow these instructions may result in serious personal injury to the vehicle occupant(s).**

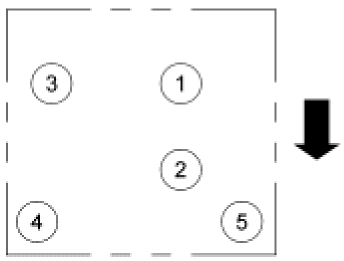
9. Install the 40 percent seat in the vehicle with the seat backrest in the upright position and the recliners aligned to the stamped index mark.



N0066671

Fig. 435: Installing 40 Percent Seat In Vehicle With Seat Backrest In Upright Position
Courtesy of FORD MOTOR CO.

10. Install the seat fasteners and tighten in the sequence shown in illustration.
    - Tighten to 70 Nm (52 lb-ft).
        - The outboard and inboard recliner arms must be aligned to the stamped index mark on the recliners and remain there until the seat-to-floor fasteners are tightened to specification in the sequence shown in illustration. If the outboard and inboard recliner arms do not align to the stamped index mark on the recliners or the recliner handle is actuated before the seat-to-floor fasteners are tightened to specification in the sequence shown in illustration, remove the seat and carry out the recliner synchronization steps.



N0066668

Fig. 436: Identifying Seat-To-Floor Fasteners Tightening Sequence
Courtesy of FORD MOTOR CO.

11. Connect the heated seat (if equipped) and the power-fold actuator (if equipped) electrical connector(s).

12. Install the 40 percent seat outboard bolt cover.
13. Install the 40 percent seat kneeling assembly rubber stud cap (if equipped).
14. Install the 60 percent and 40 percent seat inboard nut covers (if equipped).
15. The recliner arm on the outboard recliner must be aligned to the stamped index mark as shown in illustration.

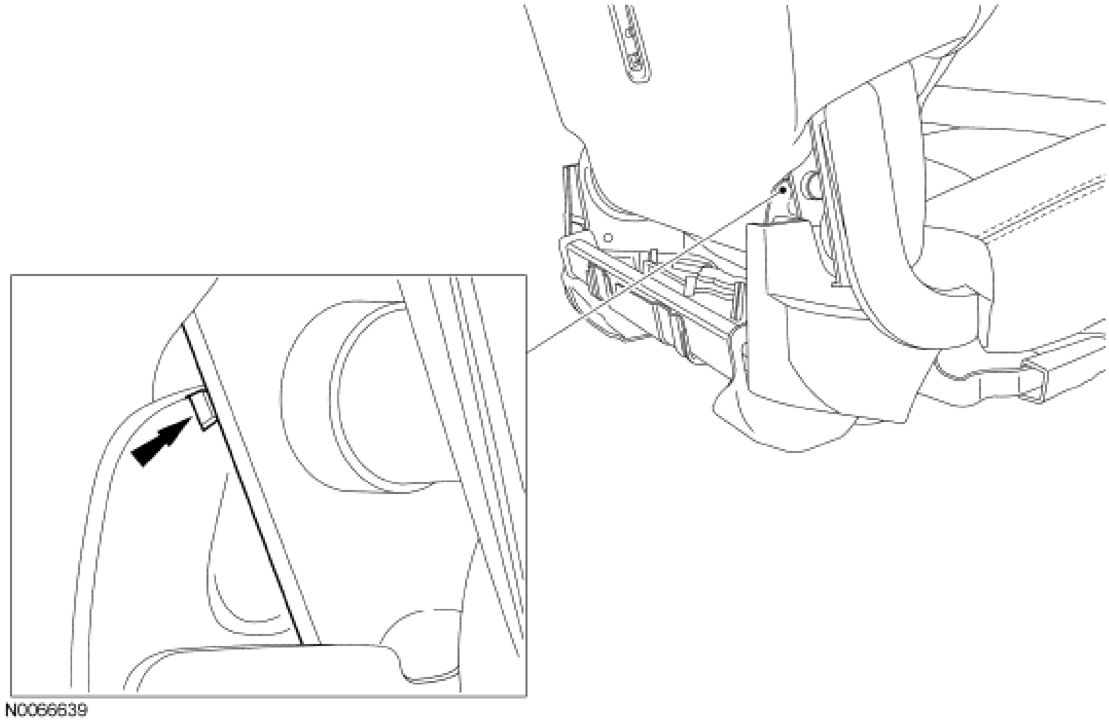


Fig. 437: Recliner Arm On Outboard Recliner Must Be Aligned To Stamped Index Mark
Courtesy of FORD MOTOR CO.

16. The recliner arm on the inboard recliner must be aligned to the stamped index mark as shown in illustration.

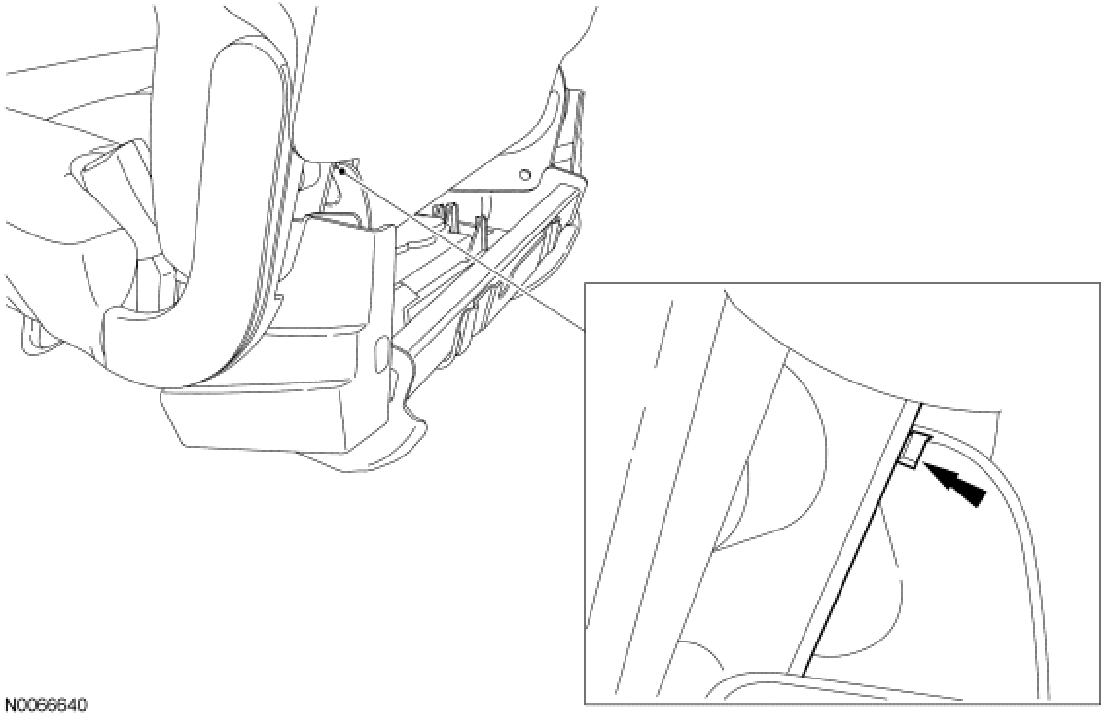


Fig. 438: Recliner Arm On Inboard Recliner Must Be Aligned To Stamped Index Mark
Courtesy of FORD MOTOR CO.

17. Make sure that the 40 percent seat outboard and inboard recliners are aligned to the stamped index marks and still synchronized. If the outboard and inboard recliner arms do not align to the stamped index mark on the recliners or the recliner handle is actuated, remove the 40 percent seat and carry out the recliner synchronization steps.
18. Make sure the safety belt buckles are accessible to the occupants after installation.

SEAT - REAR, 60 PERCENT

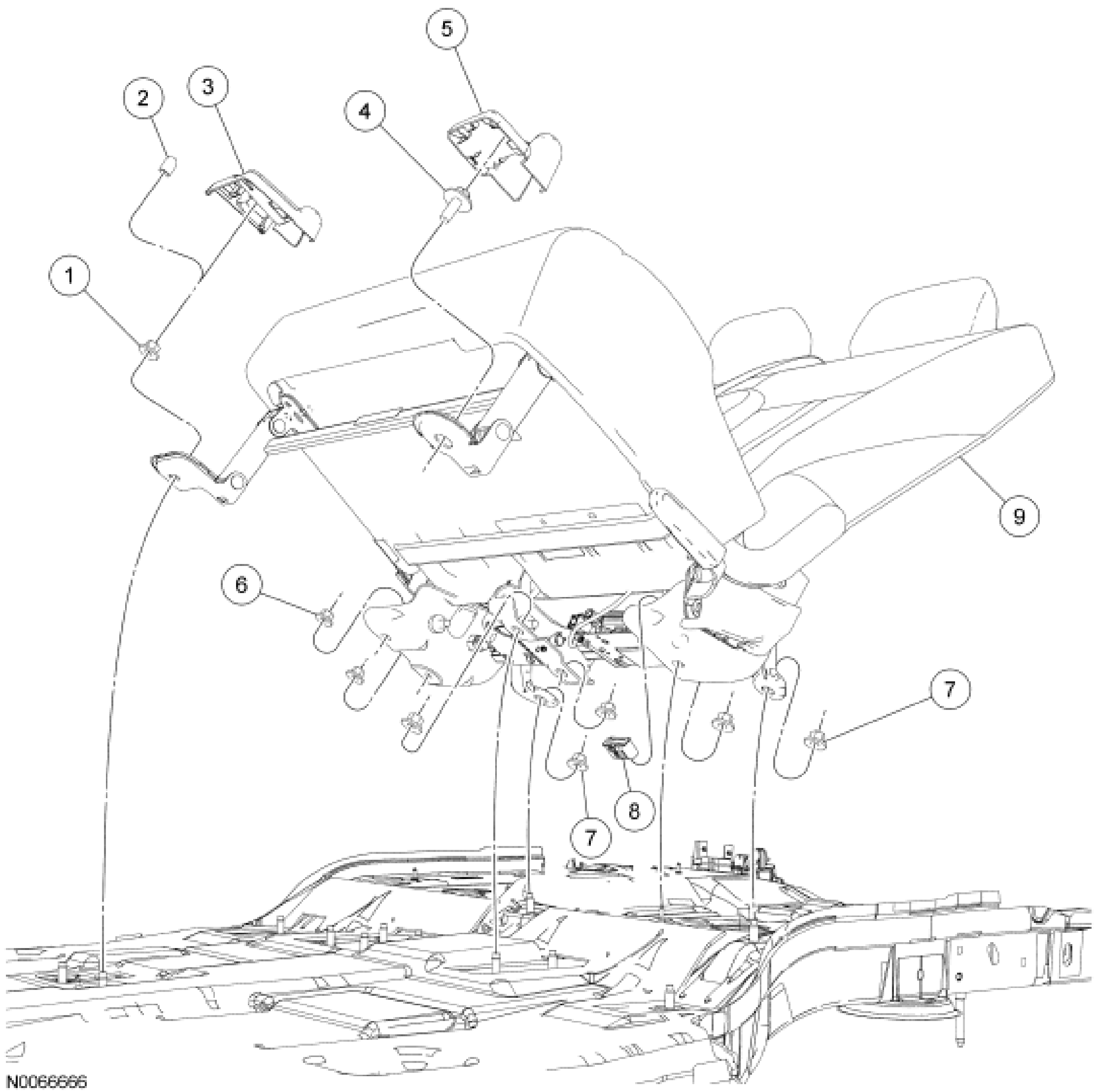


Fig. 439: Second Row 60 Percent Seat
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N801995	60 percent seat kneeling assembly-to-floor nut
2	-	Rubber stud cap (Edge only)
3	63386	Inboard nut cover (MKX only)
4	W712026	60 percent seat kneeling assembly-to-floor bolt
5	63386	Outboard bolt cover
6	N801995	60 percent seat backrest assembly anchor bracket-to-floor nut (5 required)
7	-	60 percent seat rear tie-down-to-floor

		nuts (2 required)
8	-	Electrical connector (if equipped) (part of 14A005)
9	-	60 percent seat

REMOVAL

WARNING: **Keep hands clear of all moving seat mechanisms when releasing the recliner lever. The recliners are spring loaded and release with high force. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Follow all seat recliner synchronization steps exactly as indicated. Always verify correct seat recliner alignment. Any misalignment may adversely affect seat back and seat retractor performance in a crash. Failure to follow these steps may result in serious personal injury to the vehicle occupant(s).**

WARNING: **Always keep the seat back in the upright position while installing the seat and when tightening all retainers to specification. Always verify correct seat recliner alignment. Correct seat recliner alignment is critical for correct seat and safety belt retractor operation in a crash. Failure to follow these instructions may result in serious personal injury to the vehicle occupant(s).**

WARNING: **Synchronize the seat recliners following the steps in the seat removal and installation procedure any time the seat is removed for service. The following actions may result in the loss of recliner synchronization that cannot be corrected and may cause the seat back to fail in a crash:**

- **Dropping the seat**
- **Sitting on the seat when removed**
- **Applying any load to the seat when removed**
- **Removing or loosening any recliner fasteners except for the safety belt buckle bolt**

Install a new seat back frame assembly if the seat recliners cannot be synchronized. Failure to follow these instructions may result in serious personal injury to the vehicle occupant(s) in a crash.

NOTE: **A new heater mat will come assembled on a new foam pad.**

NOTE: **When removing the 60 percent seat, the 40 percent seat must be removed first to gain access to the 60 percent seat backrest assembly anchor bracket-to-floor nuts.**

1. Remove the 40 percent seat. For additional information, refer to **Seat - Rear, 40 Percent**.
2. Position the 60 percent seat backrest in the upright position.
3. Remove the outboard bolt cover.
4. Remove the kneeling assembly rubber stud cap (if equipped).
5. Remove the kneeling assembly-to-floor nut and bolt.
6. Pivot the 60 percent seat cushion upward.
7. Disconnect the heated seat (if equipped) and the power-fold actuator (if equipped) electrical connector.
8. Remove the 5 backrest assembly anchor bracket-to-floor nuts.
9. Lift out and remove the load floor from the cargo area.
10. Through the rear hatch, remove the 2 rear tie-down-to-floor nuts.
11. Remove the 60 percent seat.

INSTALLATION

WARNING: **Keep hands clear of all moving seat mechanisms when releasing the recliner lever. The recliners are spring loaded and release with high force. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Follow all seat recliner synchronization steps exactly as indicated. Always verify correct seat recliner alignment. Any misalignment may adversely affect seat back and seat retractor performance in a crash. Failure to follow these steps may result in serious personal injury to the vehicle occupant(s).**

WARNING: **Always keep the seat back in the upright position while installing the seat and when tightening all retainers to specification. Always verify correct seat recliner alignment. Correct seat recliner alignment is critical for correct seat and safety belt retractor operation in a crash. Failure to follow these instructions may result in serious personal injury to the vehicle occupant(s).**

WARNING: **Synchronize the seat recliners following the steps in the seat removal and installation procedure any time the seat is removed for service. The following actions may result in the loss of recliner synchronization that cannot be corrected and may cause the seat back to fail in a crash:**

- **Dropping the seat**
- **Sitting on the seat when removed**
- **Applying any load to the seat when removed**
- **Removing or loosening any recliner fasteners except for the safety belt buckle bolt**

Install a new seat back frame assembly if the seat recliners cannot be synchronized. Failure to follow these instructions may result in serious personal injury to the vehicle occupant(s) in a crash.

Check for recliner synchronization

1. The recliner arm on the outboard recliner must be aligned to the stamped index mark as shown in illustration.

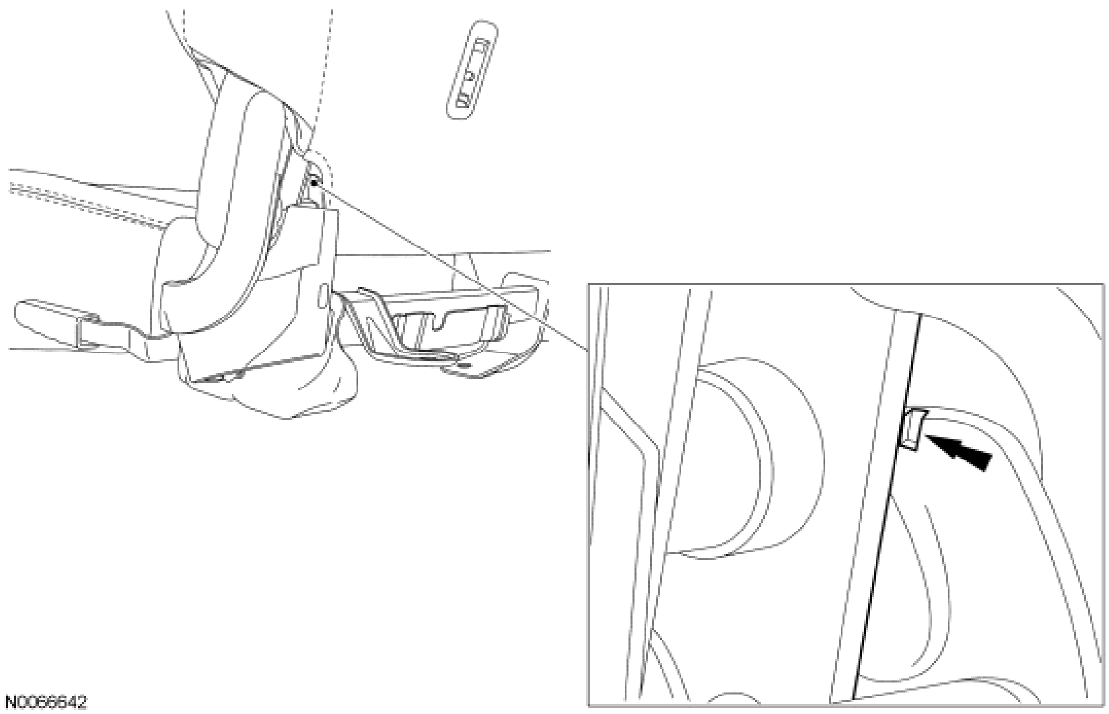


Fig. 440: Recliner Arm On Outboard Recliner Must Be Aligned To Stamped Index Mark
Courtesy of FORD MOTOR CO.

2. The recliner arm on the inboard recliner must be aligned to the stamped index mark as shown in illustration.

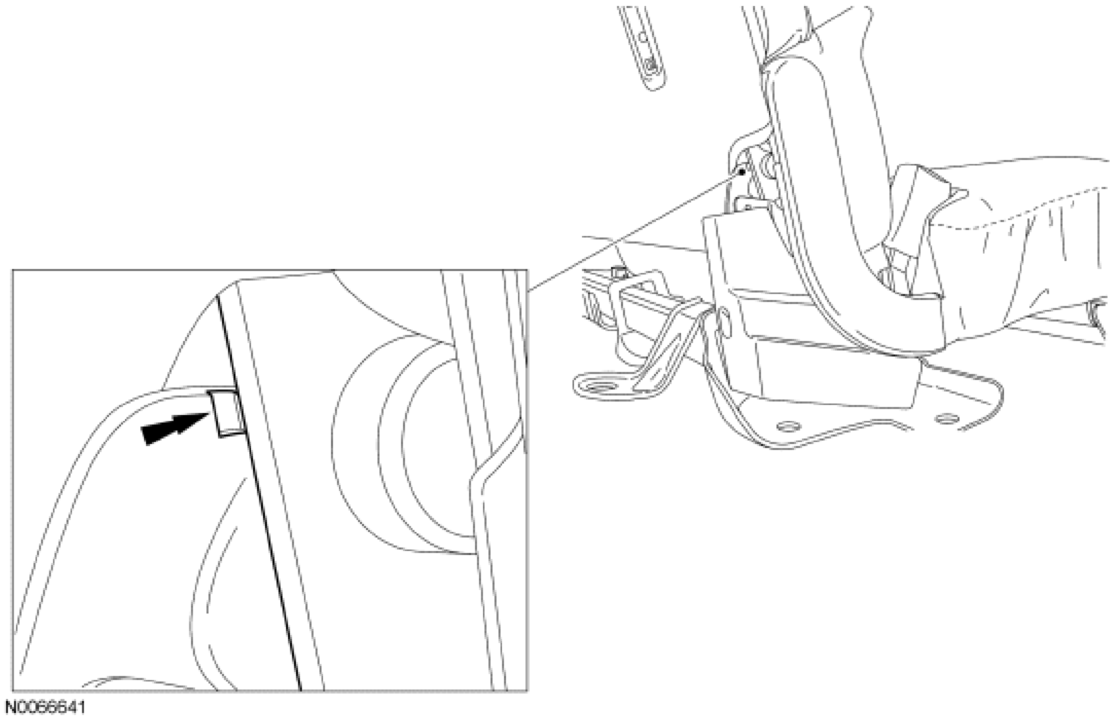


Fig. 441: Recliner Arm On Inboard Recliner Must Be Aligned To Stamped Index Mark
Courtesy of FORD MOTOR CO.

3. Make sure that the outboard and inboard recliners are aligned to the stamped index marks. This synchronizes the outboard and inboard recliners.
   - If the outboard and inboard recliner arms align to the stamped index mark on the recliners, the 60 percent seat can be installed. If the recliners are moved from this position or the recliner handle is actuated before the seat is secured in the vehicle, the recliners must be synchronized again.
   - If the outboard and inboard recliner arms do not align to the stamped index mark on the recliners, carry out the recliner synchronization steps.

Recliner synchronization

WARNING: **Follow all seat recliner synchronization steps exactly as indicated. Always verify correct seat recliner alignment. Any misalignment may adversely affect seat back and seat retractor performance in a crash. Failure to follow these steps may result in serious personal injury to the vehicle occupant(s).**

WARNING: **Keep hands clear of all moving seat mechanisms when releasing the recliner lever. The recliners are spring loaded and release with high force. Failure to follow these instructions may result in serious personal injury.**

4. Using the recliner lever, release the recliners allowing the backrest assembly anchor brackets to pivot

upward.

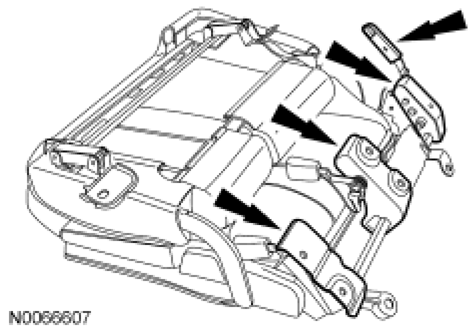


Fig. 442: Releasing Recliners Allowing Backrest Assembly Anchor Brackets To Pivot Upward Using Recliner Lever
Courtesy of FORD MOTOR CO.

NOTE: **The outboard recliner (side with the recliner handle) must be pushed downward and latched in place first for correct synchronization to occur.**

5. Synchronize the inboard and outboard recliners.
    1. Push downward on the outboard (side with the recliner handle) backrest assembly anchor bracket until an audible click is heard and the outboard recliner is latched in place.
    2. Push downward on the inboard backrest assembly anchor bracket until an audible click is heard and the inboard recliner is latched in place.

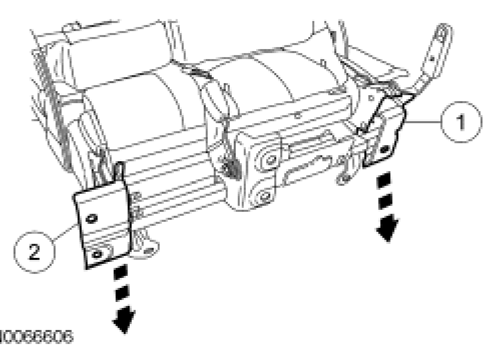


Fig. 443: Pushing Downward On Inboard Backrest Assembly Anchor Bracket Until An Audible Click Is Heard
Courtesy of FORD MOTOR CO.

6. The recliner arm on the outboard recliner must be aligned to the stamped index mark as shown in illustration.
    - If the outboard recliner arm does not align to the stamped index mark on the recliner, repeat the recliner synchronization steps.

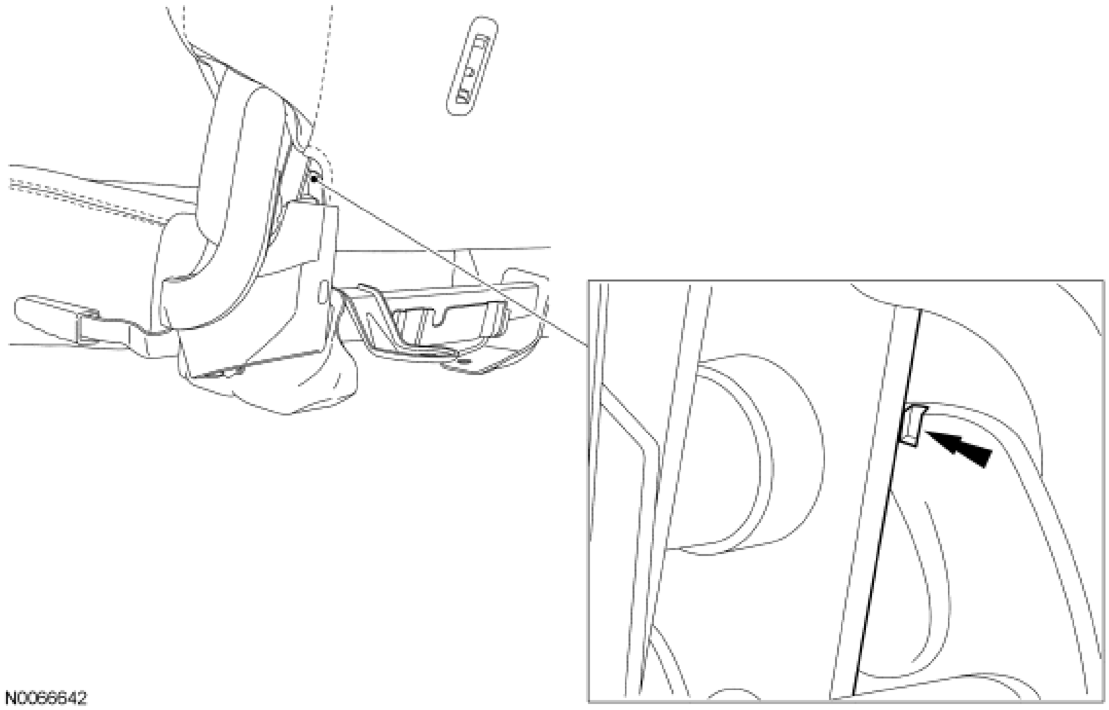


Fig. 444: Recliner Arm On Outboard Recliner Must Be Aligned To Stamped Index Mark
Courtesy of FORD MOTOR CO.

7. The recliner arm on the inboard recliner must be aligned to the stamped index mark as shown in illustration.
   - If the inboard recliner arm does not align to the stamped index mark on the recliner, repeat the recliner synchronization steps.

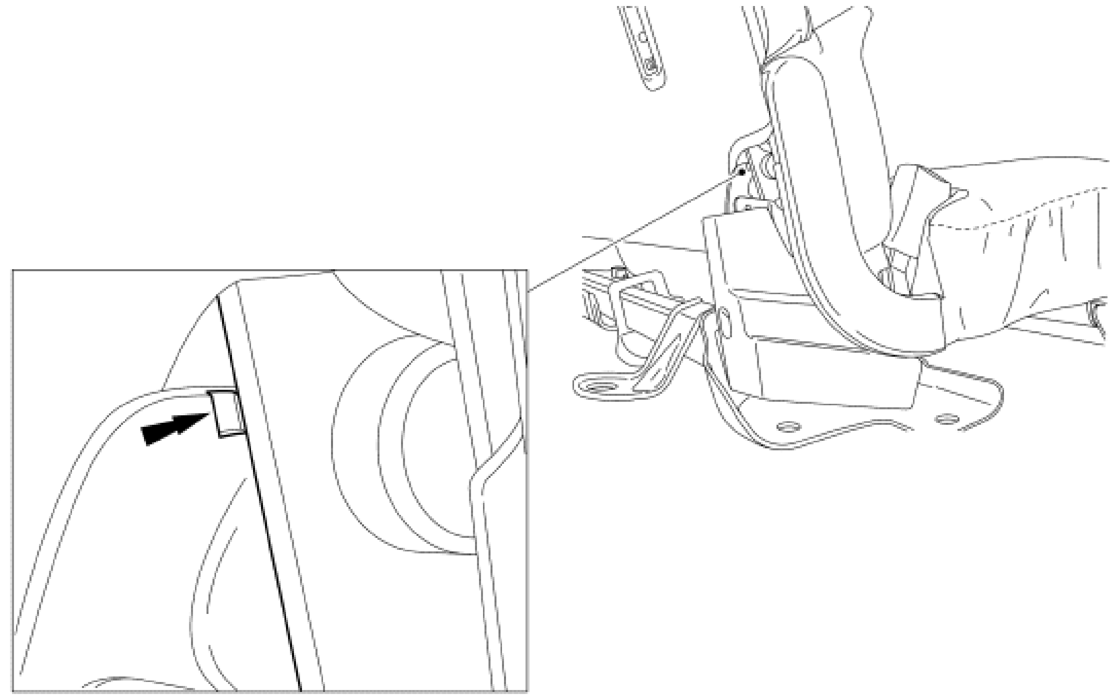


Fig. 445: Recliner Arm On Inboard Recliner Must Be Aligned To Stamped Index Mark
Courtesy of FORD MOTOR CO.

8. If the outboard and inboard recliner arms align to the stamped index mark on the recliners, proceed to the seat installation steps. If the outboard and inboard recliner arms do not align to the stamped index mark on the recliners or the recliner handle is actuated, repeat the recliner synchronization steps.

Seat installation

WARNING: **Always keep the seat back in the upright position while installing the seat and when tightening all retainers to specification. Always verify correct seat recliner alignment. Correct seat recliner alignment is critical for correct seat and safety belt retractor operation in a crash. Failure to follow these instructions may result in serious personal injury to the vehicle occupant(s).**

9. Install the 60 percent seat in the vehicle with the seat backrest in the upright position and the recliners aligned to the stamped index mark.

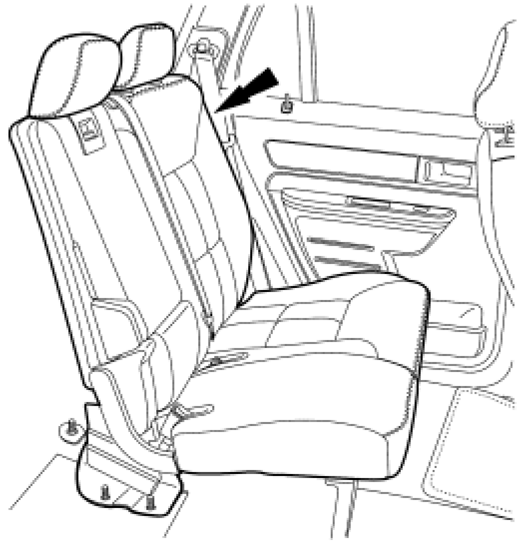


Fig. 446: Installing 60 Percent Seat In Vehicle With Seat Backrest In Upright Position
Courtesy of FORD MOTOR CO.

10. Position the 60 percent seat in the vehicle. Install and tighten seat fasteners 1 through 7 in the sequence shown in illustration.
    - Tighten to 70 Nm (52 lb-ft).
        - The outboard and inboard recliner arms must be aligned to the stamped index mark on the recliners and remain there until the seat-to-floor fasteners are tightened to specification in the sequence shown in illustration. If the outboard and inboard recliner arms do not align to the stamped index mark on the recliners or the recliner handle is actuated before the seat-to-floor fasteners are tightened to specification in the sequence shown in illustration, remove the seat and carry out the recliner synchronization steps.

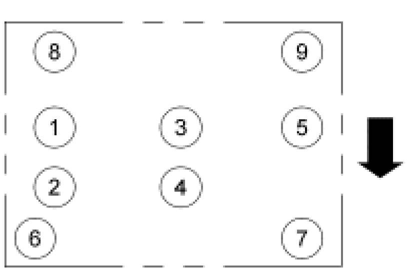


Fig. 447: Fastener Tightening Sequence
Courtesy of FORD MOTOR CO.

11. Through the back hatch, install and tighten seat fasteners 8 and 9 in the sequence shown in illustration.
    - Tighten to 55 Nm (41 lb-ft).
        - The outboard and inboard recliner arms must be aligned to the stamped index mark on the recliners and remain there until the seat-to-floor fasteners are tightened to specification in the sequence shown in illustration. If the outboard and inboard recliner arms do not align to the stamped index mark on the recliners or the recliner handle is actuated before the seat-to-floor fasteners are tightened to specification in the sequence shown in illustration, remove the seat and carry out the recliner synchronization steps.

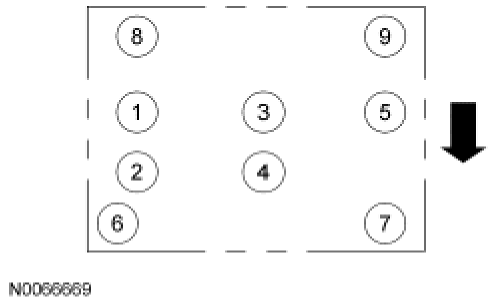


Fig. 448: Fastener Tightening Sequence
Courtesy of FORD MOTOR CO.

12. Connect the heated seat (if equipped) and the power-fold actuator (if equipped) electrical connector(s).
13. Install the load floor to the cargo area.
14. Install the 60 percent seat outboard bolt cover.
15. Install the kneeling assembly rubber stud cap (if equipped).
16. The recliner arm on the outboard recliner must be aligned to the stamped index mark as shown in illustration.

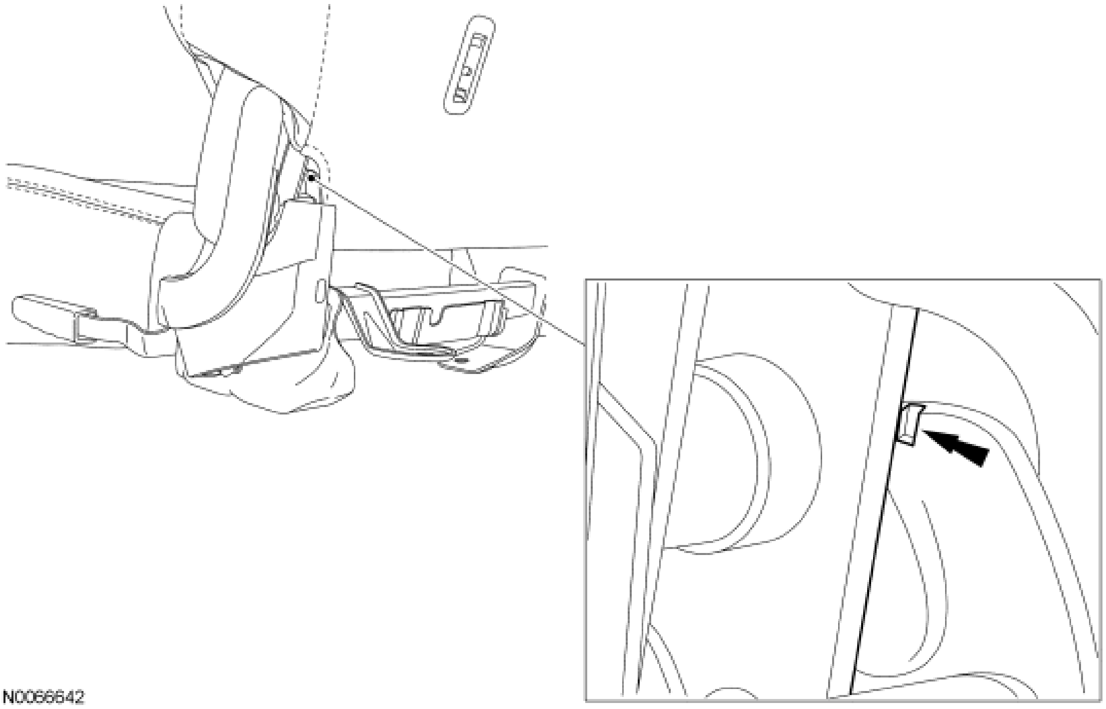


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Fig. 449: Recliner Arm On Outboard Recliner Must Be Aligned To Stamped Index Mark
Courtesy of FORD MOTOR CO.

17. The recliner arm on the inboard recliner must be aligned to the stamped index mark as shown in illustration.

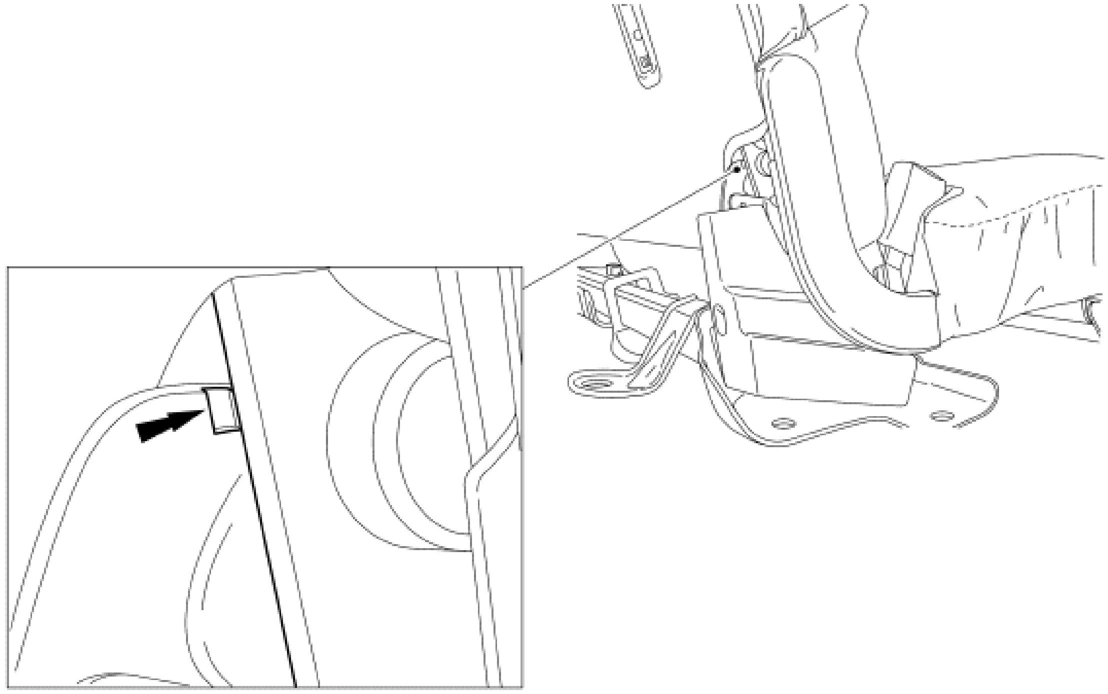

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Fig. 450: Recliner Arm On Inboard Recliner Must Be Aligned To Stamped Index Mark
Courtesy of FORD MOTOR CO.

18. Make sure that the 60 percent seat outboard and inboard recliners are aligned to the stamped index marks and still synchronized. If the outboard and inboard recliner arms do not align to the stamped index mark on the recliners or the recliner handle is actuated, remove the 60 percent seat and carry out the recliner synchronization steps.
19. Install the 40 percent seat. For additional information, refer to **Seat - Rear, 40 Percent**.
20. Make sure the safety belt buckles are accessible to the occupants after installation.

SEAT - EXPLODED VIEW, REAR

NOTE: A new heater mat will come assembled on a new foam pad.

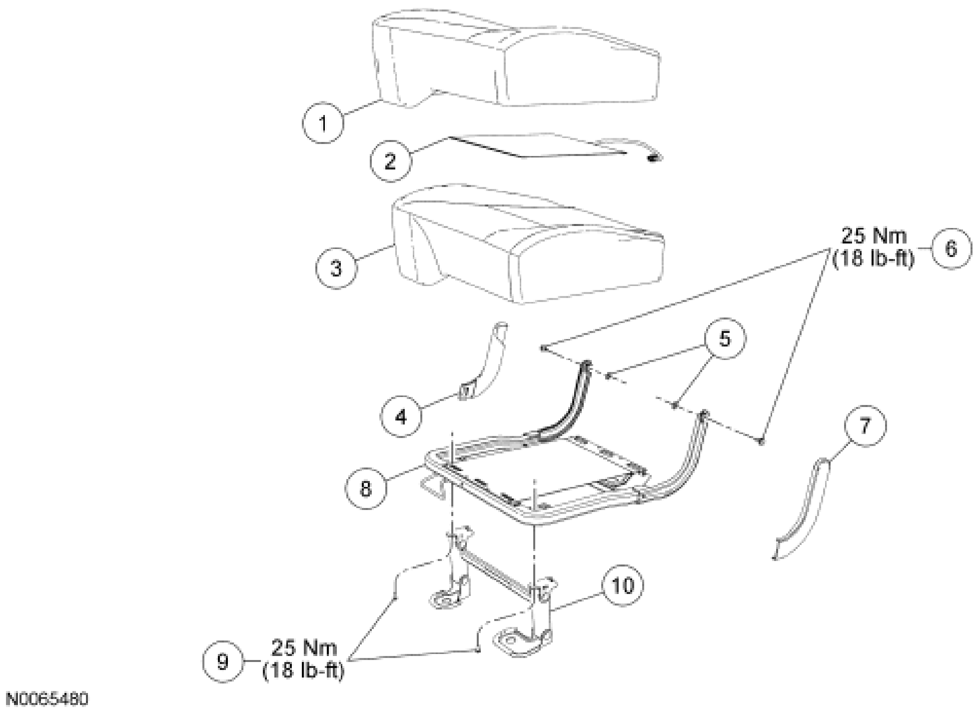


Fig. 451: Exploded View Of Rear Seat Cushion, 40 Percent With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	63804	Cushion trim cover
2	-	Cushion heater mat (if equipped) (part of 63840)
3	63840	Cushion foam pad
4	666L76	Outboard cushion frame pivot bracket cover

5	-	Wave washers
6	W712172	Cushion frame pivot bracket bolts
7	66L75	Inboard cushion frame pivot bracket cover
8	63160	Cushion frame
9	N605892	Kneeling assembly-to-cushion frame bolts
10	605B10	Kneeling assembly

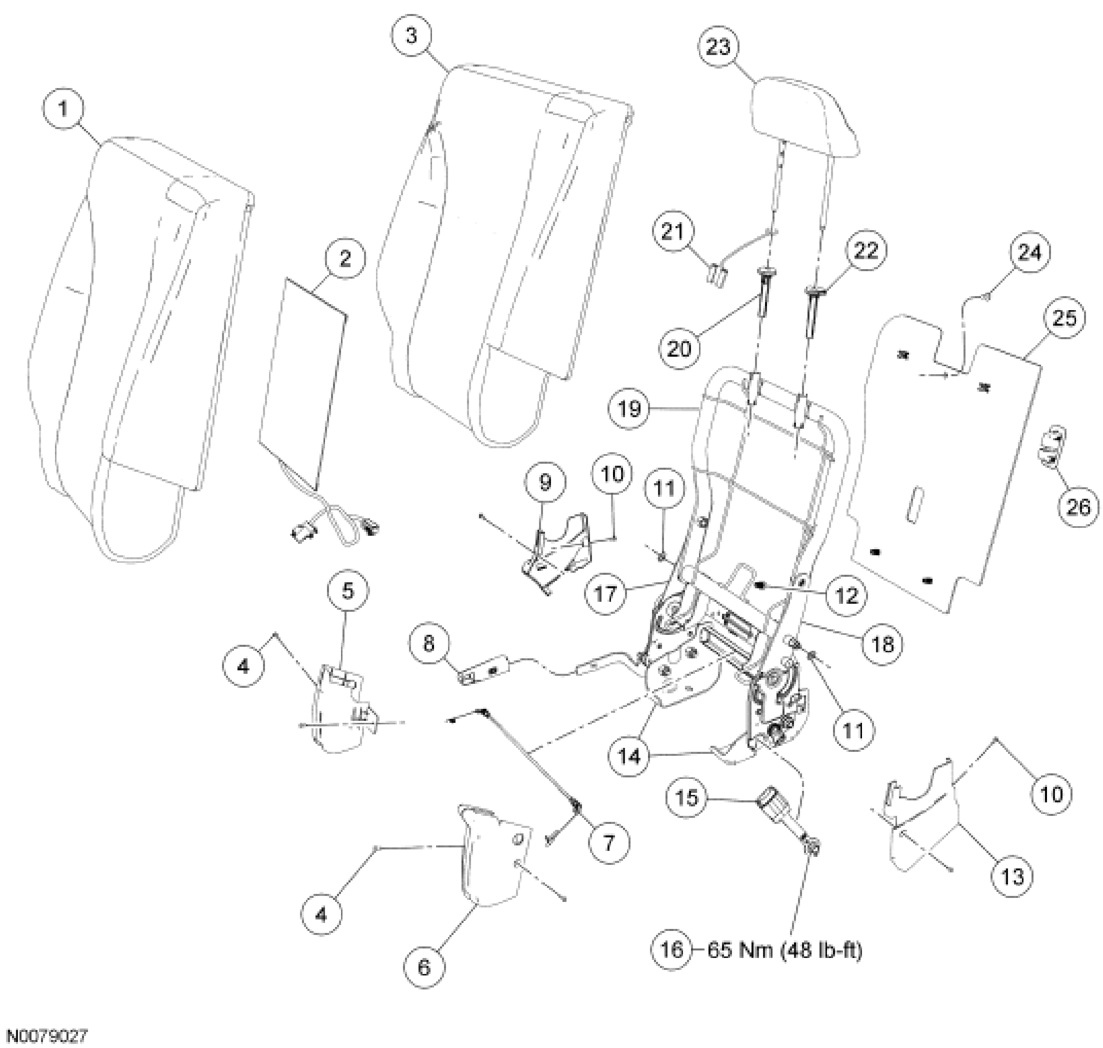


Fig. 452: Rear Seat Backrest, 40 Percent
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	66600	Backrest trim cover

2	-	Backrest heater mat (if equipped) (part of 66800)
3	66800	Backrest foam pad
4	-	Screws (4 required)
5	61348	Outboard upper side shield
6	61348	Inboard upper side shield
7	601L60	Recliner cable
8	62418	Recliner handle cover
9	61348	Outboard lower side shield
10	-	Screws (4 required)
11	-	Wave washers (2 required)
12	-	Pin-type retainer
13	61349	Inboard lower side shield
14	-	Anchor brackets (part of backrest assembly 613A38)
15	60044	Safety belt buckle
16	-	Safety belt buckle bolt (part of 60044)
17	-	Outboard recliner (part of backrest assembly 613A38)
18	-	Inboard recliner (part of backrest assembly 613A38)
19	-	Backrest frame (part of backrest assembly 613A38)
20	610A16	Head restraint guide (slave)
21	-	Safety belt comfort guide
22	610A16	Head restraint guide (master)
23	611A08	Head restraint
24	-	Pin-type retainer
25	60508	Back panel
26	666L76	Child safety seat tether anchor bezel

NOTE: **A new heater mat will come assembled on a new foam pad.**

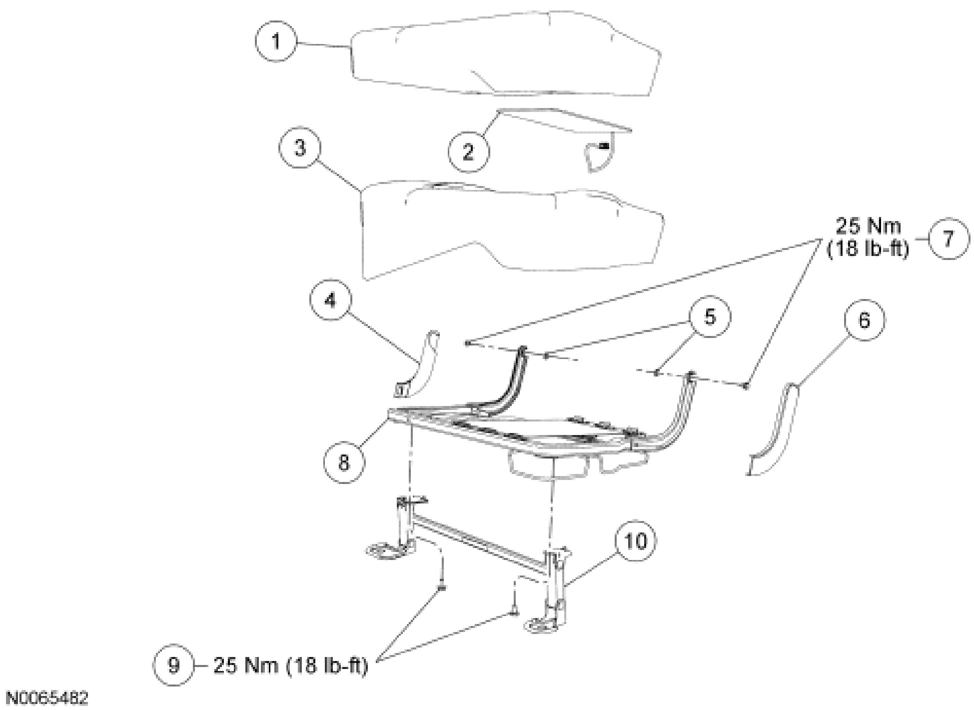


Fig. 453: Exploded View Of Rear Seat Cushion, 60 Percent With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	63805	Cushion trim cover
2	-	Cushion heater mat (if equipped) (part of 63841)
3	63841	Cushion foam pad
4	666L76	Inboard cushion frame pivot bracket cover
5	-	Wave washers
6	666L75	Outboard cushion frame pivot bracket cover
7	W712172	Cushion frame pivot bracket bolts
8	63161	Cushion frame
9	N605892	Kneeling assembly-to-cushion frame bolts
10	605B11	Kneeling assembly

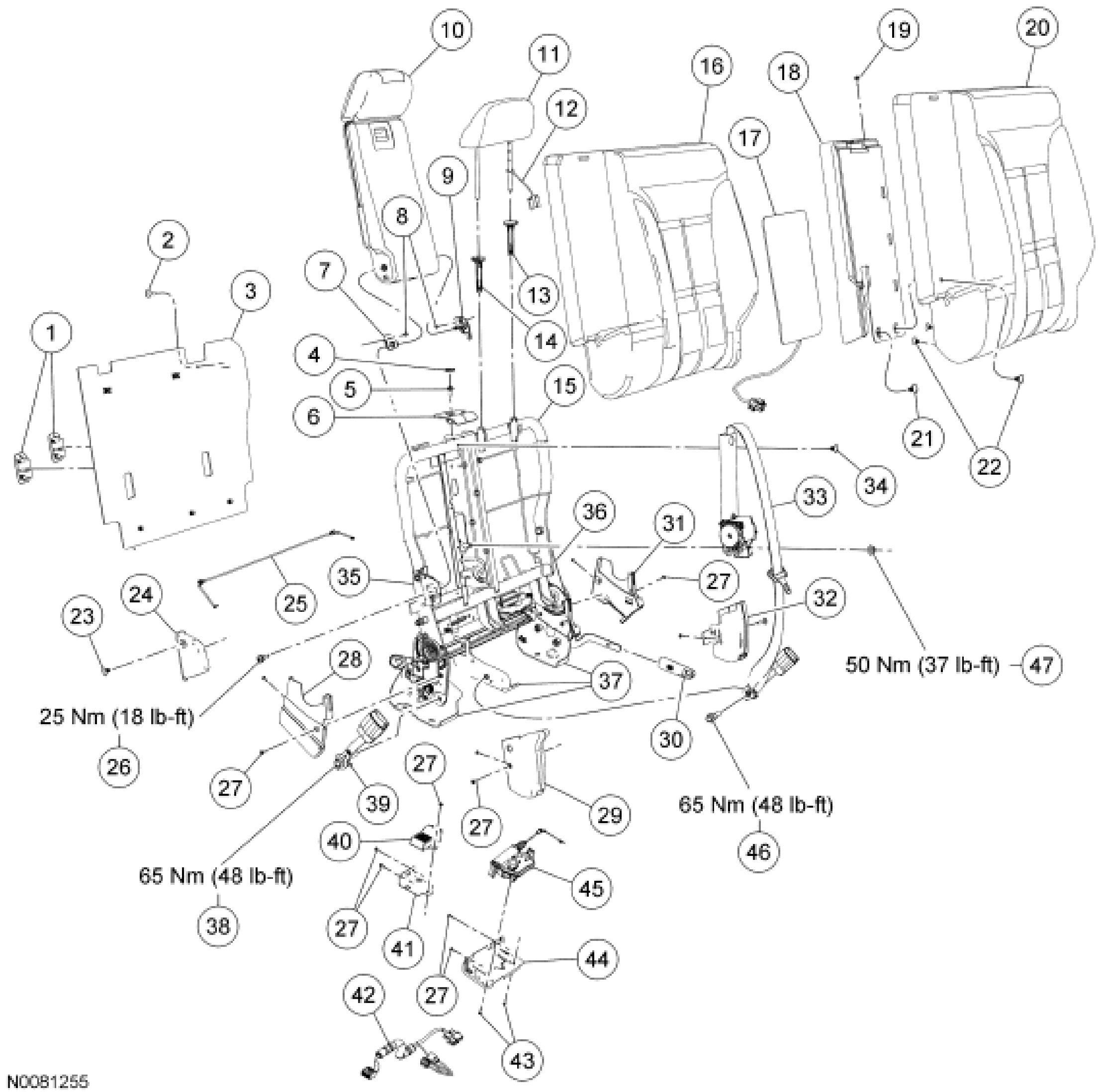


Fig. 454: Rear Seat Backrest, 60 Percent
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	666L76	Child safety seat tether anchor bezels
2	-	Pin-type retainer
3	60509	Back panel
4	237W10	Safety belt bezel screw cover (part of 611A70)
5	-	Safety belt bezel screw
6	611A70	Safety belt bezel
7	67336	RH armrest detent
8	-	Armrest detent-to-backrest frame screws
9	67336	LH armrest detent

10	67112	Armrest
11	611A08	Head restraint
12	-	Safety belt comfort guide
13	610A16	Head restraint guide (master)
14	610A16	Head restraint guide (slave)
15	-	Backrest frame (part of backrest assembly 613A39)
16	66801	Backrest foam pad
17	-	Backrest heater mat (if equipped) (part of 66801)
18	61046	Armrest filler panel
19	-	Screw
20	66601	Backrest trim cover
21	-	Pin-type retainer
22	-	Pin-type retainers
23	-	Pin-type retainer
24	61349	Armrest bracket trim cover
25	601L60	Recliner cable
26	-	Armrest bolt
27	W712241	Screws
28	61349	Inboard lower side shield
29	61349	Inboard upper side shield
30	62419	Recliner handle cover
31	61349	Outboard lower side shield
32	61349	Outboard upper side shield
33	611B64	Safety belt retractor
34	-	Pin-type retainer
35	-	Inboard recliner (part of backrest assembly 613A39)
36	-	Outboard recliner (part of backrest assembly 613A39)
37	-	Anchor brackets (part of backrest assembly 613A39)
38	-	Safety belt buckle bolt (part of 60044)
39	60044	Safety belt buckle
40	-	Heated seat module (if equipped)
41	60328	Heated seat module bracket (if equipped)
42	19K315	Wire harness (if equipped)
43	-	Screws (2 required) (if equipped)
44	-	Power fold motor bracket (if equipped)
45	613A68	Power fold motor (if equipped)

46	-	Safety belt retractor belt and buckle anchor bolt (part of 611B64)
47	-	Safety belt retractor nut

1. For additional information, refer to the appropriate procedure.

SEAT BACKREST COVER - REAR, 40 PERCENT

REMOVAL AND INSTALLATION

NOTE: A new heater mat will come assembled on a new foam pad.

1. Remove the 40 percent seat. For additional information, refer to **Seat - Rear, 40 Percent**.
2. Remove the 40 percent cushion. For additional information, refer to **Seat Cushion - Rear, 40 Percent**.
3. Remove the head restraint.
    1. Push in the hole, lift up on the head restraint and release one side of the head restraint.
    2. Push the release button and remove the head restraint.
    3. Remove the safety belt comfort guide.

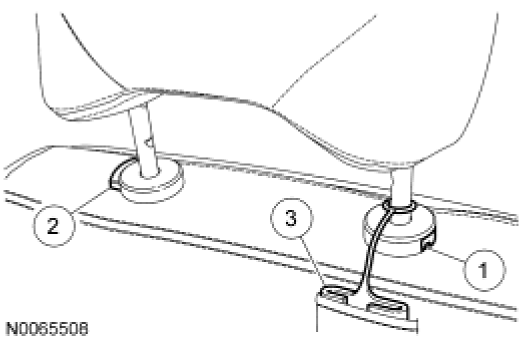


Fig. 455: Locating Safety Belt Comfort Guide & Release Button On Head Restraint
Courtesy of FORD MOTOR CO.

NOTE: Always install a new slave head restraint guide.

4. Pull out and remove the master and slave head restraint guides.
5. Release the tabs and remove the child safety seat tether anchor bezel.

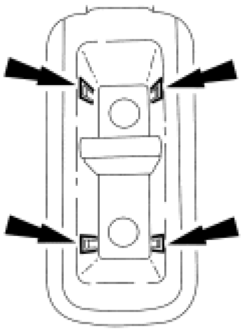


Fig. 456: Locating Tabs On Child Safety Seat Tether Anchor Bezel
Courtesy of FORD MOTOR CO.

6. Release the backrest trim cover lower J-clip.
   - Pull the heated seat electrical connector through the backrest trim cover opening (if equipped).
7. At the rear inboard side of the backrest, access the zipper tucked up behind the back panel and unzip the zipper.
8. Remove the pin-type retainer holding the backrest trim cover around the lower anchors and tethers for children (LATCH) and attaching to the lower rear of the backrest frame.
9. Remove the pin-type retainer from inside the safety belt comfort guide pocket.

NOTE: Use care when separating the backrest trim cover from the hook-and-loop strips, or the hook-and-loop strips can be torn from the backrest foam pad.

10. Release the hook-and-loop strips and invert the backrest trim cover in an inside out fashion to the wire in the backrest trim cover attached to the clips in the backrest foam pad.
11. Separate the backrest trim cover wire from the clips in the backrest foam pad and remove the backrest trim cover.
12. To install, reverse the removal procedure.

SEAT BACKREST COVER - REAR, 60 PERCENT

REMOVAL AND INSTALLATION

NOTE: A new heater mat will come assembled on a new foam pad.

1. Remove the 60 percent seat. For additional information, refer to **Seat - Rear, 60 Percent**.
2. Remove the 60 percent cushion. For additional information, refer to **Seat Cushion - Rear, 60 Percent**.

NOTE: Make sure the safety belt webbing is not twisted prior to installation.

3. Remove the bolt and separate the safety belt retractor belt and buckle anchor from the riser.
   - To install, tighten to 65 Nm (48 lb-ft).
4. Remove the head restraint.

1. Push in the hole, lift up on the head restraint and release one side of the head restraint.
2. Push the release button and remove the head restraint.
3. Remove the safety belt comfort guide.

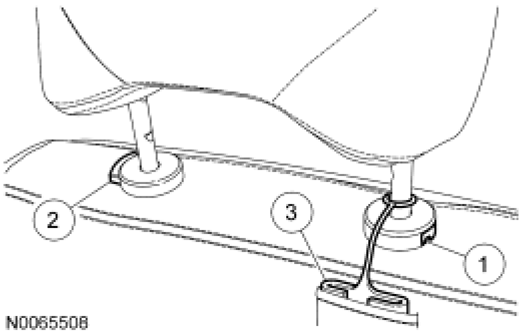


Fig. 457: Locating Safety Belt Comfort Guide & Release Button On Head Restraint
Courtesy of FORD MOTOR CO.

NOTE: Always install a new slave head restraint guide.

5. Pull out and remove the master and slave head restraint guides.
6. Remove the armrest bracket trim cover pin-type retainer and the armrest bracket trim cover.
   - Cycle the armrest up and down to aid trim cover removal.
7. Remove the armrest bolt.
   - To install, tighten to 25 Nm (18 lb-ft).
8. Remove the armrest.
   - With the armrest upright, tip the outboard side of the armrest to disengage the stop from the backrest frame channel.
9. Remove the pin-type retainer in the armrest pocket, attaching the backrest trim cover to the backrest.
10. Release the tabs and remove the child safety seat tether anchor bezel.
    - Repeat for the other child safety seat tether anchor bezel.

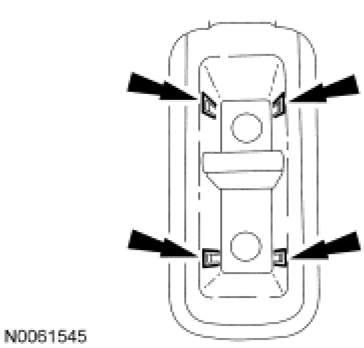


Fig. 458: Locating Tabs On Child Safety Seat Tether Anchor Bezel
Courtesy of FORD MOTOR CO.

11. Remove the safety belt bezel screw cover, the screw and the safety belt bezel.
    - During assembly, make sure the safety belt bezel clips in place.
12. Release the backrest trim cover lower J-clip.
    - Pull the heated seat electrical connector through the backrest trim cover opening (if equipped).
13. At the rear inboard side of the backrest, access the zipper tucked up behind the back panel and unzip the zipper.
14. Remove the 2 pin-type retainers holding the backrest trim cover around each of the 2 lower anchors and tethers for children (LATCH) and attaching to the lower rear of the backrest frame.
15. Remove the pin-type retainer from inside the safety belt comfort guide pocket.
16. Pull back the backrest trim cover over the armrest bracket and backrest frame latching wire for the armrest.
17. Remove the screw at the top and the pin-type retainer at the bottom of the armrest filler panel.
18. Lift the armrest filler panel over the armrest pivot bracket and slide out to the outboard side of the seat.
    - During assembly, make sure the armrest filler panel clips in place around the backrest trim cover J-clip, at the inboard side.
19. Release the backrest trim cover J-clip from the backrest frame in the armrest pocket.
20. From the back, invert the backrest trim cover up and over the backrest frame and remove the backrest trim cover and backrest foam pad.

NOTE: Use care when separating the backrest trim cover from the hook-and-loop strips, or the hook-and-loop strips can be torn from the backrest foam pad.

21. Remove the backrest trim cover from the backrest foam pad in the following sequence.
    1. Invert the backrest trim cover in an inside out fashion to the wire in the backrest trim cover attached to the clips in the backrest foam pad.
        - Separate the hook-and-loop strips.
    2. Separate the backrest trim cover wire from the clips in the backrest foam pad.
    3. Remove the backrest trim cover.
        - Feed the safety belt retractor belt and safety belt buckle through the backrest trim cover and backrest foam pad.
22. To install, reverse the removal procedure.
    - Check the active restraint system for correct operation. For additional information, refer to safety belt system in the Diagnosis and Testing portion of **SAFETY BELT SYSTEM** article.
        - Verify the safety belt retractor operates without excessive effort or binding.
        - Make sure the LATCH is accessible to the occupant.

SEAT CUSHION - REAR, 40 PERCENT

REMOVAL AND INSTALLATION

All seats

1. Remove the 40 percent seat. For additional information, refer to **Seat - Rear, 40 Percent**.

   Seats equipped with heat

2. Disconnect the backrest heater mat electrical connector. Separate the 2 heated seat electrical connectors from the backrest assembly.

   All seats

3. Release the tab and remove the outboard cushion frame pivot bracket cover.
4. Release the tab and remove the inboard cushion frame pivot bracket cover.
5. Remove the 2 cushion frame pivot bracket bolts and the cushion assembly.
   - To install, tighten to 25 Nm (18 lb-ft).
6. To install, reverse the removal procedure.

SEAT CUSHION COVER - REAR, 40 PERCENT

REMOVAL AND INSTALLATION

NOTE: A new heater mat will come assembled on a new foam pad.

1. Remove the 40 percent seat. For additional information, refer to **Seat - Rear, 40 Percent**.
2. Release all the cushion trim cover-to-cushion frame retainers and remove the cushion foam pad and cushion trim cover.

   NOTE: Use care when separating the cushion trim cover from the hook-and-loop strips, or the hook-and-loop strips can be torn from the cushion foam pad.

3. Remove the cushion trim cover in the following sequence.
   1. Feed the heater mat wire harness and electrical connectors back through the cushion trim cover (if equipped).
   2. Release the hook-and-loop strips.
   3. Separate the cushion trim cover wire retainer from the clips in the cushion foam pad and remove the cushion trim cover.
4. To install, reverse the removal procedure.

SEAT CUSHION - REAR, 60 PERCENT

All seats

1. Remove the 60 percent seat. For additional information, refer to **Seat - Rear, 60 Percent**.

   Seats equipped with heat

2. Disconnect the 2 heater mat electrical connectors. Separate the 2 heater mat electrical connectors from the backrest assembly.

   All seats

3. Release the tab and remove the outboard cushion frame pivot bracket cover.
4. Release the tab and remove the inboard cushion frame pivot bracket cover.
5. Remove the 2 cushion frame pivot bracket bolts and the cushion assembly.
   - To install, tighten to 25 Nm (18 lb-ft).
6. To install, reverse the removal procedure.

SEAT CUSHION COVER - REAR, 60 PERCENT

REMOVAL AND INSTALLATION

NOTE: A new heater mat will come assembled on a new foam pad.

1. Remove the 60 percent seat. For additional information, refer to **Seat - Rear, 60 Percent**.
2. Release all the cushion trim cover-to-cushion frame retainers and remove the cushion foam pad and cushion trim cover.

   NOTE: Use care when separating the cushion trim cover from the hook-and-loop strips, or the hook-and-loop strips can be torn from the cushion foam pad.

3. Remove the cushion trim cover in the following sequence.
   1. Feed the heater mat wire harness and electrical connectors back through the cushion trim cover (if equipped).
   2. Release the hook-and-loop strips.
   3. Separate the cushion trim cover wire retainer from the clips in the cushion foam pad and remove the cushion trim cover.
4. To install, reverse the removal procedure.

POWER-FOLD SEAT MOTOR - REAR SEAT

REMOVAL AND INSTALLATION

1. Remove the affected 40 percent or 60 percent seat. For additional information, refer to **Seat - Rear, 40 Percent** or **Seat - Rear, 60 Percent**.
2. Remove 2 screws and the outboard lower side shield.
3. Remove the power fold motor in the following sequence.
   1. Remove the 2 screws from the power fold motor.
   2. Slide the cable housing out of the recliner.

3. Turn the cable end so the tab aligns with the slot in the lever and separate the cable.
4. Remove the power fold motor.

4. To install, reverse the removal procedure.

HEATED SEAT SWITCH - REAR SEAT

NOTE: RH switch shown in illustration, LH similar.

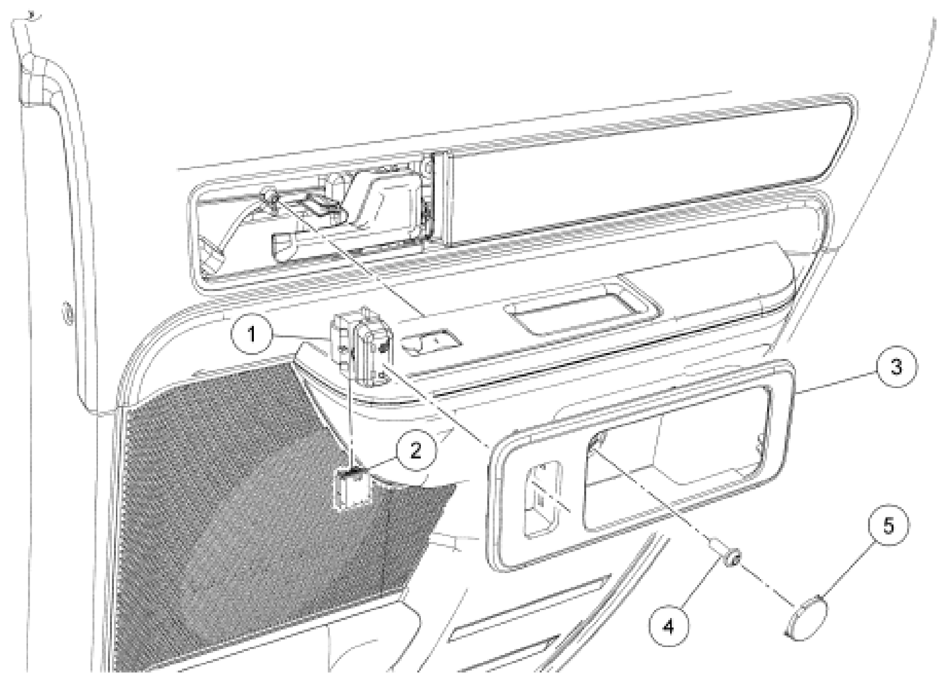


Fig. 459: Exploded View Of Rear Seat Heated Seat Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Heated seat switch
2	-	Electrical connector (part of 14632)
3	-	Rear door handle bezel
4	-	Rear door handle bezel screw
5	-	Rear door handle bezel screw cover

REMOVAL AND INSTALLATION

1. Remove the door handle bezel on the side of the affected switch in the following sequence.
   1. Remove the rear door handle bezel screw cover.
   2. Remove the rear door handle bezel screw.

   3. Separate the rear door handle bezel from the door trim panel.
2. Disconnect the electrical connector, release the clips and remove the heated seat switch from the back side of the rear door handle bezel.
3. To install, reverse the removal procedure.

SEAT CONTROL SWITCH - REAR SEAT

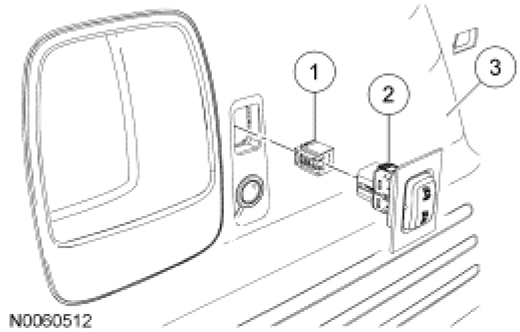


Fig. 460: Seat Control Switch Without Power Liftgate
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Electrical connector (part of 14A005)
2	-	Seat control switch
3	-	Quarter trim panel

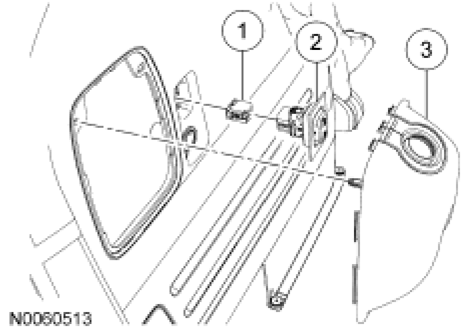


Fig. 461: Seat Control Switch With Power Liftgate
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Electrical connector (part of 14A005)
2	-	Seat control switch
3	-	Power liftgate strut cover

REMOVAL AND INSTALLATION

Vehicles without power liftgate

1. Remove the quarter trim panel. For additional information, refer to **INTERIOR TRIM & ORNAMENTATION** article.

   Vehicles with power liftgate

2. Pull out and remove the power liftgate strut cover in the quarter trim panel.

   All vehicles

3. Remove the seat control switch.
   - Disconnect the electrical connector.
   - Squeeze the tab at the top and bottom of the seat control switch and remove from the quarter trim panel.
4. To install, reverse the removal procedure.

HEATED SEAT MODULE - REAR SEAT

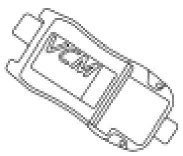
REMOVAL AND INSTALLATION

1. Remove the second row 60 percent seat front riser-to-floor nut and bolt.
   - To install, tighten to 70 Nm (52 lb-ft).
2. Pivot the front of the 60 percent seat cushion upward.
3. Remove the screw, disconnect the electrical connector and remove the heated seat module.
4. To install, reverse the removal procedure.

DISASSEMBLY AND ASSEMBLY

SEAT BACKREST - FRONT, WITHOUT FOLD FLAT

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

NOTE: **Driver backrest shown in illustration, passenger similar.**

NOTE: **Manual recliners without fold-flat backrest are serviced with the backrest frame. Power recliners without fold-flat backrest are serviced separately.**

NOTE: A new heater mat will come assembled on a new foam pad.

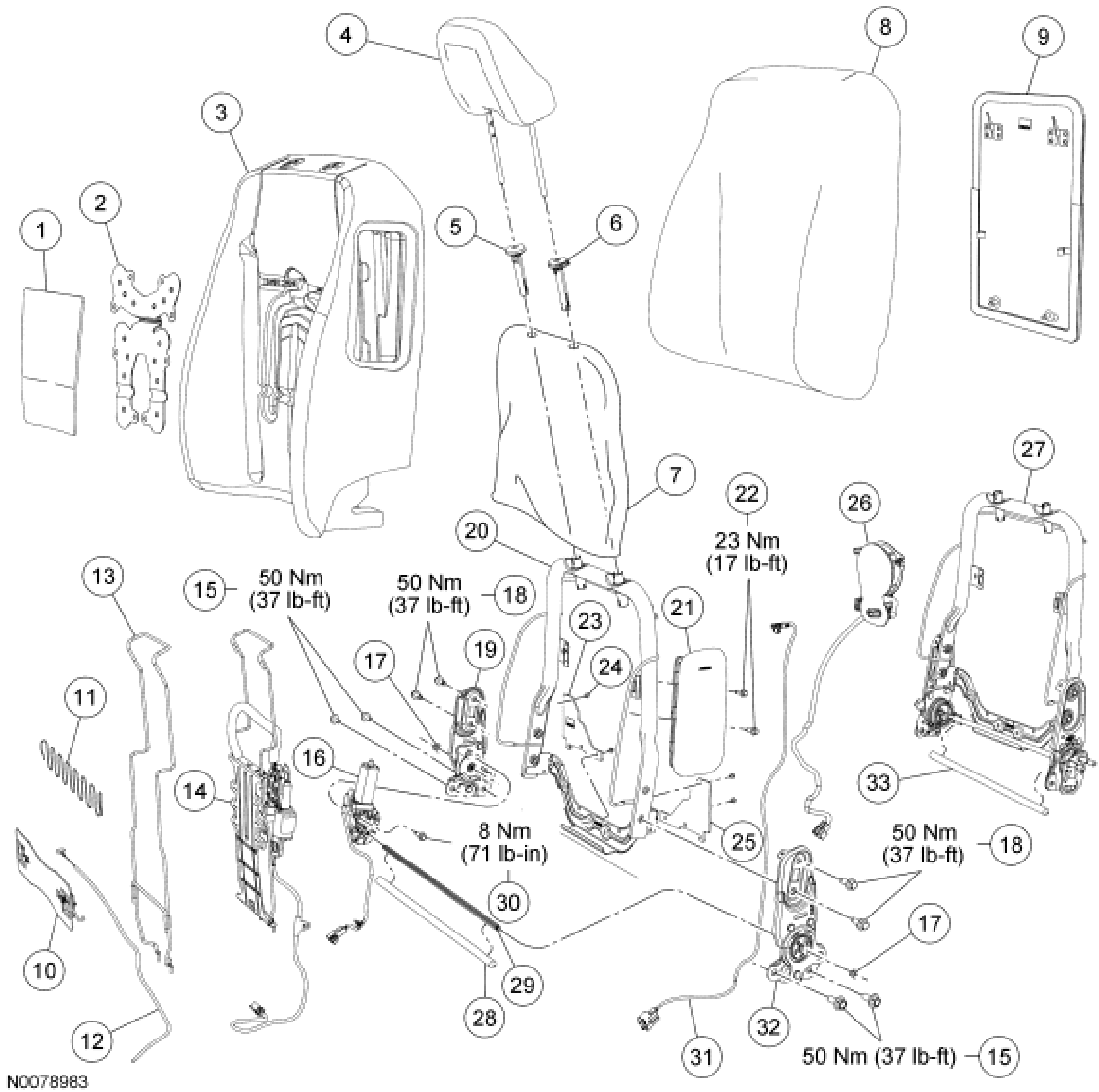


Fig. 462: Front Seat Backrest, Manual and Power Recline, Without Fold Flat
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Backrest heater mat (part of 64811) (if equipped)
2	18D507	Backrest climate control seat manifold (if equipped)
3	64811	Backrest foam pad
4	611A08	Head restraint
5	610A16	Head restraint guide, slave
6	610A16	Head restraint guide, master

7	-	Anti-squeak bag
8	64417	Backrest trim cover
9	-	Backrest trim panel
10	65500	Manual lumbar assembly (if equipped)
11	-	Upper support spring
12	-	Manual lumbar cable (part of 65500) (if equipped)
13	65500	Static lumbar
14	65500	Power lumbar assembly (if equipped)
15	W712240	Power/manual recliner-to-seat track bolts (4 required)
16	14547	Recliner motor (if equipped)
17	-	Recliner torque shaft clips (2 required) (if equipped)
18	W712240	Power recliner-to-backrest frame bolts (4 required) (if equipped)
19	62648	Inboard power recliner (if equipped)
20	61019	Backrest frame (with power recline) (if equipped)
21	611D11	Side air bag module
22	W506021	Side air bag module bolts
23	-	RH attachment panel
24	-	Screw (4 required)
25	-	LH attachment panel
26	18D507	Backrest thermo-electric device (TED) (if equipped)
27	61018	Backrest frame (with manual recline) (if equipped)
28	625A84	Power recline torque shaft cover (if equipped)
29	61726	Recliner torque shaft
30	-	Recliner motor bolt (if equipped)
31	14K155	Side air bag wire harness
32	62648	Outboard power recliner (if equipped)
33	625A84	Manual recline torque shaft cover (if equipped)

DISASSEMBLY

WARNING: **Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result**

in serious personal injury in the event of an accidental deployment.

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the front seat backrest. For additional information, refer to **Seat Backrest - Front**.

   NOTE: The seat backrest trim cover and foam pad have been removed to show the backrest trim panel retainers.

3. Remove the backrest trim panel in the following sequence.
   1. Release the 2 pin-type retainers at the bottom of the backrest trim panel.
   2. Slide the backrest trim panel down to release the upper clips.
   3. Turn the backrest trim panel to release the middle clips and remove the backrest trim panel.

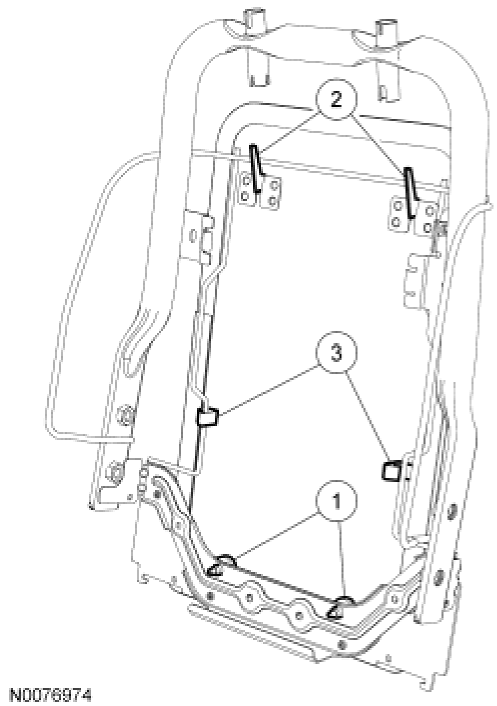


Fig. 463: Locating Pin-Type Retainers, Upper Clips & Middle Clips
Courtesy of FORD MOTOR CO.

NOTE: Lower outer J-clips are unfastened to show inner J-clips.

4. Release the backrest trim cover outer and inner J-clips.

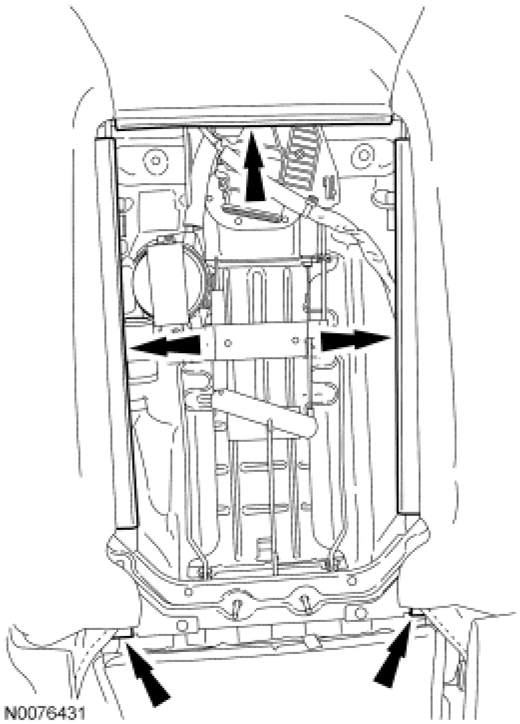


Fig. 464: Locating Inner J-Clips
Courtesy of FORD MOTOR CO.

5. Remove the head restraint.
    1. Using an appropriate tool, push in the hole, lift up on the head restraint and release one side of the head restraint.
    2. Push the release button and remove the head restraint.

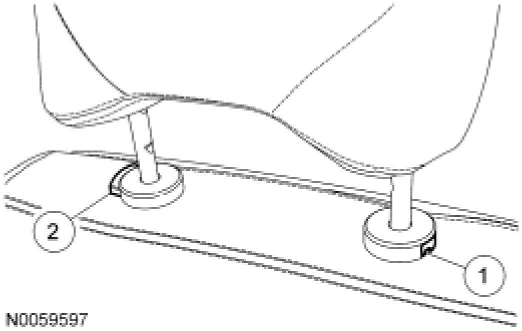


Fig. 465: Locating Release Button On Head Restraint
Courtesy of FORD MOTOR CO.

NOTE: Always install a new slave head restraint guide.

6. Pull out and remove the master and slave head restraint guides.

NOTE: When installing, make sure the side air bag module wiring harness is not pinched between the side air bag module and the backrest frame or damage to the wiring harness can occur.

NOTE: When installing the side air bag module, new bolts must be installed.

7. Remove the side air bag module.
    1. Remove the 2 side air bag module bolts.
        - To install, tighten to 23 Nm (17 lb-ft).
    2. Remove the side air bag module with wire harness.
        - Detach any side air bag module wire harness retainers.

NOTE: Use care when separating the backrest trim cover from the hook-and-loop strips, or the hook-and-loop strips can be torn from the backrest foam pad.

NOTE: A new heater mat will come attached on a new foam pad.

8. Remove the backrest trim cover from the backrest foam pad in the following sequence.
    1. Invert the backrest trim cover in an inside out fashion to the wire in the backrest trim cover attached to the clips in the backrest foam pad.
        - Separate the hook-and-loop strips.
    2. Separate the backrest trim cover wire from the clips in the backrest foam pad.
        - If equipped with climate controlled seats, on assembly make sure the climate control seat manifold is in place before snapping the backrest trim cover wire back into the backrest foam pad clips.
    3. Remove the backrest trim cover.
9. Separate the backrest frame from the backrest foam pad.
    - If equipped with climate controlled seats, on assembly make sure there is no air gap between the backrest thermo-electric device (TED) and the backrest foam pad.

Seats with climate control

10. Remove the backrest climate control seat manifold from the backrest foam pad.
11. Separate the wire harness pin-type retainer from the backrest frame, release the 3 clips and remove the TED.

Seats with power lumbar

12. Remove the power lumbar assembly in the following sequence.
    1. Disconnect the power lumbar motor.
    2. Release the power lumbar assembly clip at the top of the backrest frame.
    3. Slide the lumbar wire frame up and out at the bottom of the backrest frame.

4. Remove the power lumbar assembly.

Seats with manual lumbar

13. Release the manual lumbar hooks from the backrest frame, route out the manual lumbar cable and remove the manual lumbar assembly.

Seats with power recline

NOTE: The recliners are synchronized. Avoid rotating the recliner shaft until fully installed to keep the recliners synchronized.

14. Remove the power recline motor in the following sequence.
    1. Remove the clip from the torque shaft on the power recline motor side.
    2. Slide out and remove the torque shaft.
    3. Remove the power recline motor bolt.
        - To install, tighten to 8 Nm (71 lb-in).
    4. Disconnect and remove the power recline motor.

NOTE: Manual recliners are only serviced with the backrest frame. Do not remove the bolts retaining the manual recliners to the backrest frame.

NOTE: To install a new power recliner, using the torque shaft, rotate both recliners to their front or rear stop.

15. Remove the 4 bolts and the inboard and outboard **power** recliners.
    - To install, tighten to 50 Nm (37 lb-ft).

All seats

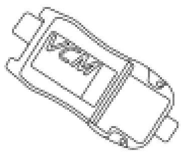
16. To assemble, reverse the disassembly procedure.
17. Install the front seat backrest. For additional information, refer to **Seat Backrest - Front**.
18. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

Passenger seat

19. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT BACKREST - FRONT, WITH FOLD FLAT

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

NOTE: Optional backrest on passenger seat only.

NOTE: Manual recliners with fold-flat backrest are serviced separately.

NOTE: A new heater mat will come assembled on a new foam pad.

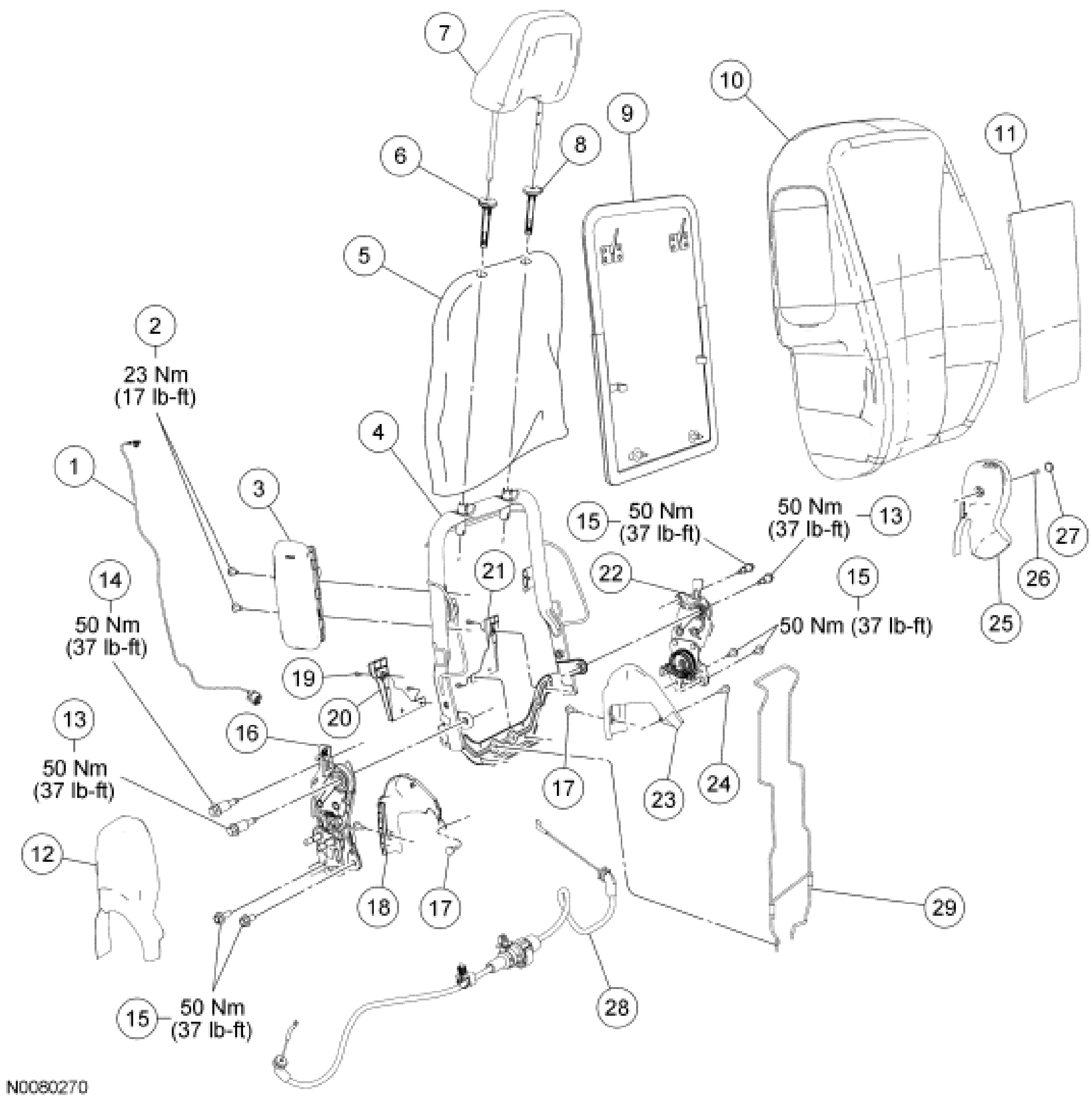


Fig. 466: Front Seat Backrest, Manual Recline With Fold Flat
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14K155	Side air bag wire harness
2	W506021	Side air bag module bolts
3	611D10	Side air bag module
4	-	Fold-flat backrest frame
5	-	Anti-squeak bag
6	610A16	Head restraint guide, slave
7	611A08	Head restraint
8	610A16	Head restraint guide, master
9	60508	Backrest trim panel
10	64810/64416	Backrest foam pad/backrest trim cover

11	-	Backrest heater mat (part of 64810) (if equipped)
12	62186	RH outer fold-flat recliner cover
13	W712059	Fold-flat recliner-to-fold-flat backrest frame front bolts (2 required)
14	W500720	Fold-flat recliner-to-fold-flat backrest frame rear bolts (2 required)
15	W712240	Fold-flat recliner-to-seat track bolts (4 required)
16	-	RH fold-flat recliner
17	62294	Inboard fold-flat recliner cover screws (3 required)
18	62186	RH inboard fold-flat recliner cover
19	-	Screw (4 required)
20	-	RH attachment panel
21	-	LH attachment panel
22	-	LH fold-flat recliner
23	62187	LH inboard fold-flat recliner cover
24	W714053	Scrivet
25	62187	LH outer fold-flat recliner cover
26	62294	LH outer fold-flat recliner cover screw
27	-	Screw cover
28	-	Fold-flat recliner cable
29	65500	Static lumbar

DISASSEMBLY AND ASSEMBLY

WARNING: **Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury**

or death in a crash.

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Only the front passenger seat can come equipped with optional fold-flat backrest.

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the front seat backrest. For additional information, refer to **Seat Backrest - Front**.
3. Remove the LH and RH outer fold-flat recliner covers.
   - Pull to release the clips.
   - Slide up to disengage the retainer and remove.
4. Remove the 4 fold-flat recliner-to-fold-flat backrest frame bolts.
   - To install, tighten to 50 Nm (37 lb-ft).
   - If necessary, remove the fold-flat recliner cable.

   NOTE: The seat backrest trim cover and foam pad have been removed to show the backrest trim panel retainers.

5. Remove the backrest trim panel in the following sequence.
   1. Release the 2 pin-type retainers at the bottom of the backrest trim panel.
   2. Slide the backrest trim panel down to release the upper clips.
   3. Turn the backrest trim panel to release the middle clips and remove the backrest trim panel.

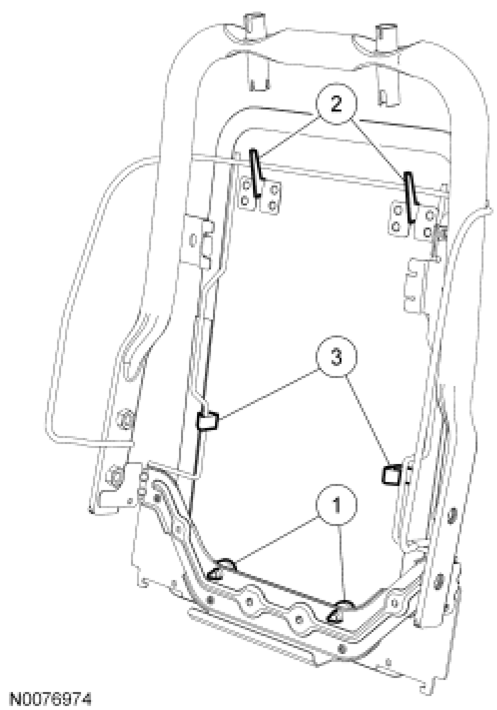


Fig. 467: Locating Pin-Type Retainers, Upper Clips & Middle Clips
Courtesy of FORD MOTOR CO.

NOTE: Lower outer J-clips are unfastened to show inner J-clips.

6. Release the backrest trim cover outer and inner J-clips.

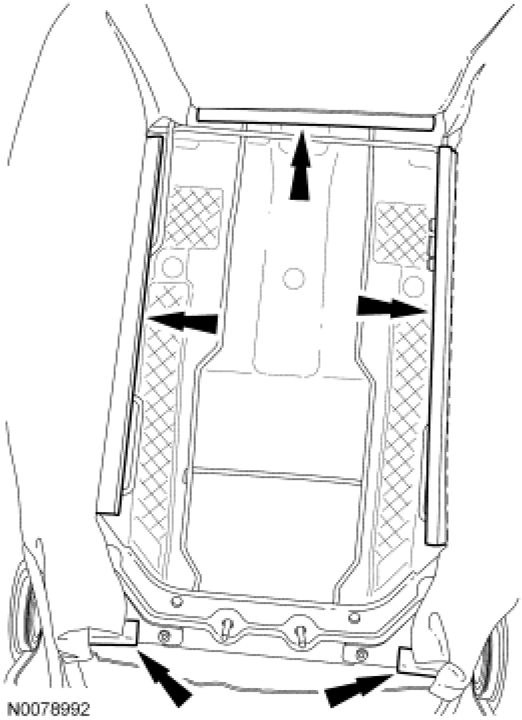


Fig. 468: Locating J-Clips
Courtesy of FORD MOTOR CO.

7. Remove the head restraint.
    1. Using an appropriate tool, push in the hole, lift up on the head restraint and release one side of the head restraint.
    2. Push the release button and remove the head restraint.

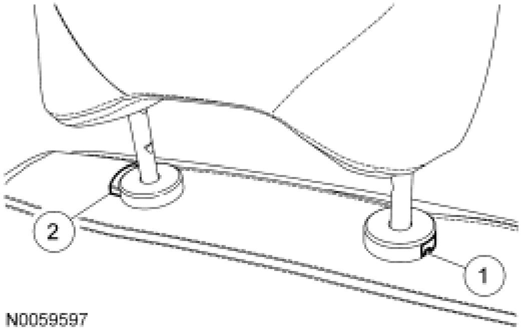


Fig. 469: Locating Release Button On Head Restraint
Courtesy of FORD MOTOR CO.

NOTE: Always install a new slave head restraint guide.

8. Pull out and remove the master and slave head restraint guides.

NOTE: **When installing, make sure the side air bag module wiring harness is not pinched between the side air bag module and the backrest frame or damage to the wiring harness can occur.**

NOTE: **When installing the side air bag module, new bolts must be installed.**

9. Remove the side air bag module.
   - Remove the 2 side air bag module bolts.
     - To install, tighten to 23 Nm (17 lb-ft).
   - Remove the side air bag module with wire harness.
     - Detach any side air bag module wire harness retainers.

NOTE: **Use care when separating the backrest trim cover from the hook-and-loop strips, or the hook-and-loop strips can be torn from the backrest foam pad.**

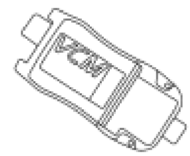
NOTE: **A new heater mat will come attached on a new foam pad.**

10. Remove the backrest trim cover.
    - Invert the backrest trim cover in an inside out fashion to the wire in the backrest trim cover attached to the clips in the backrest foam pad.
      - Separate the hook-and-loop strips.
    - Separate the backrest trim cover wire from the clips in the backrest foam pad.
    - If equipped, feed out the backrest heater mat wire harness from the opening in the side of the backrest trim cover.
    - Remove the backrest trim cover.
11. Separate the backrest frame from the backrest foam pad.
12. To assemble, reverse the disassembly procedure.
13. Install the front seat backrest. For additional information, refer to **Seat Backrest - Front**.
14. Install the front seat. **Do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.
15. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test and prove out the SRS. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT CUSHION - FRONT

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with	

 ST2834-A	appropriate hardware, or equivalent scan tool	

NOTE: Driver seat shown in illustration, passenger similar.

NOTE: A new heater mat will come assembled on a new foam pad.

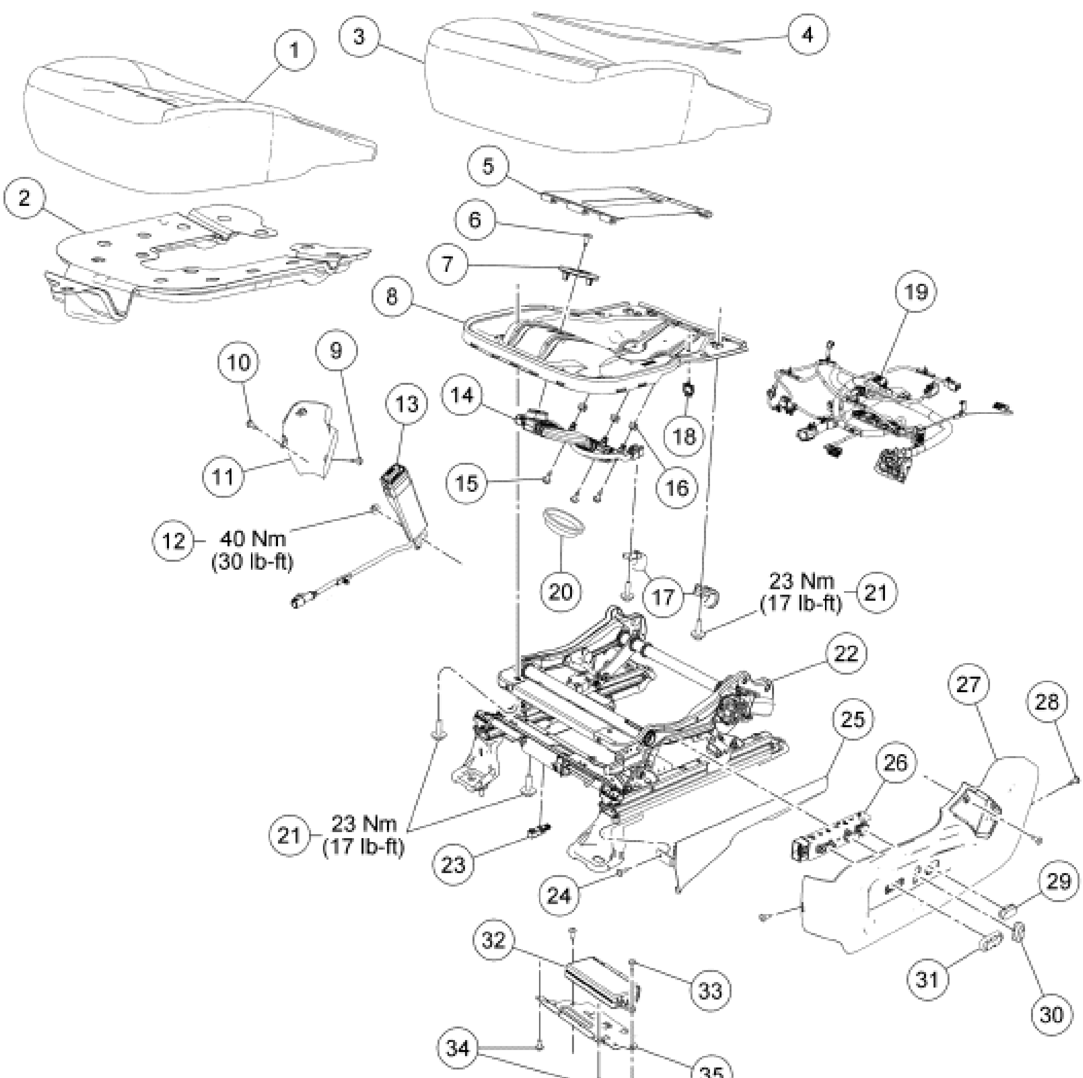


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Fig. 470: Seat Cushion With Power Seat Track
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	62901	Cushion trim cover
2	18D507	Cushion climate control seat manifold (if equipped)
3	632A23	Cushion foam pad
4	-	Cushion heater mat (part of 632A23)
5	63226	Cushion support
6	-	Cushion thermo-electric device (TED)-to-climate control seat cushion adapter screw (if equipped)
7	18D507	Cushion TED adapter (if equipped)
8	63100	Cushion frame
9	62294	Recliner side shield screws
10	W714053	Scrivet
11	62187	Recliner side shield
12	-	Safety belt buckle-to-seat track nut (part of 61203)
13	61203	Safety belt buckle
14	18D507	Cushion TED (if equipped)
15	W505945	Cushion TED-to-cushion frame screw (3 required) (if equipped)
16	-	Screw grommet
17	-	Cushion frame-to-seat track rear brackets
18	-	Wire clip
19	14A699	Driver seat wire harness
20	19E880	Cushion TED filter (if equipped)
21	-	Seat track-to-cushion frame bolts (4 required)
22	61711	Power seat track assembly
23	14B416	Seat position sensor (driver only)
24	62294	Seat track cover retainer
25	62187	Seat track cover
26	14A701	Seat control switch
27	62187	Cushion side shield
28	62294	Cushion side shield retainer (3 required)
29	14711	Power lumbar switch knob (if equipped)
30	14711	Power seat recliner knob
31	14711	Seat control switch knob
32	14C708	Driver seat module (DSM) (if equipped)
33	62294	DSM-to-bracket screw (2 required) (if equipped)
		Bracket-to-seat track screws (if

34	62294	equipped)
35	14A301	DSM bracket (if equipped)

NOTE: A new heater mat will come assembled on a new foam pad.

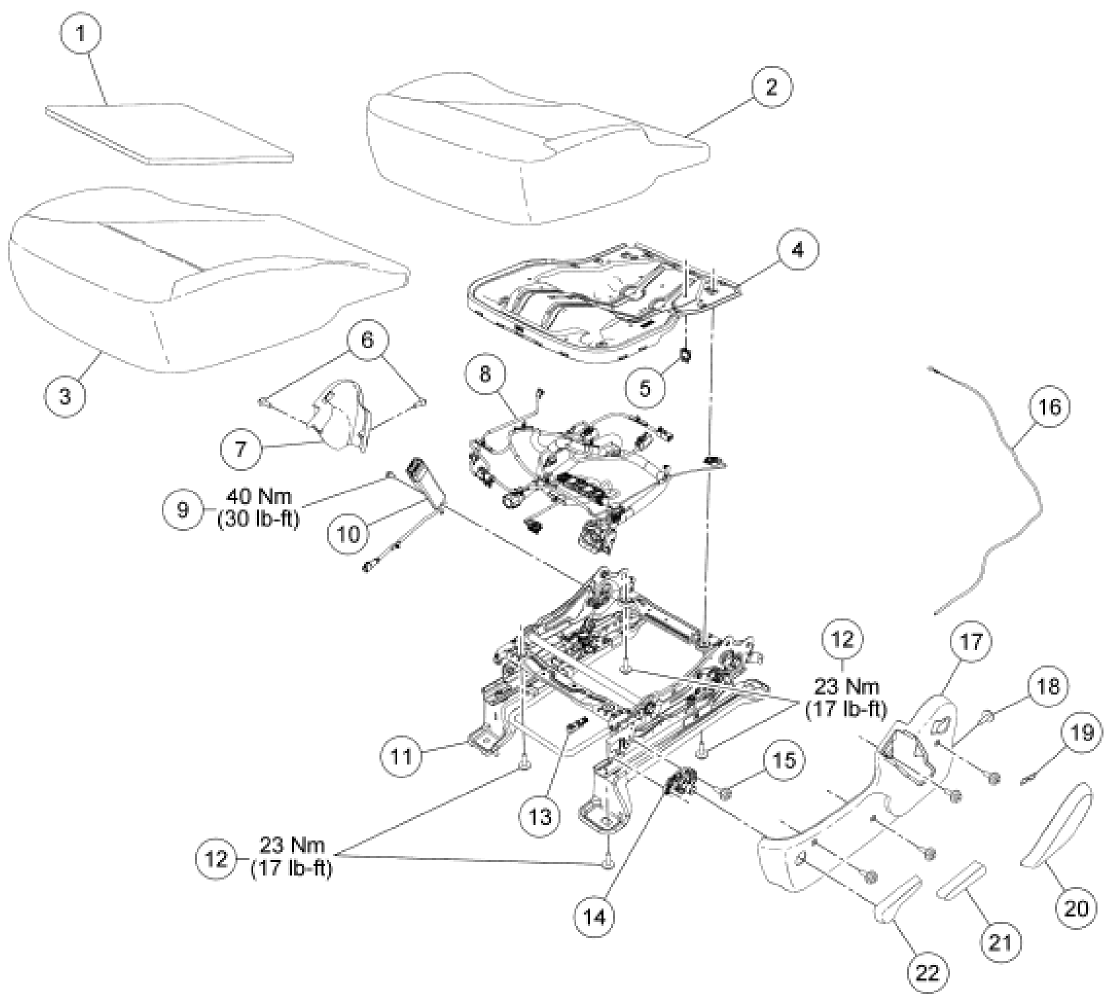


Fig. 471: Driver Seat Cushion With Manual Seat Track
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Cushion heater mat (part of 632A23) (if equipped)
2	62901	Cushion trim cover
3	632A23	Cushion foam pad
4	63100	Cushion frame

5	-	Wire clip
6	62294	Recliner side shield screws
7	-	Recliner side shield
8	14A699	Driver seat wire harness
9	-	Safety belt buckle-to-seat track bolt (part of 61203) (manual driver seat track only)
10	61203	Safety belt buckle
11	61711	Manual seat track assembly
12	-	Seat track-to-cushion frame bolts (4 required)
13	14B416	Seat track position sensor
14	610C01	Manual lumbar adjuster (if equipped)
15	62294	Manual lumbar adjuster-to-seat track screw (if equipped)
16	-	Manual lumbar cable (if equipped)
17	62187	Cushion side shield
18	62294	Cushion side shield retainer (4 required)
19	-	Manual recliner handle spring clip
20	61737	Manual recliner handle
21	61737	Manual height adjust handle (if equipped)
22	617B70	Manual lumbar adjust handle (if equipped)

NOTE: A new heater mat will come assembled on a new foam pad.

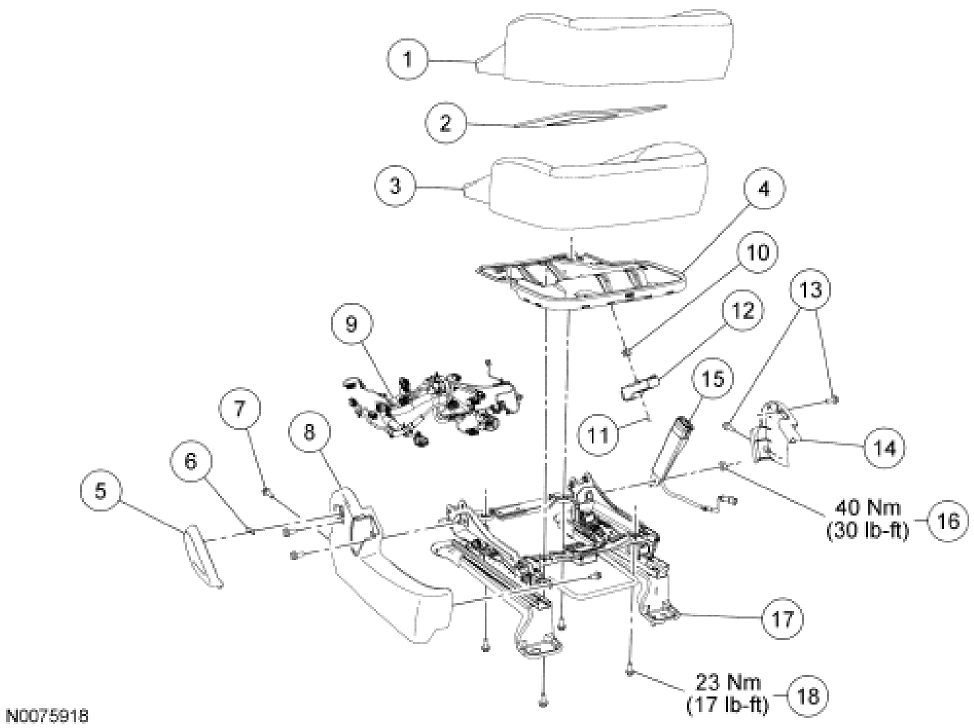


Fig. 472: Passenger Seat Cushion With Manual Seat Track
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	62900	Cushion trim cover
2	-	Cushion heater mat (part of 632A22) (if equipped)
3	632A22	Cushion foam pad
4	63100	Cushion frame
5	61736	Manual recliner handle
6	-	Manual recliner handle cover spring clip
7	62294	Cushion side shield screw (4 required)
8	62186	Cushion side shield
9	14A698	Passenger seat wire harness
10	-	Grommet
11	-	Screw
12	14C724	Heated seat module (if equipped)
13	62294	Recliner side shield screws
14	62187	Recliner side shield
15	61202	Safety belt buckle
16	W520113	Safety belt buckle nut
17	61704	Manual seat track assembly
18	-	Seat track-to-cushion frame bolts (4

		required)

NOTE: **To install a new occupant classification system module (OCSM) or an occupant classification sensor (OCS) weight sensor bolt, refer to the appropriate procedure in SUPPLEMENTAL RESTRAINT SYSTEM article.**

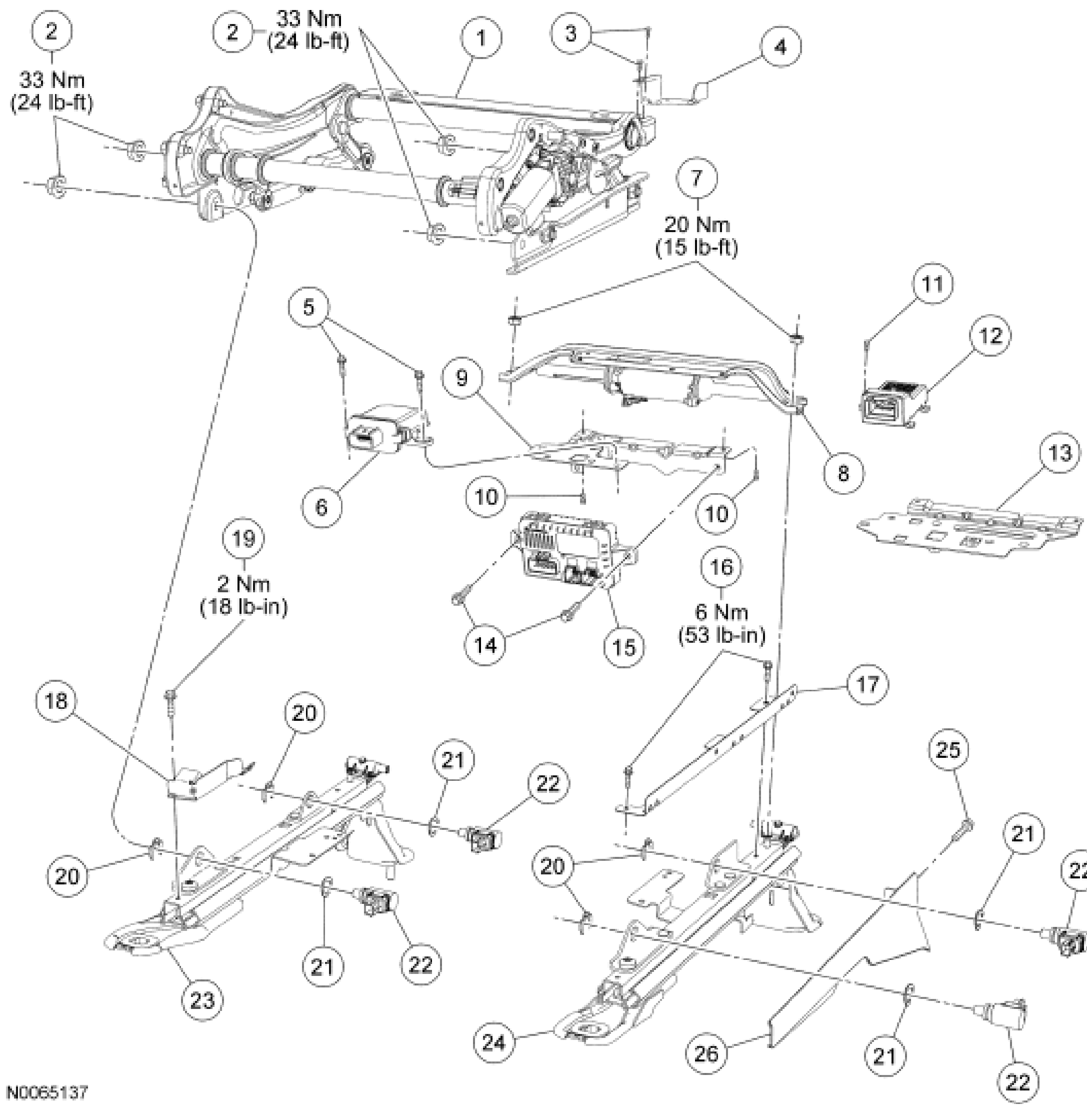


Fig. 473: Passenger Power Seat Track
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Power seat track adjuster assembly (part of 61710)
2	63100	Occupant classification sensor (OCS) weight sensor bolt nuts (4 required)

3	62294	Cushion side shield bracket screws
4	14A301	Cushion side shield bracket
5	62294	Occupant classification system module (OCSM) retainers
6	14B422	OCSM
7	-	Seat track front cross brace nuts (part of 61710)
8	-	Seat track front cross brace (part of 61710)
9	14A301	Bracket (with dual climate controlled seat module [DCSM]) (if equipped)
10	62294	Bracket screws
11	-	Heated seat module screw (if equipped)
12	14C724	Heated seat module (if equipped)
13	14A301	Bracket (with heated seat module) (if equipped)
14	62294	DCSM retainers (if equipped)
15	14C724	DCSM (if equipped)
16	62294	Outboard OCS weight sensor bolt protection bracket screws
17	-	Outboard OCS weight sensor bolt protection bracket
18	-	Inboard OCS weight sensor bolt protection bracket
19	62294	Inboard OCS weight sensor bolt protection bracket screw
20	12655	OCS weight sensor bolt retaining clips (4 required)
21	12656	OCS weight sensor bolt spring washers (4 required)
22	14B422	OCS weight sensor bolts (4 required) (part of 61710)
23	-	Inboard seat track rail (part of 61710)
24	-	Outboard seat track rail (part of 61710)
25	62294	Seat track cover retainer
26	62186	Seat track cover

DISASSEMBLY AND ASSEMBLY

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

NOTE: **Driver seat shown in illustration, passenger similar.**

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the front seat cushion. For additional information, refer to **Seat Cushion - Front**.
3. Release the cushion trim cover retainers from the cushion frame and remove the cushion trim cover and cushion foam pad.

   NOTE: **Use care when separating the cushion trim cover from the hook-and-loop strips, or the hook-and-loop strips can be torn from the cushion foam pad.**

   NOTE: **A new heater mat will come assembled on a new foam pad.**

4. Remove the cushion trim cover from the cushion foam pad in the following sequence.
   1. Separate the hook-and-loop strips.
   2. Separate the cushion trim cover wire retainer from the clips in the cushion foam pad.
      - For vehicles with climate controlled seat, on assembly make sure the climate control seat manifold is in place before snapping the cushion trim cover wire retainer back into the cushion foam pad.

   Seats with climate control

5. Remove the cushion climate control seat manifold from the cushion foam pad.
6. Remove the 3 cushion thermo-electric device (TED)-to-cushion frame screws.
7. Remove the cushion TED-to-climate control seat cushion adapter screw and remove the TED.
8. Release the clips and remove the cushion TED adapter from the cushion frame.

   Heated seats

9. Remove the screw and the heated seat module.

   All seats

10. Release the retainers from the cushion frame and remove the cushion support.
11. To assemble, reverse the disassembly procedure.

12. Install the front seat cushion. For additional information, refer to **Seat Cushion - Front**.
    - For correct front passenger seat cushion wire harness routing, refer to **Seat Wire Harness Routing - Front Passenger Cushion**.
13. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

    Passenger seat

14. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT BACKREST - REAR, 60 PERCENT

NOTE: A new heater mat will come assembled on a new foam pad.

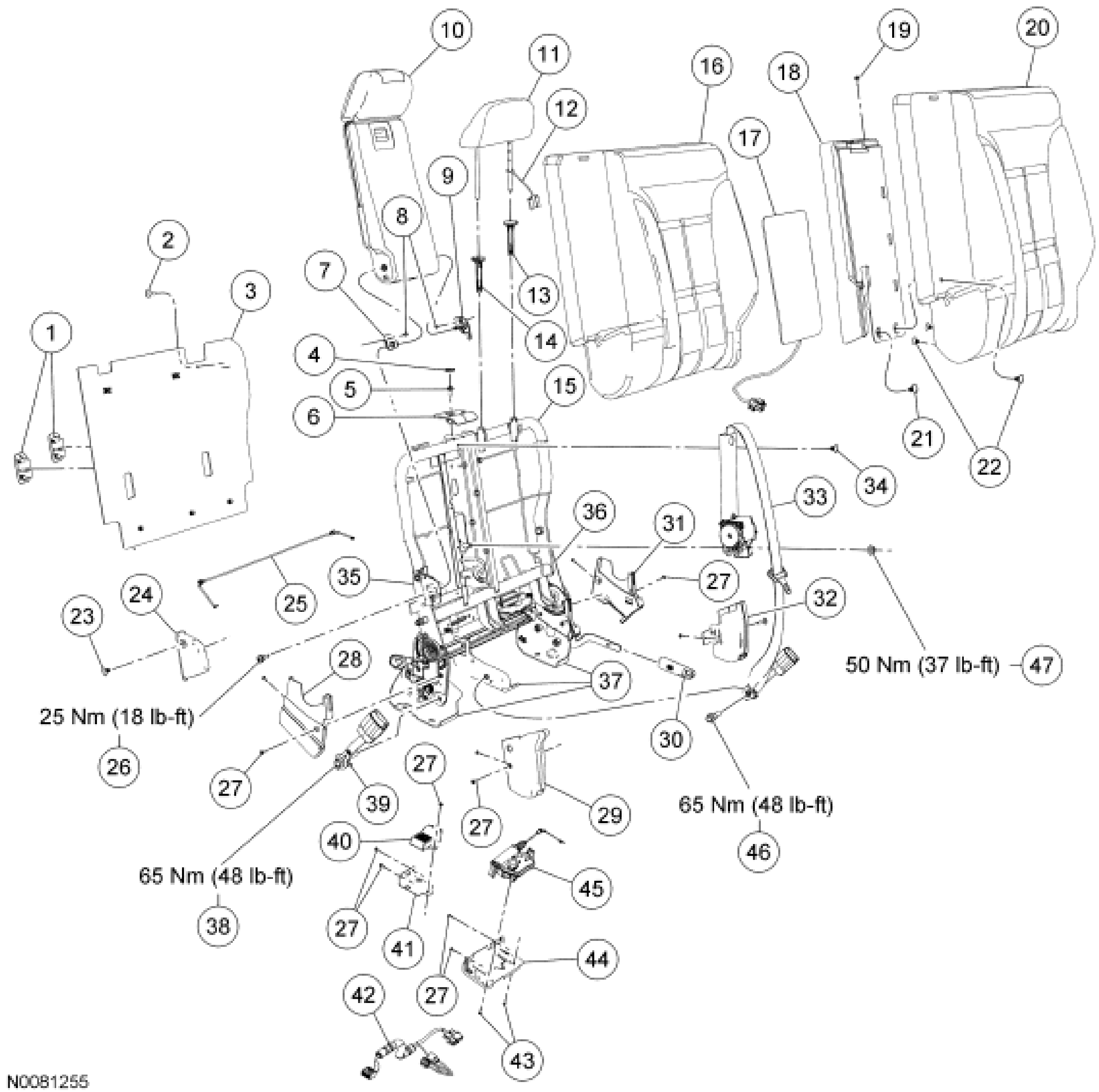


Fig. 474: Rear Seat Backrest, 60 Percent
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	666L76	Child safety seat tether anchor bezels
2	-	Pin-type retainer
3	60509	Back panel
4	237W10	Safety belt bezel screw cover (part of 611A70)
5	-	Safety belt bezel screw
6	611A70	Safety belt bezel
7	67336	RH armrest detent
8	-	Armrest detent-to-backrest frame screws
9	67336	LH armrest detent

10	67112	Armrest
11	611A08	Head restraint
12	-	Safety belt comfort guide
13	610A16	Head restraint guide (master)
14	610A16	Head restraint guide (slave)
15	-	Backrest frame (part of backrest assembly 613A39)
16	66801	Backrest foam pad
17	-	Backrest heater mat (if equipped) (part of 66801)
18	61046	Armrest filler panel
19	-	Screw
20	66601	Backrest trim cover
21	-	Pin-type retainer
22	-	Pin-type retainers
23	-	Pin-type retainer
24	61349	Armrest bracket trim cover
25	601L60	Recliner cable
26	-	Armrest bolt
27	W712241	Screws
28	61349	Inboard lower side shield
29	61349	Inboard upper side shield
30	62419	Recliner handle cover
31	61349	Outboard lower side shield
32	61349	Outboard upper side shield
33	611B64	Safety belt retractor
34	-	Pin-type retainer
35	-	Inboard recliner (part of backrest assembly 613A39)
36	-	Outboard recliner (part of backrest assembly 613A39)
37	-	Anchor brackets (part of backrest assembly 613A39)
38	-	Safety belt buckle bolt (part of 60044)
39	60044	Safety belt buckle
40	-	Heated seat module (if equipped)
41	60328	Heated seat module bracket (if equipped)
42	19K315	Wire harness (if equipped)
43	-	Screws (2 required) (if equipped)
44	-	Power fold motor bracket (if equipped)
45	613A68	Power fold motor (if equipped)

46	-	Safety belt retractor belt and buckle anchor bolt (part of 611B64)
47	-	Safety belt retractor nut

DISASSEMBLY AND ASSEMBLY

WARNING: Synchronize the seat recliners following the steps in the seat removal and installation procedure any time the seat is removed for service. The following actions may result in the loss of recliner synchronization that cannot be corrected and may cause the seat back to fail in a crash:

- **Dropping the seat**
- **Sitting on the seat when removed**
- **Applying any load to the seat when removed**
- **Removing or loosening any recliner fasteners except for the safety belt buckle bolt**

Install a new seat back frame assembly if the seat recliners cannot be synchronized. Failure to follow these instructions may result in serious personal injury to the vehicle occupant(s) in a crash.

All seats

1. Remove the 60 percent seat. For additional information, refer to **Seat - Rear, 60 Percent**.
2. Remove the 60 percent cushion. For additional information, refer to **Seat Cushion - Rear, 60 Percent**.

NOTE: Make sure the safety belt webbing is not twisted prior to installation.

3. Remove the bolt and separate the safety belt retractor belt and buckle anchor from the riser.
   - To install, tighten to 65 Nm (48 lb-ft).
4. Remove the head restraint.
   1. Push in the hole, lift up on the head restraint and release one side of the head restraint.
   2. Push the release button and remove the head restraint.
   3. Remove the safety belt comfort guide.

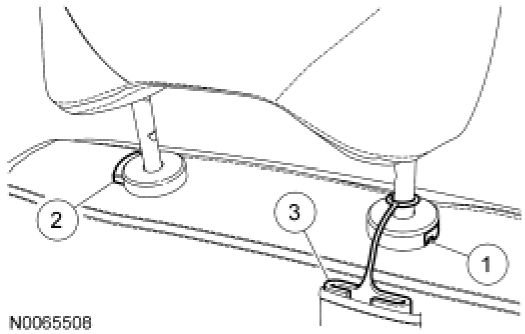


Fig. 475: Locating Safety Belt Comfort Guide & Release Button On Head Restraint
Courtesy of FORD MOTOR CO.

NOTE: Always install a new slave head restraint guide.

5. Pull out and remove the master and slave head restraint guides.
6. Remove the armrest bracket trim cover pin-type retainer and the armrest bracket trim cover.
    - Cycle the armrest up and down to aid trim cover removal.
7. Remove the armrest bolt.
    - To install, tighten to 25 Nm (18 lb-ft).
8. Remove the armrest.
    - With the armrest upright, tip the outboard side of the armrest to disengage the stop from the backrest frame channel.
9. Remove the pin-type retainer in the armrest pocket, attaching the backrest trim cover to the backrest.
10. Release the tabs and remove the child safety seat tether anchor bezel.
    - Repeat for the other child safety seat tether anchor bezel.

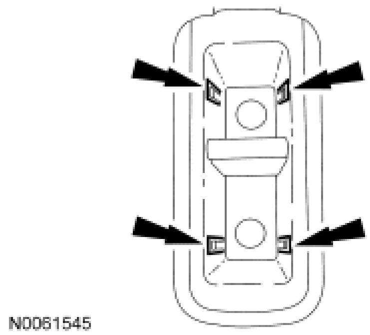


Fig. 476: Locating Tabs On Child Safety Seat Tether Anchor Bezel
Courtesy of FORD MOTOR CO.

11. Remove the safety belt bezel screw cover, the screw and the safety belt bezel.
    - During assembly, make sure the safety belt bezel clips in place.
12. Release the backrest trim cover lower J-clip.
    - Pull the heated seat electrical connector through the backrest trim cover opening (if equipped).

13. At the rear inboard side of the backrest, access the zipper tucked up behind the back panel and unzip the zipper.
14. Remove the 2 pin-type retainers holding the backrest trim cover around each of the 2 lower anchors and tethers for children (LATCH) and attaching to the lower rear of the backrest frame.
15. Remove the pin-type retainer from inside the safety belt comfort guide pocket.
16. Pull back the backrest trim cover over the armrest bracket and backrest frame latching wire for the armrest.
17. Remove the screw at the top and the pin-type retainer at the bottom of the armrest filler panel.
18. Lift the armrest filler panel over the armrest pivot bracket and slide out to the outboard side of the seat.
    - During assembly, make sure the armrest filler panel clips in place around the backrest trim cover J-clip, at the inboard side.
19. Release the backrest trim cover J-clip from the backrest frame in the armrest pocket.
20. From the back, invert the backrest trim cover up and over the backrest frame and remove the backrest trim cover and backrest foam pad.

NOTE: **Use care when separating the backrest trim cover from the hook-and-loop strips, or the hook-and-loop strips can be torn from the backrest foam pad.**

NOTE: **If a new heater mat or foam pad with heat are needed, the parts will already be assembled from the factory. There is no need to remove the heater mat from the foam pad.**

21. Remove the backrest trim cover from the backrest foam pad in the following sequence.
    1. Invert the backrest trim cover in an inside out fashion to the wire in the backrest trim cover attached to the clips in the backrest foam pad.
        - Separate the hook-and-loop strips.
    2. Separate the backrest trim cover wire from the clips in the backrest foam pad.
    3. Remove the backrest trim cover.
        - Feed the safety belt retractor belt and safety belt buckle through the backrest trim cover and backrest foam pad.
22. Remove the backrest foam pad.
23. Release the retainers and remove the back panel.
24. Remove the safety belt retractor nut, pin-type retainer under the safety belt and the safety belt retractor.
    - To install, tighten to 50 Nm (37 lb-ft).
25. Remove 2 screws and the outboard upper side shield.
26. Remove 2 screws and the inboard upper side shield.
27. Remove 2 screws and the outboard lower side shield.
28. Remove 2 screws and the inboard lower side shield.

WARNING: **Keep hands clear of all moving seat mechanisms when releasing the**

recliner lever. The recliners are spring loaded and release with high force. Failure to follow these instructions may result in serious personal injury.

NOTE: Note the position of the safety belt buckle anti-rotation tab for installation.

29. With the recliners released (backrest folded), remove the bolt and safety belt buckle.
    - To install, tighten to 65 Nm (48 lb-ft).
30. Separate the recliner cable casing at both ends from the recliners.
31. Remove the recliner cable in the following sequence.
    1. Turn the cable end so the tab aligns with the slot in the lever and separate the cable at one end.
    2. Turn the cable end so the tab aligns with the slot in the lever and separate the cable at the other end.
        - Remove the recliner cable.

Seats with power fold

32. Remove the power fold motor in the following sequence.
    1. Remove the 2 screws from the power fold motor.
    2. Slide the cable casing out of the recliner.
    3. Turn the cable end so the tab aligns with the slot in the lever and separate the cable.
    4. Remove the power fold motor.

Seats with heat

33. Disconnect the electrical connector, remove the screw and the heated seat module.

All seats

34. To assemble, reverse the disassembly procedure.
    - Check the active restraint system for correct operation. For additional information, refer to safety belt system in the diagnosis and testing portion of **SAFETY BELT SYSTEM** article.
        - Verify the safety belt retractor operates without excessive effort or binding.
        - Make sure the LATCH is accessible to the occupant.

SEAT BACKREST - REAR, 40 PERCENT

NOTE: A new heater mat will come assembled on a new foam pad.

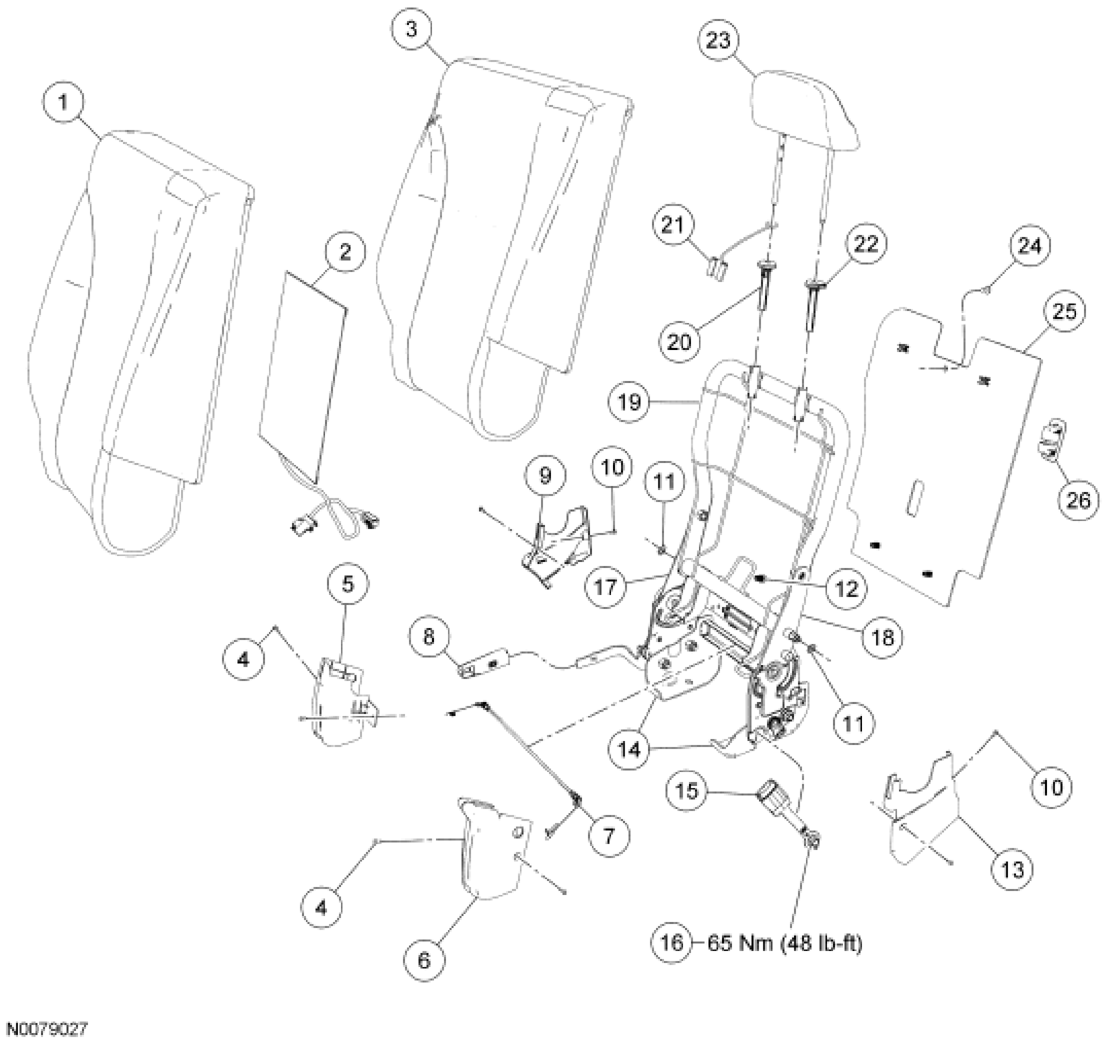


Fig. 477: Rear Seat Backrest, 40 Percent
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	66600	Backrest trim cover
2	-	Backrest heater mat (if equipped) (part of 66800)
3	66800	Backrest foam pad
4	-	Screws (4 required)
5	61348	Outboard upper side shield
6	61348	Inboard upper side shield
7	601L60	Recliner cable
8	62418	Recliner handle cover
9	61348	Outboard lower side shield

10	-	Screws (4 required)
11	-	Wave washers (2 required)
12	-	Pin-type retainer
13	61349	Inboard lower side shield
14	-	Anchor brackets (part of backrest assembly 613A38)
15	60044	Safety belt buckle
16	-	Safety belt buckle bolt (part of 60044)
17	-	Outboard recliner (part of backrest assembly 613A38)
18	-	Inboard recliner (part of backrest assembly 613A38)
19	-	Backrest frame (part of backrest assembly 613A38)
20	610A16	Head restraint guide (slave)
21	-	Safety belt comfort guide
22	610A16	Head restraint guide (master)
23	611A08	Head restraint
24	-	Pin-type retainer
25	60508	Back panel
26	666L76	Child safety seat tether anchor bezel

DISASSEMBLY AND ASSEMBLY

WARNING: **Synchronize the seat recliners following the steps in the seat removal and installation procedure any time the seat is removed for service. The following actions may result in the loss of recliner synchronization that cannot be corrected and may cause the seat back to fail in a crash:**

- **Dropping the seat**
- **Sitting on the seat when removed**
- **Applying any load to the seat when removed**
- **Removing or loosening any recliner fasteners except for the safety belt buckle bolt**

Install a new seat back frame assembly if the seat recliners cannot be synchronized. Failure to follow these instructions may result in serious personal injury to the vehicle occupant(s) in a crash.

All seats

1. Remove the 40 percent seat. For additional information, refer to **Seat - Rear, 40 Percent**.
2. Remove the 40 percent cushion. For additional information, refer to **Seat Cushion - Rear, 40 Percent**.

3. Remove the head restraint.
    1. Push in the hole, lift up on the head restraint and release one side of the head restraint.
    2. Push the release button and remove the head restraint.
    3. Remove the safety belt comfort guide.

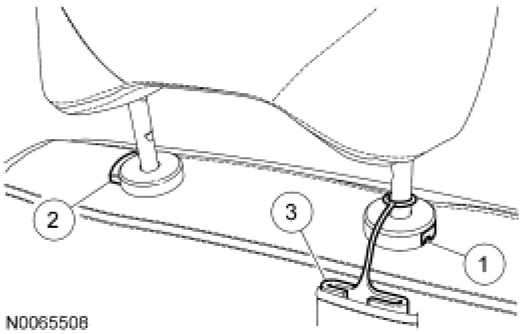


Fig. 478: Locating Safety Belt Comfort Guide & Release Button On Head Restraint
Courtesy of FORD MOTOR CO.

NOTE: Always install a new slave head restraint guide.

4. Pull out and remove the master and slave head restraint guides.
5. Release the tabs and remove the child safety seat tether anchor bezel.

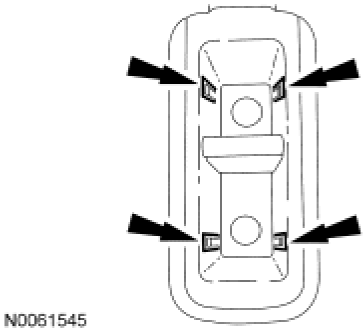


Fig. 479: Locating Tabs On Child Safety Seat Tether Anchor Bezel
Courtesy of FORD MOTOR CO.

6. Release the backrest trim cover lower J-clip.
    - Pull the heated seat electrical connector through the backrest trim cover opening (if equipped).
7. At the rear inboard side of the backrest, access the zipper tucked up behind the back panel and unzip the zipper.
8. Remove the pin-type retainer holding the backrest trim cover around the lower anchors and tethers for children (LATCH) and attaching to the lower rear of the backrest frame.
9. Remove the pin-type retainer from inside the safety belt comfort guide pocket.

NOTE: Use care when separating the backrest trim cover from the hook-and-loop strips, or the hook-and-loop strips can be torn from the backrest foam pad.

10. Release the hook-and-loop strips and invert the backrest trim cover in an inside out fashion to the wire in the backrest trim cover attached to the clips in the backrest foam pad.
11. Separate the backrest trim cover wire from the clips in the backrest foam pad and remove the backrest trim cover.
12. Remove the backrest foam pad.
13. Release the retainers and remove the back panel.
14. Remove 2 screws and the outboard upper side shield.
15. Remove 2 screws and the inboard upper side shield.
16. Remove 2 screws and the outboard lower side shield.
17. Remove 2 screws and the inboard lower side shield.

WARNING: Keep hands clear of all moving seat mechanisms when releasing the recliner lever. The recliners are spring loaded and release with high force. Failure to follow these instructions may result in serious personal injury.

NOTE: Note the position of the safety belt buckle anti-rotation tab for installation.

18. With the recliners released (backrest folded), remove the bolt and safety belt buckle.
    - To install, tighten to 65 Nm (48 lb-ft).
19. Separate the recliner cable casing at both ends from the recliners.
20. Remove the recliner cable in the following sequence.
    1. Turn the cable end so the tab aligns with the slot in the lever and separate the cable at one end.
    2. Turn the cable end so the tab aligns with the slot in the lever and separate the cable at the other end.
       - Remove the recliner cable.

Seats with power fold

21. Remove the power fold motor in the following sequence.
    1. Remove the 2 screws from the power fold motor.
    2. Slide the cable casing out of the recliner.
    3. Turn the cable end so the tab aligns with the slot in the lever and separate the cable.
    4. Remove the power fold motor.

All seats

22. To assemble, reverse the disassembly procedure.
    - Make sure the LATCH is accessible to the occupant.

- Check the active restraint system for correct operation. For additional information, refer to safety belt system in the diagnosis and testing portion of **SAFETY BELT SYSTEM** article.

SEAT CUSHION - REAR, 40 PERCENT

NOTE: A new heater mat will come assembled on a new foam pad.

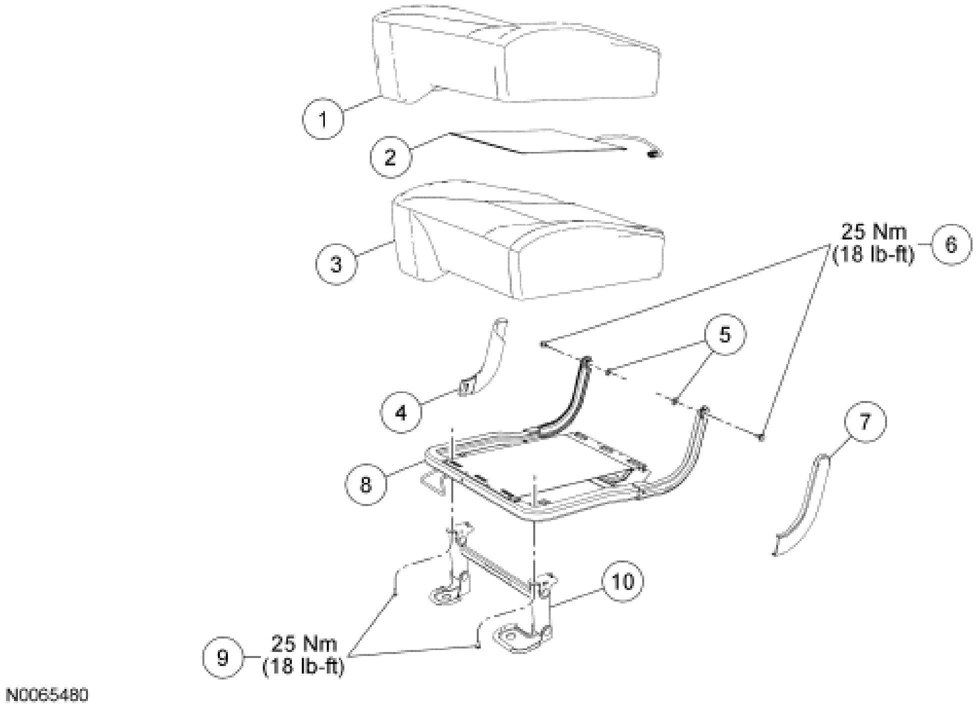


Fig. 480: Exploded View Of Rear Seat Cushion, 40 Percent With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	63804	Cushion trim cover
2	-	Cushion heater mat (if equipped) (part of 63840)
3	63840	Cushion foam pad
4	666L76	Outboard cushion frame pivot bracket cover
5	-	Wave washers
6	W712172	Cushion frame pivot bracket bolts
7	66L75	Inboard cushion frame pivot bracket cover
8	63160	Cushion frame
9	N605892	Kneeling assembly-to-cushion frame bolts

10	605B10	Kneeling assembly

DISASSEMBLY AND ASSEMBLY

1. Remove the 40 percent seat. For additional information, refer to **Seat - Rear, 40 Percent**.
2. Remove the 40 percent seat cushion. For additional information, refer to **Seat Cushion - Rear, 40 Percent**.
3. Remove the 2 kneeling assembly-to-cushion frame bolts. Remove the kneeling assembly.
   - To install, tighten to 25 Nm (18 lb-ft).
4. Release all the cushion trim cover-to-cushion frame retainers and remove the cushion foam pad and cushion trim cover.

NOTE: Use care when separating the cushion trim cover from the hook-and-loop strips, or the hook-and-loop strips can be torn from the cushion foam pad.

5. Remove the cushion trim cover in the following sequence.
   1. Feed the heater mat wire harness and electrical connectors back through the cushion trim cover (if equipped).
   2. Release the hook-and-loop strips.
   3. Separate the cushion trim cover wire retainer from the clips in the cushion foam pad and remove the cushion trim cover.
6. To assemble, reverse the disassembly procedure.

SEAT CUSHION - REAR, 60 PERCENT

NOTE: A new heater mat will come assembled on a new foam pad.

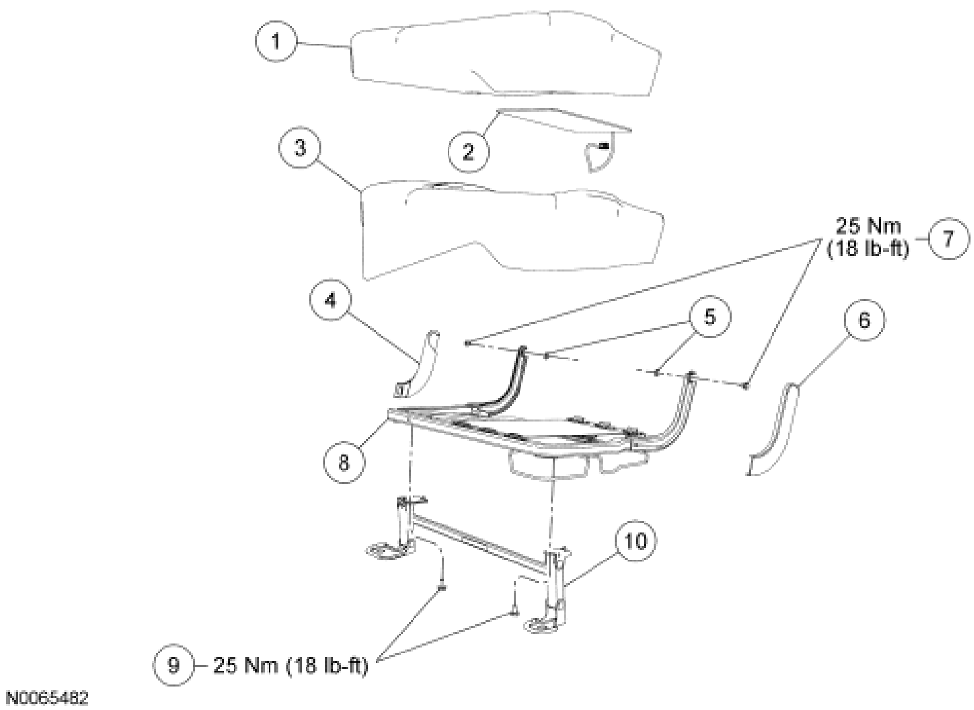


Fig. 481: Exploded View Of Rear Seat Cushion, 60 Percent With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	63805	Cushion trim cover
2	-	Cushion heater mat (if equipped) (part of 63841)
3	63841	Cushion foam pad
4	666L76	Inboard cushion frame pivot bracket cover
5	-	Wave washers
6	666L75	Outboard cushion frame pivot bracket cover
7	W712172	Cushion frame pivot bracket bolts
8	63161	Cushion frame
9	N605892	Kneeling assembly-to-cushion frame bolts
10	605B11	Kneeling assembly

DISASSEMBLY AND ASSEMBLY

1. Remove the 60 percent seat. For additional information, refer to **Seat - Rear, 60 Percent**.
2. Remove the 60 percent seat cushion. For additional information, refer to **Seat Cushion - Rear, 60 Percent**.

3. Remove the 2 bolts and the kneeling assembly.
   - To install, tighten to 25 Nm (18 lb-ft).
4. Release all the cushion trim cover-to-cushion frame retainers and remove the cushion foam pad and cushion trim cover.

NOTE: **Use care when separating the cushion trim cover from the hook-and-loop strips, or the hook-and-loop strips can be torn from the cushion foam pad.**

5. Remove the cushion trim cover in the following sequence.
   1. Feed the heater mat wire harness and electrical connectors back through the cushion trim cover (if equipped).
   2. Release the hook-and-loop strips.
   3. Separate the cushion trim cover wire retainer from the clips in the cushion foam pad and remove the cushion trim cover.
6. To assemble, reverse the disassembly procedure.

2008 ENGINE

Starting System - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Starter motor bolt	27	20	-
Starter motor solenoid battery cable nut	12	9	-
Starter motor solenoid wire nut	5	-	44
Starter motor stud bolt	27	20	-
Transmission manual control lever nut	18	13	-

DESCRIPTION AND OPERATION

STARTING SYSTEM

The starting system consists of the following:

- Starter motor
- Starter motor relay
- Transmission range (TR) sensor
- Battery
- Ignition switch
- PCM
- Start diode

When the starter solenoid is energized, a magnetic field is created in the starter solenoid windings. The iron plunger core is drawn into the starter solenoid coil, and a drive lever and pin connected to the starter drive engages the drive pinion gear to the flexplate ring gear. When the plunger is pulled all the way in, its contact disc closes the circuit between the battery and the motor feed terminals. This sends current to the motor, and the drive pinion gear cranks the flexplate to start the engine. When current flows to the starter motor, the starter solenoid pull-in coil is bypassed, and the hold-in coil keeps the drive pinion gear engaged with the flexplate.

An overrunning clutch in the starter drive protects the starter motor from excessive speeds during the brief period before the driver releases the ignition switch from the START position as the engine starts.

The starting system uses a TR sensor located in the transmission. The TR sensor prevents operation of the starter motor unless NEUTRAL or PARK is selected. The vehicle has one-touch integrated start (OTIS), a computer-assisted cranking system. This feature assists in starting the engine. If the ignition key is turned to the START position and released when the engine begins cranking, the engine may continue cranking for up to 10 seconds or until the vehicle starts.

One-Touch Integrated Start (OTIS)

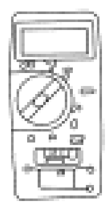
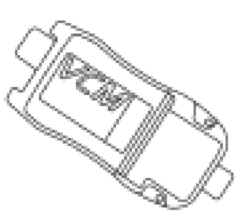
Once the ignition is turned to the START position and the vehicle is in NEUTRAL or PARK, the PCM reads starter motor request (SMR) from the ignition switch and gains control of the starter engagement. The customer is no longer in the loop after the initial crank request, the customer may release the key to the RUN/START position. The PCM will disengage the starter motor based on the following events:

- The engine is started (RPM threshold)
- A set time has been exceeded (calibrated)
- The ignition key has been turned to the OFF position

DIAGNOSTIC TESTS

STARTING SYSTEM

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2574-A	Flex Probe Kit	105-R025C or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	-

Principles of Operation

The starting system is electronically controlled by the passive anti-theft system (PATS). PATS is controlled by the instrument cluster. PATS recognizes the correct electronically coded ignition key and the instrument cluster sends a message to the PCM to provide a ground for the starter relay. The energized relay provides voltage to the starter solenoid with the key in the START position, thereby allowing the starter motor to activate.

Inspection and Verification

WARNING: Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.

NOTE: The anti-theft system must be functioning correctly before a logical starting system diagnosis can be carried out. Address anti-theft system concerns before continuing.

1. Verify the customer concern by operating the starting system to duplicate the conditions.
2. Inspect to determine if any of the following mechanical or electrical concerns apply.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Starter motor • Starter motor bolts • Flexplate	• Battery • Open fuse • Battery junction box (BJB) fuse 41 (30A) • Smart junction box (SJB) fuse 27 (20A) • Damaged wiring harness • Starter relay • Anti-theft system • Loose or corroded connections

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.

- check the scan tool connection to the VCM.
- refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM.
9. If the DTCs retrieved are related to the concern, go to PCM DTC Chart or the Passive Anti-Theft System (PATS) DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **SYMPTOM CHART**.

PCM DTC CHART

DTC	Description	Source	Action
P0512	Starter Request Circuit - Circuit has Power With the Ignition in the OFF Position	PCM	CARRY OUT the Ignition Switch Component Test. Refer to COMPONENT TESTING. If necessary, INSTALL a new ignition switch. If the ignition switch passed the component test, REPAIR circuit CDC35 (BU/WH) for a short to power.
P0705	TR Sensor Circuit Failure	PCM	Refer to the appropriate Automatic Transmission article for the procedure.
P0706	TR Sensor Circuit Failure	PCM	Refer to the appropriate Automatic Transmission article for the procedure.
P0708	TR Sensor Circuit Failure	PCM	Refer to the appropriate Automatic Transmission article for the procedure.
P0709	TR Sensor Circuit Failure	PCM	Refer to the appropriate Automatic Transmission article for the procedure.

PASSIVE ANTI-THEFT SYSTEM (PATS) DTC CHART

DTC	Description	Source	Action
B1213	Anti-Theft Number of Programmed Keys is Below Minimum	Instrument Cluster/PCM	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.

B1342	ECU is Defective	Instrument Cluster/PCM	INSTALL a PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article.
B1600	Passive Anti-Theft System (PATS) Key Transponder Signal is Not Received	Instrument Cluster/PCM	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	Instrument Cluster/PCM	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder	Instrument Cluster/PCM	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1681	PATS Transceiver Module Signal is Not Received	Instrument Cluster/PCM	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2103	Antenna Not Connected	Instrument Cluster/PCM	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2141	NVM Configuration Failure	Instrument Cluster/PCM	There is no PCM ID stored in the instrument cluster. CARRY OUT a parameter reset of the instrument cluster and PCM, then CYCLE the ignition and make an attempt to start the vehicle. REFER to Passive Anti-Theft System (PATS) Parameter Reset in **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2431	Transponder Programming Failed	Instrument Cluster/PCM	VERIFY if the correct PATS key is being used. If the PATS key is defective, use a new key for programming. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
U0100	Lost Communication	Instrument Cluster/PCM	REFER to **ANTI-THEFT**

	With ECM/PCM		**- PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
U2510	Antenna Not Connected	Instrument Cluster/PCM	If DTC U2511 is not present also, CARRY OUT a parameter reset of the instrument cluster and the PCM and CYCLE the ignition 3-5 times, making an attempt to start the vehicle each key cycle. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.

Symptom Chart

SYMPTOM CHART

Condition	Possible Sources	Action
• The engine does not crank	• Battery • Fuse(s) • Starter motor • Circuitry • PCM • Starter motor relay • Ignition switch • Start diode • Anti-theft system	• Go to **Pinpoint Test A** .
• One-touch integrated start (OTIS) does not operate correctly	• Circuitry • PCM	• Go to **Pinpoint Test A** .
• The engine cranks slowly	• Battery • Starter motor • Circuitry	• CARRY OUT the Starter Motor Component Test.
• Unusual starter noise	• Starter motor mounting • Starter motor • Incorrect starter drive engagement	• Go to **Pinpoint Test C** .
• The starter spins but the engine does not crank	• Starter motor	• INSPECT the starter motor mounting and engagement.

-	• Damaged flexplate teeth	REPAIR as necessary. • INSPECT the flexplate for damaged, missing or worn teeth. REPAIR as necessary.

Pinpoint Tests

Pinpoint Test A: The Engine Does Not Crank

Refer to appropriate SYSTEM WIRING DIAGRAM article for Starting System schematic and connector information.

Normal Operation

Under normal operation, constant power is supplied to the starter motor relay from the battery junction box (BJB) fuse 41 (30A). When the ignition switch is turned in the START position and held, with the vehicle in PARK or NEUTRAL, power flows to the starter motor relay through CDC35 (BU/WH). A ground is supplied through circuit CDC12 (YE) from the PCM causing the starter motor relay coil to energize and the relay contacts close. This allows power to be supplied from the starter motor relay contacts which then flows through circuit CDC25 (BN/GN) to the starter solenoid. The solenoid is grounded at the starter motor. Energizing the starter solenoid will engage the starter drive into the ring gear and closes the solenoid contacts allowing power directly from the battery through circuit SDC02 (RD) to the starter motor to start the engine.

This pinpoint test is intended to diagnose the following:

- Battery
- Anti-theft system
- Starter relay
- Ignition switch
- Circuitry
- PCM
- Start diode

PINPOINT TEST A: THE ENGINE DOES NOT CRANK

A1 CHECK THE BATTERY

- Check the battery condition and charge. Refer to **BATTERY, MOUNTING AND CABLES** article.
- **Is the battery OK?**

  YES : Go to A2.

  NO : CHARGE or INSTALL a new battery as necessary. REFER to **BATTERY, MOUNTING AND CABLES** article. TEST the system for normal operation.

A2 CHECK FOR PASSIVE ANTI-THEFT SYSTEM (PATS) DTCs

NOTE: **Passive anti-theft system (PATS) DTCs are the only DTCs of concern in this step. Only repair retrieved non-PATS DTCs if a customer concern is reported.**

- Check for PATS DTCs.
- **Were any PATS DTCs retrieved?**

  YES : REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article to diagnose the PATS DTCs.

  NO : Go to A3.

A3 CHECK THE BATTERY GROUND CABLE

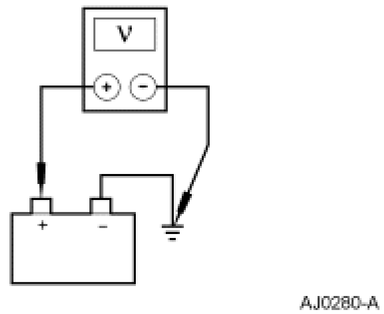


Fig. 1: Checking Battery Ground Cable
Courtesy of FORD MOTOR CO.

- Measure the voltage between the positive battery post and the battery ground cable connection at the engine.
- **Is the voltage greater than 10 volts?**

  YES : Go to A4.

  NO : INSTALL a new battery ground cable. REFER to **BATTERY, MOUNTING AND CABLES** article. TEST the system for normal operation.

A4 CHECK THE STARTER MOTOR GROUND

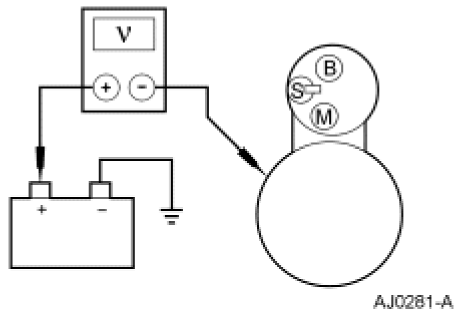


Fig. 2: Checking Starter Motor Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the positive battery post and the starter motor case.
- **Is the voltage greater than 10 volts?**

  YES : Go to A5.

  NO : CLEAN the starter motor mounting flange and make sure the starter motor is correctly mounted. TEST the system for normal operation.

A5 CHECK THE POWER SUPPLY TO THE STARTER MOTOR

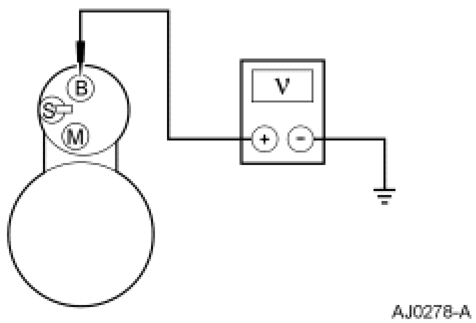


Fig. 3: Checking Power Supply To Starter Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between starter motor C197A, circuit SDC02 (RD) and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to A6.

  NO : INSTALL a new positive battery cable. REFER to **BATTERY, MOUNTING AND CABLES** article. TEST the system for normal operation.

A6 CHECK THE STARTER MOTOR B-PIN

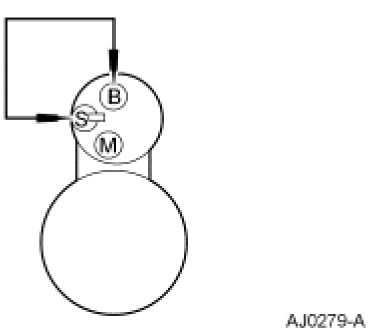


Fig. 4: Checking Starter Motor
Courtesy of FORD MOTOR CO.

- Connect one end of a fused (30A) jumper wire to starter motor solenoid C197A, circuit SDC02 (RD). Momentarily connect the other end of the jumper to starter motor C197B, circuit CDC25 (BN/GN).
- **Did the starter motor engage and the engine crank?**

YES : Go to A7.

NO : INSTALL a new starter motor. REFER to **STARTER MOTOR**. TEST the system for normal operation.

A7 CHECK STARTER MOTOR RELAY POWER

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

- Disconnect: Starter Motor Relay

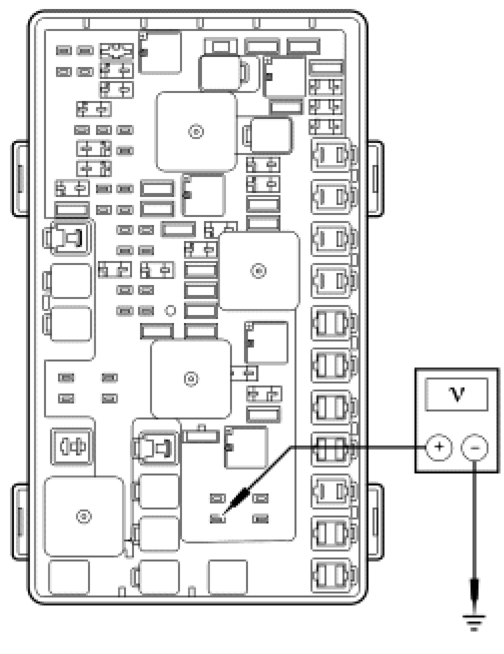


Fig. 5: Measuring Voltage Between BJB Starter Relay Pin 30, Circuit SDC02 (RD) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between battery junction box (BJB) starter motor relay pin 30, harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to A8.

NO : REPAIR or REPLACE the BJB. TEST the system for normal operation.

A8 CHECK THE STARTER MOTOR RELAY

- Carry out the Starter Motor Relay Component Test. Refer to COMPONENT TESTING.
- **Did the starter motor relay pass the component test?**

YES : Go to A9.

NO : INSTALL a new starter motor relay. TEST the system for normal operation.

A9 CHECK THE CIRCUIT TO THE STARTER MOTOR

- Key in OFF position.
- Disconnect: Starter Motor Solenoid C197B

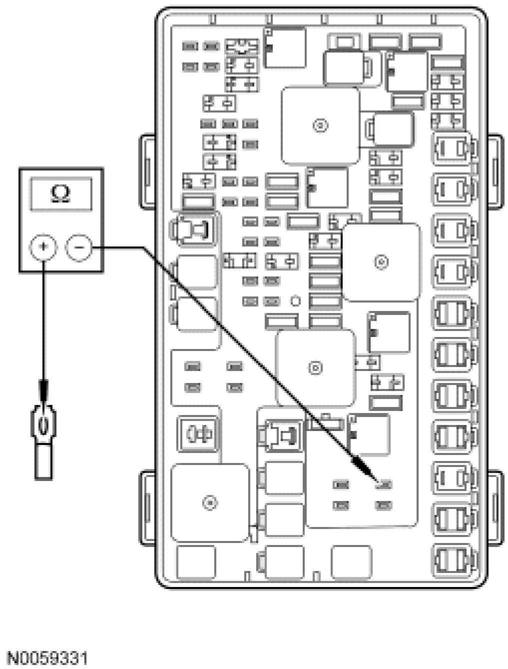


Fig. 6: Measuring Resistance Between BJB Starter Relay Pin 87, Circuit CDC25 (BN/GN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between starter motor solenoid S-terminal C197B, circuit CDC25 (BN/GN), harness side and the BJB starter motor relay pin 87, circuit CDC25 (BN/GN), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to A10.

NO : REPAIR circuit CDC25 (BN/GN). TEST the system for normal operation.

A10 CHECK CIRCUIT CDC35 (BU/WH) FOR VOLTAGE

- Connect: Starter Motor Solenoid C197B
- Connect: Starter Motor Relay
- Disconnect: Starter Diode

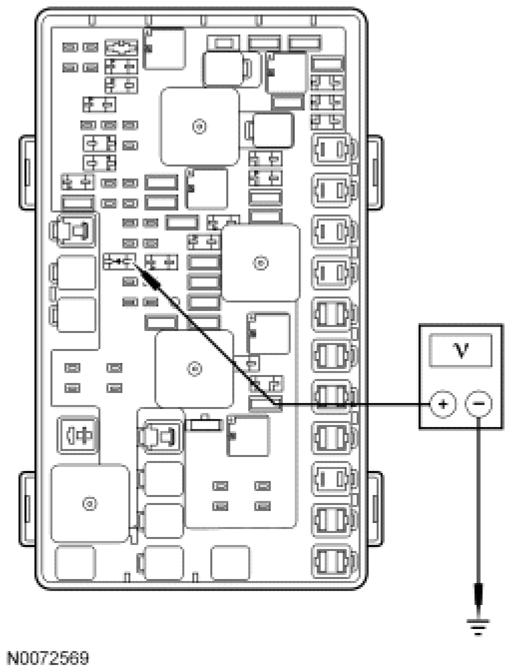


Fig. 7: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between BJB starter diode cell, circuit CDC35 (BU/WH) and ground with the ignition switch in the START position.
- **Is the voltage greater than 10 volts?**

  YES : Go to A13.

  NO : Go to A11.

A11 CHECK CIRCUIT SBP27 (BU/RD) FOR VOLTAGE

- Disconnect: Ignition Switch C250

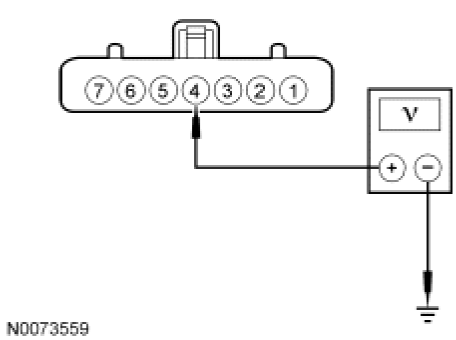


Fig. 8: Measuring Voltage Between Ignition Switch C250--4 And SBP27 (BU/RD)
Courtesy of FORD MOTOR CO.

- Measure the voltage between ignition switch C250-4, circuit SBP27 (BU/RD), harness side and

ground.

- **Is the voltage greater than 10 volts?**

  YES : Go to A12.

  NO : REPAIR circuit SBP27 (BU/RD). TEST the system for normal operation.

A12 CHECK THE IGNITION SWITCH

- Carry out the Ignition Switch Component Test. Refer to COMPONENT TESTING.
- **Did the ignition switch pass the component test?**

  YES : REPAIR circuit CDC35 (BU/WH) for an open. TEST the system for normal operation.

  NO : INSTALL a new ignition switch. REFER to **STEERING COLUMN SWITCHES** article. TEST the system for normal operation.

A13 CHECK THE STARTER DIODE

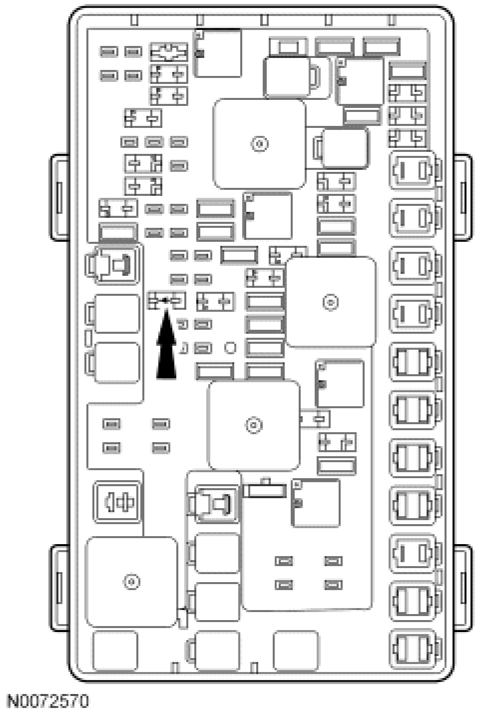


Fig. 9: Identifying Starter Diode
Courtesy of FORD MOTOR CO.

- Carry out a Starter Diode Test.
- **Is the starter diode open or shorted?**

  YES : INSTALL a new starter diode. TEST the system for normal operation.

  NO : Go to A14.

A14 CHECK THE STARTER MOTOR RELAY ENABLE (STRT_RLY) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID STRT_RLY with the ignition switch in the START position.

- **Does the PID change from DISABLED to ENABLED?**

  YES : Go to A17.

  NO : Go to A15.

A15 CHECK CIRCUIT CDC35 (BU/WH) BETWEEN THE BJB AND THE PCM

- Key in OFF position.
- Disconnect: Starter Relay
- Disconnect: PCM C175B
- Disconnect: Smart Junction Box (SJB) C2280B

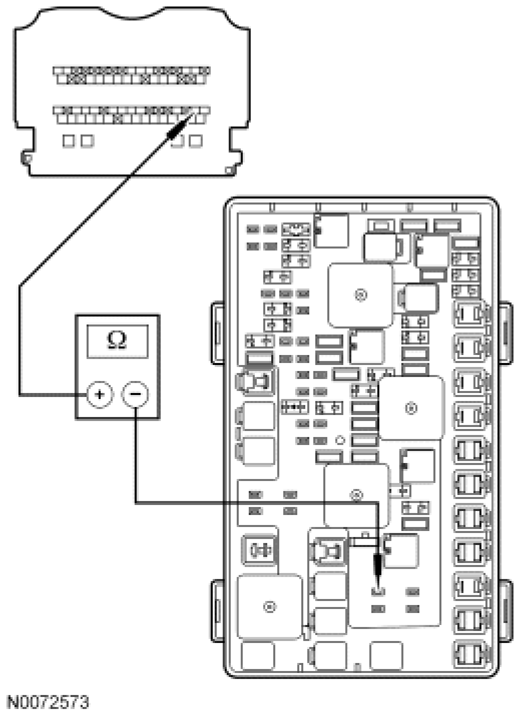


Fig. 10: Measuring Resistance Between BJB Starter Motor Relay Pin 85 And PCM C175b-35 Circuit CDC35
Courtesy of FORD MOTOR CO.

- Measure the resistance between the BJB starter motor relay pin 85, circuit CDC35 (BU/WH), harness side and PCM C175b-35, circuit CDC35 (BU/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A16.

  NO : REPAIR circuit CDC35 (BU/WH). TEST the system for normal operation.

A16 CHECK CIRCUIT CDC35 (BU/WH) BETWEEN THE BJB AND THE SJB

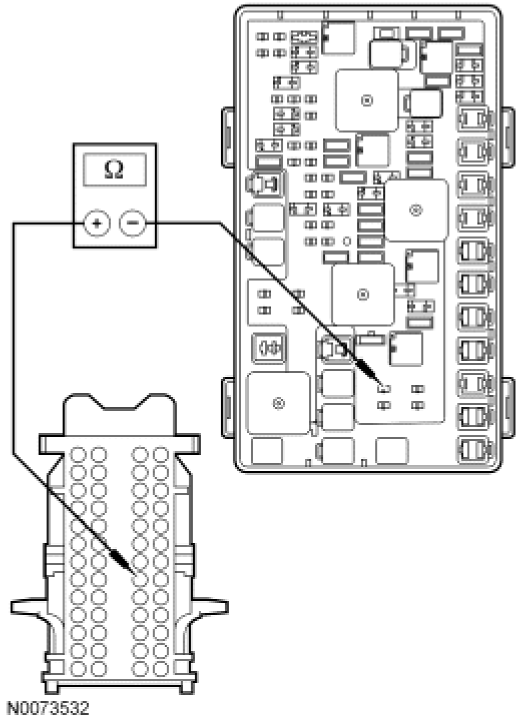


Fig. 11: Measuring Resistance Between BJB Starter Motor Relay Pin 85 And SJB C2280B-32 Circuit CDC35
Courtesy of FORD MOTOR CO.

- Measure the resistance between the BJB starter motor relay pin 85, circuit CDC35 (BU/WH), harness side and SJB C2280B-32, circuit CDC35 (BU/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

  NO : REPAIR circuit CDC35 (BU/WH) for an open. TEST the system for normal operation.

A17 CHECK THE STARTER MOTOR CONTROL OUTPUT DETECTED (SMC_MON) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID SMC_MON with the ignition switch in the START position.
- **Does the PID change from OFF to ON?**

  YES : REPAIR circuit CDC12 (YE). TEST the system for normal operation.

  NO : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

Pinpoint Test B: One-Touch Integrated Start (OTIS) Does Not Operate Correctly

Refer to appropriate SYSTEM WIRING DIAGRAM article for Starting System schematic and connector information.

Normal Operation

When the ignition switch is turned in the START position and released, the PCM receives a starter motor request (SMR) signal through circuit CDC35 (BU/WH). With the vehicle in PARK or NEUTRAL, power flows from the PCM to the starter motor relay through circuit CDC35 (BU/WH). A ground is supplied through circuit CDC12 (YE) from the PCM causing the starter motor relay coil to energize and the relay contacts close. This allows power from starter motor relay through circuit CDC25 (BN/GN) to the starter solenoid. The solenoid is grounded at the starter motor. Energizing the starter solenoid will engage the starter drive into the ring gear and closes the solenoid contacts allowing power directly from the battery through circuit SDC02 (RD) to the starter motor to start the engine. The customer is no longer in the loop after the initial crank request, the customer may release the key to the RUN/START position. The PCM will disengage the starter motor based on engine running (rpm threshold), a set crank time has been exceeded or the ignition switch has been turned to the OFF position.

This pinpoint test is intended to diagnose the following:

- Circuitry
- PCM

PINPOINT TEST B: ONE-TOUCH INTEGRATED START (OTIS) DOES NOT OPERATE CORRECTLY

B1 CHECK THE STATUS OF ONE-TOUCH INTEGRATED START (OTIS) (OTS_STAT) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID OTS_STAT with the ignition switch in the RUN position.
- **Is the OTIS PID enabled?**

  YES : Go to B2.

  NO : ENABLE OTIS. TEST the system for normal operation. If OTIS will not enable, INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

B2 CHECK THE KEY POSITION FOR START INDICATED (START_KEY) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID START_KEY with the ignition switch in the START position.
- **Does the PID change from OFF to ON?**

  YES : Go to B4.

  NO : Go to B3.

B3 CHECK CIRCUIT CDC35 (BU/WH)

- Disconnect: Start Diode
- Disconnect: PCM C175B

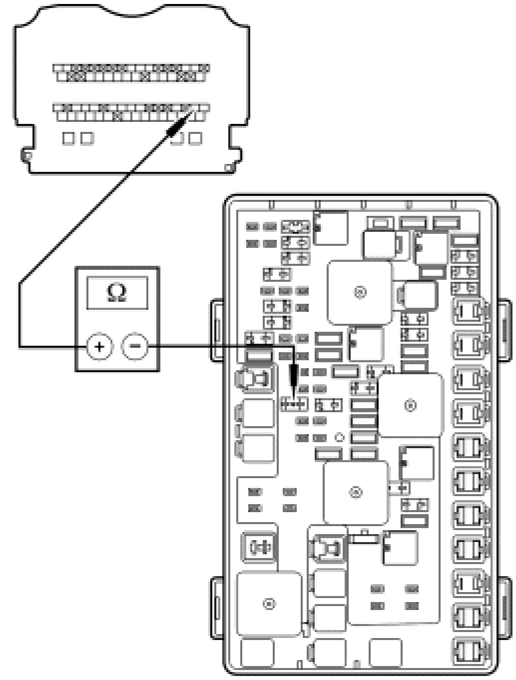


Fig. 12: Measuring Resistance Between Start Diode Cell Circuit CDC35 And PCM C175B-35 Circuit CDC35
Courtesy of FORD MOTOR CO.

- Measure the resistance between the start diode cell, circuit CDC35 (BU/WH), harness side and PCM C175B-35, circuit CDC35 (BU/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

  NO : REPAIR circuit CDC35 (BU/WH). TEST the system for normal operation.

B4 CHECK THE STARTER MOTOR RELAY ENABLE (STRT_RLY) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID STRT_RLY with the ignition switch in the START position.
- **Does the PID change from DISABLED to ENABLED?**

  YES : Go to B6.

  NO : Go to B5.

B5 CHECK CIRCUIT CDC35 (BU/WH) BETWEEN THE BJB AND THE PCM

- Key in OFF position.
- Disconnect: PCM C175B
- Disconnect: SJB C2280B

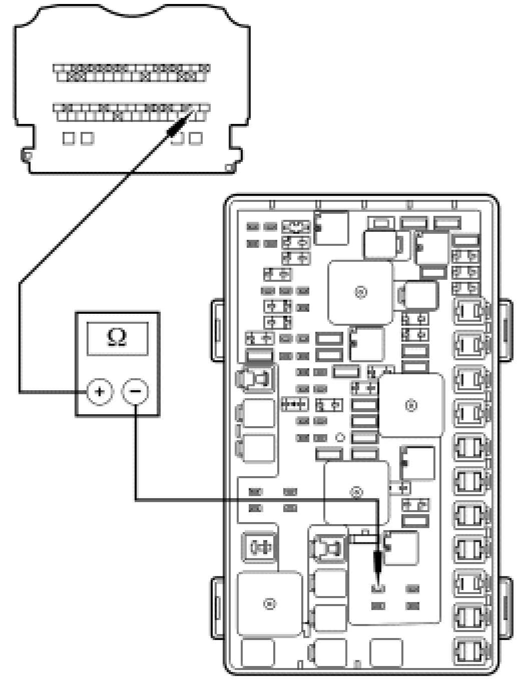


Fig. 13: Measuring Resistance Between BJB Starter Motor Relay Pin 85 And PCM C175b-35 Circuit CDC35
Courtesy of FORD MOTOR CO.

- Measure the resistance between the BJB starter motor relay pin 85, circuit CDC35 (BU/WH), harness side and PCM C175b-35, circuit CDC35 (BU/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

  NO : REPAIR circuit CDC35 (BU/WH). TEST the system for normal operation.

B6 CHECK THE STARTER MOTOR CONTROL OUTPUT DETECTED (SMC_MON) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID SMC_MON with the ignition switch in the START position.
- **Does the PID change from OFF to ON?**

  YES : REPAIR circuit CDC12 (YE). TEST the system for normal operation.

  NO : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

Pinpoint Test C: Unusual Starter Noise

This pinpoint test is intended to diagnose the following:

- Starter motor
- Ring gear

PINPOINT TEST C: UNUSUAL STARTER NOISE

C1 CHECK THE STARTER MOUNTING

- Inspect the starter mounting bolts for looseness.
- **Is the starter motor mounted correctly?**

  YES : Go to C2.

  NO : INSTALL the starter motor correctly. REFER to **STARTER MOTOR**. TEST the system for normal operation.

C2 CHECK FOR ENGINE NOISE

- Key in OFF position.

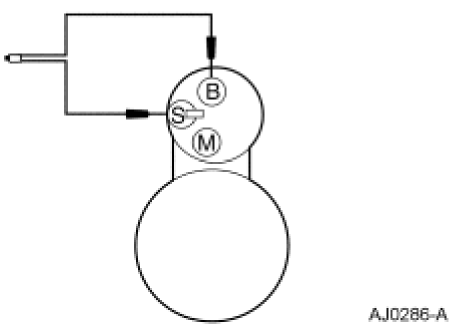


Fig. 14: Inspecting Starter Motor
Courtesy of FORD MOTOR CO.

- Connect a remote starter switch between the starter solenoid B- and S-terminals.
- Engage the starter motor and verify the noise is due to the starter operation.
- **Is the noise due to the starter motor engagement?**

  YES : Go to C3.

  NO : REFER to **ENGINE SYSTEM - GENERAL INFORMATION** article to continue diagnosis.

C3 CHECK FOR UNUSUAL WEAR

- Remove the starter motor.
- Inspect the ring gear for damaged or worn teeth. Refer to **ENGINE - 3.5L** article.
- **Is the noise due to ring gear tooth damage?**

  YES : INSTALL a new flexplate ring gear. REFER to **ENGINE - 3.5L** article. EXAMINE the starter pinion teeth. If damaged, INSTALL a new starter motor. REFER to **Starter Motor**. TEST the system for normal operation.

  NO : INSTALL a new starter motor. REFER to **STARTER MOTOR**. TEST the system for normal operation.

Component Tests

WARNING: Always disconnect the battery ground cable at the battery before

disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.

Always make the 73III Automotive Meter connections at the component terminal rather than at the wiring end connector. Making a connection at the wiring end connector could result in false readings because the meter will not pick up a high resistance between the wiring connector and the component.

Starter Motor - Motor Feed Circuit

1. Make sure the battery is fully charged; carry out a battery load test. Refer to **BATTERY, MOUNTING AND CABLES** article.
2. Disconnect the inertia fuel shutoff (IFS) switch.
3. Connect a remote starter switch between the starter solenoid S-terminal and the battery positive (+) terminal.
4. Connect the 73III Automotive Meter positive lead to the battery positive (+) post. Connect the negative lead to the starter solenoid M-terminal.

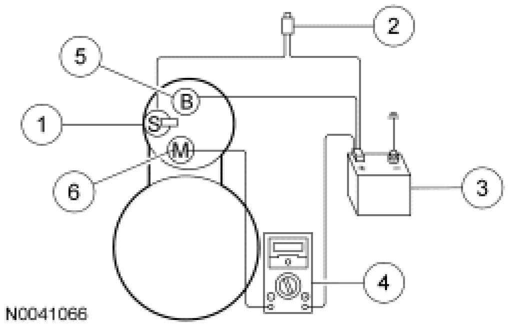


Fig. 15: Identifying S, M & B Terminals, 73III Automotive Meter, Battery, Remote Starter Switch & Motor Feed Circuit
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	S-terminal
2	-	Remote starter switch
3	10653	Battery
4	-	73III Automotive Meter
5	-	B-terminal
6	-	M-terminal

5. Engage the remote starter switch. Read and record the voltage. The voltage reading should be 0.5 volt or less.
6. If the voltage reading is 0.5 volt or less, go to the starter motor-ground circuit component test.

7. If the voltage reading is greater than 0.5 volt, this is an indication of excessive resistance in the connections, the positive battery cable or in the starter solenoid. Move the 73III Automotive Meter negative lead to the starter solenoid B-terminal and repeat the test. If the voltage reading at the B-terminal is lower than 0.5 volt, the concern is either in the connections at the starter solenoid or in the solenoid contacts.

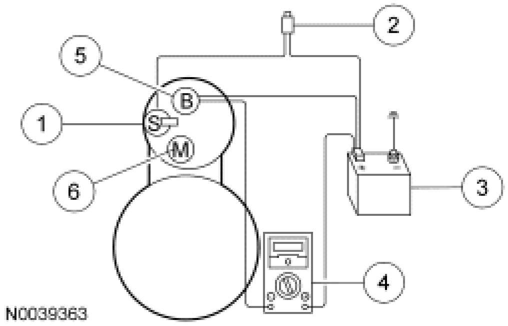


Fig. 16: Identifying S, M & B Terminals, 73III Automotive Meter, Battery & Remote Starter Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	S-terminal
2	-	Remote starter switch
3	10653	Battery
4	-	73III Automotive Meter
5	-	B-terminal
6	-	M-terminal

8. Remove the cables from solenoid B-, S- and M-terminals. Clean the cables and connections and reinstall the cables to the correct terminals. Repeat Steps 3 through 6. If the voltage drop reading is still greater than 0.5 volt when checked at the M-terminal or less than 0.5 volt when checked at the B-terminal, the concern is in the solenoid contacts. Install a new starter motor.
9. If the voltage reading taken at the solenoid B-terminal is still greater than 0.5 volt after cleaning the cables and connections at the solenoid, the concern is either in the positive (+) battery cable connection or in the positive battery cable itself.
10. Clean the positive (+) battery cable connection. If this does not solve the problem, install a new positive battery cable.

Starter Motor - Ground Circuit

A slow cranking condition can be caused by resistance in the ground or return portion of the cranking circuit. Check the voltage drop in the ground circuit as follows:

1. Connect the 73III Automotive Meter positive lead to the starter motor housing (the connection must be clean and free of rust or grease). Connect the negative lead to the negative (-) battery terminal.

2. Engage the remote starter switch and crank the engine. Read and record the voltage reading. The reading should be 0.2 volt or less.
3. If the voltage drop is more than 0.2 volt, clean the negative cable connections at the battery, the body ground connections and the starter ground connection. Retest.
4. If the voltage drop is greater than 0.2 volt, install a new cable. If the voltage reading is less than 0.2 volt and the engine still cranks slowly, install a new starter motor.

REMOVAL AND INSTALLATION

STARTER MOTOR

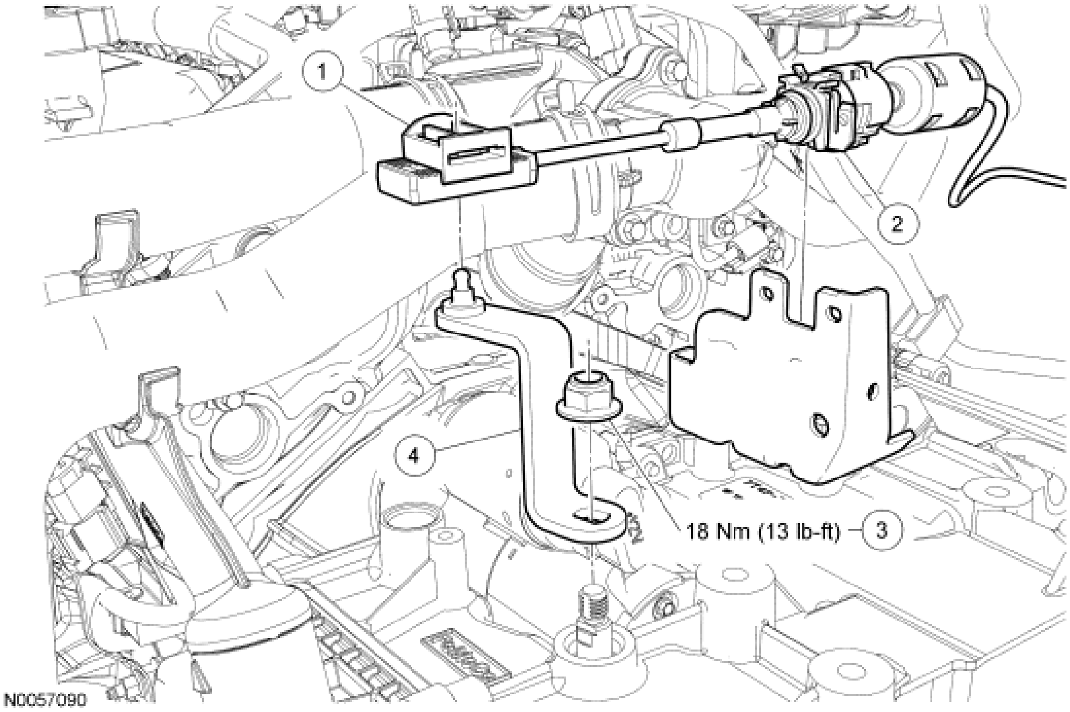


Fig. 17: Exploded View Of Starter Motor Components With Torque Specification (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7E395	Transmission shift cable adjustment lock
2	7H181	Transmission shift cable rotating slide snap
3	W520103	Transmission manual control lever nut
4	7A257	Transmission manual control lever

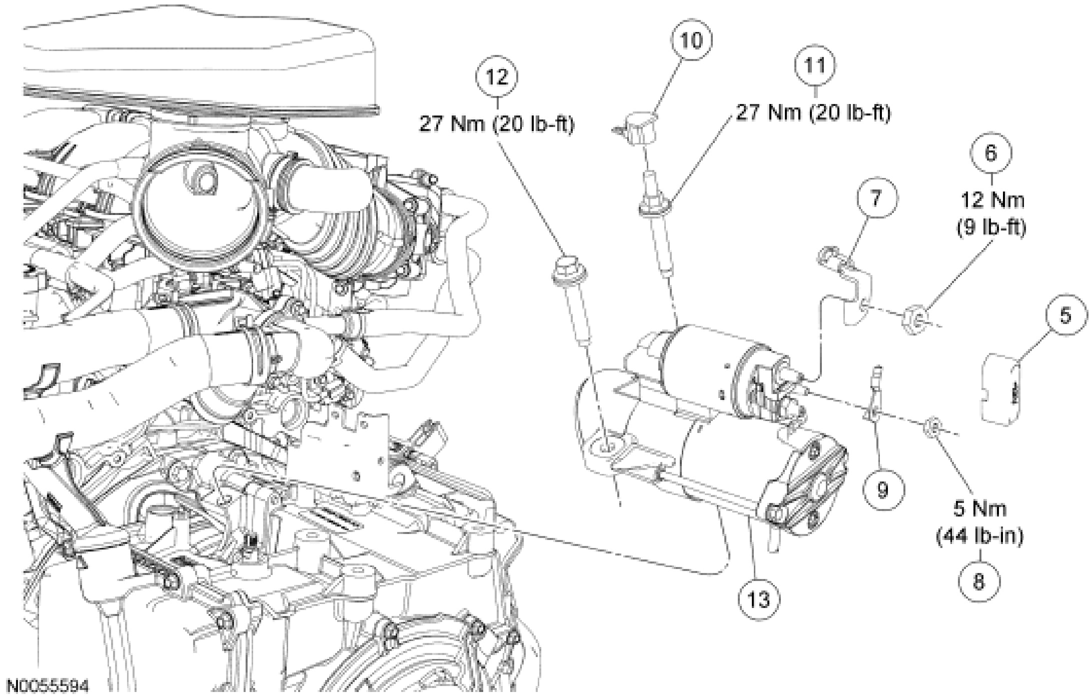


Fig. 18: Exploded View Of Starter Motor Components With Torque Specifications (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
5	11N087	Starter motor solenoid battery cable terminal cover
6	W706414	Starter motor solenoid battery cable nut
7	14463	Starter motor solenoid battery cable (part of 14B060)
8	N805320	Starter motor solenoid wire nut
9	14463	Starter motor solenoid wire (part of 14B060)
10	13A506	Wire harness retainer (part of 14B060)
11	W711515	Starter motor stud bolt
12	W503320	Starter motor bolt
13	11000	Starter motor

REMOVAL AND INSTALLATION

WARNING: **Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.**

1. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
2. Remove the air cleaner. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.
3. Disconnect the transmission shift cable and adjustment lock from the transmission manual control lever.
4. Disconnect the transmission shift cable rotating slide snap and position aside the transmission cable.
5. Remove the nut and the transmission manual control lever.
    - To install, tighten to 18 N.m (13 lb-ft).
6. Remove the starter motor terminal cover.
7. Remove the starter motor solenoid battery cable nut.
    - To install, tighten to 12 N.m (9 lb-ft).
8. Remove the starter motor solenoid wire nut.
    - To install, tighten to 5 N.m (44 lb-in).
9. Detach the wiring harness retainer from the starter motor stud bolt and position the wiring harness aside.
10. Remove the starter motor bolt, stud bolt and the starter.
    - To install, tighten to 27 N.m (20 lb-ft).
11. To install, reverse the removal procedure.

2008 ENGINE

Starting System - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Starter motor bolt	27	20	-
Starter motor solenoid battery cable nut	12	9	-
Starter motor solenoid wire nut	5	-	44
Starter motor stud bolt	27	20	-
Transmission manual control lever nut	18	13	-

DESCRIPTION AND OPERATION

STARTING SYSTEM

The starting system consists of the following:

- Starter motor
- Starter motor relay
- Transmission range (TR) sensor
- Battery
- Ignition switch
- PCM
- Start diode

When the starter solenoid is energized, a magnetic field is created in the starter solenoid windings. The iron plunger core is drawn into the starter solenoid coil, and a drive lever and pin connected to the starter drive engages the drive pinion gear to the flexplate ring gear. When the plunger is pulled all the way in, its contact disc closes the circuit between the battery and the motor feed terminals. This sends current to the motor, and the drive pinion gear cranks the flexplate to start the engine. When current flows to the starter motor, the starter solenoid pull-in coil is bypassed, and the hold-in coil keeps the drive pinion gear engaged with the flexplate.

An overrunning clutch in the starter drive protects the starter motor from excessive speeds during the brief period before the driver releases the ignition switch from the START position as the engine starts.

The starting system uses a TR sensor located in the transmission. The TR sensor prevents operation of the starter motor unless NEUTRAL or PARK is selected. The vehicle has one-touch integrated start (OTIS), a computer-assisted cranking system. This feature assists in starting the engine. If the ignition key is turned to the START position and released when the engine begins cranking, the engine may continue cranking for up to 10 seconds or until the vehicle starts.

One-Touch Integrated Start (OTIS)

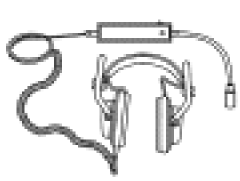
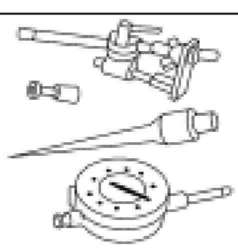
Once the ignition is turned to the START position and the vehicle is in NEUTRAL or PARK, the PCM reads starter motor request (SMR) from the ignition switch and gains control of the starter engagement. The customer is no longer in the loop after the initial crank request, the customer may release the key to the RUN/START position. The PCM will disengage the starter motor based on the following events:

- The engine is started (RPM threshold)
- A set time has been exceeded (calibrated)
- The ignition key has been turned to the OFF position

DIAGNOSTIC TESTS

STARTING SYSTEM

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST2311-A	73III Automotive Meter	105-R0057 or equivalent
 ST2312-A	Flex Probe Kit	105-R025C or equivalent
 ST1214-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	-

Principles of Operation

The starting system is electronically controlled by the passive anti-theft system (PATS). PATS is controlled by the instrument cluster. PATS recognizes the correct electronically coded ignition key and the instrument cluster sends a message to the PCM to provide a ground for the starter relay. The energized relay provides voltage to the starter solenoid with the key in the START position, thereby allowing the starter motor to activate.

Inspection and Verification

WARNING: Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.

NOTE: The anti-theft system must be functioning correctly before a logical starting system diagnosis can be carried out. Address anti-theft system concerns before continuing.

1. Verify the customer concern by operating the starting system to duplicate the conditions.
2. Inspect to determine if any of the following mechanical or electrical concerns apply.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Starter motor • Starter motor bolts • Flexplate	• Battery • Open fuse • Battery junction box (BJB) fuse 41 (30A) • Smart junction box (SJB) fuse 27 (20A) • Damaged wiring harness • Starter relay • Anti-theft system • Loose or corroded connections

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.

- check the scan tool connection to the VCM.
- refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
    - verify the ignition key is in the ON position.
    - verify the scan tool operation with a known good vehicle.
    - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM.
9. If the DTCs retrieved are related to the concern, go to PCM DTC Chart or the Passive Anti-Theft System (PATS) DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **SYMPTOM CHART**.

PCM DTC CHART

DTC	Description	Source	Action
P0512	Starter Request Circuit - Circuit has Power With the Ignition in the OFF Position	PCM	CARRY OUT the Ignition Switch Component Test. Refer to COMPONENT TESTING. If necessary, INSTALL a new ignition switch. If the ignition switch passed the component test, REPAIR circuit CDC35 (BU/WH) for a short to power.
P0705	TR Sensor Circuit Failure	PCM	Refer to the appropriate Automatic Transmission article for the procedure.
P0706	TR Sensor Circuit Failure	PCM	Refer to the appropriate Automatic Transmission article for the procedure.
P0708	TR Sensor Circuit Failure	PCM	Refer to the appropriate Automatic Transmission article for the procedure.
P0709	TR Sensor Circuit Failure	PCM	Refer to the appropriate Automatic Transmission article for the procedure.

PASSIVE ANTI-THEFT SYSTEM (PATS) DTC CHART

DTC	Description	Source	Action
B1213	Anti-Theft Number of Programmed Keys is Below Minimum	Instrument Cluster/PCM	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.

B1342	ECU is Defective	Instrument Cluster/PCM	INSTALL a PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article.
B1600	Passive Anti-Theft System (PATS) Key Transponder Signal is Not Received	Instrument Cluster/PCM	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	Instrument Cluster/PCM	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder	Instrument Cluster/PCM	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1681	PATS Transceiver Module Signal is Not Received	Instrument Cluster/PCM	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2103	Antenna Not Connected	Instrument Cluster/PCM	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2141	NVM Configuration Failure	Instrument Cluster/PCM	There is no PCM ID stored in the instrument cluster. CARRY OUT a parameter reset of the instrument cluster and PCM, then CYCLE the ignition and make an attempt to start the vehicle. REFER to Passive Anti-Theft System (PATS) Parameter Reset in **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2431	Transponder Programming Failed	Instrument Cluster/PCM	VERIFY if the correct PATS key is being used. If the PATS key is defective, use a new key for programming. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
U0100	Lost Communication	Instrument Cluster/PCM	REFER to **ANTI-THEFT**

	With ECM/PCM		**- PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
U2510	Antenna Not Connected	Instrument Cluster/PCM	If DTC U2511 is not present also, CARRY OUT a parameter reset of the instrument cluster and the PCM and CYCLE the ignition 3-5 times, making an attempt to start the vehicle each key cycle. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.

Symptom Chart

SYMPTOM CHART

Condition	Possible Sources	Action
• The engine does not crank	• Battery • Fuse(s) • Starter motor • Circuitry • PCM • Starter motor relay • Ignition switch • Start diode • Anti-theft system	• Go to **Pinpoint Test A** .
• One-touch integrated start (OTIS) does not operate correctly	• Circuitry • PCM	• Go to **Pinpoint Test A** .
• The engine cranks slowly	• Battery • Starter motor • Circuitry	• CARRY OUT the Starter Motor Component Test.
• Unusual starter noise	• Starter motor mounting • Starter motor • Incorrect starter drive engagement	• Go to **Pinpoint Test C** .
• The starter spins but the engine does not crank	• Starter motor	• INSPECT the starter motor mounting and engagement.

-	• Damaged flexplate teeth	REPAIR as necessary. • INSPECT the flexplate for damaged, missing or worn teeth. REPAIR as necessary.

Pinpoint Tests

Pinpoint Test A: The Engine Does Not Crank

Refer to appropriate SYSTEM WIRING DIAGRAM article for Starting System schematic and connector information.

Normal Operation

Under normal operation, constant power is supplied to the starter motor relay from the battery junction box (BJB) fuse 41 (30A). When the ignition switch is turned in the START position and held, with the vehicle in PARK or NEUTRAL, power flows to the starter motor relay through CDC35 (BU/WH). A ground is supplied through circuit CDC12 (YE) from the PCM causing the starter motor relay coil to energize and the relay contacts close. This allows power to be supplied from the starter motor relay contacts which then flows through circuit CDC25 (BN/GN) to the starter solenoid. The solenoid is grounded at the starter motor. Energizing the starter solenoid will engage the starter drive into the ring gear and closes the solenoid contacts allowing power directly from the battery through circuit SDC02 (RD) to the starter motor to start the engine.

This pinpoint test is intended to diagnose the following:

- Battery
- Anti-theft system
- Starter relay
- Ignition switch
- Circuitry
- PCM
- Start diode

PINPOINT TEST A: THE ENGINE DOES NOT CRANK

A1 CHECK THE BATTERY

- Check the battery condition and charge. Refer to **BATTERY, MOUNTING AND CABLES** article.
- **Is the battery OK?**

  YES : Go to A2.

  NO : CHARGE or INSTALL a new battery as necessary. REFER to **BATTERY, MOUNTING AND CABLES** article. TEST the system for normal operation.

A2 CHECK FOR PASSIVE ANTI-THEFT SYSTEM (PATS) DTCs

NOTE: Passive anti-theft system (PATS) DTCs are the only DTCs of concern in this step. Only repair retrieved non-PATS DTCs if a customer concern is reported.

- Check for PATS DTCs.
- **Were any PATS DTCs retrieved?**

  YES : REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article to diagnose the PATS DTCs.

  NO : Go to A3.

A3 CHECK THE BATTERY GROUND CABLE

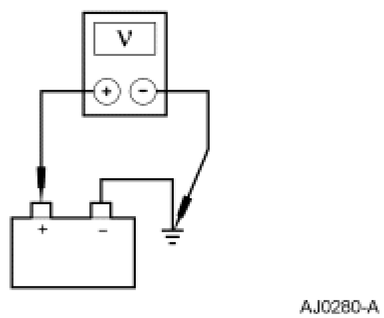


Fig. 1: Checking Battery Ground Cable
Courtesy of FORD MOTOR CO.

- Measure the voltage between the positive battery post and the battery ground cable connection at the engine.
- **Is the voltage greater than 10 volts?**

  YES : Go to A4.

  NO : INSTALL a new battery ground cable. REFER to **BATTERY, MOUNTING AND CABLES** article. TEST the system for normal operation.

A4 CHECK THE STARTER MOTOR GROUND

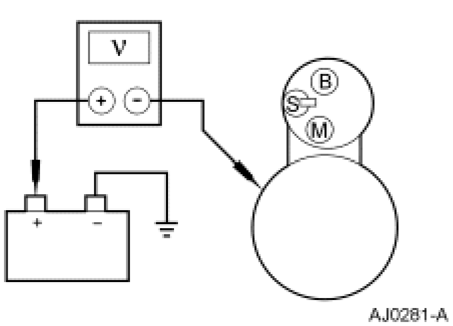


Fig. 2: Checking Starter Motor Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the positive battery post and the starter motor case.
- **Is the voltage greater than 10 volts?**

  YES : Go to A5.

  NO : CLEAN the starter motor mounting flange and make sure the starter motor is correctly mounted. TEST the system for normal operation.

A5 CHECK THE POWER SUPPLY TO THE STARTER MOTOR

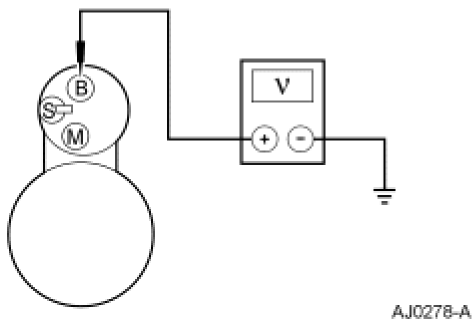


Fig. 3: Checking Power Supply To Starter Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between starter motor C197A, circuit SDC02 (RD) and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to A6.

  NO : INSTALL a new positive battery cable. REFER to **BATTERY, MOUNTING AND CABLES** article. TEST the system for normal operation.

A6 CHECK THE STARTER MOTOR B-PIN

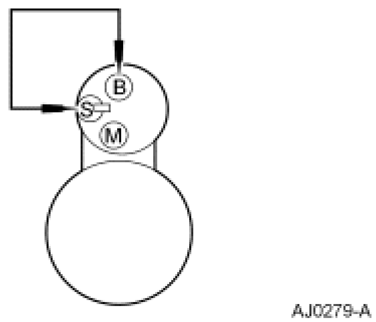


Fig. 4: Checking Starter Motor
Courtesy of FORD MOTOR CO.

- Connect one end of a fused (30A) jumper wire to starter motor solenoid C197A, circuit SDC02 (RD). Momentarily connect the other end of the jumper to starter motor C197B, circuit CDC25 (BN/GN).
- **Did the starter motor engage and the engine crank?**

YES : Go to A7.

NO : INSTALL a new starter motor. REFER to **STARTER MOTOR**. TEST the system for normal operation.

A7 CHECK STARTER MOTOR RELAY POWER

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

- Disconnect: Starter Motor Relay

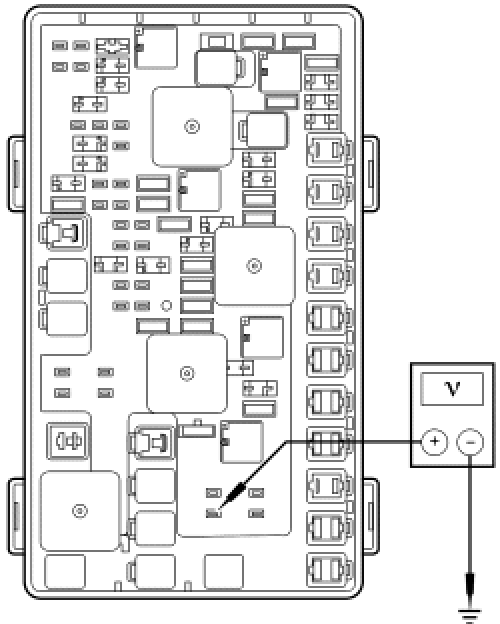


Fig. 5: Measuring Voltage Between BJB Starter Relay Pin 30, Circuit SDC02 (RD) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between battery junction box (BJB) starter motor relay pin 30, harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to A8.

NO : REPAIR or REPLACE the BJB. TEST the system for normal operation.

A8 CHECK THE STARTER MOTOR RELAY

- Carry out the Starter Motor Relay Component Test. Refer to COMPONENT TESTING.
- **Did the starter motor relay pass the component test?**

YES : Go to A9.

NO : INSTALL a new starter motor relay. TEST the system for normal operation.

A9 CHECK THE CIRCUIT TO THE STARTER MOTOR

- Key in OFF position.
- Disconnect: Starter Motor Solenoid C197B

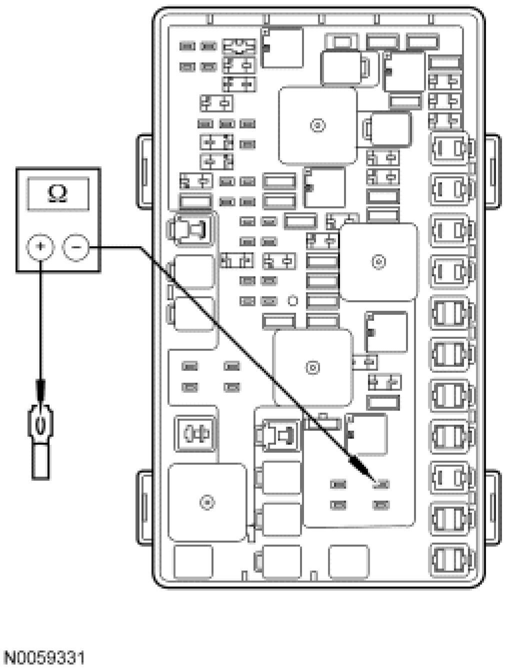


Fig. 6: Measuring Resistance Between BJB Starter Relay Pin 87, Circuit CDC25 (BN/GN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between starter motor solenoid S-terminal C197B, circuit CDC25 (BN/GN), harness side and the BJB starter motor relay pin 87, circuit CDC25 (BN/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A10.

  NO : REPAIR circuit CDC25 (BN/GN). TEST the system for normal operation.

A10 CHECK CIRCUIT CDC35 (BU/WH) FOR VOLTAGE

- Connect: Starter Motor Solenoid C197B
- Connect: Starter Motor Relay
- Disconnect: Starter Diode

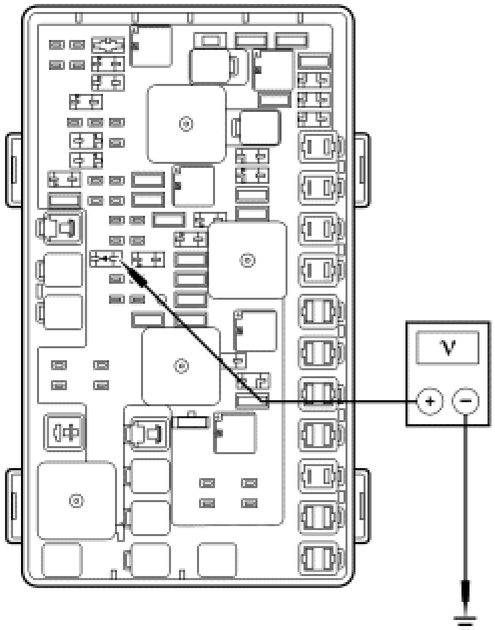


Fig. 7: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between BJB starter diode cell, circuit CDC35 (BU/WH) and ground with the ignition switch in the START position.
- **Is the voltage greater than 10 volts?**

  YES : Go to A13.

  NO : Go to A11.

A11 CHECK CIRCUIT SBP27 (BU/RD) FOR VOLTAGE

- Disconnect: Ignition Switch C250

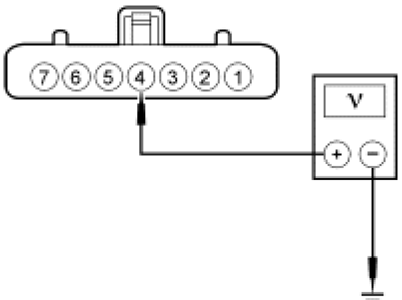


Fig. 8: Measuring Voltage Between Ignition Switch C250--4 And SBP27 (BU/RD)
Courtesy of FORD MOTOR CO.

- Measure the voltage between ignition switch C250-4, circuit SBP27 (BU/RD), harness side and

ground.

- **Is the voltage greater than 10 volts?**

  YES : Go to A12.

  NO : REPAIR circuit SBP27 (BU/RD). TEST the system for normal operation.

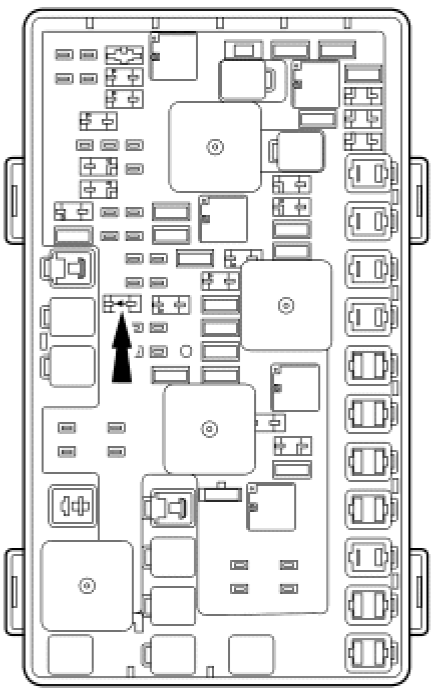
A12 CHECK THE IGNITION SWITCH

- Carry out the Ignition Switch Component Test. Refer to COMPONENT TESTING.
- **Did the ignition switch pass the component test?**

  YES : REPAIR circuit CDC35 (BU/WH) for an open. TEST the system for normal operation.

  NO : INSTALL a new ignition switch. REFER to **STEERING COLUMN SWITCHES** article. TEST the system for normal operation.

A13 CHECK THE STARTER DIODE



N0072570

Fig. 9: Identifying Starter Diode
Courtesy of FORD MOTOR CO.

- Carry out a Starter Diode Test.
- **Is the starter diode open or shorted?**

  YES : INSTALL a new starter diode. TEST the system for normal operation.

  NO : Go to A14.

A14 CHECK THE STARTER MOTOR RELAY ENABLE (STRT_RLY) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID STRT_RLY with the ignition switch in the START position.

- **Does the PID change from DISABLED to ENABLED?**

  YES : Go to A17.

  NO : Go to A15.

A15 CHECK CIRCUIT CDC35 (BU/WH) BETWEEN THE BJB AND THE PCM

- Key in OFF position.
- Disconnect: Starter Relay
- Disconnect: PCM C175B
- Disconnect: Smart Junction Box (SJB) C2280B

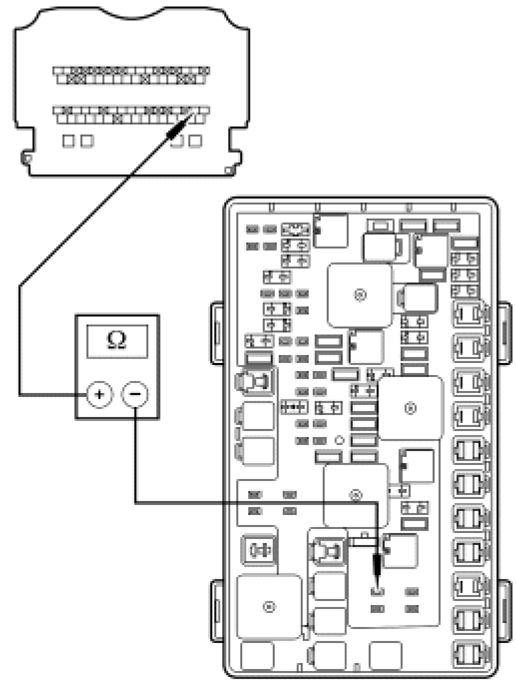


Fig. 10: Measuring Resistance Between BJB Starter Motor Relay Pin 85 And PCM C175b-35 Circuit CDC35
Courtesy of FORD MOTOR CO.

- Measure the resistance between the BJB starter motor relay pin 85, circuit CDC35 (BU/WH), harness side and PCM C175b-35, circuit CDC35 (BU/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A16.

  NO : REPAIR circuit CDC35 (BU/WH). TEST the system for normal operation.

A16 CHECK CIRCUIT CDC35 (BU/WH) BETWEEN THE BJB AND THE SJB

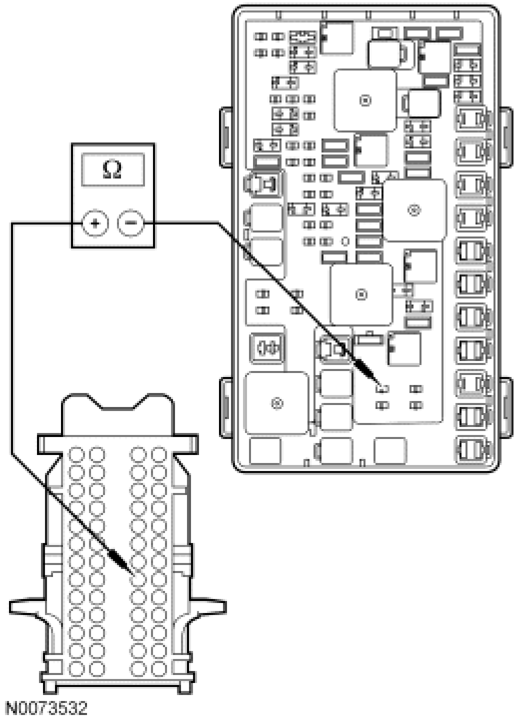


Fig. 11: Measuring Resistance Between BJB Starter Motor Relay Pin 85 And SJB C2280B-32 Circuit CDC35
Courtesy of FORD MOTOR CO.

- Measure the resistance between the BJB starter motor relay pin 85, circuit CDC35 (BU/WH), harness side and SJB C2280B-32, circuit CDC35 (BU/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

  NO : REPAIR circuit CDC35 (BU/WH) for an open. TEST the system for normal operation.

A17 CHECK THE STARTER MOTOR CONTROL OUTPUT DETECTED (SMC_MON) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID SMC_MON with the ignition switch in the START position.
- **Does the PID change from OFF to ON?**

  YES : REPAIR circuit CDC12 (YE). TEST the system for normal operation.

  NO : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

Pinpoint Test B: One-Touch Integrated Start (OTIS) Does Not Operate Correctly

Refer to appropriate SYSTEM WIRING DIAGRAM article for Starting System schematic and connector information.

Normal Operation

When the ignition switch is turned in the START position and released, the PCM receives a starter motor request (SMR) signal through circuit CDC35 (BU/WH). With the vehicle in PARK or NEUTRAL, power flows from the PCM to the starter motor relay through circuit CDC35 (BU/WH). A ground is supplied through circuit CDC12 (YE) from the PCM causing the starter motor relay coil to energize and the relay contacts close. This allows power from starter motor relay through circuit CDC25 (BN/GN) to the starter solenoid. The solenoid is grounded at the starter motor. Energizing the starter solenoid will engage the starter drive into the ring gear and closes the solenoid contacts allowing power directly from the battery through circuit SDC02 (RD) to the starter motor to start the engine. The customer is no longer in the loop after the initial crank request, the customer may release the key to the RUN/START position. The PCM will disengage the starter motor based on engine running (rpm threshold), a set crank time has been exceeded or the ignition switch has been turned to the OFF position.

This pinpoint test is intended to diagnose the following:

- Circuitry
- PCM

PINPOINT TEST B: ONE-TOUCH INTEGRATED START (OTIS) DOES NOT OPERATE CORRECTLY

B1 CHECK THE STATUS OF ONE-TOUCH INTEGRATED START (OTIS) (OTS_STAT) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID OTS_STAT with the ignition switch in the RUN position.
- **Is the OTIS PID enabled?**

  YES : Go to B2.

  NO : ENABLE OTIS. TEST the system for normal operation. If OTIS will not enable, INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

B2 CHECK THE KEY POSITION FOR START INDICATED (START_KEY) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID START_KEY with the ignition switch in the START position.
- **Does the PID change from OFF to ON?**

  YES : Go to B4.

  NO : Go to B3.

B3 CHECK CIRCUIT CDC35 (BU/WH)

- Disconnect: Start Diode
- Disconnect: PCM C175B

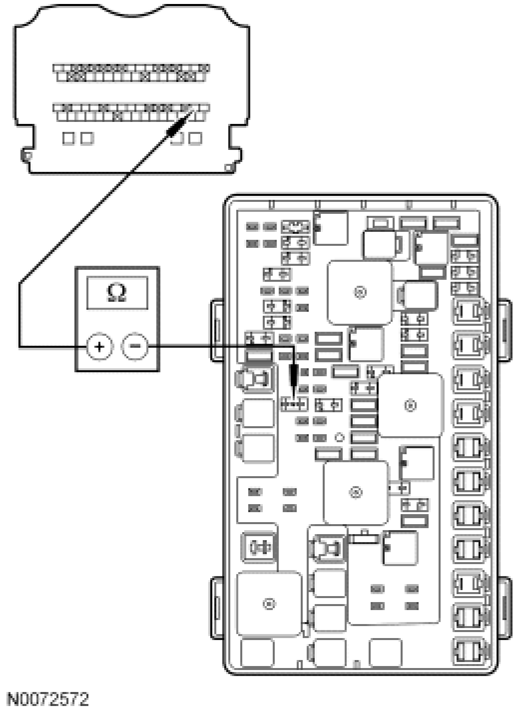


Fig. 12: Measuring Resistance Between Start Diode Cell Circuit CDC35 And PCM C175B-35 Circuit CDC35
Courtesy of FORD MOTOR CO.

- Measure the resistance between the start diode cell, circuit CDC35 (BU/WH), harness side and PCM C175B-35, circuit CDC35 (BU/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

  NO : REPAIR circuit CDC35 (BU/WH). TEST the system for normal operation.

B4 CHECK THE STARTER MOTOR RELAY ENABLE (STRT_RLY) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID STRT_RLY with the ignition switch in the START position.
- **Does the PID change from DISABLED to ENABLED?**

  YES : Go to B6.

  NO : Go to B5.

B5 CHECK CIRCUIT CDC35 (BU/WH) BETWEEN THE BJB AND THE PCM

- Key in OFF position.
- Disconnect: PCM C175B
- Disconnect: SJB C2280B

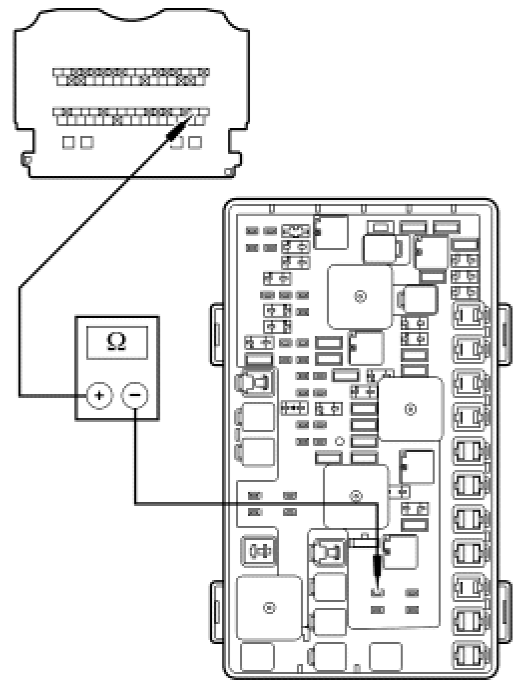


Fig. 13: Measuring Resistance Between BJB Starter Motor Relay Pin 85 And PCM C175b-35 Circuit CDC35
Courtesy of FORD MOTOR CO.

- Measure the resistance between the BJB starter motor relay pin 85, circuit CDC35 (BU/WH), harness side and PCM C175b-35, circuit CDC35 (BU/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

  NO : REPAIR circuit CDC35 (BU/WH). TEST the system for normal operation.

B6 CHECK THE STARTER MOTOR CONTROL OUTPUT DETECTED (SMC_MON) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID SMC_MON with the ignition switch in the START position.
- **Does the PID change from OFF to ON?**

  YES : REPAIR circuit CDC12 (YE). TEST the system for normal operation.

  NO : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.

Pinpoint Test C: Unusual Starter Noise

This pinpoint test is intended to diagnose the following:

- Starter motor
- Ring gear

PINPOINT TEST C: UNUSUAL STARTER NOISE

C1 CHECK THE STARTER MOUNTING

- Inspect the starter mounting bolts for looseness.
- **Is the starter motor mounted correctly?**

  YES : Go to C2.

  NO : INSTALL the starter motor correctly. REFER to **STARTER MOTOR**. TEST the system for normal operation.

C2 CHECK FOR ENGINE NOISE

- Key in OFF position.

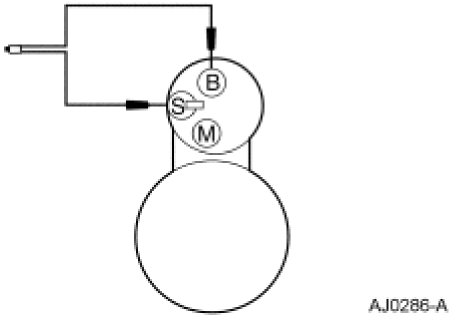


Fig. 14: Inspecting Starter Motor
Courtesy of FORD MOTOR CO.

- Connect a remote starter switch between the starter solenoid B- and S-terminals.
- Engage the starter motor and verify the noise is due to the starter operation.
- **Is the noise due to the starter motor engagement?**

  YES : Go to C3.

  NO : REFER to **ENGINE SYSTEM - GENERAL INFORMATION** article to continue diagnosis.

C3 CHECK FOR UNUSUAL WEAR

- Remove the starter motor.
- Inspect the ring gear for damaged or worn teeth. Refer to **ENGINE - 3.5L** article.
- **Is the noise due to ring gear tooth damage?**

  YES : INSTALL a new flexplate ring gear. REFER to **ENGINE - 3.5L** article. EXAMINE the starter pinion teeth. If damaged, INSTALL a new starter motor. REFER to **Starter Motor**. TEST the system for normal operation.

  NO : INSTALL a new starter motor. REFER to **STARTER MOTOR**. TEST the system for normal operation.

Component Tests

WARNING: **Always disconnect the battery ground cable at the battery before**

disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.

Always make the 73III Automotive Meter connections at the component terminal rather than at the wiring end connector. Making a connection at the wiring end connector could result in false readings because the meter will not pick up a high resistance between the wiring connector and the component.

Starter Motor - Motor Feed Circuit

1. Make sure the battery is fully charged; carry out a battery load test. Refer to **BATTERY, MOUNTING AND CABLES** article.
2. Disconnect the inertia fuel shutoff (IFS) switch.
3. Connect a remote starter switch between the starter solenoid S-terminal and the battery positive (+) terminal.
4. Connect the 73III Automotive Meter positive lead to the battery positive (+) post. Connect the negative lead to the starter solenoid M-terminal.

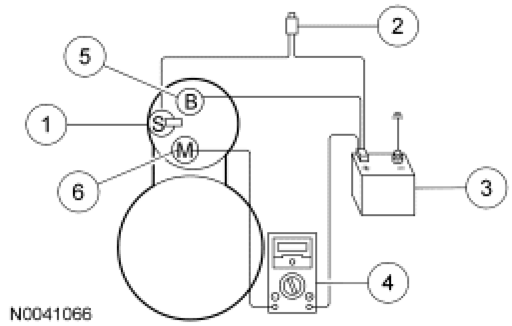


Fig. 15: Identifying S, M & B Terminals, 73III Automotive Meter, Battery, Remote Starter Switch & Motor Feed Circuit
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	S-terminal
2	-	Remote starter switch
3	10653	Battery
4	-	73III Automotive Meter
5	-	B-terminal
6	-	M-terminal

5. Engage the remote starter switch. Read and record the voltage. The voltage reading should be 0.5 volt or less.
6. If the voltage reading is 0.5 volt or less, go to the starter motor-ground circuit component test.

7. If the voltage reading is greater than 0.5 volt, this is an indication of excessive resistance in the connections, the positive battery cable or in the starter solenoid. Move the 73III Automotive Meter negative lead to the starter solenoid B-terminal and repeat the test. If the voltage reading at the B-terminal is lower than 0.5 volt, the concern is either in the connections at the starter solenoid or in the solenoid contacts.

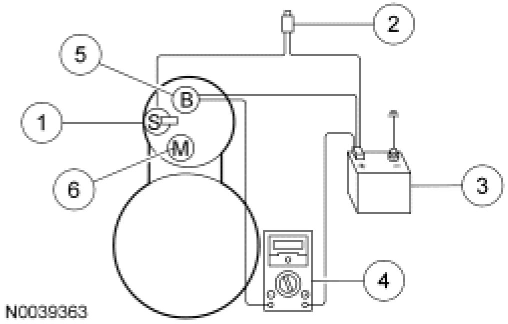


Fig. 16: Identifying S, M & B Terminals, 73III Automotive Meter, Battery & Remote Starter Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	S-terminal
2	-	Remote starter switch
3	10653	Battery
4	-	73III Automotive Meter
5	-	B-terminal
6	-	M-terminal

8. Remove the cables from solenoid B-, S- and M-terminals. Clean the cables and connections and reinstall the cables to the correct terminals. Repeat Steps 3 through 6. If the voltage drop reading is still greater than 0.5 volt when checked at the M-terminal or less than 0.5 volt when checked at the B-terminal, the concern is in the solenoid contacts. Install a new starter motor.
9. If the voltage reading taken at the solenoid B-terminal is still greater than 0.5 volt after cleaning the cables and connections at the solenoid, the concern is either in the positive (+) battery cable connection or in the positive battery cable itself.
10. Clean the positive (+) battery cable connection. If this does not solve the problem, install a new positive battery cable.

Starter Motor - Ground Circuit

A slow cranking condition can be caused by resistance in the ground or return portion of the cranking circuit. Check the voltage drop in the ground circuit as follows:

1. Connect the 73III Automotive Meter positive lead to the starter motor housing (the connection must be clean and free of rust or grease). Connect the negative lead to the negative (-) battery terminal.

2. Engage the remote starter switch and crank the engine. Read and record the voltage reading. The reading should be 0.2 volt or less.
3. If the voltage drop is more than 0.2 volt, clean the negative cable connections at the battery, the body ground connections and the starter ground connection. Retest.
4. If the voltage drop is greater than 0.2 volt, install a new cable. If the voltage reading is less than 0.2 volt and the engine still cranks slowly, install a new starter motor.

REMOVAL AND INSTALLATION

STARTER MOTOR

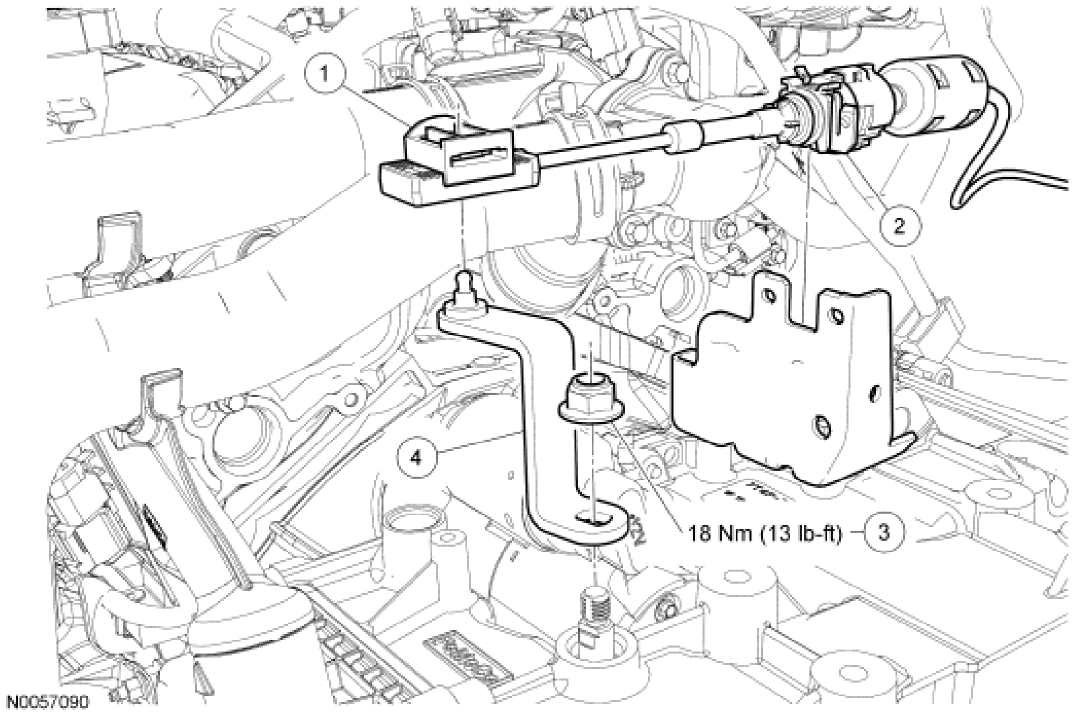


Fig. 17: Exploded View Of Starter Motor Components With Torque Specification (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7E395	Transmission shift cable adjustment lock
2	7H181	Transmission shift cable rotating slide snap
3	W520103	Transmission manual control lever nut
4	7A257	Transmission manual control lever

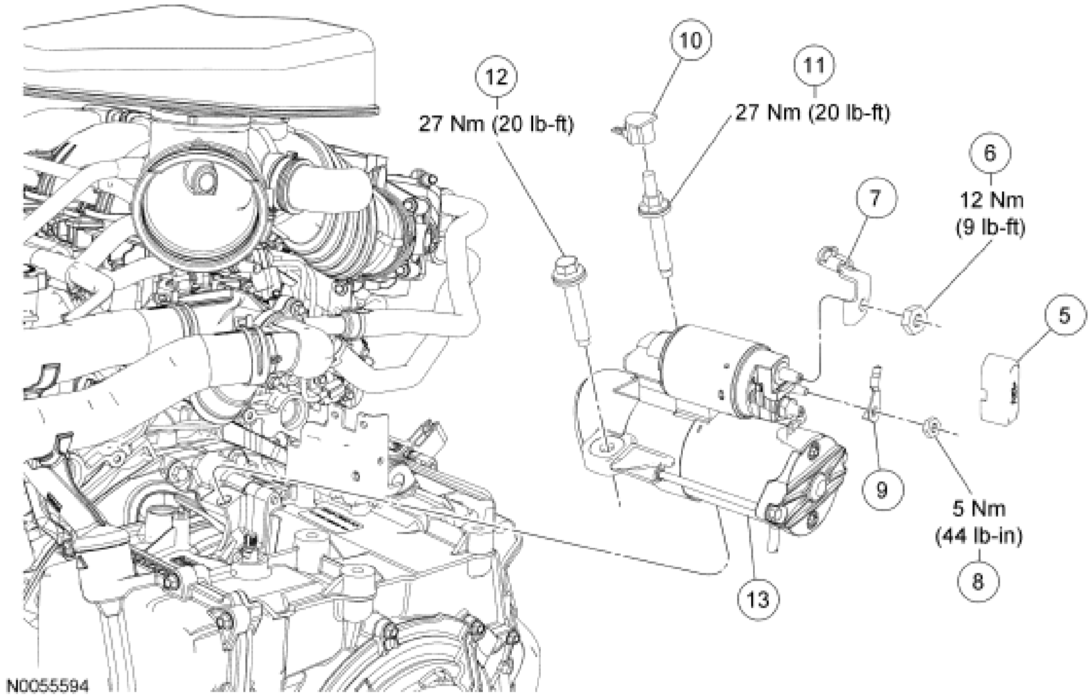


Fig. 18: Exploded View Of Starter Motor Components With Torque Specifications (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
5	11N087	Starter motor solenoid battery cable terminal cover
6	W706414	Starter motor solenoid battery cable nut
7	14463	Starter motor solenoid battery cable (part of 14B060)
8	N805320	Starter motor solenoid wire nut
9	14463	Starter motor solenoid wire (part of 14B060)
10	13A506	Wire harness retainer (part of 14B060)
11	W711515	Starter motor stud bolt
12	W503320	Starter motor bolt
13	11000	Starter motor

REMOVAL AND INSTALLATION

WARNING: **Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.**

1. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
2. Remove the air cleaner. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.
3. Disconnect the transmission shift cable and adjustment lock from the transmission manual control lever.
4. Disconnect the transmission shift cable rotating slide snap and position aside the transmission cable.
5. Remove the nut and the transmission manual control lever.
   - To install, tighten to 18 N.m (13 lb-ft).
6. Remove the starter motor terminal cover.
7. Remove the starter motor solenoid battery cable nut.
   - To install, tighten to 12 N.m (9 lb-ft).
8. Remove the starter motor solenoid wire nut.
   - To install, tighten to 5 N.m (44 lb-in).
9. Detach the wiring harness retainer from the starter motor stud bolt and position the wiring harness aside.
10. Remove the starter motor bolt, stud bolt and the starter.
    - To install, tighten to 27 N.m (20 lb-ft).
11. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Steering Column Switches - Edge & MKX

DESCRIPTION AND OPERATION

STEERING COLUMN SWITCHES

The steering column switches consist of the following:

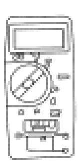
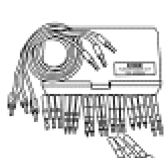
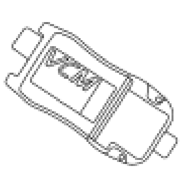
- Multifunction switch
- Ignition switch

The steering column switches receive driver inputs and send signals to various components. The multifunction switch controls the windshield wipers, hazard flasher, turn signal, headlamp low/high beam and headlamp dimmer/flash-to-pass. The ignition switch is used in conjunction with the lock cylinder key to start the vehicle. When the lock cylinder key is switched to different positions, it moves linkages which enable the ignition switch to send battery voltage to various components.

DIAGNOSTIC TESTS

STEERING COLUMN SWITCHES

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2574-A	Flex Probe Kit	105-R025B or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Principles of Operation

NOTE: The smart junction box (SJB) may also be identified as the generic electronic module (GEM).

Ignition Switch - The ignition switch is controlled by the ignition lock cylinder with a key. When the ignition cylinder is turned using the key, a mechanical connection positions the ignition switch to the selected position and allows the ignition switch to send voltage to specific components. The ignition switch is contained in the steering column lock module, if a new ignition switch needs to be installed, then a new lock module must be installed.

Multi-function Switch - The multi-function switch (flash-to-pass, high beam, turn signal, windshield wiper/washer and rear wiper/washer) controls the various components electrically. The multi-function switch is hard-wired to the SJB and controls a ground signal for the high beam, flash-to-pass and turn signal functions. The multi-function switch is also hard-wired to the smart wiper module and the rear wiper module, and controls a ground signal for the various wiper and washer functions.

For headlamp and turn signal concerns, refer to **EXTERIOR LIGHTING** article. For wiper and washer concerns, refer to **WIPERS AND WASHERS** article.

Inspection and Verification

1. Verify the customer concern by operating the multi-function switch or ignition switch.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Multi-function switch • Ignition switch • Steering column shrouds	• Smart junction box (SJB) fuse(s): ○ 27 (20A) ○ 28 (5A) ○ 43 (10A) ○ 45 (5A) • Wiring, terminals or connectors • Instrument cluster • Passive anti-theft system (PATS) module

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to Smart Junction Box (SJB) DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Source	Action
B2A20	Ignition stuck in START	Smart junction box (SJB)	Go to **Pinpoint Test E** .
B2844	Ignition fault	SJB	Go to **Pinpoint Test F** .
U2472	Unexpected Ignition State	SJB	Go to **Pinpoint Test F** .
-	All Other SJB DTCs	SJB	REFER to the Master DTC Chart in **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No power in all ignition switch positions	• Fuse • Wiring, terminals or connectors • Ignition switch	• Go to **Pinpoint Test A** .

	• Smart junction box (SJB)	
• No power in ACC	• Fuse(s) • Wiring, terminals or connectors • Ignition switch • SJB	• Go to **Pinpoint Test B** .
• No power in RUN	• Fuse(s) • Wiring, terminals or connectors • Run/start relay • Ignition switch • SJB	• Go to **Pinpoint Test C** .
• No power in START	• Fuse • Wiring, terminals or connectors • Starter motor relay • Ignition switch • SJB	• Go to **Pinpoint Test D** .
• The ignition key is hard to turn	• Key • Ignition lock cylinder • Ignition switch rod • Ignition switch	• Go to the Ignition Switch - Mechanical Component Test in this service information.
• The multi-function switch does not operate correctly	• Multi-function switch	• Go to the Multi-function Switch - Electrical Component Test in this service information.

Pinpoint Tests

Pinpoint Test A: No Power in All Ignition Switch Positions

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Distribution/SJB for schematic and connector information.

Normal Operation

The ignition switch receives fused battery voltage along circuit SBP27 (BU/RD) from smart junction box (SJB) fuse 27 (20A). The ignition switch then sends that voltage out to various systems depending on ignition switch position. The ignition switch has 4 possible states:

- OFF - No power on any circuits

- ACC - Power on circuit CDC33 (VT/GN)
- RUN - Power on circuit CDC34 (WH/OG)
- START - Power on circuit CDC35 (BU/WH)

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Ignition switch
- SJB

PINPOINT TEST A: NO POWER IN ALL IGNITION SWITCH POSITIONS

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

NOTE: Verify that battery voltage is 10 volts or greater.

A1 CHECK FOR VOLTAGE AT SJB FUSE 27 (20A)

- Key in OFF position.
- Disconnect: SJB Fuse 27 (20A)
- Measure the voltage between SJB fuse 27 (20A), input side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to A2.

  NO : Go to A3.

A2 CHECK FOR VOLTAGE ON CIRCUIT SBP27 (BU/RD)

- Connect: SJB Fuse 27 (20A)
- Disconnect: Ignition Switch C250

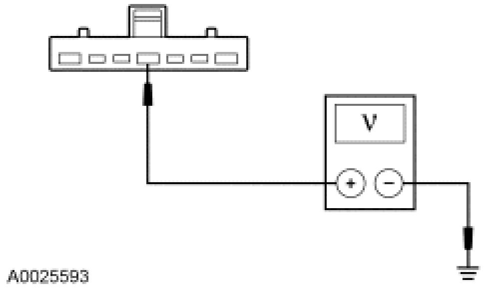


Fig. 1: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ignition switch C250-4, circuit SBP27 (BU/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new ignition switch. REFER to **Ignition Switch**. TEST the system for normal operation.

  NO : VERIFY SJB fuse 27 (20A) is OK. If OK, REPAIR circuit SBP27 (BU/RD). TEST the system for normal operation.

A3 CHECK FOR CORRECT SJB OPERATION

- Disconnect: SJB C2280a
- Disconnect: SJB C2280b
- Check the SJB connectors for:
  - corrosion.
  - pushed-out pins.
  - spread terminals.
- Connect: SJB C2280a
- Connect: SJB C2280b
- Make sure the connectors seat correctly, then operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: No Power in ACC

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Distribution/SJB for schematic and connector information.

Normal Operation

When the ignition switch is placed in the ACC position, fused ignition voltage is sent to the smart junction box (SJB) along circuit CDC33 (VT/GN).

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- Ignition switch
- SJB

PINPOINT TEST B: NO POWER IN ACC

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

NOTE: Verify that battery voltage is 10 volts or greater.

B1 CHECK THE IGNITION SWITCH

- Carry out the Ignition Switch - Electrical Component Test in this service information.
- **Is the ignition switch OK?**

  YES : Go to B2.

  NO : INSTALL a new ignition switch. REFER to **Ignition Switch**. TEST the system for normal operation.

B2 CHECK CIRCUIT CDC33 (VT/GN) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280a
- Disconnect: Ignition Switch C250

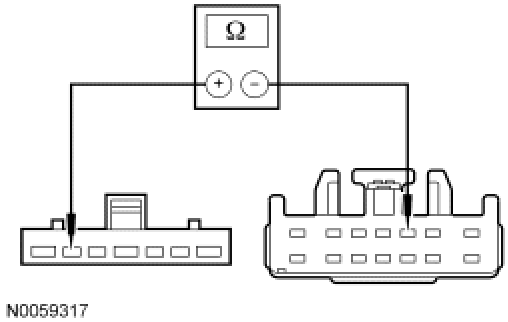


Fig. 2: Measuring Resistance Between Ignition Switch C250-6, Circuit CDC33 (VT/GN) & SJB C2280a-3
Courtesy of FORD MOTOR CO.

- Measure the resistance between ignition switch C250-6, circuit CDC33 (VT/GN), harness side and SJB C2280a-3, circuit CDC33 (VT/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to B3.

  NO : VERIFY SJB fuses 43 (10A) and 45 (5A) are OK. If OK, REPAIR circuit CDC33 (VT/GN). TEST the system for normal operation.

B3 CHECK CIRCUIT CDC33 (VT/GN) FOR A SHORT TO GROUND

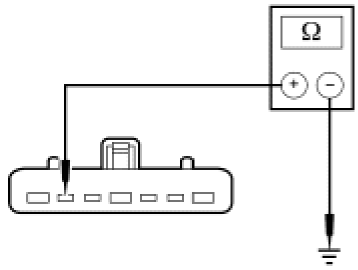


Fig. 3: Measuring Resistance Between Ignition Switch C250-6, Circuit CDC33 (VT/GN) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ignition switch C250-6, circuit CDC33 (VT/GN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to B4.

  NO : REPAIR circuit CDC33 (VT/GN). TEST the system for normal operation.

B4 CHECK FOR CORRECT SJB OPERATION

- Check SJB C2208a for:
  - corrosion.
  - pushed-out pins.
  - spread terminal.
- Connect: SJB C2280a
- Make sure the connector is seated correctly, then operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. TEST the system for normal operation.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Pinpoint Test C: No Power in RUN

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Distribution/SJB for schematic and connector information.

Normal Operation

When the ignition switch is placed in the RUN position, fused ignition voltage is sent to:

- the smart junction box (SJB) along circuit CDC34 (WH/OG).
- pin 85 of the run/start relay in the battery junction box (BJB) along circuit CDC34 (WH/OG).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Run/start relay
- Ignition switch
- SJB
- BJB

PINPOINT TEST C: NO POWER IN RUN

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

NOTE: Verify that battery voltage is 10 volts or greater.

C1 CHECK THE IGNITION SWITCH

- Carry out the Ignition Switch - Electrical Component Test in this service information.
- **Is the ignition switch OK?**

YES : Go to C2.

NO : INSTALL a new ignition switch. REFER to **Ignition Switch**. TEST the system for normal operation.

C2 CHECK FOR VOLTAGE AT THE SJB

- Key in OFF position.
- Disconnect: SJB C2280b
- Key in ON position.

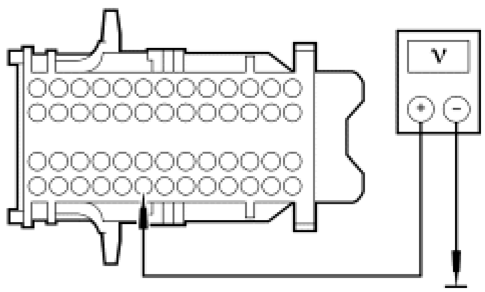


Fig. 4: Measuring Voltage Between SJB C2280B-45, Circuit CDC34 (WH/OG), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280b-45, circuit CDC34 (WH/OG), harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to C3.

NO : REPAIR circuit CDC34 (WH/OG). TEST the system for normal operation.

C3 CHECK FOR IGNITION VOLTAGE AT THE RUN/START RELAY

- Key in OFF position.
- Connect: SJB C2280b
- Disconnect: Run/Start Relay
- Key in ON position.

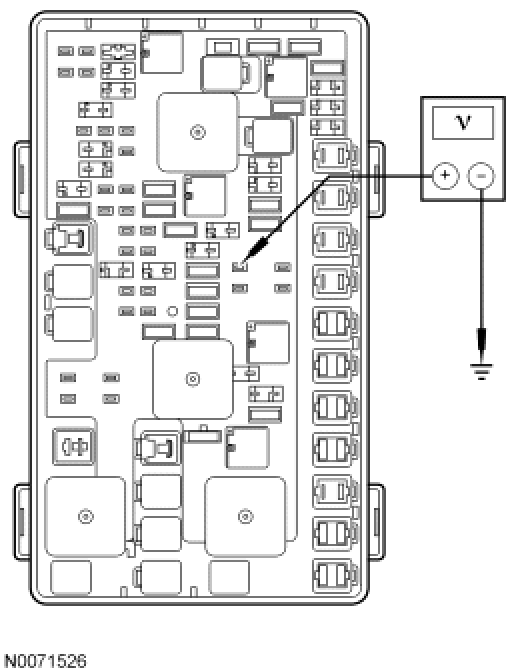


Fig. 5: Measuring Voltage Between Run/Start Relay Cavity 85, Circuit CDC34 (WH/OG) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between run/start relay cavity 85, circuit CDC34 (WH/OG), harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to C4.

NO : REPAIR circuit CDC34 (WH/OG). TEST the system for normal operation.

C4 CHECK THE RUN/START RELAY

- Carry out the Mini ISO Relay Component Test. Refer to appropriate COMPONENT TESTING article.
- **Is the relay OK?**

YES : Go to C5.

NO : INSTALL a new relay. TEST the system for normal operation.

C5 CHECK FOR BATTERY VOLTAGE AT THE RUN/START RELAY

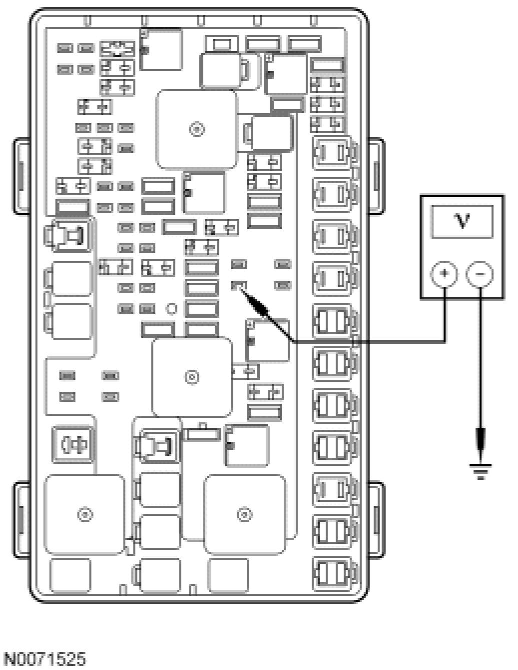


Fig. 6: Measuring Voltage Between Run/Start Relay Cavity 30, Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between run/start relay cavity 30, harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to C6.

  NO : VERIFY battery voltage is 10 volts or greater. If OK, REPAIR or INSTALL a new BJB. TEST the system for normal operation.

C6 CHECK FOR CORRECT SJB OPERATION

- Disconnect: SJB C2280b
- Check the connector for:
  - corrosion.
  - pushed-out pins.
  - spread terminal.
- Connect: SJB C2280b
- Make sure the connector is seated correctly, then operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. TEST the system for normal operation.

NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Pinpoint Test D: No Power in START

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Distribution/SJB for schematic and connector information.

Normal Operation

When the ignition switch is placed in the START position, fused ignition voltage is sent to the smart junction box (SJB) along circuit CDC35 (BU/WH).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Ignition switch
- SJB

PINPOINT TEST D: NO POWER IN START

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

NOTE: Verify that battery voltage is 10 volts or greater.

D1 CHECK THE IGNITION SWITCH

- Carry out the Ignition Switch - Electrical Component Test in this service information.
- **Is the ignition switch OK?**

YES : Go to D2.

NO : INSTALL a new ignition switch. REFER to **Ignition Switch**. TEST the system for normal operation.

D2 CHECK CIRCUIT CDC35 (BU/WH) FOR AN OPEN

- Key in OFF position.
- Disconnect: Ignition Switch C250
- Disconnect: SJB C2280b

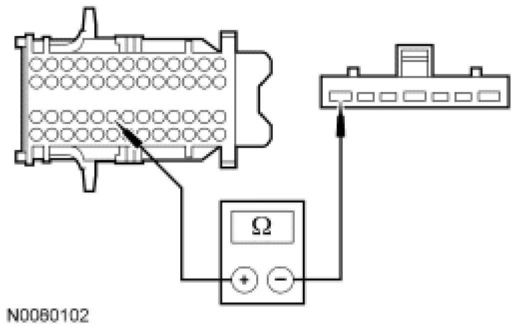


Fig. 7: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between ignition switch C250-7, circuit CDC35 (BU/WH), harness side and SJB C2280b-32, circuit CDC35 (BU/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to D3.

  NO : REPAIR circuit CDC35 (BU/WH). TEST the system for normal operation.

D3 CHECK THE SJB START CIRCUIT FOR AN OPEN

- Disconnect: SJB C2280e
- Measure the resistance between SJB C2280b pin-32, component side and SJB C2280e pin-8, component side.
- **Is the resistance less than 5 ohms?**

  YES : Go to D4.

  NO : Go to D5.

D4 CHECK CIRCUIT CDC35 (BU/WH) FOR AN OPEN

- Disconnect: Starter Relay

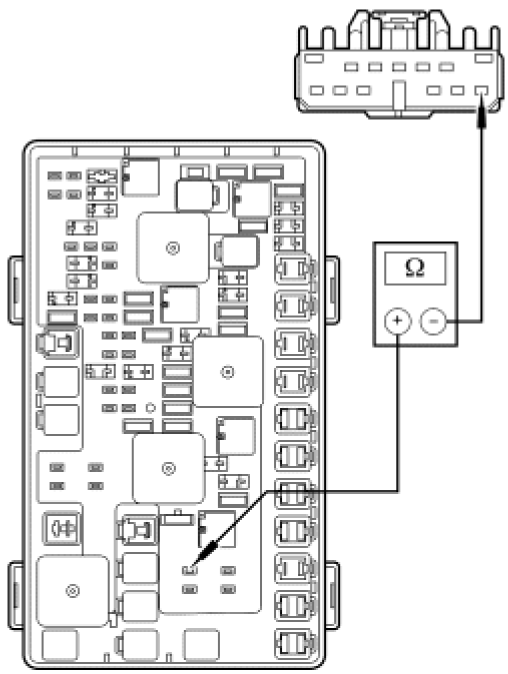


Fig. 8: Measuring Resistance Between SJB C2280E-8, Circuit CDC35 (BU/WH) & Starter Relay Cavity 85
Courtesy of FORD MOTOR CO.

- Measure the resistance between SJB C2280e-8, circuit CDC35 (BU/WH), harness side and starter relay cavity 85, harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : REPAIR circuit CDC35 (BU/WH). TEST the system for normal operation.

  NO : REFER to **STARTING SYSTEM** article to diagnose the starting system.

D5 CHECK FOR CORRECT SJB OPERATION

- Check SJB connector C2280b and C2280e for:
  - corrosion.
  - pushed-out pins.
  - spread terminal.
- Connect: SJB C2280b
- Connect: SJB C2280e
- Make sure the connectors are seated correctly, then operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. TEST the system for normal operation.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Pinpoint Test E: B2A20 - Ignition Stuck in START

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Distribution/SJB for schematic and connector information.

Normal Operation

When the ignition switch is placed in the START position, fused ignition voltage is sent to smart junction box (SJB) along circuit CDC35 (BU/WH). The ignition switch is spring-loaded to automatically return to the RUN position after being placed in the START position.

- B2A20 Ignition Stuck in START - The SJB continuously monitors the ignition switch state, if the SJB receives a START signal for more than 30 seconds, DTC B2A20 will be set.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Starter relay
- Ignition switch
- SJB
- PCM

PINPOINT TEST E: B2A20 - IGNITION STUCK IN START

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

NOTE: Verify that battery voltage is 10 volts or greater.

E1 CHECK THE IGNITION SWITCH MECHANICAL FUNCTION

- Inspect the ignition switch for mechanical function. Refer to the Ignition Switch - Mechanical Component Test in this service information.
- **Is the ignition switch OK?**

  YES : Go to E2.

  NO : INSTALL a new ignition switch. REFER to **Ignition Switch**. TEST the system for normal operation.

E2 CHECK THE IGNITION SWITCH FOR A SHORT

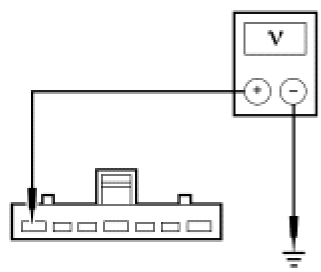
- Carry out the Ignition Switch - Electrical Component Test in this service information.
- **Is the ignition switch OK?**

  YES : Go to E3.

  NO : INSTALL a new ignition switch. REFER to **Ignition Switch**. CLEAR the DTCs. REPEAT the self-test.

E3 CHECK CIRCUIT CDC35 (BU/WH) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Ignition Switch C250
- Disconnect: SJB C2280b



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<u>Fig. 9: Measuring Voltage Between Ignition Switch C250-7, Circuit CDC35 (BU/WH), Harness Side & Ground</u>
Courtesy of FORD MOTOR CO.

- Measure the voltage between ignition switch C250-7, circuit CDC35 (BU/WH), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR circuit CDC35 (BU/WH). CLEAR the DTCs. REPEAT the self-test.

  NO : Go to E4.

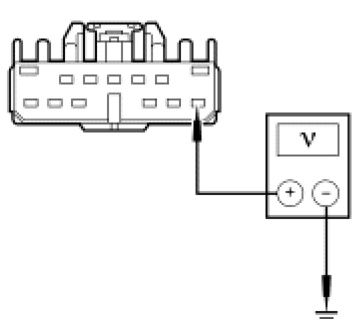
E4 CHECK THE SJB FOR A SHORT TO VOLTAGE

- Disconnect: SJB C2280e
- Measure the voltage between SJB C2280b-32, circuit CDC35 (BU/WH), component side and ground.
- **Is any voltage present?**

  YES : Go to E8.

  NO : Go to E5.

E5 CHECK CIRCUIT CDC35 (BU/WH) FOR A SHORT TO VOLTAGE



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<u>Fig. 10: Measuring Voltage Between SJB C2280E-8, Circuit CDC35 (BU/WH), Harness Side</u>

& Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280e-8, circuit CDC35 (BU/WH), harness side and ground.
- **Is any voltage present?**

  YES : Go to E6.

  NO : Go to E8.

E6 ISOLATE THE STARTER RELAY

- Disconnect: Starter Relay

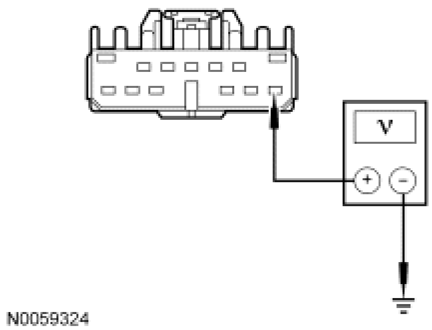


Fig. 11: Measuring Voltage Between SJB C2280E-8, Circuit CDC35 (BU/WH), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280e-8, circuit CDC35 (BU/WH), harness side and ground.
- **Is any voltage present?**

  YES : Go to E7.

  NO : INSTALL a new starter relay. CLEAR the DTCs. REPEAT the self-test.

E7 ISOLATE THE PCM

- Disconnect: PCM C175b

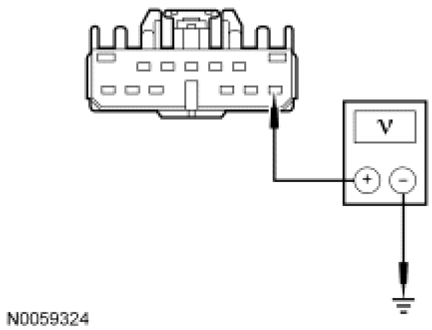


Fig. 12: Measuring Voltage Between SJB C2280E-8, Circuit CDC35 (BU/WH), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280e-8, circuit CDC35 (BU/WH), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR circuit CDC35 (BU/WH). CLEAR the DTCs. REPEAT the self-test.

  NO : INSTALL a new PCM. Refer to **ELECTRONIC ENGINE CONTROLS** article for the procedure. CLEAR the DTCs. REPEAT the self-test.

E8 CHECK FOR CORRECT SJB OPERATION

- Check SJB connectors C2280b and C2280e for:
  - corrosion.
  - pushed-out pins.
  - spread terminal.
- Connect: SJB C2280b
- Connect: SJB C2280e
- Make sure the connectors are seated correctly, then operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB, REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Pinpoint Test F: DTCs B2844 and U2472 - Ignition Fault and Unexpected Ignition State

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Distribution/SJB for schematic and connector information.

Normal Operation

The ignition switch receives fused battery voltage along circuit SBP27 (BU/RD) from smart junction box (SJB) fuse 27 (20A). The ignition switch then sends that voltage out to various systems depending on ignition switch position. The SJB continuously monitors the ignition switch state.

- DTC B2844 Ignition Fault - If the SJB receives an invalid ignition state or cannot receive the ignition switch state during normal operation, DTC B2844 is set.
- DTC U2472 Unexpected Ignition State - If the SJB does not receive the ignition RUN signal, or any ignition switch signal, while performing an on-demand self test, DTC U2472 is set.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Ignition switch
- SJB

PINPOINT TEST F: DTCs B2844 AND U2472 - IGNITION FAULT AND UNEXPECTED IGNITION STATE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

NOTE: Verify that battery voltage is 10 volts or greater.

F1 RETRIEVE THE DTCs

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test SJB
- Carry out the on-demand self test for the SJB. Retrieve and record any DTCs.
- **Is DTC U2472 present?**

  YES : Go to F2.

  NO : For DTC B2844, go to F5.

  For DTC B2A20, go to **Pinpoint Test E** .

  For all other SJB DTCs, REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

F2 CHECK THE IGNITION SWITCH

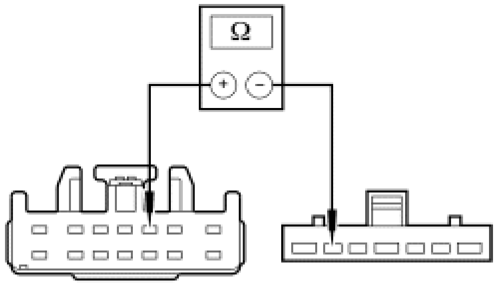
- Key in OFF position.
- Carry out the Ignition Switch - Electrical Component Test in this service information.
- **Is the ignition switch OK?**

  YES : Go to F3.

  NO : INSTALL a new ignition switch. REFER to **Ignition Switch**. CLEAR the DTC. REPEAT the self-test.

F3 CHECK CIRCUIT CDC33 (VT/GN) FOR AN OPEN

- Disconnect: Ignition Switch C250
- Disconnect: SJB C2280a



N0059325

Fig. 13: Measuring Resistance Between Ignition Switch C250-6, Circuit CDC33 (VT/GN) & SJB C2280A-3
Courtesy of FORD MOTOR CO.

- Measure the resistance between ignition switch C250-6, circuit CDC33 (VT/GN), harness side and SJB C2280a-3, circuit CDC33 (VT/GN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : REPAIR circuit CDC33 (VT/GN). CLEAR the DTC. REPEAT the self-test.

  NO : Go to F4.

F4 CHECK CIRCUIT CDC34 (WH/OG) FOR AN OPEN

- Disconnect: SJB C2280b

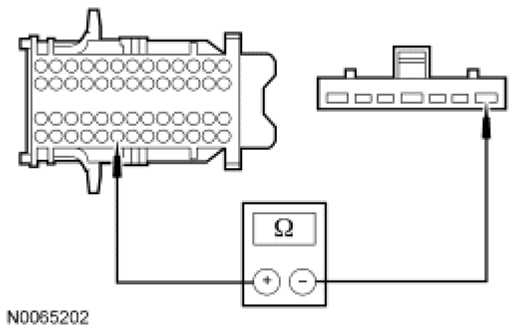


Fig. 14: Measuring Resistance Between Ignition Switch C250-1, Circuit CDC34 (WH/OG) & SJB C2280B-45
Courtesy of FORD MOTOR CO.

- Measure the resistance between ignition switch C250-1, circuit CDC34 (WH/OG), harness side and SJB C2280b-45, circuit CDC34 (WH/OG), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : REPAIR circuit CDC34 (WH/OG). CLEAR the DTC. REPEAT the self-test.

  NO : Go to F7.

F5 CHECK THE IGNITION CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Ignition Switch C250
- Disconnect: SJB C2280a
- Disconnect: SJB C2280b
- Disconnect: Run/Start Relay
- Measure the voltage between ground and:
  - SJB C2280a-3, circuit CDC33 (VT/GN), harness side.
  - SJB C2280b-32, circuit CDC35 (BU/WH), harness side.
  - SJB C2280b-45, circuit CDC34 (WH/OG), harness side.
  - run/start relay cavity 85, circuit CDC34 (WH/OG), harness side.

- **Is any voltage present?**

  YES : REPAIR the affected circuit(s). CLEAR the DTC. REPEAT the self-test.

  NO : Go to F6.

F6 CHECK THE IGNITION CIRCUITS FOR AN OPEN

- Measure the resistance between:
  - ignition switch C250-6, circuit CDC33 (VT/GN), harness side and SJB C2280a-3, circuit CDC33 (VT/GN), harness side.
  - ignition switch C250-7, circuit CDC35 (BU/WH), harness side and SJB C2280b-32, circuit CDC35 (BU/WH), harness side.
  - ignition switch C250-1, circuit CDC34 (WH/OG), harness side and SJB C2280b-45, circuit CDC34 (WH/OG), harness side.
  - ignition switch C250-1, circuit CDC34 (WH/OG), harness side and run/start relay cavity 1, circuit CDC34 (WH/OG), harness side.
- **Are any of the resistances greater than 10,000 ohms?**

  YES : REPAIR the affected circuit(s). CLEAR the DTC. REPEAT the self-test.

  NO : Go to F7.

F7 CHECK FOR CORRECT SJB OPERATION

- Check SJB connectors C2280a and C2280b for:
  - corrosion.
  - pushed-out pins.
  - spread terminal.
- Connect: SJB C2280a
- Connect: SJB C2280b
- Make sure the connectors are seated correctly, then operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CLEAR the DTC. REPEAT the self-test.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Component Tests

Ignition Switch - Mechanical

The following conditions can cause difficulty in operating the ignition switch and lock cylinder:

- Burrs on the lock cylinder key
- Insufficient lube on the lock cylinder
- Binding lock cylinder

- Burrs or foreign material around the rack-and-pinion actuator in the lock cylinder housing
- Insufficient lube on the actuator (do not apply lubricant to the inside of the ignition switch)
- Binding ignition switch

If the steering wheel lock is engaged with the wheels loaded against a curb, high effort will be necessary to turn the key from lock. Turn the steering wheel to either side of the lock to unload the system.

Carry out the following test to determine if the ignition switch and lock cylinder are operating correctly.

1. Inspect the ignition key for any burrs, damage or incorrect cut. Have a new ignition key made as necessary.

   NOTE: The steering wheel may be locked full left or full right. If the steering wheel is locked, it will be necessary to apply turning effort to the steering wheel in the direction of the lock while turning the key.

2. Turn the key to the ACC position and then the RUN position.
   - If the ignition key turns to the ACC and RUN position, continue with Step 3.
   - If the ignition key will not turn to the ACC and RUN position, continue with Step 4.

   NOTE: The ignition switch and lock cylinder should return from the START position back to the RUN position without assistance.

3. Turn the ignition key to the START position and release the key.
   - If the ignition switch and lock cylinder return from the START position back to the RUN position without assistance, the ignition switch is operating correctly at this time.
   - If the ignition switch and lock cylinder do not return from the START position back to the RUN position without assistance, continue with Step 4.
4. Remove the ignition lock cylinder. Refer to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
5. Rotate the ignition lock cylinder through all of the switch positions.
   - If the lock cylinder operates correctly, continue with Step 6.
   - If the lock cylinder does not operate correctly, install a new ignition lock cylinder. Refer to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
6. Check for binding or sticking ignition switch actuating rod, burrs around the rack-and-pinion actuator in the ignition lock cylinder housing or insufficient lubrication.
   - If there is sufficient lubrication and there are no burrs, binding or sticking conditions, install a new ignition switch. Refer to **Ignition Switch** in this service information.
   - If there is insufficient lubrication, burrs, binding or sticking conditions, repair or lubricate as necessary.

Ignition Switch - Electrical

Refer to appropriate COMPONENT TESTING article.

Multi-function Switch - Electrical

Refer to appropriate COMPONENT TESTING article.

REMOVAL AND INSTALLATION

IGNITION SWITCH

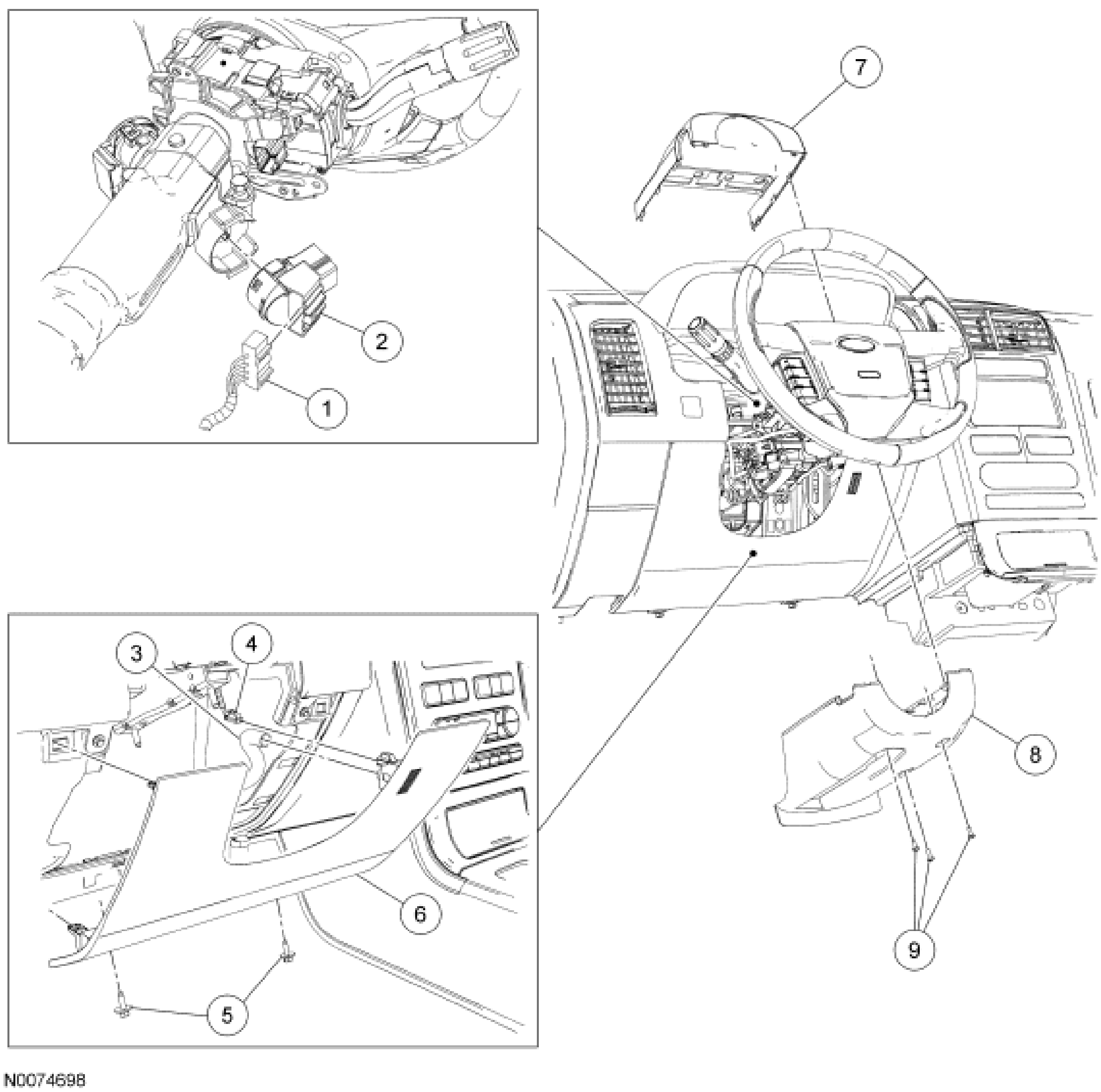


Fig. 15: Exploded View Of Ignition Switch Components
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
		Ignition switch electrical connector (part

1	-	of 14401)
2	11572	Ignition switch
3	-	In-vehicle temperature sensor hose (part of 19C734)
4	-	In-vehicle temperature sensor electrical connector (part of 14401)
5	W505002	Steering column opening cover bolts (2 required)
6	04459	Steering column opening cover
7	3530	Upper steering column shroud
8	3K512	Lower steering column shroud
9	W707658	Lower steering column shroud screws (3 required)

REMOVAL AND INSTALLATION

1. Depower the supplemental restraints system (SRS). For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NOTE: Release the upper steering column shroud by pressing inward on the sides and lifting upwards.

2. Remove the upper steering column shroud.
3. Release the tilt lever, remove the 3 lower steering column shroud screws and the shroud.

NOTE: The top of the steering column opening cover is held in by tabs that clip into the instrument panel.

4. Remove the 2 steering column opening cover screws.
   - Detach the steering column opening cover by pulling straight outward.
5. If equipped, disconnect the electrical connector and hose from the in-vehicle temperature sensor.
   - Remove the steering column opening cover.
6. Disconnect the ignition switch electrical connector.
7. Press the 2 locking tabs and remove the ignition switch.
8. To install, reverse the removal procedure.
9. Repower the SRS. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

STEERING COLUMN MULTIFUNCTION SWITCH

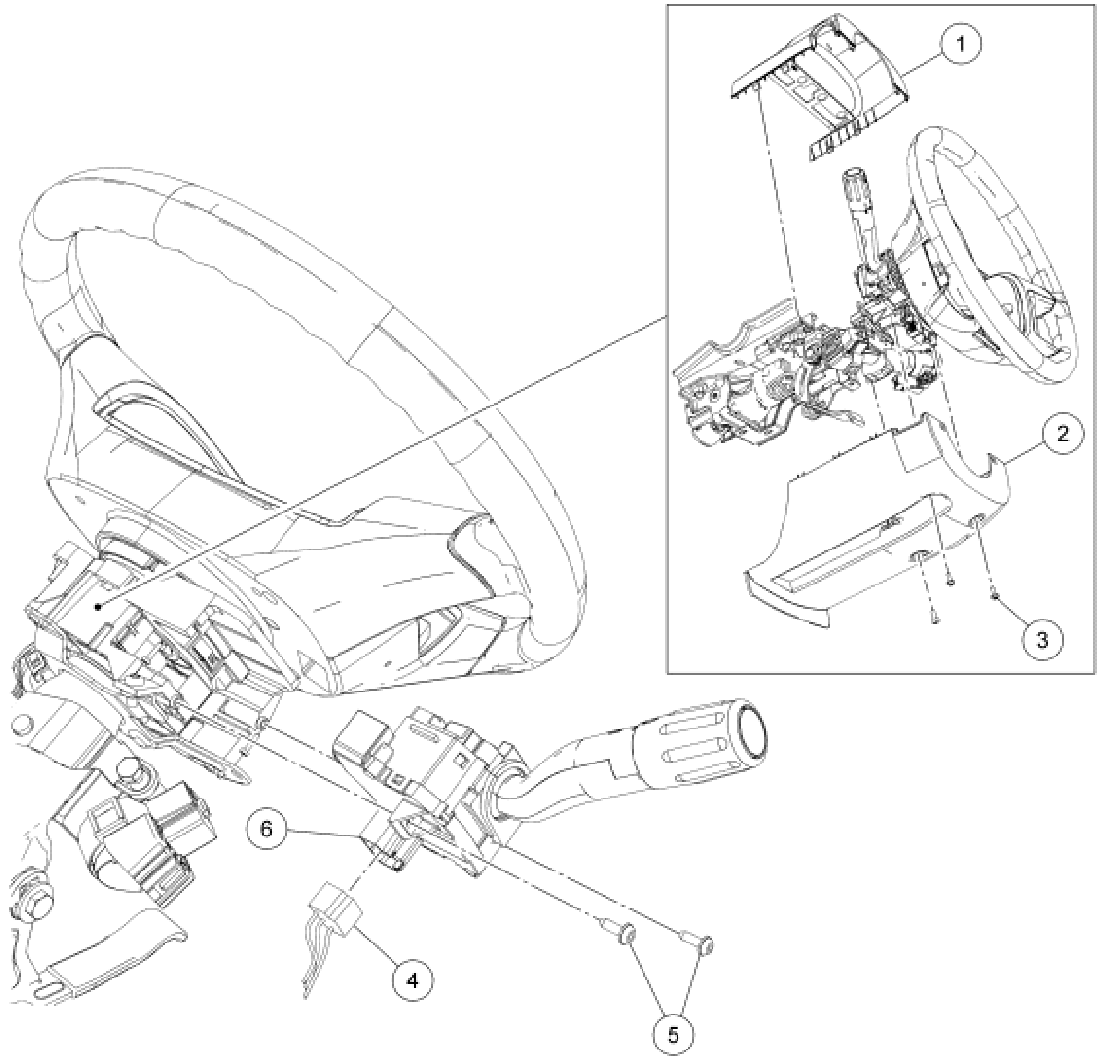


Fig. 16: Exploded View Of Steering Column Multifunction Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3530	Upper steering column shroud
2	3K512	Lower steering column shroud
3	W707658	Lower steering column shroud screw (3 required)
4	-	Multi-function switch electrical connector (part of 14401)
5	W503521	Multi-function switch screws (2 required)
6	14K147	Multi-function switch

REMOVAL AND INSTALLATION

NOTE: Release the upper steering column shroud by pressing inward on the sides of the shroud and lifting upwards.

1. Remove the upper steering column shroud.
2. Release the tilt lever, remove the 3 lower steering column shroud screws and the shroud.
3. Disconnect the multi-function switch electrical connector.
4. Remove the 2 multi-function switch screws and remove the switch.
5. To install, reverse the removal procedure.

STEERING COLUMN LOCK MODULE

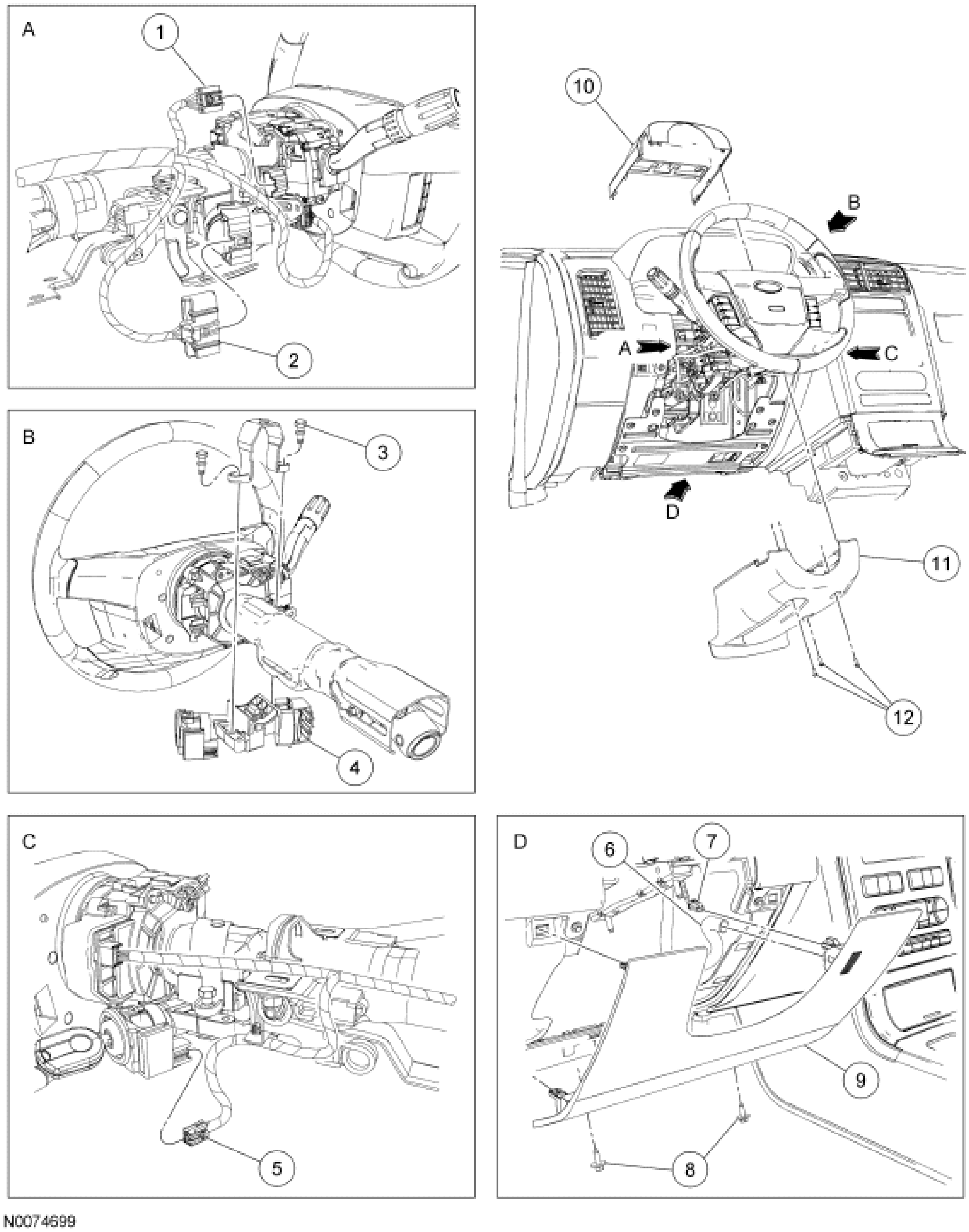


Fig. 17: Exploded View Of Steering Column Lock Module
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Multi-function switch electrical connector (part of 14401)
		Ignition switch electrical connector (part

2	-	of 14401)
3	12049	Steering column lock module bolt (2 required)
4	3511	Steering column lock module assembly
5	-	Passive anti-theft system (PATS) electrical connector (part of 14401)
6	-	In-vehicle temperature sensor hose (part of 19C734)
7	-	In-vehicle temperature sensor electrical connector (part of 14401)
8	W505002	Steering column opening cover bolts (2 required)
9	04459	Steering column opening cover
10	3530	Upper steering column shroud
11	3K512	Lower steering column shroud
12	W707658	Lower steering column shroud screws (3 required)

REMOVAL AND INSTALLATION

1. Depower the supplemental restraints system (SRS). For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NOTE: Release the upper steering column shroud by pressing inward on the sides of the shroud and lifting upwards.

2. Remove the upper steering column shroud.
3. Release the tilt lever, remove the 3 lower steering column shroud screws and remove the shroud.

NOTE: The top of the steering column opening cover is held in place by tabs that clip to the instrument panel.

4. Remove the 2 steering column opening cover screws.
    - Detach the steering column opening cover by pulling straight outward.
5. If equipped, disconnect the electrical connector and hose from the in-vehicle temperature sensor.
    - Remove the steering column opening cover.
6. Disconnect the multi-function switch electrical connector.
7. Disconnect the passive anti-theft system (PATS) and ignition switch electrical connectors.

NOTE: After cutting slots in the steering column lock module bolts, clean all metal shavings and foreign material from the steering column.

8. Using a suitable tool, cut slots into the heads of the 2 steering column lock module bolts.

NOTE: **The steering column lock module bolts are designed to sheer off when tightened.**

9. Remove the 2 steering column lock module bolts using a screwdriver.
   - Discard the bolts.
   - To install, tighten 2 new bolts until the bolt heads shear off.
10. Remove the steering column lock module assembly from the steering column.

NOTE: **Align the locating tab on the steering column lock module with the window of the steering column tube. Verify that the steering column lock module operates correctly.**

11. To install, reverse the removal procedure.
12. Repower the SRS. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

2008 STEERING

Steering Column - Edge & MKX

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft
Steering column shaft bolt	23	17
Steering column support bracket nuts	28	21
Steering wheel nut	35	26

DESCRIPTION AND OPERATION

STEERING COLUMN

The steering column consists of the following:

- Steering wheel
- Steering column
- Upper and lower steering column shafts
- Steering column switches

The steering column is the mechanical linkage between the steering wheel and the steering gear. The steering wheel is mounted to a shaft, which passes through the center of the steering column. The shaft is centered by bearings within the steering column. The steering column shaft then connects the steering column to the steering gear. The upper and lower steering column shaft connections utilize U-joint type couplings. The tilt function of the steering column is controlled by a mechanical lever on the underside of the steering column, which uses a cam to lock and unlock the steering column. When the tilt column lever is unlocked, the steering column can then be adjusted to various positions. The steering column switches (multi-function and ignition) are mounted to the steering column. These switches are covered by the upper and lower steering column shrouds.

For steering column switch service information, refer to **STEERING COLUMN SWITCHES** article.

DIAGNOSTIC TESTS

STEERING COLUMN

Refer to **STEERING SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

STEERING WHEEL

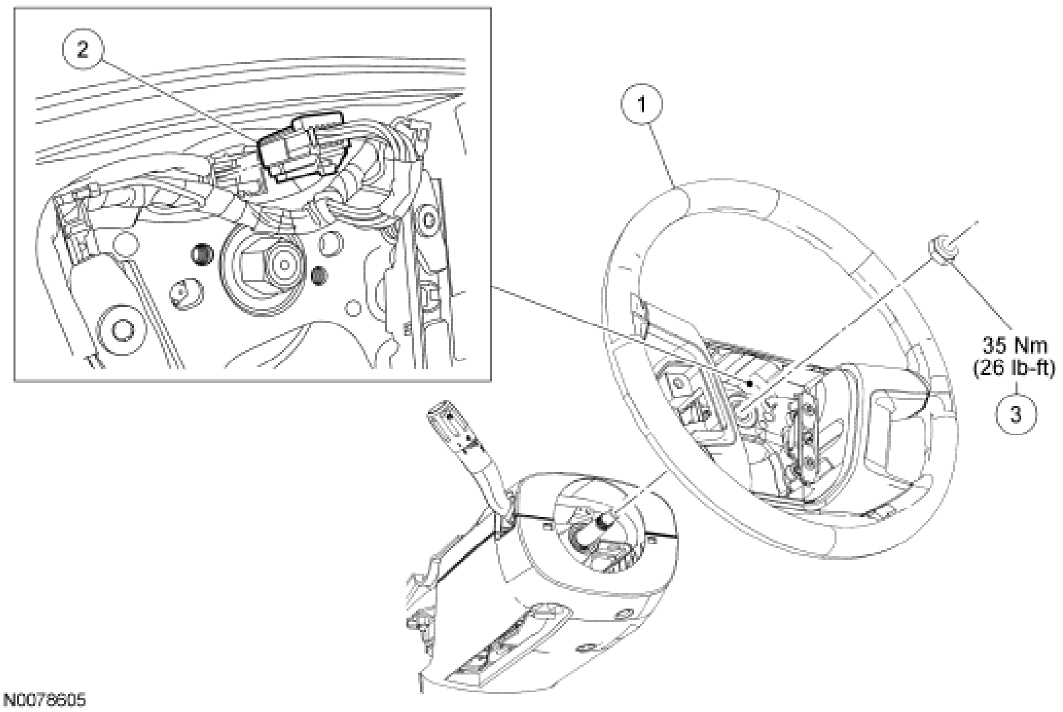


Fig. 1: Identifying Steering Wheel Mounting Bolt And Connector (With Torque Specifications)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3600/3F563	Steering wheel (urethane/leather)
2	-	Steering wheel switches electrical connector (part of 14672)
3	W711835	Steering wheel nut

REMOVAL AND INSTALLATION

1. Position the steering wheel in the straight-ahead position and turn the ignition switch to the OFF position.
   - Remove the key.
2. Remove the driver air bag module. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NOTE: Mark the steering wheel and column shaft for reference during installation.

3. Remove the steering wheel nut.
   - To install, tighten to 35 Nm (26 lb-ft).
4. Disconnect the steering wheel switches electrical connector.

CAUTION: Do not remove the steering wheel by hitting the shaft with a hammer. Damage to the column may occur.

5. Using a suitable puller, remove the steering wheel.

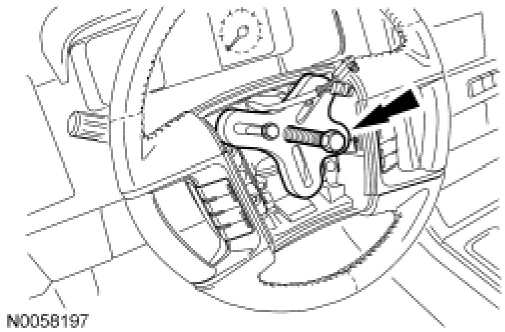


Fig. 2: Removing Steering Wheel Using A Suitable Puller
Courtesy of FORD MOTOR CO.

6. To install, reverse the removal procedure.
    - Align the steering wheel using the reference mark.

STEERING COLUMN

REMOVAL AND INSTALLATION

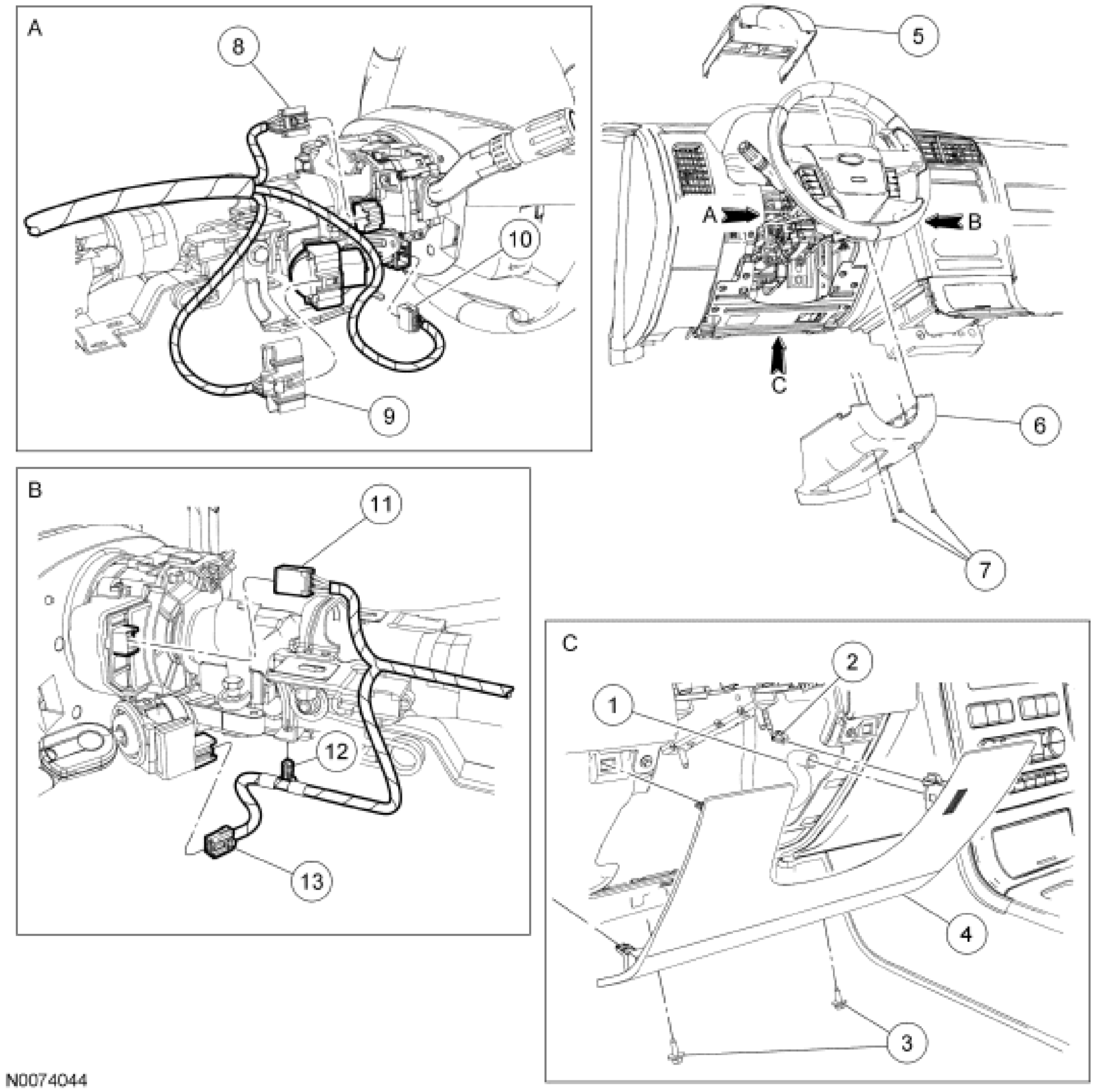


Fig. 3: Removing/Installing Steering Column
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	In-vehicle temperature sensor hose (part of 19C734)
2	-	In-vehicle temperature sensor electrical connector (part of 14401)
3	W505002	Steering column opening cover bolts (2 required)
4	04459	Steering column opening cover
5	3530	Upper steering column shroud
6	3K512	Lower steering column shroud
7	W707658	Lower steering column shroud screws (3

		required)
8	-	Multi-function switch electrical connector (part of 14401)
9	-	Ignition switch electrical connector (part of 14401)
10	-	Clockspring electrical connector (part of 14401)
11	-	Steering angle sensor electrical connector (part of 14401)
12	-	Wiring harness retainer (part of 14401)
13	-	Passive anti-theft system (PATS) electrical connector (part of 14401)

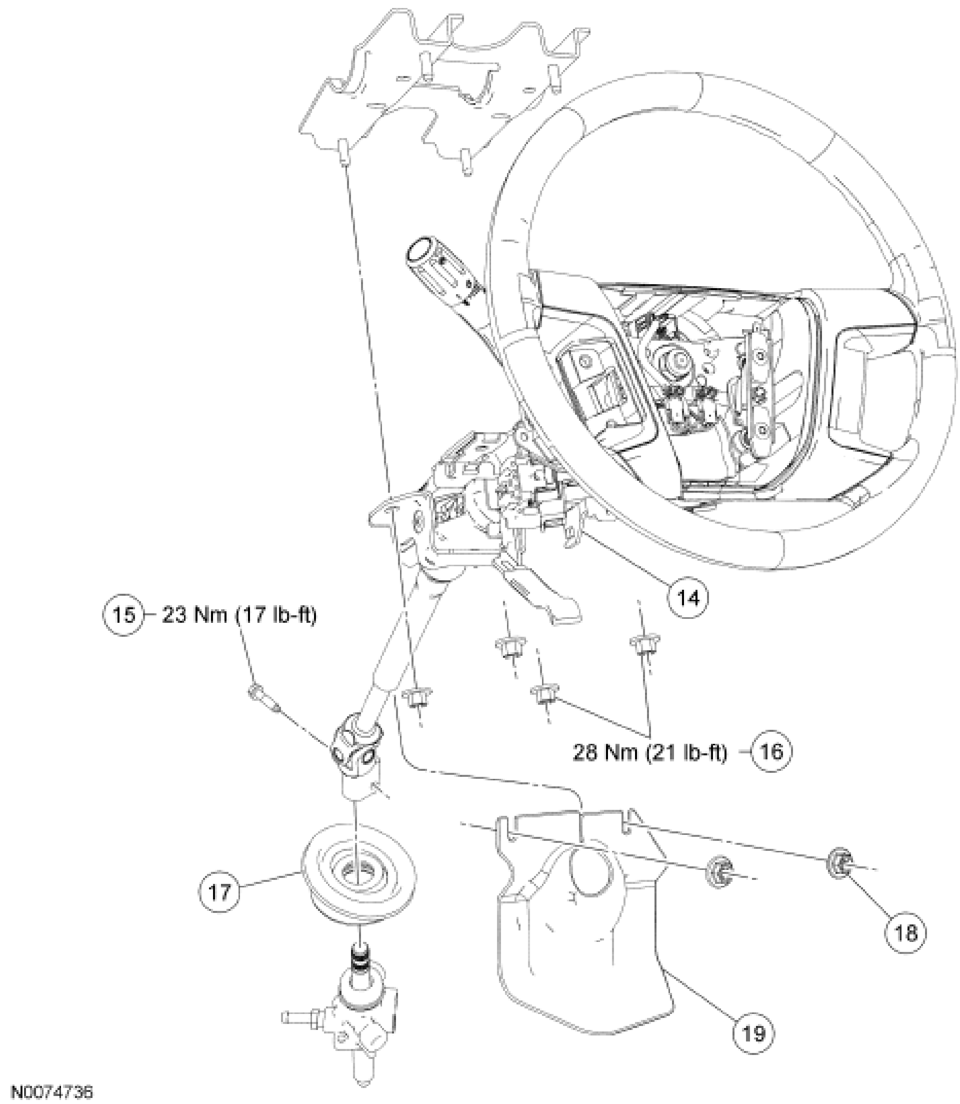


Fig. 4: Identifying Steering Wheel Assembly (With Torque Specifications)

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
14	3524	Steering column
15	W712961	Steering column shaft bolt
16	N806423	Steering column support bracket nuts (4 required)
17	3C611B	Steering column dust seal
18	W704904	Lower steering column shaft joint cover nut (2 required)
19	3C611A	Lower steering column shaft joint cover

1. Turn the steering wheel to the straight-ahead position and turn the ignition switch to the OFF position.
    - Remove the key.
2. Depower the supplemental restraint system (SRS). For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NOTE: **Release the upper steering column shroud by pressing inward on the sides and lifting upwards.**

3. Remove the upper steering column shroud.
4. Release the tilt lever, remove the 3 lower steering column shroud screws and the shroud.

NOTE: **The top of the steering column opening cover is held in by tabs that clip into the instrument panel.**

5. Remove the 2 steering column opening cover screws.
    - Detach the steering column opening cover.
6. If equipped, disconnect the electrical connector and hose from the in-vehicle temperature sensor.
    - Remove the steering column opening cover.
7. Disconnect the multi-function switch, ignition switch and clockspring electrical connectors.
8. Disconnect the steering angle sensor electrical connector.
9. Disconnect the passive anti-theft system (PATS) electrical connector.
10. Detach the wiring harness retainer and position the wiring harness aside.
11. Remove the lower steering column shaft joint cover nuts and the cover.
12. Index-mark the steering column shaft position to the steering gear for reference during installation.

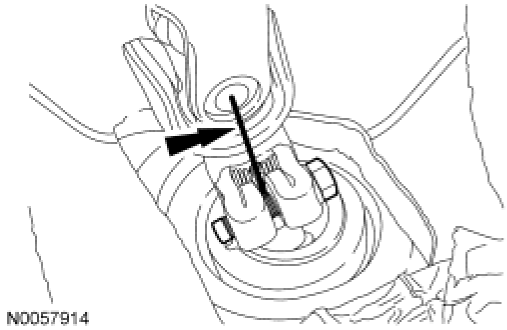


Fig. 5: Index-Marking Steering Column Shaft Position To Steering Gear
Courtesy of FORD MOTOR CO.

CAUTION: Do not allow the steering column to rotate while the steering column shaft is disconnected, or damage to the clockspring may result. If there is evidence that the shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to SUPPLEMENTAL RESTRAINT SYSTEM article.

13. Remove the steering column shaft bolt and disconnect the shaft from the steering gear.
    - To install, tighten to 23 Nm (17 lb-ft).
14. Remove the 4 steering column support bracket nuts and the steering column.
    - To install, tighten to 28 Nm (21 lb-ft).
15. To install, reverse the removal procedure.
16. Repower the SRS. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

2008 GENERAL INFORMATION

Steering System - General Information - Edge & MKX

SPECIFICATIONS

MATERIAL

Item	Specification	Fill Capacity
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	-	-
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V	-

GENERAL SPECIFICATIONS

Item	Specification
Power Steering Gear	
Turning effort	35 N (7.86 lb)
Power Steering Pump	
Flow	7.25-8.87L/min (1.91-2.34 gpm) Fluid @ 74°-80°C (165°-175°F) Engine @ 2,000 rpm
Minimum capacity	5.0L/min (1.32 gpm) Fluid @ 74°-80°C (165°-175°F) Pressure 500 kPa (725 psi)
Pressure	827 kPa (120 psi) Fluid @ 74°-80°C (165°-175°F) Engine @ 2,000 rpm
Relief pressure	11.3-11.8 kPa (1,638-1,711 psi)
Power Steering Purge Vacuum	
Air purge vacuum	68-85 kPa (20-25 in-Hg)

DESCRIPTION AND OPERATION

STEERING SYSTEM

The power steering system consists of the following components:

- Power steering pump
- Power steering fluid reservoir
- Steering gear
- Power steering lines
- Steering column
- Steering column shaft

The power steering system transfers driver inputs at the steering wheel to the front wheels of the vehicle. The steering column, hydraulic system and linkages that transfer these driver inputs make up the steering system. Gearing and hydraulic assist are used to significantly reduce steering efforts.

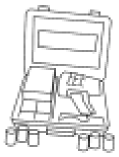
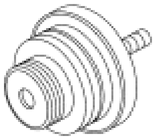
For information on the power steering fluid reservoir, power steering pump, power steering lines and steering gear, refer to **POWER STEERING** article.

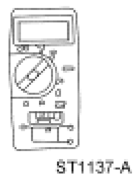
For information on the steering wheel, steering column and steering column shaft, refer to **STEERING COLUMN** article.

DIAGNOSTIC TESTS

STEERING SYSTEM

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
 ST1300-A	100W/12 Volt DC UV Lamp	164-R0751
 ST2670-A	Evacuation Cap, Power Steering	211-265 or equivalent
 ST1176-A	Vacuum Pump Kit	416-D002 (D95L-7559-A) or equivalent
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent	-

	scan tool	

MATERIAL

Item	Specification
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	-
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Principles of Operation

Power Steering - The power steering system uses a vane-type pump to move the fluid from the reservoir to the steering gear and through the rest of the steering hydraulic system. The power steering pump is mounted to the engine and driven by the engine accessory drive belt. Power steering fluid flows into the pump from the reservoir. The power steering fluid is trapped between the pump vanes and moved to the high-pressure side of the pump, creating a flow of fluid. The restriction of this flow by the steering gear creates the pressure that provides the steering assist. A combined pressure relief/flow valve is built into the pump to control the maximum pressure and flow provided to the steering system. This action prevents damage to the system and provides the correct level of assist during all engine speeds. While under pressure, the power steering fluid flows through the high-pressure power steering line to the steering gear. The fluid exits the gear and flows through the return line, cooler and finally to the reservoir. The reservoir slows the fluid, allows air to escape and filters the fluid before returning it to the pump.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

VISUAL INSPECTION CHART

Mechanical
• Fluid level • Tire pressure • Tires • Drive belt • Drive belt tensioner • Steering column alignment • Tie-rod ends

- Suspension components
- Steering column shaft U-joints
- Steering column shaft bolts
- Power steering reservoir baffle
- Power steering reservoir screen
- Pressure lines, fittings or O-rings
- Power steering return hoses and clamps
- Steering gear
- Power steering pump
- Power Steering Pressure (PSP) switch

3. Inspect the power steering fluid for the following conditions:
   - Aeration or foam: Purge the power steering system. Refer to **POWER STEERING SYSTEM PURGING**.
   - Overheating or contamination: Flush the power steering system. Refer to **POWER STEERING SYSTEM FLUSHING**.

NOTE: **It may be necessary to add power steering fluid to achieve the correct level.**

4. Check the fluid level and clean the power steering components.

   With the ignition OFF:

   - check the power steering fluid level and add fluid as necessary.
   - wipe off any visible signs of fluid or residue build up.

   NOTE: **Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.**

   - Start the engine and turn the steering wheel from stop-to-stop several times.
5. Visually inspect the power steering hydraulic line/hose connections for leaks.
   - If a leak is detected at a threaded fitting or clamp plate joint, tighten to specification. If the leak is still evident, visually inspect the O-rings or Teflon® seals. Install new O-rings or Teflon® seals as necessary. Refer to **POWER STEERING** article.
   - If a leak is detected at a constant tension spring clamp, verify that the hose is not damaged and fully installed on the hose fitting. Make sure that the constant tension spring clamp is positioned 2 mm (0.078 in) from the end of the hose. If the leak remains, install a new constant tension spring clamp.
   - If a leak is detected at a screw clamp joint, verify that the hose is fully installed on the hose fitting and the clamp is positioned 2 mm (0.078 in) from the end of the hose before tightening the screw clamp. If the leak remains, install a new screw clamp. Refer to **POWER STEERING** article.

- If a leak is detected at the Power Steering Pressure (PSP) switch, install a new switch as necessary.

6. Visually inspect the power steering components for leaks.
    - If a leak is detected in the pressure line or return hose, install a new hose. Refer to **POWER STEERING** article.
    - If a leak is detected in the power steering pump, install a new power steering pump. Refer to **POWER STEERING** article.

    NOTE: On vehicles with rack-and-pinion steering gear, it may be necessary to remove the bellows boot clamp from the steering gear bellows boot to inspect for internal steering gear leaks.

    - If a leak is detected in the steering gear, repair or install a new steering gear. Refer to **POWER STEERING** article.
    - If a leak is detected in the power steering reservoir, install a new reservoir. Refer to **POWER STEERING** article.
7. For information on power steering leak detection, refer to **COMPONENT TESTS**.
8. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding.
9. If the cause is not visually evident, verify the symptom and Go to **SYMPTOM CHART - STEERING SYSTEM** or Go to **SYMPTOM CHART - NVH**.

Steering System Symptom Definitions

Drift/Pull

Pull is described as a tugging sensation felt by the hands on the steering wheel that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with the hands off the steering wheel.

- A vehicle-related drift/pull on a flat road can cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.
- Drift/pull can be induced by conditions external to the vehicle, such as wind or road camber.

Excessive Steering Wheel Play

Excessive steering wheel play is a condition in which there is too much steering wheel movement before the wheels move. A small amount of steering wheel free play is considered normal.

Lack of Assist or Inconsistent Assist

Lack of assist or inconsistent assist is experienced when the steering wheel effort is higher than normal. Hard steering can remain constant through the full turn or occur near the end of a turn. It is important to know the difference between hard steering/lack of assist and poor returnability/sticky steering.

Hard steering or lack of assist can result from either hydraulic or mechanical conditions. It is extremely important to know if this concern occurs during driving or during high-effort parking maneuvers.

Poor Returnability/Sticky Steering

Poor returnability and sticky steering is used to describe the poor return of the steering wheel to center after a turn or steering correction is completed.

Wander

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

Symptom Chart - Steering System

SYMPTOM CHART - STEERING SYSTEM

Condition	Possible Sources	Action
• Steering has lack of assist or inconsistent assist	• Contaminated power steering fluid • Steering gear • Power steering pump • Restricted power steering lines/hoses	• Go to **Pinpoint Test A** .
• Excessive steering wheel play	• Steering gear • Steering column shaft/U-joints • Steering linkage	• Go to **Pinpoint Test B** .
• Steering system drift/pull/wander	• Steering column shaft/U-joints • Steering gear mounts • Steering gear valve	• Go to **Pinpoint Test C** .
• Poor returnability/sticky steering	• Binding steering column shaft/U-joints	• INSTALL a new steering column shaft. REFER to **STEERING COLUMN** article.
-	• Loose, worn or damaged steering linkage	• Go to Steering Linkage in **COMPONENT TESTS**.
-	• Binding suspension components	• To continue the suspension diagnosis, REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

-	• Binding steering column bearing(s)	• INSTALL a new steering column. REFER to **STEERING COLUMN** article.
-	• Binding dash boot seal	• INSTALL a new dash boot seal. REFER to **STEERING COLUMN** article.
-	• Steering gear	• INSTALL a new steering gear as necessary. REFER to **POWER STEERING** article.

Symptom Chart - NVH

NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.

SYMPTOM CHART - NVH

Condition	Possible Sources	Action
• Steering system cold start noise	• Blockage in the power steering fluid reservoir caused by power steering fluid contamination	**NOTE:** **Some noise during an extremely cold start (-12.2°C [-10°F]) is normal and should improve as the steering system warms up (usually within 60 seconds).** **NOTE:** **It may be necessary to remove the power steering fluid reservoir to flush contamination trapped in the reservoir screen.** • CHECK the power steering fluid reservoir for contamination. FLUSH the power steering system as necessary. REFER to **POWER STEERING SYSTEM FLUSHING**.

-	• Air in the steering hydraulic system (aerated fluid)	• CHECK for leaks in the system. REFER to Power Steering Leak Test in **COMPONENT TESTS**. PURGE the air from the system. REFER to **POWER STEERING SYSTEM PURGING**.
• Steering grunt or shudder - occurs when turning into or out of a turn at low speeds (temperature sensitive)	• Air in the steering hydraulic system (aerated fluid)	• CHECK for leaks in the system. REFER to Power Steering Leak Test in **COMPONENT TESTS**. PURGE the air from the system. REFER to **POWER STEERING SYSTEM PURGING**.
-	• Steering gear or power steering hoses	• Go to Steering Gear Grunt/Shudder in **COMPONENT TESTS**.
• Steering system clonk - hydraulic knocking sound	• Air in the steering hydraulic system (aerated fluid)	**NOTE:** **Some amount of clonk noise is considered acceptable. If in doubt of the acceptability, compare to another vehicle.** • CHECK for leaks in the system. REFER to Power Steering Leak Test in **COMPONENT TESTS**. PURGE the air from the system. REFER to **POWER STEERING SYSTEM PURGING**.
• Power steering pump moan - loud humming noise occurs when the steering wheel is rotated to the stop position. Produces a 120-600 Hz frequency that changes with rpm	• Low fluid and/or air in the steering hydraulic system (aerated fluid)	• CHECK for leaks in the system. REFER to Power Steering Leak Test in **COMPONENT TESTS**. PURGE the air from the system. REFER to **POWER STEERING SYSTEM PURGING**. If a pump moan still exists, INSTALL a new power steering pump. REFER to **POWER STEERING** article.

-	• Power steering fluid reservoir or screen is blocked or damaged	• INSPECT the reservoir. FLUSH or INSTALL a new reservoir as necessary.
-	• Power steering line/hose grounded to chassis	• INSPECT the power steering lines/hoses. REPAIR as necessary.
-	• Power steering pump brackets loose or misaligned	• CHECK bolts, brackets and bracket alignment. TIGHTEN bolts to specification. REPAIR or INSTALL new brackets as necessary. REFER to **POWER STEERING** article.
-	• Steering gear isolators	• INSPECT the isolators for wear or damage. REPAIR as necessary.
• Steering gear clunk - occurs only while cornering over a bump (can be temperature sensitive)	• Steering gear	• INSPECT the steering gear for loose mounting bolts. TIGHTEN to specification as necessary. REFER to **POWER STEERING** article.
• Feedback (rattle, chuckle or knocking noise in the steering gear) - roughness is felt in the steering wheel when the vehicle is driven over rough surfaces	• Steering column shaft/U-joints damaged or worn	• INSTALL a new steering column shaft. REFER to **STEERING COLUMN** article.
-	• Loose, damaged or worn tie-rod ends	• INSPECT and INSTALL new tie-rod ends as necessary. Go to Steering Linkage in **COMPONENT TESTS**.
-	• Steering gear insulators or mounting bolts loose or damaged	• TIGHTEN the bolts to specification or INSTALL new bolts as necessary. REFER to **POWER STEERING** article.
-	• Steering column shaft bolts are loose	• TIGHTEN the bolts to specification. REFER to **STEERING COLUMN** article.
-	• Steering column damaged or worn	• REPAIR or INSTALL a new steering column as necessary. REFER to **STEERING COLUMN** article.

• Power steering hiss or whistle	• Steering column shaft-to-steering gear is binding or misaligned	• REPAIR or INSTALL a new steering column shaft as necessary. REFER to **STEERING COLUMN** article.
-	• Grounded or loose steering column boot at the dash panel	• REPAIR as necessary.
-	• Damaged or worn steering gear input shaft and valve	• REPAIR or INSTALL a new steering gear as necessary. REFER to **POWER STEERING** article.
-	• Restricted power steering lines/hoses	• INSTALL new power steering lines/hoses as necessary. REFER to **POWER STEERING** article.
• Steering column rattle	• Loose bolts or attaching brackets	• TIGHTEN the bolts to specification.
-	• Loose, worn or insufficiently lubricated column bearings	• LUBRICATE bearings or INSTALL new steering column bearings or steering column as necessary. REFER to **STEERING COLUMN** article.
-	• Steering shaft insulators damaged or worn	• INSTALL new insulators. REFER to **STEERING COLUMN** article.
-	• Steering column shaft compressed or extended	• INSPECT the rubber spider coupling for damage. INSTALL a new steering column shaft. REFER to **STEERING COLUMN** article.
• Steering gear squeak	• Incorrect power steering fluid in system	• If incorrect power steering fluid is suspected, FLUSH the power steering system. REFER to **POWER STEERING SYSTEM FLUSHING**. If noise persists after system flush, INSTALL a new steering gear. REFER to **POWER STEERING** article.
		NOTE:

-	• Steering gear rotary seal	**VERIFY that the steering gear is the source of the noise. It may be necessary to replicate the customer operating conditions (fluid temperature, turning rate of steering wheel) to get the squeak to reoccur.** • INSTALL a new steering gear as necessary. REFER to **POWER STEERING** article.
-	• Stone shield (if equipped)	• MAKE SURE that the stone shield is correctly installed and that it is not making contact with the steering shaft. REPOSITION stone shield or INSTALL a new stone shield as necessary.
• Steering column squeak, cracks or grinds	• Insufficiently lubricated steering shaft bushings	• LUBRICATE the steering shaft and shaft tube seals.
-	• Loose or misaligned steering column shrouds	• TIGHTEN or ALIGN the steering column shrouds.
-	• Steering wheel rubbing against steering column shrouds	• REPOSITION the steering column shrouds.
-	• Upper or lower bearing sleeves out of position	• REPOSITION the bearing sleeves.
• Power steering pump noisy	• Power steering pump	• INSTALL a new power steering pump as necessary. REFER to **POWER STEERING** article.
• Power steering pump relief noise	• Power steering fluid flow into the bypass valve of the pump valve housing, with fluid temperature below 54°C (130°F)	• Acceptable condition.
• Power steering pump whine noise	• Aerated fluid	• CHECK for a leak in the system. REFER to Power Steering Fluid Leak Test in **COMPONENT TESTS**. PURGE the air from the system. REFER to **POWER STEERING SYSTEM PURGING**.

-	• Damaged power steering pump	• INSTALL a new power steering pump as necessary. REFER to **POWER STEERING** article.
• High speed shake or shimmy - occurs at high speeds	• Worn or damaged steering linkage components	• Go to Steering Linkage in **COMPONENT TESTS**.

Pinpoint Tests

Pinpoint Test A: Steering Has Lack of Assist or Inconsistent Assist

NOTE: **Hard steering or lack of assist is experienced when the steering wheel effort exceeds specifications. Hard steering can remain constant through the full turn, occur near the end of a turn or differ right to left. It is important to know the difference between hard steering/lack of assist and poor returnability/sticky steering.**

This pinpoint test is intended to diagnose the following:

- Power steering fluid contamination
- Steering gear
- Power steering pump
- Power steering hoses

PINPOINT TEST A: STEERING HAS LACK OF ASSIST OR INCONSISTENT ASSIST

A1 CHECK FOR POWER STEERING FLUID CONTAMINATION

- Check the power steering fluid for contamination.
- **Is the power steering fluid contaminated?**

  YES : FLUSH the power steering system. REFER to **POWER STEERING SYSTEM FLUSHING**. CHECK the system for normal operation. If assist concern still exists, go to A2.

  NO : Go to A2.

A2 CHECK THE STEERING ASSIST WITH THE ENGINE RPM RAISED

NOTE: **Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.**

- Set the engine at 2,100 rpm and turn the steering wheel fully to the left and right.
- **Is steering assist normal with the engine rpm raised?**

  YES : INSTALL a new power steering pump. REFER to **POWER STEERING** article.

  NO : Go to A3.

A3 CHECK FOR A CHANGE OF ASSIST ON LEFT AND RIGHT TURNS

- With the engine at idle, turn the steering wheel fully to the left and to the right.
- **Does the steering assist change when turning from right to left?**

  YES : INSTALL a new steering gear. REFER to **POWER STEERING** article.

  NO : Go to A4.

A4 CHECK THE STEERING LINES AND HOSES FOR RESTRICTIONS

- Inspect the steering lines and hoses for damage, kinks or restrictions.
- **Are the steering lines or hoses damaged, kinked or restricted?**

  YES : INSTALL new lines or hoses as necessary.

  NO : Go to A5.

A5 MONITOR THE ENGINE RPM CHANGES

NOTE: **Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.**

NOTE: **Make sure that the vehicle is on a flat dry surface, all accessories are in the OFF position and that the steering system is at normal operating temperature.**

- Connect the diagnostic tool.
- Start the engine.
- With the engine at idle, raise the power steering fluid temperature to 74-80°C (165-176°F) by rotating the steering wheel fully to the left and right several times.
- While monitoring the Engine Revolutions Per Minute (RPM) PID with the scan tool, turn the steering wheel quickly to the left stop position and then to the right stop position.
- Note the engine rpm during the turns.
- **Does the engine rpm change (even temporarily) more than 30 rpm when turning the steering wheel?**

  YES : INSTALL a new steering gear. REFER to **POWER STEERING** article.

  NO : INSTALL a new power steering pump. REFER to **POWER STEERING** article.

Pinpoint Test B: Excessive Steering Wheel Play

This pinpoint test is intended to diagnose the following:

- Steering linkage
- Steering column shaft U-joints
- Steering gear

PINPOINT TEST B: EXCESSIVE STEERING WHEEL PLAY

B1 CHECK THE STEERING LINKAGE

- Carry out the Steering Linkage in **COMPONENT TESTS**.
- **Is the steering linkage OK?**

  YES : Go to B2.

  NO : INSTALL new steering linkage components as necessary. Refer to the appropriate Steering System article for the procedure.

B2 CHECK THE STEERING COLUMN SHAFT

- Inspect the steering column shaft U-joints and fasteners for looseness.
- **Are the U-joints and fasteners OK?**

  YES : INSTALL a new steering gear as necessary. REFER to **POWER STEERING** article.

  NO : TIGHTEN the steering column shaft fasteners or INSTALL a new steering column shaft. REFER to **STEERING COLUMN** article.

Pinpoint Test C: Steering System Drift/Pull/Wander

This pinpoint test is intended to diagnose the following:

- Steering gear
- Steering column shaft
- Steering column shaft U-joints
- Steering gear mounts

PINPOINT TEST C: STEERING SYSTEM DRIFT/PULL/WANDER

C1 CHECK THE STEERING COLUMN SHAFT

NOTE: **Be sure to keep the clockspring centered when disconnecting the intermediate shaft. Refer to the appropriate RESTRAINTS article for the procedure.**

- Check the steering column and shaft for grounding.
- Disconnect the steering column shaft at the steering column.
- Inspect the steering column shaft U-joints for looseness or wear.
- **Are the steering column shaft U-joints OK?**

  YES : Go to C2.

  NO : INSTALL a new steering column shaft as necessary. REFER to **STEERING COLUMN** article.

C2 CHECK THE STEERING GEAR MOUNTING

- Check the steering gear mounts for looseness or wear.
- **Are the steering gear mounts OK?**

  YES : Go to C3.

NO : INSTALL a new steering gear as necessary. REFER to **POWER STEERING** article.

C3 CHECK THE STEERING GEAR

- Carry out the Steering Gear Valve in **COMPONENT TESTS**.
- **Is the steering gear valve OK?**

  YES : REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article to diagnose suspension system drift/pull/wander.

  NO : REPAIR or INSTALL a new steering gear as necessary. REFER to **POWER STEERING** article.

Component Tests

Power Steering Fluid Leak Test

NOTE: This test should only be carried out if a leak in the system has not been detected during a thorough visual inspection. Refer to INSPECTION AND VERIFICATION.

1. Check the power steering fluid level. If necessary, add the specified power steering fluid.
2. Remove the power steering pump reservoir cap and tightly install the Power Steering Evacuation Cap to the power steering pump reservoir.
3. Install the Vacuum Pump Kit to the Power Steering Evacuation Cap.
4. Using the Vacuum Pump Kit, apply 68-85 kPa (20-25 in-Hg) of vacuum to the power steering system.
5. Observe the vacuum gauge for 30 seconds. If the vacuum gauge reading drops more than 3 kPa (0.88 in-Hg) a leak is present.
6. Remove the Vacuum Pump Kit.

NOTE: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.

7. Start the engine. With the engine at idle, raise the power steering fluid temperature to 74-80°C (165-176°F) by rotating the steering wheel fully to the left and right several times.
8. Visually inspect the system for leaks. If a leak is evident, repair as necessary. If a leak is not evident, add the specified UV fluorescent tracer dye to the power steering fluid. Use 14.78 mL (1/2 oz) of dye solution for every 1.89L (2 qt) of power steering fluid.

NOTE: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.

9. Start the engine. With the engine at idle, raise the power steering fluid temperature to 74-80°C (165-176°F) by rotating the steering wheel fully to the left and right several times.
10. Using the 100W/12 Volt DC UV Lamp, inspect the system for traces of UV dye. Repair as necessary.

Steering Gear Valve Test

1. With the vehicle in NEUTRAL, position it on a hoist. Refer to **JACKING AND LIFTING** article.
    - Raise the vehicle until the front wheels are off the ground.

NOTE: Do not hold the steering wheel while carrying out this step.

2. Start the engine.
    - If the steering wheel rotates in either direction (with no hand input), install a new steering gear. Refer to **POWER STEERING** article.

Steering Gear Grunt/Shudder Test

1. Start and run the vehicle to operating temperature.
2. Set engine idle speed to 1,200 RPM.

NOTE: Do not hold the steering wheel against the stops for an extended amount of time. Damage to the power steering pump may occur.

3. Rotate the steering wheel to the RH stop, then turn the steering wheel 90 degrees back from that position. Slowly turn the steering wheel back and forth approximately one-twelfth of a full turn.
4. Turn the steering wheel another 90 degrees. Slowly turn the steering wheel back and forth approximately one-twelfth of a full turn.
5. Repeat the test with the power steering fluid at different temperatures.
6. If a light grunt is heard or a low (50-200 Hz) shudder is present, this is a normal steering system condition.
7. If a loud grunt is heard or a strong shudder is felt, purge the power steering system. Refer to **POWER STEERING SYSTEM PURGING**. If a loud grunt or strong shudder still exists, check the power steering lines/hoses for restrictions or damage and repair as necessary. Refer to **POWER STEERING** article. If the lines/hoses are OK, install a new steering gear. Refer to **POWER STEERING** article.

Steering Linkage Test

NOTE: Excessive vertical motion of the studs relative to the sockets may indicate excessive wear.

1. With the vehicle on the ground and the parking brake applied, start the vehicle and carry out the following:
    - Have an assistant rotate the steering wheel back and forth 360 degrees and watch for relative motion of the studs in the steering linkage ball sockets.
    - Watch for loose steering gear mounting.
2. As an additional check, with the Key ON Engine OFF (KOEO) and the front wheels raised off the ground, grasp the wheel at the front and rear and watch for excessive play or binding in the joints while trying to steer the wheels.
3. Install new components if necessary. Tighten any worn, damaged or loose components. Refer to the

appropriate Steering System article for the procedure.

GENERAL PROCEDURES

POWER STEERING SYSTEM FLUSHING

MATERIAL

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

NOTE: Do not mix oil types. Any mixture or any unapproved oil may lead to seal deterioration and leaks. A leak may ultimately cause loss of fluid, which may result in a loss of power steering assist.

1. Remove the power steering fluid reservoir cap.
2. Using a suitable suction device, remove the power steering fluid from the reservoir.
3. Disconnect the return hose from the reservoir.
   - Remove the clamp.
4. Plug the power steering fluid reservoir inlet port.
5. Attach an extension hose to the return hose.

   NOTE: Do not reuse the power steering fluid that has been flushed from the power steering system.

6. Place the open end of the extension hose into a suitable container.

   NOTE: Do not overfill the reservoir.

7. Fill the reservoir as needed with the specified fluid.

   NOTE: Do not allow the power steering pump to run completely dry of power steering fluid. Damage to the power steering pump may occur.

8. Start the engine while simultaneously turning the steering wheel to lock and then immediately turn the ignition switch to the OFF position.

   NOTE: Avoid turning the steering wheel without the engine running as this may cause air to be pulled into the steering gear.

   NOTE: Do not overfill the reservoir.

9. Fill the reservoir as needed.
10. Repeat Steps 8 and 9, turning the steering wheel in the opposite direction each time, until the fluid exiting the power steering fluid return hose is clean and clear of foreign material.
11. Remove the extension hose from the return hose.
12. Remove the plug from the fluid reservoir inlet port.
13. Install the power steering return hose to the reservoir.
    - Install the clamp.

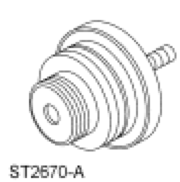
NOTE: **It is necessary to correctly fill the power steering system to remove any trapped air and completely fill the power steering system components.**

If, after correctly filling the power steering system, there is power steering noise accompanied by evidence of aerated fluid and there are no fluid leaks, it may be necessary to purge the power steering system. For additional information, refer to <u>POWER STEERING SYSTEM PURGING</u>.

14. Fill the power steering system. For additional information, refer to **<u>POWER STEERING SYSTEM FILLING</u>**.

POWER STEERING SYSTEM PURGING

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
	Evacuation Cap, Power Steering	211-265
	Vacuum Pump Kit	416-D002 (D95L-7559-A) or equivalent

MATERIAL

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

NOTE: **If the air is not purged from the power steering system correctly, premature power steering pump failure may result. The condition may occur on pre-**

delivery vehicles with evidence of aerated fluid or on vehicles that have had steering component repairs.

NOTE: A whine heard from the power steering pump can be caused by air in the system. The power steering purge procedure must be carried out prior to any component repair for which power steering noise complaints are accompanied by evidence of aerated fluid.

1. Remove the power steering pump reservoir cap. Check the fluid.
2. Raise the front wheels off the floor. Refer to the appropriate Service Information article for the procedure.
3. Tightly insert the Power Steering Evacuation Cap into the reservoir and connect the Vacuum Pump Kit.

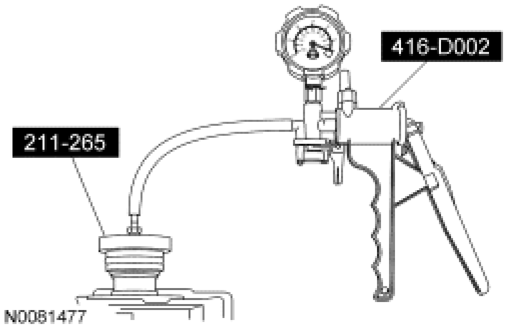


Fig. 1: Identifying Power Steering Evacuation Cap And Vacuum Pump Kit
Courtesy of FORD MOTOR CO.

4. Start the engine.
5. Using the Vacuum Pump Kit, apply vacuum and maintain the maximum vacuum of 68-85 kPa (20-25 in-Hg).
6. If equipped with Hydro-Boost®, apply the brake pedal twice.

NOTE: Do not hold the steering wheel against the stops for an extended amount of time. Damage to the power steering pump may occur.

7. Cycle the steering wheel fully from stop-to-stop 10 times.
8. Stop the engine.
9. Release the vacuum and remove the Vacuum Pump Kit and the Power Steering Evacuation Cap.

NOTE: Do not overfill the reservoir.

10. Fill the reservoir.
    - Use approved transmission fluid.
11. Start the engine.
12. Install the Power Steering Evacuation Cap and the Vacuum Pump Kit. Apply and maintain the maximum

vacuum of 68-85 kPa (20-25 in-Hg).

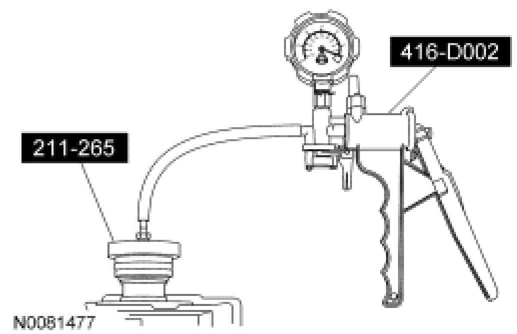


Fig. 2: Identifying Power Steering Evacuation Cap And Vacuum Pump Kit
Courtesy of FORD MOTOR CO.

NOTE: **Do not hold the steering wheel against the stops for an extended amount of time. Damage to the power steering pump may occur.**

13. Cycle the steering wheel fully from stop-to-stop 10 times.
14. Stop the engine, release the vacuum and remove the Vacuum Pump Kit and the Power Steering Evacuation Cap.

NOTE: **Do not overfill the reservoir.**

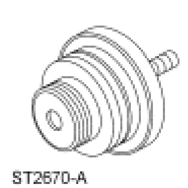
15. Fill the reservoir as needed and install the reservoir cap.
16. Visually inspect the power steering system for leaks.

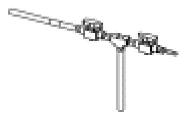
NOTE: **Do not overfill the reservoir.**

17. Fill the reservoir as needed and visually inspect the power steering system for leaks.
18. Install the reservoir cap.

POWER STEERING SYSTEM FILLING

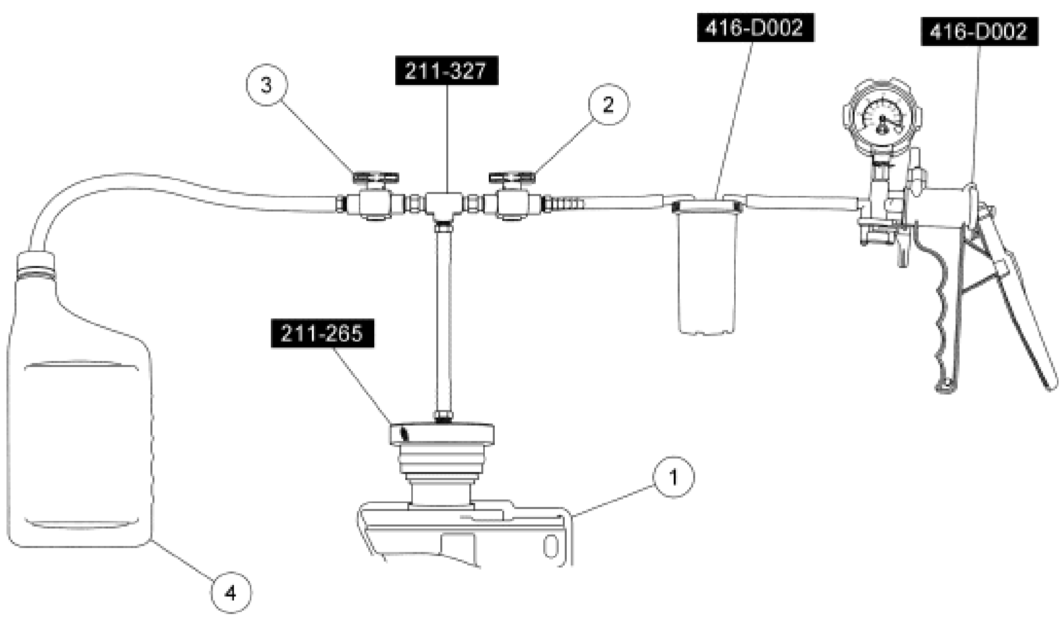
SPECIAL TOOLS

Illustration	Tool Name	Tool Number
	Evacuation Cap, Power Steering	211-265
	Fill Adapter Manifold, Power	211-327

 ST2626-A	Steering	
 ST1176-A	Vacuum Pump Kit	416-D002 (D95L-7559-A) or equivalent

MATERIAL

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



N0081484

Fig. 3: Power Steering System Filling Components
Courtesy of FORD MOTOR CO.

Item	Description
1	Power steering fluid reservoir
2	Control valve (vacuum side)

3	Control valve (fluid container side)
4	Fluid container

NOTE: **If the air is not purged from the power steering system correctly, premature power steering pump failure may result. The condition can occur on pre-delivery vehicles with evidence of aerated fluid or on vehicles that have had steering component repairs.**

1. Remove the power steering fluid reservoir cap.
2. Install the Power Steering Evacuation Cap, Power Steering Fill Adapter Manifold and Vacuum Pump Kit as shown in the illustration.

NOTE: **The Power Steering Fill Adapter Manifold control valves are in the OPEN position when the point of the handles face the center of the Power Steering Fill Adapter Manifold.**

3. Close the Power Steering Fill Adapter Manifold control valve (fluid side).
4. Open the Power Steering Fill Adapter Manifold control valve (vacuum side).
5. Using the Vacuum Pump Kit, apply 68-85 kPa (20-25 in-Hg) of vacuum to the power steering system.
6. Observe the Vacuum Pump Kit gauge for 30 seconds.
7. If the Vacuum Pump Kit vacuum gauge reading drops more than 3 kPa (0.88 in-Hg), correct any leaks in the power steering system or the Power Steering Evacuation Cap, Power Steering Fill Adapter Manifold and Vacuum Pump Kit before proceeding.

NOTE: **The Vacuum Pump Kit gauge reading will drop slightly during this step.**

8. Slowly open the Power Steering Fill Adapter Manifold control valve (fluid side) until power steering fluid completely fills the hose and then close the control valve.
9. Using the Vacuum Pump Kit, apply 68-85 kPa (20-25 in-Hg) of vacuum to the power steering system.
10. Close the Power Steering Fill Adapter Manifold control valve (vacuum side).
11. Slowly open the Power Steering Fill Adapter Manifold control valve (fluid side).
12. Once power steering fluid enters the fluid reservoir and reaches the minimum fluid level indicator line on the reservoir, close the Power Steering Fill Adapter Manifold control valve (fluid side).
13. Remove the Power Steering Evacuation Cap, Power Steering Fill Adapter Manifold and Vacuum Pump Kit.
14. Install the reservoir cap.

NOTE: **Do not hold the steering wheel against the stops for an extended amount of time. Damage to the power steering pump may occur.**

NOTE: **There will be a slight drop in the power steering fluid level in the reservoir when the engine is started.**

15. Start the engine and turn the steering wheel from stop-to-stop.
16. Turn the ignition switch to the OFF position.

NOTE: Do not overfill the reservoir.

17. Remove the reservoir cap and fill the reservoir with the specified fluid.
18. Install the reservoir cap.

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Roof Opening Panel - Edge & MKX

SPECIFICATIONS

MATERIAL SPECIFICATIONS

Item	Specification	Fill Capacity
Dow Urethane Adhesive Betaseal® Express	-	-
Dow Urethane One Step Glass Primer Betaprime® 5500/5500A/5500SA	-	-
PTFE Lubricant XG-8	ESB-M1C111-B	-
Sika Urethane Adhesive Sika Tack ASAP	-	-
Sika Urethane Metal and Glass Primer Sika 206 G+P	-	-
Silicone Spray Lubricant XL-6	ESR-M13P4-A	-
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A	-

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Air deflector catcher bracket screws	2	18
Air deflector-to-track screws	2	18
Front drive tube bracket-to-guide track screws	5	44
Front guide track-to-housing fasteners	5	44
Front idler track-to-housing fasteners	4	35
Front sunshade carrier center screws	6	53
Front sunshade carrier outer screws	5	44
Rear drive tube bracket-to-housing screws	5	44
Rear idler track-to-housing fasteners	4	35
Rear shade track-to-drive tube bracket fasteners	5	44
Rear shade track-to-housing screws	5	44
Rear sunshade carrier-to-housing fasteners	5	44
Roof opening panel glass front screws	8	71
Roof opening panel glass rear screws	8	71
Shade motor retaining screws	5	44
Sliding glass motor retaining screws	5	44

DESCRIPTION AND OPERATION

ROOF OPENING PANEL

The roof opening panel consists of the following:

- Air deflector
- Concertina blinds
- Fixed glass front seal
- Fixed glass side seals
- Front shade assembly
- Front trim panel
- Front trim panel seal
- Guide track and mechanism
- Idler track and mechanism
- Motor wiring harness
- Overhead console control switch
- Rear shade assembly
- Roof opening panel fixed glass
- Roof opening panel shade motor
- Roof opening panel sliding glass
- Roof opening panel sliding glass motor
- Rear trim ring assembly
- Shade motor block and drive tube assembly
- Shade track and mechanism
- Sliding front panel motor block and drive tube assembly
- Sliding glass primary seal
- Side trim panel
- Side trim panel seals

The roof opening panel consists of an electronically operated sliding glass panel and electronically operated sunshades that can be opened or closed by pressing a switch located on the overhead console. The sliding glass panel has one-touch open, one-touch close and one-touch vent open features. The shades have a one-touch-open feature.

The front and rear shades operate together with a 80 mm (3.14 in) delay in the closing of the rear shade to the front. The sunshade may be in any position when the sliding glass panel is in the closed position. The shades will open a proportional amount when the sliding glass panel is in any position between closed and fully open. With the sliding glass panel in the fully OPEN position, the shades are disabled to prevent wind damage.

When the sliding glass panel is in the fully CLOSED position, pressing the overhead console roof opening panel control switch rearward to the second detent and then releasing it will activate the one-touch open feature and the glass panel will open to the comfort position. Pressing the switch a second time will move the glass to the fully OPEN position. The one-touch open feature can be canceled any time the sliding glass is moving by pressing the roof opening panel control switch in either direction.

With the sliding glass panel in any open position except VENT, rocking the roof opening panel control switch forward and then releasing it will activate the one-touch close feature. Pressing the roof opening panel control switch in either direction with the roof opening panel moving will cancel the one-touch close operation and the motion will immediately stop.

If an obstacle contacts the leading edge of the sliding glass panel during one-touch close operation, the roof opening panel glass will reverse direction and open to approximately the mid position and stop. The operator cannot stop this open motion once it has begun.

If an obstacle contacts the leading edge of the roof opening panel glass during one-touch vent close operation, the roof opening panel glass will reverse direction to the VENT position.

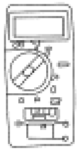
When the sliding glass panel is in the fully CLOSED position, pressing the roof opening panel control tilt switch and then releasing it will activate the one-touch vent feature. To vent the sliding glass panel from any position, press and hold the tilt switch. To close, press and hold the roof opening panel control switch in the forward position.

Global Open - MKX Only - The smart junction box (SJB) sends a signal on the global open circuit, to the roof opening panel motor, to open or close the windows based on a signal received from the remote keyless entry (RKE) transmitter. If the accessory delay relay is active, the global open feature will not operate.

DIAGNOSTIC TESTS

ROOF OPENING PANEL

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent

Principles of Operation

Roof Opening Panel Shade - The roof opening panel assembly uses an integrated motor and module to operate the roof opening panel shades. The roof opening panel shade can be opened or closed by the shade control switch. Pressing the shade control switch in either the OPEN or CLOSE position supplies a ground to the roof opening panel shade motor/module. The shade panels are equipped with express open and close features. A short press of the shade control switch will cause the shade panel to express open to the full open position or close to the safety stop position. The shade will not close when the roof opening panel is open.

NOTE: Any glass opening operation will first fully open the shade panels. Before the shade panels may be closed, the glass panel must be fully closed.

The roof opening panel shade motor must be initialized when one of the following occurs:

- The replacement or removal of the drive system
- Excessive false stalls are encountered
- The shade(s) are removed or replaced
- The shade motor becomes de-initialized (will stutter step open)

The roof opening sliding glass panel motor must be initialized when one of the following occur:

- The replacement or removal of the drive system
- Excessive false stalls are encountered
- The sliding glass panel is removed
- The sliding glass motor becomes de-initialized (will stutter step open and have no express operation)

Roof Opening Panel - The roof opening panel assembly uses an integrated motor and module to operate the roof opening panel sliding glass. The roof opening panel sliding glass can be opened, closed or tilted by the roof opening panel control switch. Pressing the open, close or tilt switch grounds those inputs to the glass panel motor/module. Momentarily pressing the tilt switch will cause the glass panel to express open to the VENT position if the glass panel is closed or cause the glass panel to close to the VENT position if the glass panel is in the slide open range and the tilt switch is pressed and held. Pressing and holding the control switch forward will close the glass panel (the safety stop position is skipped in manual mode). The glass panel has express open and close features that are activated when the switch is momentarily pressed to the double detent OPEN or CLOSE positions. Express open operation will first open the glass panel to the comfort stop position. Pressing the switch again will cause the glass to move to the full open position. Pressing the switch again will cause the glass to move to the full open position. Express close operation will move the glass panel to the full closed position.

NOTE: Any glass opening operation will first fully open the shade panels. Before the shade panels may be closed, the glass panel must be fully closed.

The shade motor and sliding glass panel motor have 3 thermal operating modes:

- Full function: In their fully functioning state, the motors allow all normal operations of the shades and glass.
- Reduced function: If either motor begins to overheat, it will enter a reduced function mode. No express operation is possible and it will allow open or close motion in steps of 50.8 mm (2 in).
- No function: Excessive heating causes no function mode. The motor will not operate in the close direction, but will open in steps of 50.8 mm (2 in). Once the open position is reached, the motor shuts itself down until it is sufficiently cooled.

Global Open - MKX only - When the unlock button of the remote keyless entry (RKE) transmitter is held for 2 seconds the global open activates. The smart junction box (SJB) sends a signal to activate the one-touch open operation of the roof opening panel. The global open feature does not operate if the delay accessory is active.

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical

• Roof opening panel sliding glass
• Roof opening panel fixed glass
• Roof opening panel front trim
• Roof opening panel side trim
• Roof opening panel blind
• Roof opening panel air deflector assembly
• Roof opening panel track(s)
• Roof opening panel seal (s)
• Roof opening panel shade(s)
• Roof opening panel module assembly
• Overhead console
• Headliner
	• Battery junction box (BJB) fuse 18 (30A)
	• Smart junction box (SJB) fuse(s):
	  ○ 17 (20A)
	  ○ 41 (15A)
	• Circuitry
	• Accessory delay relay
	• Roof opening panel switch

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, determine the symptom. Go to **Symptom Chart - Roof Opening Panel** or Go to **Symptom Chart - Noise, Vibration and Harshness (NVH)**.

Symptom Chart - Roof Opening Panel

Symptom Chart - Roof Opening Panel

Condition	Possible Sources	Action
	• Roof opening panel primary	

• The roof opening panel leaks	seal • Roof opening panel fixed rear glass urethane seal • Roof opening panel front trim • Windshield • Antenna • Roof opening panel module assembly	• Go to **Pinpoint Test B** .
	• Roof opening panel drain channel blockage	• CHECK the roof opening panel drain channels for blockage. REFER to **Water Drainage System Check and Water Leak Corrections**.
• The roof opening panel does not open or close	• Fuse(s) • Circuitry • Roof opening panel switch • Roof opening sliding glass panel motor/module • Accessory delay relay	• Go to **Pinpoint Test E** .
• The roof opening panel does not open in the VENT position	• Circuitry • Roof opening panel switch • Roof opening sliding glass panel motor/module • Roof opening panel shade motor not initialized	• Go to **Pinpoint Test F** .
• The roof opening panel shade does not open or close - both shades	• Circuitry • Roof opening panel switch • Roof opening panel shade motor/module • Roof opening panel shade motor not initialized	• Go to **Pinpoint Test G** .
• The express open/close feature is inoperative	• Roof opening panel shade motor not initialized • Roof opening sliding glass panel motor/module • Roof opening panel control switch	• Go to **Pinpoint Test H** .
	• Circuitry • Roof opening sliding glass	

• The global open function is inoperative	panel motor/module • Smart junction box (SJB) • Remote keyless entry (RKE) transmitters • Roof opening sliding glass panel motor not initialized	• Go to **Pinpoint Test I** .
• Roof opening panel reverses during operation	• Mechanism mistimed	• REFER to **Timing Adjustment**.
	• Binding or foreign material in the guide or tracks	• REMOVE the obstruction or CLEAN the foreign material from the guide or tracks.

Symptom Chart - Noise, Vibration and Harshness (NVH)

NOTE: **Noise, vibration and harshness (NVH) symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.**

Symptom Chart - Noise, Vibration and Harshness (NVH)

Condition	Possible Sources	Action
• The roof opening panel has excessive wind noise	• Roof opening panel primary seal • Roof opening panel front trim panel seal • Roof opening panel side trim panel seals • Roof opening panel fixed glass seal • Air deflector assembly	• Go to **Pinpoint Test A** .
	• Roof opening panel sliding glass • Roof opening sliding glass panel motor/module • Roof opening panel shade motor/module • Roof opening sliding glass panel motor block and drive tube assembly • Roof opening panel shade motor	

	block and drive tube assembly • Roof opening panel guide tracks • Roof opening panel shade tracks • Roof opening panel rear trim ring • Roof opening panel motor wiring harness • Roof opening panel air deflector assembly • Roof opening panel module assembly • Overhead console • Headliner	
• The roof opening panel rattles		• Go to **Pinpoint Test C** .
• The roof opening panel is noisy during operation	• Roof opening panel sliding glass • Roof opening panel guide tracks • Roof opening panel shade tracks • Roof opening sliding glass panel motor/module • Roof opening panel shade motor/module • Roof opening sliding glass panel motor block and drive tube assembly • Roof opening panel shade motor block and drive tube assembly • Overhead console • Headliner	• Go to **Pinpoint Test D** .

Pinpoint Tests

Pinpoint Test A: The Roof Opening Panel has Excessive Wind Noise

Normal Operation

When the roof opening panel glass is completely closed, it is flush with the roof panel and correctly sealed. When the roof opening panel glass is in the VENT position, the leading edge of the glass panel should contact the primary seal.

This pinpoint test is intended to diagnose the following:

- Damaged or poorly fitting roof opening panel primary seal
- Damaged or poorly fitting roof opening panel fixed glass front seal
- Damaged or poorly fitting roof opening panel front trim panel seal

- Damaged or poorly fitting roof opening panel side trim panel seal
- Damaged or poorly fitting roof opening panel fixed glass side seal
- Damaged or poorly fitting deflector assembly

PINPOINT TEST A: THE ROOF OPENING PANEL HAS EXCESSIVE WIND NOISE

A1 VERIFY ROOF OPENING PANEL NOISE

NOTE:	**It is normal to have some amount of wind noise when the roof opening panel is in the OPEN position. To determine if the wind noise is excessive, road test the vehicle at approximately 100 km/h (62 mph) with the roof opening panel closed, a single rear door window OPEN and all remaining door windows closed while observing the level of wind noise. If the level of wind noise observed with the roof opening panel OPEN (with all door windows closed) is greater than the wind noise observed with a single rear door window open, the wind noise is excessive.**

- Road test the vehicle with the roof opening panel in the CLOSED, VENT and OPEN positions.
- **Is the wind noise present only in the OPEN position?**

  YES : Go to A3.

  NO : Go to A2.

A2 CHECK THE ROOF OPENING PANEL GLASS SEALS

NOTE:	**When the roof opening panel sliding glass is in the VENT position, it is important that the leading edge of the glass is in contact with the sliding glass primary seal.**

- Check the roof opening panel front trim seal, sliding glass primary seal and fixed glass seal to make sure they are fitted properly and not damaged.
- **Are the roof opening panel front trim seal, sliding glass primary seal and fixed glass seal OK?**

  YES : CHECK for other vehicle conditions that could be causing the excessive wind noise. For example, aftermarket windshield wipers, side-view mirrors, HVAC door behind glove compartment, HVAC louvers in instrument panel, or antenna base to trim panel. REPAIR as necessary. TEST the system for normal operation.

  NO : INSTALL or REPAIR the roof opening panel seal(s) in question as necessary. REFER to **Roof Opening Panel - Exploded View** or **Roof Opening Panel Seal - Primary**. TEST the system for normal operation.

A3 CHECK THE SLIDING GLASS PRIMARY SEAL

- Make sure the air deflector is not damaged and is securely attached.
- **Is the air deflector OK?**

  YES : PARTIALLY close the roof opening panel until the noise is eliminated. If the noise is eliminated, INFORM the customer that changing glass location will eliminate the wind noise. If the wind noise is not eliminated, INSTALL a new air deflector. REFER to **Roof Opening Panel - Exploded View** and **Air Deflector**. TEST the system for normal operation.

NO : INSTALL new air deflector assembly. REFER to **Roof Opening Panel - Exploded View** and **Air Deflector**. TEST the system for normal operation.

Pinpoint Test B: The Roof Opening Panel Leaks

Normal Operation

The roof opening panel module assembly has 2 drain channels which are located under the side trim panels to direct water externally to the front and rear corners of the roof. There are no drain hoses in this system. When the roof opening panel glass is completely closed, it is flush with the roof panel and correctly sealed.

This pinpoint test is intended to diagnose the following:

- Damaged or poorly sealed roof opening panel primary seal
- Poorly sealed fixed rear glass
- Poorly sealed windshield
- Poorly sealed antenna
- Poorly sealed front trim panel
- Incorrect installation or damaged roof opening panel module assembly

PINPOINT TEST B: THE ROOF OPENING PANEL LEAKS

B1 VERIFY THE LEAK LOCATION

- Lower the headliner. Refer to **INTERIOR TRIM AND ORNAMENTATION** article.
- Check the roof opening panel and windshield for leaks.
- **Is the leak coming from the windshield?**

  YES : RESEAL the windshield. REFER to **GLASS, FRAMES AND MECHANISMS** article. TEST the system for normal operation.

  NO : Go to B2.

B2 VERIFY THE ROOF OPENING PANEL LEAK LOCATION

- Check the front and rear areas of the roof opening panel for leaks.
- **Is the leak coming from the rear fixed glass panel area of the roof opening panel?**

  YES : Go to B4.

  NO : Go to B3.

B3 CHECK THE ROOF OPENING PANEL PRIMARY SEAL CONDITION

- Check the roof opening panel primary seal for damage and correct installation. Carefully pull up on the seal to verify correct adhesion.
- **Is the roof opening panel primary seal OK?**

  YES : Go to B5.

NO : INSTALL a new roof opening panel primary seal. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Seal - Primary** . TEST the system for normal operation.

B4 CHECK THE ROOF OPENING PANEL FIXED REAR GLASS URETHANE SEAL

- Check the roof opening panel fixed rear glass urethane seal for damage.
- **Is the roof opening panel fixed rear glass urethane seal OK?**

  YES : Go to B6.

  NO : If the leak is at the front or sides of the fixed glass panel, it is possible to re-seal the area from the inside by removing the trim ring. If re-sealing the area does not correct the problem or the leak is at the rear of the fixed glass panel, REMOVE and REINSTALL the existing rear fixed glass assembly. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Glass - Rear Fixed**. TEST the system for normal operation.

B5 CHECK THE ROOF OPENING PANEL FRONT TRIM AND ANTENNA SEAL

- Check the antenna seal and roof opening panel front trim urethane seal for damage.
- **Is the roof opening panel front trim and antenna seal OK?**

  YES : Go to B6.

  NO : For the antenna seal, REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article. For the front trim panel, REFER to **Roof Opening Panel Trim - Front** . TEST the system for normal operation.

B6 CHECK THE CONDITION OF THE ROOF OPENING PANEL MODULE ASSEMBLY

- Check the roof opening panel module assembly for damage.
- **Is the roof opening panel module assembly OK?**

  YES : INSPECT other areas of the vehicle that may cause water to enter the roof area, such as the windshield or the rear window.

  NO : INSTALL a new roof opening panel module assembly. REFER to **Roof Opening Panel - Exploded View**, Roof Opening Panel Frame and **Roof Opening Panel Module** . TEST the system for normal operation.

Pinpoint Test C: The Roof Opening Panel Rattles

Normal Operation

When the roof opening panel glass is completely closed, it is flush with the roof panel. All components should be secured correctly.

This pinpoint test is intended to diagnose the following:

- Roof opening panel sliding glass
- Roof opening panel air deflector assembly
- Roof opening panel guide tracks
- Roof opening panel shade tracks
- Roof opening sliding glass panel motor/module
- Roof opening panel shade motor/module

- Roof opening sliding glass panel motor block and drive tube assembly
- Roof opening panel shade motor block and drive tube assembly
- Roof opening panel module assembly
- Roof opening panel rear trim ring
- Roof opening panel motor wiring harness
- Overhead console
- Headliner

PINPOINT TEST C: THE ROOF OPENING PANEL RATTLES

C1 CHECK THE ROOF OPENING PANEL TIGHTNESS

- Open the roof opening sliding glass panel.
- Manually push up and fore/aft on the roof opening sliding glass panel.
- **Is the roof opening sliding glass panel loose?**

  YES : TIGHTEN the roof opening sliding glass panel. REFER to **Roof Opening Panel Glass - Front Sliding**. TEST the system for normal operation. If the glass panel still has movement after tightening the roof opening sliding glass panel screws, the guide shoes for the idler mechanism and/or front guide track mechanism may be damaged. REPAIR or INSTALL a new idler mechanism or front guide track and mechanism as necessary. REFER to **Roof Opening Panel Idler Track Mechanism** and **Roof Opening Panel Guide Track and Mechanism**.

  NO : Go to C2.

C2 CHECK THE ROOF OPENING PANEL REAR TRIM RING

- Verify that the roof opening panel rear trim ring is not damaged and is securely fastened.
- **Is the roof opening panel rear trim ring OK?**

  YES : Go to C3.

  NO : REINSTALL the roof opening panel rear trim ring or INSTALL a new roof opening panel rear trim ring. REFER to **Roof Opening Panel - Exploded View** or **Roof Opening Panel Trim - Fixed Glass, Interior**. TEST the system for normal operation.

C3 CHECK THE ROOF OPENING PANEL TRACKS

- Verify that the roof opening panel guide tracks, shade tracks and idler tracks and mechanism are not damaged and are securely fastened.
- **Are the roof opening panel tracks OK?**

  YES : Go to C4.

  NO : REPAIR or TIGHTEN the roof opening panel track that is affected. If the roof opening panel track cannot be repaired, INSTALL a new roof opening panel track. REFER to **Roof Opening Panel - Exploded View**, **Roof Opening Panel Guide Track and Mechanism**, **Roof Opening Panel Idler Track Mechanism**, **Roof Opening Panel Idler Track and Mechanism** or **Roof Opening Panel Shade Track and Mechanism**. TEST the system for normal operation.

C4 CHECK THE ROOF OPENING PANEL SUNSHADES

- Check the roof opening panel sunshades for correct installation or damage.
- **Are the roof opening panel sunshades OK?**

YES : Go to C5.

NO : REINSTALL the roof opening panel shade or INSTALL a new roof opening panel shade. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Shade Assembly**. TEST the system for normal operation.

C5 CHECK THE ROOF OPENING PANEL AIR DEFLECTOR ASSEMBLY

- Check the roof opening panel air deflector assembly for correct installation or damage.
- **Is the roof opening panel air deflector assembly OK?**

  YES : Go to C6.

  NO : REINSTALL the roof opening panel air deflector assembly or INSTALL a new roof opening panel air deflector assembly. REFER to **Roof Opening Panel - Exploded View** and **Air Deflector**. TEST the system for normal operation.

C6 CHECK THE ROOF OPENING SLIDING GLASS PANEL AND SHADE MOTORS

- Check the roof opening sliding glass panel and shade motors for correct installation or damage.
- **Are the roof opening sliding glass panel and shade motors OK?**

  YES : Go to C7.

  NO : REINSTALL the roof opening sliding glass panel and/or shade motors. TIGHTEN to the correct torque specification. If the roof opening sliding glass panel motor or shade motor is still loose or damaged, INSTALL a new roof opening sliding glass panel motor or shade motor. REFER to **Roof Opening Panel - Exploded View**, **Roof Opening Panel Motor - Sliding Front Panel** or **Roof Opening Panel Motor - Shades**. TEST the system for normal operation.

C7 CHECK THE ROOF OPENING SLIDING GLASS PANEL AND SHADE MOTOR BLOCK AND DRIVE TUBE ASSEMBLIES

- Check the roof opening sliding glass panel motor and shade motor block and drive tube assemblies for correct installation or damage.
- **Are the roof opening sliding glass panel and shade motor block and drive tube assemblies OK?**

  YES : Go to C8.

  NO : REINSTALL the roof opening sliding glass panel or shade motor block and drive tube assembly. TIGHTEN to the correct torque specification. If the roof opening sliding glass panel or shade motor block and drive tube assembly is damaged, INSTALL a roof opening sliding glass panel or shade motor block and drive tube assembly. REFER to **Roof Opening Panel - Exploded View**, **Roof Opening Panel Motor Block and Drive Tube Assembly - Sliding Front Panel** or **Roof Opening Panel Motor Block and Drive Tube Assembly - Shades**. TEST the system for normal operation.

C8 CHECK THE ROOF OPENING PANEL ASSEMBLY FOR RATTLES

- Check the roof opening panel assembly for any loose parts or for any condition that will cause rattles.
- **Are there any conditions that will cause rattles?**

  YES : CHECK for correct routing of the roof opening panel motor wiring harness. REFER to **Roof Opening Panel Motor Wiring Harness**. If the roof opening panel motor wiring harness is OK, INSTALL a suitable sound damper material to correct the condition. If the rattle still persists, INSTALL a new roof opening panel module assembly. REFER to **Roof Opening Panel -**

Exploded View and **Roof Opening Panel Module**. TEST the system for normal operation.

NO : INSPECT other areas of the vehicle that may cause rattles in the roof area, such as the headliner, roof opening panel motor wiring harness, overhead console, rear wiper hose to headliner or rear dome light. REPAIR as necessary. TEST the system for normal operation.

Pinpoint Test D: The Roof Opening Panel is Noisy During Operation

Normal Operation

The roof opening panel operates smoothly and quietly while opening and closing.

This pinpoint test is intended to diagnose the following:

- Roof opening panel sliding glass
- Roof opening panel air deflector assembly
- Roof opening panel sliding glass tracks
- Roof opening panel shade tracks
- Roof opening sliding glass panel motor/module
- Roof opening panel shade motor/module
- Roof opening sliding glass panel motor block and drive tube assembly
- Roof opening panel shade motor block and drive tube assembly
- Roof opening panel module assembly
- Headliner
- Overhead console

PINPOINT TEST D: THE ROOF OPENING PANEL IS NOISY DURING OPERATION

D1 VERIFY THE ROOF OPENING PANEL SHADE OPERATION

NOTE: Before performing this pinpoint test, make sure the front guide tracks are free from any foreign material.

- With the roof opening panel glass fully closed, open and close the shades while observing the noise.
- **Is the noise present during shade operation?**

  YES : Go to D3.

  NO : Go to D2.

D2 VERIFY THE ROOF OPENING PANEL OPERATION

- With the shades fully open, open and close the roof opening sliding glass panel while observing the noise.
- **Is the noise present during sliding glass operation?**

  YES : If the noise occurs during primary seal engagement only, apply silicone spray lubricant to the primary seal. TEST the system for normal operation. If noise is still present, INSTALL a new primary seal. REFER to **Roof Opening Panel Seal - Primary**.

If the noise occurs during transition to VENT only, carefully spray PTFE lubricant to the front mechanism. TEST the system for normal operation.

If the noise occurs only while the air deflector is moving downward, LUBRICATE the air deflector arm and spring. TEST the system for normal operation. If noise is still present, INSTALL a new air deflector assembly. REFER to **Air Deflector**. If noise is still present, INSTALL new front drive track and mechanisms. REFER to **Roof Opening Panel Guide Track and Mechanism** .

If the noise sounds like a muffled ratchet/purr, INSTALL a new sliding glass motor block and drive tube assembly. REFER to **Roof Opening Panel Motor Block and Drive Tube Assembly - Sliding Front Panel**.

If none of the above conditions apply, INSTALL a new roof opening sliding glass panel motor. REFER to **Roof Opening Panel Motor - Sliding Front Panel**. TEST the system for normal operation.

NO : The roof opening panel is operating correctly at this time.

D3 CHECK THE ROOF OPENING PANEL FRONT SHADE

- With the front shade disconnected, open and close the rear shade.
- **Is the noise still present?**

YES : Go to D4.

NO : INSTALL a new front shade assembly. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Shade Assembly**. TEST the system for normal operation.

D4 CHECK THE ROOF OPENING PANEL REAR SHADE

- With the front and rear shade disconnected, open and close the shades.
- **Is the noise still present?**

YES : If the noise sounds like a muffled ratchet/purr, INSTALL a new LH and RH shade track assembly and shade motor block and tube assembly. REFER to **Roof Opening Panel Shade Track and Mechanism** and **Roof Opening Panel Motor Block and Drive Tube Assembly - Shades**. TEST the system for normal operation. If the noise is still present, INSTALL a new LH and RH guide track and mechanism. REFER to **Roof Opening Panel Guide Track and Mechanism**.

If the above condition does not apply, INSTALL a new shade motor. REFER to **Roof Opening Panel Motor - Shades**. TEST the system for normal operation.

NO : INSTALL a new rear shade assembly. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Shade Assembly**. TEST the system for normal operation.

Pinpoint Test E: The Roof Opening Panel Does Not Open or Close

The roof opening sliding glass panel motor/module must be initialized whenever the roof opening sliding glass panel motor/module has been removed from the roof opening panel system, a new roof opening sliding glass panel motor/module has been installed or a new roof opening panel module assembly has been installed. Refer to **Roof Opening Panel Motor Initialization**.

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Roof Opening Panel for schematic and connector information.

Normal Operation

The roof opening panel uses an integrated motor and module to operate the roof opening panel sliding glass.

The roof opening sliding glass panel motor/module receives voltage from the accessory delay relay through circuit CBP41 (BU) when the key is in the ACC or RUN position and voltage at all times through circuit SBB18 (YE/RD). Ground is supplied to the roof opening sliding glass panel motor/module through circuit GD133 (BK). The roof opening panel switch receives ground from the roof opening panel motor/module assembly through circuit GD133 (BK). When the roof opening panel open switch is pressed, the roof opening panel switch grounds circuit CPR31 (VT/BN) and the roof opening sliding glass panel motor/module opens the roof opening panel sliding glass. When the roof opening panel close switch is pressed, the roof opening panel switch grounds circuit CPR40 (YE/OG) and the roof opening sliding glass panel motor/module closes the roof opening panel sliding glass.

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- Roof opening panel switch
- Roof opening sliding glass panel motor/module
- Accessory delay relay
- Roof opening sliding glass panel motor not initialized

PINPOINT TEST E: THE ROOF OPENING PANEL DOES NOT OPEN OR CLOSE

E1 CHECK THE POWER WINDOWS

- Key in ON position.
- Verify that the power windows operate.
- **Do the power windows operate?**

  YES : Go to E2.

  NO : REFER to **GLASS, FRAMES AND MECHANISMS** article to diagnose the accessory delay relay circuit.

E2 CHECK THE ROOF OPENING SLIDING GLASS PANEL MOTOR FOR INITIALIZATION

- Carry out the roof opening panel motor initialization procedure. Refer to **Roof Opening Panel Motor Initialization**.
- **Is the concern still present?**

  YES : Go to E3.

  NO : The system is operating normally at this time. The roof opening sliding glass panel motor was not initialized.

E3 CHECK THE ROOF OPENING PANEL SWITCH

- Key in OFF position.
- Disconnect: Roof Opening Panel Switch C912

- Carry out the roof opening panel switch component test. Refer to COMPONENT TESTING.
- **Did the roof opening panel switch pass the component test?**

  YES : Go to E4.

  NO : INSTALL a new roof opening panel switch. REFER to **Roof Opening Panel Control Switch**. TEST the system for normal operation.

E4 CHECK VOLTAGE TO THE ROOF OPENING SLIDING GLASS PANEL MOTOR/MODULE - CIRCUIT CBP41 (BU) AND SBB18 (YE/RD)

- Disconnect: Roof Opening Panel Motor/Module C920
- Key in ON position.

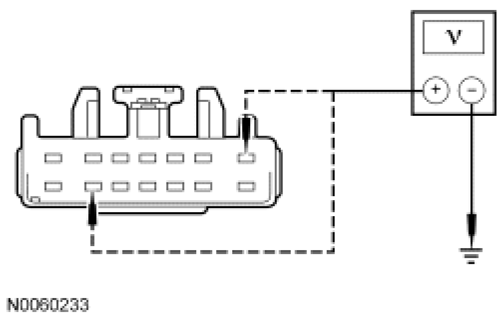


Fig. 1: Measuring Voltage Between Roof Opening Panel Motor/Module C920-13, Circuit CBP41 (BU)
Courtesy of FORD MOTOR CO.

- Measure the voltage between roof opening panel motor/module C920-13, circuit CBP41 (BU), harness side and ground; and between C920-1, circuit SBB18 (YE/RD), harness side and ground
- **Are the voltages greater than 10 volts?**

  YES : Go to E5.

  NO : VERIFY smart junction box (SJB) fuse 41 (15A) and battery junction box (BJB) fuse 18 (30A) are OK. If OK, REPAIR the circuit. TEST the system for normal operation.

E5 CHECK THE ROOF OPENING SLIDING GLASS PANEL MOTOR/MODULE GROUND - CIRCUIT GD133 (BK)

- Key in OFF position.

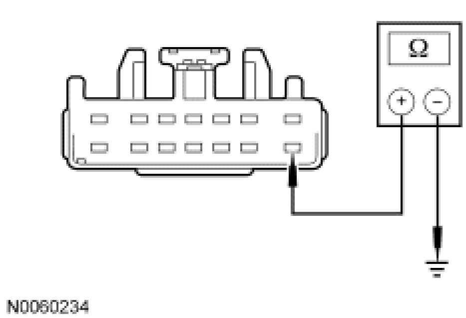


Fig. 2: Measuring Resistance Between Roof Opening Panel Motor/Module C920-8, Circuit GD133 (BK)
Courtesy of FORD MOTOR CO.

- Measure the resistance between roof opening panel motor/module C920-8, circuit GD133 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : Go to E6.

NO : REPAIR the circuit. TEST the system for normal operation.

E6 CHECK THE ROOF OPENING PANEL SWITCH GROUND - CIRCUIT GD133 (BK) FOR AN OPEN

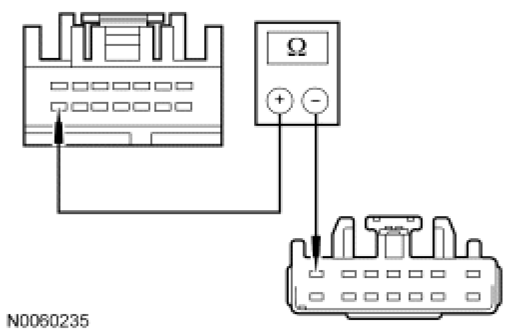


Fig. 3: Measuring Resistance Between Roof Opening Panel Switch C912-14, Circuit GD133 (BK)
Courtesy of FORD MOTOR CO.

- Measure the resistance between roof opening panel switch C912-14, circuit GD133 (BK), harness side and roof opening panel motor/module C920-7, circuit GD133 (BK) harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to E7.

NO : REPAIR the circuit. TEST the system for normal operation.

E7 CHECK CIRCUITS CPR31 (VT/BN) AND CPR40 (YE/OG) FOR AN OPEN

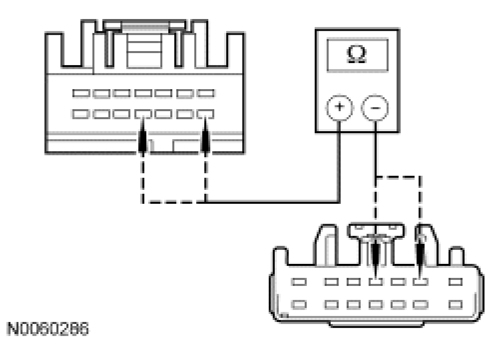


Fig. 4: Measuring Resistance Between Roof Opening Panel Switch C912-11, Circuit CPR31 (VT/BN)

Courtesy of FORD MOTOR CO.

- Measure the resistance between roof opening panel switch C912-11, circuit CPR31 (VT/BN), harness side and roof opening panel motor/module C920-2, circuit CPR31 (VT/BN) harness side; and between roof opening panel switch C912-8, circuit CPR40 (YE/OG), harness side and roof opening panel motor/module C920-4, circuit CPR40 (YE/OG) harness side
- **Are the resistances less than 5 ohms?**

YES : Go to E8.

NO : REPAIR the circuit(s) in question. TEST the system for normal operation.

E8 CHECK CIRCUITS CPR31 (VT/BN), CPR38 (WH/BU) AND CPR40 (YE/OG) FOR A SHORT TO GROUND

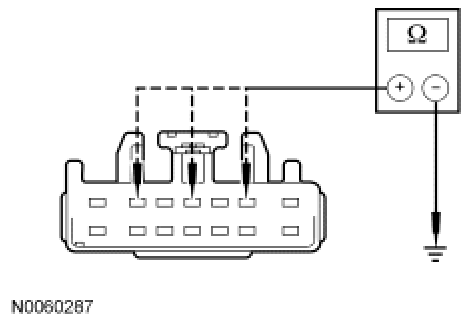


Fig. 5: Measuring Resistance Between Roof Opening Panel Switch C912 Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Using the following table, measure the resistance between roof opening panel switch C912 harness side and ground:

Roof Opening Panel Switch C912	Ground
C920-2, circuit CPR31 (VT/BN)	Ground
C920-6, circuit CPR38 (WH/BU)	Ground
C920-4, circuit CPR40	Ground

(YE/OG)	

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to E9.

  NO : REPAIR the circuit(s) in question. TEST the system for normal operation.

E9 CHECK THE ROOF OPENING PANEL MOTOR WIRING HARNESS

- Using the following table, check the roof opening panel motor wiring harness for loose pins, an open or a short between roof opening panel motor/module C920 component side and the roof opening panel motor wiring harness socket:

Roof Opening Panel Motor/Module C920	Roof Opening Panel Motor Wiring Harness Socket
C920-1, circuit SBB18	Roof opening panel motor wiring harness socket circuit SBB18
C920-13, circuit CBP41	Roof opening panel motor wiring harness socket circuit CBP41
C920-7, circuit GD133	Roof opening panel motor wiring harness socket circuit GD133
	Roof

C920-8, circuit GD133	opening panel motor wiring harness socket circuit GD133
C920-2, circuit CPR31	Roof opening panel motor wiring harness socket circuit CPR31
C920-6, circuit CPR38	Roof opening panel motor wiring harness socket circuit CPR38
C920-4, circuit CPR40	Roof opening panel motor wiring harness socket circuit CPR40

- **Is the roof opening panel motor wiring harness OK?**

  YES : Go to E10.

  NO : INSTALL a new roof opening panel motor wiring harness. REFER to **Roof Opening Panel Motor Wiring Harness**. INITIALIZE the roof opening panel motor. REFER to **Roof Opening Panel Motor Initialization**. TEST the system for normal operation.

E10 CHECK THE ROOF OPENING SLIDING GLASS PANEL MOTOR/MODULE FOR CORRECT OPERATION

- Disconnect all roof opening panel motor/module connectors.
- Check for:

    - corrosion.
    - bent or pushed-out pins.
- Connect all roof opening panel motor/module connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new roof opening sliding glass panel motor/module. REFER to **Roof Opening Panel Motor - Sliding Front Panel**. INITIALIZE the roof opening sliding glass panel motor. REFER to **Roof Opening Panel Motor Initialization**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test F: The Roof Opening Panel Does Not Open in the VENT Position

The roof opening sliding glass panel motor/module must be initialized whenever the roof opening sliding glass panel motor/module has been removed from the roof opening panel system, the roof opening panel module assembly has been removed from the vehicle, a new roof opening sliding glass panel motor/module has been installed or a new roof opening panel module assembly has been installed. Refer to **Roof Opening Panel Motor Initialization** .

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Roof Opening Panel for schematic and connector information.

Normal Operation

The roof opening panel uses an integrated motor and module to operate the roof opening panel sliding glass.

The roof opening sliding glass panel motor/module receives voltage from the accessory delay relay through circuit CBP41 (BU) when the key is in the ACC or RUN position and voltage at all times through circuit SBB18 (YE/RD). Ground is supplied to the roof opening sliding glass panel motor/module through circuit GD133 (BK). The roof opening panel switch receives ground from the roof opening panel motor/module assembly through circuit GD133 (BK). When the roof opening panel tilt switch is pressed, the roof opening panel switch grounds circuit CPR38 (WH/BU) and the roof opening sliding glass panel motor/module opens the roof opening panel sliding glass to the VENT position.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Roof opening panel switch
- Roof opening sliding glass panel motor/module
- Roof opening sliding glass panel motor not initialized

PINPOINT TEST F: THE ROOF OPENING PANEL DOES NOT OPEN IN THE VENT POSITION

F1 CHECK THE ROOF OPENING SLIDING GLASS PANEL MOTOR FOR INITIALIZATION

- Carry out the roof opening panel motor initialization procedure. Refer to **Roof Opening Panel Motor Initialization**.
- **Is the concern still present?**

  YES : Go to F2.

  NO : The system is operating normally at this time. The roof opening sliding glass panel motor was not initialized.

F2 CHECK THE ROOF OPENING PANEL SWITCH

- Key in OFF position.
- Disconnect: Roof Opening Panel Switch C912
- Carry out the roof opening panel switch component test. Refer to COMPONENT TESTING.
- **Did the roof opening panel switch pass the component test?**

  YES : Go to F3.

  NO : INSTALL a new roof opening panel switch. REFER to **Roof Opening Panel Control Switch**. TEST the system for normal operation.

F3 CHECK CIRCUIT CPR38 (WH/BU) FOR AN OPEN

- Disconnect: Roof Opening Panel Motor/Module C920

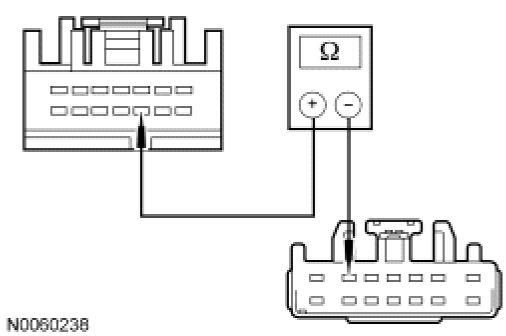


Fig. 6: Measuring Resistance Between Roof Opening Panel Switch C912-10, Circuit CPR38 (WH/BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between roof opening panel switch C912-10, circuit CPR38 (WH/BU), harness side and roof opening panel motor/module C920-6, circuit CPR38 (WH/BU) harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to F4.

  NO : REPAIR the circuit. TEST the system for normal operation.

F4 CHECK THE ROOF OPENING PANEL MOTOR WIRING HARNESS

- Check the roof opening panel motor wiring harness for loose pins, an open or a short between roof opening panel motor/module C920-6, circuit CPR38, component side and the roof opening panel motor wiring harness socket.
- **Is the roof opening panel motor wiring harness OK?**

  YES : Go to F5.

NO : INSTALL a new roof opening panel motor wiring harness. REFER to **Roof Opening Panel Motor Wiring Harness**. INITIALIZE the roof opening panel motor. REFER to **Roof Opening Panel Motor Initialization**. TEST the system for normal operation.

F5 CHECK THE ROOF OPENING SLIDING GLASS PANEL MOTOR/MODULE FOR CORRECT OPERATION

- Disconnect all roof opening panel motor/module connectors.
- Check for:
    - corrosion.
    - bent or pushed-out pins.
- Connect all roof opening panel motor/module connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new roof opening sliding glass panel motor/module. REFER to **Roof Opening Panel Motor - Sliding Front Panel**. INITIALIZE the roof opening sliding glass panel motor. REFER to **Roof Opening Panel Motor Initialization**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test G: The Roof Opening Panel Shade Does Not Open or Close - Both Shades

The roof opening panel shade motor/module must be initialized whenever the roof opening panel shade motor/module has been removed from the roof opening panel system, the roof opening panel module assembly has been removed from the vehicle, a new roof opening panel shade motor/module has been installed or a new roof opening panel module assembly has been installed. Refer to **Roof Opening Panel Motor Initialization**.

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Roof Opening Panel for schematic and connector information.

Normal Operation

The roof opening panel shade uses an integrated motor and module to operate the roof opening panel shades.

The roof opening panel shade motor/module receives voltage through circuit SBB18 (YE/RD). When the key is in the ACC or RUN position, the roof opening panel motor/module sends a signal to the roof opening panel shade motor/module. Ground is supplied to the roof opening panel shade motor/module through circuit GD133 (BK). The roof opening panel switch receives ground from the roof opening panel motor/module assembly through circuit GD133 (BK). When the roof opening panel shade OPEN switch is pressed, the roof opening panel switch grounds circuit CPR37 (YE/GY) and the roof opening panel shade motor/module opens the roof opening panel shade. When the roof opening panel shade CLOSE switch is pressed, the roof opening panel switch grounds circuit CPR32 (YE/GN) and the roof opening panel shade motor/module closes the roof opening panel shade.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Open in voltage or ground circuit of the overhead jumper harness
- Roof opening panel switch
- Roof opening panel shade panel motor/module
- Roof opening panel shade motor not initialized

PINPOINT TEST G: THE ROOF OPENING PANEL SHADE DOES NOT OPEN OR CLOSE - BOTH SHADES

G1 CHECK THE ROOF OPENING PANEL SHADE MOTOR FOR INITIALIZATION

- Carry out the roof opening panel motor initialization procedure. Refer to **Roof Opening Panel Motor Initialization**.
- **Is the concern still present?**

  YES : Go to G2.

  NO : The system is operating normally at this time. The roof opening panel shade motor was not initialized.

G2 CHECK THE ROOF OPENING PANEL SWITCH

- Key in OFF position.
- Disconnect: Roof Opening Panel Switch C912
- Carry out the roof opening panel switch component test. Refer to COMPONENT TESTING.
- **Did the roof opening panel switch pass the component test?**

  YES : Go to G3.

  NO : INSTALL a new roof opening panel switch. REFER to **Roof Opening Panel Control Switch**. TEST the system for normal operation.

G3 CHECK CIRCUITS CPR32 (YE/GN) AND CPR37 (YE/GY) FOR AN OPEN

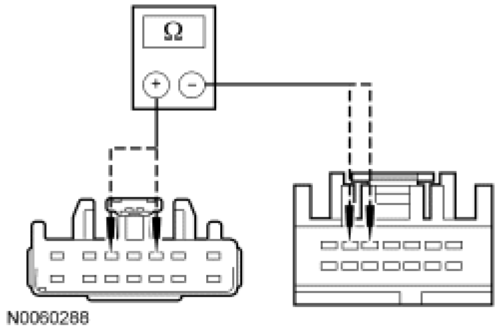


Fig. 7: Measuring Resistance Between Roof Opening Panel Switch C912-5, Circuit CPR32 (YE/GN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between roof opening panel switch C912-5, circuit CPR32 (YE/GN), harness side and roof opening panel motor/module C920-5, circuit CPR32 (YE/GN) harness side; and between roof opening panel switch C912-6, circuit CPR37 (YE/GY), harness side and roof opening panel motor/module C920-3, circuit CPR37 (YE/GY) harness side

- **Are the resistances less than 5 ohms?**

  YES : Go to G4.

  NO : REPAIR the circuit(s) in question. TEST the system for normal operation.

G4 CHECK CIRCUITS CPR32 (YE/GN) AND CPR37 (YE/GY) FOR A SHORT TO GROUND

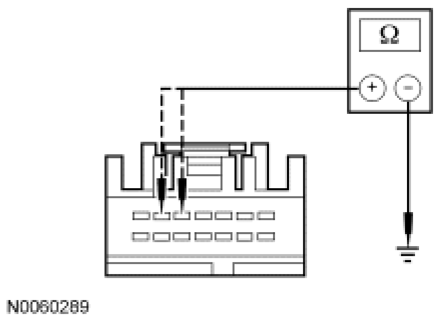


Fig. 8: Measuring Resistance Between Roof Opening Panel Switch C912-5, Circuit CPR32 (YE/GN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between roof opening panel switch C912-5, circuit CPR32 (YE/GN), harness side and ground; and between roof opening panel switch C912-6, circuit CPR37 (YE/GY), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to G5.

  NO : REPAIR the circuit(s) in question. TEST the system for normal operation.

G5 CHECK THE ROOF OPENING PANEL MOTOR WIRING HARNESS

- Using the following table, check the roof opening panel motor wiring harness for loose pins, an open or a short between roof opening panel motor/module C920 component side and the roof opening panel motor wiring harness socket:

Roof Opening Panel Motor/Module C920	Roof Opening Panel Motor Wiring Harness Socket
C920-1, circuit SBB18	Roof opening panel motor wiring harness

	socket circuit SBB18
C920-13, circuit CBP41	Roof opening panel motor wiring harness socket circuit CBP41
C920-5, circuit CPR32	Roof opening panel motor wiring harness socket circuit CPR32
C920-8, circuit GD133	Roof opening panel motor wiring harness socket circuit GD133
C920-3, circuit CPR37	Roof opening panel motor wiring harness socket circuit CPR37

- **Is the roof opening panel motor wiring harness OK?**

  YES : Go to G6.

  NO : INSTALL a new roof opening motor wiring harness. REFER to **Roof Opening Panel Motor Wiring Harness**. INITIALIZE the roof opening panel motor. REFER to **Roof Opening Panel Motor Initialization**. TEST the system for normal operation.

G6 CHECK THE ROOF OPENING PANEL SHADE MOTOR FOR CORRECT OPERATION

- Disconnect all roof opening panel shade motor connectors.
- Check for:
  - corrosion.
  - bent or pushed-out pins.
- Connect all roof opening panel shade motor connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new roof opening panel shade motor. REFER to **Roof Opening Panel Motor - Shades**. INITIALIZE the roof opening panel shade motor. REFER to **Roof Opening Panel Motor Initialization**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test H: The Express Open/Close is Inoperative

The roof opening sliding glass panel motor/module must be initialized whenever the roof opening sliding glass panel motor/module has been removed from the roof opening panel system, the roof opening panel module assembly has been removed from the vehicle, a new roof opening sliding glass panel motor/module has been installed or a new roof opening panel module assembly has been installed. Refer to **Roof Opening Panel Motor Initialization** .

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Roof Opening Panel for schematic and connector information.

Normal Operation

The roof opening panel uses an integrated motor and module to operate the roof opening panel sliding glass.

The roof opening sliding glass panel motor/module receives voltage from the accessory delay relay through circuit CBP41 (BU) when the key is in the ACC or RUN position and voltage at all times through circuit SBB18 (YE/RD). Ground is supplied to the roof opening sliding glass panel motor/module through circuit GD133 (BK). The roof opening panel switch receives ground from the roof opening panel motor/module assembly through circuit GD133 (BK). When the roof opening panel switch is momentarily pressed to the double detent express open position, the roof opening panel switch grounds circuits CPR31 (VT/BN) and CPR38 (WH/BU) and the roof opening sliding glass panel motor/module opens the roof opening panel sliding glass to the express OPEN position. The roof opening sliding glass panel motor/module also sends a signal to the roof opening panel shade motor/module to open the roof opening panel shade. When the roof opening panel switch is momentarily pressed to the double detent express close position, the roof opening panel switch grounds circuits CPR40 (YE/OG) and CPR31 (VT/BN) and the roof opening sliding glass panel motor/module closes the roof opening panel sliding glass to the CLOSE position.

This pinpoint test is intended to diagnose the following:

- Roof opening panel switch

- Roof opening sliding glass panel motor not initialized

PINPOINT TEST H: THE EXPRESS OPEN/CLOSE IS INOPERATIVE

H1 CHECK THE ROOF OPENING SLIDING GLASS PANEL MOTOR FOR INITIALIZATION

- Carry out the roof opening panel motor initialization procedure. Refer to **Roof Opening Panel Motor Initialization**.
- **Is the concern still present?**

  YES : Go to H2.

  NO : The system is operating normally at this time. The roof opening sliding glass panel motor was not initialized.

H2 CHECK THE ROOF OPENING PANEL SWITCH

- Key in OFF position.
- Disconnect: Roof Opening Panel Switch C912
- Carry out the roof opening panel switch component test. Refer to COMPONENT TESTING.
- **Did the roof opening panel switch pass the component test?**

  YES : Go to H3.

  NO : INSTALL a new roof opening panel switch. REFER to **Roof Opening Panel Control Switch**. TEST the system for normal operation.

H3 CHECK THE ROOF OPENING SLIDING GLASS PANEL MOTOR/MODULE FOR CORRECT OPERATION

- Disconnect all roof opening panel motor/module connectors.
- Check for:
  - corrosion.
  - bent or pushed-out pins.
- Connect all roof opening panel motor/module connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new roof opening sliding glass panel motor/module. REFER to **Roof Opening Panel Motor - Sliding Front Panel**. INITIALIZE the roof opening sliding glass panel motor. REFER to **Roof Opening Panel Motor Initialization**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test I: The Global Open Function is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Roof Opening Panel for schematic and connector information.

Normal Operation

When the global open feature is activated, the smart junction box (SJB) sends a signal through circuit VPW01 (GN/BU) to the roof opening sliding glass panel motor/module to open the roof opening panel sliding glass to the VENT position. The roof opening sliding glass panel motor/module also sends a signal to the roof opening panel shade motor/module to open the roof opening panel shade. The global open feature does not function when the delayed accessory is active.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Roof opening sliding glass panel motor/module
- SJB
- Remote keyless entry (RKE) transmitters
- Roof opening sliding glass panel motor is not initialized

PINPOINT TEST I: THE GLOBAL OPEN FUNCTION IS INOPERATIVE

I1 VERIFY THE POWER WINDOWS ARE OPERATIONAL

- Operate the power windows using the global open procedure.
- **Do the power windows operate correctly?**

  YES : Go to I2.

  NO : REFER to **GLASS, FRAMES AND MECHANISMS** article to diagnose the inoperative windows.

I2 CHECK CIRCUIT VPW01 (GN/BU) FOR AN OPEN

- Disconnect: Roof Opening Panel Motor/Module C920
- Disconnect: SJB C2280c

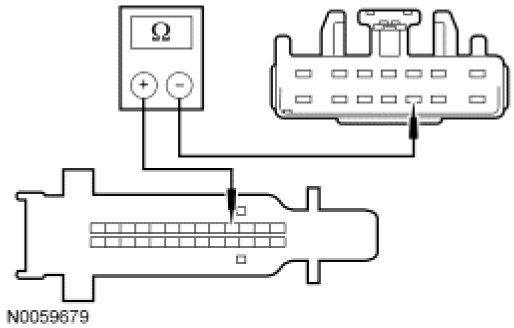


Fig. 9: Measuring Resistance Between Roof Opening Panel Motor/Module C920-10, Circuit VPW01 (GN/BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between roof opening panel motor/module C920-10, circuit VPW01 (GN/BU), harness side and SJB C2280C-10, circuit VPW01 (GN/BU) harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to I3.

NO : REPAIR the circuit. INITIALIZE the roof opening panel motor/module. REFER to **Roof Opening Panel Motor Initialization**. TEST the system for normal operation.

I3 CHECK THE ROOF OPENING PANEL MOTOR WIRING HARNESS

- Check the roof opening panel motor wiring harness for loose pins, an open or a short between roof opening panel motor/module C920-10, circuit VPW01, component side and the roof opening panel sliding glass wiring harness socket.
- **Is the roof opening panel motor wiring harness OK?**

  YES : Go to I4.

  NO : INSTALL a new roof opening panel motor wiring harness. REFER to **Roof Opening Panel Motor Wiring Harness**. INITIALIZE the roof opening panel motor. REFER to **Roof Opening Panel Motor Initialization**. TEST the system for normal operation.

I4 CHECK THE ROOF OPENING PANEL MOTORS/MODULES FOR CORRECT OPERATION

- Disconnect all roof opening panel motor/module connectors.
- Check for:
  - corrosion.
  - bent or pushed-out pins.
- Connect all roof opening panel motor/module connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : For an inoperative roof opening sliding glass panel motor, INSTALL a new roof opening sliding glass panel motor. REFER to **Roof Opening Panel Motor - Sliding Front Panel**. For an inoperative roof opening panel shade motor, INSTALL a new roof opening panel shade motor. REFER to **Roof Opening Panel Motor - Shades**. INITIALIZE the roof opening panel motors/modules. REFER to **Roof Opening Panel Motor Initialization**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

GENERAL PROCEDURES

ROOF OPENING PANEL MOTOR INITIALIZATION

WARNING: **Keep objects and body parts clear of the glass panel when carrying out the initialization procedure. During the initialization procedure, the glass panel closes with high force and cannot detect objects in its path. Failure to follow this instruction may result in serious personal injury.**

NOTE: New roof opening panel glass motor/shade motors must be initialized after installation.

NOTE: An de-initialized glass or shade motor will stutter step open when their

respective open switches are pressed.

NOTE: The glass close switch must be held during the entire initialization process or the sequence will be aborted and the roof will remain in a de-initialized state.

For a new drive assembly

NOTE: If installing a new roof opening panel shade motor assembly, use the existing drive assembly procedure.

1. Start the engine.
2. Press and hold the glass close switch.
   - The glass panel will move toward the front hard-stop, stall and then move backward a few millimeters and then forward.
   - The shade panels will move toward their front hard-stops, stall, move back a few millimeters, then forward.
   - After the shade panels have finished moving backward and forward, release the glass close switch.
3. Repress and hold the glass close switch while the glass and shades fully open and fully close.
4. Initialization is now complete. Verify successful initialization by carrying out one-touch open, one-touch close, one-touch vent (glass) and one-touch open for the shades.
   - If roof opening panel does not operate correctly, repeat Steps 2 through 4.

   For an existing drive assembly

5. Start the engine.
6. Press and hold the glass close switch until the glass is in CLOSED position.
7. Release, repress and hold the glass close switch (for at least 10 seconds).
   - The glass panel will move toward the front hard-stop and stall.
   - The shade panels will move toward their front hard-stops, stall, move back a few millimeters, then forward.
   - After the shade panels have finished moving backward and forward, release the glass close switch.
8. Press and hold the glass close switch.
   - The glass and shades will fully open together. Then, the glass will close first and then the shades will return to the fully CLOSED position. When the shades have stopped moving, release the glass close switch.
9. Initialization is now complete. Verify successful initialization by carrying out one-touch open, one-touch close, one-touch vent (glass) and one-touch open for the shades.
   - If roof opening panel does not operate correctly, repeat Steps 6 through 9.

TIMING ADJUSTMENT

NOTE: Anytime a roof opening panel glass/shade motor is removed, the cables/mechanisms can experience free-play movement. It is important that the cables do not move. The mechanisms are timed to be parallel with each other. If one or both are moved in either direction, they must be re-timed.

Roof Opening Panel - Sliding Glass Panel

1. Remove the roof opening panel sliding glass. For additional information, refer to **Roof Opening Panel Glass - Front Sliding**.
2. Remove the roof opening panel sliding glass motor. For additional information, refer to **Roof Opening Panel Motor - Sliding Front Panel**.
3. Manually move the sliding front glass mechanisms forward until they are flush against the track hard-stops.
4. Reinstall the roof opening panel sliding glass motor. For additional information, refer to **Roof Opening Panel Motor - Sliding Front Panel**.
5. With the roof opening panel sliding glass still removed, initialize the roof opening panel motor(s). For additional information, refer to **Roof Opening Panel Motor Initialization**.

   NOTE: Press the glass open switch to move the mechanisms rearward to allow installation of the sliding glass panel.

   NOTE: It will be necessary to carry out the initialization procedure again after the glass panel is installed.

6. Install the roof opening panel sliding glass. For additional information, refer to **Roof Opening Panel Glass - Front Sliding**.

   Roof Opening Panel - Shades

7. Remove the roof opening panel shade motor. For additional information, refer to **Roof Opening Panel Motor - Shades**.
8. Carefully move the front and rear shades rearward to the fully OPEN position by pushing at the edges closest to the tracks.
9. Reinstall the roof opening panel shade motor. For additional information, refer to **Roof Opening Panel Motor - Shades**.
10. Initialize the roof opening panel motor(s). For additional information, refer to **Roof Opening Panel Motor Initialization**.

WATER DRAINAGE SYSTEM CHECK AND WATER LEAK CORRECTIONS

1. The roof opening panel module assembly has 2 drain channels which are located under the side trim panels to direct water externally to the front and rear corners of the roof. There are no drain hoses in this system.

If a drainage system blockage or obstruction is suspected, pour a small amount of water into the suspected drain channel while observing the front and rear channel openings for any water flow restriction. Attempt to clear any blockage or obstruction using compressed air at the front or rear opening of the drain channel.

If the blockage or obstruction cannot be cleared, the roof opening panel front trim and/or side trim must be removed to gain full access to the drain channel. For additional information, refer to **Roof Opening Panel Trim - Front** and **Roof Opening Panel Trim - Side**.

2. For water leak corrections, refer to the Diagnosis and Testing procedure in this service information.

ROOF OPENING PANEL MANUAL OPERATION

1. Remove the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

NOTE: Roof opening sliding glass panel motor shown, shade motor similar.

2. Insert an Allen wrench into the center of the manual drive hole of the roof opening panel motor(s). Rotate the Allen wrench counterclockwise to close the roof opening panel glass/shades or clockwise to open the roof opening panel glass/shades.

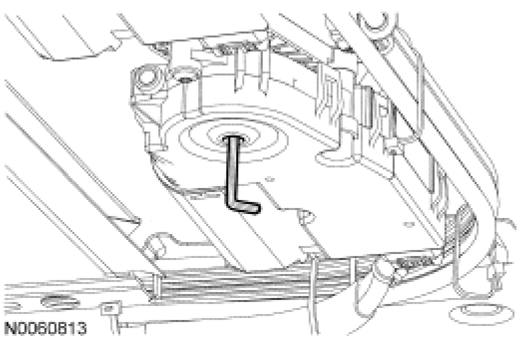


Fig. 10: Inserting An Allen Wrench Into Center Of Manual Drive Hole Of Roof Opening Panel Motor
Courtesy of FORD MOTOR CO.

REMOVAL AND INSTALLATION

ROOF OPENING PANEL - EXPLODED VIEW

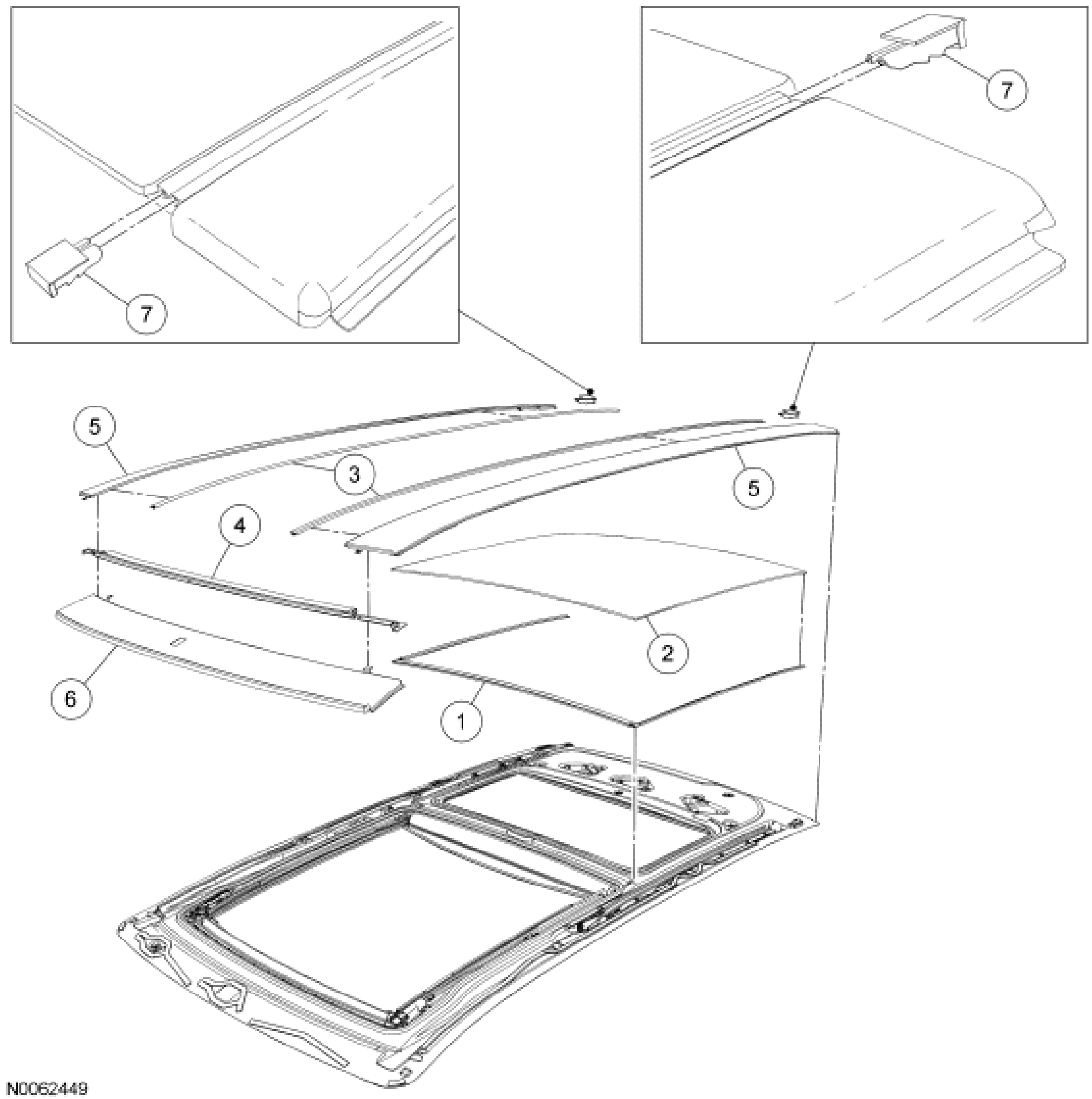


Fig. 11: Exterior Trim, Seals, Fixed Glass and End Caps
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7851707	Fixed glass front seal
2	18500A18	Fixed glass assembly
3	78503A22	Side trim seals (2 required)
4	78503A23	Front trim seal
5	7851746 RH/7851945 LH	Side trim panels
6	7850046	Front trim panel
7	78502C22	End caps (2 required)

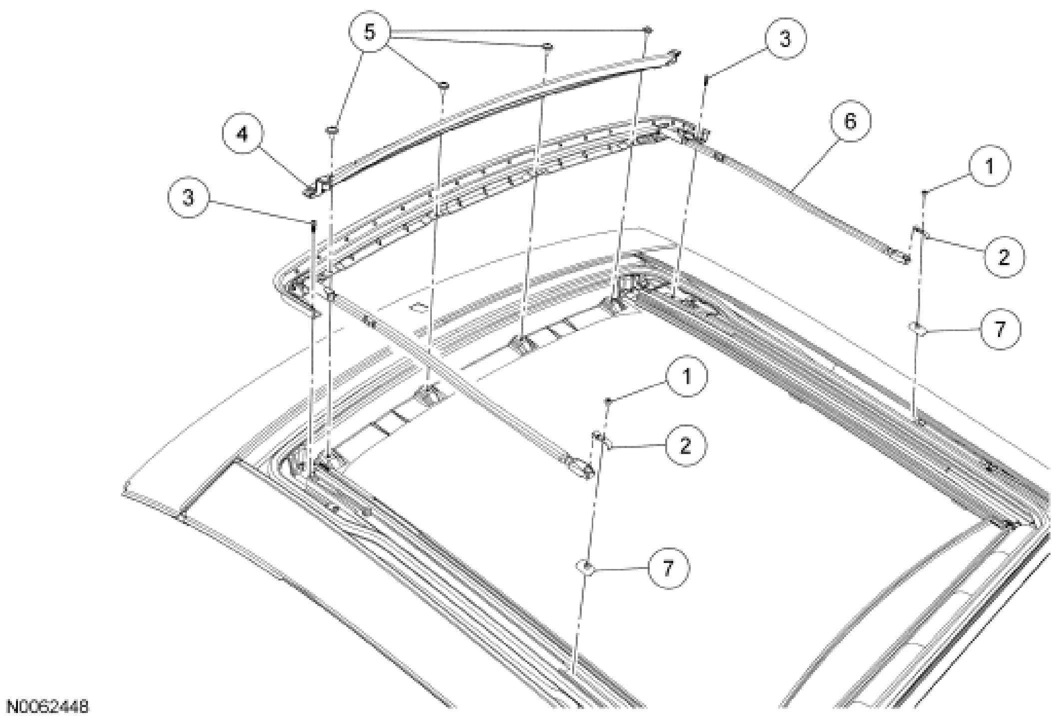


Fig. 12: Air Deflector Assembly
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W790076	Air deflector-to-track screws (2 required)
2	W790086	Air deflector arm capture plates (2 required)
3	W79004	Air deflector catcher bracket outer screws (2 required)
3	W790084	Service replacement fasteners for W79004 (use only if threaded hole becomes stripped during assembly)
4	-	Air deflector catcher bracket (part of air deflector assembly)
5	W790073	Air deflector catcher bracket center screws (4 required)
5	W790083	Service replacement fasteners for W790073 (use only if threaded hole becomes stripped during assembly)
6	78500A26	Air deflector assembly
7	W790085	Nut plates (2 required)

NOTE: **LH side shown, RH side similar.**

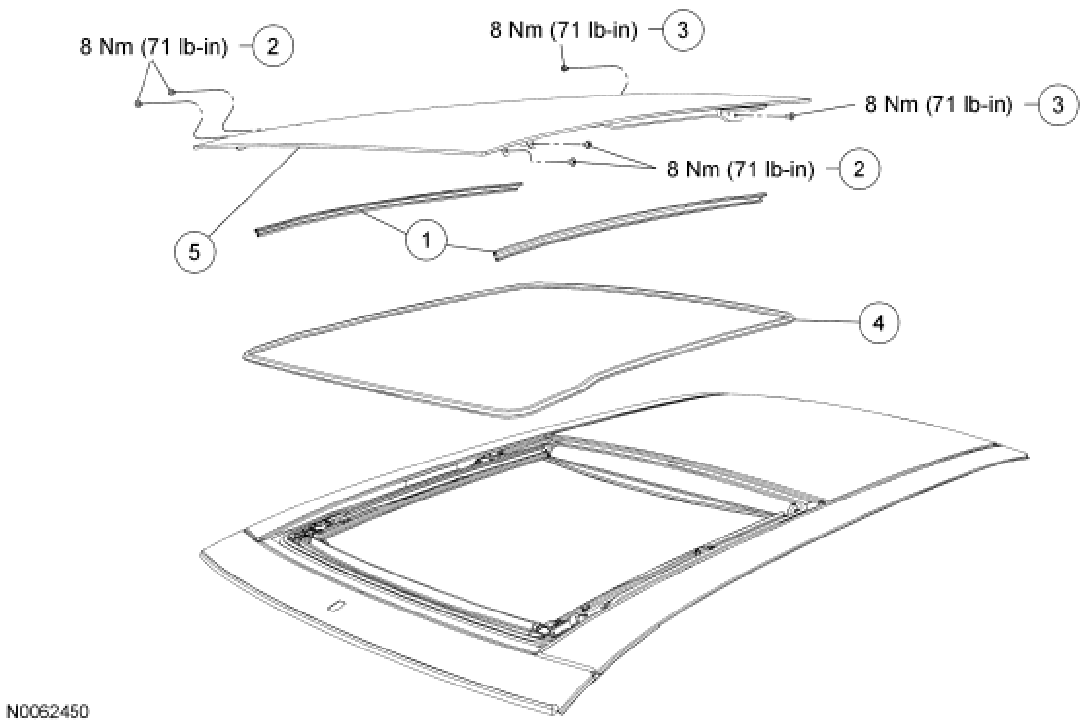


Fig. 13: Sliding Glass, Blinds and Primary Seal
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	78500A66 LH/78500A67 RH	Concertina blinds (2 required)
2	W790079	Roof opening panel front glass screws (4 required)
3	W790078	Roof opening panel rear glass screws (2 required)
4	18500A18	Roof opening panel primary glass seal
5	18500A18	Roof opening sliding glass panel

NOTE: **LH shown, RH similar.**

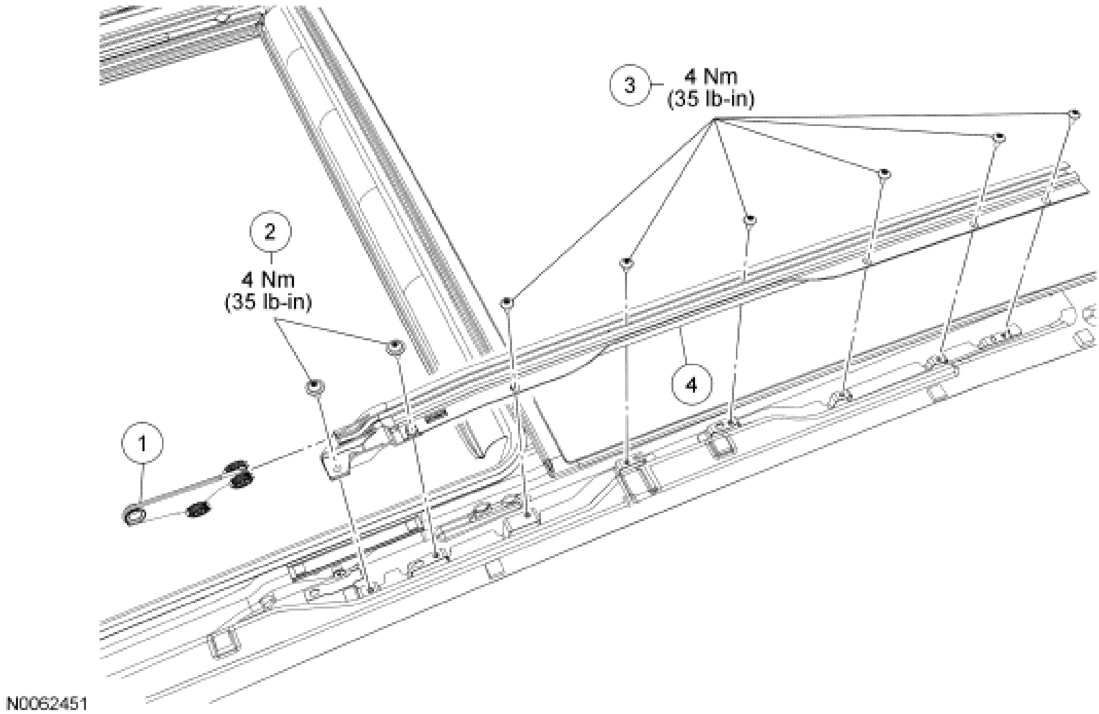


Fig. 14: Idler Track and Mechanism
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	78502M78 RH/78502M79 LH	Idler track mechanism
2	W790074	Front idler track-to-housing fasteners (2 required per side)
2	W790084	Service replacement fasteners for W790074 (use only if threaded hole becomes stripped during assembly)
3	W790073	Rear idler track-to-housing fasteners (6 required per side)
3	W790082	Service replacement fasteners for W790073 (use only if threaded hole becomes stripped during assembly)
4	78503A34 RH/7851071 LH	Idler track and mechanism

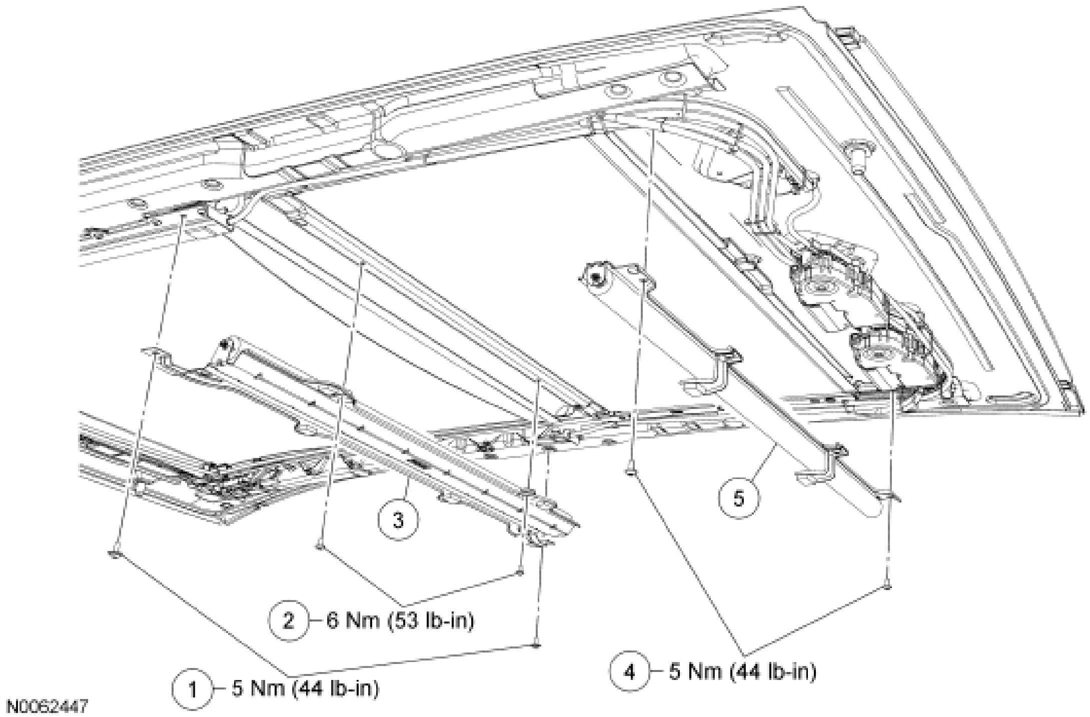


Fig. 15: Front and Rear Sunshade Assembly
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W790074	Front sunshade carrier outer screws (2 required)
1	W790084	Service replacement fasteners for W790074 (use only if threaded hole becomes stripped during assembly)
2	W790073	Front sunshade carrier center screws (2 required)
2	W790082	Service replacement fasteners for W790073 (use only if threaded hole becomes stripped during assembly)
3	78519A02	Front sunshade assembly
4	W790073	Rear sunshade carrier-to-housing screws (2 required)
4	W790082	Service replacement fasteners for W790073 (use only if threaded hole becomes stripped during assembly)
5	78519A02	Rear sunshade assembly

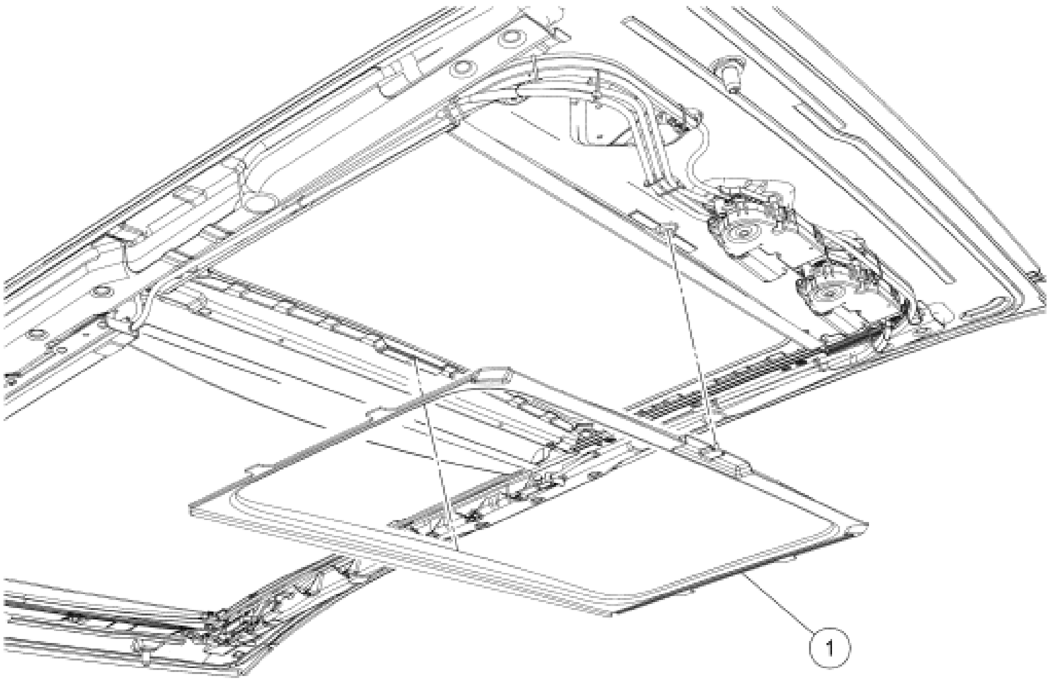


Fig. 16: Rear Trim Ring Assembly
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7850036	Rear trim ring assembly

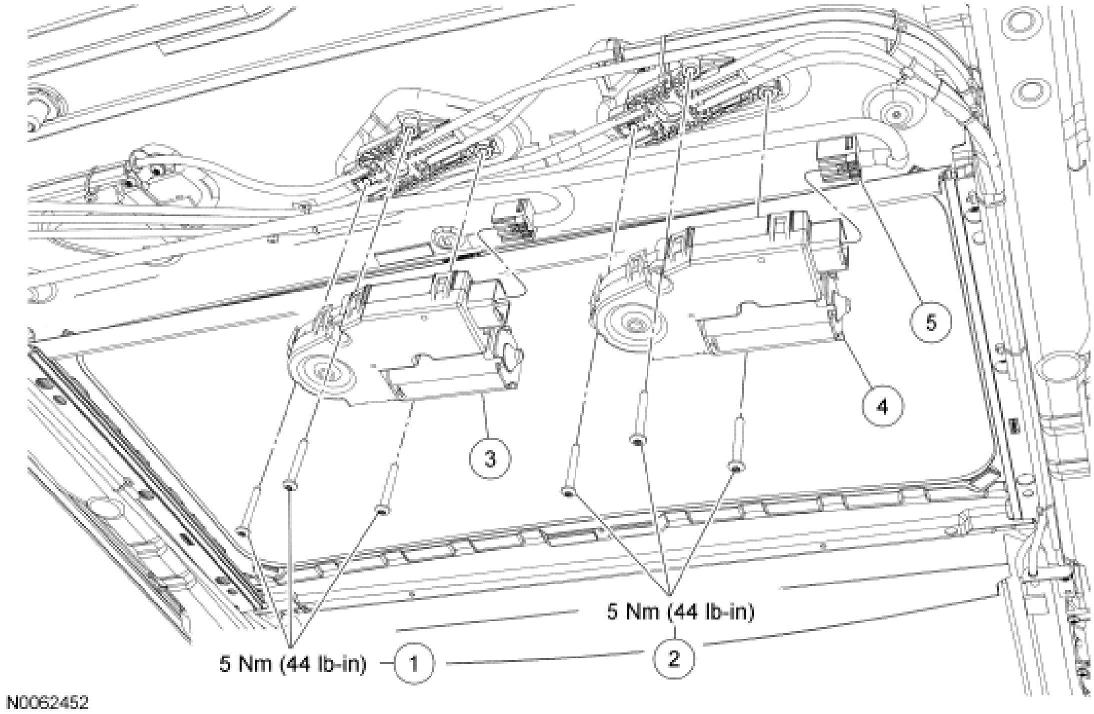


Fig. 17: Roof Opening Panel Motor(s) and Electrical
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W790077	Shade motor retaining screws (3 required)
2	W790077	Sliding glass motor retaining screws (3 required)
3	15790	Shade motor assembly (silver label)
4	15790	Sliding glass motor assembly (black label)
5	15A657	Roof opening panel motor harness assembly

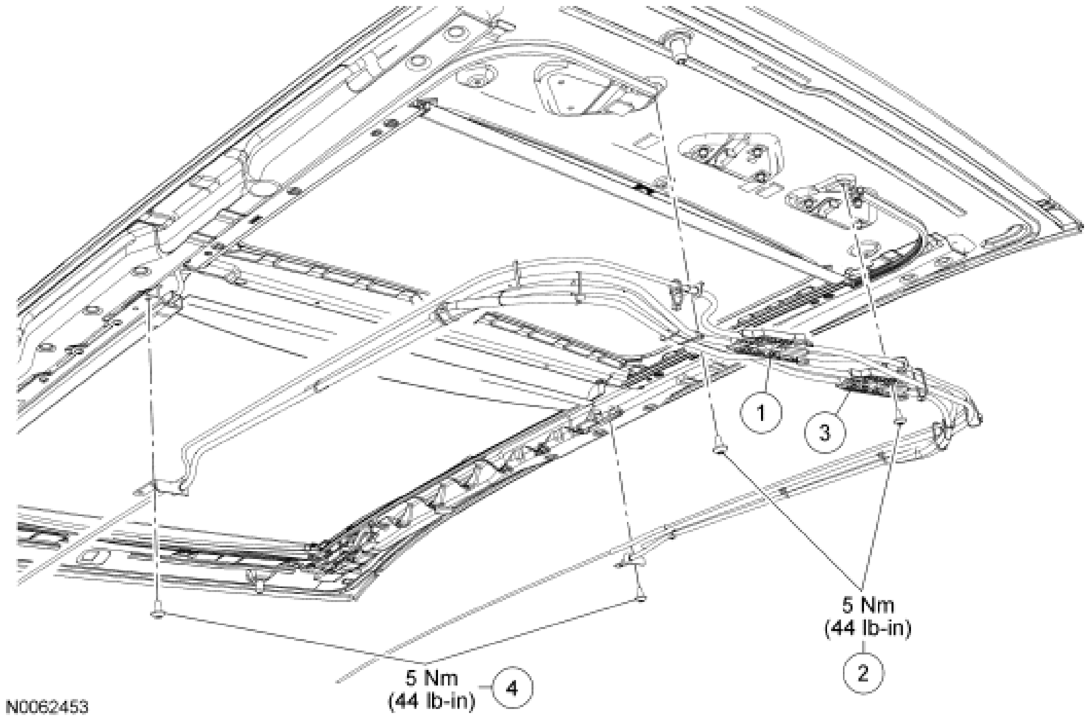


Fig. 18: Motor Block and Drive Tube Assembly
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	78502C22	Shade motor block and drive tube assembly
2	W790073	Rear drive tube bracket-to-housing screws (2 required)
2	W790082	Service replacement fasteners for W790073 (use only if threaded hole becomes stripped during assembly)
3	78502C22	Sliding glass motor block and drive tube assembly
4	W790073	Front drive tube bracket-to-guide track screws (2 required)
4	W790082	Service replacement fasteners for W790073 (use only if threaded hole becomes stripped during assembly)

NOTE: **LH shown, RH similar.**

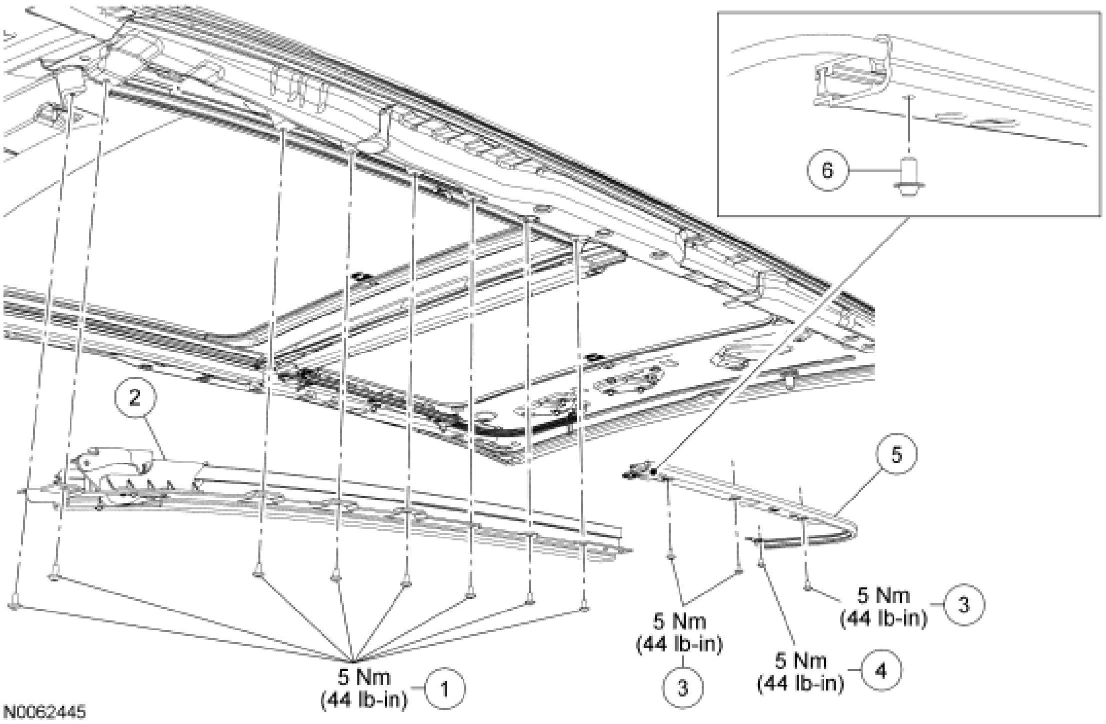


Fig. 19: Guide Tracks and Mechanisms
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W790073	Front guide track-to-housing fasteners (8 required per side)
1	W790082	Service replacement fasteners for W790073 (use only if threaded hole becomes stripped during assembly)
2	78502C07 RH/78502C06 LH	Front guide track and mechanism assembly
3	W790073	Rear shade track-to-housing fasteners (3 required per side)
3	W790082	Service replacement fasteners for W790073 (use only if threaded hole becomes stripped during assembly)
4	W790073	Rear shade track-to-drive tube bracket screws (1 required per side)
4	W790082	Service replacement fasteners for W790073 (use only if threaded hole becomes stripped during assembly)
5	78500B01 LH/78500B02 RH	Rear shade track and mechanism assembly
6	W790075	Stop screw (1 required per side)

NOTE: LH shown, RH similar.

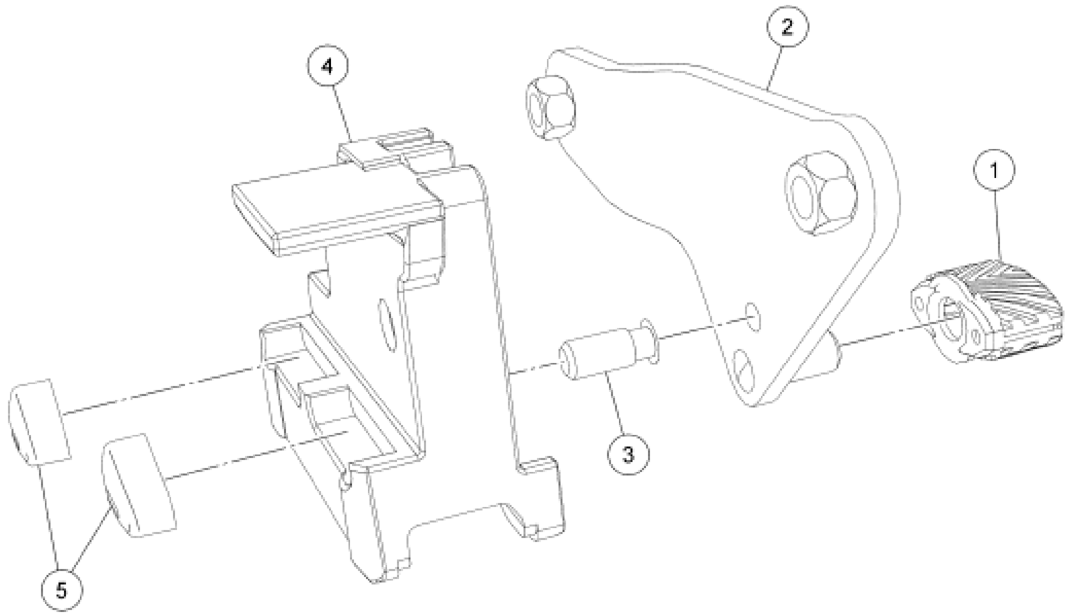


Fig. 20: Front Guide Track Mechanism
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Outer guide foot (PIA to guide track and mechanism assembly)
2	-	Sliding glass bracket (PIA to guide track and mechanism assembly)
3	-	Sliding glass bracket pin (PIA to guide track and mechanism assembly)
4	-	Guide mechanism (PIA to guide track and mechanism assembly)
5	-	Inner guide feet (2 required per side) (PIA to guide track and mechanism assembly)

1. For additional information, refer to the individual procedures in this service information.

AIR DEFLECTOR

REMOVAL AND INSTALLATION

NOTE: There may be a special service replacement fastener available if a screw hole

becomes stripped during installation. For additional information, refer to Roof Opening Panel - Exploded View .

1. Position the roof opening panel glass to the full OPEN position.
2. Remove the 2 air deflector-to-track screws and air deflector arm capture plate.

NOTE: If the nut plate(s) becomes stripped during installation, a new nut plate can be installed. For additional information, refer to Roof Opening Panel - Exploded View.

- To install, tighten to 2 N.m (18 lb-in).

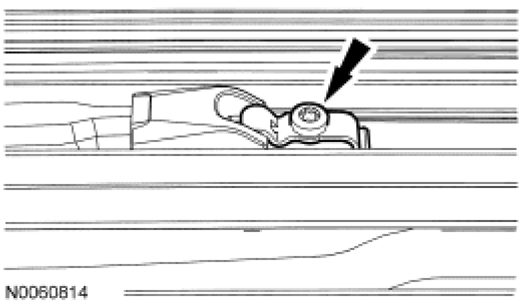


Fig. 21: Identifying Air Deflector-To-Track Screws
Courtesy of FORD MOTOR CO.

3. Remove the 6 air deflector catcher bracket screws.
   - To install, tighten to 2 N.m (18 lb-in).

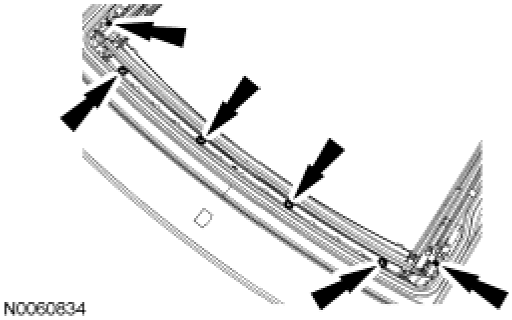


Fig. 22: Locating Air Deflector Catcher Bracket Screws
Courtesy of FORD MOTOR CO.

4. Remove the air deflector assembly.
5. To install, reverse the removal procedure.

ROOF OPENING PANEL CONTROL SWITCH

REMOVAL AND INSTALLATION

1. Remove the overhead console. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
2. Disengage the clips and remove the switch from the overhead console.
3. To install, reverse the removal procedure.

ROOF OPENING PANEL BLIND

REMOVAL AND INSTALLATION

1. Open the roof opening panel to the VENT position.
2. Detach the top of the concertina blind from the moving glass frame.
3. Open the roof opening panel to the fully OPEN position.
4. Detach the bottom of the concertina blind from the guide track and remove the blind.
    - To install, the blind should be attached to the guide track in the most forward position.
5. To install, reverse the removal procedure.

ROOF OPENING PANEL GLASS - FRONT SLIDING

REMOVAL AND INSTALLATION

1. Open the roof opening panel to the VENT position.
2. Detach the top of the concertina blind from the moving glass frame.
3. Reposition the sliding glass panel to any position rearward of VENT position.
4. Remove the 4 roof opening panel glass front screws.
    - To install, tighten to 8 N.m (71 lb-in).

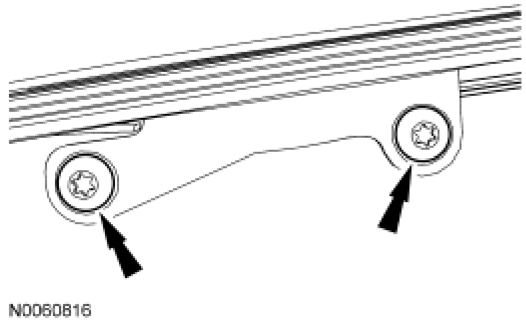


Fig. 23: Identifying Roof Opening Panel Glass Front Screws
Courtesy of FORD MOTOR CO.

5. Remove the 2 roof opening panel glass rear screws.
    - To install, tighten to 8 N.m (71 lb-in).

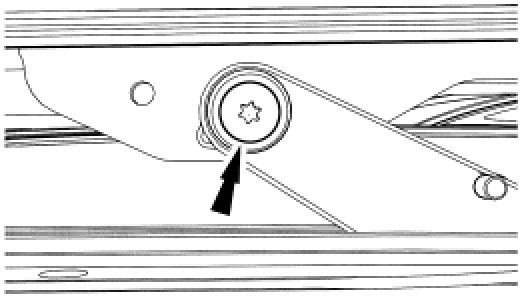


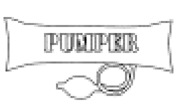
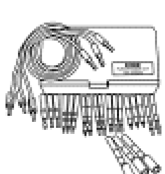
Fig. 24: Identifying Roof Opening Panel Glass Rear Screws
Courtesy of FORD MOTOR CO.

NOTE: It is possible for the idler mechanism to move freely once the glass panel is removed. Do not move the idler rearward or it may disengage from the idler track.

6. Carefully remove the roof opening panel glass.
7. To install, reverse the removal procedure.
   - Initialize the roof opening panel motor(s). For additional information, refer to **Roof Opening Panel Motor Initialization**.

ROOF OPENING PANEL GLASS - REAR FIXED

Special Tools

Illustration	Tool Name	Tool Number
	The Pumper	164-R2459 or equivalent
	Rotunda Interior Auto Glass Cut-Out Knife Kit	164-R2450 or equivalent

Material

Item	Specification
Dow Urethane Adhesive Betaseal® Express	-
Dow Urethane One Step Glass Primer Betaprime® 5500/5500A/5500SA	-
Sika Urethane Adhesive	

Sika Tack ASAP	-
Sika Urethane Metal and Glass Primer Sika 206 G+P	-
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

REMOVAL

1. Remove the roof opening panel sliding glass. For additional information, refer to **Roof Opening Panel Glass - Front Sliding**.
2. Remove the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
3. Remove the rear fixed glass interior trim ring. For additional information, refer to **Roof Opening Panel Trim - Fixed Glass, Interior**.

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow this instruction may result in serious personal injury.**

NOTE: Make sure the cutting blades are changed where the cutting depth changes to avoid damage to the body and trim panels.

NOTE: Lubricate the urethane adhesive with water to aid the special tool when cutting the urethane adhesive. Using the special tool, place the flat side of the knife against the rear glass.

NOTE: Using the special tool 164-R2459 (or equivalent), distance the roof opening panel fixed glass from the roof module as needed.

4. Refer to the adhesive path illustration and cut as follows:

   NOTE: Use caution when cutting to prevent damage to the fixed glass front trim seal.

   1. From the inside of the vehicle, start at the front and work towards the front corners.

   NOTE: Use caution when cutting to prevent damage to the side trim seals.

   2. Continue working along the side and towards the rear corners.
   3. Continue around the inside rear adhesive path.

NOTE: **Use caution when cutting along the side to prevent damage to the side trim seals.**

4. From the inside of the vehicle, work along the side of the glass.
5. From the inside of the vehicle, work from the center towards the rear corners.

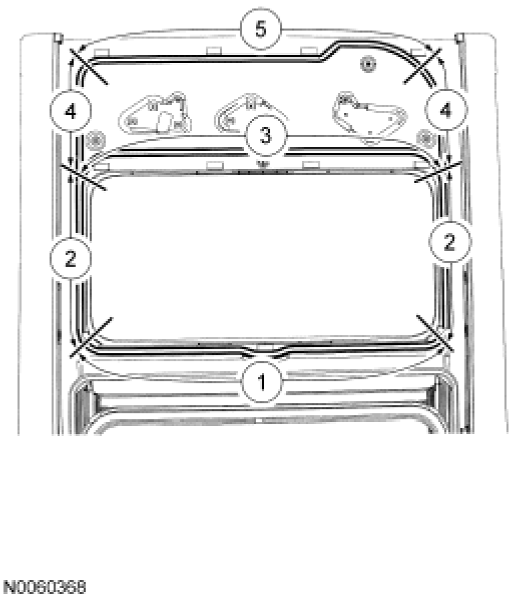


Fig. 25: Identifying Adhesive Path
Courtesy of FORD MOTOR CO.

5. Remove the fixed glass panel assembly.

NOTE: **Make sure the water channel is free from any foreign material.**

6. Using a soft brush or vacuum, remove any dirt or foreign material from the roof opening panel module.

INSTALLATION

NOTE: **For additional material guidelines, refer to the manufacturer's installation information.**

NOTE: **Avoid scratching the painted surfaces. For minor scratches or exposed metal, see the manufacturer's recommendations.**

1. Using an appropriate tool, trim the urethane adhesive leaving a 1-2 mm (0.04-0.08 in) base of original equipment urethane along the roof opening module surface.

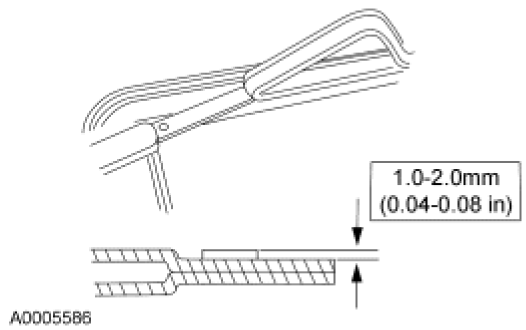


Fig. 26: Trimming Pinch Weld Urethane Adhesive
Courtesy of FORD MOTOR CO.

2. Clean the inside of the glass surface with glass cleaner.

NOTE:	**Be sure to use the same brand of cure-rate products for the adhesive and primer. Do not mix different brands of urethane and primer. Refer to the Materials Chart in this procedure.**

3. Cut the urethane adhesive applicator tip to the specification.

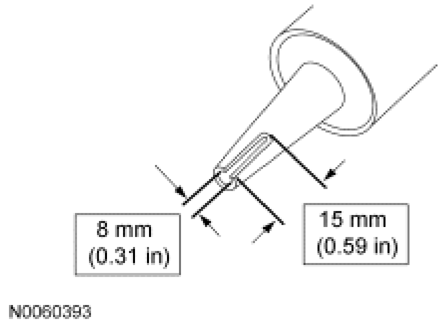


Fig. 27: Cutting Urethane Adhesive Applicator Tip To Specification
Courtesy of FORD MOTOR CO.

NOTE:	**The glass panel must be positioned within 10 minutes of applying the urethane adhesive.**

NOTE:	**Use either a high-ratio, electric or battery-operated caulk gun that will apply the urethane with less effort and a continuous bead.**

4. Apply urethane adhesive on top of the existing trimmed urethane adhesive bead. Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead.

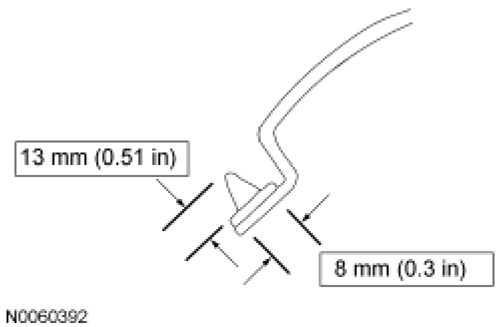


Fig. 28: Making Sure That All Gaps In Urethane Adhesive Are Smoothed Into One Continuous Bead
Courtesy of FORD MOTOR CO.

WARNING: **Do not drive vehicle until the urethane seal has cured. Follow urethane manufacturer's curing directions. Inadequate or incorrect curing of the urethane seal will adversely affect glass retention. Failure to follow these instructions may result in serious injury to vehicle occupant(s).**

NOTE: Before positioning the glass panel, open vehicle windows to prevent the air pressure of closing doors from affecting the adhesive bond.

5. Apply the fixed glass panel assembly to the roof module. Work the glass panel down using only vertical pressure.
6. Install the rear fixed glass interior trim ring. For additional information, refer to **Roof Opening Panel Trim - Fixed Glass, Interior**.
7. Install the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
8. Install the roof opening panel sliding glass. For additional information, refer to **Roof Opening Panel Glass - Front Sliding**.

ROOF OPENING PANEL GUIDE TRACK AND MECHANISM

REMOVAL

NOTE: There may be a special service replacement fastener available if a screw hole becomes stripped during installation. For additional information, refer to Roof Opening Panel - Exploded View .

1. Remove the roof opening panel blind. For additional information, refer to **Roof Opening Panel Blind**.
2. Remove the roof opening panel sliding glass. For additional information, refer to **Roof Opening Panel Glass - Front Sliding**.

NOTE: LH shown, RH similar.

3. Remove the air deflector-to-track screw and air deflector arm capture plate on the affected track.

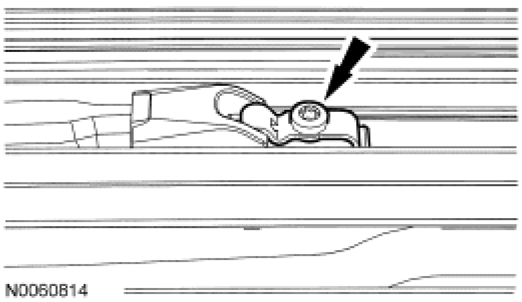


Fig. 29: Identifying Air Deflector-To-Track Screws
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

4. Remove the air deflector catcher bracket outer screw on the affected track.

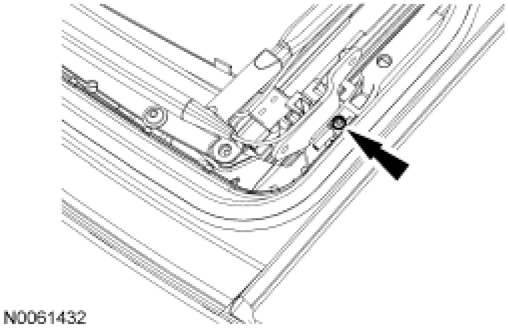


Fig. 30: Locating Air Deflector Catcher Bracket Outer Screw
Courtesy of FORD MOTOR CO.

5. Remove the front shade assembly. For additional information, refer to **Roof Opening Panel Shade Assembly**.
6. Remove the roof opening panel sliding glass motor. For additional information, refer to **Roof Opening Panel Motor - Sliding Front Panel**.
7. Move the sliding glass mechanism to the full forward position on the affected track.
8. Remove the front drive tube bracket-to-guide-track screw.

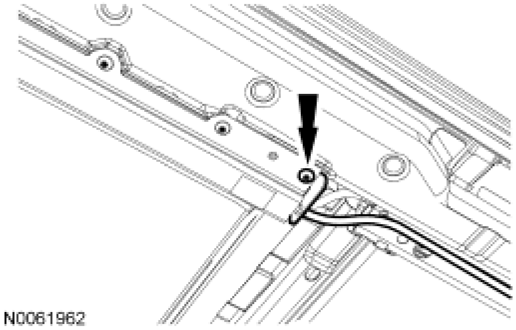


Fig. 31: Locating Front Drive Tube Bracket-To-Guide-Track Screw
Courtesy of FORD MOTOR CO.

NOTE:	**Carefully mark the location of the guide track in 3 places before removing any fasteners. The new guide track must be installed in exactly the same position.**

9. Remove the 8 front track-to-housing screws.

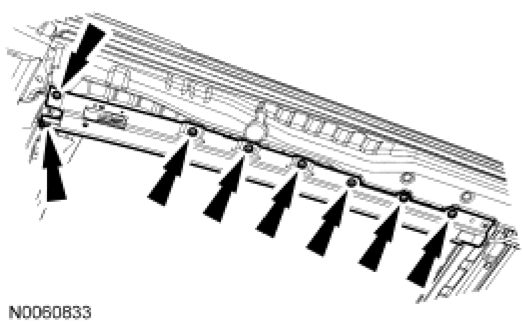


Fig. 32: Locating Front Track-To-Housing Screws
Courtesy of FORD MOTOR CO.

NOTE:	**Protect the vehicle interior from grease when cable assembly is withdrawn from the drive tube.**

10. Drop the front of the guide track down while sliding the entire track and mechanism assembly forward and down. The drive cable will slowly withdraw from the drive tube until the entire assembly is free.

INSTALLATION

NOTE:	**Protect the vehicle interior from grease when cable assembly is inserted into the drive tube.**

1. While holding the track and mechanism assembly, slowly insert the sliding glass drive cable into the drive tube. Insert the shade cable into the track and make sure the front drive tube bracket is fully seated into the track assembly.

2. Install the 8 front track-to-housing screws.
    - Align the track to the marks previously made. Tighten to 5 N.m (44 lb-in).

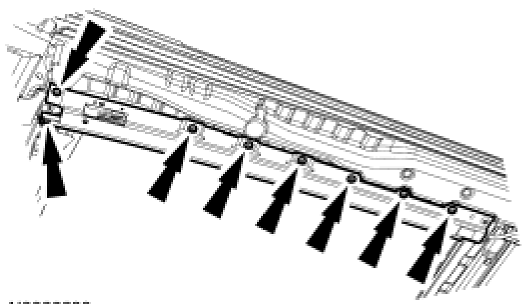


Fig. 33: Locating Front Track-To-Housing Screws
Courtesy of FORD MOTOR CO.

3. Install the front drive tube bracket-to-guide-track screw. Tighten to 5 N.m (44 lb-in).

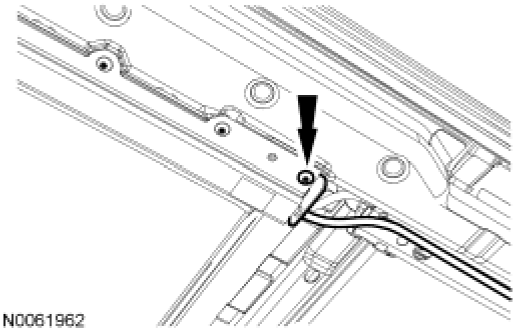


Fig. 34: Locating Front Drive Tube Bracket-To-Guide-Track Screw
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

4. Install the air deflector catcher bracket outer screw on the affected track.
    - Tighten to 2 N.m (18 lb-in).

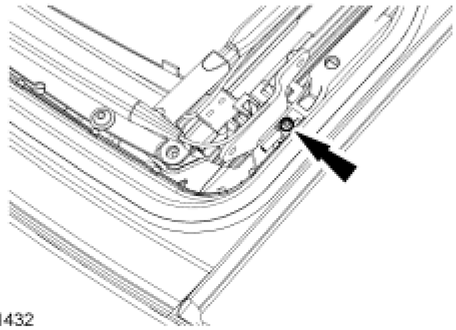


Fig. 35: Locating Air Deflector Catcher Bracket Outer Screw
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

5. Install the air deflector-to-track screw and air deflector arm capture plate on the affected track.

   NOTE: If the nut plate(s) becomes stripped during installation, a new nut plate can be installed. For additional information, refer to Roof Opening Panel - Exploded View.

   - Tighten to 2 N.m (18 lb-in).

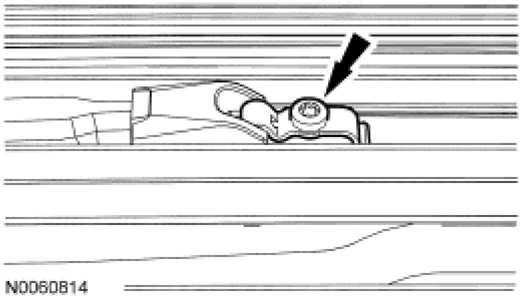


Fig. 36: Identifying Air Deflector-To-Track Screws
Courtesy of FORD MOTOR CO.

6. Attach the bottom of the concertina blind to the guide track in the most forward position.

NOTE: Do not install the headliner at this time.

7. Install the front shade assembly but do not carry out the roof opening panel motor initialization. For additional information, refer to **Roof Opening Panel Shade Assembly**.
8. Re-time the roof opening panel. For additional information, refer to **Timing Adjustment**.

ROOF OPENING PANEL IDLER TRACK MECHANISM

REMOVAL AND INSTALLATION

1. Remove the roof opening panel sliding glass. For additional information, refer to **Roof Opening Panel Glass - Front Sliding**.
2. Remove the roof opening panel side trim. For additional information, refer to **Roof Opening Panel Trim - Side**.
3. Carefully slide the idler link forward and out of the front of the track.

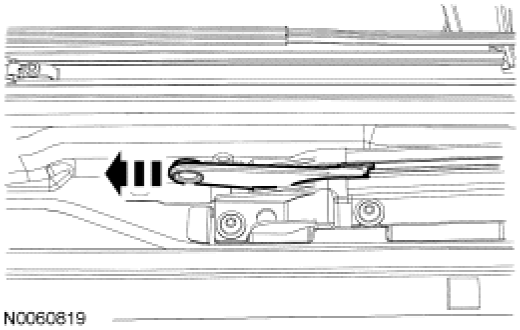


Fig. 37: Sliding Idler Link Forward & Out Of Front Of Track
Courtesy of FORD MOTOR CO.

NOTE: Make sure the idler mechanism guide shoes are compressed and aligned correctly during installation. The guide shoes cannot be serviced separately.

4. To install, reverse the removal procedure.

ROOF OPENING PANEL IDLER TRACK AND MECHANISM

REMOVAL

NOTE: There may be a special service replacement fastener available if a screw hole becomes stripped during installation. For additional information, refer to Roof Opening Panel - Exploded View .

1. Remove the roof opening panel sliding glass. For additional information, refer to **Roof Opening Panel Glass - Front Sliding**.
2. Remove the roof opening panel side trim. For additional information, refer to **Roof Opening Panel Trim - Side**.
3. If installing a new roof opening panel idler track, carefully slide the idler link forward and out of the track.

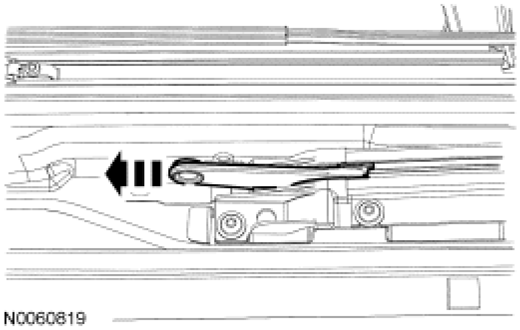


Fig. 38: Sliding Idler Link Forward & Out Of Front Of Track
Courtesy of FORD MOTOR CO.

NOTE: **Carefully mark the location of the idler track in 3 places before removing any fasteners. The new idler track must be installed in exactly the same position.**

NOTE: **LH shown, RH similar.**

4. Remove the 6 rear idler track-to-housing screws.

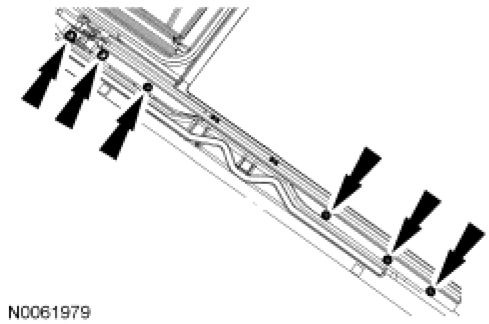


Fig. 39: Locating Rear Idler Track-To-Housing Screws
Courtesy of FORD MOTOR CO.

NOTE: **The center rear idler track-to-housing screws will be captured inside the track rail. In some cases, it may be necessary to lift rails to completely remove screws from roof threads to allow idler track removal.**

5. Completely loosen the 2 center rear idler track-to-housing screws.

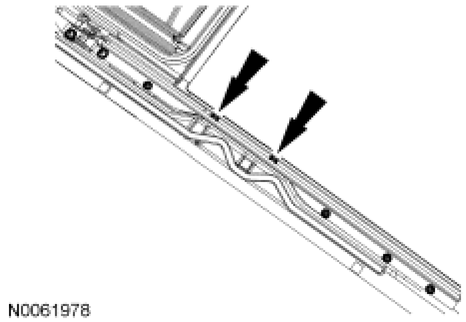


Fig. 40: Locating Center Rear Idler Track-To-Housing Screw
Courtesy of FORD MOTOR CO.

6. Slide track rearward to disengage front clip and remove assembly.
7. Remove the 2 center rear idler track-to-housing screws from the idler track.

INSTALLATION

1. Install the 2 center rear idler track-to-housing screws into the roof opening module by hand. Make sure

they are seated all the way.

2. If slots are not already present in the idler track, the idler track will need to be modified prior to installation. Using a small die grinder or equivalent, cut 2 clearance slots on the inside edge of the idler track to the specification shown.

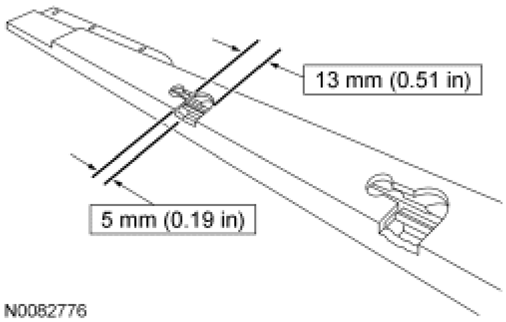


Fig. 41: Identifying Idler Track
Courtesy of FORD MOTOR CO.

3. Position the idler track into the roof module. The slots will allow clearance of the 2 center rear idler track-to-housing screws.
4. Loosen the 2 center rear idler track-to-housing screws as necessary to allow the idler track to slide forward to engage the front clip.
   - Align the idler track to the alignment marks made previously.
5. Install the remaining 6 rear idler track-to-housing screws and tighten to 4 Nm (35 lb-in).

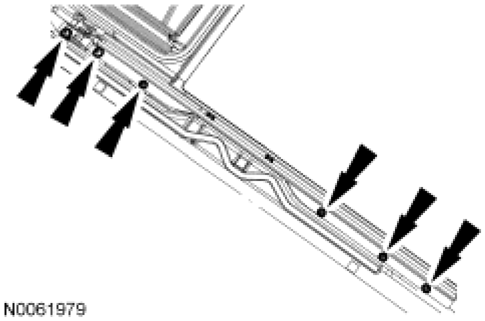


Fig. 42: Locating Rear Idler Track-To-Housing Screws
Courtesy of FORD MOTOR CO.

6. Tighten the 2 center rear idler track-to-housing screws to 4 Nm (35 lb-in).

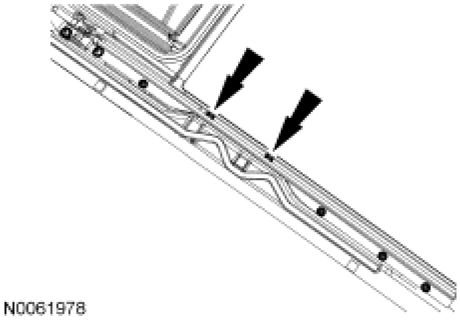
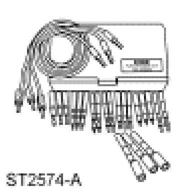


Fig. 43: Locating Center Rear Idler Track-To-Housing Screw
Courtesy of FORD MOTOR CO.

7. If installing a new roof opening panel idler track, install the link into the idler track. Make sure the idler mechanism guide shoes are compressed and aligned correctly during installation.
8. Install the roof opening panel sliding glass. For additional information, refer to **Roof Opening Panel Glass - Front Sliding**.
9. Test the operation of the roof opening panel. If roof opening panel glass appears to bind or move slowly, remove the roof opening panel sliding glass and repeat Steps 4 through 8.
10. Install the roof opening panel side trim panel. For additional information, refer to **Roof Opening Panel Trim - Side**.

ROOF OPENING PANEL MODULE

Special Tools

Illustration	Tool Name	Tool Number
	Rotunda Interior Auto Glass Cut-Out Knife Kit	164-R2450 or equivalent

Material

Item	Specification
Dow Urethane Adhesive Betaseal® Express	-
Dow Urethane One Step Glass Primer Betaprime® 5500/5500A/5500SA	-
Sika Urethane Adhesive Sika Tack ASAP	-
Sika Urethane Metal and Glass Primer Sika 206 G+P	-

REMOVAL

NOTE: If installing a new roof opening panel module assembly, the following components will need to be transferred from the original assembly: concertina blinds, front and rear shade assemblies, roof opening panel sliding glass, roof opening panel shade motor and roof opening panel sliding glass motor.

1. Remove the ditch moldings and clip strips.
2. Remove the concertina blinds. For additional information, refer to **Roof Opening Panel Blind**.
3. Remove the roof opening sliding glass panel. For additional information, refer to **Roof Opening Panel Glass - Front Sliding**.
4. Remove the air deflector assembly. For additional information, refer to **Air Deflector**.
5. Remove the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
6. Remove the roof opening panel front trim. For additional information, refer to **Roof Opening Panel Trim - Front**.
7. Remove the roof opening panel side trim panels. For additional information, refer to **Roof Opening Panel Trim - Side**.
8. Disconnect the roof opening panel electrical harness connector.

   NOTE: Do not open the liftgate during this procedure.

   NOTE: Make sure the cutting blades are changed where the cutting depth changes to avoid damage to the body and trim panels.

   NOTE: Lubricate the urethane adhesive with water to aid the special tool when cutting the urethane adhesive. Using the special tool, place the flat side of the knife against the roof module.

9. Refer to the adhesive path illustration and cut as follows:

   NOTE: Use caution when cutting to prevent damage to the windshield glass seal.

   1. From the outside of the vehicle, start at the center and work towards the front corners and around the locator pin.

      NOTE: Add wedges as necessary to separate the roof opening panel module from the body to relieve pressure on the cutting blade.

   2. From the outside of the vehicle, continue working along the side and towards the rear corners.

      NOTE: Add wedges as necessary to separate the roof opening panel module from the body to relieve pressure on the cutting blade.

3. From the inside of the vehicle, work from the center towards the rear corners and around the rear locator pin.

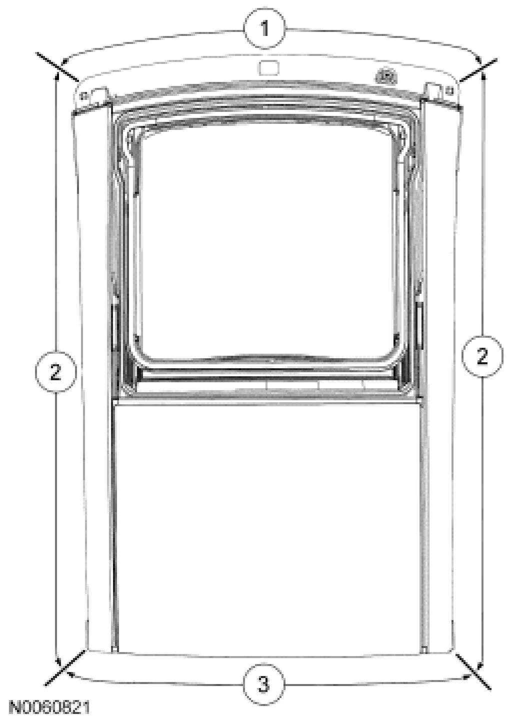


Fig. 44: Identifying Adhesive Path On Vehicle
Courtesy of FORD MOTOR CO.

10. With the aid of an assistant, remove the roof opening panel module assembly.

INSTALLATION

NOTE: **When installing urethane-installed parts, the vehicle must not be driven until the urethane has cured. Adequate cure time is specified on the drive away chart for each urethane product as the temperatures and humidity vary. Inadequate or incorrect curing can adversely affect the retention of the roof opening panel module assembly.**

NOTE: **For additional material guidelines, refer to the manufacturer's installation information.**

NOTE: **Avoid scratching the painted surfaces. For minor scratches or exposed metal, see the manufacturer's recommendations.**

1. Using an appropriate tool, trim the urethane adhesive leaving no more than 1 mm (0.03 in) base of original equipment urethane along the roof opening module body mounting surface.

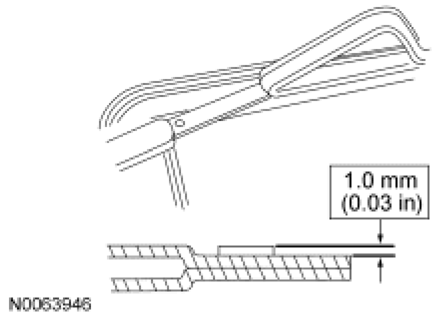


Fig. 45: Trimming Urethane Adhesive Leaving No More Than 1 Mm (0.03 in) base of original equipment urethane
Courtesy of FORD MOTOR CO.

2. Using a soft brush or vacuum, remove any dirt or foreign material from the vehicle body roof opening panel module flanges.
3. Make sure the locator pin holes are cleared of any foreign material which would affect installation of the new roof opening panel module.

NOTE: **Be sure to use the same brand of cure-rate products for the adhesive and primer. Do not mix different brands of urethane and primer. Refer to the Materials Chart in this procedure.**

4. Cut the urethane adhesive applicator tip to the specification.

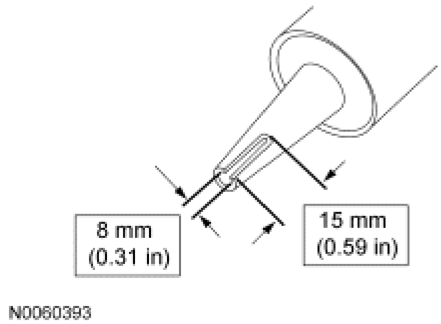
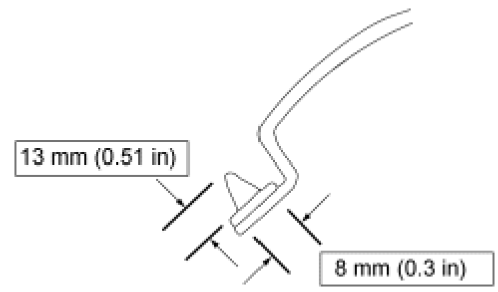


Fig. 46: Cutting Urethane Adhesive Applicator Tip To Specification
Courtesy of FORD MOTOR CO.

NOTE: **Use either a high-ratio, electric or battery-operated caulk gun that will apply the urethane with less effort and a continuous bead.**

5. Apply urethane adhesive on top of the existing trimmed urethane adhesive bead. Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead.



N0060392

Fig. 47: Making Sure That All Gaps In Urethane Adhesive Are Smoothed Into One Continuous Bead
Courtesy of FORD MOTOR CO.

6. Install the roof opening panel module assembly.

    NOTE: Make sure the roof opening panel module assembly does not come into contact with the adhesive bead.

    1. With the aid of assistants, hold the roof opening panel module assembly approximately 50.8 mm (2 in) over the body structure.
    2. Line up the locator pin to the front hole and rear guide pin to the rear hole.

    NOTE: Make sure the windshield molding does not get pinched under the roof opening panel module assembly.

    NOTE: Make sure the roof opening panel module is lowered straight down and does not shift.

    3. Carefully lower the roof opening panel module assembly into position on the body.

NOTE: When installing urethane-installed parts, the vehicle must not be driven until the urethane has cured. Adequate cure time is specified on the drive away chart for each urethane product as the temperatures and humidity vary. Inadequate or incorrect curing can adversely affect the retention of the roof opening panel module assembly.

7. Firmly apply downward pressure to the entire sealing edges of the roof opening panel module assembly to make sure it is seated correctly.
8. Install the air deflector assembly. For additional information, refer to **Air Deflector**.
9. Attach the bottom of the concertina blind to the guide track in the most forward position.

NOTE: Do not install the headliner at this time.

10. If installing a new roof opening panel module assembly, install the front and rear shade assemblies but do

not carry out the roof opening panel motor initialization at this time. For additional information, refer to **Roof Opening Panel Motor - Shades**.

11. Manually move the sliding front glass mechanisms forward until they are flush against the track hard-stops.
12. Carefully move the front and rear shades rearward to the fully OPEN position by pushing at the edges closest to the tracks.

NOTE: Do not install the headliner at this time.

13. Install the roof opening panel shade motor but do not carry out the roof opening panel motor initialization at this time. For additional information, refer to **Roof Opening Panel Motor - Shades**.

NOTE: Do not install the headliner at this time.

14. Install the roof opening panel sliding glass motor but do not carry out the roof opening panel motor initialization at this time. For additional information, refer to **Roof Opening Panel Motor - Sliding Front Panel**.
15. Connect the roof opening panel electrical harness connector.
16. Install the antenna. For additional information, refer to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
17. Install the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
18. With the roof opening sliding glass panel still removed, initialize the roof opening panel motor(s). For additional information, refer to **Roof Opening Panel Motor Initialization**.

NOTE: Press the glass open switch to move the mechanisms rearward to allow installation of the sliding glass panel.

NOTE: It will be necessary to carry out the initialization procedure again after the glass panel is installed.

19. Install the roof opening panel sliding glass. For additional information, refer to **Roof Opening Panel Glass - Front Sliding**.
20. Install the ditch moldings and clip strips.

ROOF OPENING PANEL MOTOR BLOCK AND DRIVE TUBE ASSEMBLY - SHADES

REMOVAL

NOTE: There may be a special service replacement fastener available if a screw hole becomes stripped during installation. For additional information, refer to Roof Opening Panel - Exploded View .

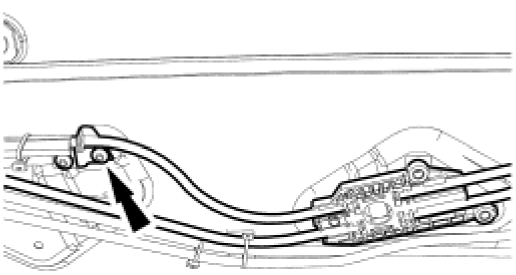
1. Remove the roof opening panel sliding glass. For additional information, refer to **Roof Opening Panel**

Glass - Front Sliding.

2. Remove the front and rear shade assemblies. For additional information, refer to **Roof Opening Panel Motor - Shades**.
3. Remove the roof opening panel shade motor. For additional information, refer to **Roof Opening Panel Motor - Shades**.
4. Remove the roof opening panel sliding glass motor. For additional information, refer to **Roof Opening Panel Motor - Sliding Front Panel**.
5. Manually move the sliding front glass mechanisms and shade mechanisms rearward.

NOTE: LH shown, RH similar.

6. Remove the LH and RH rear drive tube bracket-to-housing screws.



N0062485

Fig. 48: Locating LH & RH Rear Drive Tube Bracket-To-Housing Screws
Courtesy of FORD MOTOR CO.

NOTE: Make note of all the cable wrap locations, they must be reinstalled at the exact same locations.

7. Cut cable wraps to the shade motor block and drive tube assembly.

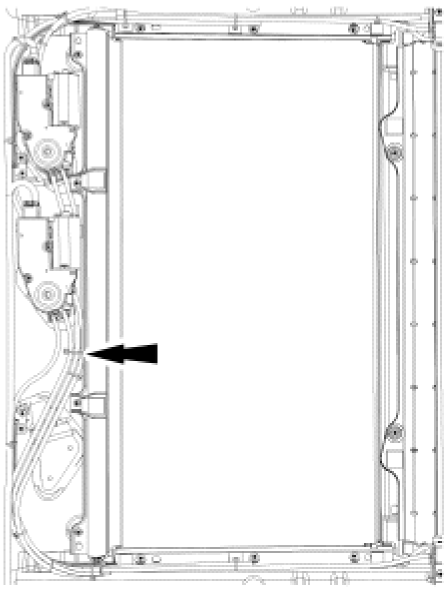

N0060826

Fig. 49: Cutting Cable Wraps To Motor Block & Drive Tube Assembly & Wiring Harness
Courtesy of FORD MOTOR CO.

NOTE:	**LH shown, RH similar.**

NOTE:	**Carefully mark the location of each guide track in 3 places before removing any fasteners. The guide tracks must be installed in exactly the same position.**

8. Remove the LH and RH rear 12 front guide track-to-housing screws.

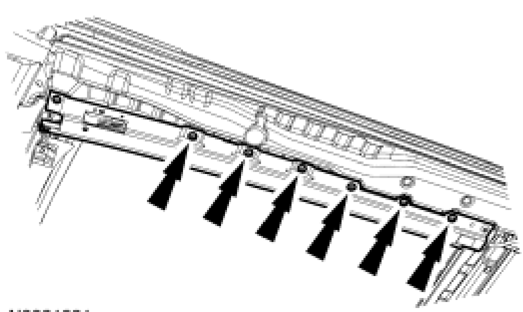

N0061961

Fig. 50: Locating LH & RH Front Guide Track-To-Housing Screws
Courtesy of FORD MOTOR CO.

NOTE:	**Carefully mark the location of each shade track in 3 places before**

removing any fasteners. The shade tracks must be installed in exactly the same position.

NOTE: **LH shown, RH similar.**

9. Remove the LH and RH 6 rear shade track-to-housing screws.

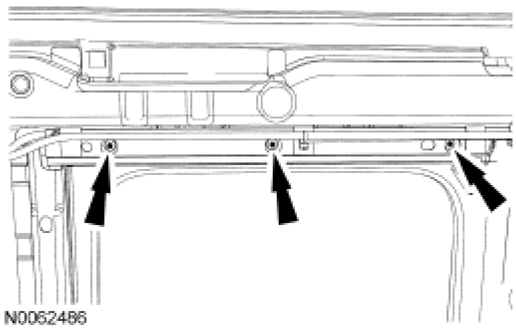


Fig. 51: Locating LH & RH Rear Shade Track-To-Housing Screws
Courtesy of FORD MOTOR CO.

NOTE: **Support the sliding glass motor block and drive tube assembly.**

NOTE: **Protect the vehicle interior from cable grease.**

10. With the rear of the front guide tracks lowered, carefully pull the front shade guide feet out of the rear of the front guide tracks to release the cable. Remove the shade tracks and the motor block and tube assembly as one unit.

NOTE: **LH shown, RH similar.**

11. Remove the LH and RH rear shade track-to-drive tube bracket screws and pull the motor block tube out of the shade track.

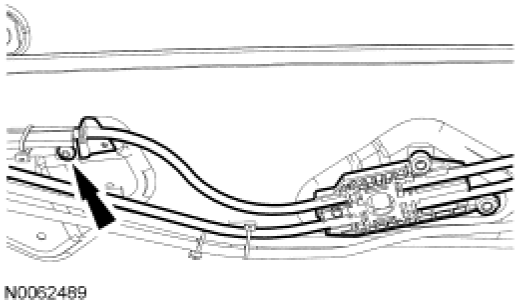


Fig. 52: Locating LH & RH Rear Shade Track-To-Drive Tube Bracket Screws
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

12. Remove the LH and RH rear shade track stop screws.

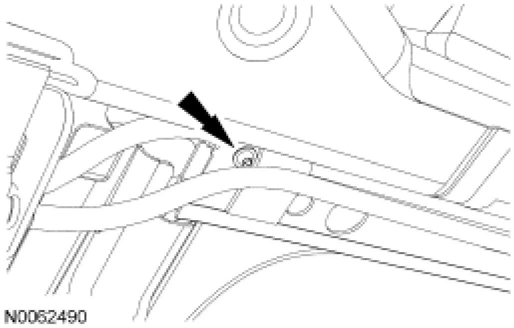


Fig. 53: Locating LH & RH Rear Shade Track Stop Screws
Courtesy of FORD MOTOR CO.

NOTE: **If installing a new LH or RH rear shade track, use the cable supplied with the replacement unit.**

13. Pull the shade cables through the front of the shade track assemblies.

INSTALLATION

NOTE: **If installing a new LH or RH rear shade track, use the cable supplied with the replacement unit.**

1. Feed the shade cables through the front of the shade track assemblies.

NOTE: **LH shown, RH similar.**

2. Install the LH and RH rear shade track stop screws.

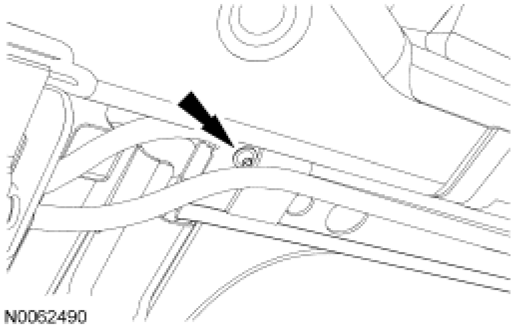


Fig. 54: Locating LH & RH Rear Shade Track Stop Screws
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

3. Push the shade motor block tubes into the rear of the shade track assemblies and install the LH and RH rear shade track-to-drive tube bracket screws.
   - Tighten to 5 N.m (44 lb-in).

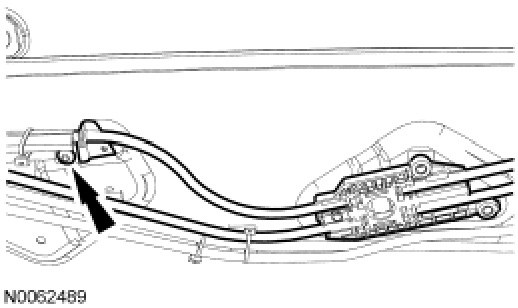


Fig. 55: Locating LH & RH Rear Shade Track-To-Drive Tube Bracket Screws
Courtesy of FORD MOTOR CO.

NOTE: Protect the vehicle interior from cable grease.

NOTE: Make sure the front drive tubes are seated fully into the front guide tracks.

4. Holding the shade tracks and the motor block and tube assembly as one unit, insert the front shade cables into the mechanisms. Move the mechanisms fully into the front guide tracks.

NOTE: LH shown, RH similar.

5. Install the center rear shade track-to-housing screws but do not tighten at this time.

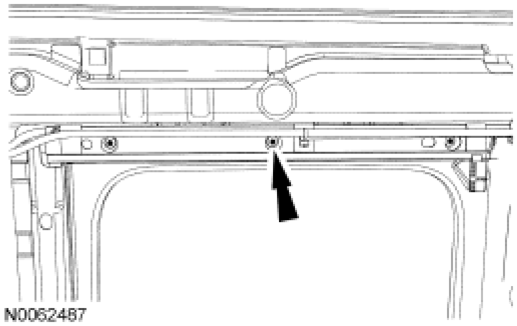


Fig. 56: Locating Center Rear Shade Track-To-Housing Screws
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

6. Install the LH and RH 12 front guide track-to-housing screws.
   - Align the track to the marks previously made. Tighten to 5 N.m (44 lb-in).

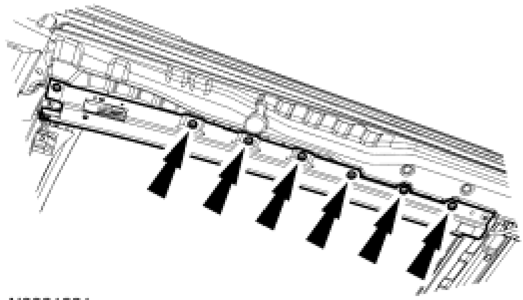


Fig. 57: Locating LH & RH Front Guide Track-To-Housing Screws
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

7. Install the remaining 4 rear shade track-to-housing screws.
   - Align the track to the marks previously made. Tighten to 5 N.m (44 lb-in).

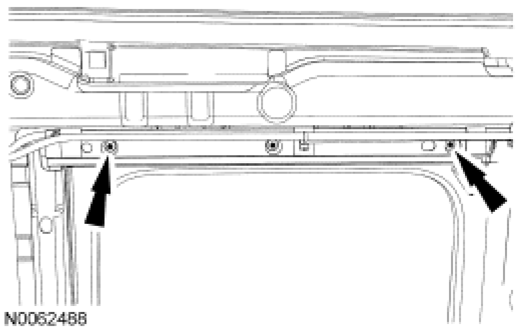


Fig. 58: Locating Rear Shade Track-To-Housing Screws
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

8. Install the LH and RH rear drive tube bracket-to-housing screws.
   - Tighten to 5 N.m (44 lb-in).

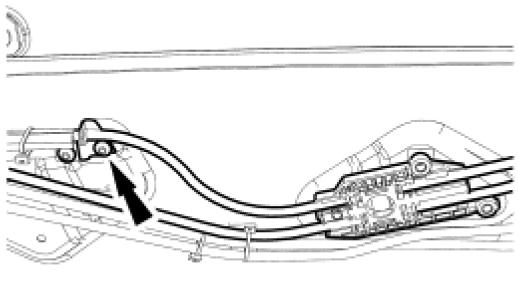


Fig. 59: Locating LH & RH Rear Drive Tube Bracket-To-Housing Screws
Courtesy of FORD MOTOR CO.

NOTE: **Be careful not to overtighten cable wraps during assembly to prevent crimping the cable sheath.**

NOTE: **The cable wraps must be reinstalled at the exact same locations.**

9. Install new cable wraps to the shade motor block and drive tube assembly.

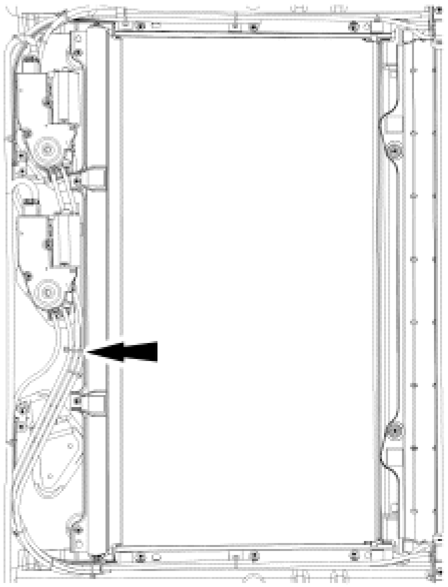


Fig. 60: Cutting Cable Wraps To Motor Block & Drive Tube Assembly & Wiring Harness
Courtesy of FORD MOTOR CO.

NOTE: **Do not install the headliner at this time.**

10. Install the front and rear shade assemblies but do not carry out the roof opening panel motor initialization at this time. For additional information, refer to **Roof Opening Panel Motor - Shades**.
11. Manually move the sliding front glass mechanisms forward until they are flush against the track hard-stops.

NOTE: Do not install the headliner at this time.

12. Install the roof opening panel sliding glass motor but do not carry out the initialization at this time. For additional information, refer to **Roof Opening Panel Motor - Sliding Front Panel** .
13. Carefully move the front and rear shades rearward to the fully OPEN position by pushing at the edges closest to the tracks.
14. Install the roof opening panel shade motor but do not carry out the initialization at this time. For additional information, refer to **Roof Opening Panel Motor - Shades**.
15. With the roof opening sliding glass panel still removed, initialize the roof opening panel motor(s). For additional information, refer to **Roof Opening Panel Motor Initialization**.

NOTE: Press the glass open switch to move the mechanisms rearward to allow installation of the sliding glass panel.

NOTE: It will be necessary to carry out the initialization procedure again after the glass panel is installed.

16. Install the roof opening panel sliding glass. For additional information, refer to **Roof Opening Panel Glass - Front Sliding**.

ROOF OPENING PANEL MOTOR BLOCK AND DRIVE TUBE ASSEMBLY - SLIDING FRONT PANEL

REMOVAL

NOTE: There may be a special service replacement fastener available if a screw hole becomes stripped during installation. For additional information, refer to Roof Opening Panel - Exploded View .

1. Remove the roof opening sliding glass panel. For additional information, refer to **Roof Opening Panel Glass - Front Sliding**.
2. Remove the front and rear shade assemblies. For additional information, refer to **Roof Opening Panel Motor - Shades**.
3. Remove the roof opening panel shade motor. For additional information, refer to **Roof Opening Panel Motor - Shades**.
4. Remove the roof opening sliding glass panel motor. For additional information, refer to **Roof Opening Panel Motor - Sliding Front Panel**.
5. Manually move the sliding front glass mechanisms and shade mechanisms rearward.

NOTE: **Make note of all the cable wrap locations, they must be reinstalled at the exact same locations.**

6. Cut cable wraps to the motor block and drive tube assembly and wiring harness.

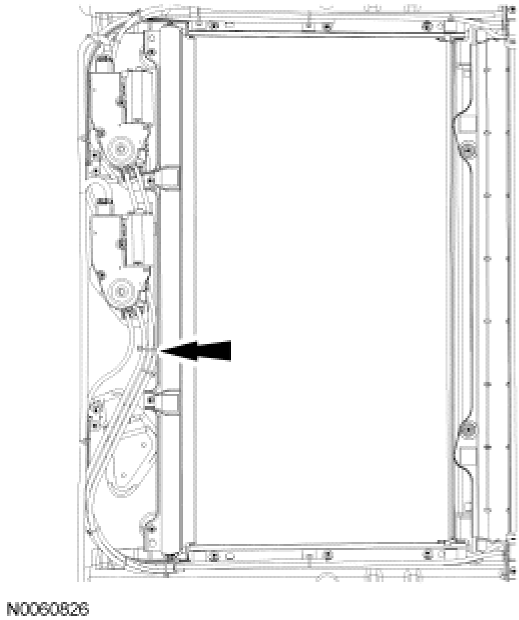


Fig. 61: Cutting Cable Wraps To Motor Block & Drive Tube Assembly & Wiring Harness
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

7. Remove the front drive tube bracket-to-guide track screws.

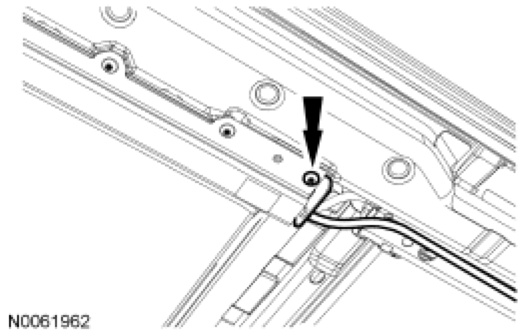


Fig. 62: Locating Front Drive Tube Bracket-To-Guide-Track Screw
Courtesy of FORD MOTOR CO.

NOTE: **Carefully mark the location of each guide track in 3 places before removing any fasteners. The guide tracks must be installed in exactly the same position.**

LH shown, RH similar.

8. Remove the LH and RH rear 12 front track-to-housing screws.

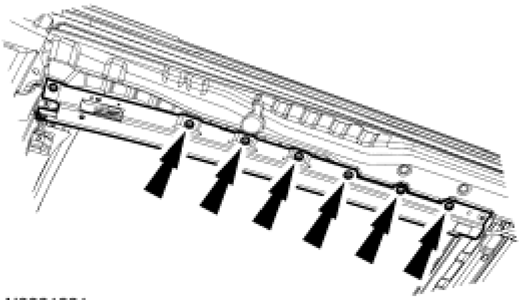


Fig. 63: Locating LH & RH Front Guide Track-To-Housing Screws
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

9. Remove the LH and RH rear drive tube bracket-to-housing screws.

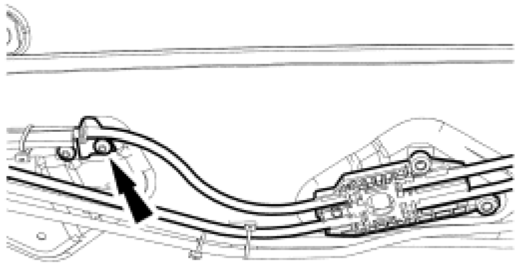


Fig. 64: Locating LH & RH Rear Drive Tube Bracket-To-Housing Screws
Courtesy of FORD MOTOR CO.

NOTE: **Carefully mark the location of each shade track in 3 places before removing any fasteners. The shade tracks must be installed in exactly the same position.**

NOTE: **LH shown, RH similar.**

NOTE: **Support the shade track and shade motor block and tube assembly.**

10. Remove the LH and RH 6 rear shade track-to-housing screws.

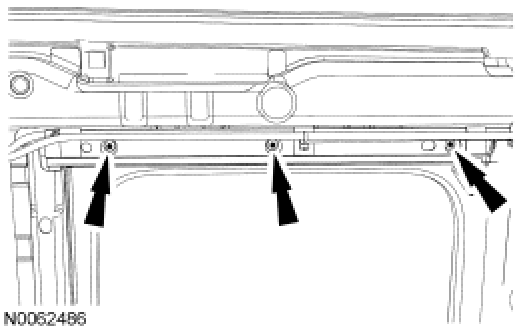


Fig. 65: Locating LH & RH Rear Shade Track-To-Housing Screws
Courtesy of FORD MOTOR CO.

NOTE: Protect the vehicle interior from cable grease.

11. Carefully pull the sliding glass front drive tube brackets out of the guide tracks.

NOTE: It is only necessary to pull the mechanisms halfway out of the guide tracks to disengage the cables. If the mechanisms are completely removed from the track, they will need to be reassembled first. For additional information, refer to Roof Opening Panel - Exploded View.

NOTE: LH shown, RH similar.

12. With the rear of the front guide tracks lowered, carefully pull the front sliding glass mechanisms halfway out of the guide tracks to disconnect the drive cables and remove the motor block and tube assembly.

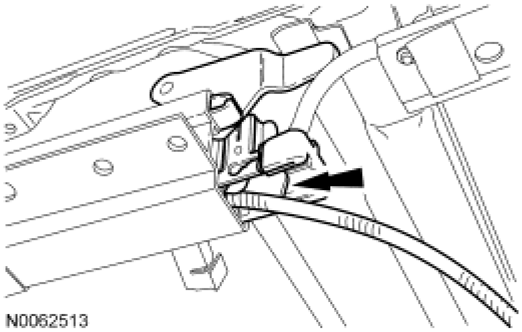


Fig. 66: Inserting Drive Cables Into Sliding Glass Mechanisms & Insert Mechanisms Completely Into Guide Tracks
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: LH shown, RH similar.

1. Insert the drive cables into the sliding glass mechanisms and insert the mechanisms completely into the guide tracks.

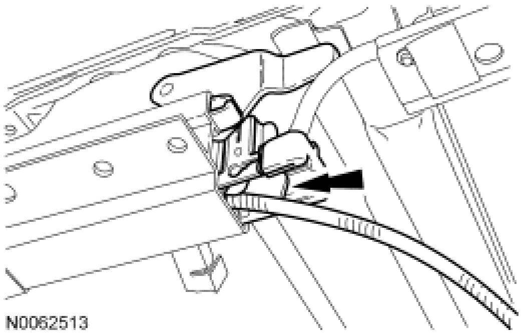


Fig. 67: Inserting Drive Cables Into Sliding Glass Mechanisms & Insert Mechanisms Completely Into Guide Tracks
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

2. Install the center rear shade track-to-housing screws but do not tighten at this time.

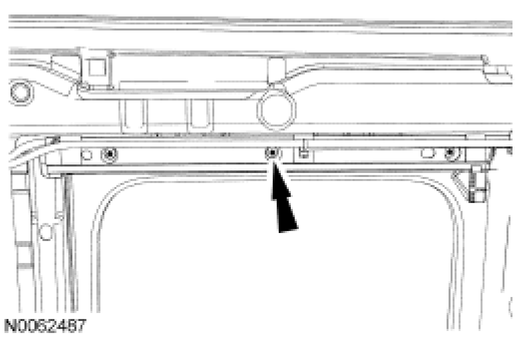


Fig. 68: Locating Center Rear Shade Track-To-Housing Screws
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

3. Install the LH and RH 12 front guide track-to-housing screws.
    - Align the track to the marks previously made. Tighten to 5 N.m (44 lb-in).

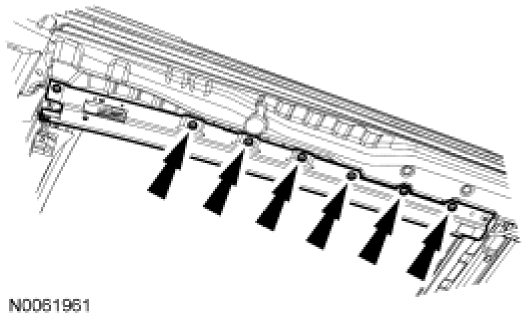


Fig. 69: Locating LH & RH Front Guide Track-To-Housing Screws
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

4. Install the front drive tube bracket-to-guide track screws.
   - Tighten to 5 N.m (44 lb-in).

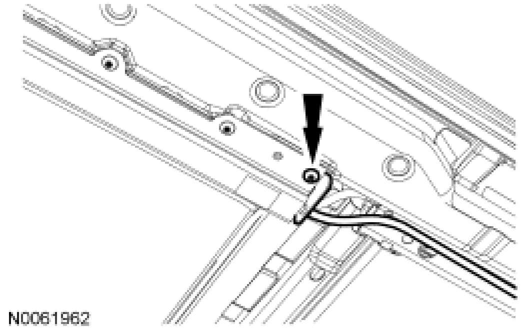


Fig. 70: Locating Front Drive Tube Bracket-To-Guide-Track Screw
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

5. Install the remaining 4 rear shade track-to-housing screws.
   - Align the track to the marks previously made. Tighten all shade track-to-housing screws to 5 N.m (44 lb-in).

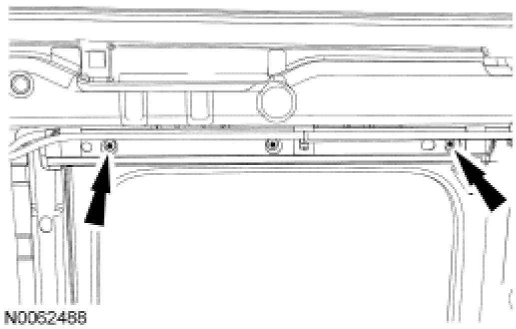


Fig. 71: Locating Rear Shade Track-To-Housing Screws
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

6. Install the LH and RH rear drive tube bracket-to-housing screws.
   - Tighten to 5 N.m (44 lb-in).

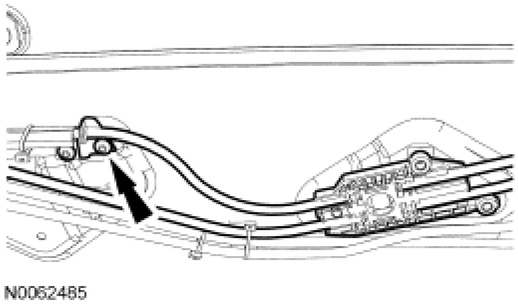


Fig. 72: Locating LH & RH Rear Drive Tube Bracket-To-Housing Screws
Courtesy of FORD MOTOR CO.

NOTE: **Be careful not to overtighten cable wraps during assembly to prevent crimping the cable sheath.**

NOTE: **The cable wraps must be reinstalled at the exact same locations.**

7. Install new cable wraps to the shade motor block and drive tube assembly.

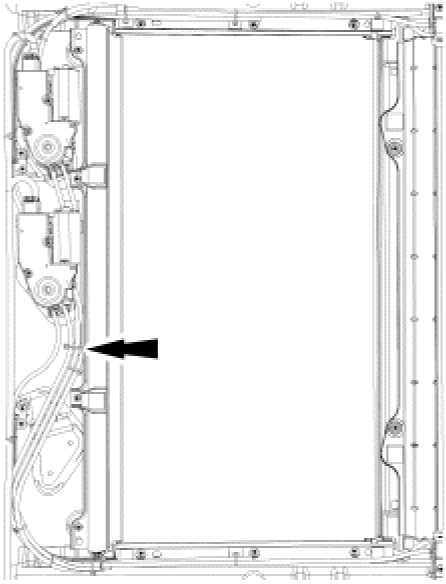


Fig. 73: Cutting Cable Wraps To Motor Block & Drive Tube Assembly & Wiring Harness
Courtesy of FORD MOTOR CO.

NOTE: Do not install the headliner at this time.

8. Install the front and rear shade assemblies but do not carry out the roof opening panel motor initialization at this time. For additional information, refer to **Roof Opening Panel Motor - Shades**.
9. Manually move the sliding front glass mechanisms forward until they are flush against the track hard-stops.

NOTE: Do not install the headliner at this time.

10. Install the roof opening panel sliding glass motor but do not carry out the initialization at this time. For additional information, refer to **Roof Opening Panel Motor - Sliding Front Panel** .
11. Carefully move the front and rear shades rearward to the fully OPEN position by pushing at the edges closest to the tracks.
12. Install the roof opening panel shade motor but do not carry out the initialization at this time. For additional information, refer to **Roof Opening Panel Motor - Shades**.
13. With the roof opening sliding glass panel still removed, initialize the roof opening panel motor(s). For additional information, refer to **Roof Opening Panel Motor Initialization**.

NOTE: Press the glass open switch to move the mechanisms rearward to allow installation of the sliding glass panel.

NOTE: It will be necessary to carry out the initialization procedure again after the glass panel is installed.

14. Install the roof opening panel sliding glass. For additional information, refer to **Roof Opening Panel Glass - Front Sliding**.

ROOF OPENING PANEL MOTOR - SHADES

REMOVAL AND INSTALLATION

NOTE: The roof opening panel shade motor contains ceramic magnets that may fail at any time if cracked. Any roof opening panel shade motor that has been dropped onto a hard surface during removal or installation should be replaced with a new motor.

1. Remove the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Disconnect the electrical connector.

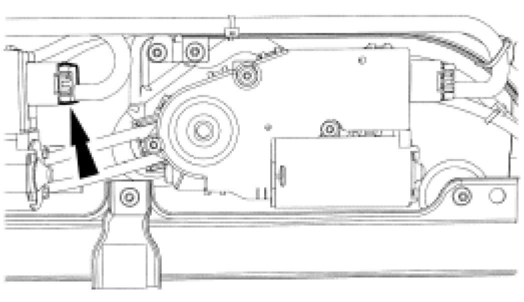


Fig. 74: Locating Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: During installation, it may be necessary to rotate the motor clockwise or counterclockwise for the gear teeth to set into the drive cable correctly.

3. Remove the 3 motor screws and the motor assembly.
   - To install, tighten to 5 N.m (44 lb-in).

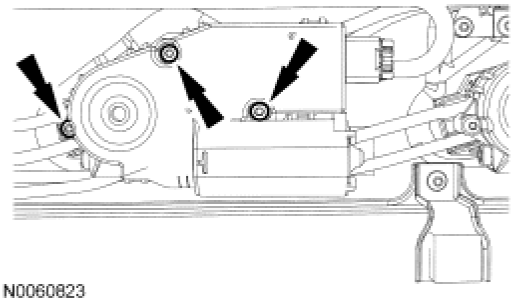


Fig. 75: Locating Motor Screws & Motor Assembly
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.
   - Initialize the roof opening panel motor(s). For additional information, refer to **Roof Opening Panel Motor Initialization**.

ROOF OPENING PANEL MOTOR - SLIDING FRONT PANEL

REMOVAL AND INSTALLATION

NOTE: **The roof opening panel sliding glass motor contains ceramic magnets that may fail at any time if cracked. Any roof opening panel sliding glass motor that has been dropped onto a hard surface during removal or installation should be replaced with a new motor.**

1. Remove the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Disconnect the electrical connector.

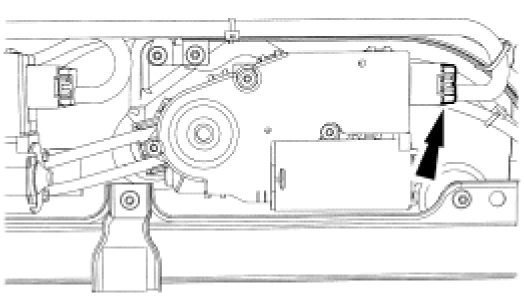


Fig. 76: Locating Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: **During installation, it may be necessary to rotate the motor clockwise or counterclockwise for the gear teeth to set into the drive cable correctly.**

3. Remove the 3 motor screws and the motor assembly.
    - To install, tighten to 5 N.m (44 lb-in).

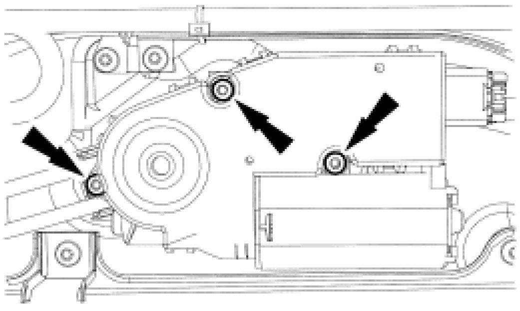


Fig. 77: Locating Motor Screws & Motor Assembly
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.
    - Initialize the roof opening panel motor(s). For additional information, refer to **Roof Opening Panel Motor Initialization**.

ROOF OPENING PANEL MOTOR WIRING HARNESS

REMOVAL AND INSTALLATION

1. Remove the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Disconnect the electrical connectors to the roof opening panel sliding glass motor, shade motor and main harness.

NOTE: **Make note of all the cable wrap locations attaching the harness to the drive tubes, they must be reinstalled at the exact same locations.**

3. Remove the cable wraps and the wiring harness.

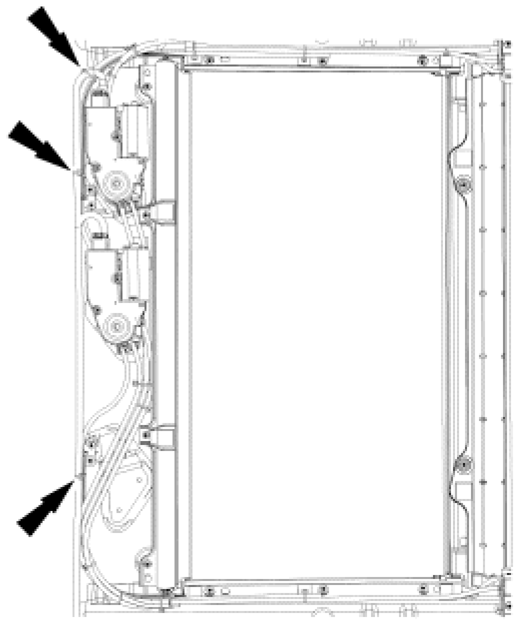


Fig. 78: Identifying Cable Wraps & Wiring Harness
Courtesy of FORD MOTOR CO.

NOTE:	**Be careful not to overtighten cable wraps during assembly to prevent crimping the cable sheath.**

4. To install, reverse the removal procedure.

ROOF OPENING PANEL SEAL - PRIMARY

REMOVAL

1. Remove the roof opening panel sliding glass. For additional information, refer to **Roof Opening Panel Glass - Front Sliding**.
2. Carefully peel off the primary seal.
    - Clean residual adhesive tape from the housing using a suitable cleaner.

INSTALLATION

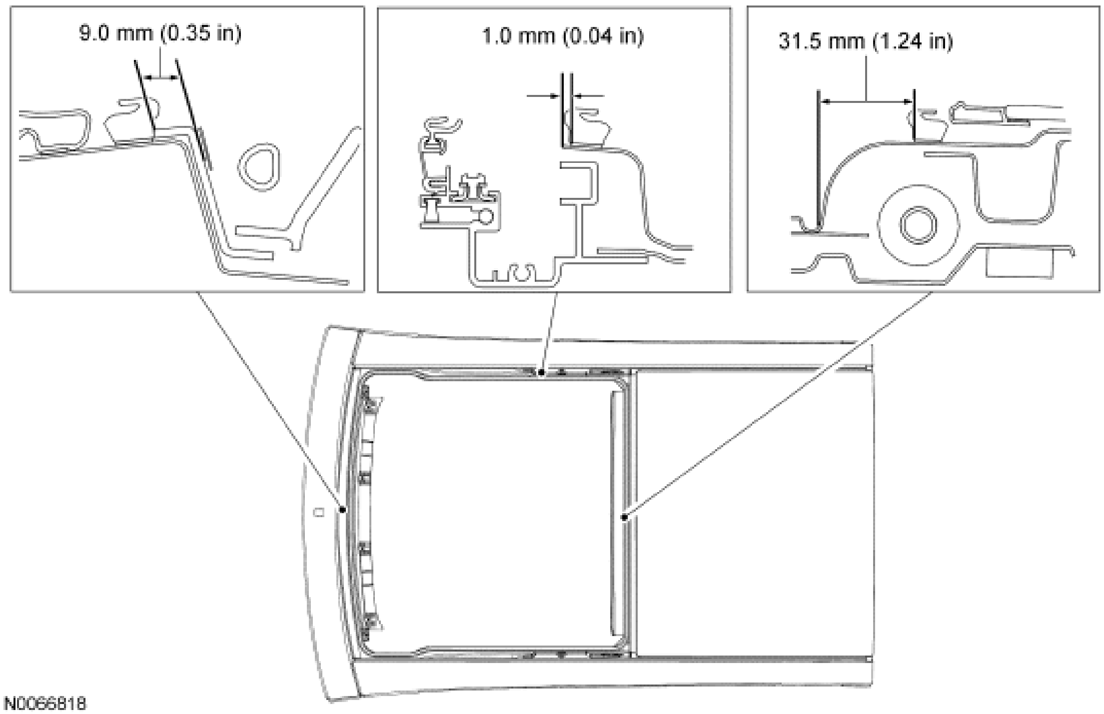


Fig. 79: Identifying Primary Seal Alignment
Courtesy of FORD MOTOR CO.

NOTE: The primary seal seam is placed at the rear centerline.

NOTE: Make sure the primary seal lip is facing outward.

1. Install the primary seal. Refer to the primary seal alignment figure above.

NOTE: When the roof opening sliding glass panel is in the VENT position, the roof opening panel primary seal should contact the leading edge of the sliding glass.

2. Install the roof opening panel sliding glass. For additional information, refer to **Roof Opening Panel Glass - Front Sliding**.
   - Initialize the roof opening panel motor(s). For additional information, refer to **Roof Opening Panel Motor Initialization**.

ROOF OPENING PANEL SHADE ASSEMBLY

REMOVAL AND INSTALLATION

Front and rear shade assembly

1. Move the glass to the fully CLOSED position.

2. Remove the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

Front shade assembly

NOTE: The shade is under spring tension.

3. Depress the tabs and slide the guide bar (leading edge of shade) forward to release it from the mechanism guide shoes and allow the shade to retract completely.

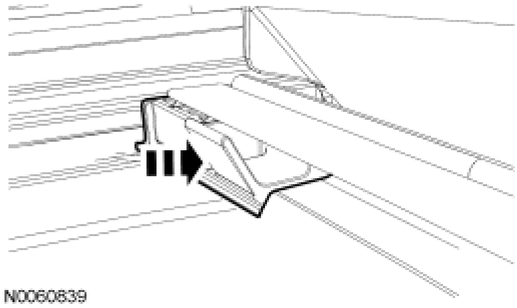


Fig. 80: Depressing Tabs & Sliding Guide Bar (Leading Edge Of Shade) Forward To Release It From Mechanism Guide Shoes
Courtesy of FORD MOTOR CO.

4. Remove the 2 front sunshade carrier outer screws.
   - To install, tighten to 5 N.m (44 lb-in).

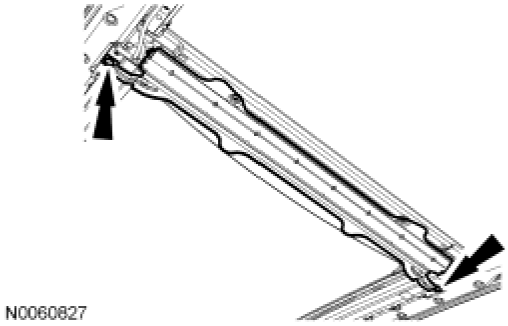


Fig. 81: Locating Front Sunshade Carrier Outer Screws
Courtesy of FORD MOTOR CO.

5. Remove the 2 front sunshade carrier center screws and the front sunshade assembly.
   - To install, tighten to 6 N.m (53 lb-in).

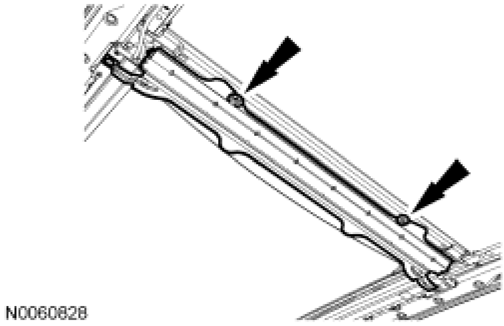


Fig. 82: Locating Front Sunshade Carrier Center Screws
Courtesy of FORD MOTOR CO.

Rear shade assembly

6. Open the rear shade to the half open position.

NOTE:	**Front guide shown, rear similar.**

NOTE:	**The shade is under spring tension.**

7. Depress the tabs and slide the guide bar (leading edge of shade) forward to release it from the mechanism guide shoes and allow the shade to retract completely.

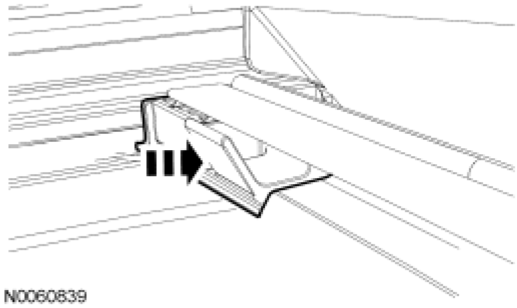


Fig. 83: Depressing Tabs & Sliding Guide Bar (Leading Edge Of Shade) Forward To Release It From Mechanism Guide Shoes
Courtesy of FORD MOTOR CO.

8. Remove the 2 rear sunshade carrier-to-housing screws and the rear sunshade assembly.
   - To install, tighten to 5 N.m (44 lb-in).

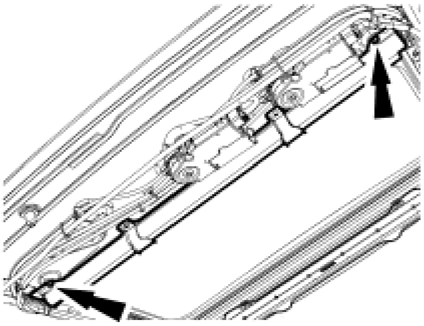


Fig. 84: Locating Rear Sunshade Carrier-To-Housing Screws
Courtesy of FORD MOTOR CO.

Front and rear shade assembly

9. To install, reverse the removal procedure.
   - Initialize the roof opening panel motor(s). For additional information, refer to **Roof Opening Panel Motor Initialization**.

ROOF OPENING PANEL SHADE TRACK AND MECHANISM

REMOVAL AND INSTALLATION

NOTE: This procedure is for the rear shade track only. To service the front shade track, refer to Roof Opening Panel Guide Track and Mechanism.

1. The shade track and mechanisms are removed as an assembly with the shade motor block and drive tube assembly. For additional information, refer to **Roof Opening Panel Motor Block and Drive Tube Assembly - Shades**.

ROOF OPENING PANEL TRIM - FRONT

Special Tools

Illustration	Tool Name	Tool Number
 ST2574-A	Rotunda Interior Auto Glass Cut-Out Knife Kit	164-R2450 or equivalent

Material

Item	Specification
Dow Urethane Adhesive Betaseal® Express	-
Dow Urethane One Step Glass Primer	

Betaprime® 5500/5500A/5500SA	-
Sika Urethane Adhesive Sika Tack ASAP	-
Sika Urethane Metal and Glass Primer Sika 206 G+P	-

REMOVAL

1. Position the roof opening sliding glass panel to the fully OPEN position.
2. Remove the antenna. For additional information, refer to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.

NOTE: A new roof opening panel front trim seal is supplied with the new front trim panel.

3. Remove the roof opening panel front trim seal.

NOTE: Make sure the cutting blades are changed where the cutting depth changes to avoid damage to the body, trim panels or windshield molding.

NOTE: Lubricate the urethane adhesive with water to aid the special tool when cutting the urethane adhesive. Using the special tool, place the flat side of the knife against the roof module.

4. Refer to the adhesive path illustration and begin cutting at the center of the front trim panel and work through towards the opposite corners.

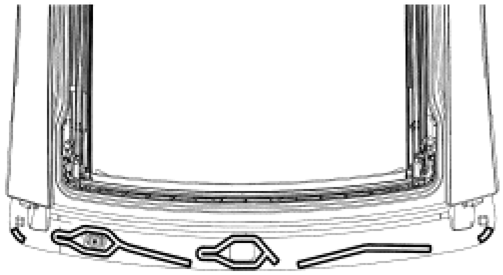


Fig. 85: Begin Cutting At Center Of Front Trim Panel And Work Through Towards Opposite Corners
Courtesy of FORD MOTOR CO.

5. Rotate the trim panel up and forward to clear the side trim panel. Cut off or bend the 2 steel alignment tabs if necessary.
6. Remove the front trim panel assembly and discard.

INSTALLATION

NOTE: **When installing urethane-installed parts, the vehicle must not be driven until the urethane has cured. Adequate cure time is specified on the drive away chart for each urethane product as the temperatures and humidity vary. Inadequate or incorrect curing can adversely affect the retention of the trim panel.**

NOTE: **For additional material guidelines, refer to the manufacturer's installation information.**

NOTE: **Avoid scratching the painted surfaces. For minor scratches or exposed metal, see the manufacturer's recommendations.**

1. Using an appropriate tool, trim the urethane adhesive and pads leaving no more than 0.5 mm (0.01 in) base of original equipment urethane along the roof opening module surface.

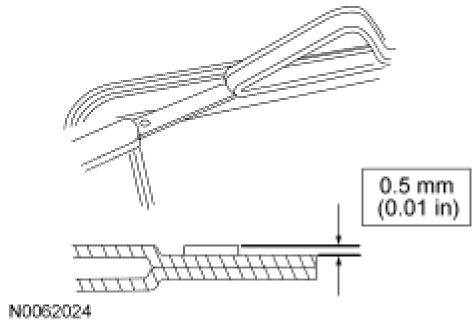


Fig. 86: Trimming Urethane Adhesive Leaving No More Than 0.5 mm (0.01 in) Base Of Original Equipment Urethane
Courtesy of FORD MOTOR CO.

NOTE: **Make sure the water channel is free from any foreign material.**

2. Using a soft brush or vacuum, remove any dirt or foreign material from the roof opening panel module. Clean residual adhesive tape from the housing using a suitable cleaner.

NOTE: **Be sure to use the same brand of cure-rate products for the adhesive and primer. Do not mix different brands of urethane and primer. For additional information, refer to the Materials Chart in this procedure.**

3. Cut the urethane adhesive applicator tip to the specification.

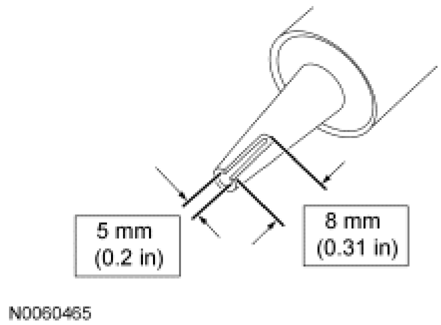


Fig. 87: Cutting Urethane Adhesive Applicator Tip To Specification
Courtesy of FORD MOTOR CO.

NOTE: Use either a high-ratio, electric or battery-operated caulk gun that will apply the urethane with less effort and a continuous bead.

4. Apply urethane adhesive on top of the existing trimmed urethane adhesive bead. Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead.

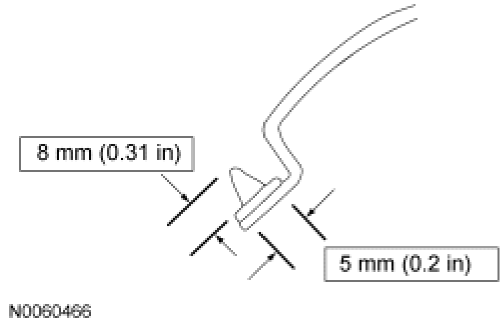


Fig. 88: Making Sure That All Gaps In Urethane Adhesive Are Smoothed Into One Continuous Bead
Courtesy of FORD MOTOR CO.

NOTE: Make sure the windshield molding does not get pinched under the front trim panel. The windshield molding should be pulled over the top of the leading edge of the trim panel during installation.

NOTE: Position front trim panel to best overall appearance.

5. Apply the front trim panel assembly to the roof module. Work the trim panel down using only vertical pressure.
6. Install the antenna. For additional information, refer to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.

ROOF OPENING PANEL TRIM - SIDE

Special Tools

Illustration	Tool Name	Tool Number
 ST2574-A	Rotunda Interior Auto Glass Cut-Out Knife Kit	164-R2450 or equivalent

Material

Item	Specification
Dow Urethane Adhesive Betaseal® Express	-
Dow Urethane One Step Glass Primer Betaprime® 5500/5500A/5500SA	-
Sika Urethane Adhesive Sika Tack ASAP	-
Sika Urethane Metal and Glass Primer Sika 206 G+P	-

REMOVAL

1. Remove the ditch moldings and clip strip.
2. Remove the end cap.

NOTE: Protect the painted roof area next to the side trim panel to prevent damage to the paint.

NOTE: Make sure the cutting blades are changed where the cutting depth changes to avoid damage to the body or glass panel seals.

NOTE: Lubricate the urethane adhesive with water to aid the special tool when cutting the urethane adhesive. Using the special tool, place the flat side of the knife against the roof module.

NOTE: Position the sliding glass panel as required for necessary access.

3. Begin cutting the urethane at the rear of the side trim panel while bending the trim panel upward as needed for access. Work forward through all urethane and rubber net pads. Remove and discard the side trim panel.

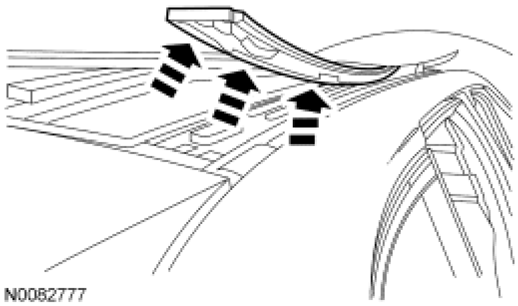


Fig. 89: Identifying Side Trim Panel
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: **When installing urethane-installed parts, the vehicle must not be driven until the urethane has cured. Adequate cure time is specified on the drive away chart for each urethane product as the temperatures and humidity vary. Inadequate or incorrect curing can adversely affect the retention of the trim panel.**

NOTE: **For additional material guidelines, refer to the manufacturer's installation information.**

NOTE: **Avoid scratching the painted surfaces. For minor scratches or exposed metal, see the manufacturer's recommendations.**

1. Using an appropriate tool, trim the urethane adhesive leaving no more than 0.5 mm (0.01 in) base of original equipment urethane along the roof opening module surface.

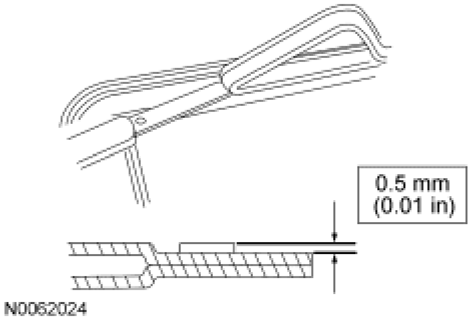


Fig. 90: Trimming Urethane Adhesive Leaving No More Than 0.5 mm (0.01 in) Base Of Original Equipment Urethane
Courtesy of FORD MOTOR CO.

NOTE: **Make sure the water channel is free from any foreign material.**

2. Using a soft brush or vacuum, remove any dirt or foreign material from the roof opening panel module.

NOTE: **Be sure to use the same brand of cure-rate products for the adhesive and primer. Do not mix different brands of urethane and primer. Refer to the Materials Chart in this procedure.**

3. Cut the urethane adhesive applicator tip to the specification.

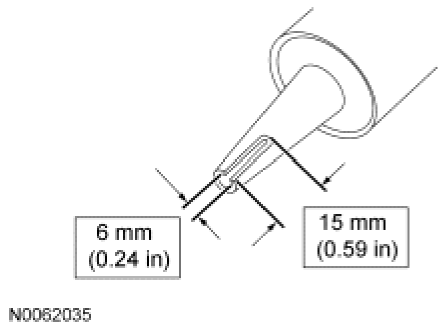


Fig. 91: Cutting Urethane Adhesive Applicator Tip To Specification
Courtesy of FORD MOTOR CO.

NOTE: **Use either a high-ratio, electric or battery-operated caulk gun that will apply the urethane with less effort and a continuous bead.**

4. Apply urethane adhesive on top of the existing trimmed urethane adhesive bead. Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead.

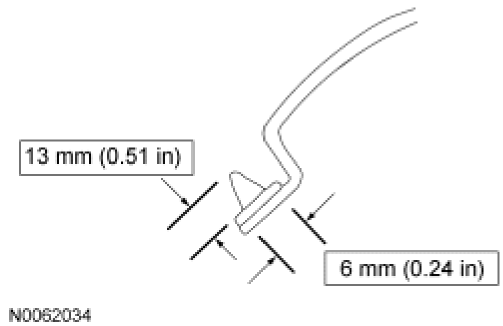


Fig. 92: Making Sure That All Gaps In Urethane Adhesive Are Smoothed Into One Continuous Bead
Courtesy of FORD MOTOR CO.

NOTE: **Position side trim panel to best overall appearance.**

5. Insert the front of the trim panel into the front trim seal then rotate the rear of the side trim panel down to engage. Apply the side trim panel assembly to the roof module.
6. Install the end cap.
7. Work the glass panel down using only vertical pressure.

8. Install the ditch moldings and clip strip.

ROOF OPENING PANEL TRIM - FIXED GLASS, INTERIOR

REMOVAL AND INSTALLATION

1. Position the sunshade(s) to the fully OPEN position.
2. Carefully bend/pry the trim ring from its hook-and-loop tape pads.

NOTE: A piece of paper may assist in keeping the hook-and-loop tape from sticking while aligning the trim ring. Once the trim ring is in position (front and rear locating pins lined up), remove the paper and press the trim firmly in place.

3. To install, reverse the removal procedure.

2008 GENERAL INFORMATION

Suspension System - General Information - Edge & MKX

SPECIFICATIONS

ALIGNMENT SPECIFICATIONS

Item	LH	RH	Total/Split
Front			
Camber	-0.50° ± -0.75°	-0.50° ± -0.75°	0° ± 0.75°[a]
Caster	4.4° ± 0.75°	4.4° ± 0.75°	0° ± 0.75°[b]
Toe	-	-	0.10° ± 0.20°
Rear			
Camber	-0.40° ± 0.75°	-0.40° ± 0.75°	0° ± 0.75°
Thrust angle	-	-	0° ± 0.30°
Toe	+0.05° ± -0.20°	+0.05° ± -0.20°	0.10° ± 0.20°

[a] Camber Total/Split = LH Camber - RH Camber

[b] Caster Total/Split = LH Caster - RH Caster

GENERAL SPECIFICATIONS

Item	Specification
Ball Joint Deflection	
Lower	0-0.2 mm (0-0.08 in)
Bushing Fastener Tightening Height	
Rear Edge	490 mm (19.29 in)
Rear MKX	497 mm (19.57 in)
Ride Height	
Front - Edge with 17-in or 18-in wheels	51 mm (2.01 in) ± 11.9 mm (0.47 in)
Front - Edge with 20-in wheels	50 mm (1.97 in) ± 11.9 mm (0.47)
Front - All MKX vehicles	54 mm (2.13 in) ± 77.9 mm (0.49)
Rear - Edge with 17-in or 18-in wheels	121 mm (4.76 in) ± 14 mm (0.55)
Rear - Edge with 20-in wheels	119 mm (4.66 in) ± 14 mm (0.55)
Rear - All MKX vehicles	127 mm (5.00) ± 14 mm (0.55)

TORQUE SPECIFICATIONS

Description	N.m	lb-ft
Front tie-rod jam nuts	90	66
Rear camber adjustment bolts	150	111
Rear toe adjustment bolts	200	148
Stabilizer bar lower nut	90	66
Strut upper mounting plate nuts	30	22

DESCRIPTION AND OPERATION

WHEEL ALIGNMENT ANGLES

NOTE: When making rear alignment adjustments, it is important to know that when adjustments are made to the rear toe, the rear camber will also be adjusted (in the same direction as the toe adjustment). When making adjustments to the rear camber, the rear toe will also be adjusted (in the opposite direction of the camber adjustment). It will be necessary to check the rear camber whenever rear toe adjustments are made and to check the rear toe whenever rear camber adjustments are made.

Front toe is adjusted through the use of adjustable tie-rod ends. Front camber is adjusted through the use of the upper strut plate. Rotating the upper strut plate 180 degrees will change the camber +0.5 degrees. Front caster is not adjustable on the vehicle. Rear toe is adjusted through the use of adjustable toe link cams. Rear camber is adjusted through the use of a cam bolt that attaches the rear lower control arm to the rear subframe.

Camber

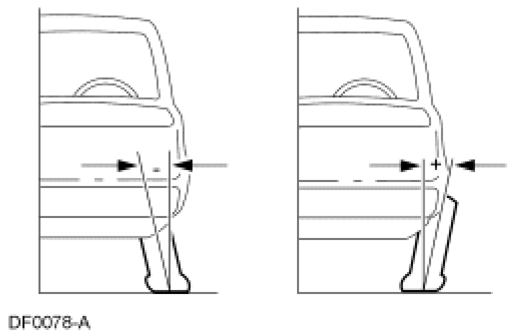


Fig. 1: Camber (Viewed from Front)
Courtesy of FORD MOTOR CO.

Camber is the vertical tilt of the wheel when viewed from the front. Camber can be positive or negative and has a direct affect on tire wear.

Caster

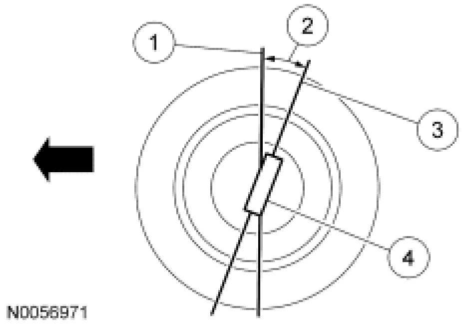


Fig. 2: Identifying Caster Angles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	True vertical
2	-	Positive caster angle
3	-	Shock-to-ball joint centerline
4	-	Pivot centerline

Caster is the deviation from vertical of an imaginary line drawn through the ball joints when viewed from the side. The caster specifications will give the vehicle the best directional stability characteristics when loaded and driven. The caster setting is not related to tire wear.

Toe

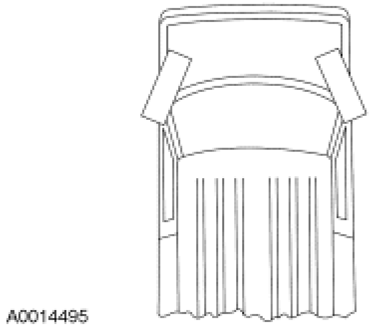


Fig. 3: Identifying Positive Toe (Toe In)
Courtesy of FORD MOTOR CO.

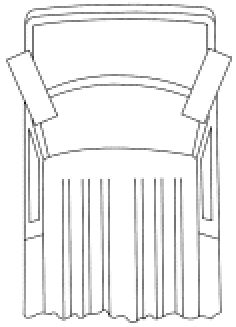


Fig. 4: Identifying Negative Toe (Toe Out)
Courtesy of FORD MOTOR CO.

The vehicle toe setting affects tire wear and directional stability.

Wander

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

Shimmy

Shimmy, as observed by the driver, is large, consistent, rotational oscillations of the steering wheel resulting from large, side-to-side (lateral) tire/wheel movements.

Shimmy is usually experienced near 64 km/h (40 mph), and can begin or be amplified when the tire contacts pot holes or irregularities in the road surface.

Nibble

Sometimes confused with shimmy, nibble is a condition resulting from tire interaction with various road surfaces and observed by the driver as small rotational oscillations of the steering wheel. For wheel and tire diagnosis, refer to **WHEELS AND TIRES** article.

Poor Returnability/Sticky Steering

Poor returnability and sticky steering is used to describe poor return of the steering wheel to center after a turn or steering correction.

Drift/Pull

Pull is a tugging sensation, felt by the hands on the steering wheel, that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with hands off the steering wheel.

- A vehicle-related drift/pull, on a flat road, will cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.

- Drift/pull may be induced by conditions external to the vehicle (for example, wind, road crown).

Poor Groove Feel

Poor groove feel is characterized by little or no buildup of turning effort felt in the steering wheel as the wheel is rocked slowly left and right within very small turns around center or straight-ahead (under 20 degrees of steering wheel turn). Efforts may be said to be "flat on center."

- Under 20 degrees of turn, most of the turning effort that builds up comes from the mesh of gear teeth in the steering gear. In this range, the steering wheel is not yet turned enough to feel the effort from the self-aligning forces at the road wheel or tire patch.
- In the diagnosis of a roadability problem, it is important to understand the difference between wander and poor groove feel.

DIAGNOSTIC TESTS

SUSPENSION SYSTEM

Inspection and Verification

1. Road test the vehicle.
    - If any suspension alignment or ride height concerns are present, go to **SYMPTOM CHART - SUSPENSION SYSTEM**.
    - Verify the customer concern by carrying out a road test on a smooth road. If any vibrations are present, go to **NOISE, VIBRATION AND HARSHNESS (NVH)**.
2. Inspect the tires.
    - Check the tire pressures with all normal loads in the vehicle and the tires cold. Refer to the vehicle certification (VC) label.
    - Verify that all tires are sized to specification. Refer to the VC label.
    - Inspect the tires for incorrect wear and damage. Install new tires as necessary.
3. Inspect the chassis and underbody.
    - Remove any excessive accumulation of mud, dirt or road deposits from the chassis and underbody.
4. Inspect for aftermarket equipment.
    - Check for aftermarket changes to the steering, suspension, and wheel and tire components (such as competition or heavy duty). The specifications shown in this service information do not apply to vehicles equipped with aftermarket equipment.

VISUAL INSPECTION CHART

Mechanical
• Front or rear suspension components • Suspension fastener(s) • Incorrect spring usage

- Spring(s)
- Shock absorber(s)
- Strut(s)
- Suspension bushing(s)
- Steering system components
- Wheel bearing and wheel hub(s)
- Non-OEM parts or modifications

5. If an obvious cause for an observed or reported condition is found, correct the cause (if possible) before proceeding to the next step.
6. If the fault is not visually evident, go to **SYMPTOM CHART - SUSPENSION SYSTEM** or go to **NOISE, VIBRATION AND HARSHNESS (NVH)**.

Symptom Chart - Suspension System

SYMPTOM CHART - SUSPENSION SYSTEM

Condition	Possible Sources	Action
• Drift/pull	• Unequal tire pressure	• ADJUST the tire pressure. REFER to the vehicle certification (VC) label.
-	• Camber total split is not within specification	• CHECK the wheel alignment. REFER to **Camber Adjustment - Front**. ADJUST as necessary.
-	• Tires	• ROTATE the tires left to right. REFER to **WHEELS AND TIRES** article.
-	• Unevenly loaded or overloaded vehicle	• NOTIFY the customer of incorrect vehicle loading.
-	• Steering components	• INSPECT the steering system. INSTALL new components as necessary. REFER to **STEERING SYSTEM - GENERAL INFORMATION** article.
-	• Brake drag	• REPAIR the base braking system as necessary. REFER to **FRONT DISC BRAKE** article or **REAR DISC BRAKE** article.
• Front bottoming or riding low	• Worn, damaged or incorrect springs	• MEASURE the ride height. REFER to **Ride Height**

		Measurement. INSTALL new springs as necessary. REFER to **FRONT SUSPENSION** article.
-	• Worn front strut(s)	• INSTALL new struts as necessary. REFER to **FRONT SUSPENSION** article.
• Abnormal/incorrect tire wear	• Incorrect tire pressure (rapid center rib or inner and outer edge wear)	• ADJUST the tire pressure. REFER to the VC label. REFER to **WHEELS AND TIRES** article Diagnosis and Testing for further tire wear diagnosis.
-	• Incorrect tire rotation intervals	• REFER to **MAINTENANCE SCHEDULE** article.
-	• High-speed cornering • Excessive front or rear toe (inner or outer edge wear) • Excessive negative or positive camber (inner or outer edge wear)	• REFER to **WHEELS AND TIRES** article Diagnosis and Testing for further tire wear diagnosis.
-	• Front or rear suspension components	• INSPECT the front and rear suspension system. REPAIR or INSTALL new suspension components as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
• Sticky steering, poor returnability	• Damaged or worn front strut mount bearing(s)	• INSTALL a new front strut mount bearing(s) as necessary. REFER to **FRONT SUSPENSION** article.
-	• Binding ball joints	• REFER to the Ball Joint Inspection under **Component Tests**.
-	• Steering components	• INSPECT the steering system. INSTALL new components as necessary. REFER to **POWER STEERING** article.
• Steering wheel off-center	• Unequal front or rear	• CHECK the wheel alignment.

	toe setting (side-to-side)	REFER to **Toe Adjustment - Front** or **Toe Adjustment - Rear**. ADJUST as necessary.
	• Steering components	• INSPECT the steering system. INSTALL new components as necessary. REFER to **STEERING SYSTEM - GENERAL INFORMATION** article.
• Sway or roll	• Overloaded, unevenly or incorrectly loaded vehicle	• NOTIFY the customer of incorrect vehicle loading.
	• Loose wheel nut(s)	• TIGHTEN the wheel nut(s) to specification. REFER to **WHEELS AND TIRES** article.
	• Strut(s) or shock absorber(s)	• INSTALL new struts or shock absorbers as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
	• Loose stabilizer bracket-to-frame bolts	• TIGHTEN the bolts to specification. REFER to **FRONT SUSPENSION** article.
	• Worn stabilizer bar bushings or links	• INSTALL new stabilizer bar bushings or links as necessary. REFER to **FRONT SUSPENSION** article.
	• Damaged or broken stabilizer bar	• INSTALL a new stabilizer bar as necessary. REFER to **FRONT SUSPENSION** article.
	• Worn spring(s)	• INSTALL new springs as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
• Vehicle leans to one side	• Unevenly loaded or overloaded vehicle	• NOTIFY the customer of incorrect vehicle loading.

	• Front or rear suspension components	• INSPECT the front and rear suspension systems. INSTALL new suspension components as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
-	• Incorrect drive axle(s) ride height. Side-to-side lean out of specification	• MEASURE the ride height. REFER to **Ride Height Measurement**. INSPECT the front and rear suspension systems. REPAIR or INSTALL new components as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
• Wander	• Overloaded, unevenly or incorrectly loaded vehicle	• NOTIFY the customer of incorrect vehicle loading.
-	• Ball joint(s)	• INSPECT the ball joints. REFER to the Ball Joint Inspection under **Component Tests**.
-	• Damaged or missing front strut mount bearing(s)	• INSTALL a new front strut mount bearing(s) as necessary. REFER to **FRONT SUSPENSION** article.
-	• Loose, worn or damaged front wheel bearing(s)	• INSPECT the wheel bearings. INSTALL new wheel bearings as necessary.
-	• Loose, worn or damaged suspension component(s)	• INSTALL new suspension component(s) as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
-	• Loose suspension fasteners	• INSPECT the suspension fasteners. TIGHTEN to specification. REFER to

		FRONT SUSPENSION article for front suspension or **REAR SUSPENSION** article for rear suspension.
-	• Steering components	• INSPECT the steering system. INSTALL new components as necessary. REFER to **STEERING SYSTEM - GENERAL INFORMATION** article.
-	• Wheel alignment (excessive total front toe out)	• ADJUST as necessary. REFER to **Toe Adjustment - Front** or **Toe Adjustment - Rear**.

Symptom Chart - Noise, Vibration and Harshness (NVH)

NOTE: **Noise, vibration and harshness (NVH) symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.**

SYMPTOM CHART - NOISE/VIBRATION AND HARSHNESS (NVH)

Condition	Possible Sources	Action
• Squeak or grunt - noise from the front suspension, occurs more in cold ambient temperatures. More noticeable over rough roads or when turning	• Front stabilizer bar insulators	• Under these conditions, the noise is acceptable. CHECK TSBs.
• Clunk - noise from the front suspension, occurs in and out of turns	• Loose front suspension	• INSPECT for loose nuts or bolts. TIGHTEN to specifications. REFER to **FRONT SUSPENSION** article for front suspension and **REAR SUSPENSION** article for rear suspension.
• Clunk - noise from the rear suspension, occurs when shifting from REVERSE to	• Loose rear suspension components	• INSPECT for loose or damaged rear suspension components. REPAIR or

DRIVE		INSTALL new components as necessary. REFER to **REAR SUSPENSION** article.
• Click or pop - noise from the front suspension. More noticeable over rough roads or over bumps	• Worn or damaged ball joint(s)	• CARRY OUT a ball joint inspection under **Component Tests**. INSTALL new ball joint(s) or control arm(s) as necessary.
• Front suspension noise - a squeak, creak or rattle noise. Occurs mostly over bumps or rough roads	• Front suspension components • Loose or damaged front struts, shock absorber(s) or shock absorber bushing(s) • Damaged spring or spring mount(s) • Damaged or worn control/radius arm bushing(s) • Worn or damaged stabilizer bar bushings or link(s)	• INSPECT the front suspension. INSTALL new components as necessary. REFER to **FRONT SUSPENSION** article.
• Rear suspension noise - a squeak, creak or rattle noise. Occurs mostly over bumps or rough roads	• Loose or damaged rear shock absorber(s) or shock absorber bushing (s) • Damaged spring or spring mount(s) • Damaged or worn control arm bushing(s) • Worn or damaged stabilizer bar bushing(s) or link(s)	• INSPECT the rear suspension. INSTALL new components as necessary. REFER to **REAR SUSPENSION** article.
• Shudder - occurs during acceleration from a slow speed or stop	• Incorrect ride height causing incorrect driveline angle	• REFER to **DRIVELINE SYSTEM - GENERAL INFORMATION** article for driveline angle diagnosis.
• Shimmy	• Loose wheel nut(s) • Loose front suspension fastener(s)	• TIGHTEN the nut(s) to specification. REFER to **WHEELS AND TIRES** article. • TIGHTEN the fastener(s) to specification. REFER to

		FRONT SUSPENSION article.
	• Loose front wheel bearing(s)	• INSPECT the front wheel bearing(s). INSTALL new bearing(s) as necessary. REFER to **FRONT SUSPENSION** article.
	• Strut(s) or shock absorber(s)	• INSTALL new struts or shock absorbers as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
• Shimmy - most noticeable on coast/deceleration. Also hard steering condition	• Excessive positive caster	• CHECK the wheel alignment. REFER to **Camber Adjustment - Front**. ADJUST as necessary.
• Rough/harsh ride	• Incorrect tire pressure	• ADJUST the tire pressure. REFER to the vehicle certification (VC) label.
	• Strut(s) or shock absorber(s)	• INSTALL new struts or shock absorbers as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
	• Spring(s)	• MEASURE the ride height. REFER to **Ride Height Measurement**. INSTALL new springs as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
	• Loose, worn or damaged suspension component(s)	• INSTALL new suspension component(s) as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.

Component Tests

Ball Joint Inspection

1. Prior to inspecting the ball joints for wear, inspect the wheel bearings. Install a new wheel bearing as necessary. Refer to **FRONT SUSPENSION** article.

NOTE: In order to obtain accurate measurements, the suspension must be in full rebound with the weight of the vehicle supported by the frame.

2. Raise and support the vehicle by the frame to allow the wheels to hang in the rebound position.
3. Inspect the ball joint and ball joint boot for damage.
   - If the ball joint or ball joint boot is damaged, install a new ball joint as necessary. Refer to **FRONT SUSPENSION** article.

CAUTION: Do not use any tools or equipment to move the wheel and tire assembly or suspension components while checking for relative movement. Suspension damage may occur. The use of tools or equipment will also create relative movement that may not exist when using hand force. Relative movement must be measured using hand force only.

4. Inspect the ball joint for relative movement by alternately pulling downward and pushing upward on the wheel and tire assembly, by hand. Note any relative vertical movement between the wheel knuckle and lower arm at the lower ball joint.
   - If relative movement is not felt or seen, the ball joint is OK. Do not install a new ball joint.
   - If relative movement is found, continue with Step 5.

NOTE: In order to obtain an accurate measurement, the dial indicator should be aligned as close as possible with the vertical axis (center line) of the ball joint.

5. To measure ball joint deflection, attach a suitable dial indicator with a flexible arm between the lower control arm and the wheel knuckle or ball joint stud.

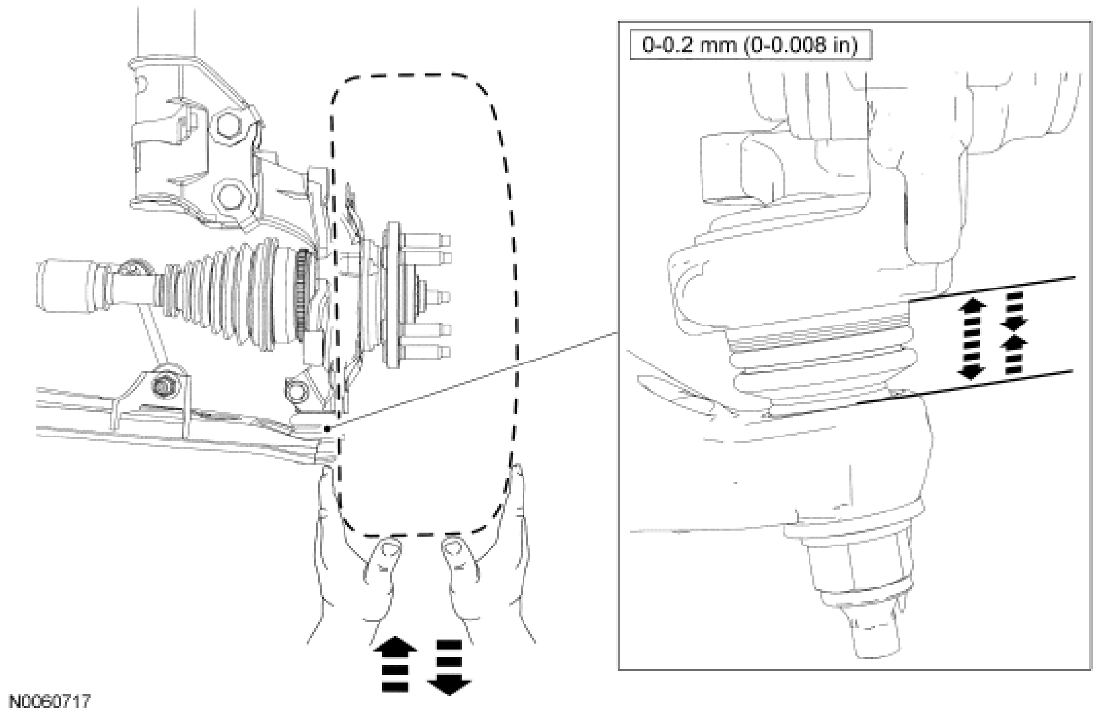


Fig. 5: Measuring Ball Joint Deflection While An Assistant Alternately Pulls Outward
Courtesy of FORD MOTOR CO.

6. Measure the ball joint deflection while an assistant pushes up and pulls down on the wheel and tire assembly, by hand.
   - If the deflection exceeds the specification, a new ball joint must be installed. Refer to **FRONT SUSPENSION** article.
   - If the deflection meets the specification, no further action is required.

GENERAL PROCEDURES

RIDE HEIGHT MEASUREMENT

Front Ride Height Measurement

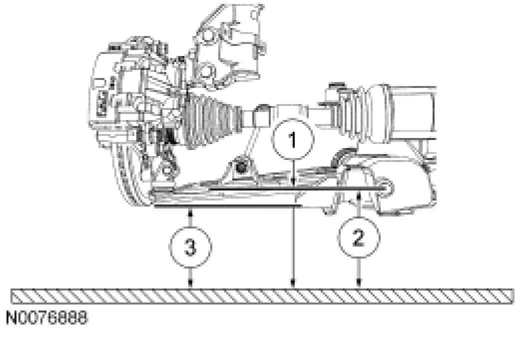


Fig. 6: Identifying Front Ride Height Measurement

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Ride height = A - B
2	-	Measurement A
3	-	Measurement B

NOTE: Make sure that the vehicle is positioned on a flat, level surface and the tires are inflated to the correct pressure. Vehicle should have a full tank of fuel.

1. Position a suitable surface gauge (such as Starrett 57D Surface Gauge) on a flat, level surface as used in Step 1, adjust the gauge's arm until the scriber point is located in the center of the lower arm forward bolt.
    - Lock the surface gauge in this position.

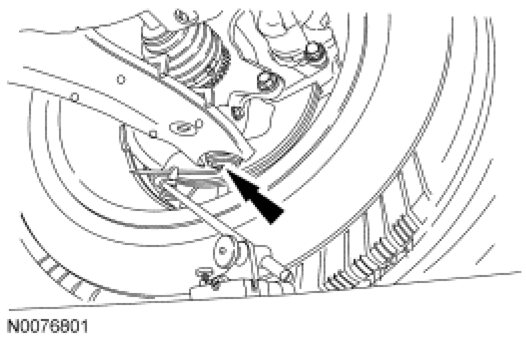


Fig. 7: Identifying Surface Gauge Position
Courtesy of FORD MOTOR CO.

2. With the surface gauge positioned on a flat, level surface, record the measurement of the surface gauge position (measurement A).

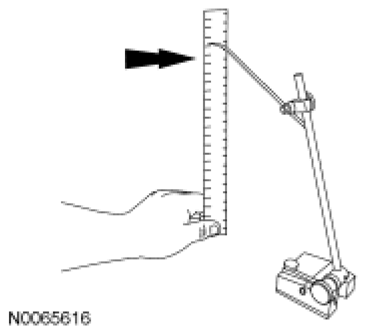


Fig. 8: Identifying Front Ride Height Measurement
Courtesy of FORD MOTOR CO.

3. Position the surface gauge on the same flat, level surface and adjust the gauge's arm until the scriber point is located on the center of the lower ball joint cap.

- Lock the surface gauge in this position.

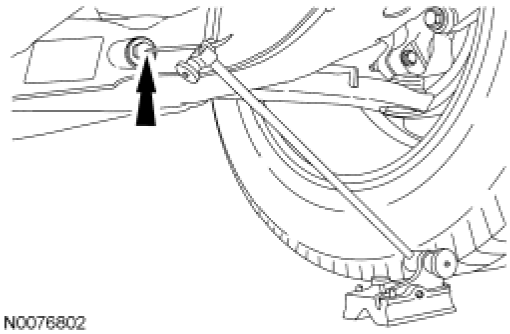


Fig. 9: Identifying Surface Gauge Position
Courtesy of FORD MOTOR CO.

4. With the surface gauge positioned on a flat, level surface, record the measurement of the surface gauge position (measurement B).

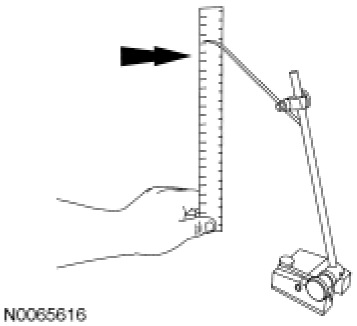


Fig. 10: Identifying Front Ride Height Measurement
Courtesy of FORD MOTOR CO.

5. Subtract measurement B from measurement A to obtain the front ride height.
   - Refer to **SPECIFICATIONS**.

Rear Ride Height Measurement

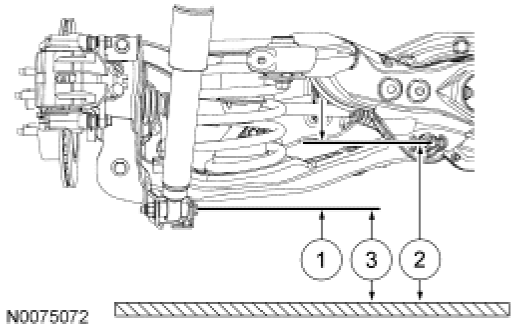


Fig. 11: Identifying Front Ride Height Measurement

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Ride height = A - B
2	-	Measurement A
3	-	Measurement B

NOTE: Make sure that the vehicle is positioned on a flat, level surface and the tires are inflated to the correct pressure. Vehicle should have a full tank of fuel.

1. Measure the distance between the same flat level surface and the center of the lower arm-to-subframe bolt (measurement A).
2. Measure the distance between the flat level surface and the center of the lower shock bolt (measurement B).
3. Subtract measurement B from measurement A to obtain the rear ride height.
   - Refer to **SPECIFICATIONS**.

CAMBER ADJUSTMENT - FRONT

NOTE: Front camber is adjusted through the use of the upper strut plate. Rotating the upper strut plate 180 degrees will change the camber +0.5 degrees.

1. Using alignment equipment and the manufacturer's instructions, measure the camber.
2. Remove and discard the stabilizer bar link lower nut and disconnect the link from the lower arm.
   - To install, tighten to 90 N.m (66 lb. ft.).
3. Remove and discard the 4 strut upper mounting plate nuts.
   - To install, tighten to 30 N.m (22 lb. ft.).
4. Using a suitable jack, raise the vehicle body enough to allow the front strut upper plate mounting studs to clear the frame.

   NOTE: Rotating the upper strut plate 180 degrees will change the camber +0.5 degrees.

5. Rotate the upper mounting plate 180 degrees.
6. Recheck the front camber settings.
7. Check and, if necessary, adjust the front toe. For additional information, refer to **Toe Adjustment - Front**.

CAMBER ADJUSTMENT - REAR

CAUTION: Before tightening any suspension bushing fasteners, the suspension must be at the bushing fastener tightening position or incorrect clamp load and

bushing damage may occur.

NOTE: **When making rear alignment adjustments, it is important to know that when adjustments are made to the rear toe, the rear camber will also be adjusted (in the same direction as the toe adjustment). When making adjustments to the rear camber, the rear toe will also be adjusted (in the opposite direction of the camber adjustment). It will be necessary to check the rear camber whenever rear toe adjustments are made and to check the rear toe whenever rear camber adjustments are made.**

1. Using alignment equipment and the manufacturer's instructions, measure the rear camber.
2. Loosen the rear camber adjustment bolt.
3. Rotate the camber adjustment bolt until the camber setting is within specifications.

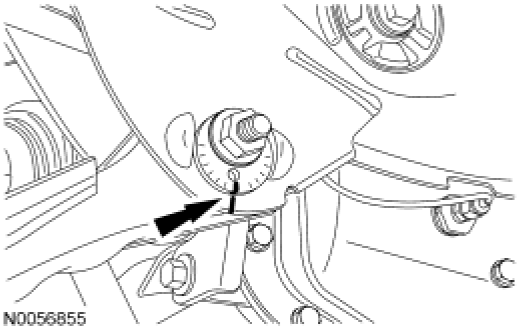


Fig. 12: Measuring Rear Camber Using Alignment Equipment
Courtesy of FORD MOTOR CO.

CAUTION: **Before tightening any suspension bushing fasteners, the weight of the vehicle must be resting on the wheels and tires or incorrect clamp load and bushing damage may occur.**

NOTE: **Do not allow the camber cam adjuster to rotate while tightening the bolt.**

4. Tighten the camber adjustment bolt to 150 N.m (111 lb. ft.).
5. Recheck the rear camber and toe.
   - Adjust as necessary.

TOE ADJUSTMENT - FRONT

1. Start the engine and center the steering wheel.
2. Turn the engine OFF and, using a suitable steering wheel holding device, lock the steering wheel in the straight ahead position.
3. Using alignment equipment and the manufacturer's instructions, measure the front toe.
4. Remove the steering gear bellows clamps.

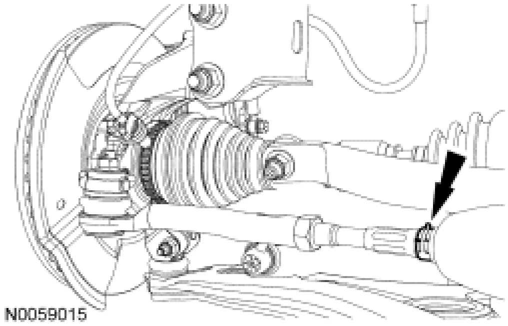


Fig. 13: Locating Steering Gear Bellows Clamps
Courtesy of FORD MOTOR CO.

5. Loosen the tie-rod jam nuts.

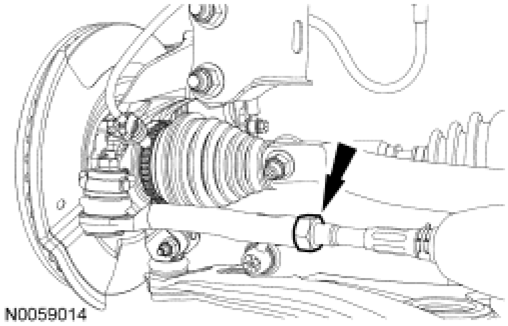


Fig. 14: Locating Tie-Rod Jam Nuts
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the steering gear bellows to twist when the tie rod is rotated.

6. Rotate the tie rods until the toe setting is within specifications.

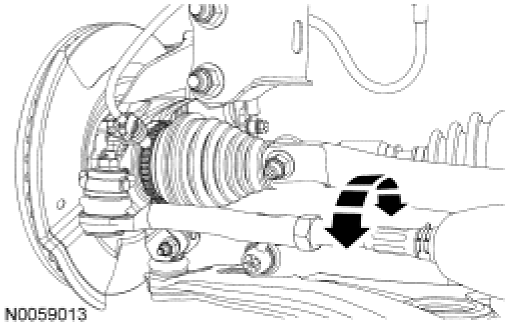


Fig. 15: Rotating Tie Rods Until Toe Setting
Courtesy of FORD MOTOR CO.

7. Tighten the jam nuts to 90 N.m (66 lb. ft.).
8. Install the steering gear bellows clamps.

TOE ADJUSTMENT - REAR

NOTE: When making rear alignment adjustments, it is important to know that when adjustments are made to the rear toe, the rear camber will also be adjusted (in the same direction as the toe adjustment). When making adjustments to the rear camber, the rear toe will also be adjusted (in the opposite direction of the camber adjustment). It will be necessary to check the rear camber whenever rear toe adjustments are made and to check the rear toe whenever rear camber adjustments are made.

1. Using alignment equipment and the manufacturer's instructions, measure the rear toe.
2. Loosen the toe link inboard bolt.
3. Rotate the toe link adjuster cam until the toe setting is within specifications.

   CAUTION: Before tightening any suspension bushing fasteners, the suspension must be at the bushing fastener tightening position or incorrect clamp load and bushing damage may occur.

   NOTE: Do not allow the toe link adjuster can to rotate while tightening the bolt.

4. Tighten the toe link inboard bolt to 200 N.m (148 lb. ft.).
5. Recheck the rear toe and camber.
   - Adjust as necessary.

2008 TRANSMISSIONS

Transfer Case - Power Transfer Unit (PTU) - Edge & MKX

SPECIFICATIONS

MATERIAL

Item	Specification	Fill Capacity
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V	-
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A	0.53L (18 oz)
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4	-
Thread Sealant with PTFE TA-24	WSK-M2G350-A2	-

TORQUE SPECIFICATIONS

Description	N.m	lb. ft.	lb-in
Ball joint bolt and nut	55	41	-
Brake hose bracket bolt	20	-	177
Driveshaft-to-power transfer unit (PTU) output flange bolts	70	52	-
Fill plug	20	-	177
Intermediate and halfshaft assembly bolts	40	30	-
Pinion flange nut (1)	-	-	-
PTU cover bolts	32	24	-
PTU-to-support bracket bolts	70	52	-
PTU-to-transaxle bolts	90	66	-
Roll restrictor bracket-to-transmission bolts	90	66	-
Roll restrictor shield	11	-	97
Roll restrictor through bolt (transmission side)	90	66	-
Roll restrictor through bolt (subframe side)	103	76	-
Stabilizer bar link nut	90	66	-
Wheel hub nut (1)	-	-	-
(1) Refer to the procedure.			

DESCRIPTION AND OPERATION

POWER TRANSFER UNIT (PTU)

The All-Wheel Drive (AWD) system consists of the following:

- Power Transfer Unit (PTU)
- Rear driveshaft
- 4X4 control module
- Rear axle with coupling device

The PTU is a gearbox that attaches to the transaxle. The RH intermediate shaft passes through the PTU and engages the differential side gear as in normal Front Wheel Drive (FWD) applications. The PTU directs power to the rear driveshaft through a helical gear spline coupled to the transaxle differential case, a helical gear drop (idler gear) and hypoid/helical ring gear assembly and pinion set. The PTU is sealed from the transaxle and has its own oil sump.

Serviceable components of the PTU are limited to the output shaft seal and flange, intermediate shaft seal and deflector, the cover seal and the PTU-transaxle compression seal. The internal components are not serviced. Do not remove the cover of the PTU. If any of the geared components, bearings, case cover or internal shafts are worn or damaged, a new PTU must be installed.

DIAGNOSTIC TESTS

POWER TRANSFER UNIT (PTU)

Principles of Operation

The Power Transfer Unit (PTU) is a gearbox that attaches to the transaxle. The RH intermediate shaft passes through the PTU and engages the differential side gear as in normal Front Wheel Drive (FWD) applications. The PTU directs power to the rear driveshaft through a helical gear spline coupled to the transaxle differential case, a helical gear drop (idler gear) and hypoid/helical ring gear assembly and pinion set. The PTU is sealed from the transaxle and has its own oil sump.

Serviceable components of the PTU are limited to the output shaft seal and flange, intermediate shaft seal and deflector, the cover seal and the PTU-transaxle compression seal. The internal components are not serviced. Do not remove the cover of the PTU. If any of the geared components, bearings, case cover or internal shafts are worn or damaged, a new PTU must be installed.

Heat Protection Mode - During very extreme off-road operation, the All-Wheel Drive (AWD) system utilizes a heat protection mode to protect the Active Torque Coupling (ATC) solenoid (part of rear axle) from damage. If the system detects an overheat condition, it enters a locked mode. If the heat in the system continues to rise once in the locked mode, the 4X4 control module disables the ATC solenoid. Allow the system to cool down at least 10 minutes with the ignition switch in the ON position.

For concerns with the 4X4 control module or ATC, refer to <u>**FOUR WHEEL DRIVE (4WD) SYSTEMS**</u> article.

Inspection and Verification

1. Verify the customer concern.
2. Inspect for obvious signs of mechanical damage.

VISUAL INSPECTION CHART

Mechanical
• Power Transfer Unit (PTU) • Halfshafts and CV joints • Driveshaft and U-joints • Wheel/tire size and brand • Matching tire size and brand • Tire pressure
-

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and Go to **SYMPTOM CHART - POWER TRANSFER UNIT (PTU)**.

SYMPTOM CHART - POWER TRANSFER UNIT (PTU)

SYMPTOM CHART - POWER TRANSFER UNIT (PTU)

Condition	Possible Sources	Action
• The Power Transfer Unit (PTU) makes noise	• Tire inflation pressure • Tire and wheel size	• MAKE SURE all tires and wheels are the same size and brand and the inflation pressures are correct.
-	• Fluid level	• FILL with the correct type and amount of lubricant. REFER to **POWER TRANSFER UNIT (PTU) DRAINING AND FILLING**.
-	• Internal components	• OPERATE the vehicle in all gears. If there is noise in the transaxle in NEUTRAL, or in some gears and not in others, REMOVE and REPAIR the transaxle. Refer to the appropriate Automatic Transmission article for the procedure. If there is noise in all gears, INSTALL a new PTU. REFER to **POWER TRANSFER UNIT (PTU)**.
• Leaking fluid from the PTU vent	• PTU over filled	• REFER to **ANALYSIS OF LEAKAGE**.

• Leaking automatic transmission fluid	• PTU intermediate shaft seal • PTU compression seal	• REFER to **ANALYSIS OF LEAKAGE**.
• Leaking gear lubricant from the seals	• The PTU vent is plugged (located on top of the PTU)	• INSTALL a new PTU. REFER to **POWER TRANSFER UNIT (PTU)**.
-	• Damaged seals	• REFER to **ANALYSIS OF LEAKAGE**.
• Vehicle has no or inadequate torque at rear wheels	• Rear axle	• REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
-	• PTU mechanical failure	• REFER to **POWER TRANSFER UNIT (PTU)**.
• Vehicle binds in a turn or resists turning/pulsates or shudders in a straight line	• Wheels/tires	• REFER to **WHEELS AND TIRES** article.
-	• Brake system	• REFER to **BRAKE SYSTEM - GENERAL INFORMATION** article.
-	• Wheel bearings	• REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.
-	• Halfshafts	• REFER to **DRIVELINE SYSTEM - GENERAL INFORMATION** article.
-	• Wheel speed sensor (s)	• REFER to **VEHICLE DYNAMIC SYSTEMS** article.
-	• ABS module	• REFER to **VEHICLE DYNAMIC SYSTEMS** article.

Analysis of Leakage

The PTU may leak different color fluids, red oil leak for an automatic transmission fluid and brown/black gear lube for PTU fluid. The PTU seals prevent these types of fluids from leaking. It is important to note which color of fluid is leaking to conduct the most appropriate service procedure.

PTU Leaks From the RH Side

NOTE: **Remove and replace leaking seals using the information found in the INTERMEDIATE SHAFT SEAL AND DEFLECTOR or COVER SEAL replacement procedure. The specified tools called out in this procedure will allow seal replacement without causing damage to the Power Transfer Unit (PTU)**

casing/drive gear.

If the leak is red automatic transmission fluid, then the PTU intermediate shaft seal needs replacement. This is inside the bore of the PTU shaft behind the deflector. Refer to the **INTERMEDIATE SHAFT SEAL AND DEFLECTOR** procedure.

If the leak is brown/black gear lube, then the PTU larger cover seal needs replacement. This is located on the PTU cover behind the deflector. Refer to **COVER SEAL** procedure.

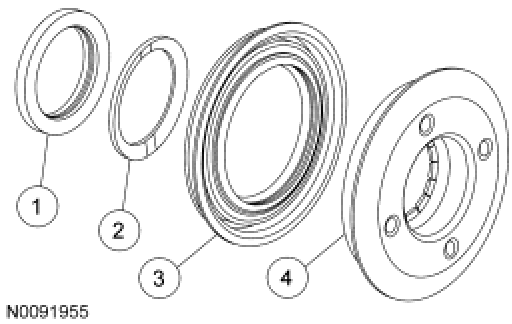


Fig. 1: Identifying Intermediate Shaft Seal
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Intermediate shaft seal (part of kit 7275)
2	-	Alignment washer (part of kit 7275)
3	-	Cover seal (part of kit 7275)
4	-	Seal deflector (part of kit 7275)

PTU Leaks From the LH Side

If the leak is the red automatic transmission fluid, the compression seal needs replacement. This is between the PTU and transmission. Refer to **POWER TRANSFER UNIT (PTU)** in the Removal portion of this service information.

If the leak is brown/black, the PTU is overfilled and venting fluid from the top of the PTU. Flush and fill the PTU. Refer to **POWER TRANSFER UNIT (PTU) DRAINING AND FILLING**.

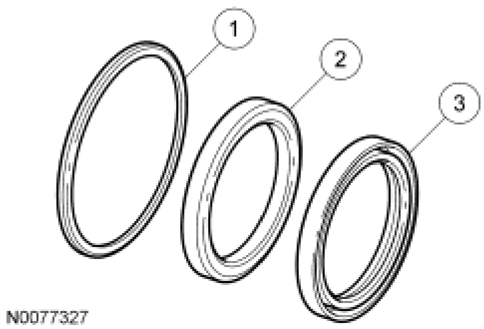


Fig. 2: PTU Leaks From LH Side
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Power Transfer Unit (PTU)-to-transaxle compression seal (7086)
2	-	Transfer case driver gear seal (not serviceable)
3	-	Transfer case driver gear seal (not serviceable)

GENERAL PROCEDURES

POWER TRANSFER UNIT (PTU) DRAINING AND FILLING

MATERIAL

Item	Specification
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A

NOTE: **A new Power Transfer Unit (PTU) must be installed any time the PTU has been submerged in water.**

NOTE: **The Power Transfer Unit (PTU) is not to be drained unless contamination is suspected. To drain the PTU fluid, the PTU must be removed from the vehicle. The fluid that is drained may appear black and have a pungent odor. Do not mistake this for contaminated fluid. For additional information, refer to POWER TRANSFER UNIT (PTU) in the Removal portion of this service information.**

NOTE: **Fill level checks are done in-vehicle only. Let the vehicle sit 10 minutes after the road test before checking the fluid level.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

2. Clean the area around the filler plug before removing.

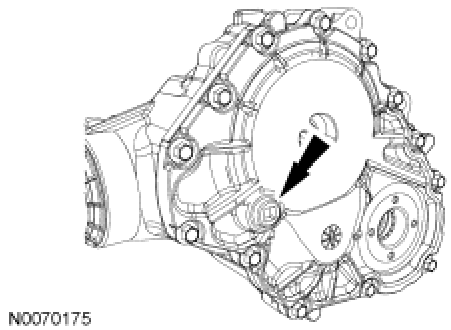


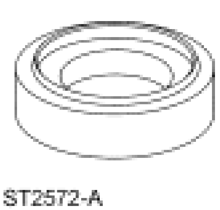
Fig. 3: Locating Fill Plug
Courtesy of FORD MOTOR CO.

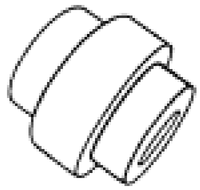
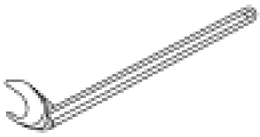
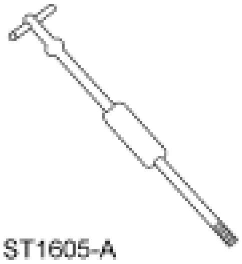
3. Remove and discard the filler plug.
4. With the vehicle on a flat, level surface, fill the PTU with lubricant. The fluid must be even with the bottom of the fill opening.
   - Fluid capacity is 0.53L (18 oz).
5. Install a new filler plug.
   - Tighten to 20 N.m (177 lb-in).

IN-VEHICLE SERVICING

COVER SEAL

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
	Handle, Driver 32 in	205-907
	Installer, Halfshaft Oil Seal	308-431
	Installer, Shaft Bearing Cup	308-221 (T94P-7025-BH)

 ST1164-A		
 ST1582-A	Remover, Halfshaft	205-241
 ST1605-A	Slide Hammer	100-01 (T50T-100-A)

REMOVAL

NOTE: **The Power Transfer Unit (PTU) may leak different color fluids, red oil leak for automatic transmission fluid and brown/black gear lube for PTU fluid. The PTU seals prevent these types of fluids from leaking. It is important to note which color fluid is leaking to conduct the most appropriate service procedure. This procedure will correct a brown/black (gear lube) leak from the RH side of the PTU. For additional information, refer to ANALYSIS OF LEAKAGE.**

NOTE: **This procedure is to be performed through the RH wheel opening. It is not necessary to remove the exhaust components to complete this repair.**

1. Remove the intermediate shaft seal and deflector. For additional information, refer to **INTERMEDIATE SHAFT SEAL AND DEFLECTOR**.

   NOTE: **There is a bearing inside the PTU directly behind the cover seal. The bearing is not serviced.**

2. Remove the cover seal using the Slide Hammer, the extension from the Halfshaft Remover and a suitable seal puller inserted into the groove of the seal.

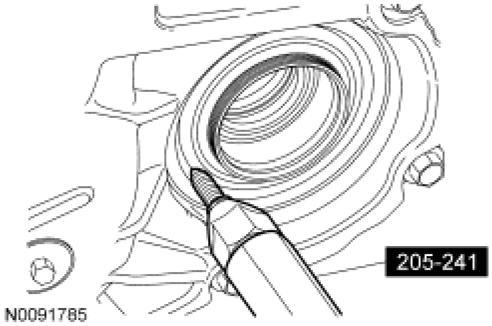


Fig. 4: Removing Cover Seal Using Slide Hammer
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Assemble the Driver Handle, the Halfshaft Oil Seal Installer and the Shaft Bearing Cup Installer as shown in illustration.

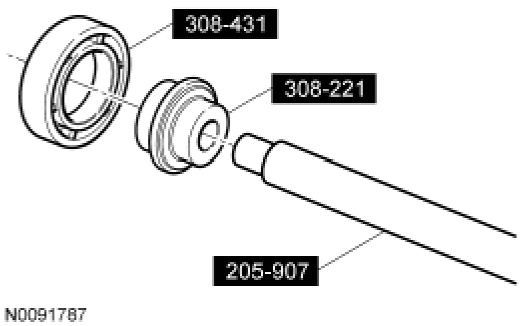


Fig. 5: Assembling Driver Handle, Halfshaft Oil Seal Installer & Shaft Bearing Cup Installer
Courtesy of FORD MOTOR CO.

2. Using the Driver Handle, the Halfshaft Oil Seal Installer and the Shaft Bearing Cup Installer, install the cover seal in the PTU.

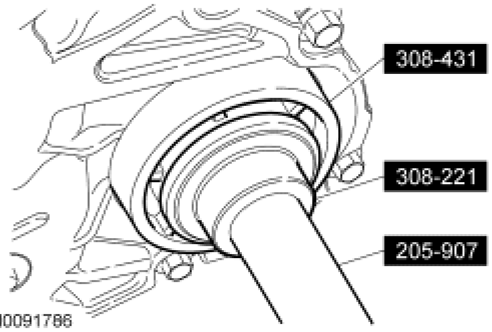
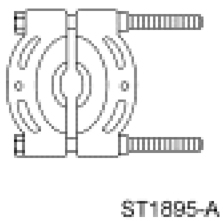
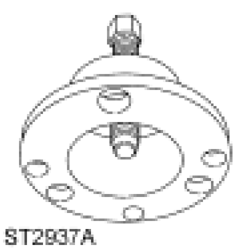


Fig. 6: Installing Cover Seal In PTU
Courtesy of FORD MOTOR CO.

3. Install the intermediate shaft seal and deflector. For additional information, refer to **INTERMEDIATE SHAFT SEAL AND DEFLECTOR**.
4. Fill the PTU fluid as necessary. For additional information, refer to **POWER TRANSFER UNIT (PTU) DRAINING AND FILLING**.

OUTPUT SHAFT SEAL

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
	Holding Fixture, Drive Pinion Flange	205-126 (T78P-4851-A)
	Installer, PTU Drive Gear Outer Oil Seal	308-430
	Remover, Output Flange	307-523

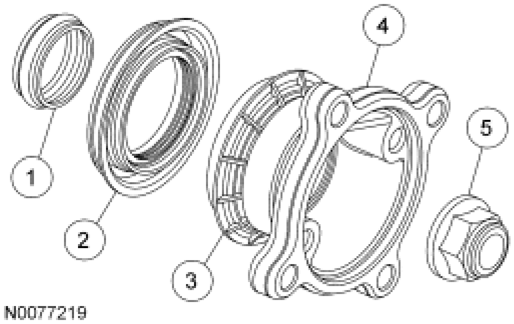


Fig. 7: Output Shaft Seal and Flange
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Collapsible spacer (part of 7275 kit)
2	-	Output shaft seal (part of 7275 kit)
3	-	Output shaft seal deflector (part of 7275 kit)
4	-	Output pinion flange (part of 7275 kit)
5	-	Pinion flange nut (part of 7275 kit)

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the exhaust flexible pipe. For additional information, refer to **EXHAUST SYSTEM** article.

NOTE: Index-mark both the driveshaft flanges for installation.

3. Remove the 4 driveshaft-to-Power Transfer Unit (PTU) output flange bolts. Disconnect the driveshaft from the PTU and position it aside.
    - Using mechanic's wire, support the driveshaft.

NOTE: Rotational torque of the PTU rear output shaft flange must be measured and recorded using a N.m (lb-in) torque wrench for correct pinion bearing preload when reassembled. This will be the torque-to-turn measurement.

4. Using a suitable torque wrench, measure and record the rotational torque.

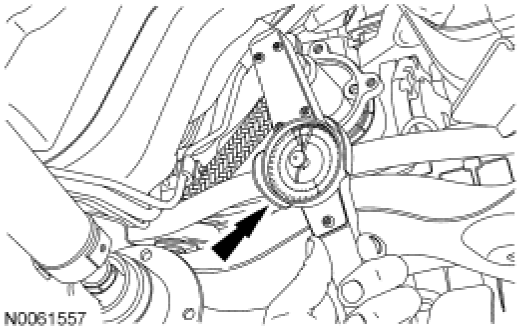


Fig. 8: Measuring Rotational Torque Using A Suitable Torque Wrench
Courtesy of FORD MOTOR CO.

5. Using the Drive Pinion Flange Holding Fixture, hold the output pinion flange. Remove and discard the pinion nut.

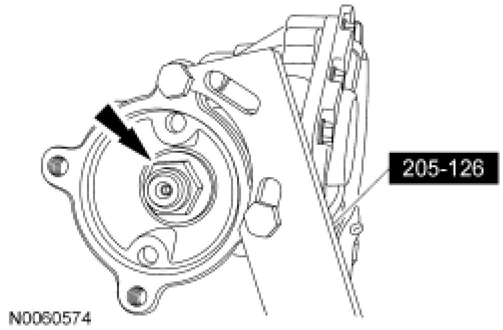


Fig. 9: Holding Output Pinion Flange Using Special Tool (205-126)
Courtesy of FORD MOTOR CO.

NOTE: Index-mark the output pinion flange to the pinion shaft.

6. Using the Output Flange Remover, remove the output pinion flange.

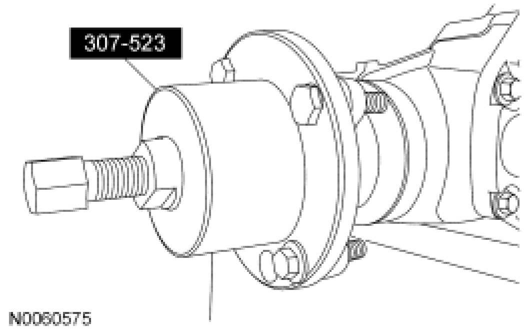


Fig. 10: Removing Output Pinion Flange Using Special Tool (307-523)
Courtesy of FORD MOTOR CO.

7. Remove and discard the output shaft seal deflector.
8. Remove and discard the output shaft seal.
9. Remove and discard the collapsible spacer.

INSTALLATION

1. Install the new collapsible spacer.
2. Using the PTU Drive Gear Outer Oil Seal Installer, install the output shaft seal.

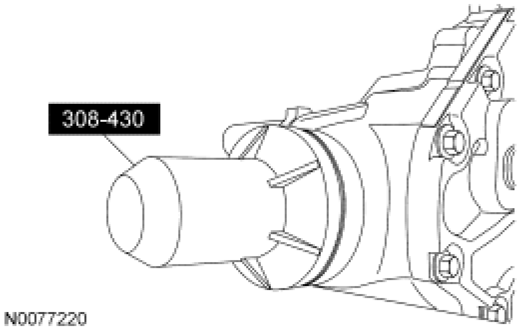


Fig. 11: Installing Output Shaft Seal Using Special Tool (308-430)
Courtesy of FORD MOTOR CO.

3. Using the PTU Drive Gear Outer Oil Seal Installer, install the output shaft seal deflector.

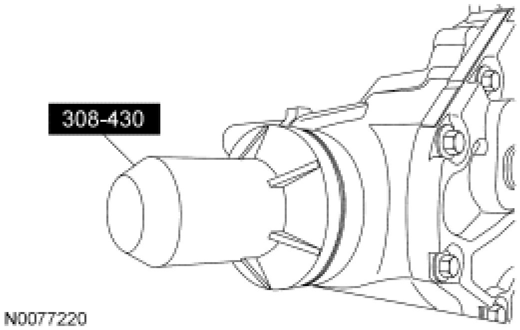


Fig. 12: Installing Output Shaft Seal Using Special Tool (308-430)
Courtesy of FORD MOTOR CO.

NOTE: **Install the output pinion flange to engage the spline as previously marked.**

4. Install the output pinion flange.

NOTE: **Refer to the rotational torque previously recorded with the N.m (lb-in) torque wrench. Tighten the pinion nut in small increments until it is within 0.3 N.m (3 lb-in) of the reference measurement. If 0.3 N.m (3 lb-in) is exceeded, then the collapsible spacer will be damaged and a new collapsible spacer will be required.**

5. Using the Drive Pinion Flange Holding Fixture to hold the output pinion flange, install and tighten the new pinion flange nut.

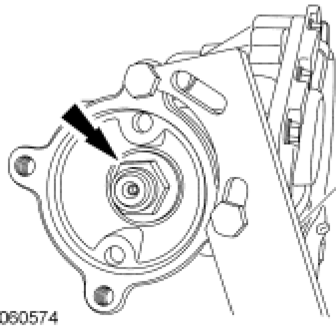
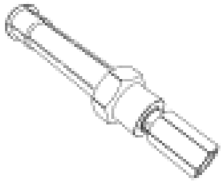


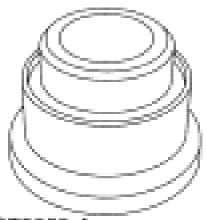
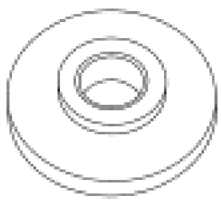
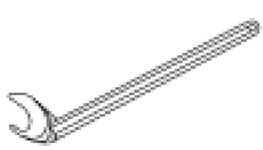
Fig. 13: Holding Output Pinion Flange Using Special Tool (205-126)
Courtesy of FORD MOTOR CO.

6. Position the driveshaft using the index mark and install the 4 driveshaft-to-PTU output flange bolts. Tighten bolts in a star pattern.
   - Tighten to 70 N.m (52 lb. ft.).
7. Install the exhaust flexible pipe. For additional information, refer to **EXHAUST SYSTEM** article.
8. Fill the PTU, if necessary. For additional information, refer to **POWER TRANSFER UNIT (PTU) DRAINING AND FILLING**.

INTERMEDIATE SHAFT SEAL AND DEFLECTOR

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
	Bearing Cup Remover	308-125 (T87P-7120-D)
	Handle, Driver 32 in	205-907
	Installer, PTU Linkshaft Seal	205-883

 ST3052-A		
 ST3053-A	Installer, PTU Linkshaft Seal Dust Shield	205-882
 ST2272-A	Remover, Front Wheel Hub	205-D070 (D93P-1175-B) or equivalent
 ST1582-A	Remover, Halfshaft	205-241

GENERAL EQUIPMENT

5/8 in (16 mm) washer (used with 308-125)

MATERIAL

Item	Specification
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-
Motorcraft MERCON® LV Automatic Transmission Fluid XT-10-QLV	MERCON® LV
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

REMOVAL

NOTE: **The Power Transfer Unit (PTU) may leak different color fluids, red oil leak for automatic transmission fluid and brown/black gear lube for PTU fluid. The PTU seals prevent these types of fluids from leaking. It is important to note which color fluid is leaking to conduct the most appropriate service procedure. This procedure will correct a red oil leak (automatic transmission fluid) from the intermediate shaft seal on the RH side of the PTU. For additional information, refer to ANALYSIS OF LEAKAGE.**

NOTE: **This procedure is to be performed through the RH wheel opening. It is not necessary to remove the exhaust components to complete this repair.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the RH front wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
3. Apply the brake to keep the halfshaft from rotating and remove the front wheel hub nut.
    - Do not discard the nut at this time.

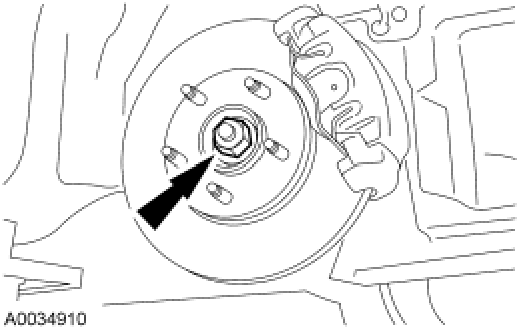


Fig. 14: Locating Front Wheel Hub Nut
Courtesy of FORD MOTOR CO.

4. Remove the brake flexible hose bracket bolt and disconnect the hose from the shock absorber.

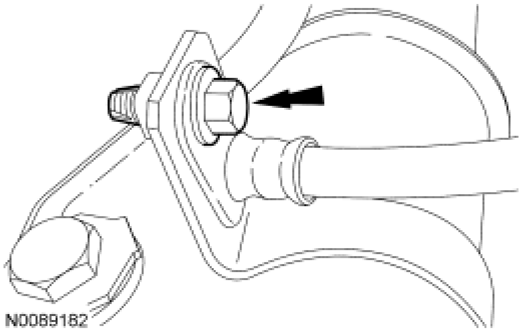


Fig. 15: Identifying Brake Flexible Hose Bracket Bolt
Courtesy of FORD MOTOR CO.

5. Disconnect the wheel speed sensor harness from the shock absorber bracket.

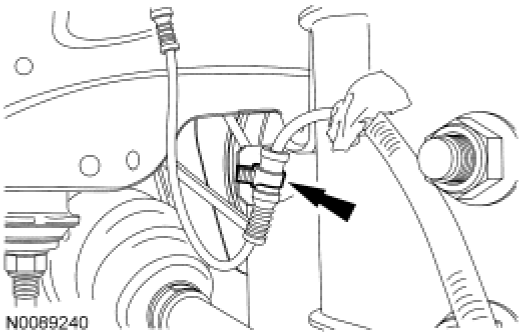


Fig. 16: Identifying Wheel Speed Sensor Harness
Courtesy of FORD MOTOR CO.

6. Remove the RH brake disc. For additional information, refer to **FRONT DISC BRAKE** article.

NOTE:	**Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

7. Remove and discard the upper stabilizer bar link nut.
   - Position the stabilizer bar link aside.

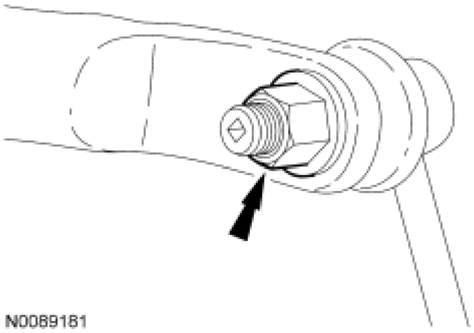


Fig. 17: Identifying Ball Joint-to-knuckle Bolt And Nut
Courtesy of FORD MOTOR CO.

8. Remove and discard the ball joint-to-knuckle bolt and nut.
   - Separate the lower control arm from the knuckle.

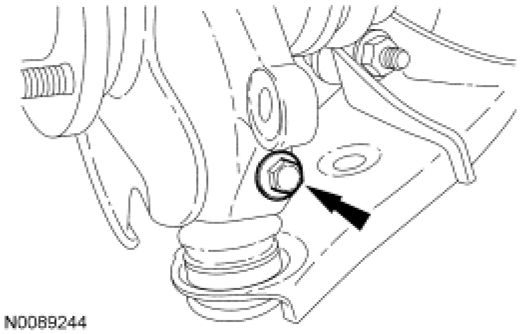


Fig. 18: Identifying Ball Joint-to-knuckle Bolt And Nut
Courtesy of FORD MOTOR CO.

9. Using the Front Wheel Hub Remover, separate the halfshaft from the wheel hub.

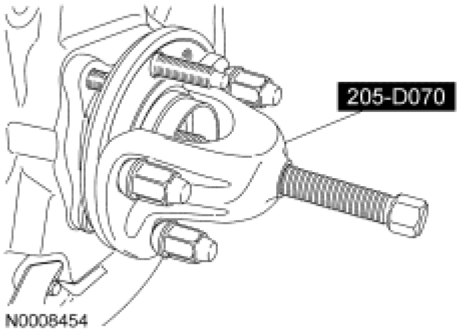


Fig. 19: Pressing Halfshaft From Wheel Bearing & Hub
Courtesy of FORD MOTOR CO.

10. Pull the knuckle outboard and rotate it toward the rear of the vehicle.
    - Secure the knuckle assembly.

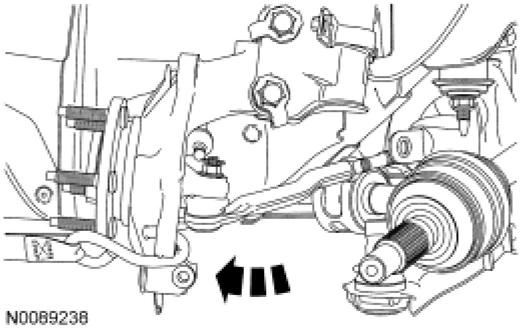


Fig. 20: Identifying Knuckle Assembly
Courtesy of FORD MOTOR CO.

NOTE:	**It is not necessary to separate the halfshaft from the intermediate shaft for this repair.**

11. Remove the 2 intermediate shaft bracket bolts and the intermediate and halfshaft assembly.
    - Inspect the intermediate shaft for pitting or damage in the seal contact area. Replace if necessary.

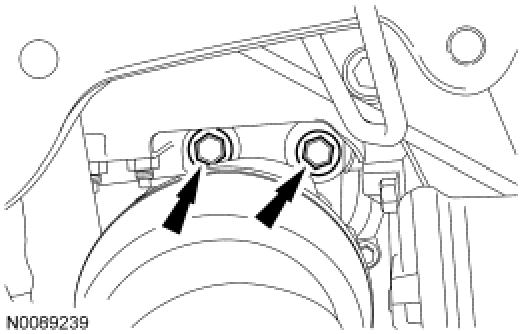


Fig. 21: Identifying Bearing Cup Remover
Courtesy of FORD MOTOR CO.

NOTE: The following instruction will prevent the Bearing Cup Remover from opening too far which would make removing the intermediate shaft seal deflector difficult.

12. Place a 16 mm (5/8 in) washer between the components of the Bearing Cup Remover as shown in illustration.

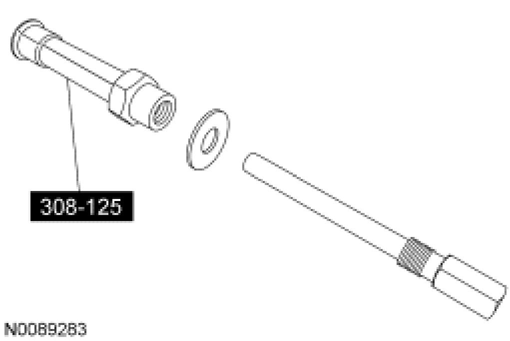


Fig. 22: Identifying 16 mm (5/8 in) Washer
Courtesy of FORD MOTOR CO.

NOTE: Using a 5-pound or larger slide hammer eases the removal of the seal deflector.

13. Using the Bearing Cup Remover, the extension from the Halfshaft Remover, and a suitable slide hammer, remove the seal deflector.
    - The seal deflector will have been damaged during removal. Remove all foreign material from the PTU before continuing with the repair.

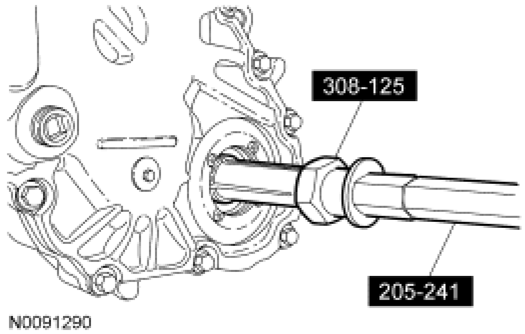


Fig. 23: Removing Seal Deflector
Courtesy of FORD MOTOR CO.

14. Using the Bearing Cup Remover, the extension from the Halfshaft Remover, and a suitable slide hammer, remove the intermediate shaft seal, and if equipped, the alignment washer.

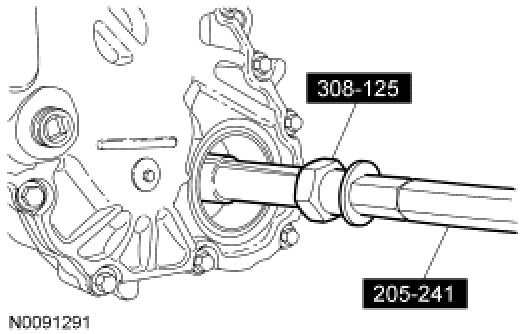


Fig. 24: Removing Intermediate Shaft Seal
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: **The following illustration shows the correct orientation of the seal components when installed in the vehicle.**

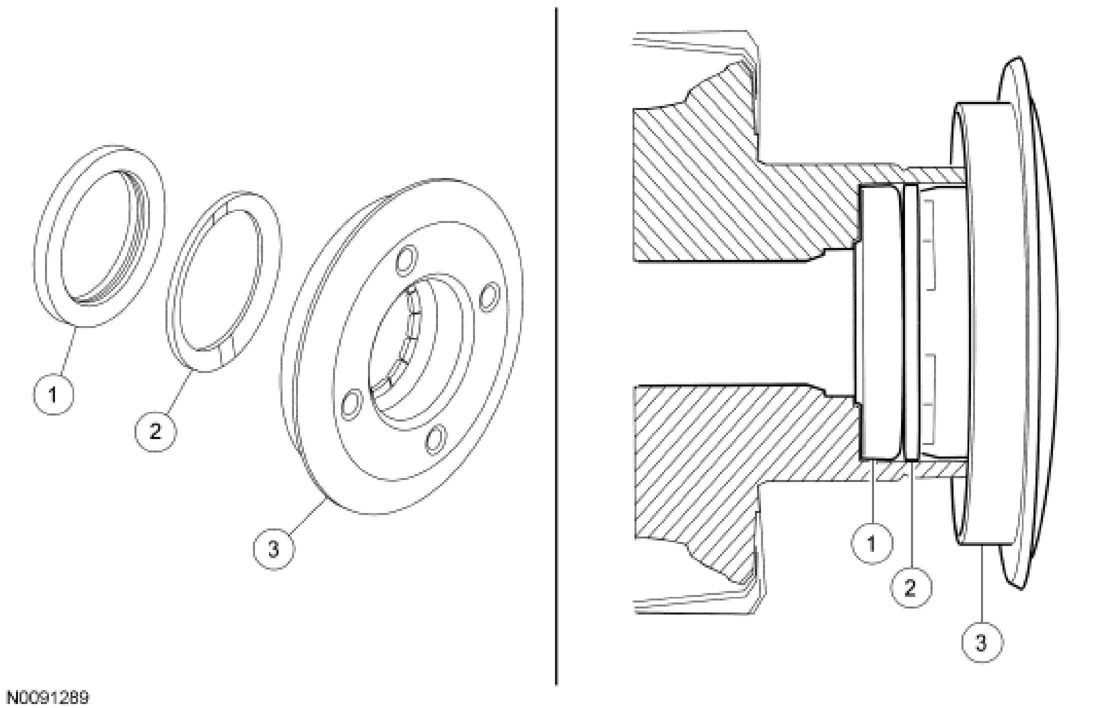


Fig. 25: View Of Correct Orientation Of Seal Components When Installed In Vehicle
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Intermediate shaft seal (part of 7275 kit)
2	-	Alignment washer (part of 7275 kit)
3	-	Seal deflector (part of 7275 kit)

1. Place the intermediate shaft seal on the PTU Linkshaft Seal Installer and Driver Handle with the spring side facing away from the tool.

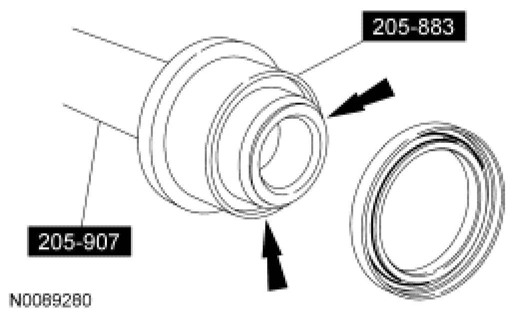


Fig. 26: Placing Intermediate Shaft Seal On PTU Link Shaft Seal Installer
Courtesy of FORD MOTOR CO.

2. Using the PTU Linkshaft Seal Installer and Driver Handle, install the intermediate shaft seal.

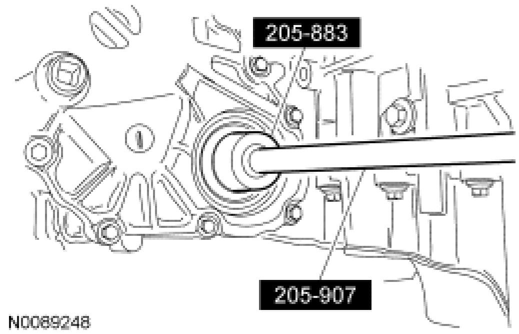


Fig. 27: Installing Intermediate Shaft Seal
Courtesy of FORD MOTOR CO.

3. Place the alignment washer on the PTU Linkshaft Seal Installer and Driver Handle with the beveled edge (white-striped side) facing towards the tool.

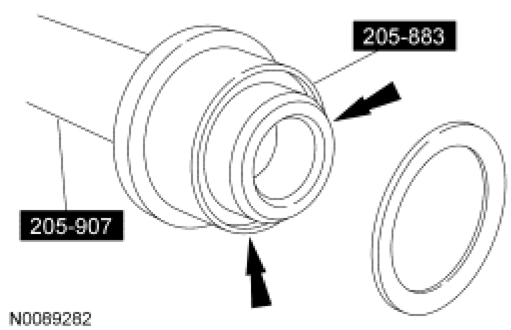


Fig. 28: Placing Intermediate Shaft Seal On PTU Link shaft Seal Installer
Courtesy of FORD MOTOR CO.

NOTE: Do not use force when installing the alignment washer or damage to the washer can occur.

4. Using the PTU Linkshaft Seal Installer and Driver Handle, install the alignment washer by hand, pushing it in until it bottoms against the seal.
    - When installed, the white-striped side should be facing out.

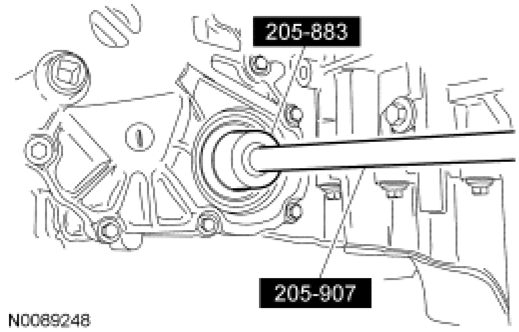


Fig. 29: Installing Intermediate Shaft Seal

Courtesy of FORD MOTOR CO.

NOTE:	**Do not overheat (melt) the seal deflector. Monitor the temperature of the deflector with a suitable temperature measuring device, such as a digital temperature laser or infrared thermometer, while heating. Do not allow the temperature to exceed 100°C (212°F). Overheating will damage the deflector. If the deflector is damaged, a new deflector must be used.**

NOTE:	**Apply a small amount of silicone brake caliper grease and dielectric compound to the inner lip of the deflector where it installs on the tube inside the PTU before heating. This will ease the installation of the deflector.**

5. Position the deflector on the PTU Linkshaft Seal Dust Shield Installer using silicone brake caliper grease and dielectric compound to retain it to the installer. Using a suitable heat gun, heat the deflector to a minimum of 66°C (150°F) and a maximum of 100°C (212°F) by concentrating the heat across the back of the installer while rotating, not directly on the deflector itself.
    - As an alternative method to heating the seal deflector, place the deflector in boiling water for 3 to 5 minutes. Dry off the deflector and install.

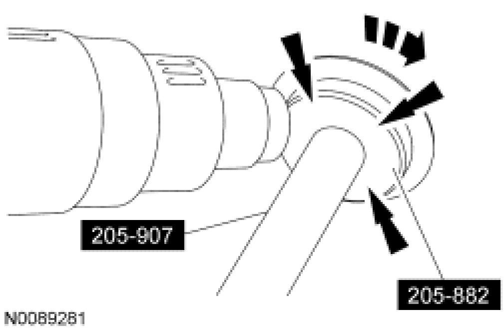


Fig. 30: Applying Small Amount Of Silicone Brake Caliper Grease & Dielectric Compound To Inner Lip Of Deflector
Courtesy of FORD MOTOR CO.

6. Install the seal deflector immediately after heating using the PTU Linkshaft Seal Dust Shield Installer and Driver Handle.

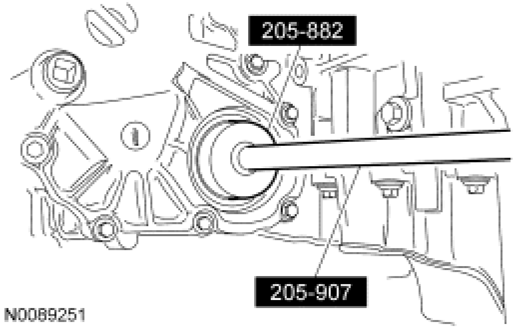


Fig. 31: Installing Seal Deflector
Courtesy of FORD MOTOR CO.

7. Make sure the deflector is completely seated all the way around and there are no cracks on the face or inner diameter white-colored tab. The deflector is correctly installed when the face of the deflector is recessed 3-5 mm (0.12-0.20 in) into the pocket all the way around.

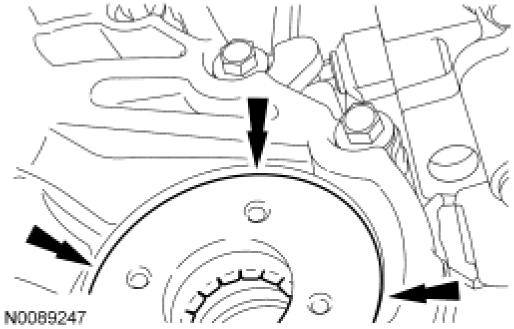


Fig. 32: Making Sure Deflector Is Completely Seated All The Way Around
Courtesy of FORD MOTOR CO.

NOTE: A slight effort may be required to fully seat the intermediate and halfshaft assembly as it passes through the alignment washer.

8. Install the intermediate and halfshaft assembly and the 2 bolts.
   - Tighten to 40 N.m (30 lb. ft.).

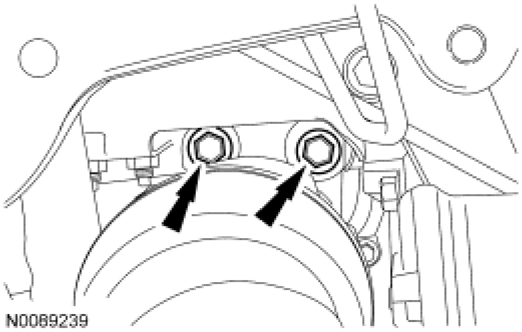


Fig. 33: Identifying Intermediate And Halfshaft Assembly And Bolts

Courtesy of FORD MOTOR CO.

NOTE: **Some residual fluid will collect between the seal and deflector during this repair. This is a normal condition and should not be misinterpreted as a leak after the repair is complete.**

9. Using brake parts cleaner, thoroughly clean the deflector and intermediate shaft area of any residual fluid that may have accumulated during the repair.
10. Position the halfshaft and ball joint into the wheel knuckle. Install the new ball joint bolt and nut.
    - Tighten to 55 N.m (41 lb. ft.).

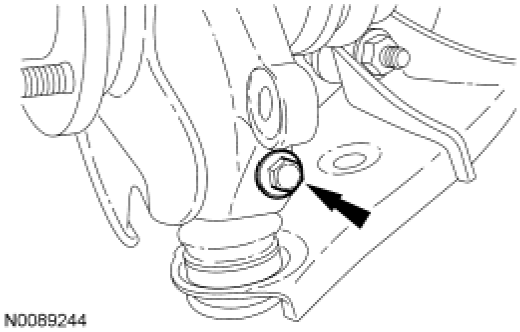


Fig. 34: Identifying Ball Joint Bolt And Nut
Courtesy of FORD MOTOR CO.

11. Position the stabilizer bar link and install the new nut.
    - Tighten to 90 N.m (66 lb. ft.).

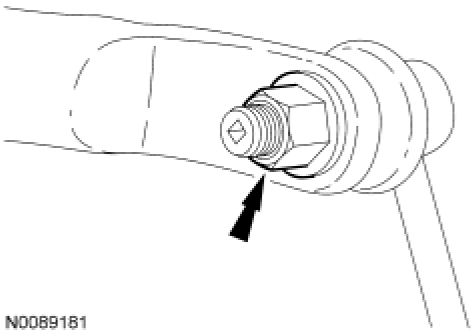


Fig. 35: Stabilizer Bar Link Nut
Courtesy of FORD MOTOR CO.

12. Install the RH brake disc. For additional information, refer to **FRONT DISC BRAKE** article.
13. Position the brake flexible hose bracket to the shock absorber and install the bolt.
    - Tighten to 20 N.m (177 lb-in).

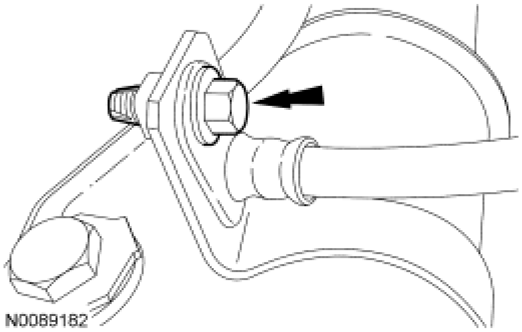


Fig. 36: Identifying Brake Flexible Hose Bracket
Courtesy of FORD MOTOR CO.

14. Connect the wheel speed sensor harness to the shock absorber bracket.

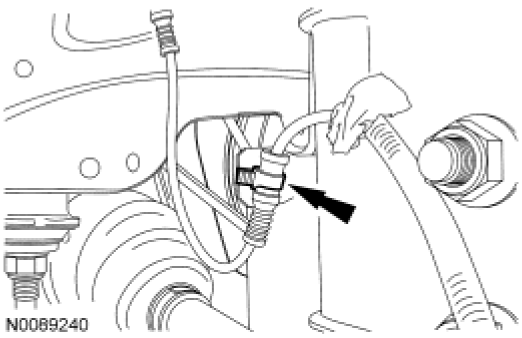


Fig. 37: Identifying Wheel Speed Sensor Harness
Courtesy of FORD MOTOR CO.

NOTE: Do not tighten the halfshaft nut with the vehicle on the ground. The nut must be tightened to specification before the vehicle is lowered onto the wheels. Wheel bearing damage will occur if the wheel bearing is loaded with the weight of the vehicle applied.

15. Apply the brake to keep the halfshaft from rotating. Using the previously removed wheel hub nut, seat the halfshaft into the front wheel hub.
    - Tighten to 350 N.m (258 lb. ft.).
    - Remove and discard the wheel hub nut.

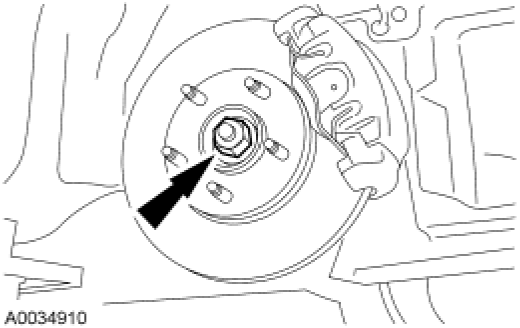


Fig. 38: Locating Front Wheel Hub Nut
Courtesy of FORD MOTOR CO.

NOTE:	**The wheel hub nut contains a one-time locking chemical that is activated by the heat created when it is tightened. Install and tighten the new wheel hub nut to specification within 5 minutes of starting it on the threads. Always install a new wheel hub nut after loosening or when not tightened within the specified time or damage to the components can occur.**

16. Apply the brake to keep the halfshaft from rotating and install a new wheel hub nut.
    - Tighten to 350 N.m (258 lb. ft.).
17. Install the RH front wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
18. Top off the transmission fluid as necessary.

REMOVAL

POWER TRANSFER UNIT (PTU)

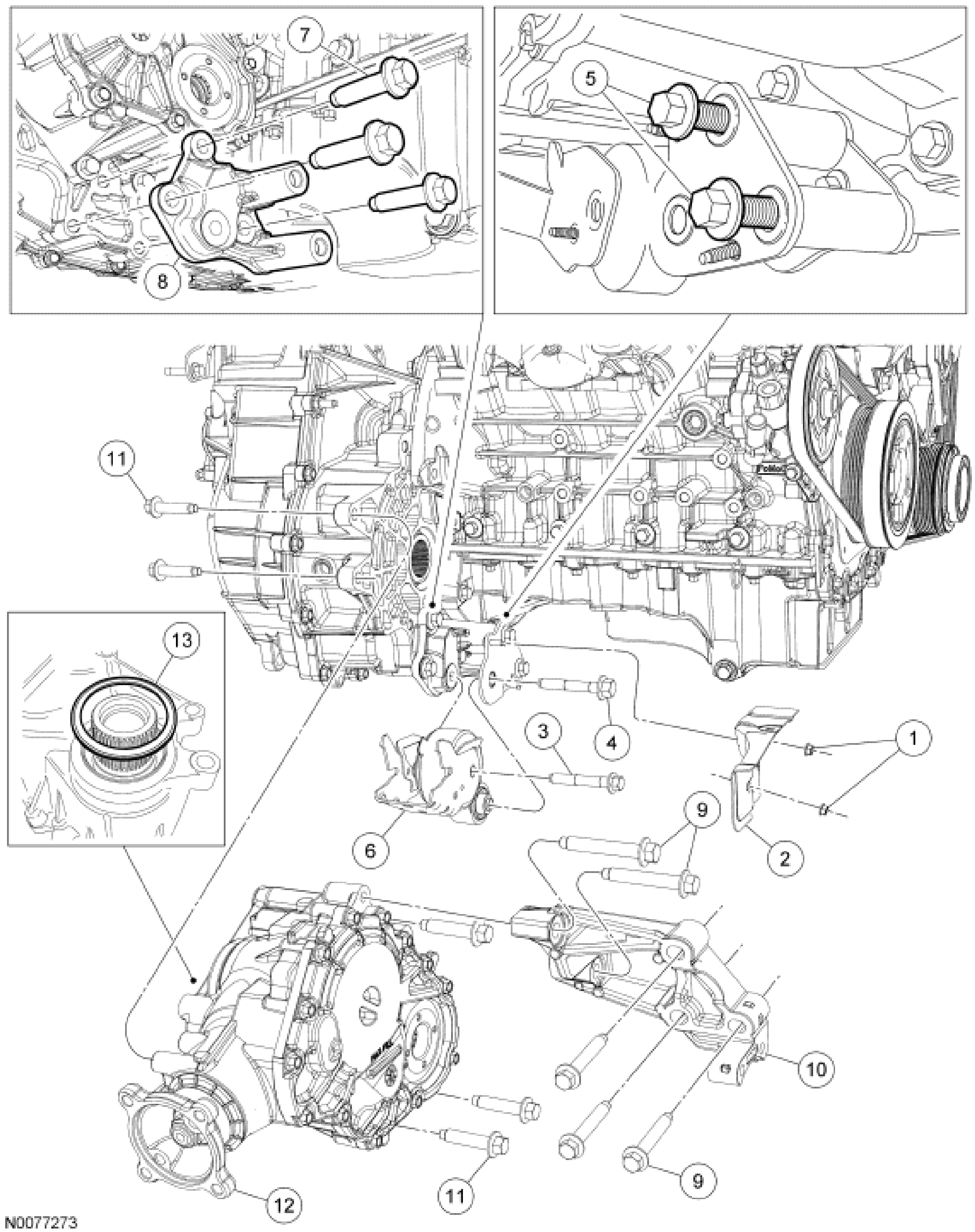


Fig. 39: Identifying Power Transfer Unit (PTU)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W700101	Roll restrictor shield nuts
2	6C038	Roll restrictor shield

3	W706674	Roll restrictor through bolt
4	W711843	Roll restrictor through bolt
5	W712830	Roll restrictor bracket bolts
6	6P082	Roll restrictor assembly
7	W712830	Roll restrictor bracket-to-transaxle bolt (3 required)
8	6P093	Roll restrictor bracket-to-transaxle
9	W500724	Power Transfer Unit (PTU)-to-support bracket bolts (5 required)
10	7A444	PTU support bracket
11	W500741	PTU-to-transaxle bolts (5 required)
12	7251	PTU
13	7086	Compression seal

NOTE: A new intermediate shaft seal and deflector must be installed whenever the intermediate shaft or Power Transfer Unit (PTU) is removed from the vehicle.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the LH and RH wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
3. Remove the intermediate shaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.

NOTE: Index-mark the driveshaft for installation.

4. Remove the 4 bolts and support the driveshaft with a length of mechanic's wire.

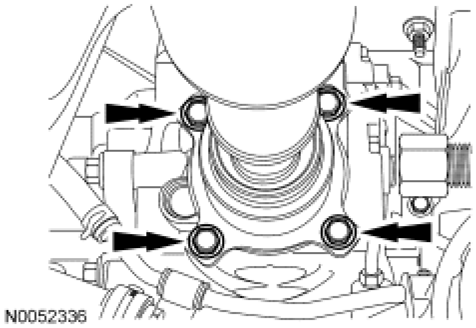


Fig. 40: Locating Driveshaft Aside Bolts
Courtesy of FORD MOTOR CO.

5. Remove the exhaust flexible pipe and the RH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.
6. Remove the 2 roll restrictor nuts and the roll restrictor shield.

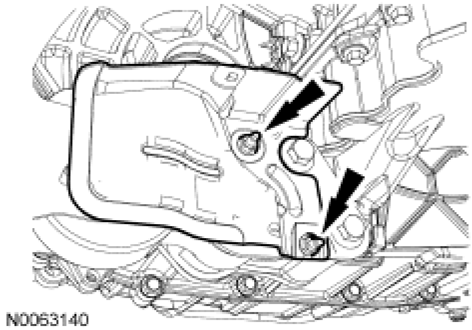


Fig. 41: Locating Roll Restrictor Heat Shield Nuts
Courtesy of FORD MOTOR CO.

7. Remove the roll restrictor through bolt.

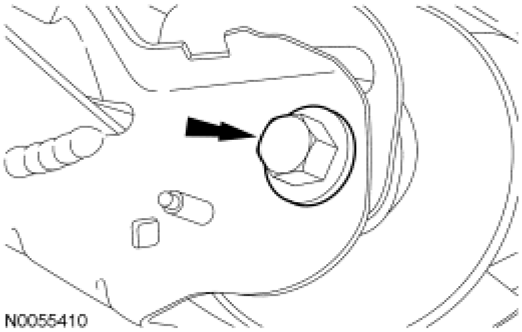


Fig. 42: Locating Roll Restrictor-To-Subframe Bolt
Courtesy of FORD MOTOR CO.

8. Remove the roll restrictor through bolt, 2 roll restrictor bracket bolts and the roll restrictor assembly.

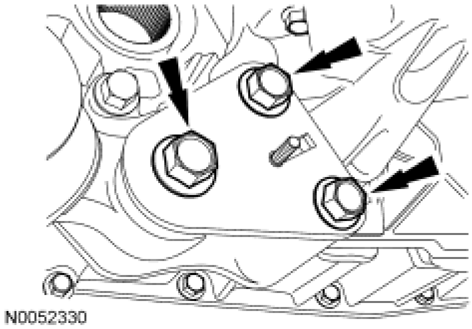


Fig. 43: Locating Roll Restrictor-To-Transaxle Bracket Plate Bolts
Courtesy of FORD MOTOR CO.

9. Remove the 3 roll restrictor bracket-to-transaxle bolts and the roll restrictor-to-transaxle bracket.

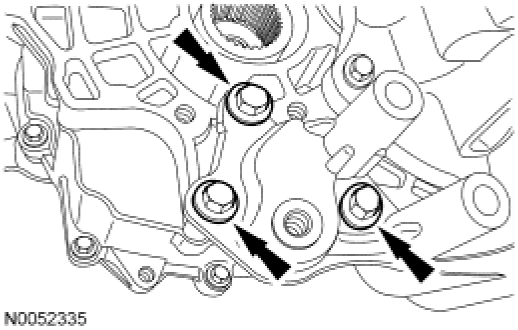


Fig. 44: Locating Transaxle Bracket Bolts
Courtesy of FORD MOTOR CO.

10. Remove the 5 PTU support bracket bolts and the PTU support bracket.

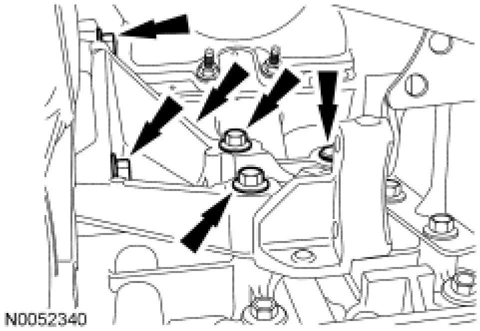


Fig. 45: Locating Power Transfer Unit (PTU) Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

11. Using a long extension, loosen but do not remove the 2 LH side PTU-to-transaxle bolts.

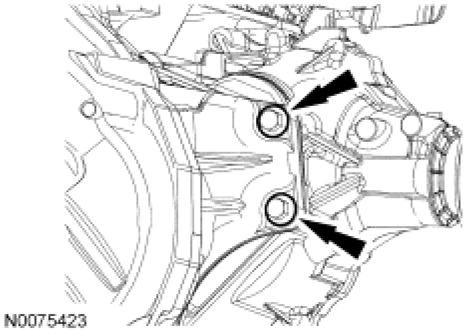


Fig. 46: Locating LH Side PTU-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

12. Remove the 3 RH side PTU-to-transaxle bolts and the 2 LH side PTU-to-transaxle bolts previously loosened.

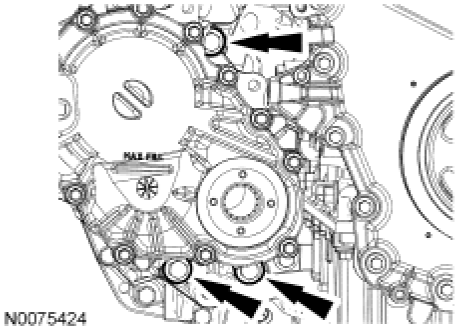


Fig. 47: Locating RH Side PTU-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

13. Separate the PTU from the transaxle and remove it from the vehicle.

NOTE: **A new compression seal must be installed whenever the PTU is removed from the vehicle.**

14. Using a suitable tool, remove the compression seal and discard.

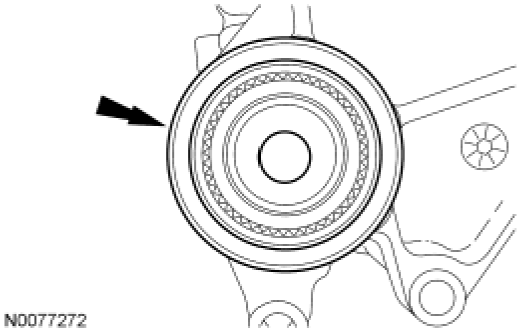


Fig. 48: Identifying Compression Seal
Courtesy of FORD MOTOR CO.

INSTALLATION

POWER TRANSFER UNIT (PTU)

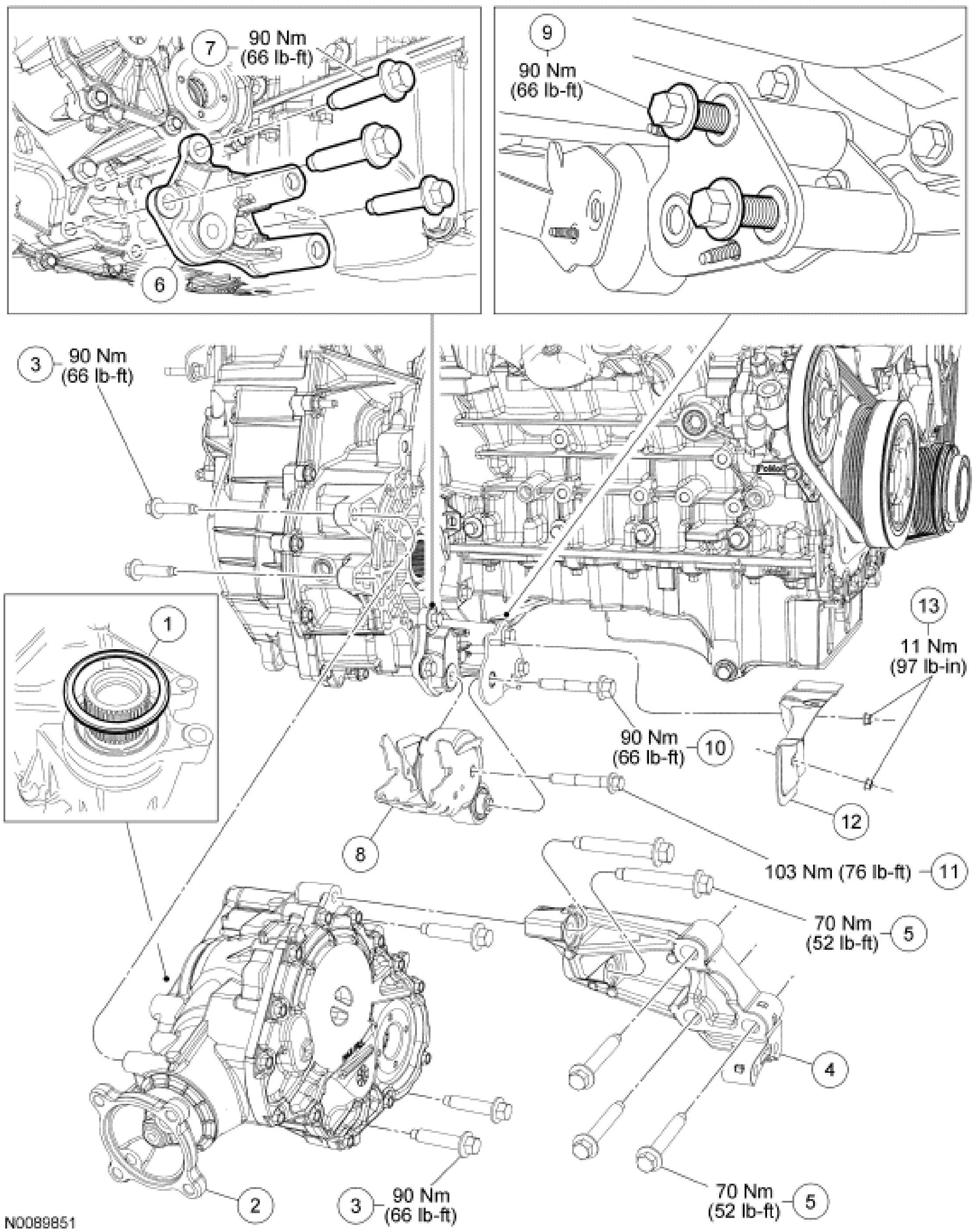


Fig. 49: Identifying Power Transfer Unit Assembly With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7086	Compression seal
2	7251	Power Transfer Unit (PTU)

3	W500741	PTU-to-transaxle bolts (5 required)
4	7A444	PTU support bracket
5	W500724	PTU-to-support bracket bolts (5 required)
6	6P093	Roll restrictor bracket
7	W712830	Roll restrictor bracket-to-transmission bolt (3 required)
8	6P082	Roll restrictor assembly
9	W712830	Roll restrictor bracket bolt (2 required)
10	W711843	Roll restrictor through bolt
11	W706674	Roll restrictor through bolt
12	6C038	Roll restrictor shield
13	W700101	Roll restrictor shield nuts

NOTE: **A new compression seal must be installed whenever the Power Transfer Unit (PTU) is removed from the vehicle.**

1. Using a suitable tool, install the new compression seal.

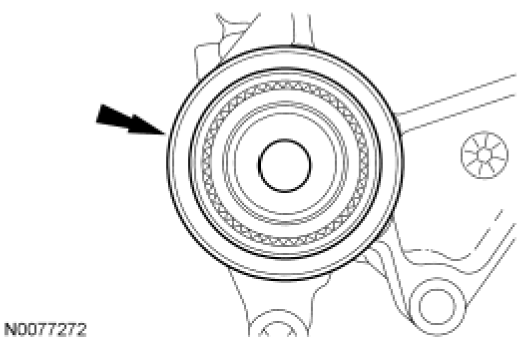


Fig. 50: Identifying Compression Seal
Courtesy of FORD MOTOR CO.

NOTE: **A new PTU intermediate shaft seal must be installed whenever the intermediate shaft or PTU is removed from the vehicle.**

2. Using a suitable pry bar, move the engine forward. Install a block of wood to hold the engine in the forward position. Install the PTU with the output flange facing the passenger side, filler plug facing upward. Rotate the PTU to the transaxle. Install the 5 PTU-to-transaxle bolts.
   - Tighten to 90 N.m (66 lb. ft.).

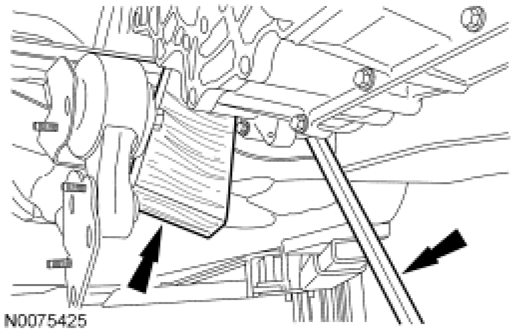


Fig. 51: Moving Engine Forward Using A Suitable Pry Bar
Courtesy of FORD MOTOR CO.

3. Position the PTU support bracket into place and hand-tighten the 5 PTU support bracket bolts.
   1. Tighten the bolts to the transaxle to 70 N.m (52 lb. ft.).
   2. Tighten the bolts to the engine to 70 N.m (52 lb. ft.).

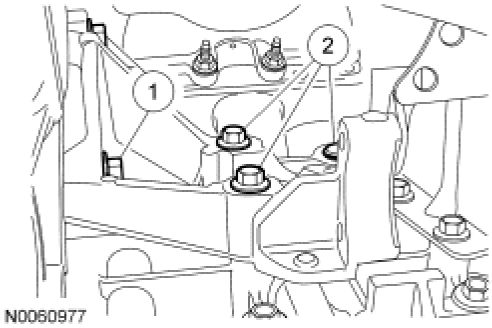


Fig. 52: Identifying Transaxle Bolts & Engine Bolts
Courtesy of FORD MOTOR CO.

4. Install the roll restrictor-to-transmission bracket and the 3 roll restrictor bracket-to-transmission bolts.
   - Tighten to 90 N.m (66 lb. ft.).

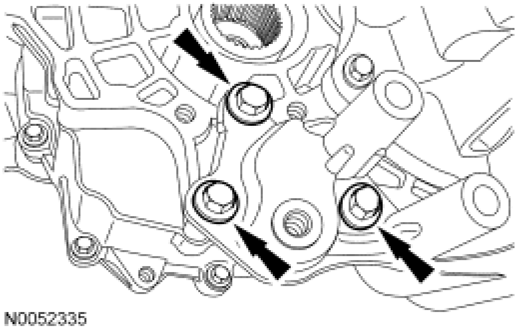


Fig. 53: Locating Transaxle Bracket Bolts
Courtesy of FORD MOTOR CO.

5. Install the roll restrictor through bolt and the 2 roll restrictor bracket bolts.
   - Tighten to 90 N.m (66 lb. ft.).

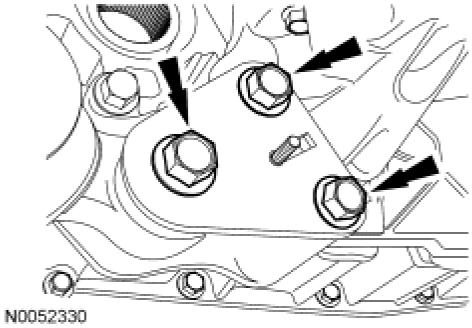


Fig. 54: Locating Roll Restrictor-To-Transaxle Bracket Plate Bolts
Courtesy of FORD MOTOR CO.

6. Install the roll restrictor through bolt
   - Tighten to 103 N.m (76 lb. ft.).

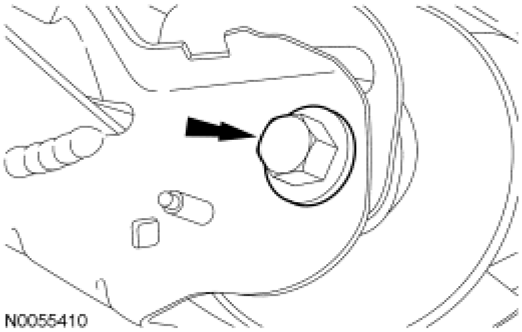


Fig. 55: Locating Roll Restrictor-To-Subframe Bolt
Courtesy of FORD MOTOR CO.

7. Install the roll restrictor shield and the 2 roll restrictor nuts.
   - Tighten to 11 N.m (97 lb-in).

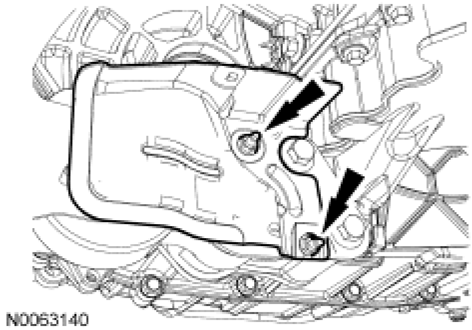


Fig. 56: Locating Roll Restrictor Heat Shield Nuts

Courtesy of FORD MOTOR CO.

8. Install the exhaust flexible pipe and RH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.
9. Install the intermediate shaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.
10. Line up the index marks on the driveshaft to the index marks on the PTU flange made during removal and install the 4 bolts.
    - Tighten to 70 N.m (52 lb. ft.).

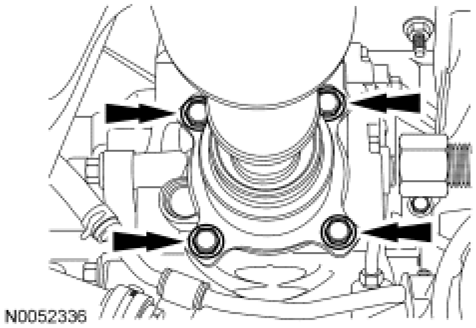


Fig. 57: Locating Driveshaft Aside Bolts
Courtesy of FORD MOTOR CO.

11. Fill the PTU, if necessary. For additional information, refer to **POWER TRANSFER UNIT (PTU) DRAINING AND FILLING**.
12. Install the LH and RH wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

2008 SUSPENSION

Wheels & Tires - Edge & MKX

SPECIFICATIONS

MATERIAL SPECIFICATIONS

Item	Specification	Fill Capacity
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A	-
Wheel and Tire Cleaner ZC-27-A or B	-	-

GENERAL SPECIFICATIONS

Item	Specification
Tire Balance Weight	
Maximum balance weight (Euro-flange wheel alloy/chrome)	180 g (6.4 oz) per inner and outer
Maximum balance weight (MC flange alloy/cladded)	135 g (4.8 oz) per inner and outer
Tire Inflation	
Tires	See Safety Certification Label located on driver door jamb.
NOTE: **Use only special tool 204-354 any time tire pressures are measured to be sure that accurate values are obtained.** **For accuracy, Ford recommends the use of a digital or dial-type tire pressure gauge rather than a stick-type pressure gauge.** Inflate the tire to the pressure specified on the safety certification sticker located on the driver door or door pillar.	

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Sensor strap (worm gear)	3	-	27
Wheel nuts	135	100	-

DESCRIPTION AND OPERATION

WHEELS AND TIRES

Safety Precautions

WARNING: **Vehicle may have multiple drive wheels. Do not use engine to power the driveline unless all drive wheels are elevated off the ground. Drive wheels in contact with ground could cause unexpected vehicle movement. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Always match the tire size to the wheel size during assembly. Incorrect matching can result in tire bead damage or tire separation from the wheel. Failure to follow this instruction may result in serious personal injury to technician or vehicle occupant(s).**

WARNING: **Before servicing any tire, ask the customer if anyone injected a tire sealant into the tire. Tire sealants may be flammable and can burn or explode if exposed to an ignition source. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Replacement wheels must be equivalent to the original equipment wheels in:**

- **load carrying capacity.**
- **diameter, width and offset.**
- **pilot hole and bolt circle.**

Combined load carrying capacity of replacement wheels for a given axle, must be equal to or greater than that axle's gross axle weight rating (GAWR) identified on the vehicle's Safety Compliance Certification label. All other specifications should be evaluated by measurement of both the original wheel and the replacement wheel. If specifications are not equivalent, the safety and handling of the vehicle may be degraded, which may result in serious injury to the vehicle occupant(s).

WARNING: **Never use wheels different than the original equipment. Additionally, never use wheel nuts different than the original equipment. Failure to follow these instructions may result in damage to the wheel or mounting system. This damage could cause the wheel to come off while the vehicle is being driven, which could result in serious personal injury or death to vehicle occupant(s).**

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Keep eyes away from valve stem when deflating tires. Reduce air pressure in tire as much as possible by pushing in valve core plunger prior to removing the core. Escaping air can carry particles that can injure the eyes. Failure to follow these instructions may result in serious**

personal injury.

WARNING: **Only use replacement tires that are the same size, load index, speed rating and type (such as P-metric versus LT-metric or all-season versus all-terrain) as those originally provided by Ford. The recommended tire and wheel size may be found on either the Safety Compliance Certification Label or the Tire Label, which is located on the B-pillar or edge of the driver's door. If the information is not found on these labels, consult a Ford dealer. Use of any tire or wheel not recommended by Ford can affect the safety and performance of the vehicle, which could result in an increased risk of loss of vehicle control, vehicle rollover, personal injury and death. Additionally, the use of non-recommended tires and wheels could cause steering, suspension, axle or transfer case/power transfer unit failure.**

NOTE: Do not clean aluminum wheels with steel wool, abrasive-type cleaners or strong detergents or damage to the wheel finish may occur. Use Wheel and Tire Cleaner ZC-27-A or -B or equivalent.

Factory-installed tires and wheels are designed to operate satisfactorily with loads up to and including full-rated load capacity when inflated to recommended inflation pressures.

Correct tire pressure and driving techniques have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increase tire wear.

To equalize tire wear, the tires should be rotated at recommended intervals.

Tire Pressure Monitoring System (TPMS)

NOTE: The Smart Junction Box (SJB) is also identified as the Generic Electronic Module (GEM).

The Tire Pressure Monitoring System (TPMS) includes:

- the SJB, TPMS functionality is integrated within the SJB.
- four tire pressure sensors.
- four tire pressure sensor cradles.
- four tire pressure sensor straps.
- an instrument cluster indicator.
- a message center (if equipped).

Tire Pressure Monitoring System (TPMS) Module

The SJB contains the TPMS functionality. Refer to **Tire Pressure Monitoring System** for TPMS fault diagnosis and repair.

The SJB compares the information of each tire pressure sensor transmission against a pressure limit. If the SJB determines that the tire pressure has fallen below the low limit, the SJB communicates this to the instrument cluster on the vehicle communication bus.

Tire Pressure Monitoring System (TPMS) Pressure Sensor

The SJB monitors the air pressure in the 4 road tires with tire pressure sensors. The sensors transmit radio frequency signals to the SJB approximately every 60 seconds when the vehicle speed exceeds 32 km/h (20 mph).

The tire pressure sensors are battery operated and are mounted to metal brackets (called cradles) on the wheels inside the tires. The sensors are mounted 180 degrees from the valve stem.

The tire pressure sensor can be serviced separately from the cradle and the strap.

Tire Pressure Monitoring System (TPMS) Pressure Sensor Cradle

The tire pressure sensor cradles are mounted to the wheels with metal straps and have an adhesive strip to aid in their retention to the wheel.

The sensor cradle is available with the strap in a kit. To service the sensor cradle, the strap must be removed and discarded.

Tire Pressure Monitoring System (TPMS) Pressure Sensor Strap

The sensor strap keeps the sensor and the cradle retained to the wheel. A factory-installed strap is joined together with a one-time-use buckle and a dealer-installed strap is joined together with a worm gear (similar to a radiator hose clamp). Both straps should be discarded after removal and should not be reused.

The cradle and strap are available as a strap kit. There are several different strap kits available based on wheel diameter.

Instrument Cluster and Message Center

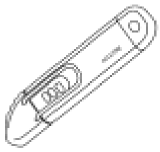
The instrument cluster illuminates the TPMS indicator when it receives a message from the SJB to do so and displays the appropriate message(s) in the message center (if equipped).

The instrument cluster and message center are diagnosed and serviced in their own respective service information . Refer to the appropriate Instrumentation and Warning Systems article for the procedure.

DIAGNOSTIC TESTS

WHEELS AND TIRES

Special Tools

Illustration	Tool Name	Tool Number
 ST2869-A	Digital Tire Gauge	204-354

Inspection and Verification

WARNING: Vehicle may have multiple drive wheels. Do not use engine to power the driveline unless all drive wheels are elevated off the ground. Drive wheels in contact with ground could cause unexpected vehicle movement. Failure to follow this instruction may result in serious personal injury.

Be sure to follow all warnings when carrying out Inspection and Verification.

Road Test

Verify the customer concern by carrying out a road test on a smooth road. If any vibrations are apparent, go to **Symptom Chart - NVH**.

To maximize tire performance, inspect for signs of incorrect inflation and uneven wear, which may indicate a need for balancing, rotation or front suspension alignment.

Correct tire pressure and driving techniques have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increase tire wear.

Replacement tires must follow the recommended:

- tire sizes.
- speed rating.
- load range.
- tire construction type.

The use of any other tire/wheel size or type can seriously affect:

- ride.
- handling.
- speedometer/odometer calibration.
- vehicle ground clearance.
- tire clearance between the body and chassis.
- wheel bearing life.
- brake cooling.

New wheels need to be installed when the vehicle's wheels:

- are bent.
- are cracked.
- are dented.
- are heavily corroded.
- are leaking.
- have elongated wheel hub bolt holes.
- have excessive lateral or radial runout.

It is mandatory to use only the tire sizes recommended on the tire chart attached to the vehicle. Larger or smaller tires can damage the vehicle, affect durability and require changing the speedometer calibration. Make sure wheel size and offsets match those recommended for the tire in use.

1. Inspect the tires for signs of uneven wear. Refer to the following descriptions to identify the type of wear and Go to **Symptom Chart - Tire Wear** for the appropriate repair action to be carried out.
2. Check the tires for:
   - cuts.
   - stone bruises.
   - abrasions.
   - blisters.
   - embedded objects.
3. Tread wear indicators are molded into the bottom of the tread grooves. Install a new tire when the indicator bands become visible.

Tire Wear

Tire wear is commonly defined as a loss of tread depth. Tire tread wear occurs due to friction with the contact surface (road/pavement). The tread should wear down uniformly all the way around the circumference of the tire and all the way across the tread face. When this does not occur, the tire may have abnormal/incorrect wear.

Normal Tire Wear

Normal tire wear is identified as even wear around and across the tread. Because there are many factors (driving style, road surfaces, type of vehicle, type of tire) that can affect tire wear, there is no absolute mileage expectation for a normal wear condition. A tire is considered worn-out when the tread has worn to the level of the tread-wear indicators.

Abnormal/Incorrect Tire Wear

Abnormal/incorrect tire wear is identified as tire wear that is not even around or across the tread and that creates performance-related issues.

Abnormal/incorrect wear can be caused by numerous factors, some of which include driving style (aggressive passive), climate (hot, cold), road conditions, vehicle loading and maintenance. It is important to determine the root cause of wear on a vehicle before carrying out repair. Tires exhibiting abnormal/incorrect tire wear may still be serviceable provided that the minimum tread depth is greater than 1.58 mm (2/32 in) and the tire is not causing a vehicle performance (noise/vibration) concern.

Some abnormal/incorrect wear patterns look the same all the way around the tread of the tire, other wear patterns are not consistent and can occur in various spots on the tread area. The underlying causes of the 6 wear categories are different. Refer to the following descriptions to identify the type of wear and Go to **Symptom Chart - Tire Wear** for the appropriate repair action to be carried out.

Inner Edge/Shoulder Wear

Inner edge (or shoulder) wear occurs on the inside edge of the tire and is usually caused by excessive toe out and/or excessive negative camber. If the tread depth of the outer shoulder is at least 50% greater than the tread depth of the inner shoulder, the tire is experiencing inner edge/shoulder wear. To determine whether tires have this type of wear, visually inspect the tires. In some instances, the tread depth of each rib may need to be measured to compare it to that of the shoulder.

NOTE: RF tire shown, others similar.

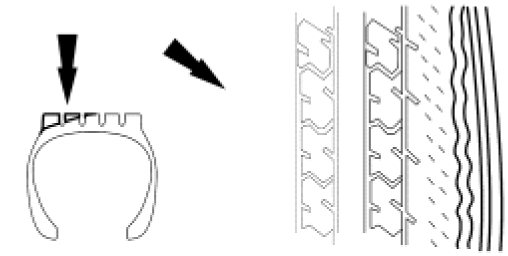


Fig. 1: Identifying Inner Edge/Shoulder Wear
Courtesy of FORD MOTOR CO.

Outer Edge/Shoulder Wear

Outer edge (or shoulder) wear occurs on the outside edge of the tire and is usually caused by excessive toe in and/or excessive positive camber. If the tread depth of the inner shoulder is at least 50% greater than the tread depth of the outer shoulder, the tire is experiencing outer edge/shoulder wear. To determine whether tires have this type of wear, visually inspect the tires. In some instances, the tread depth of each rib may need to be measured to compare it to that of the shoulder.

NOTE: RF tire shown, others similar.

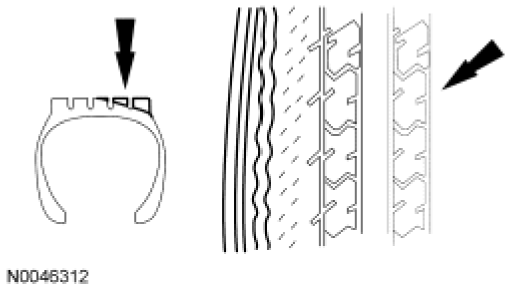


Fig. 2: Identifying Outer Edge/Shoulder Wear
Courtesy of FORD MOTOR CO.

Heel/Toe Wear

Heel/toe wear (also known as feathering) occurs along the outside or inside edge/shoulder of the tire. To determine whether tires have this type of wear, visually inspect the tires in both the inside and outside shoulder ribs. In some instances, the difference in tread depth of leading versus trailing edge of each lug in the inside and outside shoulder rib may need to be measured.

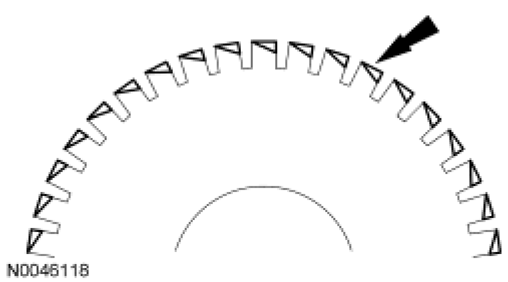


Fig. 3: Identifying Heel/Toe Wear
Courtesy of FORD MOTOR CO.

Diagonal Wear

Diagonal wear occurs diagonally across the tread area and around the circumference of the tire. To determine whether tires have this type of wear, visually inspect the tires to determine if the wear pattern runs diagonally across the tread and around the circumference of the tire. In some instances, the difference in tread depth along the diagonal wear pattern may need to be measured.

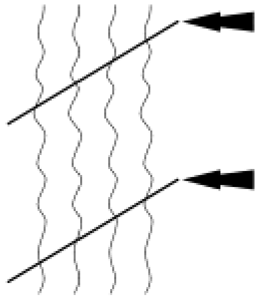


Fig. 4: Identifying Diagonal Wear
Courtesy of FORD MOTOR CO.

Symptom Chart - Tire Wear

Symptom Chart - Tire Wear

Condition	Possible Sources	Action
• Inner edge/shoulder wear	• Excessive toe out and/or negative camber • Incorrect wheel and tire assembly rotation intervals • High-speed cornering	• Go to **Pinpoint Test A** . • Go to **Pinpoint Test A** . • Go to **Pinpoint Test A** .
• Outer edge/shoulder wear	• Excessive toe in and/or positive camber • Incorrect wheel and tire assembly rotation intervals • High-speed cornering	• Go to **Pinpoint Test B** . • Go to **Pinpoint Test B** . • Go to **Pinpoint Test B** .
• Heel/toe wear	• Excessive toe in/out • Incorrect wheel and tire assembly rotation intervals	• ROTATE the wheel and tire assemblies. CHECK the alignment, ADJUST as necessary.
• Diagonal wear	• Excessive toe in/out • Incorrect tire rotation intervals • Loose, worn or damaged suspension components	• Go to **Pinpoint Test C** . • Go to **Pinpoint Test C** . • REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

Symptom Chart - NVH

NOTE: NVH symptoms should be identified using the diagnostic tools that are

available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.

Symptom Chart - NVH

Condition	Possible Sources	Action
• Wobble or shimmy	• Bent wheel • Damaged tire • Loose wheel nuts	• INSTALL a new wheel as necessary. • INSTALL a new tire as necessary. • TIGHTEN to specification.
• High-speed shake	• Tires/wheels	• REFER to **Component Tests** under Wheels And Tires .
• Vehicle vibration	• Tires/wheels	• REFER to **Component Tests** under Wheels And Tires .

Pinpoint Tests

For a description of the various tire wear patterns, refer to **Inspection and Verification**

Pinpoint Test A: Inner Edge/Shoulder Wear

This pinpoint test is intended to diagnose the following:

- Excessive toe out
- Incorrect wheel and tire rotation

PINPOINT TEST A: INNER EDGE/SHOULDER WEAR

A1 MEASURE THE TREAD DEPTH

- Using a tread depth gauge or similar tool, measure the inside edge/shoulder tread depth.
- **Is the tread depth greater than 1.58 mm (2/32 in)?**

  YES : ROTATE the wheel and tire assemblies.

  CHECK and ADJUST the toe to nominal +0.15 degree (toe in). CHECK and ADJUST caster and camber to nominal. REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

  NO : INSTALL a new tire(s).

CHECK and ADJUST the toe to nominal. CHECK and ADJUST caster and camber to nominal. REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

Pinpoint Test B: Outer Edge/Shoulder Wear

This pinpoint test is intended to diagnose the following:

- Excessive toe in
- Incorrect wheel and tire rotation

PINPOINT TEST B: OUTER EDGE/SHOULDER WEAR

B1 MEASURE THE TREAD DEPTH

- Using a tread depth gauge or similar tool, measure the outside edge/shoulder tread depth.
- **Is the tread depth greater than 1.58 mm (2/32 in)?**

YES : ROTATE the wheel and tire assemblies.

CHECK and ADJUST the toe to nominal -0.15 degree (toe out). CHECK and ADJUST caster and camber to nominal. REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

NO : INSTALL a new tire(s).

CHECK and ADJUST the toe to nominal. CHECK and ADJUST caster and camber to nominal. REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

Pinpoint Test C: Diagonal Wear

This pinpoint test is intended to diagnose the following:

- Incorrect wheel and tire rotation
- Excessive toe in/out
- Incorrect tire inflation
- Loose, worn or damaged suspension components

PINPOINT TEST C: DIAGONAL WEAR

C1 MEASURE THE TREAD DEPTH

- Using a tread depth gauge or similar tool, measure the tread depth of the wear pattern.
- **Is the tread depth greater than 1.58 mm (2/32 in)?**

YES : If no performance concerns (noise/vibration) are present, the tire can remain in service.

CHECK the air pressure in the tires, ADJUST as necessary.

ROTATE the wheel and tire assemblies.

INSPECT for loose, worn or damaged suspension components. INSTALL new components as necessary.

CHECK the alignment and ADJUST as necessary. REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

NO : INSTALL a new tire(s).

CHECK the air pressure in the tires, ADJUST as necessary.

ROTATE the wheel and tire assemblies.

INSPECT for loose, worn or damaged suspension components. INSTALL new components as necessary.

CHECK the alignment and ADJUST as necessary. REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

Component Tests

Some vehicles may exhibit a wheel and tire vibration caused by excessive runout. Runout measurements of the wheel and tire assembly can be taken both on and off the vehicle. Runout measurements can be taken both radially and laterally using a runout gauge. The runout gauge is a delicate, precision instrument and should be handled as such. The runout gauge should be mounted on a heavy solid base to eliminate gauge movement when measuring runouts. The measurements are taken using a runout gauge, which defines total runout in 64th or thousandths of an inch (depending on the brand of gauge used) and locates the high and low points of the runout.

Radial Runout

Radial runout is the egg-shaped deviation from a perfect circle and is measured perpendicular on a circumference. On a wheel and tire assembly this usually means measuring the center tire tread rib, although other tread ribs can be measured as well. The center rib is usually a solid rib, easy to measure and normally indicative of the condition of the tire as a whole. It is important to keep in mind that any rib with excessive runout can cause a concern. Total runout is the reading from the gauge. The high spot is the location of maximum runout.

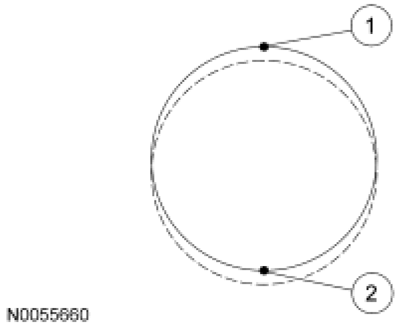


Fig. 5: Identifying Radial Runout
Courtesy of FORD MOTOR CO.

Item	Description
1	High spot
2	Low spot

NOTE: Warm up the tires prior to taking any measurements. This will eliminate slight flat spotting. This is done during a road test.

NOTE: Place the air chuck straight on the valve stem to inflate the tire. Do not cock the air chuck during the inflation cycle. Doing so may damage the valve stem and cause air leaks.

1. Make sure that the tire pressures are set to the correct pressure as indicated on the vehicle label.
2. With the vehicle in NEUTRAL, position it on a hoist. Refer to **JACKING AND LIFTING** article.
3. Make sure that all 4 positions can be measured. If measurements are to be taken with the wheel and tire assembly off the vehicle, mount each assembly on a suitable dynamic balancing machine.
4. For future reference of the original wheel and tire assembly's position on the wheel hub, index-mark the wheel and a wheel stud.
5. Position the runout gauge to take a radial measurement.
   - Rotate the wheel and tire assembly (or wheel) to locate the low spot.
   - Adjust the runout gauge to read 0.
   - Rotate the wheel and tire assembly (or wheel) one complete revolution to make sure that the low spot has been found and that the runout gauge dial returns to a 0 reading.

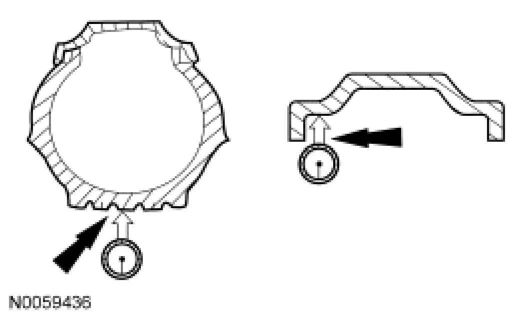


Fig. 6: Measuring Radial Runout
Courtesy of FORD MOTOR CO.

NOTE: If there is a vast difference in measurements taken from a wheel and tire assembly checked (on the vehicle) compared to readings taken (off the vehicle), check for excessive bolt circle runout, excessive hub runout or a fitting concern between the hub and wheel.

6. While slowly and constantly rotating the wheel and tire assembly (or wheel), measure the radial runout.
    - Note the variance (runout) from 0 on the dial of the gauge.
    - If the runout reading of a wheel and tire assembly is not within 1.27 mm (0.050 in), locate and mark the high spot and proceed to Match Mounting, Step 1 to correct the concern.
    - If the runout reading of a wheel is not within 1.27 mm (0.050 in), install a new wheel.

Lateral Runout

Lateral runout is a sideways variation causing a twist or wobble and is measured on a side surface. On the wheel and tire assembly, the lateral runout measurement should be taken as close to the tread shoulder as possible. Total runout is the reading from the gauge.

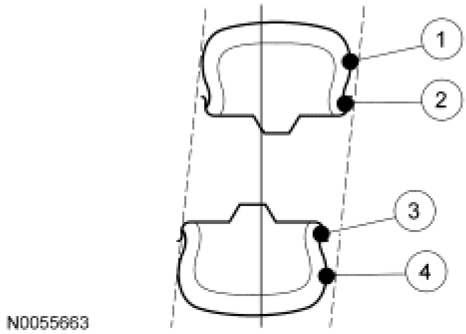


Fig. 7: Identifying Lateral Runout
Courtesy of FORD MOTOR CO.

Item	Description
1	Tire high spot
2	Wheel high spot
3	Tire low spot
4	Wheel low spot

1. Position the runout gauge to take a lateral measurement.
    - Rotate the wheel and tire assembly (or wheel) to locate the low spot.
    - Adjust the runout gauge to read 0.
    - Rotate the wheel and tire assembly (or wheel) one complete revolution to make sure that the low spot has been found and that the dial returns to a 0 reading.

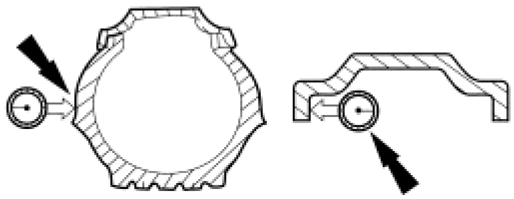


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Fig. 8: Measuring Lateral Runout
Courtesy of FORD MOTOR CO.

NOTE: **If there is a vast difference in measurements taken from a wheel and tire assembly checked on the vehicle compared to readings taken off the vehicle, check for excessive bolt circle runout, excessive hub runout or a fitting concern between the hub and wheel.**

2. While slowly and constantly rotating the wheel and tire assembly (or wheel), measure the lateral runout.
   - Note the variance (runout) from 0 on the dial of the gauge.
   - If the runout reading of a wheel and tire assembly is not within 1.27 mm (0.050 in), locate and mark the high spot and proceed to Match Mounting, Step 1 to correct the concern.
   - If the runout reading of a wheel is not within 1.27 mm (0.050 in), install a new wheel.

Match Mounting

Match mounting is a technique used to reduce radial and lateral runouts on wheel and tire assemblies. Excessive runout is a source of ride quality complaints and match mounting can be used to minimize the runout. Match mounting can be accomplished by changing the position of the tire on the wheel or by changing the position of the wheel and tire assembly on the hub.

1. Remove the wheel and tire. Refer to **Wheel and Tire**.
2. Position the wheel and tire assembly on a suitable tire machine and put a reference mark on the tire sidewall at the valve stem position.

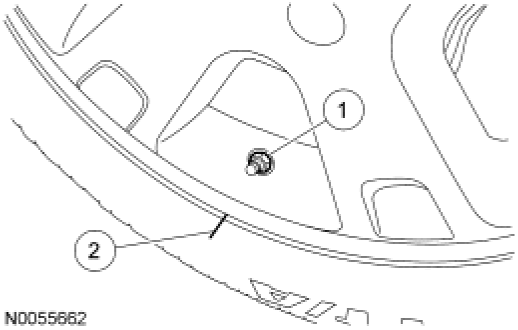

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Fig. 9: Locating Mark On Tire Side Wall At Valve Stem Position

Courtesy of FORD MOTOR CO.

Item	Description
1	Valve stem
2	Reference mark

NOTE: For tires equipped with Tire Pressure Monitoring System (TPMS), the sensor, cradle and strap can be damaged by incorrect tire mounting or dismounting. Dismount the tire from the wheel as instructed in the Disassembly and Assembly procedure. Failure to follow these instructions may result in TPMS component damage.

3. Using a suitable tire machine, break the tire down from the wheel.
   - Position the tire 180 degrees (half-way around) on the rim so the tire reference mark made in Step 2 is opposite the valve stem.
4. Re-inflate the wheel and tire assembly to the specified air pressure and measure the assembly runout again. Mark the second high spot on the tire.
   - If the runout is reduced to within specifications, the problem has been solved.
5. If the second runout measurement is still not within specification and both measurements are close to each other (within 101.6 mm [4 in]), the root cause is probably the tire.

   NOTE: To be SURE that the tire is causing the high runout, there must be 2 runout measurements that are not within specification and the high spots must be in approximately the same location on the sidewall of the tire. In other words, the high spot followed the tire when it was repositioned 180 degrees on the wheel.

   - If the second high spot is not within 101.6 mm (4 in) of the first high spot, proceed to the next step.

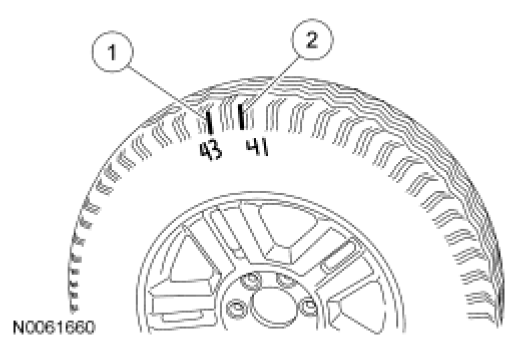


Fig. 10: Identifying High Spotting On Tire
Courtesy of FORD MOTOR CO.

Item	Description
1	First high spot on the tire

2	Second high spot on the tire

6. If the second high spot is still above specification and is within 101.6 mm (4 in) of being opposite the first high spot on the wheel, the root cause is probably the wheel (the high spot followed the wheel). Dismount the tire from the wheel, mount the wheel on a balancer and check the wheel runout. Install a new wheel if the wheel runout exceeds 1.27 mm (0.05 in).

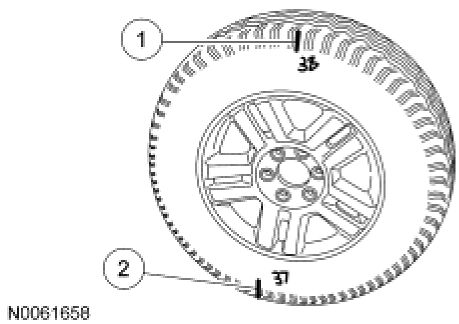


Fig. 11: Identifying High Spotting On Each End Of Tire
Courtesy of FORD MOTOR CO.

Item	Description
1	First high spot on the tire
2	Second high spot on the tire

NOTE: **If the second high spot did not follow the wheel or the tire and the runout is still not within specification, improvements may be made by rotating the tire 90 degrees (one-fourth turn).**

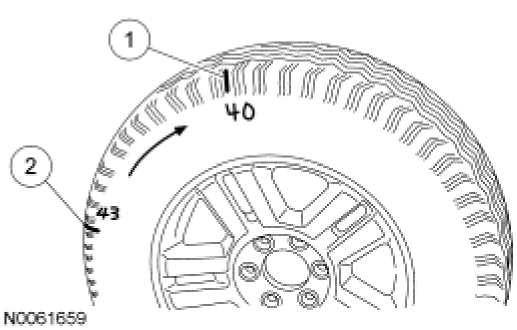


Fig. 12: Drawing Arrow On Tire Side Wall From Second High Spot Towards First High Spot
Courtesy of FORD MOTOR CO.

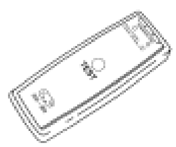
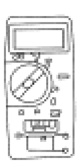
7. Draw an arrow on the tire sidewall from the second high spot towards the first high spot (in the shortest direction).
   - Rotate the tire 90 degrees (one-fourth turn) in the direction of the arrow.

Item	Description
1	First high spot on the tire
2	Second high spot on the tire

8. Install the wheel and tire. Refer to **Wheel and Tire**.
   - Align the wheel and tire assembly using the index mark made on the wheel and wheel stud during removal.

TIRE PRESSURE MONITORING SYSTEM

Special Tools

Illustration	Tool Name	Tool Number
 ST2941-A	Activation Tool, Tire Pressure Monitor	204-363
 ST2869-A	Digital Tire Gauge	204-354
 ST1137-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also referred to as the Generic Electronic Module (GEM).

The Tire Pressure Monitoring System (TPMS) monitors the air pressure of all 4 road tires. The wheel-mounted tire pressure sensors transmit via radio frequency signals, to the SJB. TPMS functionality is integral to the SJB. These transmissions are sent approximately every 60 seconds when the vehicle speed exceeds 32 km/h (20 mph). The TPMS function compares each tire pressure sensor transmission against a low-pressure limit. If it has been determined that the tire pressure has fallen below this limit, the SJB communicates this on the vehicle communication bus to the instrument cluster. The instrument cluster then illuminates the TPMS indicator and displays the appropriate message(s) in the message center (if equipped).

For vehicles with different front and rear tire pressures (such as the E-Series and certain F-Series), the tire pressures must be adjusted and the tire pressure sensors must be trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate.

For vehicles with the same tire pressures for front and rear tires, tire rotation will not affect the system.

Ambient Temperature Change and Tire Pressure

WARNING: **The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.**

Tire pressures fluctuate with temperature changes. For this reason, tire pressure must be set to specification when tires are at outdoor ambient temperatures. If the vehicle is allowed to warm up to shop temperatures, and the outside temperature is less than shop temperature, the tire inflation pressure must be adjusted accordingly.

If the tires are inflated to specification at shop temperatures, and the vehicle is moved outdoors when the outdoor ambient temperature is significantly lower, the tire pressure may drop enough to be detected by the TPMS and activate the TPMS warning lamp.

As the ambient temperature decreases by 6°C (10°F), tire pressure decreases 7 kPa (1 psi). Adjust the tire pressure by 7 kPa (1 psi) for each 6°C (10°F) ambient temperature drop as necessary to keep the tire at the specified Vehicle Certification (VC) label pressure. Refer to the following tables to adjust the tire pressure indoors for colder outside temperatures.

Table 1. Use Table to Adjust Tire Pressure Inside Garage for Colder Outside Temperature[1]

** Do Not Inflate Tire Higher than Maximum Pressure Stamped on Tire Sidewall. **

Table is based on a Garage Temperature of 70°F. Max Pressure Adjustment is 7 psi.

	Tire Placard Pressure (PSI)																	
Outside Temperature (°F)	30	32	34	35	38	40	41	42	45	50	55	60	65	70	75	80	85	90
70	30	32	34	35	38	40	41	42	45	50	55	60	65	70	75	80	85	90
60	31	33	35	36	39	41	42	43	46	51	56	61	67	72	77	82	87	92
50	32	34	36	37	40	42	43	44	47	53	58	63	68	73	79	84	89	94
40	33	35	37	38	41	43	44	45	49	54	59	64	70	75	80	86	91	96
30	34	36	38	39	42	44	46	47	50	55	61	66	72	77	82	87	92	97
20	35	37	39	40	43	46	47	48	51	57	62	67	72	77	82	87	92	97
10	36	38	40	41	45	47	48	49	52	57	62	67	72	77	82	87	92	97
0	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-10	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-20	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-30	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-40	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97

Table 2. Use Table to Adjust Tire Pressure Inside Garage for Colder Outside Temperature (Metric Units)[1]

** Do Not Inflate Tire Higher than Maximum Pressure Stamped on Tire Sidewall. **

Table is based on a Garage Temperature of 21°C. Max Pressure Adjustment is 50 kPa.

	Tire Placard Pressure (kPa)																	
Outside Temperature (°C)	205	220	235	240	260	275	285	290	310	345	380	415	450	485	515	550	585	620
21	205	220	235	240	260	275	285	290	310	345	380	415	450	485	515	550	585	620
16	215	230	240	250	270	285	290	295	315	350	385	420	460	495	530	565	600	635
10	220	235	250	255	275	290	295	305	325	365	400	435	470	505	545	580	615	650
4	230	240	255	260	285	295	305	310	340	370	405	440	485	515	550	595	625	660
-1	235	250	260	270	290	305	315	325	345	380	420	455	495	530	565	600	635	670
-7	240	255	270	275	295	315	325	330	350	395	425	460	495	530	565	600	635	670
-12	250	260	275	285	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-18	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-23	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-29	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-34	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-40	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670

[1] When Outside (Ambient) Temperature is greater than 21°C (70°F), Inflate tires to placard pressure.

[1] Use the table to adjust tire pressure for P-metric and LT tires only.

[1] Do NOT use table for Commercial Truck Tires (i.e. 19.5 inch tires for F450 & F550). See F-Super Duty Service Manual for tire inflation procedure.

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Fig. 13: Tire Pressure Table
Courtesy of FORD MOTOR CO.

Tire Pressure Monitoring System (TPMS) Indicator and Message Center Messages

The TPMS indicator and vehicle message center (if equipped) sometimes displays faults that cannot be resolved by the customer. Treat these messages as TPMS faults that must be serviced.

Tire Pressure Monitoring System (TPMS) Indicator Illuminates Continuously

NOTE:	**If the spare tire is in use, the damaged road tire must be repaired and installed on the vehicle to restore complete TPMS functionality before carrying out any diagnosis.**
NOTE:	**For vehicles with different front and rear tire pressures (such as E-Series and**

certain F-Series), the tire pressure sensors must be trained following a tire rotation. Failure to train the sensors will result in a false low tire pressure event, which will cause the TPMS indicator to illuminate.

1. The TPMS indicator remains on continuously for the following condition:
   - Low Tire Pressure - The TPMS indicator is illuminated solid and the message center displays LOW TIRE PRESSURE (if equipped). This is displayed when any of the tire pressures are low. When this condition exists, the tire pressure must be adjusted to the recommended cold pressure as indicated on the VC label.

NOTE: **The TPMS sensors do not transmit when the vehicle is stationary. If the vehicle has been stationary for more than 30 minutes, it will be necessary to wake up the sensors so they will transmit the latest tire pressure information to the SJB.**

2. If the vehicle has been stationary for more than 30 minutes, carry out the **Tire Pressure Monitoring System (TPMS) Sensor Activation** procedure .

Tire Pressure Monitoring System (TPMS) Indicator Flashes

The TPMS indicator flashes for 70 seconds, then remains ON solid when the ignition switch is turned to the ON position, for the following conditions:

1. Tire Pressure Sensor Fault - If equipped, the message center will display TIRE PRESSURE SENSOR FAULT when a tire pressure sensor is malfunctioning. Go to **Symptom Chart**.
2. No communication with the SJB (TPMS is integral to the SJB) - The TPMS indicator is illuminated when the instrument cluster has not received any signals from the SJB for more than 5 seconds. If equipped, the message center displays TIRE PRESSURE MONITOR FAULT. Go to **Symptom Chart**.
3. Tire Pressure Monitor Fault - If equipped, the message center will display TIRE PRESSURE MONITOR FAULT when the tire pressure monitoring system is malfunctioning or communication with the instrument cluster has been lost. Go to **Symptom Chart**.

Inspection and Verification

NOTE: **The tire pressure sensors are not designed to be used with aftermarket wheels.**

NOTE: **The use of run-flat tires (tires with steel body cord plies in the tire sidewall) where not originally equipped, may cause the TPMS to malfunction and is therefore not recommended.**

1. Verify the customer concern by inspecting the vehicle and observing the message center (if equipped) and the TPMS indicator.

NOTE: **The valve-mounted TPMS sensors and the strap-mounted TPMS sensors**

are not compatible. Swapping wheels from one vehicle to another with the different systems will set a TPMS fault.

NOTE: **Swapping wheels between vehicles with the same TPMS will cause a TPMS fault to be set if the sensors are not trained. Refer to Tire Pressure Monitoring System (TPMS) Sensor Training.**

NOTE: **Non-OEM modifications made to the vehicle may result in false TPMS warnings.**

2. Inspect to determine if one of the following mechanical or electrical concerns apply:

VISUAL INSPECTION CHART

Mechanical	Electrical
• Low tire pressure • Tire Pressure Monitoring System (TPMS) sensor damaged or missing • Spare tire installed as a road wheel • Incorrect TPMS sensor installed • TPMS sensor installed incorrectly • Sensors not trained after a tire rotation on vehicles with different front and rear tire pressures • Non-OEM wheels installed (aftermarket rims) • Non-OEM equipped run-flat tires installed • Other non-OEM modifications (roll cages, service barriers, part racks, ladder racks)	• Wiring, terminals or connectors • Smart Junction Box (SJB) damaged • Aftermarket electronic accessories

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

NOTE: The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no power to the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self test diagnostics for the SJB (the TPMS is part of the SJB).
9. If the DTCs retrieved are related to the concern, go to the Tire Pressure Monitoring System (TPMS) DTC Chart. For all other DTCs, refer to the Master DTC Chart in **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

TIRE PRESSURE MONITORING SYSTEM (TPMS) DTC CHART

DTC	Description	Source	Action
B106A	Pressure Sensor Range Bit Incorrect State	Smart Junction Box (SJB)	Go to **Pinpoint Test G** .
B106B	Tire Pressure Sensor Low Battery	SJB	DTC B106B can be set during SJB configuration. Go to **Pinpoint Test H** .
B106D	Tire Pressure Monitoring System (TPMS) Initiators Not Configured	SJB	DTC B106D is only present when a new SJB is installed, the SJB is incorrectly flashed or the SJB is incorrectly configured. Successfully configuring the SJB is the only way to clear this DTC. VERIFY the SJB is correctly configured. If DTC B106D is still present, REFER to **MODULE CONFIGURATION** article.

B2477	Module Configuration Failure/Mismatch	SJB	DTC B2477 is only present when a new SJB is installed, the SJB is incorrectly flashed or the SJB is incorrectly configured. Successfully configuring the SJB is the only way to clear this DTC. MAKE SURE the SJB is configured correctly. If DTC B2477 is still present, REFER to **MODULE CONFIGURATION** article.
B2868	LF Tire Pressure Sensor Fault	SJB	DTC B2868 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
B2869	RF Tire Pressure Sensor Fault	SJB	DTC B2869 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
B2870	RR Tire Pressure Sensor Fault	SJB	DTC B2870 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
B2871	LR Tire Pressure Sensor Fault	SJB	DTC B2871 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
B2872	Tire Pressure Sensor Fault	SJB	**NOTE:** **If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the SJB.** ACTIVATE the TPMS sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Activation**. Go to **Pinpoint Test F** .
B287A	Tire Pressure System Fault	SJB	Go to **Pinpoint Test F** .

C2780	ECU in Manufacturing Mode	SJB	DTC C2780 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
U0155	Lost Communication with Instrument Cluster	SJB	REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the no communication problem.
All other SJB DTCs	-	SJB	REFER to the Master DTC Chart in **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

NOTE: **For vehicles with different front and rear tire pressure (such as E-Series and certain F-Series), the tire pressures must be adjusted and the tire pressure sensors must be trained following a tire rotation. Failure to train the sensors will result in a false low tire pressure event, which will cause the Tire Pressure Monitoring System (TPMS) indicator to illuminate.**

For vehicles with the same tire pressure for front and rear tires, tire rotation will not affect the system.

Failure of a TPMS component may not cause the message center to display a fault message or a DTC to be stored. The Symptom Chart is a starting point to begin diagnosis of these concerns.

Symptom Chart

Condition	Possible Sources	Action
• Tire Pressure Monitoring System (TPMS) indicator ON solid and message center (if equipped) displays LOW TIRE PRESSURE	• Spare tire currently in use	• INSTALL the repaired road wheel/tire in place of the spare tire.
	• Air pressure not set to specifications listed on the Vehicle Certification (VC) label	• Go to **Pinpoint Test D** .
	• Sensors not trained	• ADVISE customer that on vehicles with different front and rear tire

	following tire rotation	pressure, the sensors must be trained as directed in their Owner's Literature.
• Smart Junction Box (SJB) will not enter sensor training mode when using the TPMS sensor training procedure	• Brake ON/OFF switch • Ignition switch • Vehicle communication bus • SJB	• Go to **Pinpoint Test E** .
• TPMS indicator FLASHES for 70 seconds and then remains ON solid when the ignition key is turned to the ON position, the message center (if equipped) displays TIRE PRESSURE SENSOR FAULT and DTC B2872 is present	• TPMS sensor(s) • TPMS sensor(s) not trained to the SJB • SJB	**NOTE:** **If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the SJB.** • ACTIVATE the TPMS sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Activation**. Go to **Pinpoint Test F** .
• Tire Pressure Monitoring System (TPMS) indicator FLASHES for 70 seconds and then remains ON solid when the ignition key is turned to the ON position, the message center (if equipped) displays TIRE PRESSURE MONITOR FAULT and DTC B287A is present	• All TPMS sensors not trained to the SJB or all TPMS sensors are not installed	**NOTE:** **If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the SJB.** • ACTIVATE the TPMS sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Activation**. Go to **Pinpoint Test F** .
• TPMS indicator FLASHES for 70 seconds and then remains ON solid when the ignition key is turned to the ON position, the message center (if equipped) displays TIRE PRESSURE	• Vehicle communication issue between the SJB and the instrument cluster	• REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the no communication concern.

MONITOR FAULT and there are no DTCs present		
	• SJB	• REFER to **MULTIFUNCTION ELECTRONIC MODULES** article to diagnose the SJB.
• One or more sensors will not train	• TPMS sensor(s) • Vehicle communication issue • SJB	• RETRIEVE and RECORD DTCs. REFER to **TIRE PRESSURE MONITORING SYSTEM (TPMS) DTC CHART** .
• One or more sensors will not train and no DTCs are present	• TPMS sensor(s)	• TRAIN all 4 tire pressure sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Training**. • For any sensor(s) that did not train, ATTEMPT to activate the same sensor with the activation tool. If the sensor still does not respond, MOVE the vehicle to rotate the wheels at least one-fourth turn and ATTEMPT to activate the same sensor again. • If the sensor(s) fail to train a second time, INSTALL a new sensor(s). REFER to **Tire Pressure Monitoring System (TPMS) Sensor**.

Pinpoint Tests

Pinpoint Test D: Tire Pressure Monitoring System (TPMS) Indicator ON Solid and Message Center (if equipped) Displays LOW TIRE PRESSURE

Normal Operation

The Tire Pressure Monitoring System (TPMS) monitors the air pressure of all 4 road tires. The wheel-mounted tire pressure sensors transmit via radio frequency signals, to the Smart Junction Box (SJB). TPMS functionality is integral to the SJB. These transmissions are sent approximately every 60 seconds when the vehicle speed exceeds 32 km/h (20 mph). The TPMS function (integral to the SJB) compares each tire pressure sensor transmission against a low-pressure limit. If it has been determined that the tire pressure has fallen below this limit, the SJB communicates this on the vehicle communication bus to the instrument cluster. The instrument cluster then illuminates the TPMS indicator and displays the appropriate message(s) in the message center (if equipped).

This symptom can also be caused by a spare tire currently being used in place of a road tire. Make sure that the spare tire is not currently in use. On vehicles with different front and rear tire pressures, if the sensors are not trained following a tire rotation, this symptom will also be present. Advise the customer that on vehicles with different front and rear tire pressures, the sensors must be trained as directed in the Owner's Literature.

This pinpoint test is intended to diagnose the following:

- Low air pressure in tire(s)
- Tire pressure sensor(s)

PINPOINT TEST D: Tire Pressure Monitoring System (TPMS) INDICATOR ON SOLID AND MESSAGE CENTER (IF EQUIPPED) DISPLAYS LOW TIRE PRESSURE

NOTE: **Use only the Digital Tire Gauge any time tire pressures are measured to be sure that accurate values are obtained.**

NOTE: **If a warranty case is opened for an actual TPMS fault, document and include the actual tire pressure data in all warranty communications.**

D1 CHECK THE TIRE PRESSURE

- Measure and record the air pressure in all 4 road tires.
- Adjust the air pressure for those found to be below the specification listed on the Vehicle Certification (VC) label.

  NOTE: **If the vehicle has been stationary for more than 30 minutes, activate each TPMS sensor. Refer to Tire Pressure Monitoring System (TPMS) Sensor Activation. The TPMS sensor does not transmit when the vehicle is stationary.**

- Verify system operation.
- **Have the TPMS indicator and the message center (if equipped) warnings gone out?**

  YES : The system is functioning normally, diagnosis is complete. INFORM the customer of correct tire pressure maintenance as instructed in the scheduled maintenance guide and the Owner's Literature.

  NO : Go to D2.

D2 CHECK THE SYSTEM COMPONENTS

- Train all 4 tire pressure sensors. Refer to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
- Connect the scan tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger SJB
- Read and record the following PIDs:
  - Left Front Tire Pressure (LF_PRES)
  - Right Front Tire Pressure (RF_PRES)
  - Left Rear Outer Tire Pressure (LRO_PRES)
  - Right Rear Outer Tire Pressure (RRO_PRES)

- Compare the air pressure readings recorded from the function test to those recorded in D1.
- **Do the compared tire pressure values match within ±5 psi, and have the TPMS indicator and the message center (if equipped) warnings gone out?**

  YES : The system is functioning normally, diagnosis complete.

  NO : **Before installing a new sensor(s):** If a sensor(s) does not respond to the Tire Pressure Monitor Activation Tool, ATTEMPT to activate the same sensor(s) with the Tire Pressure Monitor Activation Tool. If the sensor(s) still does not respond, MOVE the vehicle to rotate the wheels at least one-fourth turn and ATTEMPT to activate the same sensor(s) again.

  INSTALL new tire pressure sensors for those with discrepancies or those that fail to activate. REFER to **Tire Pressure Monitoring System (TPMS) Sensor**.

Pinpoint Test E: Smart Junction Box (SJB) Will Not Enter Sensor Training Mode When Using the Tire Pressure Monitoring System (TPMS) Sensor Training Procedure

Normal Operation

For the Smart Junction Box (SJB) to enter Tire Pressure Monitoring System (TPMS) sensor training mode, the SJB must receive valid inputs from the Brake Pedal Position (BPP) switch (OFF-ON-OFF) and ignition switch (both OFF and RUN), and it must receive valid vehicle speed sensor input (0 km/h [0 mph]). Refer to **Tire Pressure Monitoring System (TPMS) Sensor Training** for the complete sensor training procedure.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Brake ON/OFF switch
- Ignition switch
- SJB

PINPOINT TEST E: Smart Junction Box (SJB) WILL NOT ENTER SENSOR TRAINING MODE WHEN USING THE Tire Pressure Monitoring System (TPMS) SENSOR TRAINING PROCEDURE

E1 CHECK THE SJB BRAKE ON/OFF (GEM_BOO) PID

- Connect the scan tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger SJB
- Monitor the GEM_BOO PID (SJB reads the brake switch directly).
- Press and release the brake pedal while monitoring the PID.
- **Do the brake pedal PID values match the brake pedal positions?**

  YES : Go to E2.

  NO : REFER to **EXTERIOR LIGHTING** article to continue diagnosis of the stoplamp switch.

E2 CHECK THE SJB IGNITION SWITCH PIDs

- Monitor the following ignition switch PIDs:
  - Ignition Switch Off (IGN_O_ECU)
  - Ignition Switch RUN (IGN_R_ECU)
- Cycle the ignition switch to the RUN and OFF position while monitoring the PIDs (SJB reads the ignition switch directly).
- **Do the ignition switch status PID values match the ignition switch positions?**

  YES : Go to E3.

  NO : REFER to **STEERING COLUMN SWITCHES** article to continue diagnosis of the ignition switch.

E3 CHECK THE SJB VEHICLE SPEED (VSS_GEM) PID

- Monitor the VSS_GEM PID (SJB receives vehicle speed from the instrument cluster).
- **Does the vehicle speed PID value match the speed of the vehicle?**

  YES : Go to E4.

  NO : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article to diagnosis of the instrument cluster/vehicle speed concern.

E4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check the connectors for:
  - corrosion.
  - pushed-out pins.
  - spread terminals.
- Connect all the SJB connectors and make sure that they are seated correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CLEAR the DTCs. REPEAT the self test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self test.

Pinpoint Test F: Tire Pressure Monitoring System (TPMS) Indicator FLASHES for 70 Seconds and Then Remains ON Solid When the Ignition Key is Turned to the ON Position, the Message Center (if equipped) Displays TIRE PRESSURE SENSOR or MONITOR FAULT and DTC B2872 or B287A is Present

Normal Operation

If there is a fault with 1, 2 or 3 of the Tire Pressure Monitoring System (TPMS) sensors, DTC B2872 will be set, the TPMS warning indicator will flash for 70 seconds and then remain ON solid when the ignition switch is turned to the ON position and the message center (if equipped) will display TIRE PRESSURE SENSOR FAULT.

If the Smart Junction Box (SJB) does not get a response from all 4 of the TPMS sensors, DTC B287A will be set and the message center (if equipped) will display TIRE PRESSURE MONITOR FAULT.

- B2872 Tire Pressure Sensor Fault - When 1, 2 or 3 of the tire pressure sensors are faulted or not responding, the SJB will set DTC B2872.
- B287A Tire Pressure Monitor Fault - When **all** 4 of the tire pressure sensors are faulted, not responding or not heard by the SJB, the SJB will set DTC B287A.

This pinpoint test is intended to diagnose the following:

- TPMS sensor(s) missing
- TPMS sensor(s) not trained to the vehicle
- TPMS sensor(s) swapped due to wheel swap
- TPMS sensor(s) damaged
- Vehicle communication issue
- SJB

PINPOINT TEST F: Tire Pressure Monitoring System (TPMS) INDICATOR FLASHES FOR 70 SECONDS AND THEN REMAINS ON SOLID WHEN THE IGNITION KEY IS TURNED TO THE ON POSITION, THE MESSAGE CENTER (IF EQUIPPED) DISPLAYS TIRE PRESSURE SENSOR OR MONITOR FAULT AND DTC B2872 OR B287A IS PRESENT

NOTE: **If a warranty case is opened for an actual TPMS fault, document and include the actual tire pressure data in all warranty communications.**

F1 CHECK THE SENSOR IDs AND SYSTEM STATUS PIDs

- Connect the scan tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger SJB
- Read and record the following PIDs:
  - Left Front Tire Transmitter Identifier (LF_ID)
  - Right Front Tire Transmitter Identifier (RF_ID)
  - Left Rear Tire Transmitter Identifier (LR_ID)
  - Right Rear Tire Transmitter Identifier (RR_ID)
- Monitor the TPMS system status (TP_STAT) PID.
- **Does the TP_STAT PID display SENSOR FAULT?**

  YES : Go to F2.

  NO : If the TP_STAT PID displays SYSTEM FAULT, go to F3.

F2 CARRY OUT THE SENSOR TRAINING PROCEDURE

- Train all 4 tire pressure sensors. Refer to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
- **Did all of the tire pressure sensors transmit correctly and did the horn sound when each tire**

pressure sensor transmitted to the SJB?

YES : Using the scan tool, LOCATE the updated TPMS sensor identifiers trained to the SJB module.

COMPARE these values to those recorded prior to the TPMS sensor training procedure. Disregarding sensor position, any sensor identifiers that do not match those retrieved from the module were changed, but not retrained. The sensors are now trained to the vehicle, diagnosis is complete.

DOCUMENT all TPMS sensor identifiers on the applicable warranty claim.

VERIFY system operation.

NO : **Before installing a new sensor(s)** : If a sensor(s) does not respond to the Tire Pressure Monitor Activation Tool, ATTEMPT to activate the same sensor(s) with the Tire Pressure Monitor Activation Tool. If the sensor(s) still does not respond, MOVE the vehicle to rotate the wheels at least one-fourth of a turn and ATTEMPT to activate the same sensor(s) again.

If the sensor(s) fails to train a second time, INSTALL a new tire pressure sensor(s). REFER to **Tire Pressure Monitoring System (TPMS) Sensor**.

F3 TP_STAT PID EQUALS SYSTEM FAULT WITH DTC B287A PRESENT

- Train all 4 tire pressure sensors. Refer to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
- **Did all of the tire pressure sensors transmit correctly and did the horn sound when each tire pressure sensor transmitted to the SJB?**

  YES : Using the scan tool, LOCATE the updated TPMS sensor identifiers trained to the SJB module.

  COMPARE these values to those recorded prior to the TPMS sensor training procedure. Disregarding sensor position, any sensor identifiers that do not match those retrieved from the module were changed, but not retrained. The sensors are now trained to the vehicle, diagnosis is complete.

  DOCUMENT all TPMS sensor identifiers on the applicable warranty claim.

  VERIFY system operation.

  NO : **Before diagnosing the SJB** : If the sensors do not respond to the Tire Pressure Monitor Activation Tool, ATTEMPT to activate the same sensors with the Tire Pressure Monitor Activation Tool a second time. If the sensors still do not respond, MOVE the vehicle to rotate the wheels at least one-fourth of a turn and ATTEMPT to activate the same sensors again.

  If the sensors fail to train a second time, go to F4.

F4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB electrical connectors.
- Check the connectors for:
  - corrosion.
  - pushed-out pins.
  - spread terminals.
- Connect all the SJB connectors and make sure that they are seated correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : **NOTE:** The sensors may not be present. DISMOUNT the tire. REFER to **Wheel and Tire**. VERIFY that the sensors are present and mounted to the wheels. If missing, INSTALL new sensors.

  If the sensors are present, INSTALL a new SJB module. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CLEAR the DTCs. REPEAT the self test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self test.

Pinpoint Test G: DTC B106A - Pressure Sensor Range Bit Incorrect State

Normal Operation

This DTC may be encountered if a sensor designed for a different application is installed. Low pressure applications utilize a black- or blue-colored sensor, while heavy duty applications utilize a green-colored sensor. The Smart Junction Box (SJB) will only allow one type of sensor to be trained using the Tire Pressure Monitoring System (TPMS) sensor training procedure. Make sure the correct sensors are used to avoid compatibility issues.

- B106A Pressure Sensor Range Bit Incorrect State - When an attempt has been made to train a non-compatible sensor, the SJB will set DTC B106A.

This pinpoint test is intended to diagnose the following:

- Incorrect tire pressure sensor(s) installed

PINPOINT TEST G: DTC B106A - PRESSURE SENSOR RANGE BIT INCORRECT STATE

G1 DETERMINE IF THE VEHICLE IS EQUIPPED WITH AN INCORRECT SENSOR

- Train all 4 tire pressure sensors. Refer to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
- **Did all of the tire pressure sensors transmit correctly and did the horn sound when each tire pressure sensor transmitted to the SJB?**

  YES : CLEAR the DTCs. REPEAT the self test. VERIFY system operation.

  NO : **Before installing a new sensor(s)** : If a sensor(s) does not respond to the Tire Pressure

Monitor Activation Tool, ATTEMPT to activate the same sensor(s) with the Tire Pressure Monitor Activation Tool. If the sensor(s) still does not respond, MOVE the vehicle to rotate the wheels at least one-fourth of a turn and ATTEMPT to activate the same sensor(s) again.

If the sensor(s) fails to train a second time, INSTALL a new tire pressure sensor(s). REFER to **Tire Pressure Monitoring System (TPMS) Sensor**.

Pinpoint Test H: DTC B106B - Tire Pressure Sensor Low Battery

Normal Operation

If there is a fault in the Tire Pressure Monitoring System (TPMS), such as a damaged or missing sensor(s), damaged module or a communication issue within the vehicle, DTCs are set in the Smart Junction Box (SJB), the TPMS warning indicator will flash for 70 seconds and then remain ON solid when the ignition switch is turned to the ON position and the message center (if equipped) will display TIRE PRESSURE SENSOR FAULT.

The tire pressure sensor is battery powered.

This DTC may be set when attempting to train a tire pressure sensor(s) with a low battery.

This pinpoint test is intended to diagnose the following:

- Tire pressure sensor battery
- Tire pressure sensor(s)

PINPOINT TEST H: DTC B106B - TIRE PRESSURE SENSOR LOW BATTERY

H1 DETERMINE WHICH SENSOR HAS A LOW BATTERY

- Train all 4 tire pressure sensors. Refer to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
- **Did all of the tire pressure sensors transmit correctly and did the horn sound when each tire pressure sensor transmitted to the SJB?**

  YES : CLEAR the DTCs. REPEAT the self test. VERIFY system operation.

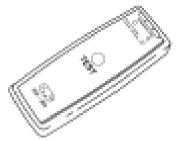
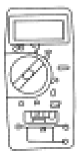
  NO : **Before installing a new sensor(s)** : If a sensor(s) does not respond to the Tire Pressure Monitor Activation Tool, ATTEMPT to activate the same sensor(s) with the Tire Pressure Monitor Activation Tool. If the sensor(s) still does not respond, MOVE the vehicle to rotate the wheels at least one-fourth of a turn and ATTEMPT to activate the same sensor(s) again.

  If the sensor(s) fails to train a second time, INSTALL a new tire pressure sensor(s). REFER to **Tire Pressure Monitoring System (TPMS) Sensor**.

GENERAL PROCEDURES

TIRE PRESSURE MONITORING SYSTEM (TPMS) SENSOR TRAINING

Special Tools

Illustration	Tool Name	Tool Number
 ST2941-A	Activation Tool, Tire Pressure Monitor	204-363
 ST1137-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

NOTE: **If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the Smart Junction Box (SJB). For additional information, refer to Tire Pressure Monitoring System (TPMS) Sensor Activation.**

NOTE: **The tire pressure sensor training procedure must be done on a single vehicle, in an area without radio frequency noise and at least 1 m (3 ft) away from other vehicles equipped with a Tire Pressure Monitoring System (TPMS).**

Radio frequency noise is generated by electrical motors and appliance operation, cellular telephones, remote transmitters, power inverters and portable entertainment equipment.

NOTE: **If a sensor does not respond to the Tire Pressure Monitor Activation Tool, attempt to activate the same sensor with the Tire Pressure Monitor Activation Tool. If the sensor still does not respond, move the vehicle to rotate the wheels at least one-fourth of a turn and attempt to activate the same sensor again.**

NOTE: **The SJB has a 2-minute time limit between sensor responses. If the SJB does not recognize any 1 of the 4 tire pressure sensors during this time limit, the horn will sound twice and the message center (if equipped) will display TIRE NOT TRAINED REPEAT and the entire procedure must be repeated.**

NOTE: **For vehicles with different front and rear tire pressures (such as the E-Series and certain F-Series), the tire pressure sensors must be trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate. For vehicles with the same tire pressure for front and rear tires, tire rotation will not affect the system.**

1. Turn the ignition switch to the OFF position, then press and release the brake pedal.
2. Cycle the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position.
3. Press and release the brake pedal.
4. Turn the ignition switch to the OFF position.
5. Turn the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position.
    - The horn will sound once and the TPMS indicator will flash if the training mode has been entered successfully. If equipped, the message center will display TRAIN LF TIRE.

NOTE: **It may take up to 6 seconds to activate a tire pressure sensor. During this time, the Tire Pressure Monitor Activation Tool must remain in place 180 degrees from the valve stem.**

6. Place the Tire Pressure Monitor Activation Tool on the LF tire sidewall opposite (180 degrees) from the valve stem. Press and release the test button on the Tire Pressure Monitor Activation Tool. The horn will sound briefly to indicate that the tire pressure sensor has been recognized by the SJB.

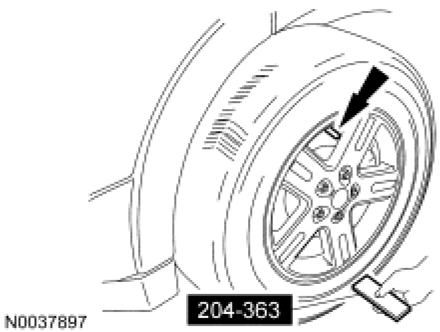


Fig. 14: Identifying Special Tool On LF Tire Side Wall Opposite (180 Degrees) From Valve Stem
Courtesy of FORD MOTOR CO.

7. Within 2 minutes of the horn sounding, place the Tire Pressure Monitor Activation Tool on the RF tire sidewall opposite (180 degrees) from the valve stem and press and release the test button to train the RF tire pressure sensor.

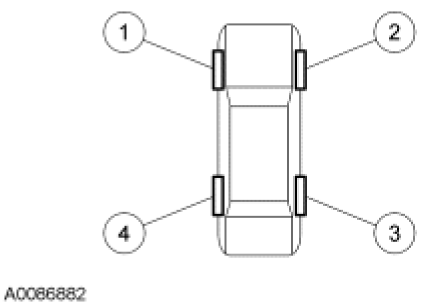


Fig. 15: Identifying Position Of Activation Tool

Courtesy of FORD MOTOR CO.

NOTE: Do not wait more than 2 minutes between training each sensor or the SJB will time out and the entire procedure must be repeated.

8. Repeat Step 7 for the RR and LR tires.

   The procedure is completed after the last tire has been trained. When the training procedure is complete, the message center (if equipped) will display TIRE TRAINING COMPLETE.

   For vehicles not equipped with a message center, successful completion of the training procedure will be verified by turning the ignition switch to the OFF position without the horn sounding. If the horn sounds twice when the switch is turned to the OFF position, the training procedure was not successful.

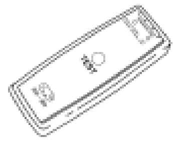
9. Using the scan tool, locate the updated TPMS sensor identifiers trained to the SJB and document them on the applicable warranty claim.

   NOTE: This step is required to clear DTC C2780, cause the SJB to exit the manufacturing mode and to make sure there are no other concerns with a newly programmed SJB.

10. If the sensors are being trained due to the installation of a new SJB, clear any DTCs and carry out the SJB On-Demand Self Test.

TIRE PRESSURE MONITORING SYSTEM (TPMS) SENSOR ACTIVATION

Special Tools

Illustration	Tool Name	Tool Number
 ST2941-A	Activation Tool, Tire Pressure Monitor	204-363

NOTE: The tire pressure sensors will go into a "sleep mode" after 30 minutes of inactivity to conserve battery power. The sensors do not transmit information while in sleep mode. It will be necessary to wake them up so they will transmit the latest tire pressure information.

1. Turn the ignition switch to the ON position.
2. Position the Tire Pressure Monitor Activation Tool against the LF tire sidewall, 180 degrees from the tire valve stem.

   NOTE: The Tire Pressure Monitor Activation Tool will provide feedback in the

form of a flashing green light and a beep sound for each successful response from a tire pressure sensor.

3. Press the test button on the Tire Pressure Monitor Activation Tool to activate the sensor, activate the sensor at least 2 times.
4. Repeat Steps 2 and 3 for the remaining tires.
5. If the Tire Pressure Monitoring System (TPMS) indicator remains illuminated after adjusting and activating each sensor, refer to the appropriate Symptom Chart under **DIAGNOSTIC TESTS** .

REMOVAL AND INSTALLATION

WHEEL AND TIRE

Material

Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

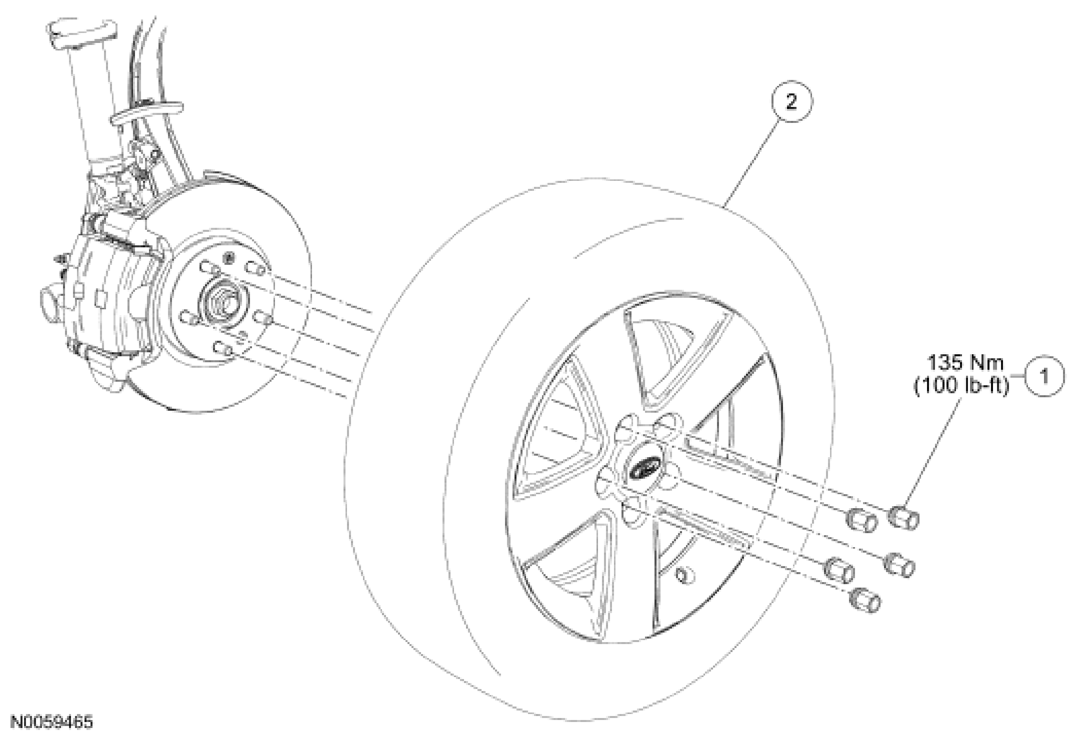


Fig. 16: Exploded View Of Wheel Nuts & Tire With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	1012	Wheel nut (5 required)

2	-	Wheel and tire assembly

REMOVAL

CAUTION: Do not use heat to loosen a seized wheel nut or damage to the wheel and wheel bearing can occur.

1. With the weight of the vehicle on the wheels, loosen the wheel nuts.
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
3. Remove the 5 wheel nuts.
4. Remove the wheel and tire assembly.

INSTALLATION

WARNING: When a wheel is installed, always remove any corrosion, dirt or foreign material present on the mounting surface of the wheel and the mounting surface of the wheel hub, brake drum or brake disc. Make sure that any fasteners that attach the rotor to the hub are secured so they do not interfere with the mounting surfaces of the wheel. Failure to follow these instructions when installing wheels may result in the wheel nuts loosening and the wheel coming off while the vehicle is in motion, which could result in loss of control, leading to serious injury or death to vehicle occupant(s).

1. Clean the wheel mounting surfaces and apply a thin coat of silicone grease and dielectric compound to the wheel hub pilot surface (inner wheel lip surface only).
2. Install the wheel and tire assembly.

WARNING: Retighten wheel nuts within 160 km (100 mi) after a wheel is reinstalled. Wheels can loosen after initial tightening. Failure to follow this instruction may result in serious injury to vehicle occupant(s).

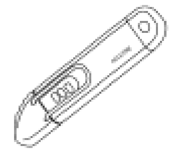
CAUTION: Failure to tighten the wheel nuts in a star pattern can result in high brake disc runout, which will speed up the development of brake roughness, shudder, and vibration.

3. Install the 5 wheel nuts.
   - Tighten the wheel nuts in a star pattern.
   - Tighten to 135 Nm (100 lb-ft).

DISASSEMBLY AND ASSEMBLY

WHEEL AND TIRE

Special Tools

Illustration	Tool Name	Tool Number
	Digital Tire Gauge	204-354

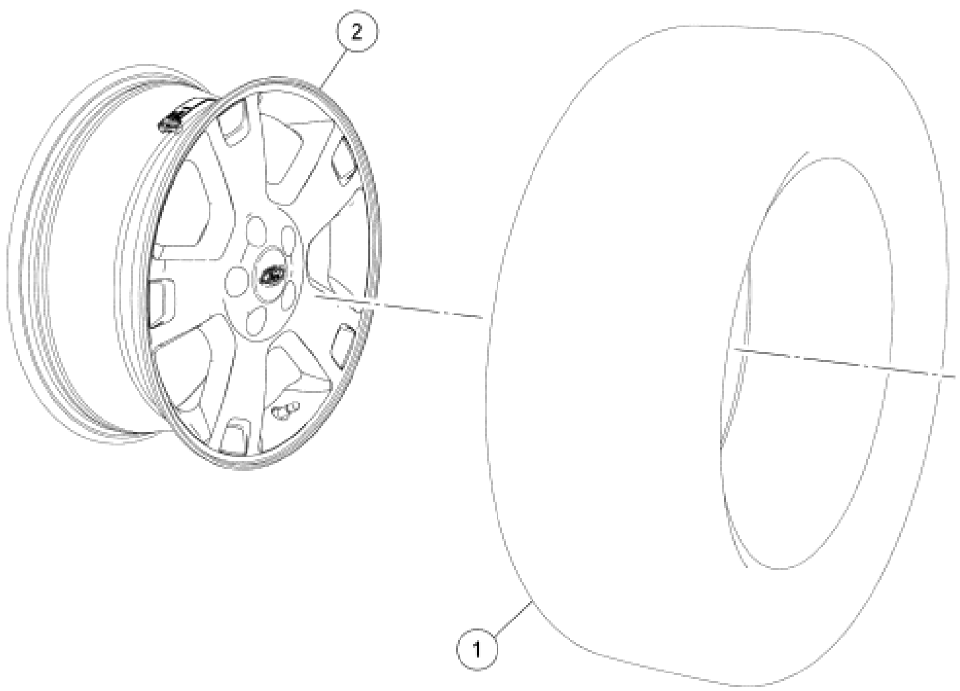


Fig. 17: Exploded View Of Wheel & Tire With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	1508	Tire
2	1007	Wheel

DISASSEMBLY

NOTE: **Failure to follow the instructions below may result in damage to the Tire Pressure Monitoring System (TPMS) sensor.**

NOTE: **Use only the Digital Tire Gauge any time tire pressures are measured to be sure that accurate values are obtained.**

NOTE: A wheel and tire equipped with a Tire Pressure Monitoring System (TPMS) sensor will have the following verbiage stamped or cast on the wheel: SENSOR MAY BE INSIDE.

NOTE: The TPMS sensor is mounted to the wheel 180 degrees opposite of the valve stem and is held in place by a stainless steel strap. The sensor is not mounted to the valve stem.

1. Remove the wheel and tire. For additional information, refer to **Wheel and Tire**.

    NOTE: Do not allow the tire beads to move beyond the wheel mid-plane (middle of the wheel) when separating the beads from the wheels, damage to the Tire Pressure Monitoring System (TPMS) sensor may occur.

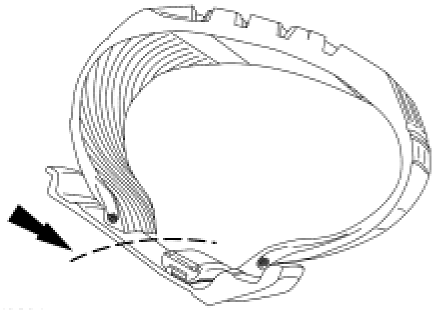


Fig. 18: Locating Tire Pressure Monitoring System (TPMS) Sensor
Courtesy of FORD MOTOR CO.

NOTE: Tire and valve stem position is critical to prevent damage to the Tire Pressure Monitoring System (TPMS) sensor when using a paddle-type bead separator.

NOTE: Some machines may have a nylon roller bead separator at the 12 o'clock position instead of the paddle-type bead separator at the 3 o'clock position.

2. Position the wheel and tire assembly on a suitable tire machine and separate both beads of the tire from the wheel.
    - For a paddle-type tire machine, position the valve stem at the 12 o'clock or 6 o'clock position and the paddle at the 3 o'clock position.
    - For a roller-type tire machine, align the valve stem with the roller at any position.

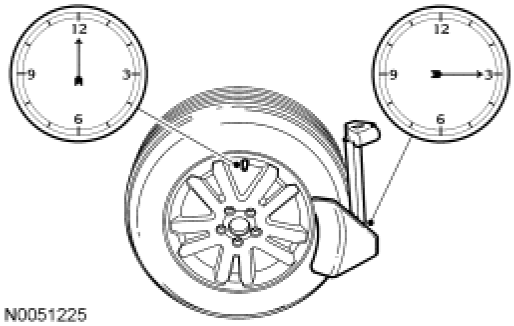


Fig. 19: Identifying Valve Stem And Paddle Position
Courtesy of FORD MOTOR CO.

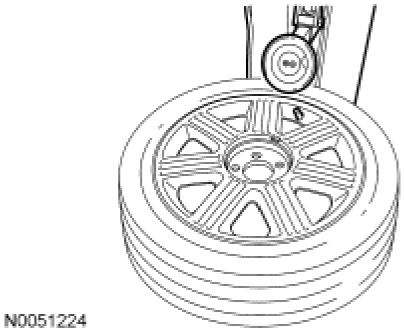


Fig. 20: Identifying Valve Stem And Roller
Courtesy of FORD MOTOR CO.

NOTE: Index-mark the valve stem and wheel weight positions on the tire.

3. Place the wheel and tire assembly on the turntable of the tire machine with the valve stem between the 5 o'clock and 6 o'clock positions and the machine arm at the 12 o'clock position and dismount the outer bead from the wheel.

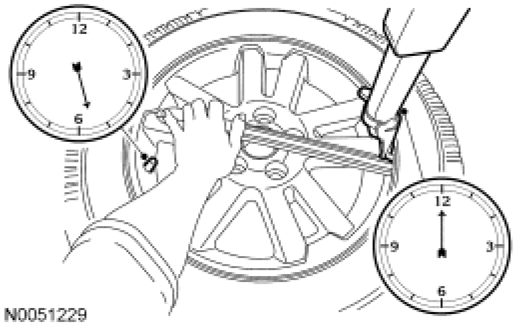


Fig. 21: Identifying Wheel And Tire Assembly On Turntable Tire Machine (Dismounting Outer Bead)
Courtesy of FORD MOTOR CO.

4. Reset the wheel and tire assembly on the turntable of the tire machine with the valve stem between the 5

o'clock and 6 o'clock positions and the machine arm at the 12 o'clock position and dismount the inner bead from the wheel.

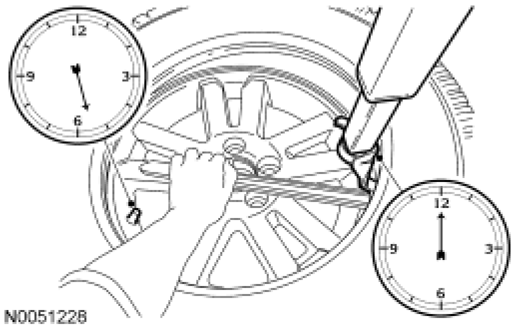


Fig. 22: Resetting Wheel And Tire Assembly On Turntable Of Tire Machine
Courtesy of FORD MOTOR CO.

5. Inspect the TPMS sensor, cradle and strap for damage. Install new parts as necessary.
   - For information on removal and installation of the TPMS sensor, refer to **Tire Pressure Monitoring System (TPMS) Sensor**.
   - When installing a new wheel, reuse the TPMS sensor from the previous wheel if possible. The TPMS will not have to be trained if the sensor is reused. The new wheel will not come with a sensor strap. A sensor strap kit will need to be ordered with the new wheel.

ASSEMBLY

NOTE: **Damage to the Tire Pressure Monitoring System (TPMS) sensor may result if the tire mounting is not carried out as instructed.**

NOTE: **Use only a soap and water solution to lubricate the tire. Use of anything other than soap and water may result in damage to the Tire Pressure Monitoring System (TPMS) sensor.**

NOTE: **Do not mount the tire at this time.**

1. Position the wheel on the turntable of the tire machine, then lubricate and position the bottom bead of the tire on the wheel.
2. Position the wheel to align the valve stem with the machine arm at the 12 o'clock position and mount the bottom bead of the tire.

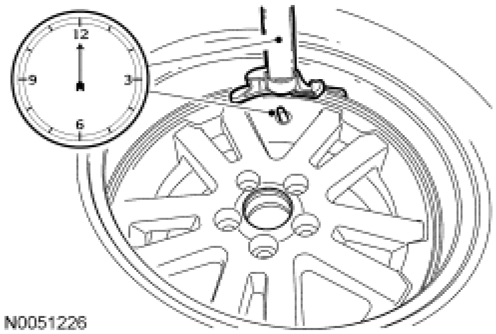


Fig. 23: Identifying Alignment Position Of Valve Stem With Machine Arm (Bottom Bead Of Tire)
Courtesy of FORD MOTOR CO.

3. Reposition the wheel to align the valve stem with the machine arm at the 12 o'clock position and mount the top bead of the tire.

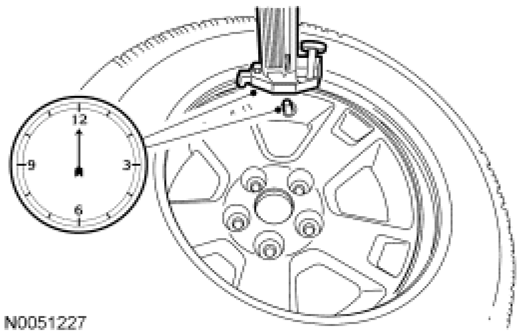


Fig. 24: Identifying Alignment Position Of Valve Stem With Machine Arm (Top Bead)
Courtesy of FORD MOTOR CO.

NOTE: Use only the Digital Tire Gauge any time tire pressures are measured to make sure that accurate values are obtained.

4. Using the Digital Tire Gauge, inflate the tire to the pressure specified on the Vehicle Certification (VC) label located on the driver door or door pillar.
   - Proceed to Step 5 if the tire beads do not seat at the specified inflation pressure.

WARNING: If there is a need to exceed the maximum pressure indicated on the sidewall of the tire, in order to seat the beads, follow ALL the steps listed below. Failure to follow these steps may result in serious personal injury.

5. **The following steps should only be carried out if the tire beads cannot be seated by inflating the tire up to the maximum inflation pressure listed on the tire sidewall.**
   1. Relubricate the tire bead and wheel bead seat area.
   2. Install a remote valve and pressure gauge.

3. Wear eye and ear protection and stand at a minimum of 3.65 m (12 ft) away from the wheel and tire assembly.
4. Inflate tire using the remote valve and pressure gauge until the beads have seated or until the pressure gauge is 138 kPa (20 psi) more than maximum inflation pressure on tire sidewall. If beads have not seated, deflate the tire and proceed to the next step.
5. Place the wheel and tire assembly in an OSHA-approved tire safety cage.
6. Inflate the tire using the remote valve and pressure gauge until the beads have seated or until the pressure gauge is 276 kPa (40 psi) more than maximum inflation pressure on the tire sidewall. **Do not exceed 276 kPa (40 psi) above the maximum pressure on tire sidewall. Install a new tire if the beads do not seat at this pressure.**

6. Install the wheel and tire. For additional information, refer to **Wheel and Tire**.

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

TIRE PRESSURE MONITORING SYSTEM (TPMS) SENSOR

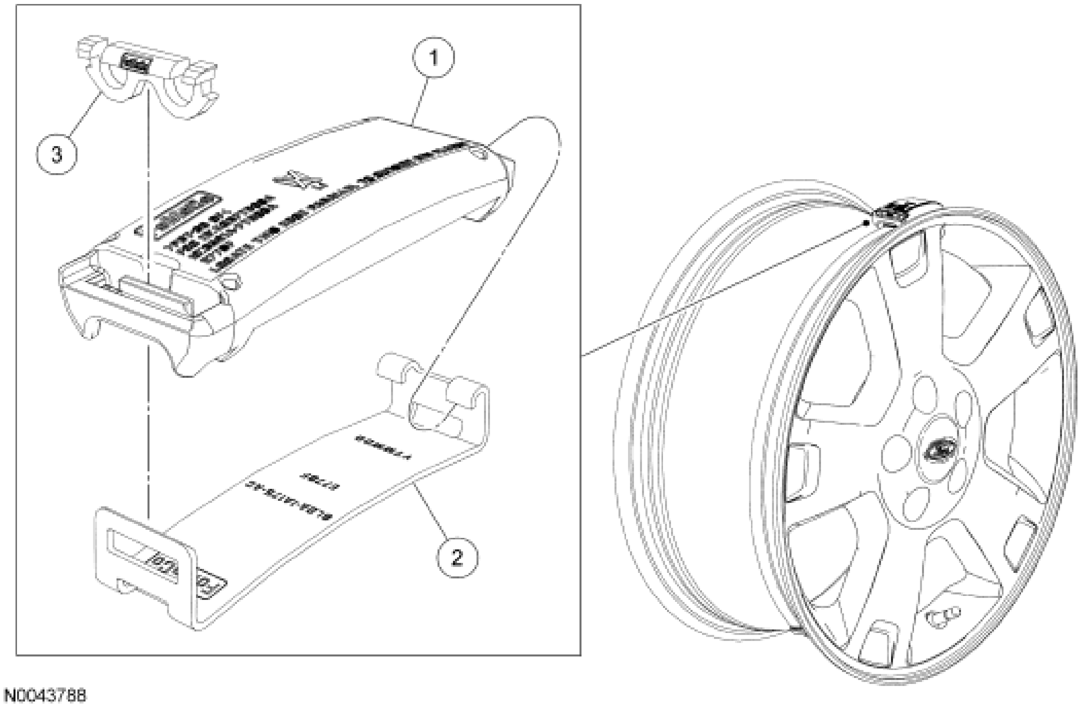


Fig. 25: Exploded View Of Tire Pressure Monitoring System (TPMS) Sensor
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	1A150/1A189	Tire pressure sensor/sensor kit
2	1A175	Sensor cradle
3	14C202	Locking clip (also part of 1A189)

DISASSEMBLY

WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

NOTE: The sensor can be removed and installed without removing the strap or the cradle.

NOTE: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Dismount the tire only as instructed.

1. Remove the tire from the wheel. For additional information, refer to **Wheel and Tire**.

NOTE: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor locking clip may occur.

2. Using a pocket screwdriver or similar tool, remove the sensor locking clip.

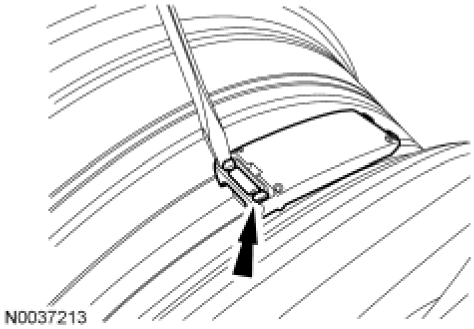


Fig. 26: Locating Sensor Locking Clip
Courtesy of FORD MOTOR CO.

NOTE: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor may occur.

3. Using a pocket screwdriver or similar tool, detach the sensor from the cradle.

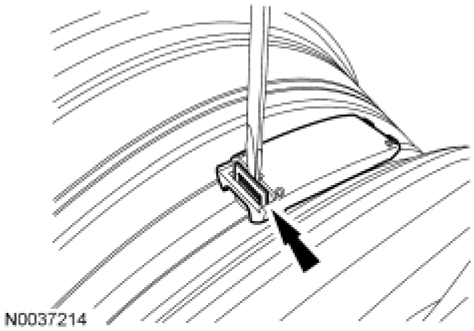


Fig. 27: Removing Sensor From Cradle
Courtesy of FORD MOTOR CO.

4. Remove the sensor.

ASSEMBLY

NOTE: Damage to the sensor may occur if excessive force is applied during sensor installation.

NOTE: Make sure the sensor is fully seated into the cradle. The sensor will make a "click" noise when correctly seated.

1. Position the sensor into the cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

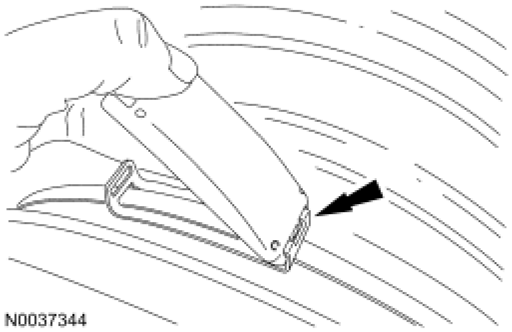


Fig. 28: Positioning Sensor Into Cradle
Courtesy of FORD MOTOR CO.

NOTE: The locking clip can only be fully seated when installed in the correct orientation. If the sensor locking clip cannot be fully inserted, then the

sensor may not be fully seated on the cradle or the locking clip may be inserted backward.

2. Insert a new locking clip into the sensor.

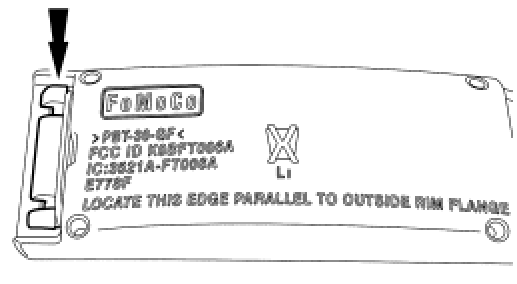


Fig. 29: Locating Locking Clip
Courtesy of FORD MOTOR CO.

NOTE: **The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.**

3. Install the tire onto the wheel. For additional information, refer to **Wheel and Tire**.

NOTE: **A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.**

4. Train the tire pressure sensor(s). For additional information, refer to **Tire Pressure Monitoring System (TPMS) Sensor Training**.

TIRE PRESSURE MONITORING SYSTEM (TPMS) STRAP AND CRADLE

Material

Item	Specification
Wheel and Tire Cleaner ZC-37-A	-

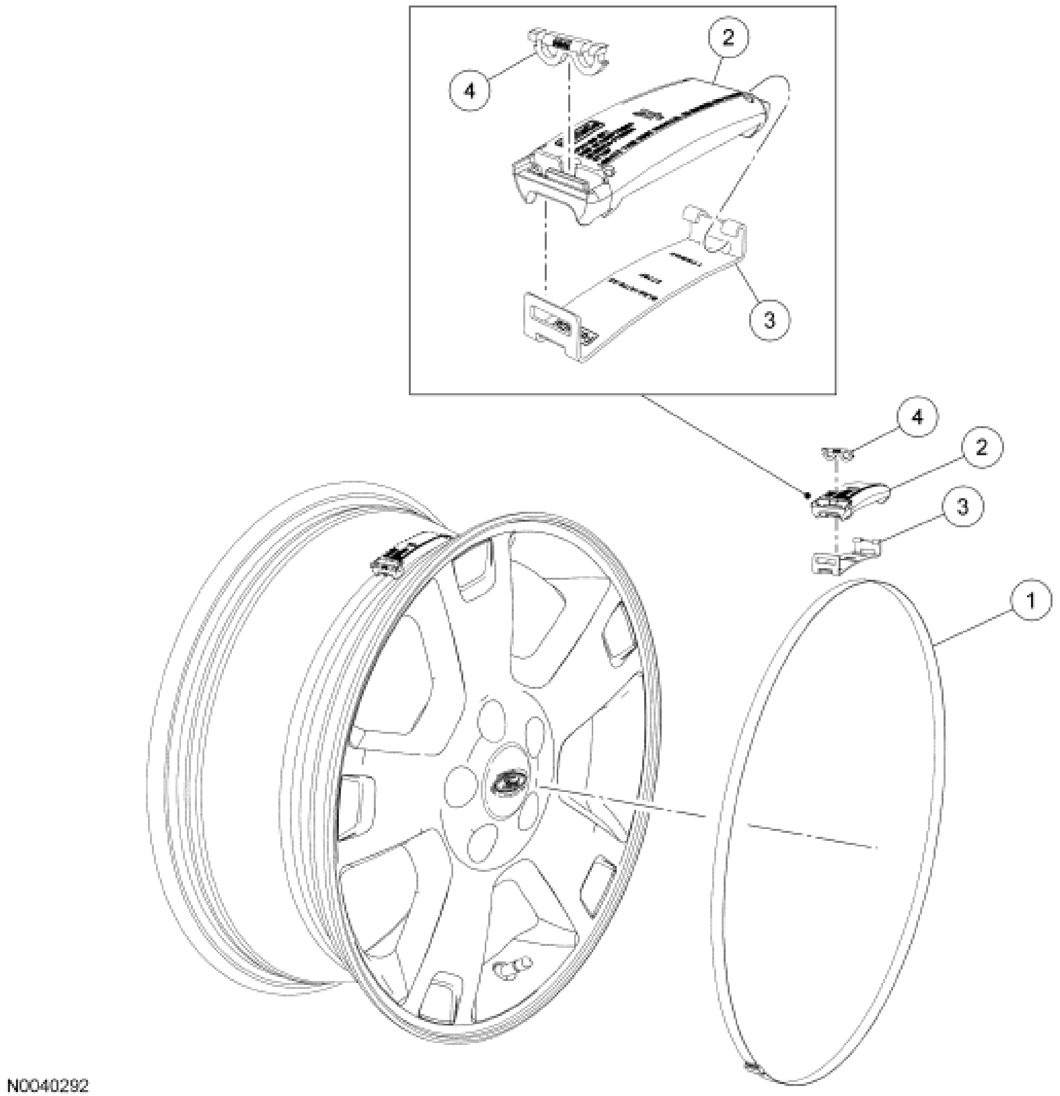


Fig. 30: Exploded View Of Tire Pressure Monitoring System (TPMS) Strap & Cradle
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	1A177/1A193	Strap/strap kit
2	1A150/1A189	Tire pressure sensor/sensor kit
3	1A175	Sensor cradle (also part of 1A193)
4	14C202	Locking clip (also part of 1A189)

DISASSEMBLY

WARNING: **The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a**

minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: **Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.**

NOTE: **Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.**

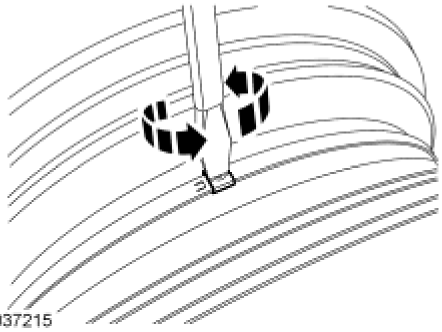
NOTE: **The sensor is available separately, the cradle and strap are available as a strap kit. There are several different strap kits available based on wheel diameter, but all strap kits share the same base part number.**

1. Remove the Tire Pressure Monitoring System (TPMS) sensor. For additional information, refer to **Tire Pressure Monitoring System (TPMS) Sensor** .

   WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

   WARNING: **Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow this instruction may result in serious personal injury.**

2. Remove a factory-installed strap in the following sequence:
   1. Locate the strap buckle and secure the strap to the wheel using duct tape or a similar item on both sides of the buckle, approximately 25 mm (0.98 in) from the buckle.
   2. Using a large screwdriver and a twisting motion, unbuckle the strap.
   3. Discard the strap.



N0037215

Fig. 31: Removing Factory Installed Strap
Courtesy of FORD MOTOR CO.

3. To remove a dealer-installed strap, turn the worm gear screw until the strap is fully released from the worm gear.
    - Discard the strap.

NOTE: **To aid assembly, mark the location of the cradle prior to disassembly.**

4. Using a screwdriver, or similar tool, remove the cradle by inserting the screwdriver under the cradle and prying up.

ASSEMBLY

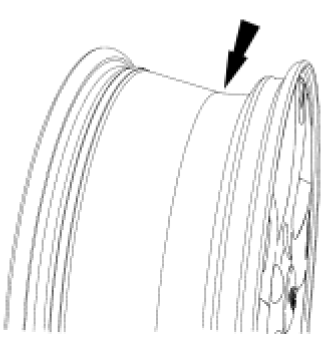
NOTE: **Make sure the sensor is fully seated into the new cradle. The sensor will make a "click" noise when fully seated.**

1. Position the sensor into the new cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

NOTE: **Metal scrapers may damage the wheel. Use only plastic or non-metallic scrapers to remove the cradle adhesive strip residue.**

NOTE: **The sensor and cradle must be installed in the drop well of the wheel, 180 degrees from the valve stem.**

2. Using wheel and tire cleaner, clean the area where the sensor and cradle are to be installed.



N0037814

Fig. 32: Locating Sensor & Cradle Area
Courtesy of FORD MOTOR CO.

NOTE: **The sensor and cradle must be positioned with the hinge side of the sensor on the RH side when viewed from the curb side (beauty side) of the wheel.**

NOTE: The sensor has raised markings indicating how to position the sensor.

3. Remove the adhesive tape liner from the cradle and position the sensor and cradle into the wheel drop well 180 degrees from the valve stem.

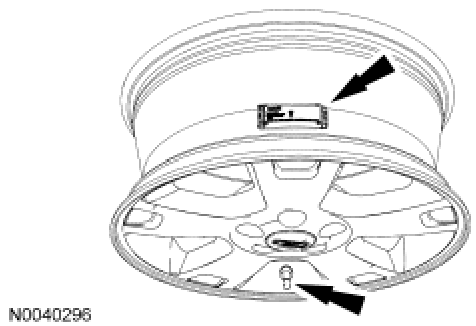


Fig. 33: Locating Sensor & Cradle Into Wheel Drop Well
Courtesy of FORD MOTOR CO.

4. Install the tapered end of the strap through the opening of the cradle on the hinge side of the sensor. This will position the worm gear on the locking clip side of the sensor.

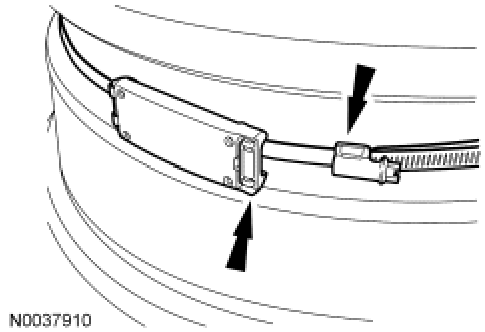


Fig. 34: Locating Worm Gear And Locking Clip
Courtesy of FORD MOTOR CO.

NOTE: Steel wheels have a "high spot" along their circumference. Make sure the strap and sensor are mounted at the lowest spot possible to avoid damaging the sensor during wheel and tire disassembly and assembly.

NOTE: Keep the strap parallel with the wheel flange while tightening the worm gear.

5. Position the worm gear 13-26 mm (0.5-1.0 in) away from the sensor and tighten the worm gear.
   - Tighten to 3 Nm (27 lb-in).

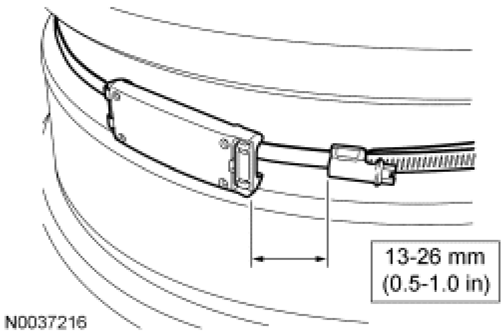


Fig. 35: Identifying Worm Gear Distance From Sensor (With Specifications)
Courtesy of FORD MOTOR CO.

NOTE: **The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.**

6. Install the tire onto the wheel. For additional information, refer to **Wheel and Tire**.

NOTE: **A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.**

7. Train the tire pressure sensor(s). For additional information, refer to **Tire Pressure Monitoring System (TPMS) Sensor Training**.

2008 ACCESSORIES & BODY, CAB

Glass, Frames and Mechanisms - Edge & MKX

SPECIFICATIONS

Material

Item	Specification	Fill Capacity
Dow Urethane Adhesive Betaseal® Express[a]	-	-
Dow Urethane One Step Glass Primer Betaprime® 5500 / 5500A / 5500SA[a]	-	-
Lacquer Touch-Up Paint (match color to exterior grid wire) PM-19500-XXXX or PMP-19500-XXXX	ESR-M2P100-C	-
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B	-
Rear Window Defroster Repair PM-11 (US); CPM-11 (Canada)	-	-
Sika Urethane Adhesive Sika Tack ASAP[b]	-	-
Sika Urethane Metal and Glass Primer Sika 206 G+P[b]	-	-
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A	-

[a] Dow Automotive 2-hour cure

[b] Sika 2-hour cure

GENERAL SPECIFICATIONS

Item	Specification
Terminal Kit - Back Glass 4F1Z-14421-AA	-

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Door latch screws	12	9	-
Front door module bolts	9	-	80

Front window glass clamp bolts	8	-	71
Rear door module bolts	9	-	80
Rear window glass clamp bolt	9	-	80

DESCRIPTION AND OPERATION

GLASS, FRAMES AND MECHANISMS

The glass, frames and mechanisms consist of the following:

- Accessory delay relay
- Door window regulator motors
- Front door glass top run
- Front door window glass
- Heated rear window grid
- Heated rear window grid relay
- Liftgate window glass
- Rear door glass top run
- Rear door window glass
- Rear fixed window glass
- Rear quarter glass
- Rear window regulator and motor - run and brackets
- Smart junction box (SJB)
- Window control switches
- Window regulators
- Windshield glass

The glass, frames and mechanisms include the following:

Edge

- Standard power windows, which include one-touch UP, one-touch DOWN and LOCK-OUT feature (LH front windows only)

MKX

- Standard power windows, which include one-touch UP, one-touch DOWN and LOCK-OUT feature (LH and RH front windows only)

All vehicles

- Liftgate glass which includes the rear defrost grid and rear wiper arm

- Standard plastic and laminate safety glass
- Windshield glass which is bonded to the opening flange with a urethane sealant

The window regulator control switch:

- is located on each door trim panel.
- may be used to manually raise or lower all windows from the left front window control switch or the individual side window from the corresponding individual door switch.
- can manually lower the driver side window when the left front window control switch is pressed and held in the DOWN position.
- can automatically lower the driver side window when the left front window control switch is momentarily pressed to the DOWN position and released.

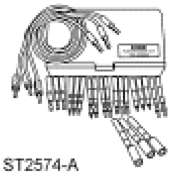
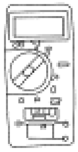
Global Open - MKX Only

The SJB sends a signal on the global open circuit, to both front door window motors to open or close the windows based on a signal received from the remote keyless entry (RKE) transmitter. If the accessory delay relay is active, the global open feature will not operate.

DIAGNOSTIC TESTS

GLASS, FRAMES AND MECHANISMS

Special Tools

Illustration	Tool Name	Tool Number
 ST2574-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent

Principles of Operation

Delayed Accessory Power

NOTE: The smart junction box (SJB) may also be identified as the generic electronic module (GEM).

The SJB controls power to the power windows, the audio system and the power roof opening panel with the delayed accessory relay. The SJB activates the delayed accessory relay whenever the ignition switch is in the RUN or the ACCESSORY position, or when the ignition switch is changed from RUN or ACCESSORY to the OFF/LOCK position and the LH and RH front doors are closed.

The SJB will deactivate the delayed accessory feature when:

- the LF door is ajar and the ignition switch is in the OFF/LOCK or key-out position.
- the RF door is ajar and the ignition switch is in the OFF/LOCK or key-out position.
- ten minutes have elapsed since the ignition switch was changed from ACC or RUN to the OFF/LOCK position.

LH and RH Front Power Window Control - MKX

The LH and RH front window motors contain integral electronics which must be initialized whenever a new window motor has been installed. Initialization is required to learn both the full UP and full DOWN positions and the profile of the glass as it travels through the glass channel. Once initialized, obstacle detection is enabled. When mechanical repairs have been carried out on either front window regulator or glass run, the applicable front window motor must be de-initialized, and then initialized. Both the LH and RH front window control switches send 3 separate signals to the front window motors: up, down and auto. The front window control switches provide a 12-volt signal to the front window motor to request an up or down operation. When auto up or auto down is requested, the front window control switches provide a 12-volt signal on the up or down line and a ground signal on the auto line simultaneously. The up, down and auto feeds to the front window motors are all low current.

The LH and RH front window motors operate with the ignition switch in the RUN or ACCESSORY positions, or when the delayed accessory relay is active. The high current required to move the front windows are supplied through the B+ and motor ground input.

When the LH or RH front window motor is operating in auto up or auto down mode, movement of the front window can be stopped by pressing the switch to any position (UP, DOWN, auto UP, auto DOWN). The front window control switches must be released before the window will move again.

The LH and RH front window motors have a security override feature. If an obstacle has been detected in the window opening as the window glass is moving upward, the window motor will automatically reverse direction and move the glass toward the fully OPEN position (in both manual up and one-touch up modes). This is known as "bounce-back". Once the window motor stops the glass at its bounce-back position, and within 2 seconds the switch is released, then held in the auto UP position, the window motor will move the glass up with no bounce-back protection (security override). If the switch is released before the window glass reaches the fully CLOSED position, the window motor will stop with bounce-back automatically enabled for the next window up movement. If the ignition switch is turned to OFF or START (without delayed accessory), the window motor will stop. The only exception is when an obstacle is detected in the window opening while delayed accessory power is not present. In this case the window motor will bounce back, then stop. Ice, contaminant buildup and environmentally induced tight spots in the front window seals are all possible conditions that will activate the bounce-back feature. If an obstruction occurs between 4 mm (0.15 in) and 200 mm (7.87 in) of window opening, the bounce-back position will be 250 mm (9.84 in) of window opening. If an obstruction occurs at a position greater than 200 mm (7.87 in) of window opening, the bounce-back position will be 50 mm (1.96 in) below where the obstruction occurred.

The LH and RH front window control switches have illumination and illumination ground inputs, which are used to illuminate the switch when the headlamp switch is turned to the PARK or ON position (the AUTOLAMP position may also energize this input). These switch inputs do not directly affect operation of the front windows. The front window control switches use the delayed accessory power input, which is transferred to the up or down outputs when the corresponding switch contact is closed. The front window control switches are grounded to the chassis through the main switch ground input, which is transferred to the auto output when the corresponding front window control switch contact is closed. If the delayed accessory feed to the front window control switch is missing, the window will not function. If the main ground signal is missing, the auto functions will be inoperative and the window will also be inoperative.

If there is an open in the LH or RH front window control switch or the associated wiring, the related function will become inoperative. If the up contact of the switch or the associated wiring develops an open circuit, the front window will only operate in the down direction, or in the one-touch down mode. If the down contact of the switch or the associated wiring develops an open circuit, the window will only operate in the up direction or in the one-touch up mode. If the auto contact of the switch or the associated wiring develops an open circuit, the window will only move manually up or down.

A new LH or RH front window motor will not operate in one-touch up or one-touch down mode, and the bounce back feature will be disabled prior to initialization. If the switch is actuated to the auto UP or auto DOWN position and released, window movement will stop when the up or down contact in the front window control switch is released. If the front window motor is removed from the window regulator drum housing, or if a new front window motor is installed, it must be initialized. Refer to **Window Motor Initialization**.

Once initialized, the front window motors will soft stall into the upper and lower positions contributing to extended durability of the system. If the front window does not seal completely in the full UP position (very small gaps/non bounce-back events only), the front window switch can be actuated to the proportional UP position and the front window will be energized for a fraction of a second to fully seal and this new position will be learned.

LH Front Power Window Control - Edge

The one-touch UP/DOWN features are identical to the MKX LH front window.

Passenger Window Operation

Passenger windows may be raised or lowered using the LH front window control switch or the corresponding passenger window control switch. Passenger window control switches receive power when the delayed accessory relay is active and the LH front window lock switch is in the UNLOCK position. When the LH front window lock switch is in the LOCK position, the passenger windows will not operate.

Global Open

When the unlock button of the remote keyless entry (RKE) transmitter is held for 2 seconds, the global open activates. The smart junction box (SJB) sends a signal to activate the one-touch down operation of both front windows. The global open feature does not operate if the delay accessory is active.

Rear Window Defrost

The heated rear window control switch is part of the HVAC module located in the instrument panel. When the heated rear window control switch is pressed, ground is provided to the heated rear window relay coil. The heated rear window relay supplies voltage to the rear window defrost grid and the LH and RH exterior rear view mirror defrost grids.

The SJB will deactivate the heated rear window relay when one of the following conditions is met:

- The heated rear window control switch is pressed when the feature is active
- Ignition switch state is changed from RUN to OFF/LOCK
- The 17-minute timer completes

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical

• Door window regulator and motor
• Door glass run
• Door window glass
	• Loose, corroded connectors
	• Circuitry
	• Window control switch
	• Battery junction box (BJB) fuses:
	  ○ 1 (40A)
	  ○ 39 (40A)
	• Smart junction box (SJB) fuses:
	  ○ 1 (30A)
	  ○ 4 (30A)
	  ○ 17 (20A)
	  ○ 41 (15A)
	  ○ 45 (5A)
	• Circuit breaker
	• Delayed accessory relay
	• Heated rear window relay
	• Rear window defrost grid

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
    - check the VCM connection to the vehicle.
    - check the scan tool connection to the VCM.
    - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
    - verify the ignition key is in the ON position.
    - verify the scan tool operation with a known good vehicle.
    - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the smart junction box (SJB).
7. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to the Smart Junction Box (SJB) DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1302	Accessory Delay Relay Coil Circuit Failure	Go to **Pinpoint Test L** .
B1304	Accessory Delay Relay Coil Circuit Short To Battery	If the accessory delay is always on, go to **Pinpoint Test M** . If the accessory delay is inoperative, go to **Pinpoint Test L** .
B2947	Global Opening/Closing Circuit Open	Go to **Pinpoint Test I** .
B2949	Global Opening/Closing Circuit Short to Battery	Go to **Pinpoint Test I** .
All Other	-	REFER to the Master DTC Chart in **MULTIFUNCTION ELECTRONIC**

DTCs		**MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB) module	• Circuitry • SJB	• REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.
• All power windows are inoperative - MKX	• Fuse • Circuitry • Window control switch • SJB	• Go to **Pinpoint Test A** .
• All power windows are inoperative - Edge	• Circuit breaker • Circuitry • Accessory delay relay • Window control switch • SJB	• Go to **Pinpoint Test B** .
• A single power window is inoperative - LH front, MKX	• Fuse • Circuitry • LH front window control switch • LF power window motor • SJB	• Go to **Pinpoint Test C** .
• A single power window is inoperative - LH front, Edge	• Circuitry • LH front window control switch • LF power window motor • SJB	• Go to **Pinpoint Test D** .
• A single power window is inoperative - RH front, MKX	• Fuse • Circuitry • LH or RH front window control switch • RH front power	• Go to **Pinpoint Test E** .

	window motor	
• A single power window is inoperative - LH or RH rear, MKX	• Fuse • Circuitry • LH or RH front window control switch • LH or RH rear power window motor	• Go to **Pinpoint Test F** .
• A single power window is inoperative - RH front, LH or RH rear, Edge	• Circuitry • LH or RH front window control switch • LH or RH rear window control switch • RH front, LH or RH rear power window motor	• Go to **Pinpoint Test G** .
• The one-touch up/down feature is inoperative	• Circuitry • LH or RH front power window motor • LH or RH front window control switch • LH or RH front motor not initialized • Battery power was lost while LH or RH front window was operating	• Go to **Pinpoint Test H** .
• The global open function is inoperative/does not operate correctly - MKX	• Fuse • Door window motors not initialized • RKE transmitters • Circuitry • SJB	• Go to **Pinpoint Test I** .
	• Fuse(s) • Circuitry	

• The defrost system is inoperative	• Rear window defrost grid • HVAC module • SJB • Battery junction box (BJB)	• Go to **Pinpoint Test J** .
• The defrost system will not shut off automatically	• Circuitry • SJB • HVAC module	• Go to **Pinpoint Test K** .
• The delayed accessory is inoperative/does not operate correctly	• Door ajar switch • Accessory delay relay • SJB	• Go to **Pinpoint Test L** .
• The delayed accessory does not turn off	• Circuitry • Accessory delay relay • SJB	• Go to **Pinpoint Test M** .

Pinpoint Tests

Pinpoint Test A: All Power Windows are Inoperative - MKX

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Windows for schematic and connector information.

Normal Operation

Under normal operation, the LH front power window control switch receives power through circuits CBP41 (BU) and CBP47 (GN/BU), which is the delayed accessory relay output from the smart junction box (SJB). The delayed accessory relay is integral to the SJB module. The LH and RH front power window motors each have their own separate power feeds and grounds and do not share any circuits with the LH or RH rear power window motors except through the master window control switch.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- LH front window control switch
- SJB

PINPOINT TEST A: ALL POWER WINDOWS ARE INOPERATIVE - MKX

A1 CHECK CIRCUITS CBP41 (BU) AND CBP47 (GN/BU) FOR VOLTAGE

- Disconnect: LH Front Window Control Switch C535A
- Disconnect: LH Front Window Control Switch C535B
- Key in ON position.

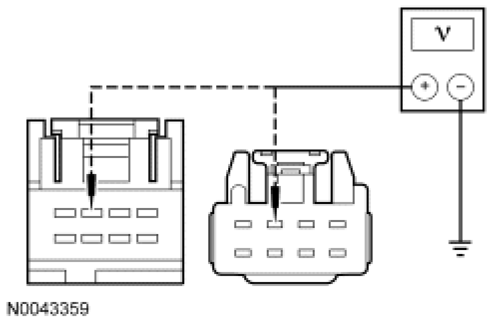


Fig. 1: Checking Circuit CBP02 (GN) And CPW30 (GY/YE) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between LH front window control switch C535A-3, circuit CBP41 (BU), harness side and ground; and between LH front window control switch C535B-3, circuit CBP47 (GN/BU), harness side and ground.
- **Is the voltage greater than 10 volts for both measurements?**

  YES : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : VERIFY the SJB fuse 41 (15A) is OK. If OK, go to A2.

A2 CHECK CIRCUITS CBP41 (BU) AND CBP47 (GN/BU) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280D

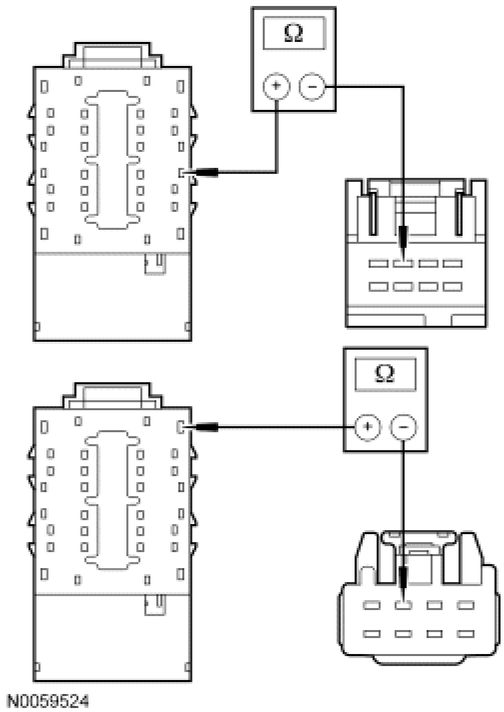


Fig. 2: Measuring Resistance Between LH Front Window Control Switch C535A-3, Circuit CBP41 (BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window control switch C535A-3, circuit CBP41 (BU), harness side and SJB C2280D-16, circuit CBP41 (BU), harness side; and between LH front window control switch C535B-3, circuit CBP47 (GN/BU), harness side and SJB C2280D-32, circuit CBP47 (GN/BU), harness side.
- **Are the resistances less than 5 ohms for both measurements?**

  YES : Go to **Pinpoint Test L** to diagnose the delayed accessory relay circuit.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test B: All Power Windows are Inoperative - Edge

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Windows for schematic and connector information.

Normal Operation

Under normal operation, the LH front power window control switch receives power through circuit CBP47 (GN/BU), which is the delayed accessory relay output from the smart junction box (SJB). The delayed accessory relay is integral to the SJB module. The LH front power window control switch is grounded to the chassis through circuit GD133 (BK).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- LH front window control switch
- SJB

PINPOINT TEST B: ALL POWER WINDOWS ARE INOPERATIVE - EDGE

B1 CHECK CIRCUIT CBP47 (GN/BU) FOR VOLTAGE

- Disconnect: LH Front Window Control Switch C504A
- Key in ON position.

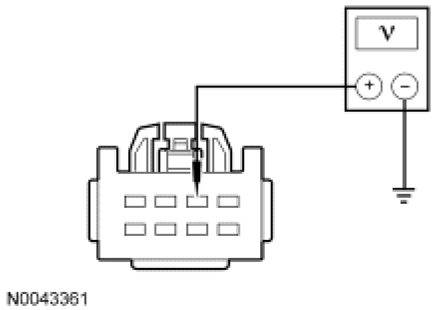


Fig. 3: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between LH front window control switch C504A-2, circuit CBP47 (GN/BU), harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to B3.

NO : Go to B2.

B2 CHECK CIRCUIT CBP47 (GN/BU) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280D

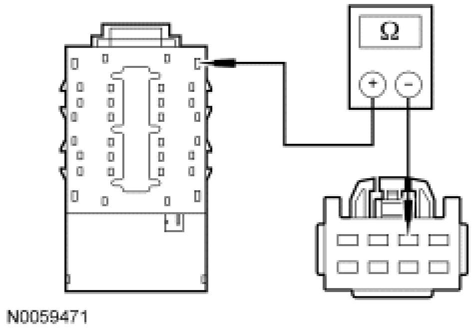


Fig. 4: Measuring Resistance Between LH Front Window Control Switch C504A-2, Circuit CBP47 (GN/BU)

Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window control switch C504A-2, circuit CBP47 (GN/BU), harness side and SJB C2280D-32, circuit CBP47 (GN/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to **Pinpoint Test L** to diagnose the delayed accessory relay circuit.

  NO : REPAIR the circuit. TEST the system for normal operation.

B3 CHECK CIRCUIT GD133 (BK) FOR AN OPEN

- Key in OFF position.
- Disconnect: LH Front Window Control Switch C504B

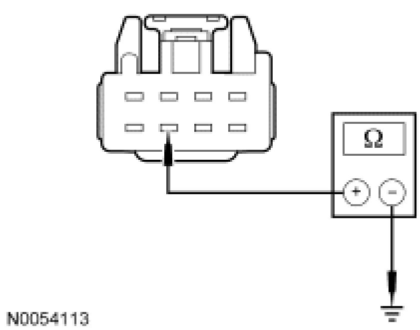


Fig. 5: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window control switch C504B-7, circuit GD133 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test C: A Single Power Window is Inoperative - LH Front, MKX

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Windows for schematic and connector information.

NOTE:	**A new LH front power window motor will not operate in one-touch up or one-touch down mode until initialized. Refer to Window Motor Initialization.**
NOTE:	**The LH front power window motor must be initialized whenever a new motor is installed.**
NOTE:	**The front window motor must be de-initialized, then initialized whenever the LH or RH (MKX) or LH (Edge) front window motor is removed from the window**

regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.

Normal Operation

The LH front power window control switch receives power from the delay accessory relay through circuit CBP41 (BU). The LH window motor receives battery power through circuit SBP04 (GN/RD) and ground through circuit GD133 (BK). When the LH front window control switch is operated in the UP position, the LH front window motor receives a voltage signal through circuit CPW11 (BU/GY). When the LH front window control switch is operated in the DOWN position, the LH front window motor receives a voltage signal through circuit CPW10 (YE/VT). When the LH front window motor receives a ground signal on circuit CPW29 (VT/GY), the LH front window motor will enter one-touch up/down mode.

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- LH front window motor
- LH front window control switch
- LH front window motor not initialized

PINPOINT TEST C: A SINGLE POWER WINDOW IS INOPERATIVE - LH FRONT, MKX

C1 CHECK THE POWER TO THE WINDOW MOTOR

- Disconnect: LH Front Window Motor C540

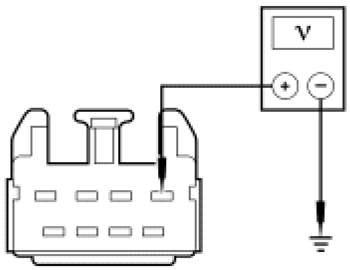


Fig. 6: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between LH front window motor C540-1, circuit SBP04 (GN/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to C2.

  NO : VERIFY smart junction box (SJB) fuse 4 (30A) is OK. If OK, REPAIR the circuit. DE-

INITIALIZE, then INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

C2 CHECK CIRCUIT CBP41 (BU) FOR AN OPEN

- Key in ON position.

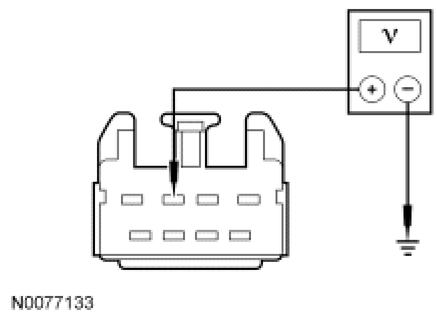


Fig. 7: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between LH front window motor C540-3, circuit CBP41 (BU), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to C3.

  NO : REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

C3 CHECK CIRCUIT GD133 (BK) FOR AN OPEN

- Key in OFF position.

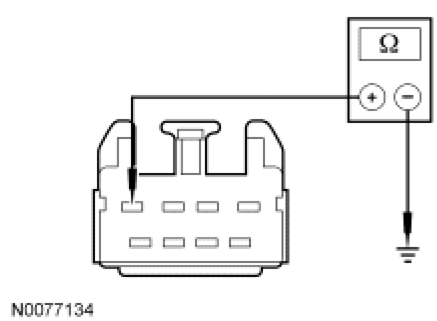


Fig. 8: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window motor C540-4, circuit GD133 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to C4.

  NO : REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH front window motor.

REFER to **Window Motor Initialization**. TEST the system for normal operation.

C4 CHECK THE LH FRONT WINDOW CONTROL SWITCH-TO-LH FRONT WINDOW MOTOR FEEDS

- Disconnect: LH Front Window Control Switch C535A

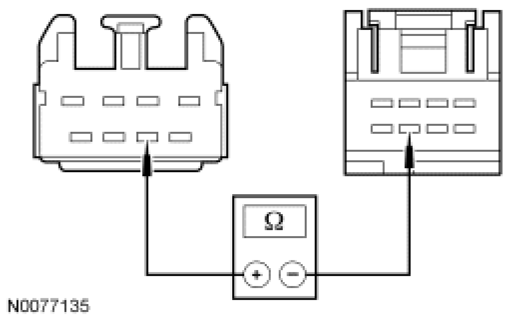


Fig. 9: Measuring Voltage Between LH Front Window Motor C540-6, Circuit CPW10 (YE/VT) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window motor C540-6, circuit CPW10 (YE/VT), harness side and LH front window control switch C535A-7, circuit CPW10 (YE/VT), harness side.

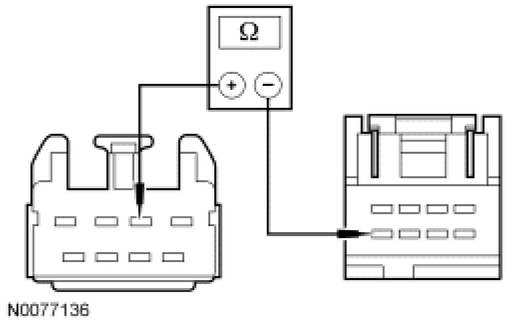


Fig. 10: Measuring Voltage Between LH Front Window Motor C540-2, Circuit CPW29 (VT/GY) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window motor C540-2, circuit CPW29 (VT/GY), harness side and LH front window control switch C535A-8, circuit CPW29 (VT/GY), harness side.

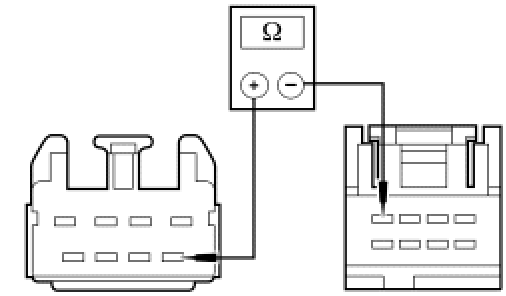


Fig. 11: Measuring Voltage Between LH Front Window Motor C540-5, Circuit CPW11 (BU/GY) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window motor C540-5, circuit CPW11 (BU/GY), harness side and LH front window control switch C535A-4, circuit CPW11 (BU/GY), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to C5.

  NO : REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

C5 CHECK THE LH FRONT WINDOW CONTROL SWITCH

- Carry out the LH Front Window Control Switch Component Test. Refer to appropriate COMPONENT TESTING article.
- **Did the window control switch pass the component test?**

  YES : INSTALL a new LH front window motor. REFER to **Glass, Frames and Mechanisms - Exploded View, Front Door** and **Window Regulator and Motor - Front Door**. INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

  NO : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

Pinpoint Test D: A Single Power Window is Inoperative - LH Front, Edge

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Windows for schematic and connector information.

NOTE: **A new LH front power window motor will not operate in one-touch up or one-touch down mode until initialized. Refer to Window Motor Initialization.**

NOTE: **The LH front power window motor must be initialized whenever a new motor is installed.**

NOTE: **The front window motor must be de-initialized, then initialized whenever the LH**

or RH (MKX) or LH (Edge) front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.

Normal Operation

The LH front power window control switch receives power from the delay accessory relay through circuit CBP41 (BU). The LH window motor receives battery power through circuit SBP04 (GN/RD) and ground through circuit GD133 (BK). When the LH front window control switch is operated in the UP position, the LH front window motor receives a voltage signal through circuit CPW11 (BU/GY). When the LH front window control switch is operated in the DOWN position, the LH front window motor receives a voltage signal through circuit CPW10 (YE/VT). When the LH front window motor receives a ground signal on circuit CPW29 (VT/GY), the LH front window motor will enter one-touch up/down mode.

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- LH front window motor
- LH front window control switch
- LH front window motor not initialized

PINPOINT TEST D: A SINGLE POWER WINDOW IS INOPERATIVE - LH FRONT, EDGE

D1 CHECK THE POWER TO THE WINDOW MOTOR

- Disconnect: LH Front Window Motor C540

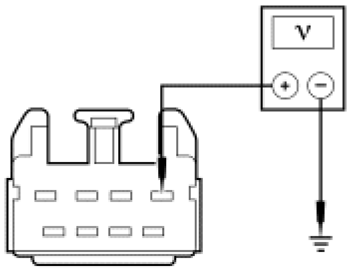


Fig. 12: Measuring Voltage
Courtesy of FORD MOTOR CO.

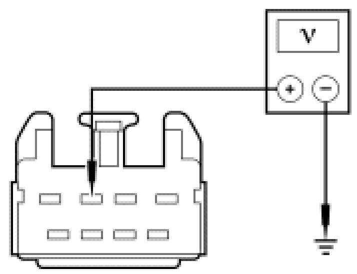
- Measure the voltage between LH front window motor C540-1, circuit SBP04 (GN/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to D2.

NO : VERIFY smart junction box (SJB) fuse 4 (30A) is OK. If OK, REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

D2 CHECK CIRCUIT CBP41 (BU) FOR AN OPEN

- Key in ON position.



N0077133

Fig. 13: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between LH front window motor C540-3, circuit CBP41 (BU), harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to D3.

NO : REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

D3 CHECK CIRCUIT GD133 (BK) FOR AN OPEN

- Key in OFF position.

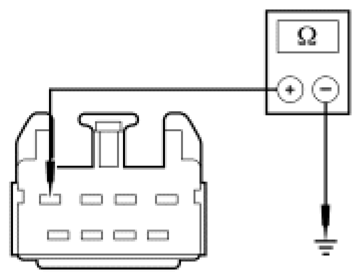


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Fig. 14: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window motor C540-4, circuit GD133 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : Go to D4.

NO : REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

D4 CHECK THE LH FRONT WINDOW CONTROL SWITCH-TO-LH FRONT WINDOW MOTOR FEEDS

- Disconnect: LH Front Window Control Switch C504A

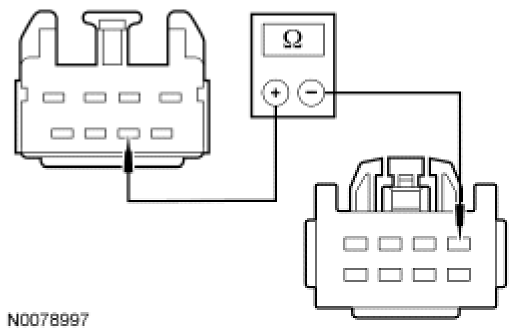

Fig. 15: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window motor C540-6, circuit CPW10 (YE/VT), harness side and LH front window control switch C504A-1, circuit CPW10 (YE/VT), harness side.

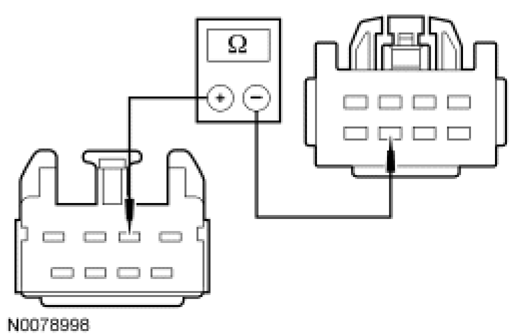

Fig. 16: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window motor C540-2, circuit CPW29 (VT/GY), harness side and LH front window control switch C504A-7, circuit CPW29 (VT/GY), harness side.

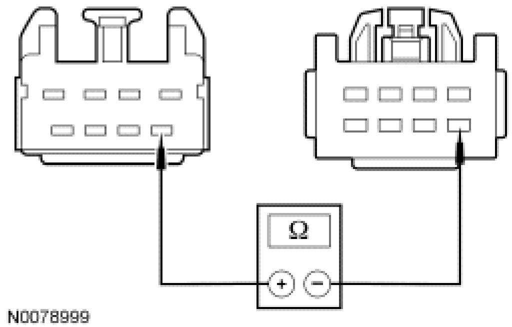

Fig. 17: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window motor C540-5, circuit CPW11 (BU/GY), harness side and LH front window control switch C504A-5, circuit CPW11 (BU/GY), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to D5.

  NO : REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

D5 CHECK THE LH FRONT WINDOW CONTROL SWITCH

- Carry out the LH Front Window Control Switch Component Test. Refer to appropriate COMPONENT TESTING article.
- **Did the window control switch pass the component test?**

  YES : INSTALL a new LH front window motor. REFER to **Glass, Frames and Mechanisms - Exploded View, Front Door** and **Window Regulator and Motor - Front Door**. INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

  NO : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

Pinpoint Test E: A Single Power Window is Inoperative - RH Front, MKX

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Windows for schematic and connector information.

NOTE:	**A new RH front power window motor will not operate in one-touch up or one-touch down mode until initialized. Refer to Window Motor Initialization.**
NOTE:	**The RH front power window motor must be initialized whenever a new motor is installed.**
NOTE:	**The front window motor must be de-initialized, then initialized whenever the LH or RH (MKX) or LH (Edge) front window motor is removed from the window**

regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.

Normal Operation

The LH and RH front power window control switches receive power from the delay accessory relay through circuit CBP41 (BU). The RH window motor receives battery power through circuit SBP01 (RD) and ground through circuit GD140 (BK/GN). When the LH or RH front window control switch is operated in the UP position, the RH front window motor receives a voltage signal through circuit CPW13 (BN/YE). When the LH or RH front window control switch is operated in the DOWN position, the RH front window motor receives a voltage signal through circuit CPW12 (GN/OG). When the RH front window motor receives a ground signal on circuit CPW31 (GN/WH), the RH front window motor will enter one-touch up/down mode.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- RH front window motor
- LH or RH front window control switch
- RH front window motor not initialized

PINPOINT TEST E: A SINGLE POWER WINDOW IS INOPERATIVE - RH FRONT, MKX

E1 CHECK THE LH FRONT WINDOW CONTROL SWITCH OPERATION

- Attempt to operate the RH window using the LH front power window control switch.
- **Does the RH window operate when using the LH front power window control switch?**

  YES : Go to E7.

  NO : Go to E2.

E2 CHECK THE POWER TO THE WINDOW MOTOR

- Key in OFF position.
- Disconnect: RH Front Window Motor C646

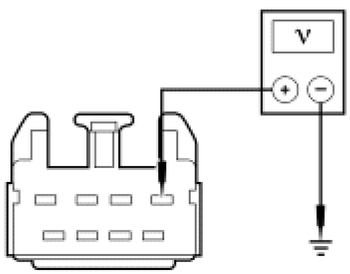

Fig. 18: Measuring Voltage

Courtesy of FORD MOTOR CO.

- Measure the voltage between RH front window motor C646-1, circuit SBP01 (RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to E3.

NO : VERIFY smart junction box (SJB) fuse 1 (30A) is OK. If OK, REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the RH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

E3 CHECK CIRCUIT CBP41 (BU) FOR AN OPEN

- Key in ON position.

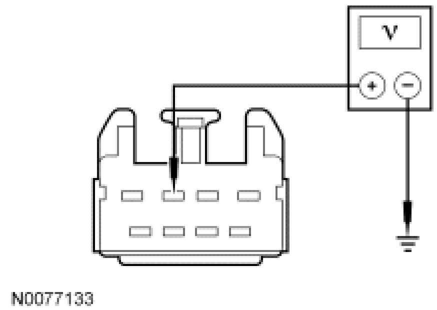

Fig. 19: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between RH front window motor C646-3, circuit CBP41 (BU), harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to E4.

NO : REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the RH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

E4 CHECK CIRCUIT GD140 (BK/GN) FOR AN OPEN

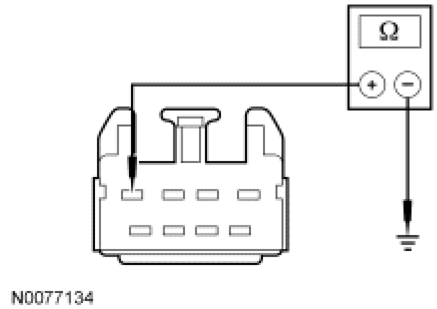

Fig. 20: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RH front window motor C646-4, circuit GD140 (BK/GN), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to E5.

  NO : REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the RH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

E5 CHECK THE LH FRONT WINDOW CONTROL SWITCH-TO-RH FRONT WINDOW MOTOR FEEDS

- Disconnect: LH Front Window Control Switch C535A

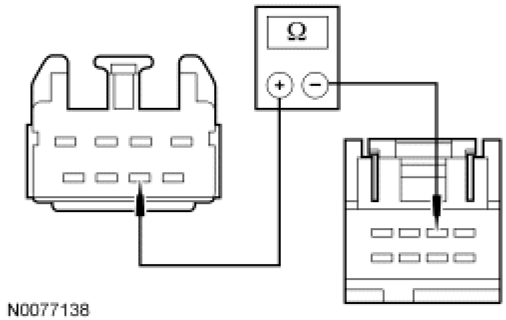

Fig. 21: Measuring Resistance Between RH Front Window Motor C646-6, Circuit CPW12 (GN/OG)
Courtesy of FORD MOTOR CO.

- Measure the resistance between RH front window motor C646-6, circuit CPW12 (GN/OG), harness side and LH front window control switch C535A-2, circuit CPW12 (GN/OG), harness side.

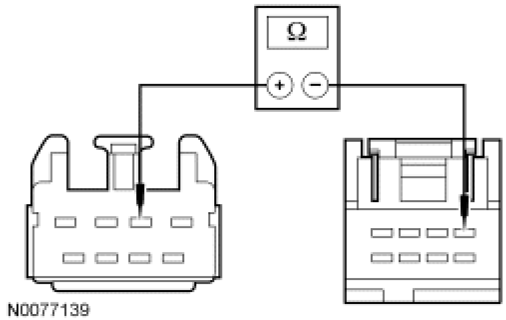

Fig. 22: Measuring Resistance Between RH Front Window Motor C646-2, Circuit CPW31 (GN/WH)
Courtesy of FORD MOTOR CO.

- Measure the resistance between RH front window motor C646-2, circuit CPW31 (GN/WH), harness side and LH front window control switch C535A-1, circuit CPW31 (GN/WH), harness side.

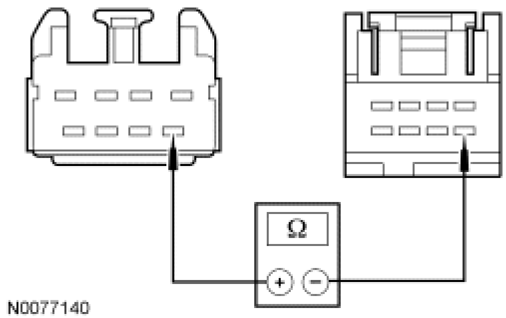

Fig. 23: Measuring Resistance Between RH Front Window Motor C646-5, Circuit CPW13 (BN/YE)
Courtesy of FORD MOTOR CO.

- Measure the resistance between RH front window motor C646-5, circuit CPW13 (BN/YE), harness side and LH front window control switch C535A-5, circuit CPW13 (BN/YE), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to E6.

  NO : REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the RH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

E6 CHECK THE LH FRONT WINDOW CONTROL SWITCH

- Carry out the LH Front Window Control Switch Component Test. Refer to appropriate COMPONENT TESTING article.
- **Did the window control switch pass the component test?**

  YES : INSTALL a new RH front window motor. REFER to **Glass, Frames and Mechanisms - Exploded View, Front Door** and **Window Regulator and Motor - Front Door**. INITIALIZE the RH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

  NO : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. INITIALIZE the RH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

E7 CHECK CIRCUIT CBP41 (BU) FOR VOLTAGE

- Disconnect: RH Front Window Control Switch C648
- Key in ON position.

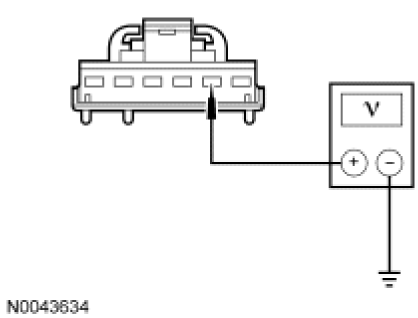

Fig. 24: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the voltage between RH front window control switch C648-2, circuit CBP41 (BU), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to E8.

  NO : REPAIR the circuit. TEST the system for normal operation.

E8 CHECK THE LH FRONT WINDOW CONTROL SWITCH-TO-RH FRONT WINDOW CONTROL SWITCH CIRCUITS

- Key in OFF position.
- Disconnect: LH Front Window Control Switch C535A

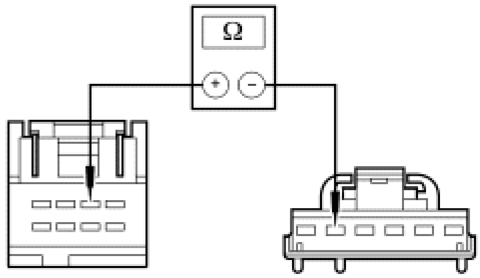

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Fig. 25: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RH front window control switch C648-5, circuit CPW12 (GN/OG), harness side and LH front window control switch C535A-2, circuit CPW12 (GN/OG), harness side.

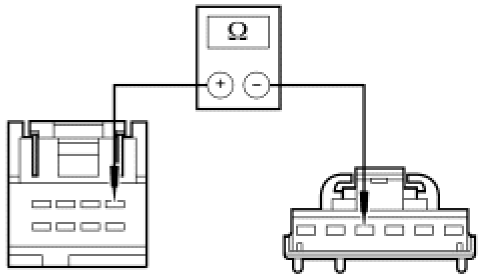

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Fig. 26: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RH front window control switch C648-4, circuit CPW31 (GN/WH), harness side and LH front window control switch C535A-1, circuit CPW31 (GN/WH), harness side.

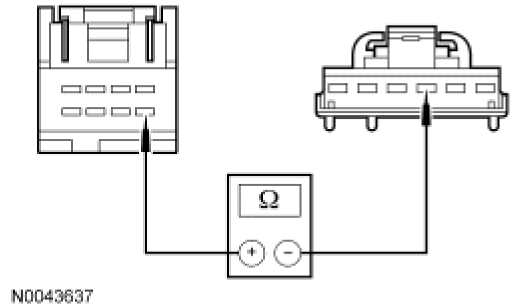


Fig. 27: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RH front window control switch C648-3, circuit CPW13 (BN/YE), harness side and LH front window control switch C535A-5, circuit CPW13 (BN/YE), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new RH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test F: A Single Power Window is Inoperative - LH or RH Rear, MKX

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Windows for schematic and connector information.

Normal Operation

The LH rear window control switch receives delayed accessory power from the LH front window control switch through circuit CPW14 (VT/WH) when the window lock switch is set to the UNLOCK position, and the delayed accessory relay is active. When the LH rear window is operated in the up direction from the LH rear window control switch, power is sent to the LH rear window motor through circuit CPW21 (BN) and ground through circuit CPW22 (GN/VT). When the LH rear window is operated in the down direction from the LH rear window control switch, power is sent to the LH rear window motor through circuit CPW22 (GN/VT) and ground through circuit CPW21 (BN).

The RH rear window control switch receives delayed accessory power from the LH front window control switch through circuit CPW14 (VT/WH) when the window lock switch is set to the UNLOCK position, and the delayed accessory relay is active. When the RH rear window is operated in the up direction from the RH rear window control switch, power is sent to the RH rear window motor through circuit CPW24 (WH/VT) and ground through circuit CPW23 (GY). When the RH rear window is operated in the down direction from the RH rear window control switch, power is sent to the RH rear window motor through circuit CPW23 (GY) and ground through circuit CPW24 (WH/VT).

Rear Window Operation From LH Front Switch

When the LH rear power window is operated in the up direction from the LH front window control switch, power is sent to the LH rear window control switch through circuit CPW16 (BU/OG), which transfers power to the LH rear window motor through circuit CPW21 (BN). The LH front window control switch provides ground to the LH rear window switch through circuit CPW15 (YE), which transfers ground to the LH rear window motor through circuit CPW22 (GN/VT).

During LH rear power window down operation from the LH front window control switch, power is sent to the LH rear window control switch through circuit CPW15 (YE), which transfers power to the LH rear window motor through circuit CPW22 (GN/VT). The LH front window control switch provides ground to the LH rear window switch through circuit CPW16 (BU/OG), which transfers ground to the LH rear window motor through circuit CPW21 (BN).

When the RH rear power window is operated in the up direction from the LH front window control switch, power is sent to the RH rear window control switch through circuit CPW18 (GY/VT), which transfers power to the RH rear window motor through circuit CPW24 (WH/VT). The LH front window control switch provides ground to the RH rear window switch through circuit CPW17 (BN/GN), which transfers ground to the RH rear window motor through circuit CPW23 (GY).

During RH rear power window down operation from the LH front window control switch, power is sent to the RH rear window control switch through circuit CPW17 (BN/GN), which transfers power to the RH rear window motor through circuit CPW23 (GY). The LH front window control switch provides ground to the RH rear window switch through circuit CPW18 (GY/VT), which transfers ground to the RH rear window motor through circuit CPW24 (WH/VT).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- LH front window switch
- Rear window motor
- Rear window switch

PINPOINT TEST F: A SINGLE POWER WINDOW IS INOPERATIVE - LH OR RH REAR, MKX

F1 CHECK THE VOLTAGE TO THE LH REAR OR RH REAR WINDOW CONTROL SWITCH

- Disconnect: Inoperative Rear Window Control Switch C701 (LH) or C801 (RH)
- Key in ON position.

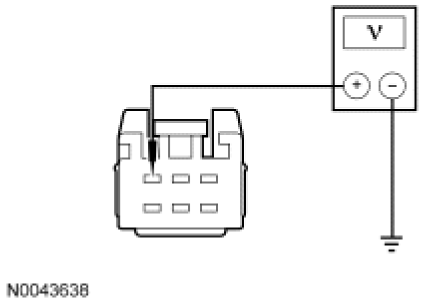


Fig. 28: Measuring Voltage
Courtesy of FORD MOTOR CO.

NOTE: Set the LH front window lock switch to the UNLOCK position.

- Measure the voltage between the inoperative rear window connector and ground:
  - for the RH rear window control switch, measure the voltage between RH rear window control switch C801-3, circuit CPW14 (VT/WH), harness side and ground.
  - for the LH rear window control switch, measure the voltage between C701-3, circuit CPW14 (VT/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to F4.

  NO : Go to F2.

F2 CHECK THE VOLTAGE TO THE LH FRONT WINDOW CONTROL SWITCH

- Disconnect: LH Front Window Control Switch C535B

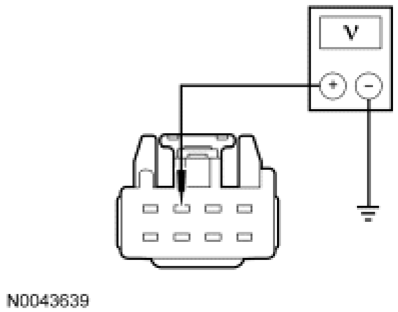


Fig. 29: Measuring Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between LH front window control switch C535B-3, circuit CBP47 (GN/BU), and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to F3.

  NO : REPAIR the circuit. TEST the system for normal operation.

F3 CHECK FOR AN OPEN IN CIRCUIT CPW14 (VT/WH)

- Key in OFF position.

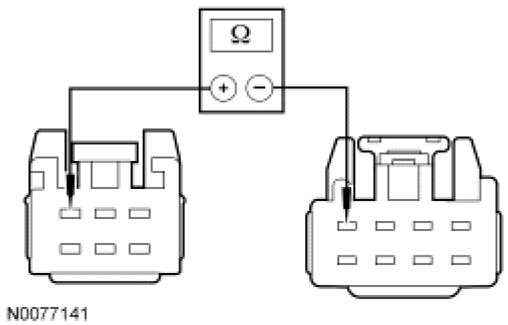


Fig. 30: Measuring Resistance Between Inoperative Rear Window Connector & LH Front Window Control Switch Connector
Courtesy of FORD MOTOR CO.

- Measure the resistance between the inoperative rear window connector and the LH front window control switch connector.
  - for the RH rear window control switch, measure the resistance between RH window control switch C801-3, circuit CPW14 (VT/WH), harness side and LH front window control switch C535B-4, circuit CPW14 (VT/WH), harness side.
  - for the LH rear window control switch, measure the resistance between LH window control switch C701-3, circuit CPW14 (VT/WH), harness side and LH front window control switch C535B-4, circuit CPW14 (VT/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

F4 CHECK THE GROUNDS TO THE INOPERATIVE REAR WINDOW CONTROL SWITCH

- Key in OFF position.

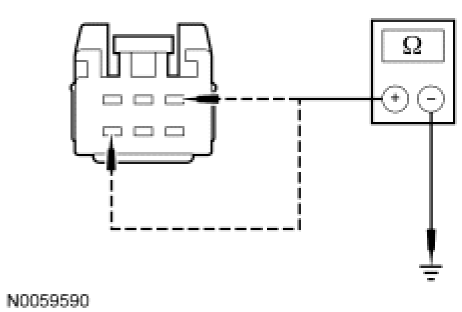


Fig. 31: Measuring Resistance Between Inoperative Window Control Switch & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the inoperative window control switch and ground:
  - for the RH rear window control switch, measure the resistance between RH rear window control switch C801-1, circuit CPW17 (BN/GN), harness side and ground; and between RH rear window control switch C801-6, circuit CPW18 (GY/VT), harness side and ground.
  - for the LH rear window control switch, measure the resistance between LH rear window control switch C701-1, circuit CPW15 (YE), harness side and ground; and between LH rear window control switch C701-6, circuit CPW16 (BU/OG), harness side and ground.
- **Are the resistances less than 5 ohms?**

  YES : Go to F7.

  NO : Go to F5.

F5 CHECK THE CIRCUITS TO THE INOPERATIVE REAR WINDOW CONTROL SWITCH FOR AN OPEN

- Key in OFF position.
- Disconnect: LH Front Window Control Switch C535B

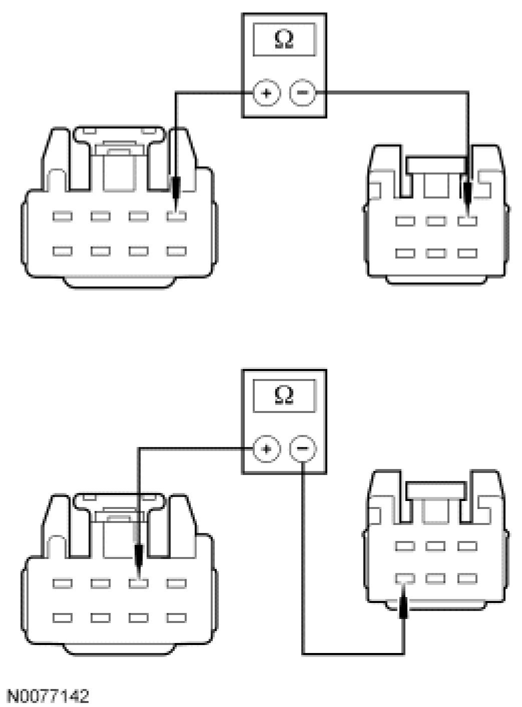


Fig. 32: Measuring Resistance Between LH Front Window Control Switch C535B-1, Circuit CPW15 (YE)
Courtesy of FORD MOTOR CO.

- For an inoperative LH rear power window, measure the resistance between LH front window control switch C535B-1, circuit CPW15 (YE) and LH rear window control switch C701-1, circuit CPW15 (YE), harness side; and between LH front window control switch C535B-2, circuit CPW16 (BU/OG) and LH rear window control switch C701-6, circuit CPW16 (BU/OG) harness side.

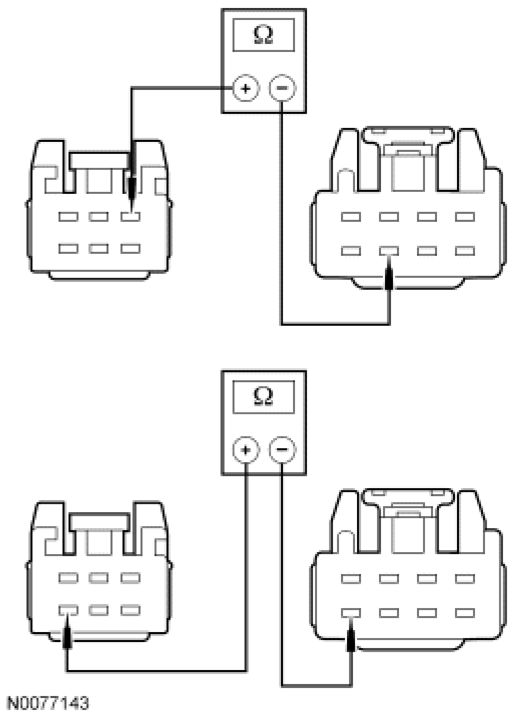


Fig. 33: Measuring Resistance Between LH Front Window Control Switch C535B-7, Circuit CPW17 (BN/GN)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear power window, measure the resistance between LH front window control switch C535B-7, circuit CPW17 (BN/GN) and RH window control switch C819-1, circuit CPW17 (BN/GN), harness side; and between LH front window control switch C535B-8, circuit CPW18 (GY/VT) and RH rear window control switch C819-6, circuit CPW18 (GY/VT) harness side.
- **Are the resistances less than 5 ohms?**

YES : Go to F6.

NO : REPAIR the circuit(s) for an open. TEST the system for normal operation.

F6 CHECK THE GROUND TO THE LH FRONT WINDOW CONTROL SWITCH

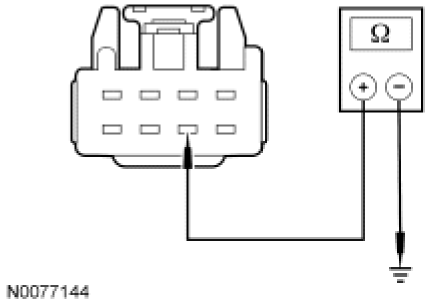


Fig. 34: Measuring Resistance Between LH Front Window Control Switch C535B-6, Circuit

GD133 (BK)
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window control switch C535B-6, circuit GD133 (BK), and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

F7 CHECK THE INOPERATIVE WINDOW CONTROL SWITCH

- Connect: LH Front Window Control Switch C535B
- Key in ON position.
- For an inoperative LH rear window, connect a fused jumper wire between LH rear window control switch C701-2, circuit CPW22 (GN/VT), harness side and LH rear window control switch C701-3, circuit CPW14 (VT/WH), harness side; and between LH rear window control switch C701-5, circuit CPW21 (BN), harness side and LH rear window control switch C701-6, circuit CPW16 (BU/OG), harness side. The LH rear window should operate in the downward direction.

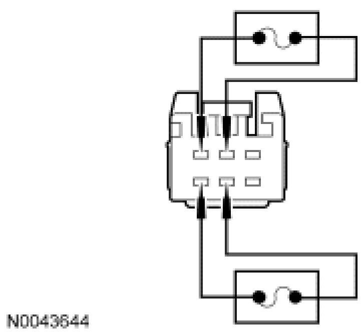


Fig. 35: Checking Inoperative Window Control Switch (1 Of 2)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear window, connect a fused jumper wire between RH rear window control switch C801-2, circuit CPW23 (GY), harness side and RH rear window control switch C801-3, circuit CPW14 (VT/WH), harness side; and between RH rear window control switch C801-5, circuit CPW24 (WH/VT), harness side and RH rear window control switch C801-6, circuit CPW18 (GY/VT), harness side. The RH rear window should operate in the downward direction.
- For an inoperative LH rear window, connect a fused jumper wire between LH rear window control switch C701-2, circuit CPW22 (GN/VT), harness side and LH rear window control switch C701-1, circuit CPW15 (YE), harness side; and between LH rear window control switch C701-5, circuit CPW21 (BN), harness side and LH rear window control switch C701-3, circuit CPW14 (VT/WH), harness side. The LH rear window should operate in the upward direction.

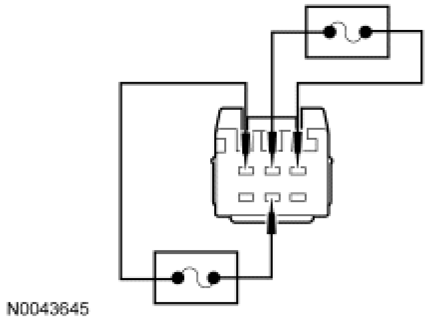


Fig. 36: Checking Inoperative Window Control Switch (2 Of 2)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear window, connect a fused jumper wire between RH rear window control switch C801-2, circuit CPW22 (GN/VT), harness side and RH rear window control switch C801-1, circuit CPW17 (BN/GN), harness side; and between RH rear window control switch C801-5, circuit CPW24 (WH/VT), harness side and RH rear window control switch C801-3, circuit CPW14 (VT/WH), harness side. The RH rear window should operate in the upward direction.
- **Did the inoperative window operate correctly?**

  YES : INSTALL a new LH or RH rear window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : Go to F8.

F8 CHECK THE POWER WINDOW MOTOR CIRCUITS

- Key in OFF position.
- Disconnect: Inoperative Rear Window Motor C703 (LH) or C828 (RH)
- For an inoperative LH rear window, measure the resistance between LH rear window control switch C701-2, circuit CPW22 (GN/VT), harness side and LH rear window motor C703-2, circuit CPW22 (GN/VT), harness side.

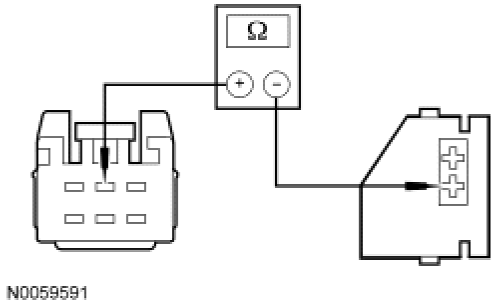


Fig. 37: Measuring Resistance Between RH Rear Window Control Switch C801-2, Circuit CPW23 (GY)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear window, measure the resistance between RH rear window control switch C801-2, circuit CPW23 (GY), harness side and RH rear window motor C828-2, circuit

CPW23 (GY), harness side.

- For an inoperative LH rear window, measure the resistance between LH rear window control switch C701-5, circuit CPW21 (BN), harness side and LH rear window motor C703-1, circuit CPW21 (BN), harness side.

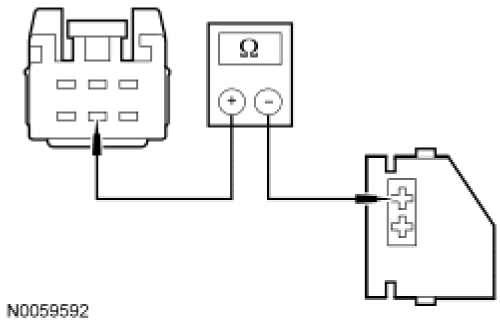


Fig. 38: Measuring Resistance Between RH Rear Window Control Switch C801-5, Circuit CPW24 (WH/VT)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear window, measure the resistance between RH rear window control switch C801-5, circuit CPW24 (WH/VT), harness side and RH rear window motor C703-1, circuit CPW24 (WH/VT), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new LH or RH rear window motor. REFER to **Window Regulator Motor**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test G: A Single Power Window is Inoperative- RH Front, LH or RH Rear, Edge

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Windows for schematic and connector information.

Normal Operation

The RH front window control switch receives delayed accessory power from the LH front window control switch through circuit CPW14 (VT/WH) when the window lock switch is set to the UNLOCK position, and the delayed accessory feature is active. When the RH front window is operated in the up direction from the RH front window control switch, power is sent to the RH front window motor through circuit CPW20 (WH/OG) and ground through circuit CPW19 (VT). When the RH front window is operated in the down direction from the RH front window control switch, power is sent to the RH front window motor through circuit CPW19 (VT) and ground through circuit CPW20 (WH/OG).

The LH rear window control switch receives delayed accessory power from the LH front window control switch through circuit CPW14 (VT/WH) when the window lock switch is set to the UNLOCK position, and the delayed accessory feature is active. When the LH rear window is operated in the up direction from the LH rear window control switch, power is sent to the LH rear window motor through circuit CPW21 (BN) and ground through circuit CPW22 (GN/VT). When the LH rear window is operated in the down direction from the LH rear window control switch, power is sent to the LH rear window motor through circuit CPW22 (GN/VT) and ground through circuit CPW21 (BN).

The RH rear window control switch receives delayed accessory power from the LH front window control switch through circuit CPW14 (VT/WH) when the window lock switch is set to the UNLOCK position, and the delayed accessory feature is active. When the RH rear window is operated in the up direction from the RH rear window control switch, power is sent to the RH rear window motor through circuit CPW24 (WH/VT) and ground through circuit CPW23 (GY). When the RH rear window is operated in the down direction from the RH rear window control switch, power is sent to the RH rear window motor through circuit CPW23 (GY) and ground through circuit CPW24 (WH/VT).

Window Operation From LH Front Switch

When the RH front power window is operated in the up direction from the LH front window control switch, power is sent to the RH front window control switch through circuit CPW13 (BN/YE), which transfers power to the RH front window motor through circuit CPW20 (WH/OG). Ground is provided to the RH front window switch through circuit CPW12 (GN/OG), which transfers ground to the RH front window motor through circuit CPW19 (VT).

During RH front power window down operation from the LH front window control switch, power is sent to the RH front window control switch through circuit CPW12 (GN/OG), which transfers power to the RH front window motor through circuit CPW19 (VT). Ground is provided to the RH front window switch through circuit CPW13 (BN/YE), which transfers ground to the RH front window motor through circuit CPW20 (WH/OG).

When the LH rear power window is operated in the up direction from the LH front window control switch, power is sent to the LH rear window control switch through circuit CPW16 (BU/OG), which transfers power to the LH rear window motor through circuit CPW21 (BN). Ground is provided to the LH rear window switch through circuit CPW15 (YE), which transfers ground to the LH rear window motor through circuit CPW22 (GN/VT).

During LH rear power window down operation from the LH front window control switch, power is sent to the LH rear window control switch through circuit CPW15 (YE), which transfers power to the LH rear window motor through circuit CPW22 (GN/VT). Ground is provided to the LH rear window switch through circuit CPW16 (BU/OG), which transfers ground to the LH rear window motor through circuit CPW21 (BN).

When the RH rear power window is operated in the up direction from the LH front window control switch, power is sent to the RH rear window control switch through circuit CPW18 (GY/VT), which transfers power to the RH rear window motor through circuit CPW24 (WH/VT). Ground is sent to the RH rear window switch through circuit CPW17 (BN/GN), which transfers ground to the RH rear window motor through circuit CPW23 (GY).

During RH rear power window down operation from the LH front window control switch, power is sent to the RH rear window control switch through circuit CPW17 (BN/GN), which transfers power to the RH rear window motor through circuit CPW23 (GY). Ground is sent to the RH rear window switch through circuit CPW18 (GY/VT), which transfers ground to the RH rear window motor through circuit CPW24 (WH/VT).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- LH front window switch
- RH front window switch
- Rear window motor
- Front window motor
- Rear window switch

PINPOINT TEST G: A SINGLE POWER WINDOW IS INOPERATIVE - RH FRONT, LH OR RH REAR, EDGE

G1 CHECK THE VOLTAGE TO THE RH FRONT, LH REAR OR RH REAR WINDOW CONTROL SWITCH

- Disconnect: Inoperative Rear Window Control Switch C624 (RH front), C701 (LH rear) or C801 (RH rear)
- Key in ON position.

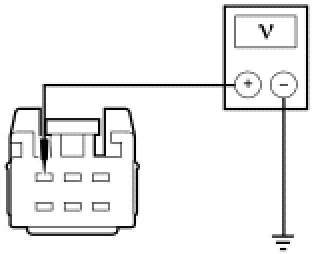


Fig. 39: Measuring Voltage
Courtesy of FORD MOTOR CO.

NOTE: Set the LH front window lock switch to the UNLOCK position.

- Measure the voltage between the inoperative rear window connector and ground:
  - for the RH front window control switch, measure the voltage between RH front window control switch C624-3, circuit CPW14 (VT/WH), harness side and ground.
  - for the RH rear window control switch, measure the voltage between RH rear window control switch C801-3, circuit CPW14 (VT/WH), harness side and ground.
  - for the LH rear window control switch, measure the voltage between C701-3, circuit CPW14 (VT/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to G3.

NO : Go to G2.

G2 CHECK FOR AN OPEN IN CIRCUIT CPW14 (VT/WH)

- Disconnect: LH Front Window Control Switch C504B
- Key in OFF position.

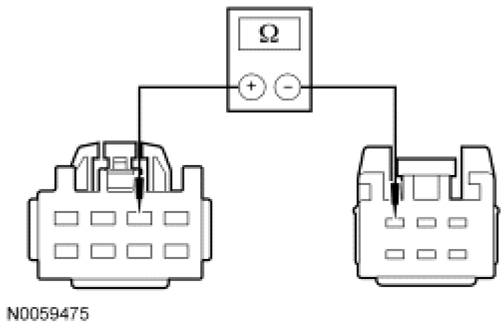


Fig. 40: Measuring Resistance Between Inoperative Rear Window Connector & LH Front Window Control Switch Connector
Courtesy of FORD MOTOR CO.

- Measure the resistance between the inoperative rear window connector and the LH front window control switch connector:
  - for the RH front window control switch, measure the resistance between RH front window control switch C624-3, circuit CPW14 (VT/WH), harness side and LH front window control switch C504B-2, circuit CPW14 (VT/WH), harness side.
  - for the RH rear window control switch, measure the resistance between RH rear window control switch C819-3, circuit CPW14 (VT/WH), harness side and LH front window control switch C504B-2, circuit CPW14 (VT/WH), harness side.
  - for the LH rear window control switch, measure the resistance between LH rear window control switch C701-3, circuit CPW14 (VT/WH), harness side and LH front window control switch C504B-2, circuit CPW14 (VT/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

G3 CHECK THE GROUNDS TO THE INOPERATIVE REAR WINDOW CONTROL SWITCH

- Key in OFF position.

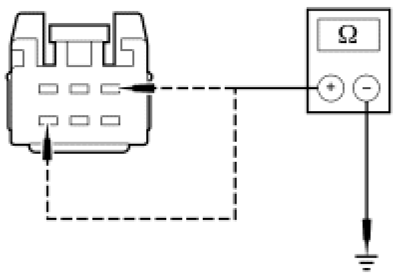


Fig. 41: Measuring Resistance Between Inoperative Window Control Switch & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the inoperative window control switch and ground:
  - for the RH front window control switch, measure the resistance between RH front window control switch C624-1, circuit CPW12 (GN/OG), harness side and ground; and between RH front window control switch C624-6, circuit CPW13 (BN/YE), harness side and ground.
  - for the RH rear window control switch, measure the resistance between RH rear window control switch C801-1, circuit CPW17 (BN/GN), harness side and ground; and between RH rear window control switch C801-6, circuit CPW18 (GY/VT), harness side and ground.
  - for the LH rear window control switch, measure the resistance between LH rear window control switch C701-1, circuit CPW15 (YE), harness side and ground; and between LH rear window control switch C701-6, circuit CPW16 (BU/OG), harness side and ground.
- **Are the resistances less than 5 ohms?**

  YES : Go to G5.

  NO : Go to G4.

G4 CHECK THE CIRCUITS TO THE INOPERATIVE REAR WINDOW CONTROL SWITCH FOR AN OPEN

- Key in OFF position.
- Disconnect: LH Front Window Control Switch C504A and C504B

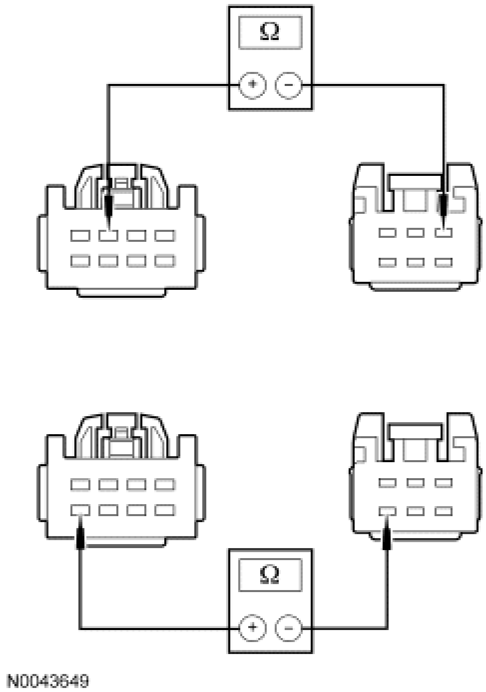


Fig. 42: Measuring Resistance
Courtesy of FORD MOTOR CO.

- For an inoperative RH front power window, measure the resistance between LH front window control switch C504A-3, circuit CPW12 (GN/OG) and RH front window control switch C624-1, circuit CPW12 (GN/OG), harness side; and between LH front window control switch C504A-8, circuit CPW13 (BN/YE) and RH front window control switch C624-6, circuit CPW13 (BN/YE) harness side.

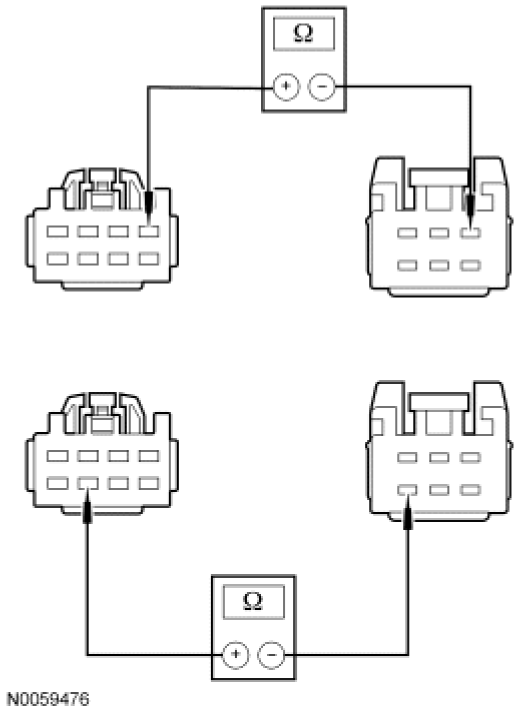


Fig. 43: Measuring Resistance Between LH Front Window Control Switch C504B-1, Circuit CPW15 (YE)
Courtesy of FORD MOTOR CO.

- For an inoperative LH rear power window, measure the resistance between LH front window control switch C504B-1, circuit CPW15 (YE) and LH rear window control switch C701-1, circuit CPW15 (YE), harness side; and between LH front window control switch C504B-2, circuit CPW16 (BU/OG) and LH rear window control switch C701-6, circuit CPW16 (BU/OG) harness side.

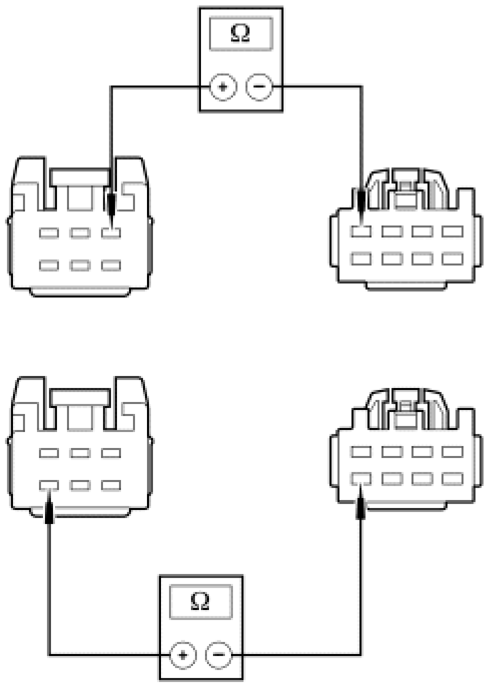


Fig. 44: Measuring Resistance Between LH Front Window Control Switch C504B-4, Circuit CPW17 (BN/GN)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear power window, measure the resistance between LH front window control switch C504B-4, circuit CPW17 (BN/GN) and RH window control switch C801-1, circuit CPW17 (BN/GN), harness side; and between LH front window control switch C504B-8, circuit CPW18 (GY/VT) and RH rear window control switch C801-6, circuit CPW18 (GY/VT) harness side.
- **Are the resistances less than 5 ohms?**

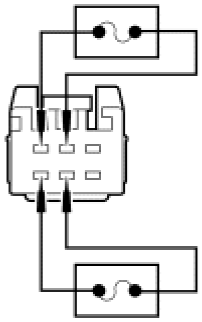
  YES : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit(s) for an open. TEST the system for normal operation.

G5 CHECK THE INOPERATIVE WINDOW CONTROL SWITCH

- Key in ON position.
- For an inoperative RH front window, connect a fused jumper wire between RH front window control switch C624-2, circuit CPW19 (VT), harness side and RH front window control switch C624-3, circuit CPW14 (VT/WH), harness side; and between RH front window control switch C624-5, circuit CPW20 (WH/OG), harness side and RH front window control switch C624-6, circuit CPW13 (BN/YE), harness side. The RH front window should operate in the downward direction.
- For an inoperative LH rear window, connect a fused jumper wire between LH rear window control switch C701-2, circuit CPW22 (GN/VT), harness side and LH rear window control switch C701-3, circuit CPW14 (VT/WH), harness side; and between LH rear window control switch C701-5, circuit CPW21 (BN), harness side and LH rear window control switch C701-6, circuit CPW16

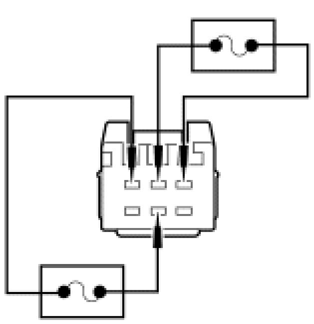
(BU/OG), harness side. The LH rear window should operate in the downward direction.



N0043644

Fig. 45: Checking Inoperative Window Control Switch (1 Of 2)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear window, connect a fused jumper wire between RH rear window control switch C801-2, circuit CPW23 (GY), harness side and RH rear window control switch C801-3, circuit CPW14 (VT/WH), harness side; and between RH rear window control switch C801-5, circuit CPW24 (WH/VT), harness side and RH rear window control switch C801-6, circuit CPW18 (GY/VT), harness side. The RH rear window should operate in the downward direction.
- For an inoperative RH front window, connect a fused jumper wire between RH front window control switch C624-2, circuit CPW19 (VT), harness side and RH front window control switch C624-1, circuit CPW12 (GN/OG), harness side; and between RH front window control switch C624-5, circuit CPW20 (WH/OG), harness side and RH front window control switch C624-3, circuit CPW14 (VT/WH), harness side. The RH front window should operate in the upward direction.
- For an inoperative LH rear window, connect a fused jumper wire between LH rear window control switch C701-2, circuit CPW22 (GN/VT), harness side and LH rear window control switch C701-1, circuit CPW15 (YE), harness side; and between LH rear window control switch C701-5, circuit CPW21 (BN), harness side and LH rear window control switch C701-3, circuit CPW14 (VT/WH), harness side. The LH rear window should operate in the upward direction.



N0043645

Fig. 46: Checking Inoperative Window Control Switch (2 Of 2)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear window, connect a fused jumper wire between RH rear window control switch C801-2, circuit CPW22 (GN/VT), harness side and RH rear window control switch C801-1, circuit CPW17 (BN/GN), harness side; and between RH rear window control switch C801-5, circuit CPW24 (WH/VT), harness side and RH rear window control switch C801-3, circuit CPW14 (VT/WH), harness side. The RH rear window should operate in the upward direction.

- **Did the inoperative window operate correctly?**

  YES : INSTALL a new LH or RH rear window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : Go to G6.

G6 CHECK THE POWER WINDOW MOTOR CIRCUITS

- Key in OFF position.
- Disconnect: Inoperative Window Motor C608 (RH front), C703 (LH rear) or C828 (RH rear)
- For an inoperative RH front window, measure the resistance between RH front window control switch C624-2, circuit CPW19 (VT), harness side and RH front window motor C608-2, circuit CPW19 (VT), harness side.

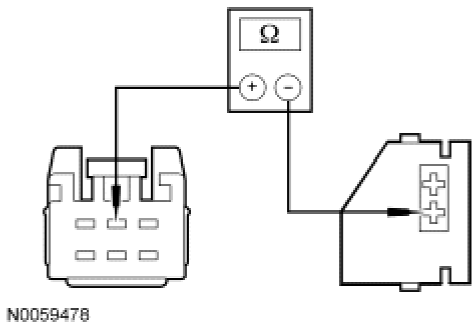


Fig. 47: Measuring Resistance Between LH Rear Window Control Switch C701-2, Circuit CPW22 (GN/VT)
Courtesy of FORD MOTOR CO.

- For an inoperative LH rear window, measure the resistance between LH rear window control switch C701-2, circuit CPW22 (GN/VT), harness side and LH rear window motor C703-2, circuit CPW22 (GN/VT), harness side.

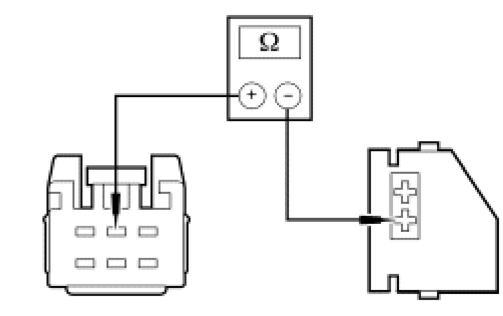


Fig. 48: Measuring Resistance Between RH Rear Window Control Switch C801-2, Circuit CPW23 (GY)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear window, measure the resistance between RH rear window control switch C801-2, circuit CPW23 (GY), harness side and RH rear window motor C828-2, circuit CPW23 (GY), harness side.
- For an inoperative RH front window, measure the resistance between RH front window control switch C624-5, circuit CPW20 (WH/OG), harness side and RH front window motor C608-1, circuit CPW20 (WH/OG), harness side.

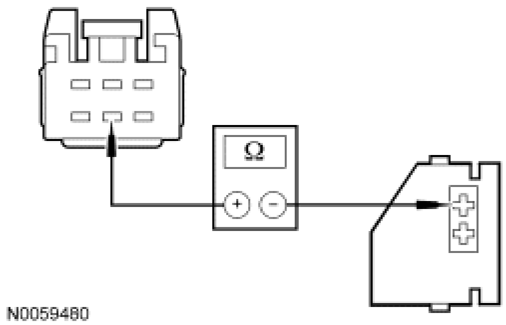


Fig. 49: Measuring Resistance Between LH Rear Window Control Switch C701-5, Circuit CPW21 (BN)
Courtesy of FORD MOTOR CO.

- For an inoperative LH rear window, measure the resistance between LH rear window control switch C701-5, circuit CPW21 (BN), harness side and LH rear window motor C703-1, circuit CPW21 (BN), harness side.

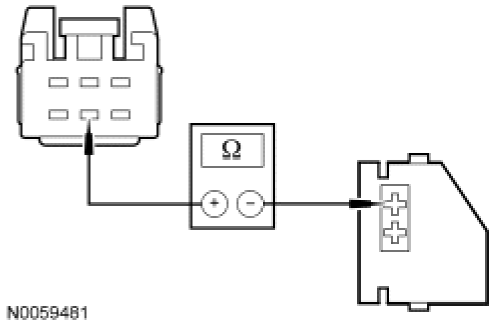


Fig. 50: Measuring Resistance Between RH Rear Window Control Switch C801-5, Circuit CPW24 (WH/VT)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear window, measure the resistance between RH rear window control switch C801-5, circuit CPW24 (WH/VT), harness side and RH rear window motor C828-1, circuit CPW24 (WH/VT), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new RH front, LH or RH rear window motor. REFER to **Window Regulator Motor**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test H: The One-Touch Up/Down Feature is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Windows for schematic and connector information.

NOTE: **A new LH or RH (MKX) or LH (Edge) front power window motor will not operate in one-touch up or one-touch down mode until initialized. Refer to Window Motor Initialization.**

NOTE: **The LH or RH front power window motor must be initialized whenever a new motor is installed.**

NOTE: **The front window motor must be de-initialized, then initialized whenever the LH or RH (MKX) or LH (Edge) front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.**

Normal Operation

The LH front power window control switch receives power from the delayed accessory relay through circuit CBP41 (BU) and is grounded through circuit GD133 (BK). When the LH front window control switch is pressed to the UP position, the LH front motor receives power through circuit CPW11 (BU/GY). When the LH front window control switch is pressed to the DOWN position, the LH front motor receives power through circuit CPW10 (YE/VT). When the LF window motor receives a ground signal on circuit CPW29 (VT/GY), the LF window motor will enter one-touch up or one-touch down.

The RH (MKX only) front power window control switch receives power from the delayed accessory relay through circuit CBP41 (BU) and is grounded through circuit GD133 (BK). When the RH front window control switch is pressed to the UP position, the RH front motor receives power through circuit CPW13 (BN/YE). When the RH front window control switch is pressed to the DOWN position, the RH front motor receives power through circuit CPW12 (GN/OG). When the RH window motor receives a ground signal on circuit CPW31 (GN/WH), the RH window motor will enter one-touch up or one-touch down.

This pinpoint test is intended to diagnose the following:

- B(+) power lost during LH or RH front window operation
- LH or RH front window motor
- LH or RH front window control switch
- LH or RH front motor not initialized
- Wiring, terminals or connectors

PINPOINT TEST H: THE ONE-TOUCH UP/DOWN FEATURE IS INOPERATIVE

H1 CHECK FOR POWER (B+) LOSS DURING LH OR RH FRONT WINDOW OPERATION

- Verify if power (B+) was lost during LH or RH front window operation.
- **Was power (B+) lost while LH or RH front window was in operation?**

  YES : RAISE the LH or RH front window to the fully CLOSED position. VERIFY the window glass stalls into the upper header seal. The front window should function normally. TEST the system for normal operation.

  NO : Go to H2.

H2 DE-INITIALIZE, THEN INITIALIZE THE FRONT MOTOR

- De-initialize the front window motor, then carry out the front window motor initialization procedure. Refer to **Window Motor Initialization**.
- **Is the one-touch down feature operating correctly?**

  YES : The system is operating normally at this time. The front window motor lost initialization.

  NO : For LH window, go to H3.

  For RH window (MKX only), go to H5.

H3 CHECK THE LH FRONT WINDOW CONTROL SWITCH

- Key in OFF position.
- Disconnect: LH Front Window Control Switch C535A and C535B (MKX) or C504A and C504B (Edge)
- Carry out the LH Front Window Switch Component Test. Refer to appropriate COMPONENT TESTING article.
- **Did the LH front window switch pass the component test?**

  YES : Go to H4.

  NO : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

H4 CHECK CIRCUIT CPW29 (VT/GY) FOR AN OPEN

- Disconnect: LH Front Window Motor C540

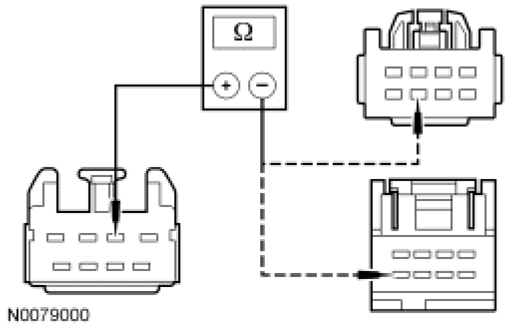


Fig. 51: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window control switch C535A-8 (MKX) or C504A-7 (Edge), circuit CPW29 (VT/GY), harness side and LH front window motor connector C540-2, circuit CPW29 (VT/GY).

- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new LH front window motor. REFER to **Window Regulator Motor**. TEST the system for normal operation.

  NO : REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

H5 CHECK THE LH and RH FRONT WINDOW CONTROL SWITCH

- Key in OFF position.
- Disconnect: LH Front Window Control Switch C535A, C535B and RH Front Window Control Switch C648
- Carry out the LH and RH front window switch component tests. Refer to appropriate COMPONENT TESTING article.
- **Did the LH and RH front window switches pass the component tests?**

  YES : Go to H6.

  NO : INSTALL a new front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

H6 CHECK CIRCUIT CPW31 (GN/WH) FOR AN OPEN

- Disconnect: RH Front Window Motor C646

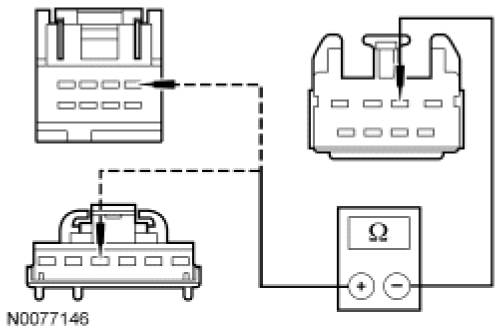


Fig. 52: Measuring Resistance Between LH Front Window Control Switch C535A-1, Circuit CPW31 (GN/WH)
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window control switch C535A-1, circuit CPW31 (GN/WH), harness side and RH front window motor connector C646-2, circuit CPW31 (GN/WH); and between RH front window control switch C648-4, circuit CPW31 (GN/WH), harness side and RH front window motor connector C646-2, circuit CPW31 (GN/WH).
- **Are the resistances less than 5 ohms for both measurements?**

  YES : INSTALL a new RH front window motor. REFER to **Window Regulator Motor**. TEST the system for normal operation.

  NO : REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the RH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

Pinpoint Test I: The Global Open Function is Inoperative/Does Not Operate Correctly - MKX

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Windows for schematic and connector information.

Normal Operation

When the unlock button of the remote keyless entry (RKE) transmitter is held for 2 seconds the global open activates. The smart junction box (SJB) sends a signal on circuit VPW01 (GN/BU) to activate the one-touch down operation of both front windows.

The global open feature does not operate if the delayed accessory is active.

- DTC B2947 Global Opening/Closing Circuit Open - Open or short to ground in the global opening circuit.
- DTC B2949 Global Opening/Closing Circuit Short to Battery - Short to battery in the global opening circuit.

This pinpoint test is intended to diagnose the following:

- Fuse
- RKE transmitters
- Wiring, terminals or connectors
- SJB
- Window motors not initialized

PINPOINT TEST I: THE GLOBAL OPEN FUNCTION IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - MKX

NOTE: **One-touch up/down must be operational for the global open function to operate correctly. Make sure one-touch up/down is operational before proceeding with this diagnostic.**

I1 CHECK THE DTCs

- Refer to the results from the previous SJB self-test.
- **Was DTC B2947 or B2949 retrieved?**

  YES : For B2949, go to I2.

  For B2947, go to I5.

  NO : VERIFY SJB fuse 41 (15A) is OK. If OK, go to I7.

I2 CHECK CIRCUIT VPW01 (GN/BU) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280C
- Key in ON position.

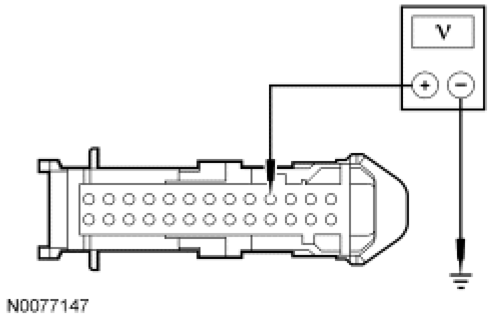


Fig. 53: Measuring Voltage Between SJB C2280C-10, Circuit VPW01 (GN/BU), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280C-10, circuit VPW01 (GN/BU), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to I3.

  NO : Go to I9.

I3 CHECK CIRCUIT VPW01 (GN/BU) FOR A SHORT TO VOLTAGE

- Disconnect: LH Front Window Motor C540

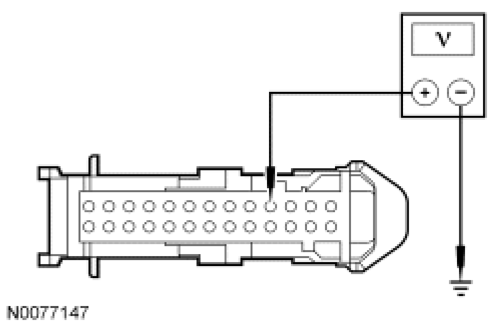


Fig. 54: Measuring Voltage Between SJB C2280C-10, Circuit VPW01 (GN/BU), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280C-10, circuit VPW01 (GN/BU), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to I4.

  NO : INSTALL a new LH front window motor. REFER to **Glass, Frames and Mechanisms - Exploded View, Front Door** and **Window Regulator and Motor - Front Door**. INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

I4 CHECK CIRCUIT VPW01 (GN/BU) FOR A SHORT TO VOLTAGE

- Disconnect: RH Front Window Motor C646

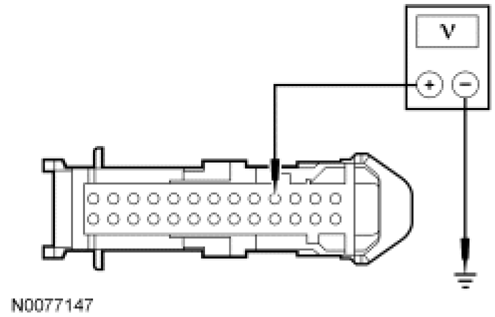


Fig. 55: Measuring Voltage Between SJB C2280C-10, Circuit VPW01 (GN/BU), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280C-10, circuit VPW01 (GN/BU), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH and RH front window motors. REFER to **Window Motor Initialization**. TEST the system for normal operation.

  NO : INSTALL a new RH front window motor. REFER to **Glass, Frames and Mechanisms - Exploded View, Front Door** and **Window Regulator and Motor - Front Door**. INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

I5 CHECK CIRCUIT VPW01 (GN/BU) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280C
- Disconnect: LH Front Window Motor C540
- Disconnect: RH Front Window Motor C646

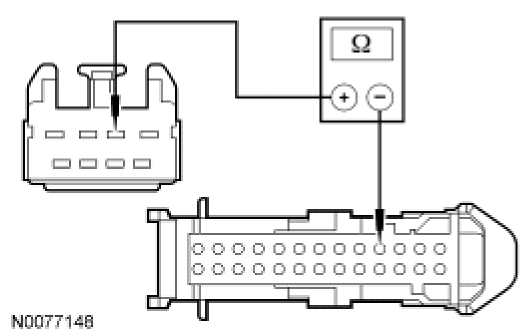


Fig. 56: Measuring Voltage Between SJB C2280C-10, Circuit VPW01 (GN/BU) & LH Front Window Motor C540-2
Courtesy of FORD MOTOR CO.

- Measure the resistance between SJB C2280C-10, circuit VPW01 (GN/BU), harness side and LH front window motor C540-2, circuit CPW01 VPW01 (GN/BU), harness side; and between SJB C2280C-10, circuit VPW01 (GN/BU), harness side and RH front window motor C646-2, circuit

VPW01 (GN/BU), harness side.

- **Are the resistances less than 5 ohms?**

  YES : Go to I6.

  NO : REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH and RH front window motors. REFER To **Window Motor Initialization**. TEST the system for normal operation.

I6 CHECK CIRCUIT VPW01 (GN/BU) FOR A SHORT TO GROUND

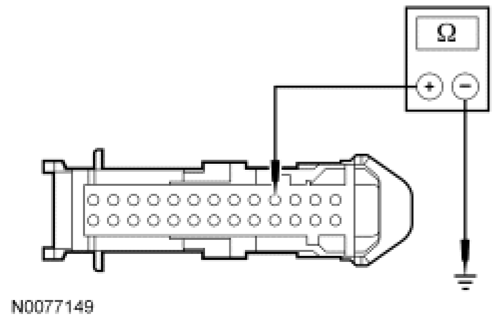


Fig. 57: Measuring Voltage Between SJB C2280C-10, Circuit VPW01 (GN/BU), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between SJB C2280C-10, circuit VPW01 (GN/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to I9.

  NO : REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH and RH front window motors. REFER to **Window Motor Initialization**. TEST the system for normal operation.

I7 CHECK THE RKE TRANSMITTER OPERATION

- Operate the RKE lock/unlock function using all of the RKE transmitters.
- **Does the RKE lock/unlock function operate correctly with at least one of the RKE transmitters?**

  YES : Go to I8.

  NO : REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article to continue diagnosis of the RKE system. TEST the system for normal operation.

I8 CHECK THE RKE TRANSMITTERS GLOBAL OPEN OPERATION

- Operate the global open function using all of the RKE transmitters.
- **Does the global open function operate correctly with at least one of the RKE transmitters?**

  YES : PROVIDE new RKE transmitters. REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article. TEST the system for normal operation.

  NO : Go to I9.

I9 CHECK THE SJB FOR CORRECT OPERATION

- Disconnect all of the SJB connectors.

- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all of the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test J: The Defrost System is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Heated Window for schematic and connector information.

Normal Operation

The heated rear window relay, which is integral to the battery junction box (BJB), receives power from circuit CBP45 (YE). When the heated rear window switch is pressed, the HVAC module grounds circuit CH122 (WH/OG) to activate the heated rear window relay. When the heated rear window relay is activated, power is sent from the heated rear window relay to the heated rear window grid through circuit CRD06 (BN/YE). The heated rear window grid is grounded through circuit GD149 (BK/GY).

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- Heated rear window relay
- HVAC module

PINPOINT TEST J: THE DEFROST SYSTEM IS INOPERATIVE

J1 CHECK CIRCUIT CRD06 (BN/YE) FOR POWER

- Disconnect: Heated Rear Window Grid C402A
- Key in ON position.
- Turn the heated rear window control switch on.

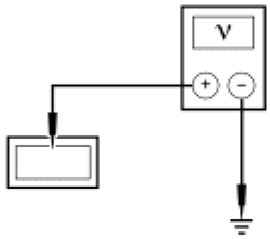


Fig. 58: Measuring Voltage Between Heated Rear Window Grid C402A-1, Circuit CRD06 (BN/YE)
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated rear window grid C402A-1, circuit CRD06 (BN/YE), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to J4.

  NO : INSPECT BJB fuse 39 (40A). If OK, go to J2.

J2 CHECK CIRCUIT CRD06 (BN/YE) FOR AN OPEN

- Key in OFF position.
- Disconnect: Heated Rear Window Relay

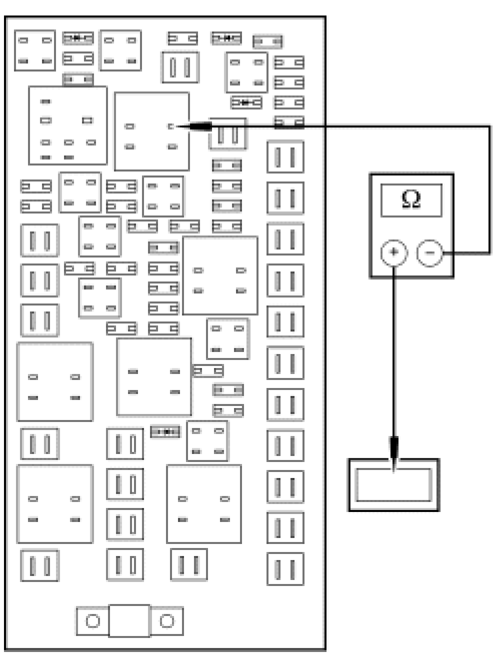


Fig. 59: Measuring Resistance Between Heated Rear Window Grid C402A-1, CRD06 (BN/YE)

Courtesy of FORD MOTOR CO.

- Measure the resistance between heated rear window grid C402A-1, CRD06 (BN/YE), harness side and heated rear window relay pin 87, CRD06 (BN/YE), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to J3.

NO : REPAIR the circuit. TEST the system for normal operation.

J3 CHECK THE BJB

- Key in ON position.

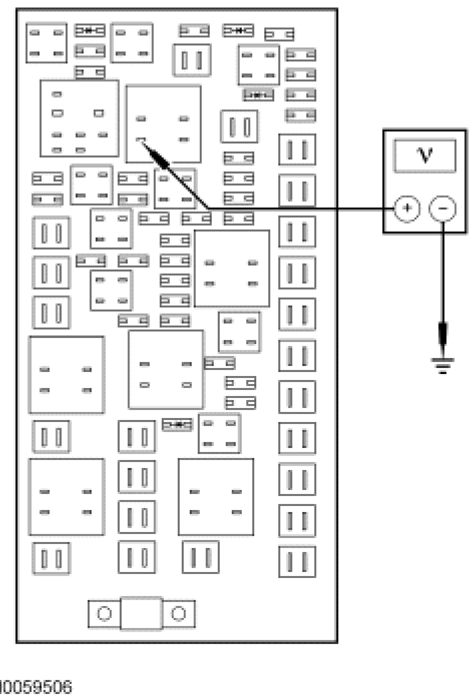


Fig. 60: Measuring Voltage Between Heated Rear Window Relay Pin 30, Circuit SDC02 (RD)
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated rear window relay pin 30, circuit SDC02 (RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to J5.

NO : VERIFY BJB fuse 1 (40A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

J4 CHECK CIRCUIT GD149 (BK/GY) FOR AN OPEN

- Key in OFF position.
- Disconnect: Heated Rear Window Grid C402B

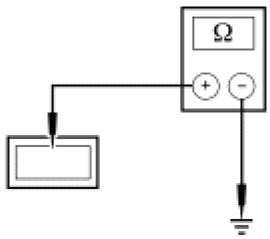


Fig. 61: Measuring Resistance Between C402B-1, Circuit GD149 (BK/GY), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between C402B-1, circuit GD149 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : CARRY OUT the heated rear window grid wire test. REFER to the component tests. REPAIR as necessary. TEST the system for normal operation.

NO : Go to J6.

J5 CHECK CIRCUIT CBP45 (YE) FOR AN OPEN

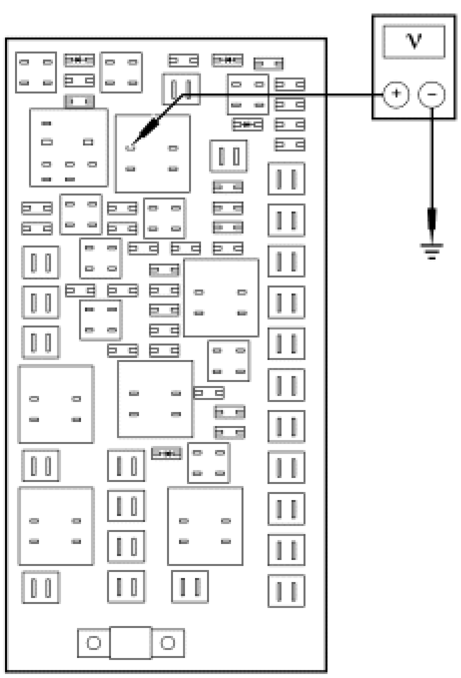


Fig. 62: Measuring Voltage Between Heated Rear Window Relay Pin 85, Circuit CBP45 (YE) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated rear window relay pin 85, circuit CBP45 (YE), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to J6.

  NO : REPAIR the circuit. TEST the system for normal operation.

J6 CHECK THE HVAC MODULE OUTPUT

- Key in ON position.
- Turn the heated rear window control switch on.

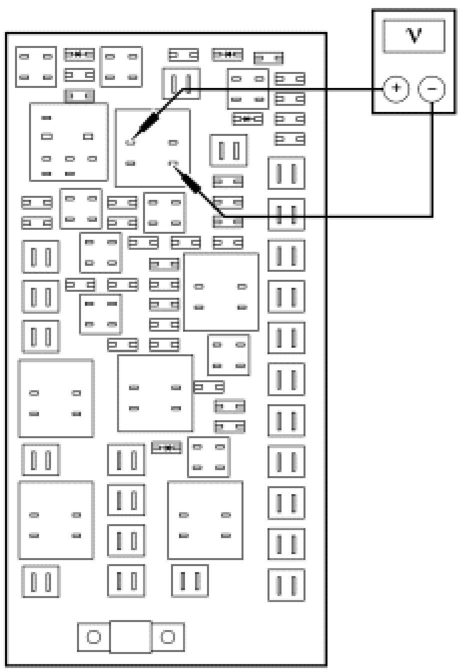


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Fig. 63: Measuring Voltage Between Heated Rear Window Relay Pin 85, Circuit CBP45 (YE)
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated rear window relay pin 85, circuit CBP45 (YE), harness side and heated rear window relay pin 86, circuit CH122 (WH/OG).
- **Is the voltage greater than 10 volts?**

  YES : Go to J7.

  NO : Go to J8.

J7 CHECK THE HEATED REAR WINDOW RELAY

- Carry out the Heated Rear Window Relay Component Test. Refer to appropriate COMPONENT TESTING article.
- **Did the heated rear window relay pass the component test?**

  YES : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

NO : INSTALL a new heated rear window relay. TEST the system for normal operation.

J8 CHECK CIRCUIT CH122 (WH/OG) FOR AN OPEN

- Key in OFF position.
- Disconnect: HVAC Module - Electronic Automatic Temperature Control (EATC) C228B or HVAC module - Electronic Manual Temperature Control (EMTC) C2357A

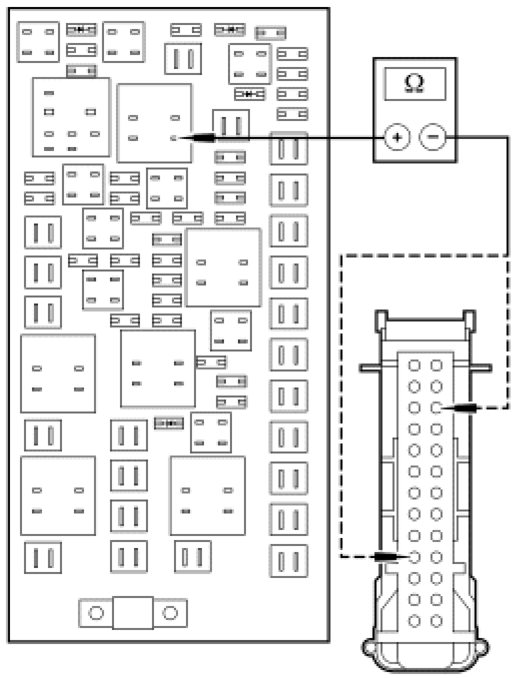


Fig. 64: Measuring Resistance Between Heated Rear Window Relay Socket, Circuit CH122 (WH/OG)
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated rear window relay socket, circuit CH122 (WH/OG), harness side and HVAC module - EATC C228B-23, circuit CH122 (WH/OG), harness side; or HVAC module - EMTC C2357A-3, circuit CH122 (WH/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test K: The Defrost System Will Not Shut Off Automatically

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Heated Window for schematic and connector information.

Normal Operation

The heated rear window relay, which is integral to the battery junction box (BJB), receives power from circuit CBP45 (YE). When the heated rear window switch is pressed, the HVAC module grounds circuit CH122 (WH/OG) to activate the heated rear window relay. When the heated rear window relay is activated, power is sent from the heated rear window relay to the heated rear window grid through circuit CRD06 (BN/YE). The heated rear window grid is grounded through circuit GD149 (BK/GY).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Heated rear window relay
- HVAC module

PINPOINT TEST K: THE DEFROST SYSTEM WILL NOT SHUT OFF AUTOMATICALLY

K1 CHECK CIRCUIT CRD06 (BN/YE) FOR SHORT TO VOLTAGE

- Disconnect: Heated Rear Window Relay
- Key in ON position.

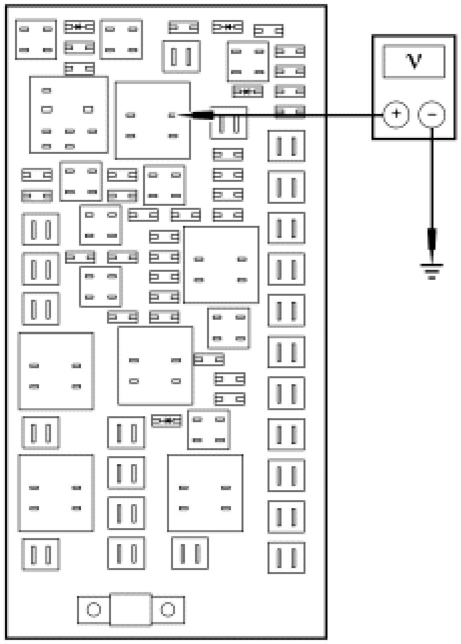


Fig. 65: Measuring Voltage Between Heated Rear Window Relay Pin 87, Circuit CRD06 (BN/YE) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated rear window relay pin 87, circuit CRD06 (BN/YE), harness side and ground.
- **Is any voltage present?**

YES : REPAIR the circuit. TEST the system for normal operation.

NO : Go to K2.

K2 CHECK CIRCUIT CH122 (WH/OG) FOR A SHORT TO GROUND

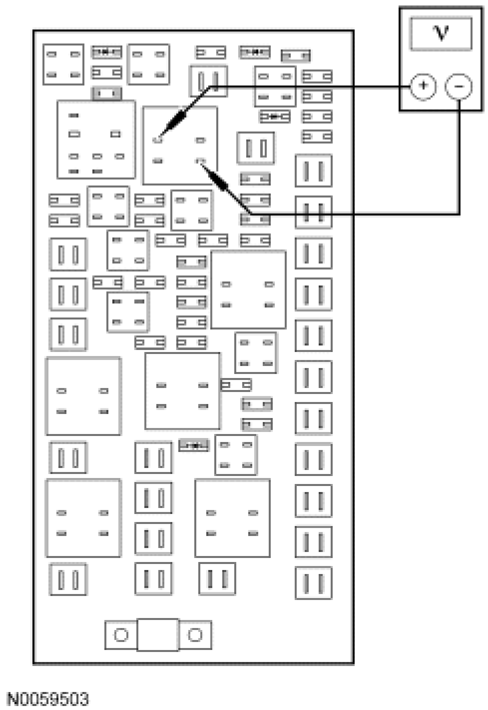


Fig. 66: Measuring Voltage Between Heated Rear Window Relay Pin 85, Circuit CBP45 (YE)
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated rear window relay pin 85, circuit CBP45 (YE), harness side and heated rear window relay pin 86, circuit CH122 (WH/OG), harness side.
- **Is any voltage present?**

YES : Go to K3.

NO : Go to K4.

K3 CHECK THE HVAC MODULE

- Key in OFF position.
- Disconnect: EATC C228B or EMTC C2357A
- Key in ON position.

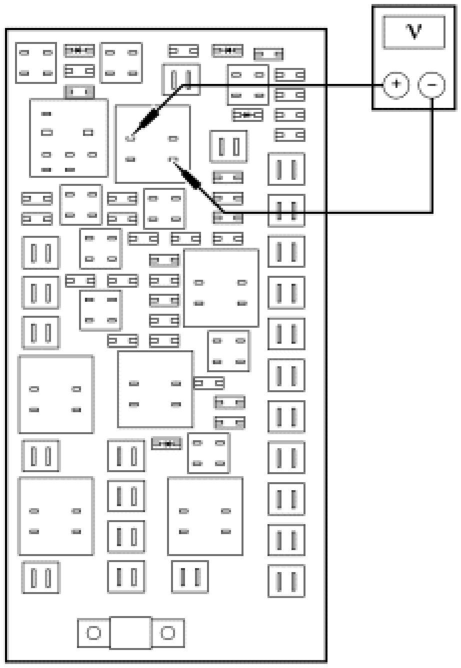


Fig. 67: Measuring Voltage Between Heated Rear Window Relay Pin 85, Circuit CBP45 (YE)
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated rear window relay pin 85, circuit CBP45 (YE), harness side and heated rear window relay pin 86, circuit CH122 (WH/OG), harness side.
- **Is any voltage present?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

K4 CHECK THE HEATED REAR WINDOW RELAY

- Carry out the Heated Rear Window Relay Component Test. Refer to appropriate COMPONENT TESTING article.
- **Did the heated rear window relay pass the component test?**

  YES : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

  NO : INSTALL a new heated rear window relay. TEST the system for normal operation.

Pinpoint Test L: The Delayed Accessory is Inoperative/Does Not Operate Correctly

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Windows for schematic and connector information.

Normal Operation

The accessory delay relay, which is integral to the smart junction box (SJB), receives power from the battery junction box (BJB) through circuit SDC02 (RD). When the ignition key is turned ON, the SJB activates the accessory delay relay. The accessory delay relay provides power to the LH front window control switch through circuit CBP47 (GN/BU). On MKX, the accessory delay relay also provides power to the RH front window switch and the LH and RH front window motors through circuit CBP41 (BU). The accessory delay relay remains active for 10 minutes after the ignition key is turned OFF or until either front door is opened.

- DTC B1302 Accessory Delay Relay Coil Circuit Failure - Open or short to ground in the accessory delay relay coil circuit.
- DTC B1304 Accessory Delay Relay Coil Circuit Short To Battery - Short to ground on accessory delay relay coil circuit.

This pinpoint test is intended to diagnose the following:

- SJB
- Accessory delay relay
- Door ajar switches

PINPOINT TEST L: THE DELAYED ACCESSORY IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

L1 CHECK FOR CORRECT OPERATION OF THE INTERIOR LIGHTS

- Open and close the front doors. Verify the interior lights turn on when the doors are open, and off when the doors are closed.
- **Do the interior lights operate normally?**

  YES : Go to L2.

  NO : REFER to **INTERIOR LIGHTING** article to diagnose the interior lighting and door ajar switches.

L2 CHECK THE ACCESSORY DELAY RELAY

- Carry out the Accessory Delay Relay Component Test. Refer to appropriate COMPONENT TESTING article.
- **Did the accessory delay relay pass the component test?**

  YES : Go to L3.

  NO : INSTALL a new accessory delay relay. TEST the system for normal operation.

L3 CHECK FOR CORRECT SJB OPERATION

- Disconnect all SJB connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article for the removal and installation procedure. TEST the system for normal operation.

NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test M: The Delayed Accessory Does Not Turn Off

Refer to appropriate SYSTEM WIRING DIAGRAMS article, Power Windows for schematic and connector information.

Normal Operation

The accessory delay relay, which is integral to the smart junction box (SJB), receives power from the battery junction box (BJB) through circuit SDC02 (RD). When the ignition key is turned ON, the SJB activates the accessory delay relay. The accessory delay relay provides power to the LH front window control switch through circuit CBP47 (GN/BU). On MKX, the accessory delay relay also provides power to the RH front window switch and the LH and RH front window motors through circuit CBP41 (BU). The accessory delay relay remains active for 10 minutes after the ignition key is turned OFF or until either front door is opened.

- DTC B1304 - Accessory delay relay coil circuit short to battery, short to ground on output.

This pinpoint test is intended to diagnose the following:

- Accessory delay relay
- SJB

PINPOINT TEST M: THE DELAYED ACCESSORY DOES NOT TURN OFF

M1 CHECK FOR STUCK/STICKING ACCESSORY DELAY RELAY

- Disconnect: Accessory Delay Relay
- **Are any delayed accessory features still operative?**

  YES : Go to M3.

  NO : Go to M2.

M2 CHECK THE ACCESSORY DELAY RELAY

- Carry out the Accessory Delay Relay Component Test. Refer to appropriate COMPONENT TESTING article.
- **Did the accessory delay relay pass the component test.**

  YES : Go to M4.

  NO : INSTALL a new accessory delay relay. CLEAR all DTCs. TEST the system for normal operation.

M3 CHECK CIRCUIT CBP47 (GN/BU) FOR A SHORT TO POWER

- Key in OFF position.

- Disconnect: SJB C2280D
- Key in ON position.

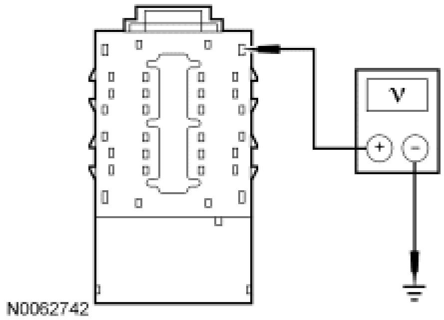


Fig. 68: Measuring Voltage Between SJB C2280D-32, Circuit CBP47 (GN/BU), Harness Side & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280D-32, circuit CBP47 (GN/BU), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. CLEAR all DTCs. TEST the system for normal operation.

  NO : Go to M4.

M4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR all DTCs. TEST the system for normal operation.

Component Test

Grid Wire Test

1. Using a bright lamp in the vehicle, inspect the wire grid from the exterior. A broken grid wire will appear as a brown spot.
2. Run the engine at idle. Set the heated rear window switch to ON. The indicator light should come on.
3. Working in the vehicle with a voltmeter, contact the broad red-brown stripes of the rear glass window positive lead to battery side and the negative lead to ground side. The meter should read 10-13 volts. A

lower voltage reading indicates a loose ground connection.

4. Contact a good ground point with the negative lead of the meter. The voltage reading should not change.
5. With the negative lead of the meter grounded, touch each grid line of the heated rear window glass at its midpoint with the positive lead. A reading of approximately 6 volts indicates the line is good. A reading of 0 volt indicates the line is broken between the midpoint and the B+ side of the grid line. A reading of 12 volts indicates the circuit is broken between the midpoint of the grid line and ground.
6. Pinpointing the exact position of the break can be accomplished (if the voltmeter reads 0 volt when the midpoint of the grid line is touched with the positive lead of the voltmeter) by moving the positive lead of the voltmeter toward the B+ side of the grid line and touching the grid line until the voltmeter reads 12 volts. If the voltmeter reads 12 volts when the midpoint of the grid line is touched with the positive lead of the voltmeter, simply move the positive lead of the voltmeter toward the ground connection of the grid line and touch the grid line until the voltmeter reads 0 volt.

GENERAL PROCEDURES

WINDOW GRID WIRE REPAIR

Material

Item	Specification
Lacquer Touch-Up Paint (match color to exterior grid wire) PM-19500-XXXXX or PMP-19500-XXXXX	ESR-M2P100-C
Polypropylene Film Fine Line Tape (commercially available)	-
Rear Window Defroster Repair PM-11 (US); CPM-11 (Canada)	-
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

NOTE: The grid line material is not embedded into the glass but is baked to the glass surface and consequently can be scraped off. An undamaged grid line will have small ridges that project above the surface of the glass and can easily be felt when running a fingernail across them. Grid lines that have been "razor bladed" will feel smooth when a fingernail is dragged across the affected area. Inoperative lines may appear to the eye to be undamaged due to residue remaining on the glass and will require diagnosis with a voltmeter or 12V test lamp. For additional information, refer to Diagnosis and Testing in this service information.

1. Bring the vehicle up to a room temperature of at least 16°C (60°F) or above.

CAUTION: Do not use scrapers, sharp instruments or abrasive window cleaners on the interior surface of the rear window glass as this may cause damage to the grid lines.

2. Clean the entire grid line repair area with window cleaner and 0000 steel wool to remove all dirt, wax, grease, oil or other foreign material.
3. Mark the location of the grid break on the exterior of the rear window glass.

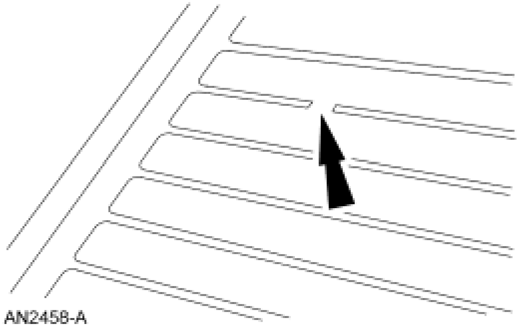


Fig. 69: Locating Grid Break
Courtesy of FORD MOTOR CO.

4. Using a polypropylene film fine line tape, mask the area directly above and below the grid break extending the tape 26 mm (1.02 in) beyond the concern area in both directions. The break area should be at the center of the mask.

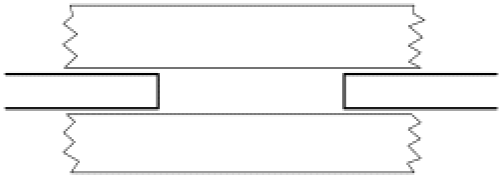


Fig. 70: Masking Grid Break Area
Courtesy of FORD MOTOR CO.

NOTE:	**If the brown layer is not broken or missing, apply only the silver grid repair compound to the break. If both the brown and silver layers of the grid are broken or missing, apply a coating of the lacquer touch up paint across the break in the grid line prior to applying the rear window defroster repair compound. Do not overlap the silver grid line with the paint. Several applications may be necessary to achieve a color match.**

NOTE:	**Allow at least 5 minutes of drying time between applications for the touch up paint or the silver repair coating. Applying fewer coats or not allowing adequate drying time between coats will produce repaired resistance that is greater than OEM resistance, resulting in poor defrost performance and excessive localized heating.**

5. Apply the repair coating to the grid break area in several smooth, continuous strokes. Extend the silver repair coating at least 6.35 mm (0.25 in) on both sides of the break area.

   Apply a minimum of 6 applications of the grid repair compound.

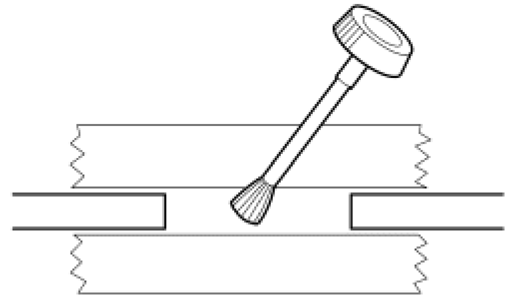


Fig. 71: Applying Repair Coating To Grid Break Area
Courtesy of FORD MOTOR CO.

NOTE: The repair coating air-dries in approximately one minute and can be energized after 5 minutes. Optimum adhesion occurs after approximately 24 hours.

6. Allow the repair area to dry completely and remove the mask.

CAUTION: Be careful not to damage the grid line with the razor blade. If this occurs, additional repair may be necessary.

7. Remove any excess repair compound above or below the grid line with a razor blade.

NOTE: The interior side of the grid lines are not painted, but due to the silver tarnishing will tend to change the grid to a gold or brown color. The repair area will be bright silver and will also tarnish over time to match the rest of the grid.

8. Test the system for normal operation.

LEAD TERMINAL REPAIR

Material

Item	Specification
Terminal Kit - Back Glass 4F1Z-14421-AA	-
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

1. Bring the vehicle up to room temperature of at least 16°C (60°F) or above.

NOTE: **The new terminal will cover the original terminal location, but it must be placed so that the terminal conductive areas will be placed on a good conductive base.**

2. Clean the bus bar in the area to be repaired with steel wool (000 to 0000 grade), and then with window cleaner to remove all dirt, wax, grease, oil or other foreign material.

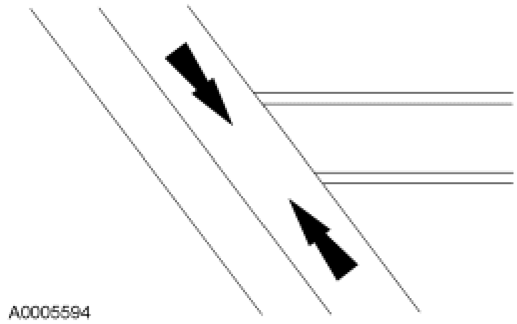


Fig. 72: Identifying Bus Bar Area To Be Repaired
Courtesy of FORD MOTOR CO.

CAUTION: **Do not use any type of flame torch or flame heated soldering gun for this procedure. Use of these tools provide inadequate heat generation at the tip and the exhaust heat can cause damage to plastic trim parts in the area. Use only an electric soldering gun with 100 watts or more of power. Before using the soldering gun, be sure to melt a small amount of rosin core solder to the tip. The solder will assist in achieving better heat transfer from the soldering gun tip to the new terminal.**

NOTE: **Depending on the original terminal location, and whether the terminal is covered by pillar trim, will determine where to locate the new terminal. Some grid line buss-bars may only allow the placement of the terminal above or below the original tab location due to space limitations. For most vehicle applications, the replacement tab location will cover the original tab location, but still allow the replacement tab to attach to the buss-bar on good conductive material.**

3. Place the replacement terminal type A over the original tab location, making sure the conductive areas of the terminal will be on a good conductive area. Do not place the terminal tab foot on the original location, which does not have conductive material.
4. Hold the terminal in place with an item such as a regular lead pencil at a 90 degree angle from the terminal. (Holding at other than a 90 degree angle may allow the terminal to slip when the solder liquefies.)

NOTE: The new terminal has pre-applied solder, flux and temperature-sensitive paint. The paint provides a visual indication when the terminal has reached the correct temperature to melt solder on the terminal. When the correct temperature is achieved, the temperature paint will liquefy and change color.

5. Place the soldering gun tip on the top of the terminal but not on the painted areas of the tab. Energize the soldering gun and watch for the painted area of the terminal to liquefy and change color. The paint should liquefy in approximately 25-45 seconds after heating. As soon as the paint color completely changes on either side of the terminal, de-energize the soldering gun and continue to hold the terminal in place with the soldering gun and pencil for an additional 30 seconds.
6. Remove the soldering gun and pencil from the terminal. The terminal should be allowed to cool for another 2 minutes before the wiring lead is attached to the terminal.
7. Attach the electrical lead connection to this terminal, turn on the heated rear window and verify the operation.

WINDOW MOTOR INITIALIZATION

NOTE: Initialization is required to learn both the full UP and full DOWN positions and the profile of the glass as it travels through the glass channel. Once initialized, obstacle detection is enabled. This procedure is only required for MKX (LH and RH front) or Edge (LH front only) window motors.

NOTE: The front window motor must be de-initialized, then initialized whenever the front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.

NOTE: A new (original factory setting) or de-initialized front window motor will not operate in one-touch up or one-touch-down mode until initialized. If a new front window motor has been installed, proceed to the initialization procedure.

NOTE: If diagnosing a LH or RH front window switch problem, carry out the window initialization procedure before installing a new window switch.

NOTE: All front window components (window glass, window regulator, window motor, seals and glass top run) must be installed and tightened to specification before carrying out the initialization procedure.

NOTE: Excessive bounce-back (window reverses direction with no obstructions present) may indicate that a de-initialization procedure may need to be carried out.

De-Initialization procedure

NOTE: The front window motor must be reset to its original factory settings first, then carry out the following de-initialization procedure.

1. Turn the ignition key ON.
2. Operate the window control switch in one-touch mode and remove power from the window motor **while the window is moving** by one of the following methods:
    1. Disconnect the vehicle battery cable **while the window is moving** .
    2. Disconnect the window motor connector **while the window is moving** .
    3. Remove the LH or RH front window motor fuse **while the window is moving** .
3. This will de-initialize the window motor and reset the window motor to its original factory settings.
4. Carry out the initialization procedure to turn the one-touch-up feature on.

Initialization procedure

WARNING: **Keep objects and body parts clear of the glass panel when carrying out the initialization procedure. During the initialization procedure, the glass panel closes with high force and cannot detect objects in its path. Failure to follow this instruction may result in serious personal injury.**

NOTE: The front window must be in the full OPEN position for this procedure to operate correctly.

NOTE: If the initialization procedure is only partially completed, the front window motor will remain un-initialized and will operate only in proportional up/down and one-touch-down modes.

5. Turn the ignition key ON.
6. Activate and hold the window control switch in the UP position at the second detent until the window glass stalls for 2 seconds into the glass top run and release the switch.
7. Activate and hold the window control switch in the DOWN position at the second detent until the window glass stalls for 2 seconds at the bottom of its travel and release the switch.
8. Test for correct window operation by carrying out the one-touch-up and one-touch-down features.

GLASS RESEAL - WINDSHIELD

Material

Item	Specification
DOW AUTOMOTIVE 2-HOUR CURE	
Dow Urethane Adhesive Betaseal® Express	

	-
SIKA 2-HOUR CURE	
Sika Urethane Adhesive Sika Tack ASAP	-
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

1. Remove the cowl panel grille. For additional information, refer to **FRONT END BODY PANELS** article.
2. Remove the LH and RH A-pillar trim panels. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
3. Remove the LH and RH sun visors.
4. If equipped, remove the overhead console. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
5. Lower the front portion of the headliner and block with a suitable material.
6. Clean the interior and exterior of the windshield glass surface with glass cleaner.
7. Cut the urethane adhesive applicator tip to 6 mm (0.24 in).

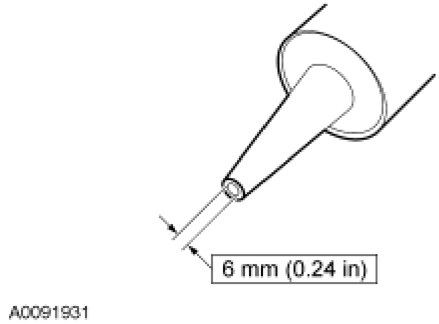


Fig. 73: Identifying Urethane Applicator Tip Specification
Courtesy of FORD MOTOR CO.

NOTE: **Use either a high-ratio, electric or battery-operated caulk gun that will apply the urethane with less effort and a continuous bead.**

NOTE: **Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead.**

8. Apply urethane adhesive over top of the existing urethane adhesive.
    - Apply the urethane to the top and sides of the windshield from the interior of the vehicle.
    - Apply the urethane to the bottom of the windshield from the exterior of the vehicle.

NOTE: **The urethane adhesive must cure for a minimum of one hour before**

testing for air or water leaks.

9. After the urethane has cured, check the windshield seal for air or water leaks through the urethane bead and add urethane adhesive as necessary.
10. Position the front portion of the headliner.
11. If equipped, install the overhead console. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
12. Install the LH and RH sun visors.
13. Install the LH and RH A-pillar trim panels. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
14. Install the cowl panel grille. For additional information, refer to **FRONT END BODY PANELS** article.
15. Clean the interior and exterior windshield glass with glass cleaner.

GLASS RESEAL - REAR

Material

Item	Specification
DOW AUTOMOTIVE 2-HOUR CURE	
Dow Urethane Adhesive Betaseal® Express	-
SIKA 2-HOUR CURE	
Sika Urethane Adhesive Sika Tack ASAP	-
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

1. Remove the upper and lower liftgate trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Clean the interior and exterior of the rear window glass surface with glass cleaner.
3. Cut the urethane adhesive applicator tip to specification.

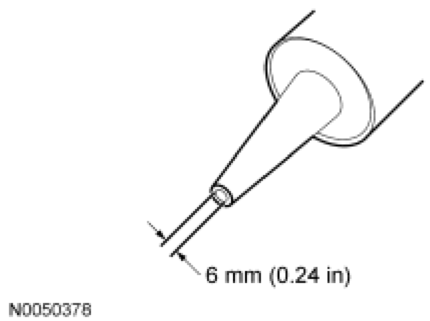


Fig. 74: Cutting Urethane Adhesive Applicator Tip To Specification

Courtesy of FORD MOTOR CO.

NOTE: **Use either a high ratio, electric or battery-operated caulk gun that applies the urethane with less effort and continuous bead.**

NOTE: **Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead.**

4. Apply the urethane adhesive over the top of the existing urethane adhesive from the interior of the vehicle.

NOTE: **The urethane adhesive must cure for a minimum of one hour before testing for air or water leaks.**

5. After the urethane cures, check the rear glass seal for air or water leaks through the urethane adhesive bead and add urethane adhesive as necessary.
6. Install the upper and lower liftgate trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

REMOVAL AND INSTALLATION

GLASS, FRAMES AND MECHANISMS - EXPLODED VIEW, FRONT DOOR

NOTE: **LH shown, RH similar.**

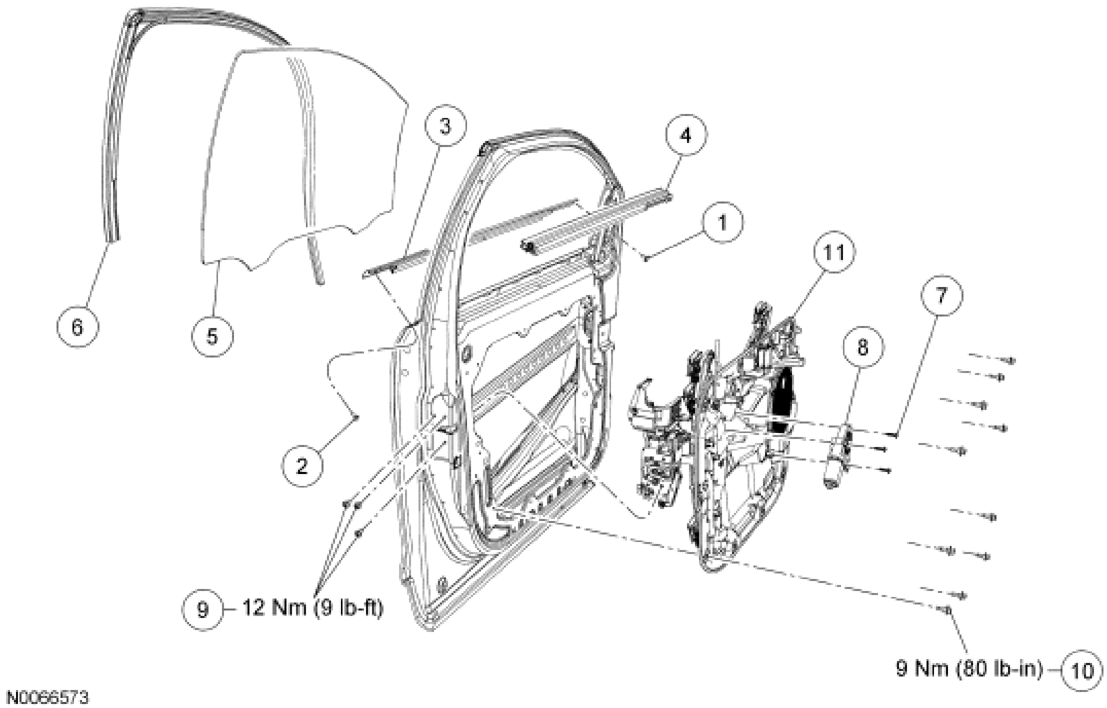


Fig. 75: Exploded View Of Front Door, Glass, Frames & Mechanisms With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W709451	Weatherstrip A-pillar screw
2	W709451	Weatherstrip B-pillar screw
3	5421453 LH/ 5421452 RH	Exterior door window glass molding
4	5421434	Interior door window glass molding
5	5421411 LH/ 5421410 RH	Front door window glass
6	5421597 LH/ 5421597 RH	Door window glass top run
7	166193	Window motor screw (3 required)
8	14A389 LH/ 14553 RH	Window motor
9	N811471	Door latch screws (3 required)
10	W713426	Door module bolt (10 required)
11	013300 LH/ 203A28 RH	Door module

1. For additional information, refer to the appropriate procedures in this service information.

WINDOW GLASS - FRONT DOOR

REMOVAL AND INSTALLATION

NOTE: LH shown, RH similar.

NOTE: The front window motor must be de-initialized, then initialized whenever the LH or RH (MKX) or LH (Edge) front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.

1. Remove the front door speaker. For additional information, refer to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
2. Remove the 2 access plug hole covers.
3. Reconnect the window control switch.
4. Lower the window until the glass clamp bolts can be accessed through the 2 access holes.
5. Loosen the window glass clamp bolts.
    - To install, tighten to 8 N.m (71 lb-in).

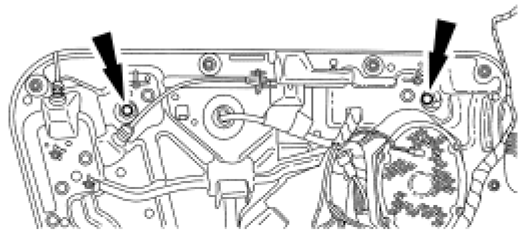


Fig. 76: Locating Window Glass Clamp Bolts
Courtesy of FORD MOTOR CO.

6. Tape the window in position, then lower the window regulator downward until it reaches the stops at the bottom of the regulator tracks.
7. Lift the window glass out of the door.
8. To install, reverse the removal procedure.
    - The front window motor must be de-initialized, then initialized whenever the LH or RH (MKX) or LH (Edge) front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run. For additional information, refer to **Window Motor Initialization**.

WINDOW REGULATOR MOTOR

REMOVAL AND INSTALLATION

NOTE: LH shown, RH similar.

NOTE: Front door window motor removal shown, rear door window motor removal

similar.

NOTE: **The front window motor must be de-initialized, then initialized whenever the LH or RH (MKX) or LH (Edge) front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.**

1. Remove the door trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Disconnect the window motor electrical connector.

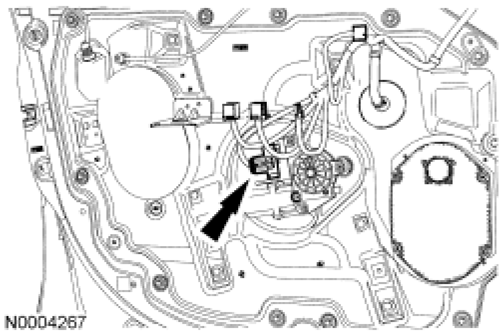


Fig. 77: Locating Window Motor Electrical Connector
Courtesy of FORD MOTOR CO.

3. Secure the glass in position with tape.
4. Remove the 3 window motor screws.

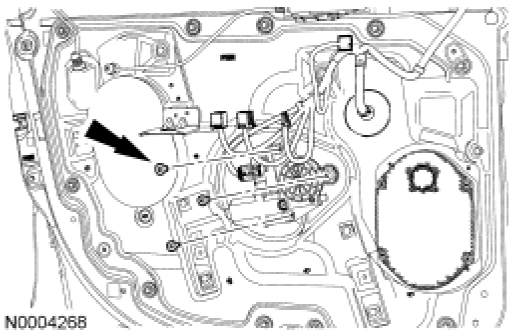


Fig. 78: Locating Window Motor Screws
Courtesy of FORD MOTOR CO.

5. Remove the window motor.
6. To install, reverse the removal procedure.
   - The front window motor must be de-initialized, then initialized whenever the LH or RH (MKX) or LH (Edge) front window motor is removed from the window regulator drum housing, a new

window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run. For additional information, refer to **Window Motor Initialization**.

WINDOW REGULATOR AND MOTOR - FRONT DOOR

REMOVAL AND INSTALLATION

NOTE: LH shown, RH similar.

NOTE: The front window motor must be de-initialized, then initialized whenever the LH or RH (MKX) or LH (Edge) front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.

Window operating/not operating

1. Remove the front door speaker. For additional information, refer to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.

   Window not operating

   NOTE: Cutting the regulator cable should only be done if installing a new window regulator assembly.

   NOTE: Support window glass before cutting the window regulator cable.

2. Cut the window regulator cable.

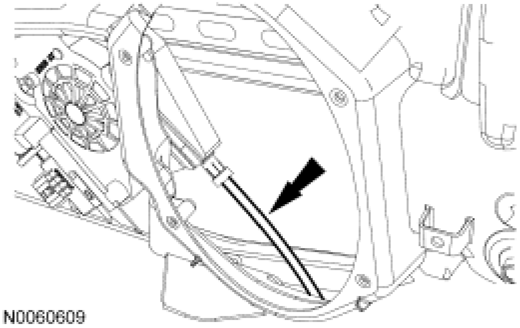


Fig. 79: Identifying Window Regulator Cable
Courtesy of FORD MOTOR CO.

   Window operating

3. Reconnect the window control switch.

Window operating/not operating

4. Remove the access plugs and lower the window until the glass clamp bolts can be accessed through the 2 access holes. Tape the glass in position.

NOTE: If the window regulator cable was cut previously, support the regulator before the glass clamp bolts are loosened.

5. Loosen the glass clamp bolts.
   - To install, tighten to 8 N.m (71 lb-in).

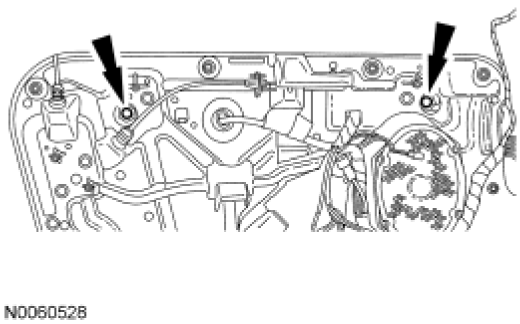


Fig. 80: Locating Window Glass Clamp Bolts
Courtesy of FORD MOTOR CO.

6. Lower the window regulator downward until it reaches the stops at the bottom of the regulator tracks.
7. If equipped, remove trim and disconnect the power mirror electrical connector.
   - Remove the wiring harness pushpins from the door.

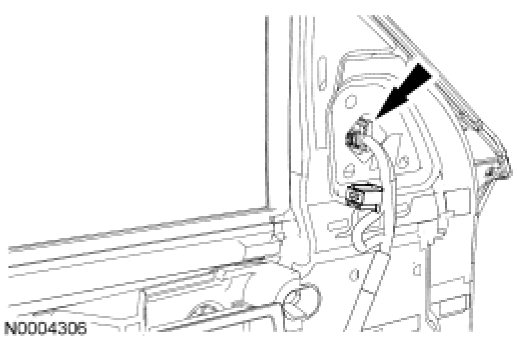


Fig. 81: Locating Power Mirror Electrical Connector
Courtesy of FORD MOTOR CO.

8. Disconnect the electrical connector at the A-pillar.

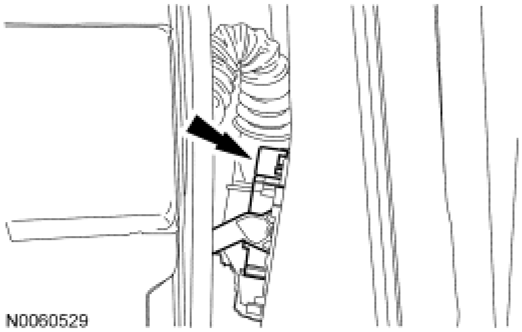


Fig. 82: Locating Electrical Connector At A-Pillar
Courtesy of FORD MOTOR CO.

9. Remove the 2 bolts from the electrical harness grommet to the door.

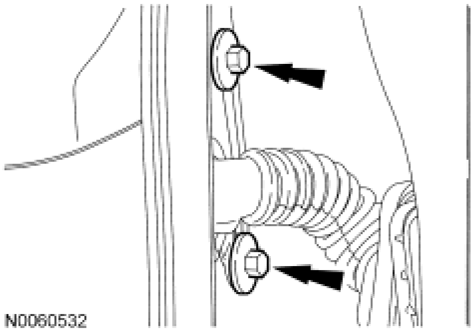


Fig. 83: Locating Electrical Harness Grommet Bolts
Courtesy of FORD MOTOR CO.

10. Using the speaker hole for access, release the clip on the harness from the inside to disconnect the harness from the door.
11. Unclip the weatherstrip and feed through the wiring harness between the weatherstrip and door.
12. Remove the 3 door latch screws.
    - To install, tighten to 12 N.m (9 lb-ft).

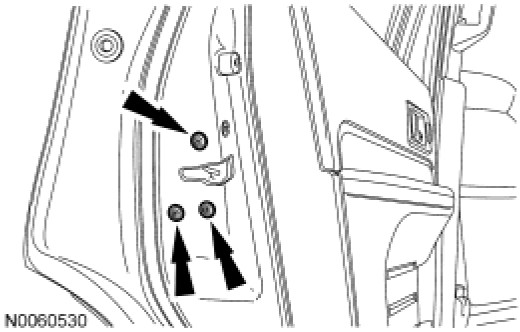


Fig. 84: Locating Door Latch Screws
Courtesy of FORD MOTOR CO.

13. Remove the access plug from the latch side of door and remove the outside door handle reinforcement screw.

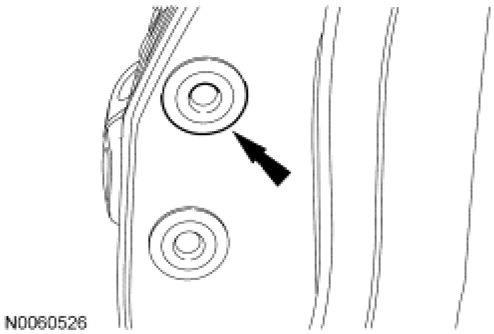


Fig. 85: Locating Access Plug From Latch Side Of Door
Courtesy of FORD MOTOR CO.

14. Remove the outside door handle. For additional information, refer to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
15. Using a suitable tool, release the retaining tab and remove the front door lock cylinder.
16. Remove the screw.
    - To install, tighten to 8 N.m (71 lb-in).

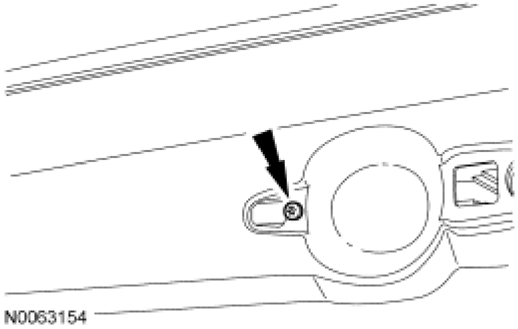


Fig. 86: Identifying Outside Door Handle Screw
Courtesy of FORD MOTOR CO.

17. If equipped, remove the keypad. For additional information, refer to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
18. Remove the 10 door module bolts and remove the front door module, transfer parts as necessary.
    - To install, tighten to 9 N.m (80 lb-in).

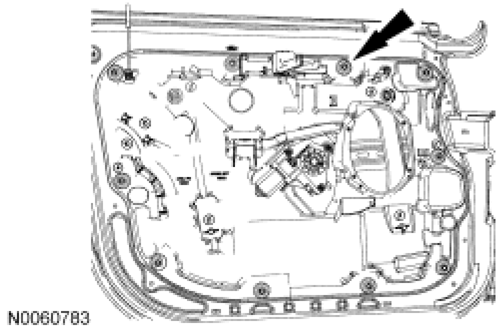


Fig. 87: Locating Door Module Bolts
Courtesy of FORD MOTOR CO.

19. To install, reverse the removal procedure.
    - The front window motor must be de-initialized, then initialized whenever the LH or RH (MKX) or LH (Edge) front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run. For additional information, refer to Window Motor Initialization in this service information.

DOOR GLASS TOP RUN - FRONT

REMOVAL AND INSTALLATION

NOTE: **The front window motor must be de-initialized, then initialized whenever the LH or RH (MKX) or LH (Edge) front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.**

1. Remove the front door window glass. For additional information, refer to **Window Glass - Front Door**.
2. Remove the front door window glass inner weatherstrip.

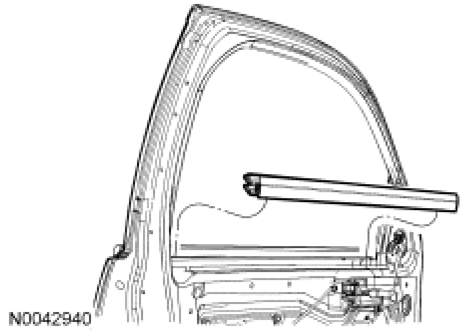


Fig. 88: Identifying Front Door Window Glass Inner Weatherstrip
Courtesy of FORD MOTOR CO.

3. Remove the front door glass top run.

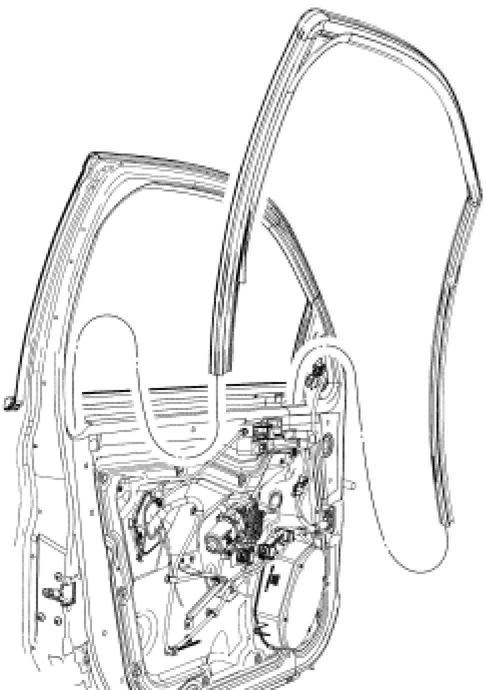


Fig. 89: Identifying Front Door Glass Top Run
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.
    - Make sure the top run is fully seated before reinstalling the front door window glass.
    - The front window motor must be de-initialized, then initialized whenever the LH or RH (MKX) or LH (Edge) front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run. For additional information, refer to **Window Motor Initialization**.

GLASS, FRAMES AND MECHANISMS - EXPLODED VIEW, REAR DOOR

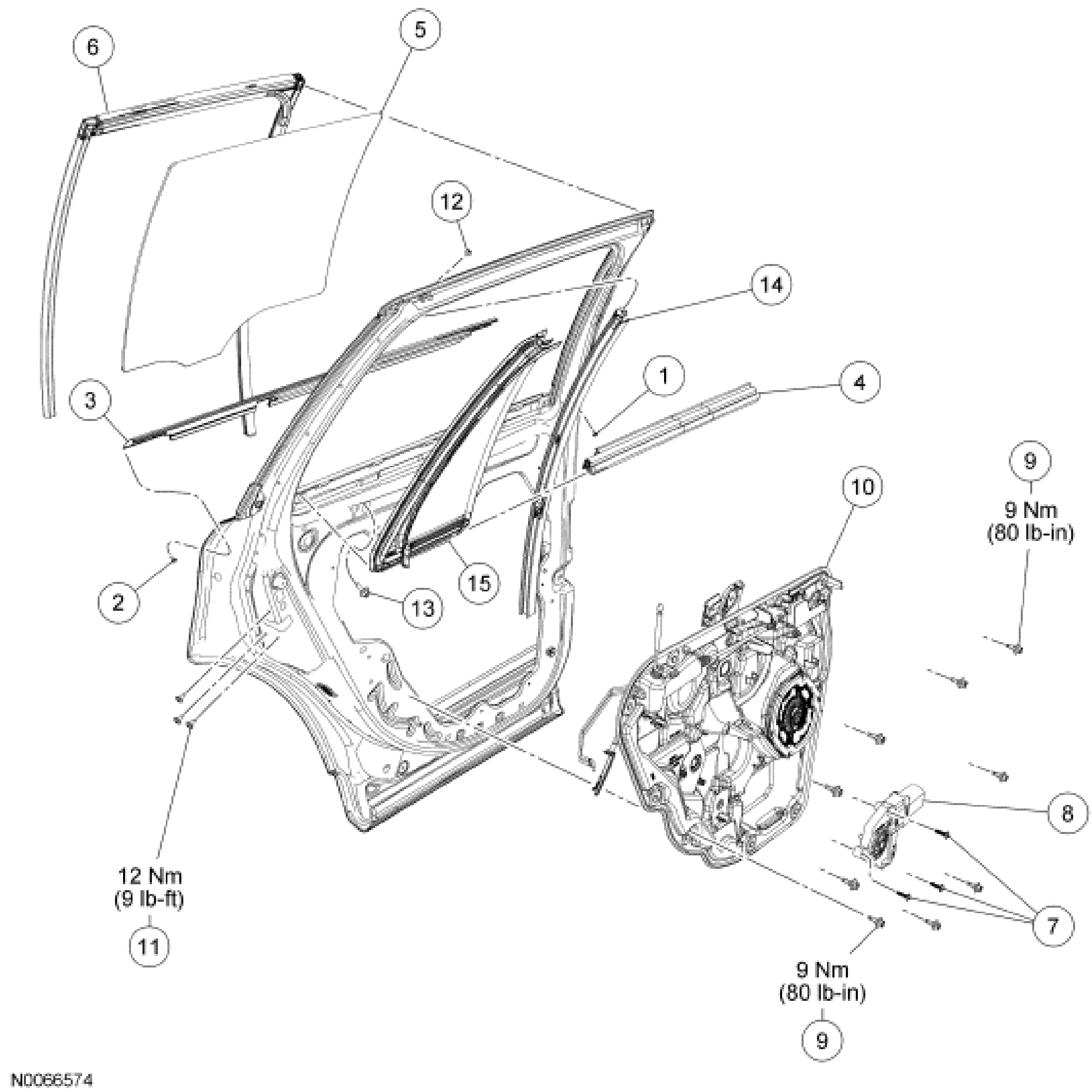


Fig. 90: Exploded View Of Rear Door, Glass, Frames & Mechanisms With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W709451	Rear door glass weatherstrip C-pillar screw
2	W709451	Rear door glass weatherstrip D-pillar
3	5425597 LH/ 5425596 RH	Rear door glass weatherstrip
4	5425860	Interior weatherstrip
5	5425713 LH/ 5425712 RH	Rear door window glass
6	5425767 LH/ 5425766 RH	Rear door glass top run
7	166193	Window motor screws
8	7423394 LH/ 7423395 RH	Window regulator motor
9	W713426	Door module bolts (9 required)

10	5424995 LH/ 5424994 RH	Rear door module
11	W505821	Door latch screw (3 required)
12	-	Upper fixed window screw
13	-	Lower fixed window screw
14	7825797 LH/ 7825796 RH	Center guide bracket
15	7829905	Fixed glass assembly

1. For additional information, refer to the appropriate procedures in this service information.

WINDOW GLASS - REAR DOOR

REMOVAL AND INSTALLATION

NOTE: LH shown, RH similar.

1. Remove the door trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Reconnect the window control switch.
3. Lower the window until the glass clamp bolt can be accessed through the access hole, then loosen the glass clamp bolt.
   - To install, tighten to 9 Nm (80 lb-in).

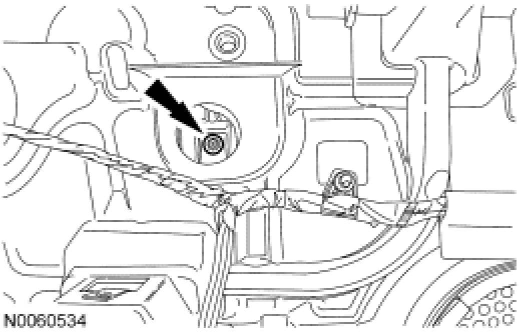


Fig. 91: Locating Glass Clamp Bolt
Courtesy of FORD MOTOR CO.

4. Tape the window in position, then lower the window regulator downward until it reaches the stops at the bottom of the regulator tracks.
5. Remove the rear door glass interior weatherstrip.

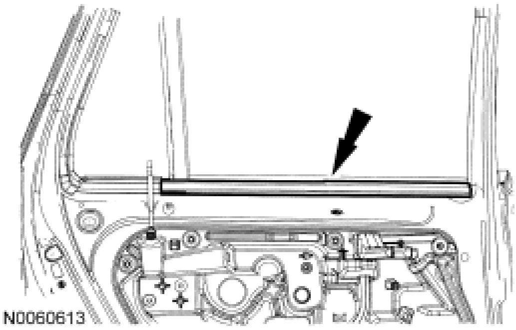


Fig. 92: Identifying Rear Door Glass Interior Weatherstrip
Courtesy of FORD MOTOR CO.

6. Remove the rear door window glass lower fixed window screw.

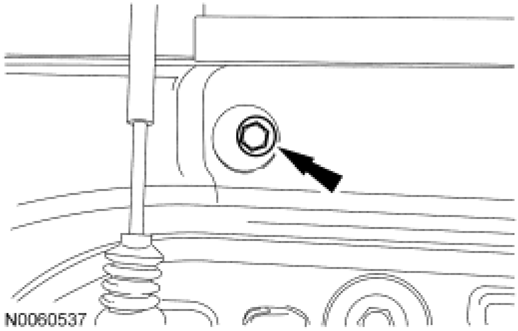


Fig. 93: Identifying Rear Door Window Glass Lower Fixed Window Screw
Courtesy of FORD MOTOR CO.

7. Remove the rear door window glass upper fixed window screw.

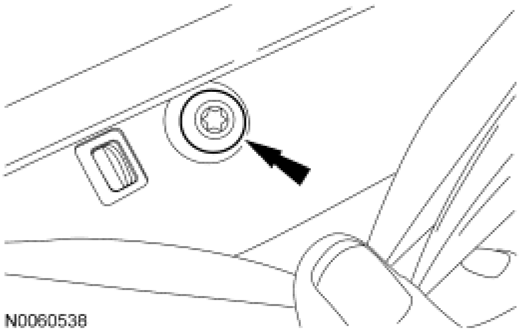


Fig. 94: Identifying Rear Door Window Glass Upper Fixed Window Screw
Courtesy of FORD MOTOR CO.

8. Position the top run aside as shown.

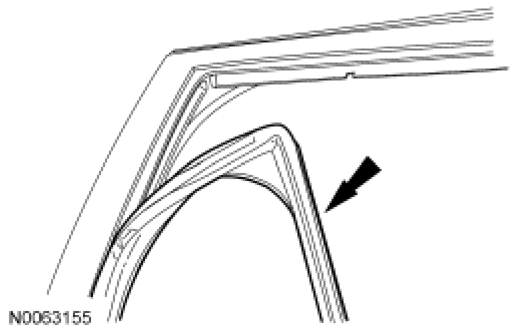


Fig. 95: Positioning Top Run Aside
Courtesy of FORD MOTOR CO.

NOTE: Protect the painted surfaces of the vehicle.

9. With the aid of an assistant (holding the glass in a lowered position to allow clearance), carefully pull the top of the bracket forward slightly, then upward and completely out of the door towards the inside of the vehicle.

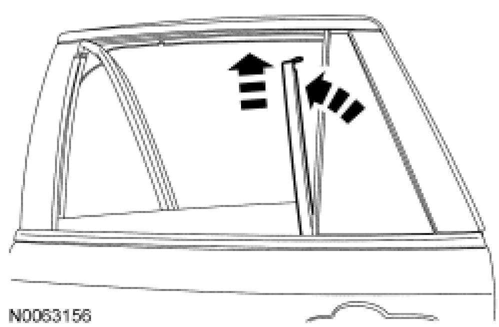


Fig. 96: Pulling Top Of Bracket Forward Slightly, Then Upward & Completely Out Of Door Towards Inside Of Vehicle
Courtesy of FORD MOTOR CO.

10. Slide the glass down, tilt and bring the glass back through the top of the window opening and remove the glass from the door.
11. To install, reverse the removal procedure.

WINDOW REGULATOR AND MOTOR - REAR DOOR

REMOVAL AND INSTALLATION

NOTE: LH shown, RH similar.

Window operating/not operating

1. Remove the rear door speaker. For additional information, refer to **INFORMATION AND**

ENTERTAINMENT SYSTEMS article.

Window not operating

NOTE: Cutting the regulator cable should only be done if installing a new window regulator assembly.

NOTE: Support window glass before cutting the window regulator cable.

2. Cut the window regulator cable.

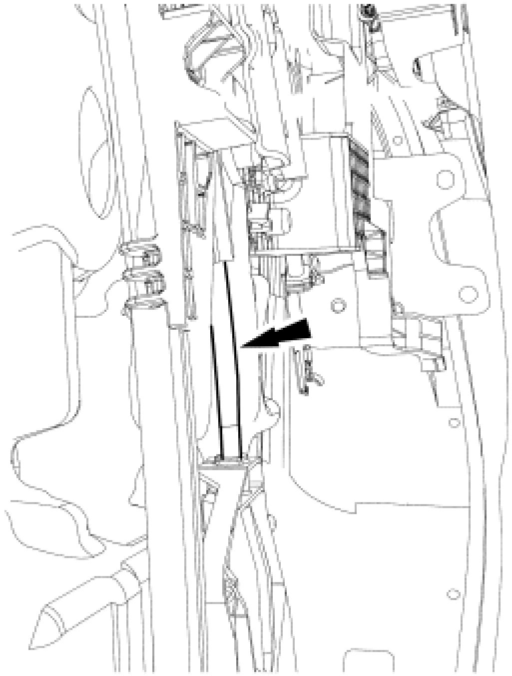


Fig. 97: Identifying Window Regulator Cable
Courtesy of FORD MOTOR CO.

Window operating

3. Reconnect the window control switch.

Window operating/not operating

4. Remove the access plug and lower the window until the glass clamp bolt can be accessed through the access hole. Tape the glass in position.

NOTE: If the window regulator cable was cut previously, support the regulator before the glass clamp bolt is loosened.

5. Loosen the glass clamp bolt.
   - To install, tighten to 9 Nm (80 lb-in).

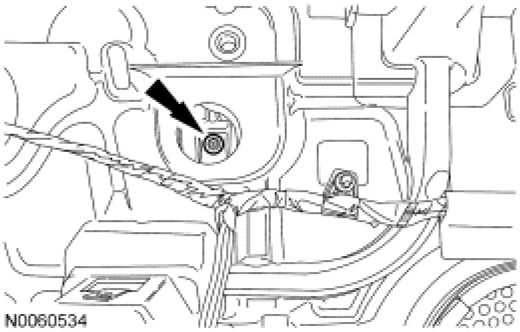


Fig. 98: Locating Glass Clamp Bolt
Courtesy of FORD MOTOR CO.

6. Lower the window regulator downward until it reaches the stops at the bottom of the regulator tracks.
7. Disconnect the electrical connector at the B-pillar.

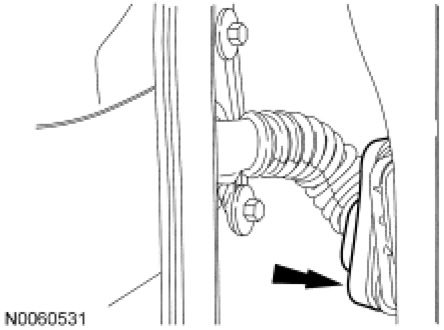


Fig. 99: Locating Electrical Connector At B-Pillar
Courtesy of FORD MOTOR CO.

8. Remove the 2 bolts from the electrical harness grommet to the door.

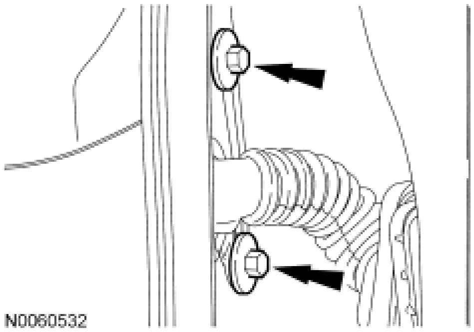


Fig. 100: Locating Electrical Harness Grommet Bolts
Courtesy of FORD MOTOR CO.

9. Using the speaker hole for access, release the clip on the harness from the inside to disconnect the harness from the door.
10. Unclip the weatherstrip and feed through the wiring harness between the weatherstrip and door.
11. Remove the 3 door latch screws.
    - To install, tighten to 12 Nm (9 lb-ft).

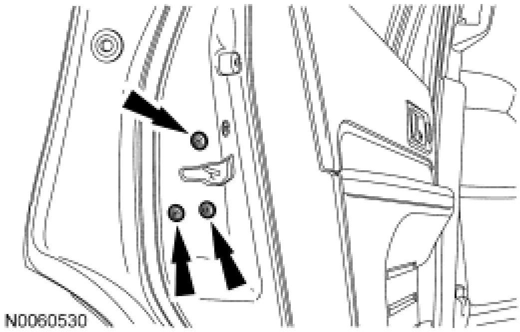


Fig. 101: Locating Door Latch Screws
Courtesy of FORD MOTOR CO.

12. Remove the access plug from the latch side of the door and remove the outside door handle reinforcement screw.

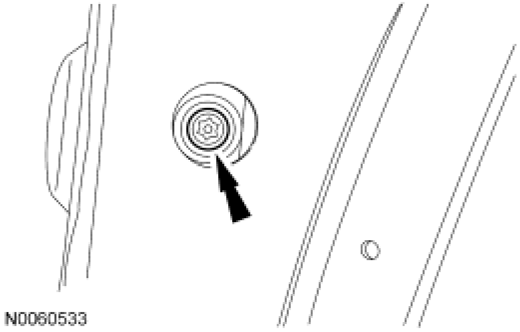


Fig. 102: Identifying Access Plug From Latch Side Of The Door
Courtesy of FORD MOTOR CO.

13. Remove the outside door handle. For additional information, refer to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
14. Remove the screw.
    - To install, tighten to 8 Nm (71 lb-in).

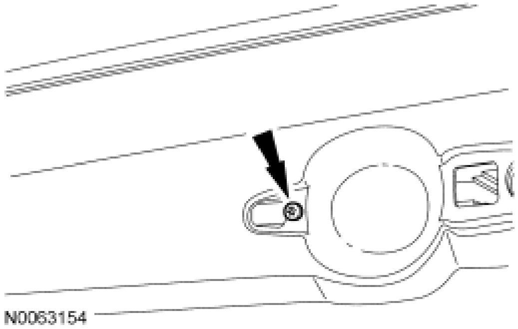


Fig. 103: Identifying Outside Door Handle Screw
Courtesy of FORD MOTOR CO.

15. If equipped, remove the door keypad. For additional information, refer to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
16. Remove the 9 door module bolts and remove the rear door module, transfer parts as necessary.
    - To install, tighten to 9 Nm (80 lb-in).

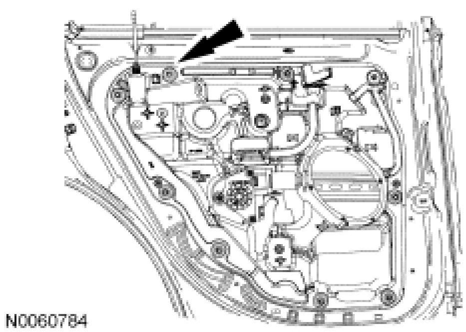


Fig. 104: Locating Door Module Bolts
Courtesy of FORD MOTOR CO.

17. To install, reverse the removal procedure.

DOOR GLASS RUN AND BRACKET - REAR

REMOVAL AND INSTALLATION

NOTE: The bracket is removed with the rear door glass.

1. Remove the rear door glass. For additional information, refer to **Window Glass - Rear Door**.
2. Remove the rear door speaker.
3. Remove the rear door glass top run.
4. To install, reverse the removal procedure.

WINDOW GLASS - REAR DOOR, FIXED

REMOVAL AND INSTALLATION

1. Remove the rear door window glass. For additional information, refer to **Window Glass - Rear Door**.
2. Remove the rear door fixed window glass from the door.
3. To install, reverse removal procedure.

WINDOW CONTROL SWITCH

REMOVAL AND INSTALLATION

Edge only

1. Pull the switch bezel straight up to unclip it from the door trim panel.

   MKX only

   NOTE: LH front shown, all others similar.

2. Pull up on the front edge of the switch bezel and pull forward to unhook it from the door trim panel.

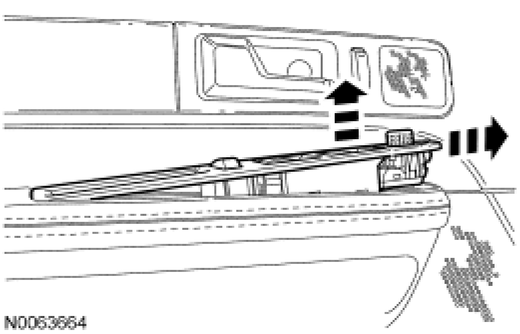


Fig. 105: Pulling Up On Front Edge Of Switch Bezel & Pulling Forward To Unhook It From Door Trim Panel
Courtesy of FORD MOTOR CO.

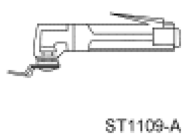
All vehicles

3. Disconnect the electrical connector(s).
4. Unclip the window control switch from the switch bezel.
5. To install, reverse the removal procedure.

WINDOW GLASS - REAR QUARTER

Special Tools

Illustration	Tool Name	Tool Number

	Interior Auto Glass Cut-Out Knife Kit (Electric)	164-R2450 or equivalent
	Pneumatic Knife with Offset Blade	107-R1511 or equivalent
	The Pumper	164-R2459 or equivalent

Material

Item	Specification
DOW AUTOMOTIVE 2-HOUR CURE	
Dow Urethane Adhesive Betaseal® Express	-
Dow Urethane One Step Glass Primer Betaprime® 5500 / 5500A / 5500SA	-
SIKA 2-HOUR CURE	
Sika Urethane Adhesive Sika Tack ASAP	-
Sika Urethane Metal and Glass Primer Sika 206 G+P	-
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

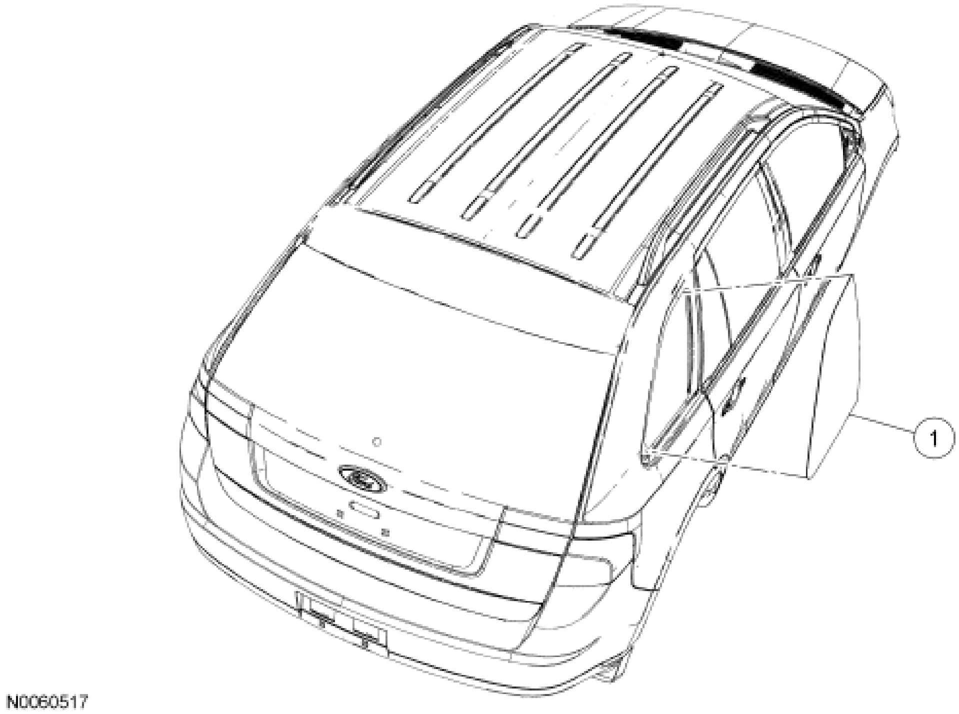


Fig. 106: Identifying Rear Quarter Window Glass
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	29711 LH/ 29710 RH	Rear quarter window glass

REMOVAL

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow this instruction may result in serious personal injury.**

1. Remove the C-pillar, D-pillar and rear quarter trim panels, For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

NOTE: **Lubricate the existing urethane adhesive with water to aid the special tool while cutting.**

2. From inside the vehicle, using the special tool, cut the glass starting at the upper C-pillar and work down, across the D-pillar, then across the bottom.
3. Remove the rear quarter window glass.

4. Using a soft brush or vacuum, remove any dirt or foreign material from the pinch weld.

INSTALLATION

NOTE: For additional material guidelines, refer to the manufacturer's installation information.

1. Dry fit the rear quarter window glass to the existing urethane adhesive bead on the body pinch weld.
2. For a uniform fit, use the 2 alignment pins on the rear quarter window glass to align the rear quarter window glass in the opening.
3. Remove the rear quarter window glass.

WARNING: Repair any corrosion found on the pinch weld. The pinch weld is a structural component of the vehicle. Corrosion left unrepaired may reduce the structural integrity of the vehicle. Failure to follow this instruction may result in serious injury to vehicle occupant(s).

NOTE: Avoid scratching the pinch weld. For minor scratches or exposed metal on the pinch weld, see the manufacturer's recommendations.

4. Using an appropriate tool, trim the urethane adhesive leaving a 1 mm (0.03 in) to 2 mm (0.07 in) base of original equipment urethane on the pinch weld.
5. If installing the original rear quarter window glass, remove the excess urethane adhesive.
6. Clean the inside of the rear quarter window glass surface with glass cleaner.

NOTE: Be sure to use the same brand urethane and cure-rate products for adhesive and primer. Do not mix different brands of urethane and primer. For additional information, refer to the Material Chart in this procedure.

NOTE: Sika uses the same black primer for the glass and pinch weld area.

7. If installing a new rear quarter window glass, apply urethane glass primer according to the manufacturer's instructions. Allow at least 6 minutes to dry.
8. Cut the urethane adhesive applicator tip to specification.

NOTE: Use either a high-ratio, electric or battery-operated caulk gun that will apply the urethane with less effort and continuous bead.

9. Apply urethane adhesive on top of the existing trimmed urethane adhesive bead on the pinch weld. Make sure that all gaps in the urethane are smoothed into one continuous bead starting and ending at the bottom of the rear quarter window glass opening near the center.

WARNING: Do not drive vehicle until the urethane seal has cured. Follow

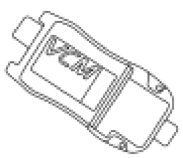
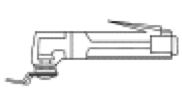
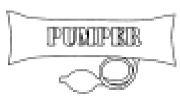
urethane manufacturer's curing directions. Inadequate or incorrect curing of the urethane seal will adversely affect glass retention. Failure to follow these instructions may result in serious injury to vehicle occupant(s).

NOTE: **Before the urethane has set, partially lower the windows to prevent the glass from being pushed out of position when a door is closed.**

10. After the urethane has cured, check the rear quarter window glass seal for air or water leaks through the urethane adhesive bead and add urethane adhesive as necessary.
11. Install the C-pillar, D-pillar and rear quarter trim panels. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

WINDOW GLASS - LIFTGATE

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Interior Auto Glass Cut-Out Knife Kit (Electric)	164-R2450 or equivalent
 ST1109-A	Pneumatic Knife with Offset Blade	107-R1511 or equivalent
 ST2085-A	The Pumper	164-R2459 or equivalent

Material

Item	Specification
DOW AUTOMOTIVE 2-HOUR CURE	
Dow Urethane Adhesive Betaseal® Express	-
Dow Urethane One Step Glass Primer Betaprime® 5500/5500A/5500SA	-
SIKA 2-HOUR CURE	

Sika Urethane Adhesive Sika Tack ASAP	-
Sika Urethane Metal and Glass Primer Sika 206 G+P	-
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

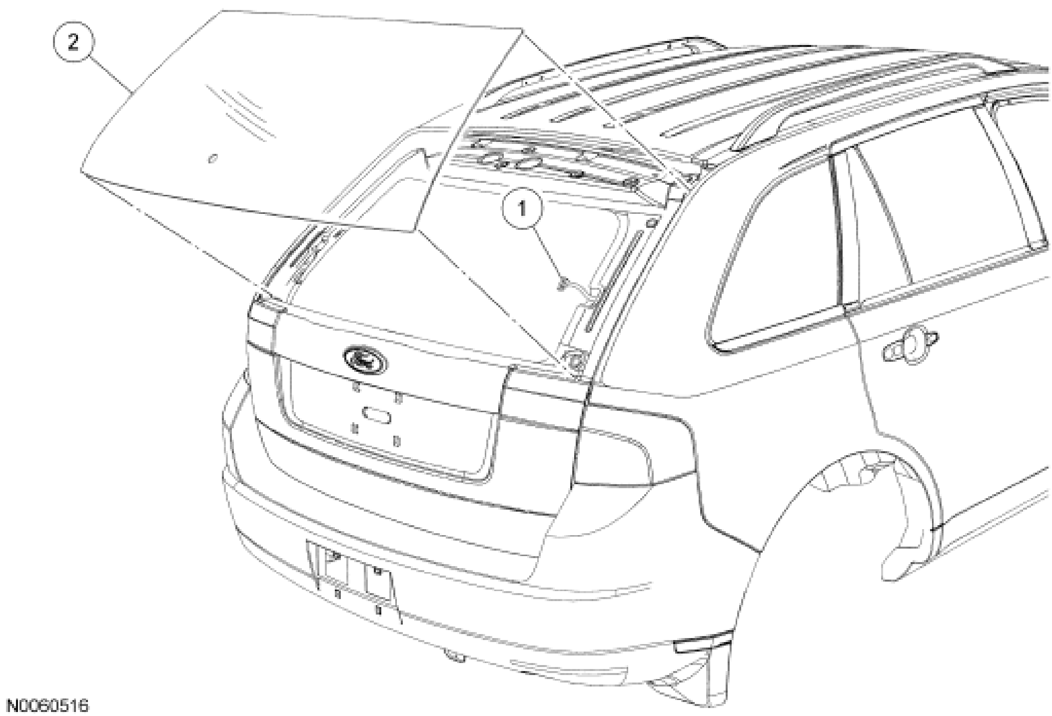


Fig. 107: Identifying Rear Window Glass
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5442006	Rear window glass
2	-	Electrical connector

REMOVAL

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow this instruction may result in serious personal injury.**

1. Remove the liftgate window wiper arm and motor. For additional information, refer to **WIPERS AND WASHERS** article.
2. Remove the liftgate spoiler. For additional information, refer to **EXTERIOR TRIM AND ORNAMENTATION** article.
3. Remove the liftgate trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
4. Disconnect the 2 liftgate window defrost electrical connectors.

NOTE: Lubricate the existing urethane adhesive with water to aid the special tool while cutting.

5. Using the special tool, place the flat side of the knife against the liftgate window glass. Start cutting the adhesive away from the liftgate window glass at the top and work toward the corners.
6. Using the special tool, distance the liftgate window glass from the body.

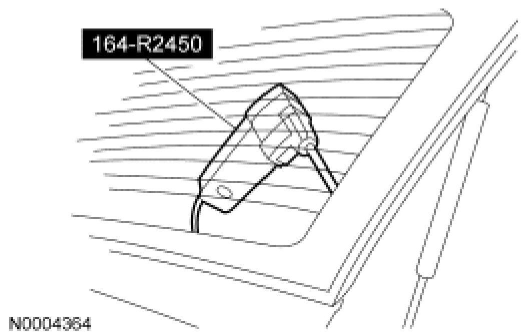


Fig. 108: Distance The Liftgate Window Glass From Body Using Special Tool (164-R2450)
Courtesy of FORD MOTOR CO.

7. Using the special tool, cut the remaining urethane adhesive and remove the liftgate window glass.

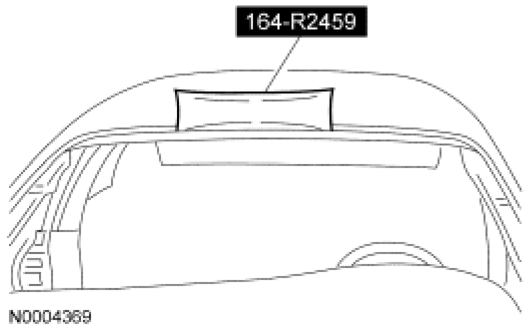


Fig. 109: Distancing Windshield Glass From The Body
Courtesy of FORD MOTOR CO.

8. Using a soft brush or vacuum, remove any dirt or foreign material from the pinch weld.

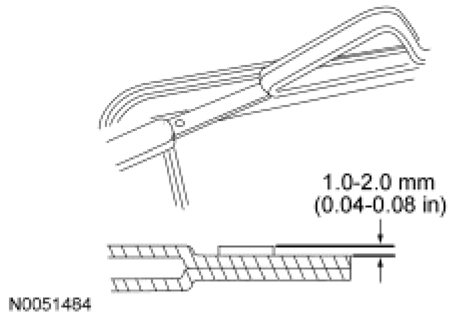


Fig. 110: Measuring Urethane With Appropriate Tool
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: For additional material guidelines, refer to the manufacturer's installation information.

1. Dry fit the liftgate window glass to the existing urethane adhesive bead on the body pinch weld.
2. For a uniform fit, use the 2 liftgate window glass alignment pins to align the liftgate window glass in the opening.
3. Remove the liftgate window glass.

WARNING: Repair any corrosion found on the pinch weld. The pinch weld is a structural component of the vehicle. Corrosion left unrepaired may reduce the structural integrity of the vehicle. Failure to follow this instruction may result in serious injury to vehicle occupant(s).

NOTE: Avoid scratching the pinch weld. For minor scratches or exposed metal on the pinch weld, see the manufacturer's recommendations.

4. Using an appropriate tool, trim the urethane adhesive leaving a 1 mm (0.03 in) to 2 mm (0.07 in) base of original equipment urethane on the pinch weld.
5. If installing the original liftgate window glass, remove the excess urethane adhesive.
6. Clean the inside of the liftgate window glass surface with glass cleaner.

NOTE: Be sure to use the same brand and cure-rate products for adhesive and primer. Do not mix different brands of urethane and primer. For additional information, refer to the Material Chart in this procedure.

NOTE: Sika uses the same black primer for the glass and pinch weld area.

7. If installing a new liftgate window glass, apply urethane glass primer according to the manufacturer's instructions.

8. Cut the urethane adhesive applicator tip to specification.

NOTE: Use either a high ratio, electric or battery-operated caulk gun that will apply the urethane with less effort and a continuous bead.

9. Apply urethane adhesive on top of the existing trimmed urethane adhesive bead on the pinch weld. Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead starting and ending at the bottom of the liftgate window glass opening near the center.

NOTE: Before the urethane has set, partially lower the windows to prevent the glass from being pushed out of position when a door is closed.

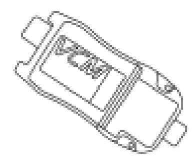
10. Install the liftgate window glass on the vehicle using the alignment pins.

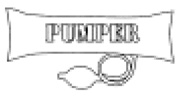
WARNING: **Do not drive vehicle until the urethane seal has cured. Follow urethane manufacturer's curing directions. Inadequate or incorrect curing of the urethane seal will adversely affect glass retention. Failure to follow these instructions may result in serious injury to vehicle occupant(s).**

11. After the urethane has cured, check the liftgate window glass seal for air or water leaks through the urethane adhesive bead and add urethane adhesive as necessary.
12. Connect the 2 liftgate window defrost electrical connectors.
13. Install the liftgate trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
14. Install the liftgate spoiler. For additional information, refer to **EXTERIOR TRIM AND ORNAMENTATION** article.
15. Install the liftgate window wiper arm and motor. For additional information, refer to **WIPERS AND WASHERS** article.

WINDSHIELD GLASS

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Interior Auto Glass Cut-Out Knife Kit (Electric)	164-R2450 or equivalent
	Pneumatic Knife with Offset Blade	107-R1511 or equivalent

 ST1109-A		
 ST2085-A	The Pumper	164-R2459 or equivalent

Material

Item	Specification
DOW AUTOMOTIVE 2-HOUR CURE	
Dow Urethane Adhesive Betaseal® Express	-
Dow Urethane One Step Glass Primer Betaprime® 5500 / 5500A / 5500SA	-
SIKA 2-HOUR CURE	
Sika Urethane Adhesive Sika Tack ASAP	-
Sika Urethane Metal and Glass Primer Sika 206 G+P	-
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

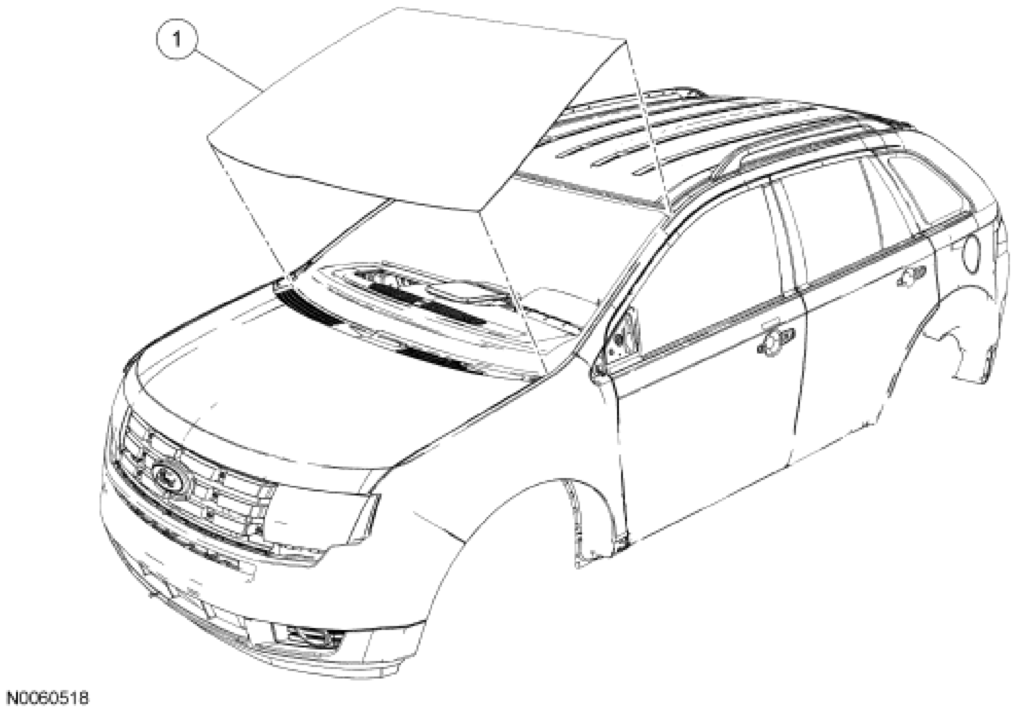


Fig. 111: Identifying Windshield Glass
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5403100	Windshield

REMOVAL

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow this instruction may result in serious personal injury.**

1. Remove the A-pillar trim panels. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the sun visors.
3. Remove the interior mirror. For additional information, refer to **REAR VIEW MIRRORS** article.
4. Partially lower the front portion of the headliner near the windshield header and block with suitable material. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
5. Remove the cowl panel grille. For additional information, refer to **FRONT END BODY PANELS** article.

NOTE: Lubricate the existing urethane adhesive with water to aid the special tool while cutting.

NOTE: Removing the windshield glass requires more than one technician.

6. Using the special tool, cut the urethane adhesive from the windshield glass starting at the top center and working toward the bottom corners.

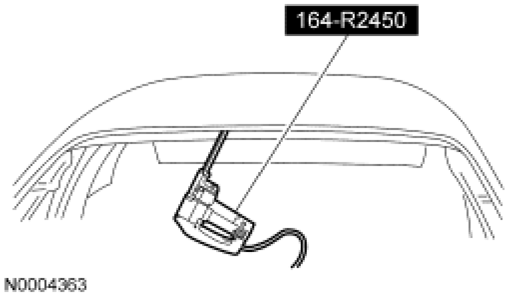


Fig. 112: Cutting Urethane Adhesive From Glass
Courtesy of FORD MOTOR CO.

7. Using the special tool, distance the windshield glass from the body.

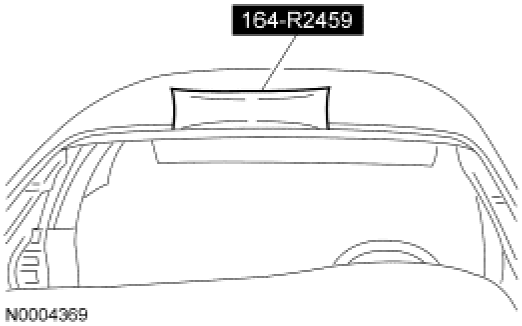


Fig. 113: Distancing Windshield Glass From The Body
Courtesy of FORD MOTOR CO.

8. Using the Pneumatic Knife with offset blade , cut the remaining urethane adhesive and remove the windshield glass.
9. Using a soft brush or vacuum, remove any dirt or foreign material from the pinch weld.

INSTALLATION

NOTE: For additional material guidelines, refer to the manufacturer's installation information.

1. Dry fit the windshield glass to the existing urethane adhesive bead on the body pinch weld. Align the

windshield glass in the opening for a uniform fit.

2. For a uniform fit, use the 2 alignment pins on windshield glass to align the windshield glass in the pin holes on the top pinch weld.
3. Use a non-permanent pencil to make alignment marks on the windshield glass at the setting blocks and the body to aid in the installation alignment of the windshield glass.
4. Remove the windshield glass.

WARNING: **Repair any corrosion found on the pinch weld. The pinch weld is a structural component of the vehicle. Corrosion left unrepaired may reduce the structural integrity of the vehicle. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

NOTE: Avoid scratching the pinch weld. For minor scratches or exposed metal on the pinch weld, see the manufacturer's recommendations.

5. Using an appropriate tool, trim the urethane adhesive leaving a 1-2 mm (0.04-0.08 in) base of original equipment urethane on the pinchweld.

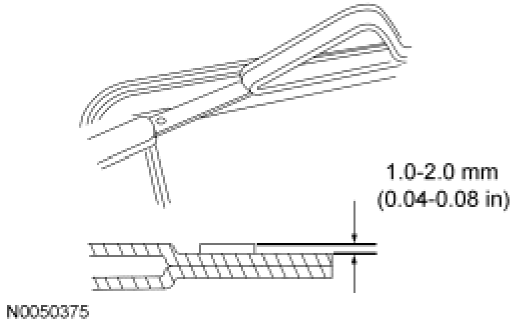


Fig. 114: Trimming Remaining Urethane Adhesive To Specification
Courtesy of FORD MOTOR CO.

6. If installing the original windshield glass, remove the excess urethane adhesive.
7. Clean the inside of the windshield glass surface with glass cleaner.

NOTE: Be sure to use the same brand urethane and cure-rate products for adhesive and primer. Do not mix different brands of urethane and primer. For additional information, refer to the Material Chart in this procedure.

NOTE: Sika uses the same black primer for the glass and pinch weld area.

8. If installing a new windshield glass, apply urethane glass primer according to manufacturer's instructions.
9. Cut the urethane adhesive applicator tip to specification.

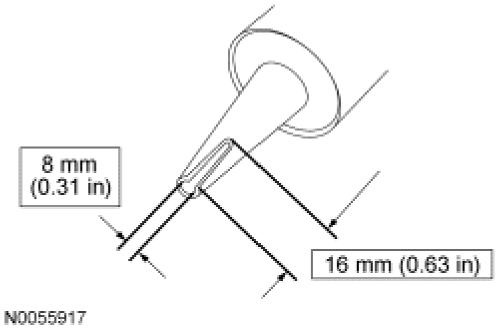


Fig. 115: Cutting Urethane Adhesive Applicator Tip (With Specifications)
Courtesy of FORD MOTOR CO.

NOTE: **Use either a high-ratio, electric or battery-operated caulk gun that will apply the urethane with less effort and a continuous bead.**

10. Apply urethane adhesive on top of the existing trimmed urethane adhesive bead on the pinch weld. Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead starting and ending at the bottom of the windshield near the center.

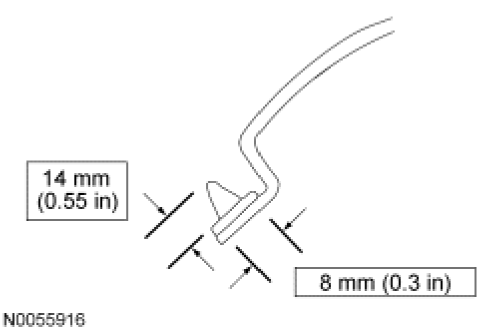


Fig. 116: Identifying Adhesive Application (With Specifications)
Courtesy of FORD MOTOR CO.

11. Install the windshield glass on the vehicle, aligning it with the markings made previously.

WARNING: **Do not drive vehicle until the urethane seal has cured. Follow urethane manufacturer's curing directions. Inadequate or incorrect curing of the urethane seal will adversely affect glass retention. Failure to follow these instructions may result in serious injury to vehicle occupant(s).**

12. After the urethane has cured, check the windshield glass seal for air or water leaks through the urethane adhesive bead and add urethane adhesive as necessary.
13. Install the cowl panel grille. For additional information, refer to **FRONT END BODY PANELS** article.
14. Install the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

15. Install the interior mirror. For additional information, refer to **REAR VIEW MIRRORS** article.
16. Install the sun visors.
17. Install the A-pillar trim panels. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

2008 ACCESSORIES & BODY, CAB

Wipers And Washers - Edge & MKX

SPECIFICATIONS

MATERIAL

Item	Specification	Fill Capacity
Premium Quality Windshield Washer Fluid (Canada) CXC-37-(A, B, C, D, E, F, G, H) (Canada)	-	-
Premium Windshield Washer Concentrate (US) ZC-32-A or B (US)	WSB-M8B16-A2	-

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Front wiper pivot arm nuts	30	22	-
Rear wiper motor screws	11	8	-
Rear wiper pivot arm nut	12	9	-
Washer reservoir filler neck bolt	7	-	62
Washer reservoir nuts	7	-	62
Windshield wiper mounting arm and pivot shaft assembly bolts	7	-	62

DESCRIPTION AND OPERATION

WIPERS AND WASHERS

The wiper and washer system consists of the following:

- Rear window wiper blade
- Rear window wiper pivot arm
- Rear window wiper motor
- Smart junction box (SJB)
- Washer pump
- Washer reservoir
- Windshield wiper blades
- Windshield wiper mounting arm and pivot shaft
- Windshield wiper motor
- Windshield wiper pivot arms

- Windshield wiper/wash switch (part of the multi-function switch)

NOTE: The SJB may also be identified as the generic electronic module (GEM).

If equipped with automatic headlamps, the SJB will illuminate the exterior lamps, including the parking lamps, when the front wipers are on for more than 10 seconds and the headlamp control is in the AUTOLAMP position. When the wipers are turned off, the exterior lamps will remain on for 30 seconds before turning off.

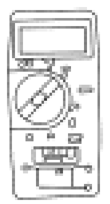
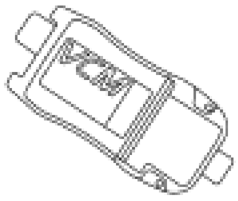
Windshield Wiper/Wash Switch - The windshield wiper/washer switch is an integral component of the steering column multi-function switch. Refer to **STEERING COLUMN SWITCHES** article.

Windshield Washer Courtesy Wipe - When the front windshield washer system is activated, the wipers will cycle 3 times with washer fluid followed by one final courtesy wipe a few seconds later to clear any remaining fluid that is dripping down from the top of the windshield.

DIAGNOSTIC TESTS

WIPERS AND WASHERS

SPECIAL TOOLS

Illustration	Tool Name	Tool Number
	73III Automotive Meter	105-R00057 or equivalent
	Flex Probe Kit	105-R025B or equivalent
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	-

Principles of Operation

The wiper motors receive inputs from the following:

- Multi-function switch
- PCM
- Smart junction box (SJB)
- Battery junction box (BJB)

The following components are integrated in the wiper motors:

- Windshield wiper motor module
- Run/park relay
- High/low speed relay
- Run/park sense (Hall-effect)
- Washer pump relay

High-Speed Windshield Wipers

When the multi-function switch is set to the high-speed position, it supplies ground to the integral high/low speed relay coil and the integral run/park relay coil, which causes the windshield wiper motor to operate at high speed. During high-speed operation only, both the integral high/low-speed relay coil ground and the integral run/park relay coil ground are controlled directly by the multi-function switch. This differs from low speed or intermittent operation when the integral run/park relay coil is controlled by the microprocessor. When the switch is placed in the OFF position, the motor continues to operate until the motor returns to the PARK position and the internal Hall-effect sensor senses the motor magnet. The output to the integral run/park relay deactivates the relay and disconnects the voltage to the motor.

Since the integral high/low relay coil and the integral run/park relay coil are both controlled by a hard wired circuit to the multi-function switch, the windshield wipers will still operate in high speed mode if the internal windshield wiper module fails, but will not automatically park when the multi-function switch is turned to the OFF position.

Low-Speed Windshield Wipers

When the multi-function switch is set to the low-speed position, it supplies ground to the internal windshield wiper motor module low-speed inputs and the windshield wiper motor operates at low speed. During low-speed operation, the integral run/park relay is activated by the microprocessor and supplies 12 volts to the low-speed brush of the windshield wiper motor. The integral run/park relay coil ground is controlled by the internal windshield wiper motor module based on inputs received from the multi-function switch. When the switch is placed in the OFF position, the motor continues to operate until the motor returns to the PARK position and the internal Hall-effect sensor senses the motor magnet. The output to the integral run/park relay deactivates the relay and disconnects the voltage to the motor.

Since the integral run/park relay is controlled by the internal windshield wiper motor microprocessor, the wipers will only operate in high-speed mode if the internal windshield wiper motor module fails, and will not automatically park when the multi-function switch is turned to the OFF position. This is due to the integral run/park and integral high/low relay coils being directly hard-wired to the switch in high speed. The diode prevents current flow through the high/low relay coil so the relay remains in the normally closed low-speed position.

Intermittent Speed Windshield Wipers

When the multi-function switch is set to the intermittent position(s), it supplies ground to the windshield wiper motor module inputs and the windshield wiper motor operates in intermittent mode. During intermittent operation, the windshield wiper motor activates the integral run/park relay coil which sends voltage through the integral high/low relay. The integral high/low relay remains deactivated, supplying the voltage to the low-speed brush of the windshield wiper motor. The windshield motor continues to operate until the internal Hall-effect sensor senses the magnet (PARK position) and deactivates the integral run/park relay, which disconnects voltage from the wiper motor. The windshield wipers remain parked until the windshield wiper motor module completes a time-out and then repeats the intermittent windshield wiper cycle.

Speed Dependent Windshield Wipers

The speed-dependent feature increases the frequency of wiping to compensate for the extra moisture that accumulates on the windshield as the vehicle speed increases, when the multi-function switch is in any intermittent setting except the INT 1 position. The windshield wiper module receives vehicle speed sensor (VSS) information directly from the PCM. As vehicle speed increases, the speed-dependent feature gradually shortens the delay between wipes.

The speed-dependent feature is easiest to verify in the INT 2 position. With the vehicle at a standstill and the multi-function switch in the INT 2 position, the wipers should operate once every 10 seconds. As vehicle speed increases, the delay between wipes will gradually shorten. For example, by the time the vehicle reaches 100 km/h (62 mph), the wipers should operate every 5 seconds. Speed dependent operation is similar in INT 3, INT 4 and INT 5 modes.

Wiper Activated Headlamps (If Equipped with Autolamp System)

The headlamps will automatically turn on within 10 seconds when the headlamp switch is in the automatic position and the windshield wipers are activated in any mode except in the MIST or WASH positions. When the windshield wipers are deactivated, the headlamps will automatically turn off within 30 seconds.

Intermittent Rear Window Wiper System

When the multi-function switch is set to the rear intermittent position(s), it supplies ground to the rear window wiper motor module input and the wiper operates in intermittent mode. During intermittent operation, the rear wiper motor momentarily activates the rear window wiper relay (internal), which sends voltage to the motor. Once the rear window wiper motor is activated, the internal run/park switch connects voltage to the motor, keeping it operating. When the rear window wiper motor returns to the PARK position, the run/park switch disconnects voltage internally from the wiper motor input, reconnecting it to the rear window wiper motor module output. The rear window wiper remains parked until the rear window wiper motor module completes a time-out and then repeats the cycle.

Washer System

The front and rear washer system share the same washer reservoir and washer pump. The front and rear wiper motor modules each contain an integral washer relay that supplies a ground path for the washer pump whenever they are inactive. When windshield wash is selected on the multi-function switch, the windshield wiper motor module activates its integral washer relay which sends voltage to the washer pump to direct fluid to the windshield. When rear wash is selected on the multi-function switch, the rear wiper motor module activates its integral washer relay to send voltage to the washer pump to direct fluid to the rear window. If the front or rear washer button is applied for greater than 10 seconds, the associated wiper motor will default the washer system to off and the washer system will be inoperative for that ignition cycle.

Software Safe Mode

The windshield wiper motor defaults to software safe mode when the run/park sensor does not sense the Hall-effect magnet inside the wiper motor. This can be caused by an obstruction of the windshield wipers, a binding linkage or loss of the Hall sensor signal. The motor continues to operate in a high/low-speed condition, and when turned off, the wipers immediately park on the windshield. If necessary, the wipers can be turned on and off until they return to the PARK position.

WINDSHIELD WIPER CIRCUIT FUNCTION TABLE

Multi-Function Switch Position	Circuit CRW07 (GY/BN)	Circuit CRW08 (VT/OG)	Circuit CRW19 (BU/OG)	Circuit CRW18 (VT/WH)	Circuit CRW17 (GN/VT)
OFF	OPEN	OPEN	OPEN	OPEN	OPEN
INT 1	OPEN	OPEN	OPEN	OPEN	GROUND
INT 2	OPEN	OPEN	OPEN	GROUND	GROUND
INT 3	OPEN	OPEN	OPEN	GROUND	OPEN
INT 4	OPEN	OPEN	GROUND	GROUND	OPEN
INT 5	OPEN	OPEN	GROUND	OPEN	OPEN
LOW	OPEN	OPEN	GROUND	OPEN	GROUND
HIGH	OPEN	GROUND	GROUND	OPEN	GROUND
WASH	GROUND	OPEN/GROUND	OPEN/GROUND	OPEN/GROUND	OPEN/GROUND

REAR WIPER CIRCUIT FUNCTION TABLE

Multi-Function Switch Position	Circuit CRW21 (YE/VT)	Circuit CRW20 (GY/YE)
OFF	OPEN	OPEN
INT 1	OPEN	GROUND
INT 2	GROUND	GROUND
WASH	GROUND	OPEN

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical

• Windshield washer hoses
• Wiper linkage
• Multi-function switch
	• Battery junction box (BJB) fuse:
	  ○ 58 (30A)
	• Smart junction box (SJB) fuses:
	  ○ 19 (25A)
	  ○ 43 (10A)
	  ○ 45 (5A)
	• Circuitry
	• Windshield wiper motor
	• Rear wiper motor

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: The windshield wiper motor does not communicate on the network. The windshield wiper motor provides wiper on/off status directly to the smart junction box (SJB).

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the SJB.
7. Carry out the network test.
   - If the scan tool responds with no communication from one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.

- If the network test passes, retrieve and record the continuous memory DTCs.

NOTE: The SJB may also be identified as the generic electronic module (GEM).

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB and PCM.
9. If the DTCs retrieved are related to the concern, go to the Smart Junction Box (SJB) DTC Chart or the **INTRODUCTION - GASOLINE ENGINES** article for PCM related DTCs. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **SYMPTOM CHART - WIPERS AND WASHERS** table.

Smart Junction Box (SJB) DTC Chart

DTC	Description	Action
B2008	Wipers On Signal Circuit Short to Ground	Go to **Pinpoint Test I** .

For a complete list of SJB DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart - Wipers and Washers

SYMPTOM CHART - WIPERS AND WASHERS

Condition	Possible Sources	Action
• The wipers are inoperative - windshield	• Fuse(s) • Multi-function switch • Circuitry • Windshield wiper motor	• Go to **Pinpoint Test A** .
• The wipers are inoperative - rear window	• Fuse(s) • Multi-function switch • Circuitry • Rear window wiper motor	• Go to **Pinpoint Test B** .
• The wipers stay on continuously - windshield	• Windshield wiper motor • Multi-function switch • Circuitry	• Go to **Pinpoint Test C** .
• The wipers stay on continuously - rear window	• Rear window wiper motor • Multi-function switch • Circuitry	• Go to **Pinpoint Test D** .
• The high/low wiper speeds do not operate correctly - windshield	• Multi-function switch • Circuitry • Windshield wiper motor	• Go to **Pinpoint Test E** .

• The intermittent wiper speed does not operate correctly - windshield	• Circuitry • Multi-function switch • Windshield wiper motor	• Go to **Pinpoint Test F** .
• The intermittent wiper speed does not operate correctly - rear window	• Multi-function switch • Circuitry • Rear window wiper motor	• Go to **Pinpoint Test G** .
• The wash and wipe function is inoperative - rear window	• Multi-function switch • Rear window wiper motor	• If the washer pump is inoperative, go to **Pinpoint Test H** . • If the washer pump is operative, INSTALL a new rear wiper motor. TEST the system for normal operation.
• The wash and wipe function is inoperative - windshield	• Windshield wiper motor	• If the washer pump is inoperative, go to **Pinpoint Test H** . • If the washer pump is operative, INSTALL a new windshield wiper motor. TEST the system for normal operation.
• The washer pump is inoperative	• Circuitry • Washer pump motor • Multi-function switch • Windshield wiper motor • Rear window wiper motor	• Go to **Pinpoint Test H** .
• The washer pump activates for 10 seconds whenever the ignition is turned on - front	• Circuitry	• CARRY OUT the Multi-Function Switch Component Test. Refer to COMPONENT TESTING.
-	• Multi-function switch	• CHECK circuit CRW17 (GY/BN) for a short to ground.
-	• Windshield wiper motor	• INSTALL a new windshield wiper motor. REFER to **Wiper Motor - Windshield**.
• The washer pump activates for 10 seconds whenever the ignition is turned on - rear	• Circuitry	• CARRY OUT the Multi-Function Switch Component Test. Refer to COMPONENT TESTING.
-		

-	• Multi-function switch • Rear wiper motor	• CHECK circuit CRW20 (GY/YE) for a short to ground. • INSTALL a new rear wiper motor. REFER to **Wiper Motor - Rear Window**.
• The speed dependent interval mode does not operate correctly	• Circuitry • Windshield wiper motor • PCM	• Go to **Pinpoint Test I** .
• The wipers will not park at the correct position	• Linkage • Windshield wiper motor	• If the wipers immediately stop on the windshield as soon as they are turned off, INSTALL a new windshield wiper motor.
-	• Pivot arm adjustment	• ADJUST pivot arm, REFER to **Wiper Blade and Pivot Arm Adjustment - Windshield**.
• The wipers will not park at the correct position - rear window	• Pivot arm adjustment	• ADJUST pivot arm, REFER to **Wiper Blade and Pivot Arm Adjustment - Rear Window**.
• The headlamps do not illuminate when the wipers are on	• Circuitry • Windshield wiper motor • Smart junction box (SJB)	• Go to **Pinpoint Test J** .

Pinpoint Tests

Pinpoint Test A: The Wipers are Inoperative - Windshield

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Wipers and Washers schematic and connector information.

Normal Operation

Under normal operation, the front windshield wiper motor receives power through circuits SBB58 (YE/RD) and CBP45 (YE). The front windshield wiper motor is grounded through circuit GD120 (BK/GN). The front windshield wiper motor receives open and ground inputs from the multi-function switch through circuits CRW17 (GN/VT), CRW18 (VT/WH), CRW19 (BU/OG) and CRW08 (VT/OG) to activate the wipers to the appropriate speeds. The multi-function switch receives ground through circuit GD116 (BK/VT).

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- Multi-function switch
- Windshield wiper motor

PINPOINT TEST A: THE WIPERS ARE INOPERATIVE - WINDSHIELD

A1 CHECK CIRCUITS SBB58 (YE/RD) AND CBP45 (YE) FOR VOLTAGE

- Key in OFF position.
- Disconnect: Windshield Wiper Motor C1552
- Key in ON position.

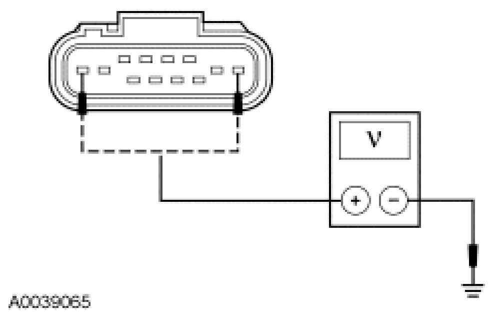


Fig. 1: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between windshield wiper motor C1552-5, circuit SBB58 (YE/RD), harness side and ground; and between windshield wiper motor C1552-8, circuit CBP45 (YE), harness side and ground.
- **Are the voltages greater than 10 volts?**

  YES : Go to A2.

  NO : VERIFY that battery junction box (BJB) fuse 58 (30A) and smart junction box (SJB) fuse 45 (5A) are OK. If OK, REPAIR the circuit(s) in question. TEST the system for normal operation.

A2 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN

- Key in OFF position.

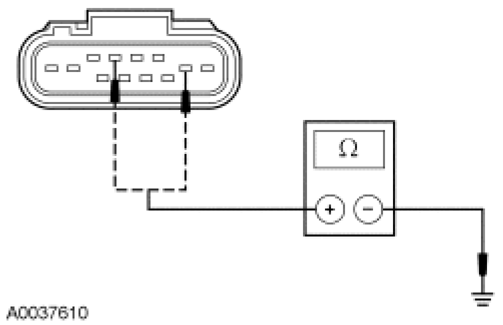


Fig. 2: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between windshield wiper motor C1552-6, circuit GD120 (BK/GN), harness side and ground; and between windshield wiper motor C1552-3, circuit GD120 (BK/GN), harness side and ground.
- **Are the resistances less than 5 ohms?**

  YES : Go to A3.

  NO : REPAIR the circuit(s) in question. TEST the system for normal operation.

A3 CHECK THE MULTI-FUNCTION SWITCH

- Disconnect: Multi-function Switch C202
- Carry out the Multi-Function Switch Component Test. Refer to COMPONENT TESTING.
- **Did the multi-function switch pass the component test?**

  YES : Go to A4.

  NO : INSTALL a new multi-function switch. REFER to **STEERING COLUMN SWITCHES** article.

A4 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

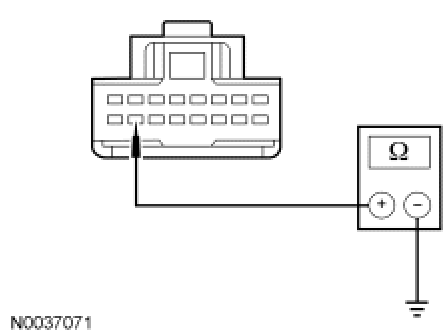


Fig. 3: Measuring Resistance Between Multi-Function Switch C202-15, Circuit GD116 (BK/VT) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between multi-function switch C202-15, circuit GD116 (BK/VT), harness side and ground.

- **Is the resistance less than 5 ohms?**

  YES : Go to A5.

  NO : REPAIR the circuit. TEST the system for normal operation.

A5 CHECK FOR SHORTS IN THE WINDSHIELD WIPER MOTOR HARNESS

- Measure the resistance at the windshield wiper motor electrical connector between the circuits shown in the table.

Windshield Wiper Motor C1552	Windshield Wiper Motor C1552
Pin 10, circuit CRW19 (BU/OG)	Pin 11, circuit CRW18 (VT/WH)
-	Pin 1, circuit CRW08 (VT/OG)
-	Pin 9, circuit CRW17 (GN/VT)
Pin 11, circuit CRW18 (VT/WH)	Pin 1, circuit CRW08 (VT/OG)
-	Pin 9, circuit CRW17 (GN/VT)
Pin 1, circuit CRW08 (VT/OG)	Pin 9, circuit CRW17 (GN/VT)

- **Is the resistance greater than 10,000 ohms for all measurements?**

  YES : Go to A6.

  NO : REPAIR the circuit. TEST the system for normal operation.

A6 CHECK FOR CORRECT WINDSHIELD WIPER MOTOR OPERATION

- Disconnect all windshield wiper motor connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all the windshield wiper motor connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new windshield wiper motor. REFER to **Wiper Motor - Windshield**.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test B: The Wipers are Inoperative - Rear Window

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Wipers and Washers schematic and connector information.

Normal Operation

Under normal operation, the rear window wiper motor receives power through circuits SBB19 (BU/RD) and CBP43 (GY). The rear window wiper motor is grounded through circuit GD149 (BK/GY). The rear window wiper motor receives open and ground inputs from the multi-function switch through circuits CRW20 (GY/YE) and CRW21 (YE/VT) to activate the wiper to the appropriate speeds. The multi-function switch supplies a ground input to the rear wiper motor on CRW21 (YE/VT) when INT 1 is selected. The multi-function switch supplies ground to the rear wiper motor on CRW21 (YE/VT) and CRW20 (GY/YE) when INT 2 is selected.

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- Multi-function switch
- Rear window wiper motor

PINPOINT TEST B: THE WIPERS ARE INOPERATIVE - REAR WINDOW

B1 CHECK CIRCUITS SBB19 (BU/RD) AND CBP43 (GY) FOR VOLTAGE

- Key in OFF position.
- Disconnect: Rear Window Wiper Motor C4218
- Key in ON position.

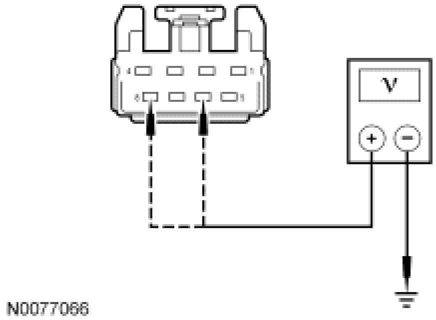


Fig. 4: Measuring Voltage Between Rear Window Wiper Motor Circuits, Harness Side And Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between rear window wiper motor C4218-6, circuit SBP19 (BU/RD), harness side and ground; and between rear window wiper motor C4218-8, circuit CBP43 (GY), harness side and ground.
- **Are the voltages greater than 10 volts?**

  YES : Go to B2.

  NO : VERIFY smart junction box (SJB) fuses 19 (25A) and 43 (10A) are OK. If OK, REPAIR the circuit(s) in question. TEST the system for normal operation.

B2 CHECK CIRCUIT GD149 (BK/GY) FOR AN OPEN

- Key in OFF position.

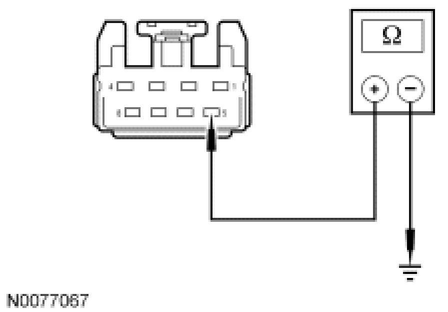


Fig. 5: Measuring Resistance Between Rear Window Wiper C4218-5, Circuit GD149 (BK/GY), Harness Side And Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between rear window wiper C4218-5, circuit GD149 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to B3.

  NO : REPAIR the circuit(s) in question. TEST the system for normal operation.

B3 CHECK THE MULTI-FUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multi-function Switch C202
- Carry out the Multi-Function Switch Component Test. Refer to COMPONENT TESTING.
- **Did the multi-function switch pass the component test?**

  YES : Go to B4.

  NO : INSTALL a new multi-function switch. REFER to **STEERING COLUMN SWITCHES** article.

B4 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

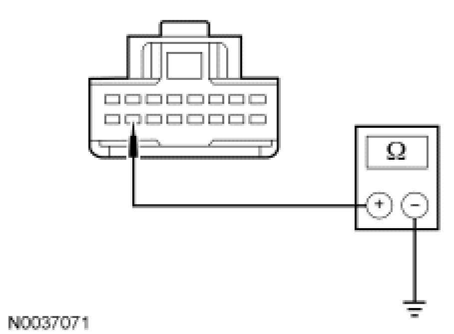


Fig. 6: Measuring Resistance Between Multi-Function Switch C202-15, Circuit GD116 (BK/VT) & Ground

Courtesy of FORD MOTOR CO.

- Measure the resistance between multi-function switch C202-15, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to B5.

  NO : REPAIR the circuit. TEST the system for normal operation.

B5 CHECK CIRCUIT CRW21 (YE/VT) FOR AN OPEN

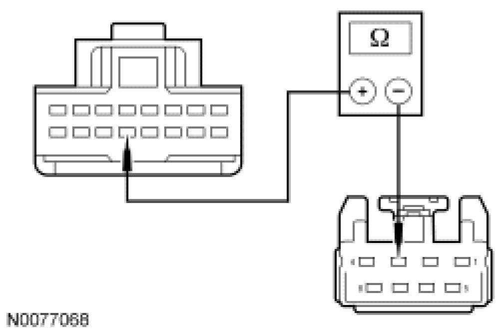


Fig. 7: Measuring Resistance Between Multi-Function Switch C202-13, Circuit CRW21 (YE/VT), Harness Side & Rear Window Wiper C4218-3, Circuit CRW21 (YE/VT), Harness Side
Courtesy of FORD MOTOR CO.

- Measure the resistance between multi-function switch C202-13, circuit CRW21 (YE/VT), harness side and rear window wiper C4218-3, circuit CRW21 (YE/VT), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to B6.

  NO : REPAIR the circuit. TEST the system for normal operation.

B6 CHECK FOR CORRECT WIPER MOTOR OPERATION

- Disconnect all wiper motor connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all wiper motor connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new rear window wiper motor. REFER to **Wiper Motor - Rear Window**.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test C: The Wipers Stay on Continuously - Windshield

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Wipers and Washers schematic and connector information.

Normal Operation

Under normal operation, the windshield wiper motor receives open and ground inputs from the multi-function switch through circuits CRW17 (GN/VT), CRW18 (VT/WH), CRW19 (BU/OG) and CRW08 (VT/OG) to activate the wipers to the appropriate speeds.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Windshield wiper motor
- Multi-function switch

PINPOINT TEST C: THE WIPERS STAY ON CONTINUOUSLY - WINDSHIELD

C1 CHECK THE MULTI-FUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multi-function Switch C202
- Carry out the Multi-Function Switch Component Test. Refer to COMPONENT TESTING.
- **Did the multi-function switch pass the component test?**

  YES : Go to C2.

  NO : INSTALL a new multi-function switch. REFER to **STEERING COLUMN SWITCHES** article.

C2 CHECK CIRCUITS CRW19 (BU/OG), CRW18 (VT/WH), CRW08 (VT/OG) OR CRW17 (GN/VT) FOR A SHORT TO GROUND

- Disconnect: Windshield Wiper Motor C1552

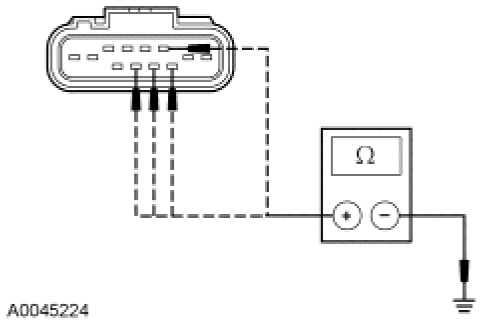


Fig. 8: Checking Circuits For Short To Ground
Courtesy of FORD MOTOR CO.

- Using the following table, measure the resistance between windshield wiper motor C1552 harness side and ground:

Windshield Wiper Motor C1552	Ground
C1552-10, circuit CRW19 (BU/OG)	ground
C1552-11, circuit CRW18 (VT/WH)	ground
C1552-1, circuit CRW08 (VT/OG)	ground
C1552-9, circuit CRW17 (GN/VT)	ground

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to C3.

  NO : REPAIR the circuit(s) in question. TEST the system for normal operation.

C3 CHECK FOR CORRECT WIPER MOTOR OPERATION

- Disconnect all wiper motor connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all wiper motor connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new windshield wiper motor. REFER to **Wiper Motor - Windshield**.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test D: The Wipers Stay on Continuously - Rear Window

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Wipers and Washers schematic and connector information.

Normal Operation

Under normal operation, the rear window wiper motor receives open and ground inputs from the multi-function switch through circuits CRW20 (GY/YE) and CRW21 (YE/VT) to activate the wiper to the appropriate speeds. The multi-function switch supplies a ground input to the rear wiper motor on CRW21 (YE/VT) when INT 1 is selected. The multi-function switch supplies ground to the rear wiper motor on CRW21 (YE/VT) and CRW20 (GY/YE) when INT 2 is selected.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Rear window wiper motor

- Multi-function switch

PINPOINT TEST D: THE WIPERS STAY ON CONTINUOUSLY - REAR WINDOW

D1 CHECK THE MULTI-FUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multi-function Switch C202
- Carry out the Multi-Function Switch Component Test. Refer to COMPONENT TESTING.
- **Did the multi-function switch pass the component test?**

  YES : Go to D2.

  NO : INSTALL a new multi-function switch. REFER to **STEERING COLUMN SWITCHES** article.

D2 CHECK CIRCUITS CRW20 (GY/YE) AND CRW21 (YE/VT) FOR A SHORT TO GROUND

- Disconnect: Rear Window Wiper Motor C4218

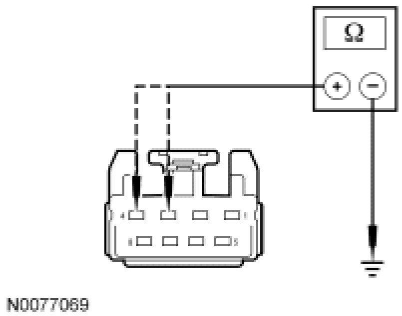


Fig. 9: Measuring Resistance Between Rear Window Wiper Motor Circuits, Harness Side And Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between rear window wiper motor C4218-4, circuit CRW20 (GY/YE), harness side and ground; and between rear window wiper motor C4218-3, circuit CRW21 (YE/VT), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to D3.

  NO : REPAIR the circuit(s) in question. TEST the system for normal operation.

D3 CHECK FOR CORRECT WIPER MOTOR OPERATION

- Disconnect all wiper motor connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all wiper motor connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.

- **Is the concern still present?**

  YES : INSTALL a new rear window wiper motor. REFER to **Wiper Motor - Rear Window**.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test E: The High/Low Wiper Speeds Do Not Operate Correctly - Windshield

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Wipers and Washers schematic and connector information.

Normal Operation

Under normal operation, the windshield wiper motor receives open and ground inputs from the multi-function switch through circuits CRW17 (GN/VT), CRW18 (VT/WH), CRW19 (BU/OG) and CRW08 (VT/OG) to activate the wipers to the appropriate speeds.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Windshield wiper motor
- Multi-function switch

PINPOINT TEST E: THE HIGH/LOW WIPER SPEEDS DO NOT OPERATE CORRECTLY - WINDSHIELD

E1 CHECK THE MULTI-FUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multi-function Switch C202
- Carry out the Multi-Function Switch Component Test. Refer to COMPONENT TESTING.
- **Did the multi-function switch pass the component test?**

  YES : Go to E2.

  NO : INSTALL a new multi-function switch. REFER to **STEERING COLUMN SWITCHES** article. TEST the system for normal operation.

E2 CHECK CIRCUITS CRW19 (BU/OG), CRW08 (VT/OG) AND CRW17 (GN/VT) FOR AN OPEN

- Disconnect: Windshield Wiper Motor C1552

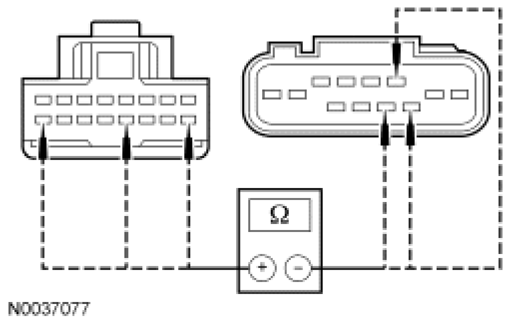


Fig. 10: Measuring Resistance Between Multi-Function Switch C202 Harness Side And Windshield Wiper Motor C1552 Harness Side Circuits
Courtesy of FORD MOTOR CO.

- Using the following table, measure the resistance between multi-function switch C202 harness side and windshield wiper motor C1552 harness side:

Multi-function Switch C202	Windshield Wiper Motor C1552
C202-16, circuit CRW19 (BU/OG)	C1552-10, circuit CRW19 (BU/OG)
C202-9, circuit CRW08 (VT/OG)	C1552-1, circuit CRW08 (VT/OG)
C202-12, circuit CRW17 (GN/VT)	C1552-9, circuit CRW17 (GN/VT)

- **Is the resistance less than 5 ohms?**

  YES : Go to E3.

  NO : REPAIR the circuit(s) in question. TEST the system for normal operation.

E3 CHECK CIRCUITS CRW19 (BU/OG), CRW08 (VT/OG) OR CRW17 (GN/VT) FOR A SHORT TO GROUND

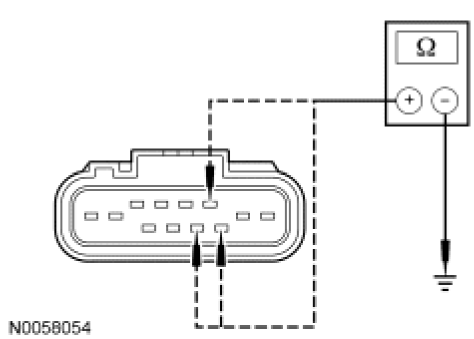


Fig. 11: Checking Circuits For Short To Ground
Courtesy of FORD MOTOR CO.

- Using the following table, measure the resistance between windshield wiper motor C1552 harness side and ground:

Windshield Wiper Motor C1552	Ground
C1552-10, circuit CRW19 (BU/OG)	ground
C1552-1, circuit CRW08 (VT/OG)	ground
C1552-9, circuit CRW17 (GN/VT)	ground

- **Is the resistance greater than 10,000 ohms?**

  YES : Go to E4.

  NO : REPAIR the circuit(s) in question. TEST the system for normal operation.

E4 CHECK FOR SHORTS IN THE WINDSHIELD WIPER MOTOR HARNESS

- Measure the resistance at the windshield wiper motor electrical connector between the circuits shown in the table.

Windshield Wiper Motor C1552	Windshield Wiper Motor C1552
Pin 10, circuit CRW19 (BU/OG)	Pin 11, circuit CRW18 (VT/WH)
-	Pin 1, circuit CRW08 (VT/OG)
-	Pin 9, circuit CRW17 (GN/VT)
Pin 11, circuit CRW18 (VT/WH)	Pin 1, circuit CRW08 (VT/OG)
-	Pin 9, circuit CRW17 (GN/VT)
Pin 1, circuit CRW08 (VT/OG)	Pin 9, circuit CRW17 (GN/VT)

- **Is the resistance greater than 10,000 ohms for all measurements?**

  YES : Go to E5.

  NO : REPAIR the circuit. TEST the system for normal operation.

E5 CHECK FOR CORRECT WIPER MOTOR OPERATION

- Disconnect all wiper motor connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all wiper motor connectors and make sure they seat correctly.

- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new windshield wiper motor. REFER to **Wiper Motor - Windshield**.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test F: The Intermittent Wiper Speed Does Not Operate Correctly - Windshield

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Wipers and Washers schematic and connector information.

Normal Operation

Under normal operation, the windshield wiper motor receives open and ground inputs from the multi-function switch through circuits CRW17 (GN/VT), CRW18 (VT/WH), CRW19 (BU/OG) and CRW08 (VT/OG) to activate the wipers to the appropriate speeds.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Windshield wiper motor
- Multi-function switch

PINPOINT TEST F: THE INTERMITTENT WIPER SPEED DOES NOT OPERATE CORRECTLY - WINDSHIELD

F1 CHECK THE MULTI-FUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multi-function Switch C202
- Carry out the Multi-Function Switch Component Test. Refer to COMPONENT TESTING.
- **Did the multi-function switch pass the component test?**

  YES : Go to F2.

  NO : INSTALL a new multi-function switch. REFER to **STEERING COLUMN SWITCHES** article. TEST the system for normal operation.

F2 CHECK CIRCUIT CRW19 (BU/OG), CRW18 (VT/WH) OR CRW17 (GN/VT) FOR AN OPEN

- Disconnect: Windshield Wiper Motor C1552

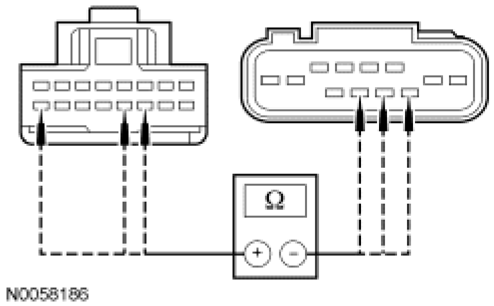


Fig. 12: Checking Circuits For Open
Courtesy of FORD MOTOR CO.

- Using the following table, measure the resistance between multi-function switch C202 harness side and windshield wiper motor C1552 harness side:

Multi-function Switch C202	Windshield Wiper Motor C1552
C202-16, circuit CRW19 (BU/OG)	C1552-10, circuit CRW19 (BU/OG)
C202-12, circuit CRW17 (GN/VT)	C1552-9, circuit CRW17 (GN/VT)
C202-11, circuit CRW18 (VT/WH)	C1552-11, circuit CRW18 (VT/WH)

- **Is the resistance less than 5 ohms?**

  YES : Go to F3.

  NO : REPAIR the circuit(s) in question. TEST the system for normal operation.

F3 CHECK CIRCUIT CRW19 (BU/OG), CRW18 (VT/WH) OR CRW17 (GN/VT) FOR A SHORT TO GROUND

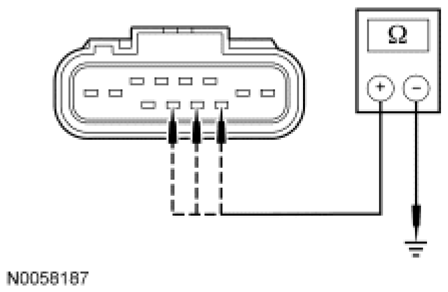


Fig. 13: Checking Circuits For Short To Ground
Courtesy of FORD MOTOR CO.

- Using the following table, measure the resistance between windshield wiper motor C1552 harness side and ground:

Windshield Wiper Motor C1552	Ground
C1552-10, circuit CRW19 (BU/OG)	ground
C1552-11, circuit CRW18 (VT/WH)	ground
C1552-9, circuit CRW17 (GN/VT)	ground

- **Is the resistance greater than 10,000 ohms?**

  YES : Go to F4.

  NO : REPAIR the circuit(s) in question. TEST the system for normal operation.

F4 CHECK FOR SHORTS IN THE WINDSHIELD WIPER MOTOR HARNESS

- Measure the resistance at the windshield wiper motor electrical connector between the circuits shown in the table.

Windshield Wiper Motor C1552	Windshield Wiper Motor C1552
Pin 10, circuit CRW19 (BU/OG)	Pin 11, circuit CRW18 (VT/WH)
-	Pin 1, circuit CRW08 (VT/OG)
-	Pin 9, circuit CRW17 (GN/VT)
Pin 11, circuit CRW18 (VT/WH)	Pin 1, circuit CRW08 (VT/OG)
-	Pin 9, circuit CRW17 (GN/VT)
Pin 1, circuit CRW08 (VT/OG)	Pin 9, circuit CRW17 (GN/VT)

- **Is the resistance greater than 10,000 ohms for all measurements?**

  YES : Go to F5.

  NO : REPAIR the circuit. TEST the system for normal operation.

F5 CHECK FOR CORRECT WIPER MOTOR OPERATION

- Disconnect all wiper motor connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all wiper motor connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.

- **Is the concern still present?**

  YES : INSTALL a new windshield wiper motor. REFER to **Wiper Motor - Windshield**.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test G: The Intermittent Wiper Speed Does Not Operate Correctly - Rear Window

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Wipers and Washers schematic and connector information.

Normal Operation

Under normal operation, the rear window wiper motor receives open and ground inputs from the multi-function switch through circuits CRW20 (GY/YE) and CRW21 (YE/VT) to activate the wiper to the appropriate speeds. The multi-function switch supplies a ground input to the rear wiper motor on CRW21 (YE/VT) when INT 1 is selected. The multi-function switch supplies ground to the rear wiper motor on CRW21 (YE/VT) and CRW20 (GY/YE) when INT2 is selected.

This pinpoint test is intended to diagnose the following:

- Rear window wiper motor
- Multi-function switch

PINPOINT TEST G: THE INTERMITTENT WIPER SPEED DOES NOT OPERATE CORRECTLY - REAR WINDOW

G1 VERIFY REAR WASHER PUMP OPERATION

- Key in ON position.
- Activate the rear washer pump.
- **Does the rear washer pump activate?**

  YES : Go to G2.

  NO : Go to **Pinpoint Test I** .

G2 CHECK THE MULTI-FUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multi-function Switch C202
- Carry out the Multi-Function Switch Component Test. Refer to COMPONENT TESTING.
- **Did the multi-function switch pass the component test?**

  YES : Go to G3.

  NO : INSTALL a new multi-function switch. REFER to **STEERING COLUMN SWITCHES** article.

G3 CHECK FOR A SHORT BETWEEN CIRCUITS CRW20 (GY/YE) AND CRW21 (YE/VT)

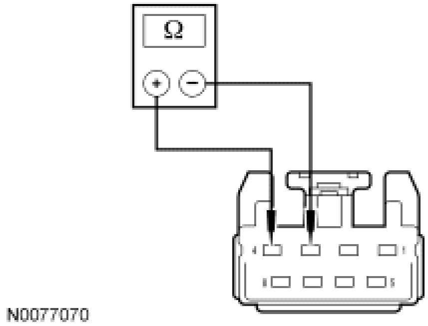


Fig. 14: Measuring Resistance Between Rear Window Wiper Circuits
Courtesy of FORD MOTOR CO.

- Measure the resistance between rear window wiper C4218-4, circuit CRW20 (GY/YE), harness side and rear window wiper C4218-3, circuit CRW21 (YE/VT), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to G4.

  NO : REPAIR the circuit. TEST the system for normal operation.

G4 CHECK FOR CORRECT WIPER MOTOR OPERATION

- Disconnect all wiper motor connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all wiper motor connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new rear window wiper motor. REFER to **Wiper Motor - Rear Window**.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test H: The Washer Pump is Inoperative

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Wipers and Washers schematic and connector information.

Normal Operation

Under normal operation, the windshield washer pump motor is grounded through internal relays in the wiper motors using circuits CRW14 (BU/WH) and CRW23 (VT/GN). The multi-function switch provides input to the windshield wiper motor through circuit CRW07 (GY/BN) to activate the washer. The windshield wiper motor activates the internal relay and then provides power through circuit CRW14 (BU/WH). When the rear window washer is activated, the multi-function switch provides input to the rear window wiper motor through circuit CRW20 (GY/YE) to activate the washer. The rear window wiper motor activates the internal relay and then provides power through circuit CRW23 (VT/GN).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Multi-function switch
- Washer pump motor
- Windshield wiper motor
- Rear window wiper motor

PINPOINT TEST H: THE WASHER PUMP IS INOPERATIVE

H1 CHECK CIRCUIT CRW14 (BU/WH) FOR GROUND

- Disconnect: Washer Pump Motor C137
- Key in ON position.

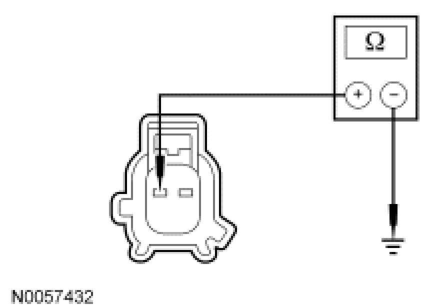


Fig. 15: Measuring Resistance Between Washer Pump Motor C137-2, Circuit CRW14 (BU/WH) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between washer pump motor C137-2, circuit CRW14 (BU/WH) harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to H3.

  NO : Go to H2.

H2 CHECK CIRCUIT CRW14 (BU/WH) FOR AN OPEN

- Key in OFF position.
- Disconnect: Windshield Wiper Motor C1552

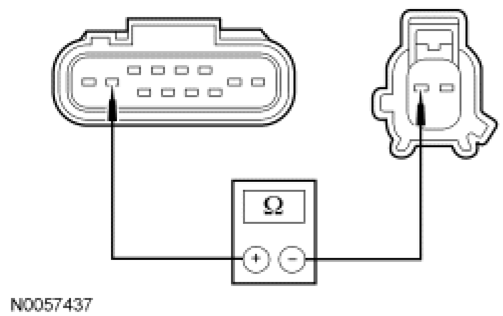


Fig. 16: Measuring Resistance Between Windshield Wiper Motor C1552-7, CRW14 (BU/WH) & Washer Pump Motor C137-2
Courtesy of FORD MOTOR CO.

- Measure the resistance between windshield wiper motor C1552-7, circuit CRW14 (BU/WH), harness side and washer pump motor C137-2, circuit CRW14 (BU/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to H13.

  NO : REPAIR the circuit. TEST the system for normal operation.

H3 CHECK CIRCUIT CRW23 (VT/GN) FOR GROUND

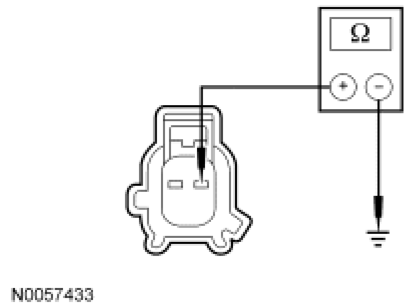


Fig. 17: Measuring Resistance Between Washer Pump Motor C137-1, Circuit CRW23 (VT/GN) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between washer pump motor C137-1, circuit CRW23 (VT/GN) harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to H5.

  NO : Go to H4.

H4 CHECK CIRCUIT CRW23 (VT/GN) FOR AN OPEN

- Key in OFF position.
- Disconnect: Rear Window Wiper Motor C4218

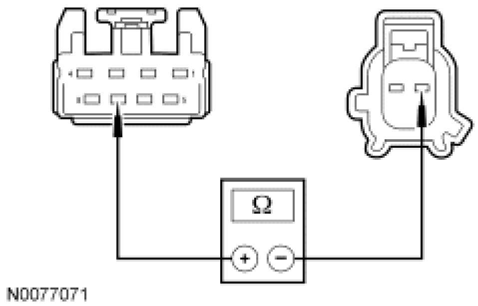


Fig. 18: Measuring Resistance Between Rear Window Wiper Motor C4218-7, Circuit CRW23 (VT/GN), Harness Side And Washer Pump Motor C137-1, Circuit CRW23 (VT/GN), Harness Side
Courtesy of FORD MOTOR CO.

- Measure the resistance between rear window wiper motor C4218-7, circuit CRW23 (VT/GN), harness side and washer pump motor C137-1, circuit CRW23 (VT/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to H14.

  NO : REPAIR the circuit. TEST the system for normal operation.

H5 CHECK CIRCUIT CRW14 (BU/WH) FOR VOLTAGE

NOTE:	**Holding the multi-function switch to the windshield wiper WASH position for greater than 10 seconds will default the washer system to OFF for that ignition cycle.**

- Key in ON position.

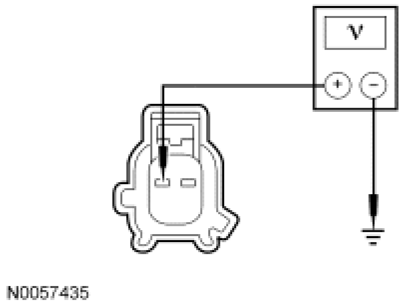


Fig. 19: Measuring Voltage Between Washer Pump Motor C137-2, Circuit CRW14 (BU/WH) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between washer pump motor C137-2, circuit CRW14 (BU/WH) harness side and ground while depressing the multi-function switch to the windshield wiper WASH position.
- **Is the voltage greater than 10 volts?**

YES : Go to H9.

NO : Go to H6.

H6 CHECK CIRCUIT CRW14 (BU/WH) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: Windshield Wiper Motor C1552

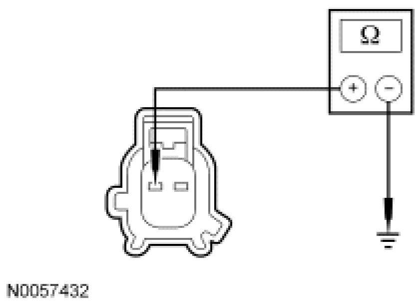


Fig. 20: Measuring Resistance Between Washer Pump Motor C137-2, Circuit CRW14 (BU/WH) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between washer pump motor C137-2, circuit CRW14 (BU/WH), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

YES : Go to H7.

NO : REPAIR the circuit. TEST the system for normal operation.

H7 CHECK THE MULTI-FUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multi-function Switch C202
- Carry out the Multi-Function Switch Component Test. Refer to COMPONENT TESTING.
- **Did the multi-function switch pass the component test?**

YES : Go to H8.

NO : INSTALL a new multi-function switch. REFER to **STEERING COLUMN SWITCHES** article.

H8 CHECK CIRCUIT CRW07 (GY/BN) FOR AN OPEN OR SHORT TO GROUND

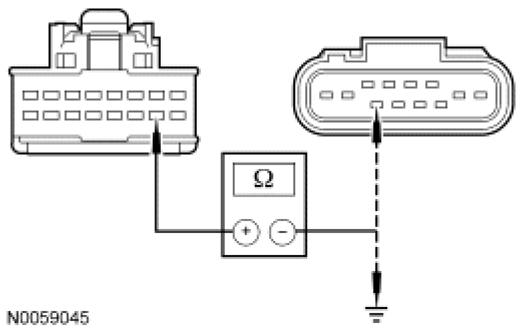


Fig. 21: Checking Circuit For Open Or Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between windshield wiper motor C1552-12, circuit CRW07 (GY/BN), harness side and multi-function switch C202-10, circuit CRW07 (GY/BN), harness side; and between multi-function switch C202-10, circuit CRW07 (GY/BN), harness side and ground.
- **Is the resistance less than 5 ohms between multi-function switch and wiper motor; and greater than 10,000 ohms between multi-function switch and ground?**

  YES : Go to H13.

  NO : REPAIR the circuit. TEST the system for normal operation.

H9 CHECK CIRCUIT CRW23 (VT/GN) FOR VOLTAGE

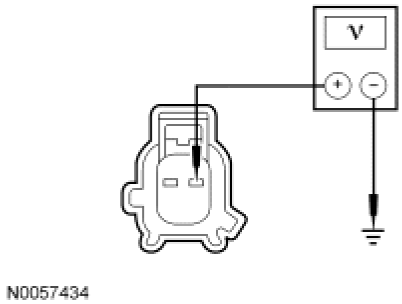


Fig. 22: Measuring Voltage Between Washer Pump Motor C137-1, Circuit CRW23 (VT/GN) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between washer pump motor C137-1, circuit CRW23 (VT/GN) harness side and ground while depressing the multi-function switch to the rear window wiper WASH position.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new washer pump. REFER to **Washer Pump**. TEST the system for normal operation.

  NO : Go to H10.

H10 CHECK CIRCUIT CRW23 (VT/GN) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: Rear Window Wiper Motor C4218

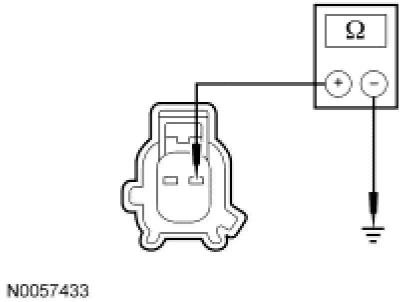


Fig. 23: Measuring Resistance Between Washer Pump Motor C137-1, Circuit CRW23 (VT/GN) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between washer pump motor C137-1, circuit CRW23 (VT/GN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to H11.

  NO : REPAIR the circuit. TEST the system for normal operation.

H11 CHECK THE MULTI-FUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multi-function Switch C202
- Carry out the Multi-Function Switch Component Test. Refer to COMPONENT TESTING.
- **Did the multi-function switch pass the component test?**

  YES : Go to H12.

  NO : INSTALL a new multi-function switch. REFER to **STEERING COLUMN SWITCHES** article.

H12 CHECK CIRCUIT CRW20 (GY/YE) FOR AN OPEN OR SHORT TO GROUND

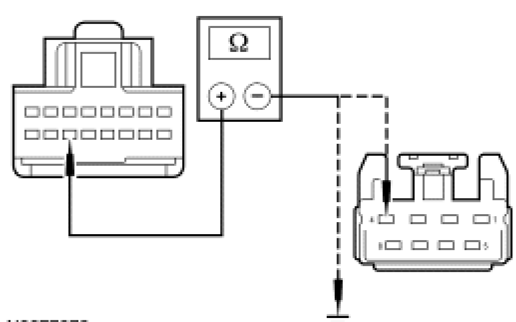


Fig. 24: Measuring Resistance Between Windshield Wiper Motor C4218-4, Circuit CRW20 (GY/YE), Harness Side And Multi-Function Switch Circuits, Harness Side
Courtesy of FORD MOTOR CO.

- Measure the resistance between windshield wiper motor C4218-4, circuit CRW20 (GY/YE), harness side and multi-function switch C202-14, circuit CRW20 (GY/YE), harness side; and between multi-function switch C202-14, circuit CRW20 (GY/YE), harness side and ground.

- **Is the resistance less than 5 ohms between multi-function switch and wiper motor; and greater than 10,000 ohms between multi-function switch and ground?**

  YES : Go to H14.

  NO : REPAIR the circuit. TEST the system for normal operation.

H13 CHECK THE WINDSHIELD WIPER MOTOR

- Disconnect all wiper motor connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all wiper motor connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new windshield wiper motor. REFER to **Wiper Motor - Windshield**.

  NO : The system is operating correctly at this time. Concern may have been caused by binding or incorrect pivot arm adjustment. REFER to **WIPER BLADE AND PIVOT ARM ADJUSTMENT - WINDSHIELD**. TEST the system for normal operation.

H14 CHECK THE REAR WINDOW WIPER MOTOR

- Disconnect all wiper motor connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all wiper motor connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new rear window wiper motor. REFER to **Wiper Motor - Rear Window**.

  NO : The system is operating correctly at this time. Concern may have been caused by binding or incorrect pivot arm adjustment. REFER to **WIPER BLADE AND PIVOT ARM ADJUSTMENT - REAR WINDOW**. TEST the system for normal operation.

Pinpoint Test I: The Speed Dependent Interval Mode Does Not Operate Correctly

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Wipers and Washers schematic and connector information.

Normal Operation

Under normal operation, the windshield wiper motor receives vehicle speed information from the PCM through circuit VMC05 (VT/OG). The windshield wiper motor electronics then determine the speed of the windshield wiper motor. The speed dependent wipers function in all INT modes except INT 1.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- PCM
- Windshield wiper motor

PINPOINT TEST I: THE SPEED DEPENDENT INTERVAL MODE DOES NOT OPERATE CORRECTLY

I1 REVIEW THE DTCs

- Review the DTCs from the PCM self-test.
- **Are any vehicle speed sensor (VSS) related DTCs present?**

  YES : REFER to the **INTRODUCTION - GASOLINE ENGINES** article to diagnose the VSS.

  NO : Go to I2.

I2 CHECK CIRCUIT VMC05 (VT/OG) FOR AN OPEN

- Key in OFF position.
- Disconnect: PCM C175b
- Disconnect: Windshield Wiper Motor C1552

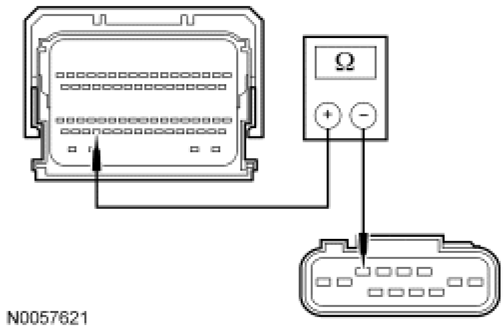


Fig. 25: Measuring Resistance Between PCM C175B-63, Circuit VMC05 (VT/OG) & Windshield Wiper Motor C125-4
Courtesy of FORD MOTOR CO.

- Measure the resistance between PCM C175b-63, circuit VMC05 (VT/OG), harness side and windshield wiper motor C125-4, circuit VMC05 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to I3.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

I3 CHECK CIRCUIT VMC05 (VT/OG) FOR A SHORT TO GROUND

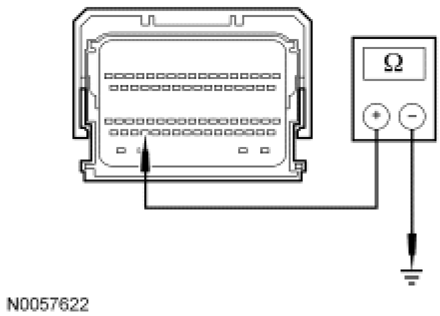


Fig. 26: Measuring Resistance Between PCM C175B-63, Circuit VMC05 (VT/OG) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between PCM C175b-63, circuit VMC05 (VT/OG), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to I4.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

I4 CHECK CIRCUIT VMC05 (VT/OG) FOR A SHORT TO VOLTAGE

- Key in ON position.

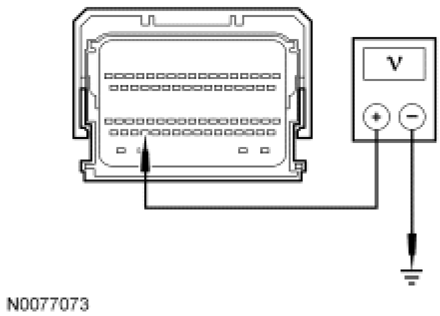


Fig. 27: Measuring Voltage Between PCM C175b-63, Circuit VMC05 (VT/OG), Harness Side And Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between PCM C175b-63, circuit VMC05 (VT/OG), harness side and ground.
- **Is any voltage present?**

  YES : Go to I5.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

I5 CHECK FOR CORRECT WIPER MOTOR OPERATION

- Disconnect all wiper motor connectors.
- Check for:
  - corrosion.
  - pushed-out pins.

- Connect all wiper motor connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new windshield wiper motor. REFER to **Wiper Motor - Windshield**.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test J: The Headlamps Do Not Illuminate When the Wipers are On

Refer to appropriate SYSTEM WIRING DIAGRAMS article for Wipers and Washers schematic and connector information.

Normal Operation

If equipped with automatic headlamps, the smart junction box (SJB) will illuminate the exterior lamps, including the parking lamps, when the front wipers are on for more than 10 seconds. The SJB monitors the front wiper motor on circuit CRW01 (WH).

- DTC B2008 Wipers On Signal Circuit Short to Ground - Short to ground on wiper motor on input circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Windshield wiper motor
- SJB

PINPOINT TEST J: THE HEADLAMPS DO NOT ILLUMINATE WHEN THE WIPERS ARE ON

J1 CHECK CIRCUIT CRW01 (WH) FOR VOLTAGE

- Key in OFF position.
- Disconnect: Windshield Wiper Motor C1552
- Key in ON position.

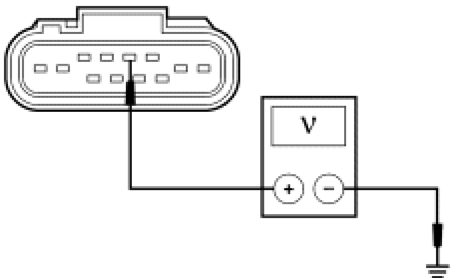


Fig. 28: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between windshield wiper motor C1552-2 circuit CRW01 (WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new windshield wiper motor. REFER to **Wiper Motor - Windshield**. TEST the system for normal operation.

  NO : Go to J2.

J2 CHECK CIRCUIT CRW01 (WH) FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280F

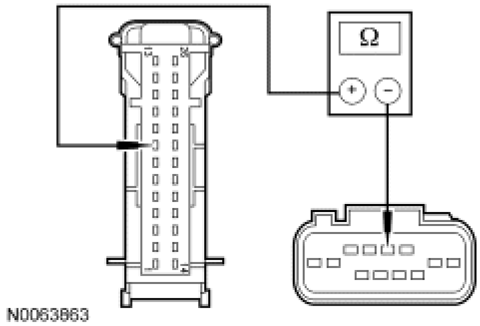


Fig. 29: Measuring Resistance Between SJB C2280F-8 Circuit CRW01 (WH), Harness Side And Windshield Wiper Motor C1552-2 Circuit, & Between SJB C2280F-8 Circuit CRW01 (WH), Harness Side And Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between SJB C2280F-8 circuit CRW01 (WH), harness side and windshield wiper motor C1552-2 circuit CRW01 (WH); then between SJB C2280F-8 circuit CRW01 (WH), harness side and ground.
- **Is the resistance less than 5 ohms between the SJB and windshield wiper motor and greater than 10,000 ohms between the SJB and ground?**

  YES : Go to J3.

  NO : REPAIR the circuit. TEST the system for normal operation.

J3 CHECK FOR CORRECT MODULE OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all the SJB connectors and make sure they are seated correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CLEAR the DTCs. REPEAT the SJB self-test.

NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

GENERAL PROCEDURES

WIPER BLADE AND PIVOT ARM ADJUSTMENT - WINDSHIELD

1. Cycle and park the windshield wipers.
2. Verify that the RH and LH windshield wiper blades are located at the alignment marks on the glass.

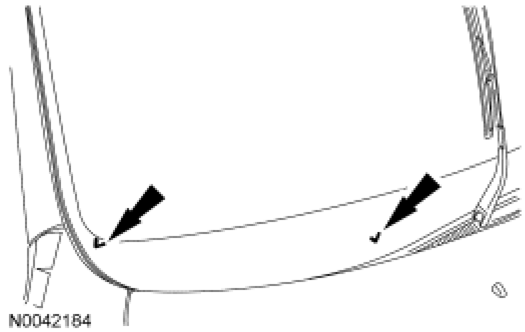


Fig. 30: Locating RH & LH Wiper Blade Alignment Marks
Courtesy of FORD MOTOR CO.

NOTE: Make sure there is no mechanical binding in the linkage preventing the wiper arms from returning to the fully parked position.

3. If necessary, remove the windshield wiper pivot arm nuts and the windshield wiper pivot arms and reposition them to the correct locations.
   - To install, tighten to 30 N.m (22 lb-ft).

WIPER BLADE AND PIVOT ARM ADJUSTMENT - REAR WINDOW

1. Cycle and park the rear window wiper.
2. Verify that the rear wiper blade is positioned at the first defroster line located on the rear window glass.

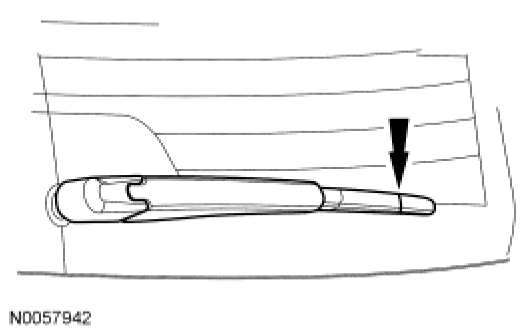


Fig. 31: Identifying Rear Wiper Blade
Courtesy of FORD MOTOR CO.

3. If necessary, remove the rear wiper pivot arm nut and the rear wiper pivot arm and reposition it to the correct location.
   - To install, tighten to 12 Nm (9 lb-ft).

WASHER HOSE REPAIR

1. Locate and verify the leaking washer hose.
2. Cut the hose cleanly and remove the damaged portion of the washer hose.
3. Install a windshield washer hose adapter between the cut ends of the hose.

NOTE: **In difficult cases, clamping may be required.**

4. Install a segment of 6.4 mm (0.25 in) inside diameter black rubber hose over the ends of the washer hose, and clamp both ends of the rubber hose using spring clamps.

REMOVAL AND INSTALLATION

WIPER AND WASHER SYSTEM - EXPLODED VIEW

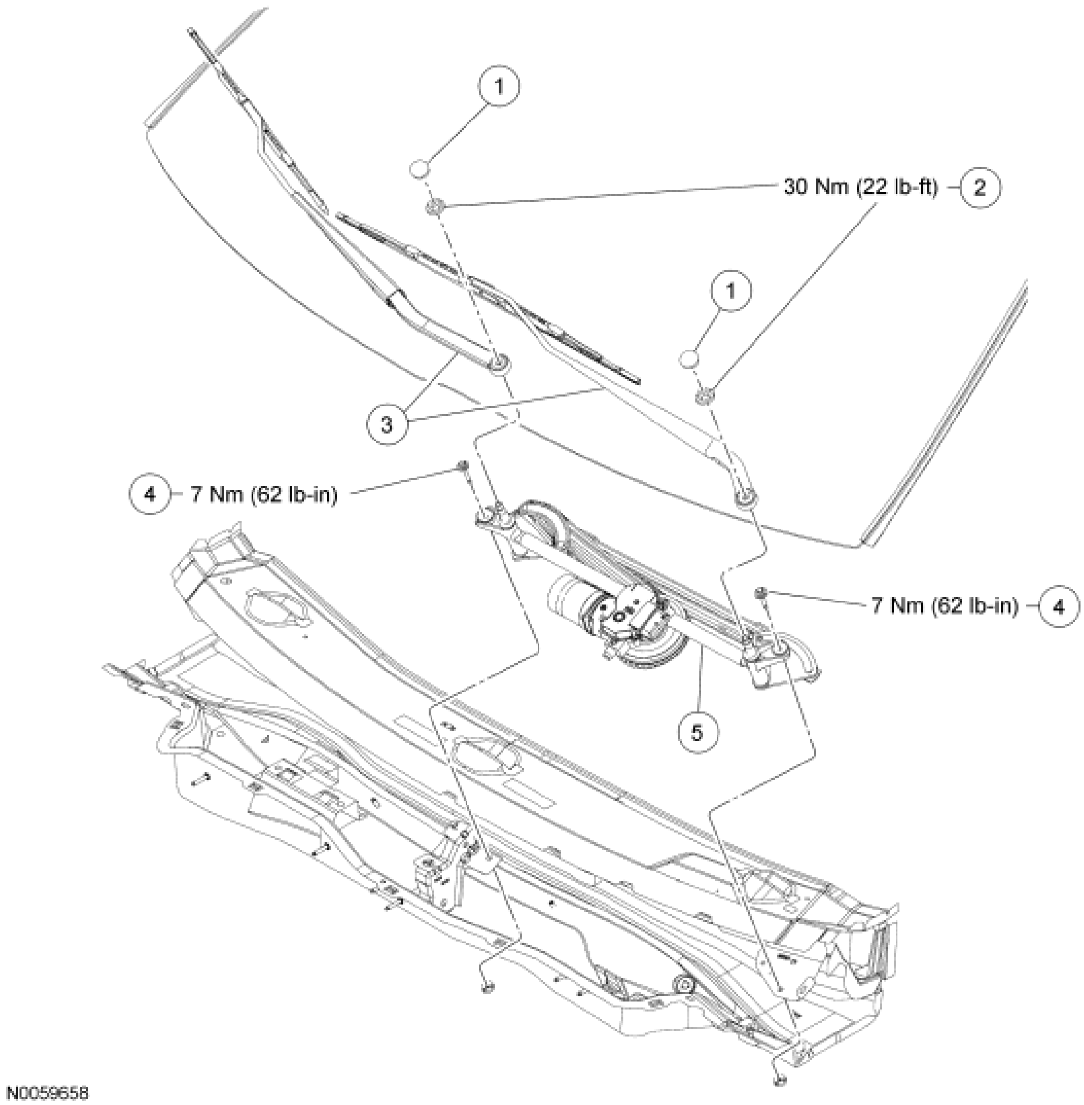


Fig. 32: Exploded View Of Front Wiper & Washer System With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	17C526	Windshield wiper pivot arm nut covers
2	W708841	Windshield wiper pivot arm nuts
3	17526 RH/ 17527 LH	Windshield wiper pivot arms
4	W707532	Windshield wiper mounting arm and pivot shaft assembly bolts (2 required)
5	17508	Windshield wiper mounting arm and pivot shaft assembly

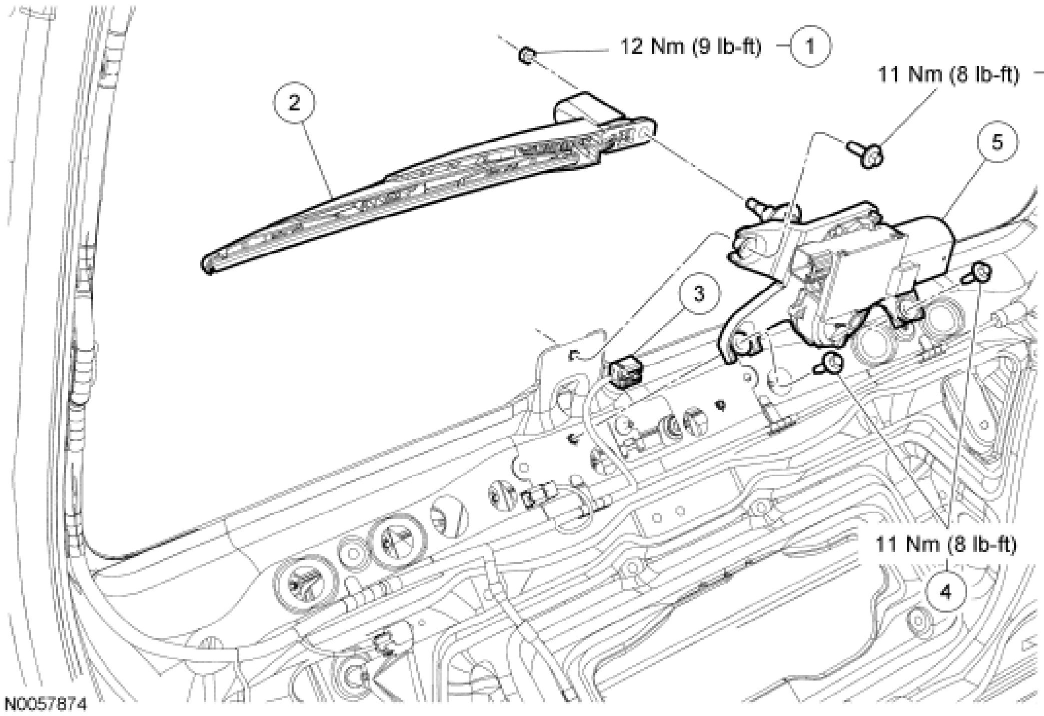


Fig. 33: Exploded View Of Rear Wiper & Washer System With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W708312	Rear wiper pivot arm nut
2	17526	Rear wiper pivot arm
3	-	Rear wiper motor electrical connector
4	N807658	Rear wiper motor screws (3 required)
5	17D400	Rear wiper motor

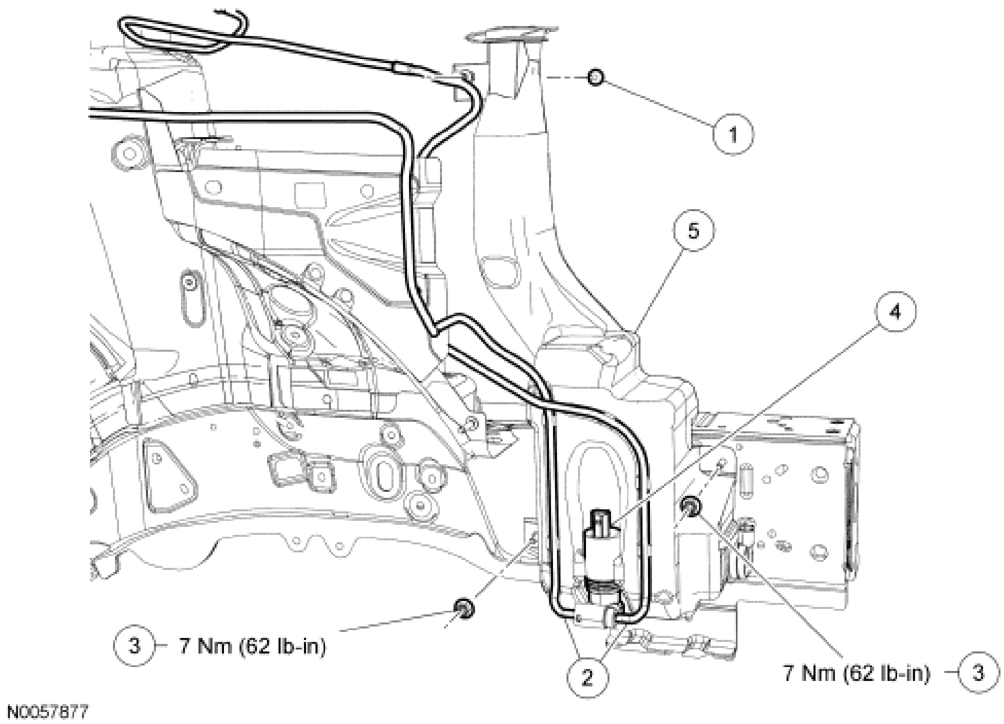


Fig. 34: Exploded View Of Washer Pump & Reservoir With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N807658	Windshield washer reservoir filler neck retaining bolt
2	17A605	Windshield washer reservoir hoses
3	W702751	Windshield washer reservoir nuts (2 required)
4	17664	Windshield washer pump
5	17618	Windshield washer reservoir

1. For additional information, refer to the procedures in this service information.

WIPER PIVOT ARM - FRONT

REMOVAL AND INSTALLATION

1. Remove the front wiper pivot arm caps.

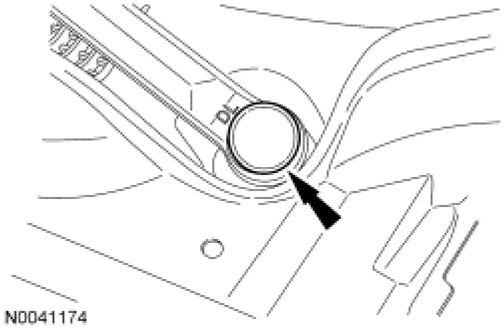


Fig. 35: Locating Wiper Pivot Arm Cap
Courtesy of FORD MOTOR CO.

2. Remove the front wiper pivot arm retaining nuts and the front wiper pivot arms.
   - To install, tighten to 30 N.m (22 lb-ft).

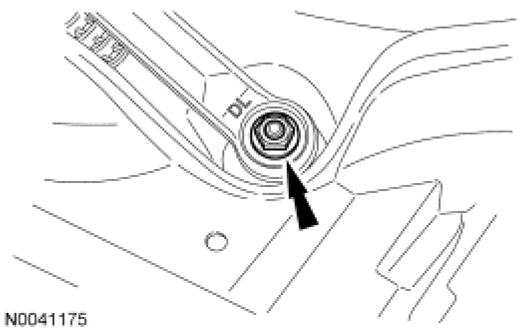


Fig. 36: Locating Wiper Pivot Arm Retaining Nut
Courtesy of FORD MOTOR CO.

3. To install, reverse the removal procedure.
   - To adjust the windshield wiper pivot arms, refer to **Wiper Blade and Pivot Arm Adjustment - Windshield**.

WIPER MOUNTING ARM AND PIVOT SHAFT

REMOVAL AND INSTALLATION

1. Remove the upper cowl panel grille. For additional information, refer to **FRONT END BODY PANELS** article.
2. Disconnect the windshield wiper motor electrical connector.
3. Remove the 2 windshield wiper mounting arm and pivot shaft assembly bolts and the windshield wiper mounting arm and pivot shaft assembly.
   - To install, tighten to 7 Nm (62 lb-in).
4. To install, reverse the removal procedure.

WIPER MOTOR - WINDSHIELD

REMOVAL AND INSTALLATION

NOTE: The windshield wiper motor is not serviceable separately. The windshield wiper motor and the mounting arm and pivot shaft must be replaced together.

1. Remove the windshield wiper mounting arm and pivot shaft. For additional information, refer to **Wiper Mounting Arm and Pivot Shaft**.
2. To install, reverse the removal procedure.

WIPER PIVOT ARM - REAR

REMOVAL AND INSTALLATION

1. Open the rear wiper pivot arm nut cover.

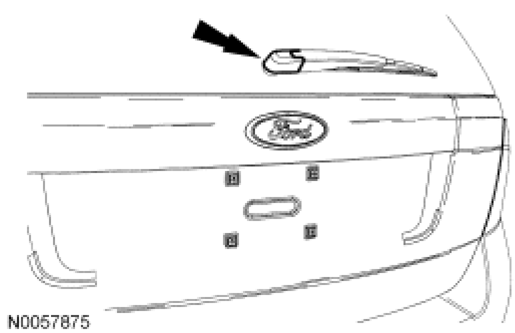


Fig. 37: Identifying Rear Wiper Pivot Arm Nut Cover
Courtesy of FORD MOTOR CO.

2. Remove the nut and the rear wiper pivot arm.
   - To install, tighten to 12 Nm (9 lb-ft).

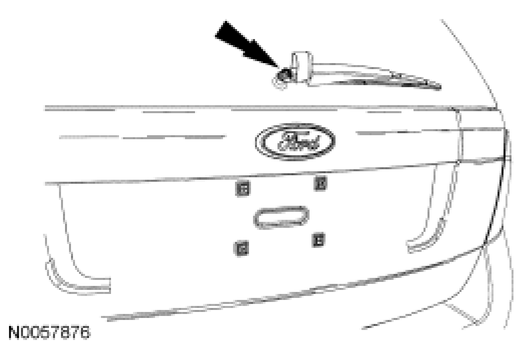


Fig. 38: Identifying Rear Wiper Pivot Arm Nut
Courtesy of FORD MOTOR CO.

3. To install, reverse the removal procedure.
   - To adjust the rear wiper pivot arm, refer to **Wiper Blade and Pivot Arm Adjustment - Rear**

Window.

WIPER MOTOR - REAR WINDOW

REMOVAL

1. Remove the rear wiper pivot arm. For additional information, refer to **Wiper Pivot Arm - Rear**.
2. Remove the liftgate interior trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
3. Disconnect the rear wiper motor electrical connector.
4. Remove the 3 rear wiper motor screws.
5. Remove the rear wiper motor.

INSTALLATION

1. Position the rear wiper motor on the liftgate and install the 3 rear wiper motor screws.
    - Tighten to 11 Nm (8 lb-ft).
2. Connect the rear wiper motor electrical connector.
3. Install the liftgate interior trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
4. Install the rear wiper pivot arm. For additional information, refer to **Wiper Pivot Arm - Rear**.

WASHER PUMP

MATERIAL

Item	Specification
Premium Quality Windshield Washer Fluid (Canada) CXC-37-(A, B, C, D, E, F, G, H) (Canada)	-
Premium Windshield Washer Concentrate (US) ZC-32-A or B (US)	WSB-M8B16-A2

REMOVAL AND INSTALLATION

1. Remove the RH front fender splash shield. For additional information, refer to **FRONT END BODY PANELS** article.

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

NOTE: To prevent spilling windshield washer fluid, drain the washer reservoir before washer pump removal.

2. Remove the washer pump.
    1. Disconnect the electrical connector.
    2. Disconnect the hoses.
    3. Remove the washer pump.

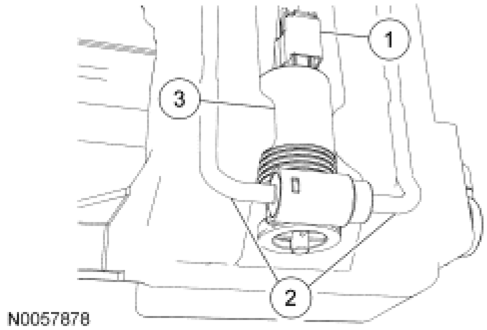


Fig. 39: Identifying Electrical Connector, Hoses & Washer Pump
Courtesy of FORD MOTOR CO.

CAUTION: Do not operate the washer pump prior to filling the washer reservoir. Failure to follow these instructions may result in premature pump failure.

3. To install, reverse the removal procedure.
    - Fill the washer reservoir with windshield washer fluid.

WASHER RESERVOIR

MATERIAL

Item	**Specification**
Premium Quality Windshield Washer Fluid (Canada) CXC-37-(A, B, C, D, E, F, G, H) (Canada)	-
Premium Windshield Washer Concentrate (US) ZC-32-A or B (US)	WSB-M8B16-A2

REMOVAL AND INSTALLATION

1. Remove the RH front fender splash shield. For additional information, refer to **FRONT END BODY PANELS** article.
2. Disconnect the washer pump electrical connector.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

NOTE: To prevent spilling windshield washer fluid, drain the washer reservoir before removal.

3. Disconnect the washer pump hoses.
4. Remove the bolt from the washer reservoir filler neck.
   - To install, tighten to 7 N.m (62 lb-in).
5. Remove the washer reservoir nuts and the washer reservoir.
   - To install, tighten to 7 N.m (62 lb-in).

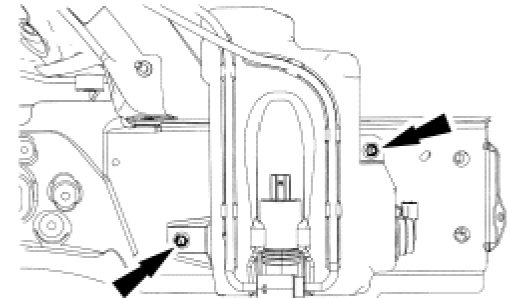
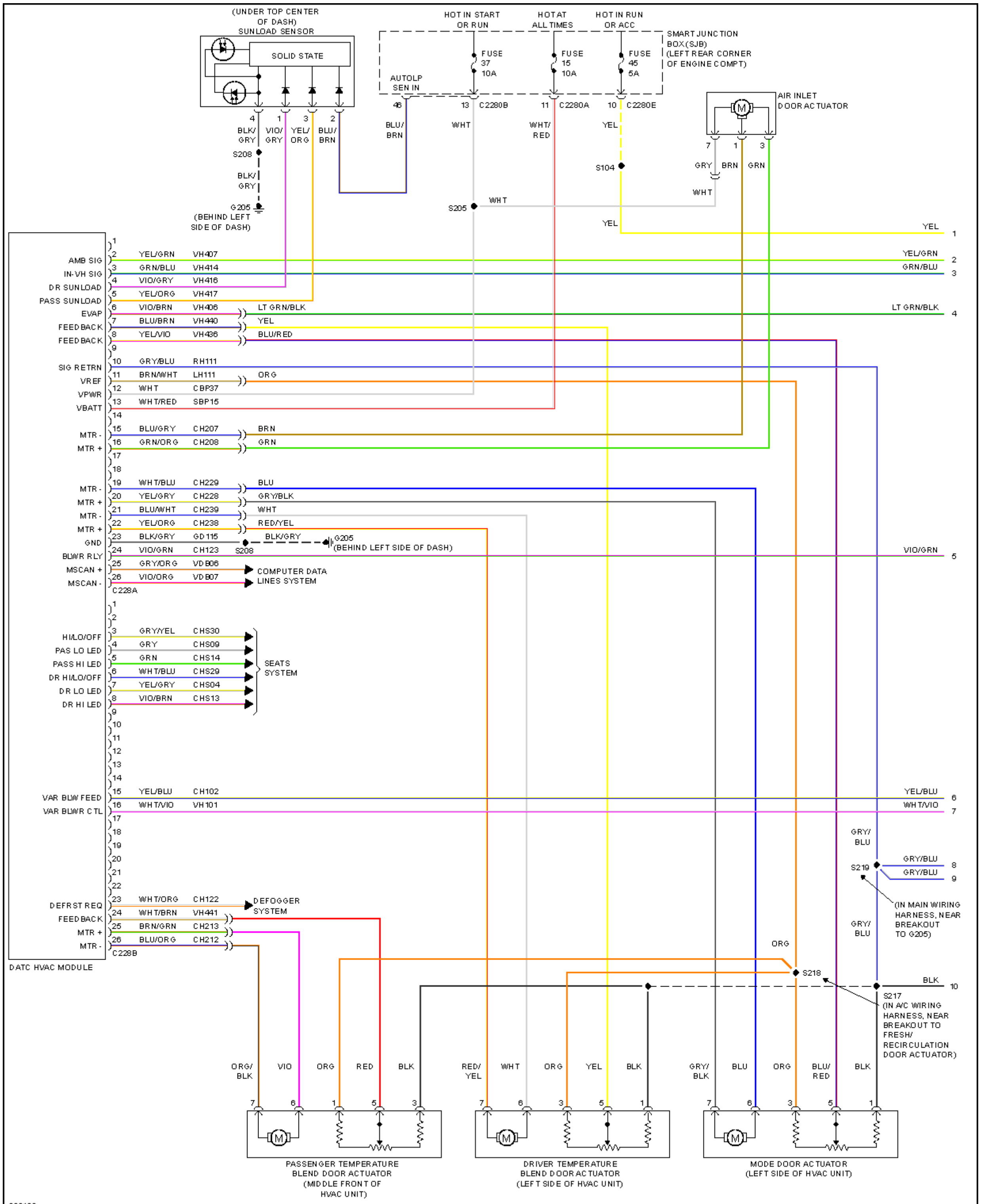


Fig. 40: Locating Washer Reservoir Nuts
Courtesy of FORD MOTOR CO.

CAUTION: Do not operate the washer pump prior to filling the washer reservoir. Failure to follow this instruction may result in premature pump failure.

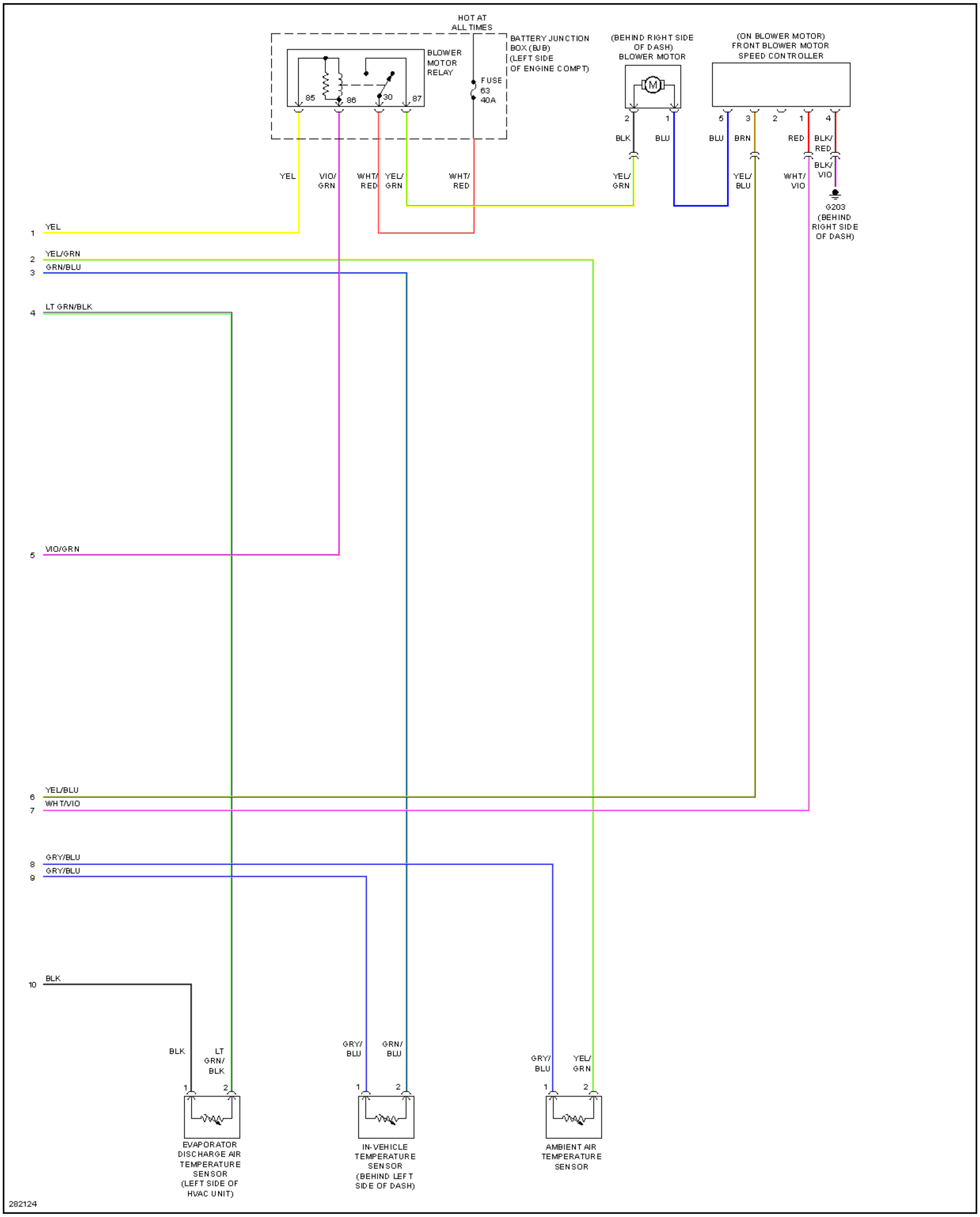
6. To install, reverse the removal procedure.
   - Fill the washer reservoir with windshield washer fluid.

AIR CONDITIONING



(UNDER TOP CENTER OF DASH) SUNLOAD SENSOR
SOLID STATE
HOT IN START OR RUN
HOT AT ALL TIMES
HOT IN RUN OR ACC
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
FUSE 37 10A
FUSE 15 10A
FUSE 45 5A
AUTOLP SEN IN
C2280B
C2280A
C2280E
AIR INLET DOOR ACTUATOR
S208
S205
S104
G205 (BEHIND LEFT SIDE OF DASH)
AMB SIG
IN-VH SIG
DR SUNLOAD
PASS SUNLOAD
EVAP
FEEDBACK
SIG RETRN
VREF
VPWR
VBATT
MTR -
MTR +
GND
BLWR RLY
MSCAN +
MSCAN -
C228A
COMPUTER DATA LINES SYSTEM
HI/LO/OFF
PAS LO LED
PASS HI LED
DR HI/LO/OFF
DR LO LED
DR HI LED
SEATS SYSTEM
VAR BLW FEED
VAR BLWR CTL
DEFRST REQ
DEFOGGER SYSTEM
C228B
DATC HVAC MODULE
S219
(IN MAIN WIRING HARNESS, NEAR BREAKOUT TO G205)
S218
S217
(IN A/C WIRING HARNESS, NEAR BREAKOUT TO FRESH/ RECIRCULATION DOOR ACTUATOR)
PASSENGER TEMPERATURE BLEND DOOR ACTUATOR (MIDDLE FRONT OF HVAC UNIT)
DRIVER TEMPERATURE BLEND DOOR ACTUATOR (LEFT SIDE OF HVAC UNIT)
MODE DOOR ACTUATOR (LEFT SIDE OF HVAC UNIT)
282123

Fig. 1: Automatic A/C Circuit (1 of 3)



HOT AT ALL TIMES
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
BLOWER MOTOR RELAY
FUSE 63 40A
85
86
30
87
(BEHIND RIGHT SIDE OF DASH) BLOWER MOTOR
M
(ON BLOWER MOTOR) FRONT BLOWER MOTOR SPEED CONTROLLER
BLK
BLU
BLU
BRN
RED
BLK/ RED
BLK/ VIO
G203 (BEHIND RIGHT SIDE OF DASH)
YEL
VIO/ GRN
WHT/ RED
YEL/ GRN
WHT/ RED
YEL/ GRN
YEL/ BLU
WHT/ VIO
1 YEL
2 YEL/GRN
3 GRN/BLU
4 LT GRN/BLK
5 VIO/GRN
6 YEL/BLU
7 WHT/VIO
8 GRY/BLU
9 GRY/BLU
10 BLK
BLK
LT GRN/ BLK
GRY/ BLU
GRN/ BLU
GRY/ BLU
YEL/ GRN
EVAPORATOR DISCHARGE AIR TEMPERATURE SENSOR (LEFT SIDE OF HVAC UNIT)
IN-VEHICLE TEMPERATURE SENSOR (BEHIND LEFT SIDE OF DASH)
AMBIENT AIR TEMPERATURE SENSOR
282124

Fig. 2: Automatic A/C Circuit (2 of 3)

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

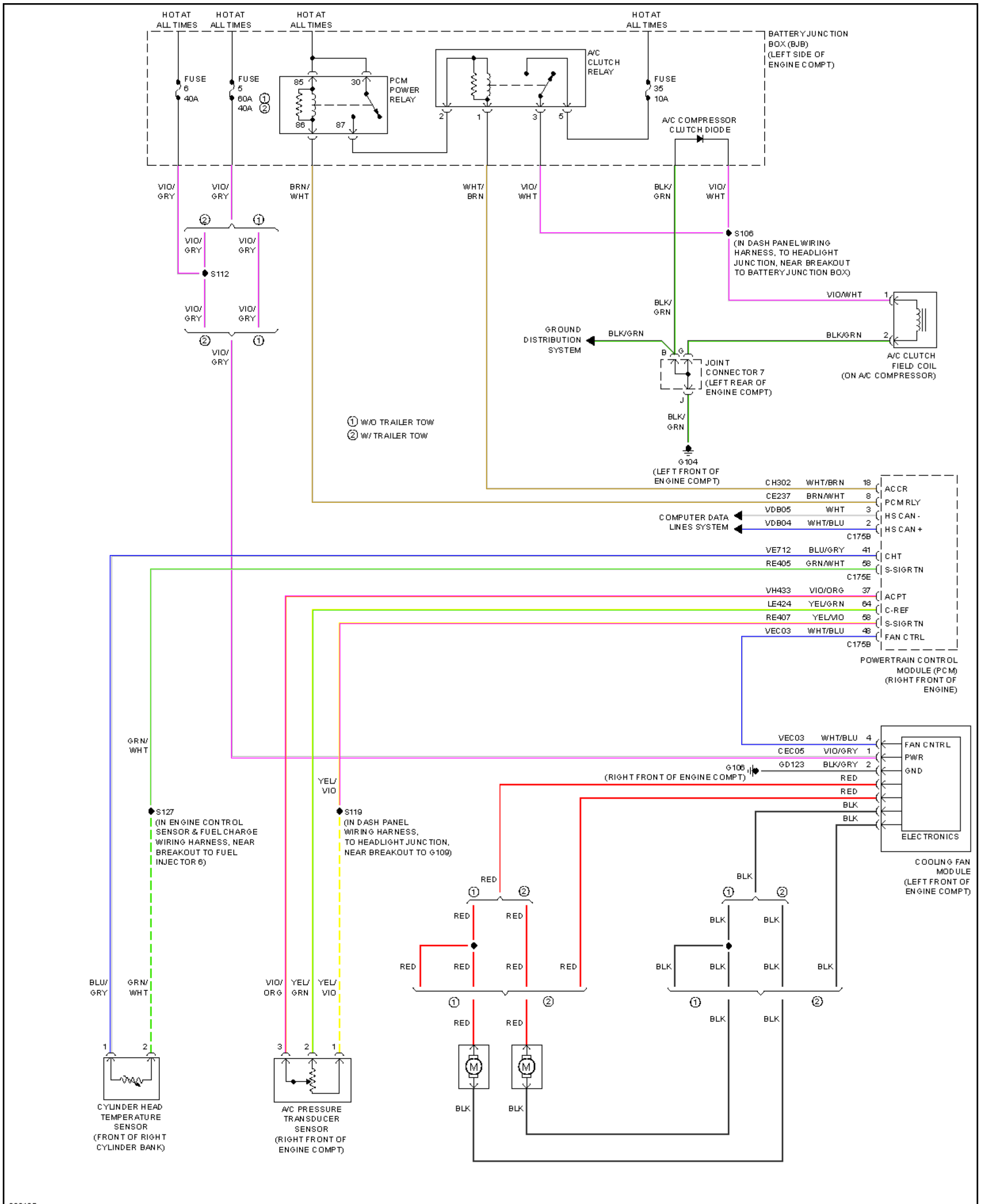


Fig. 3: Automatic A/C Circuit (3 of 3)

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

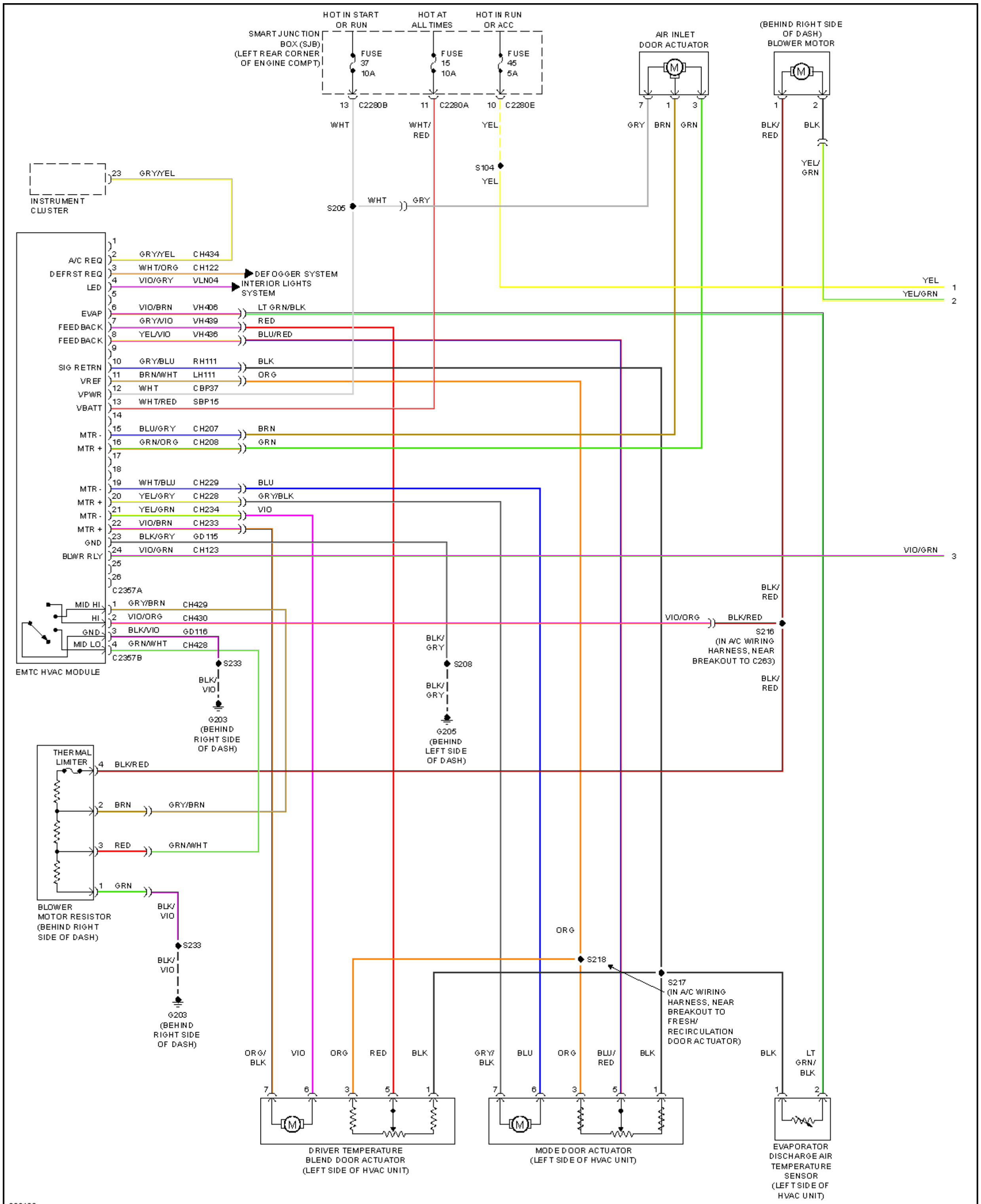
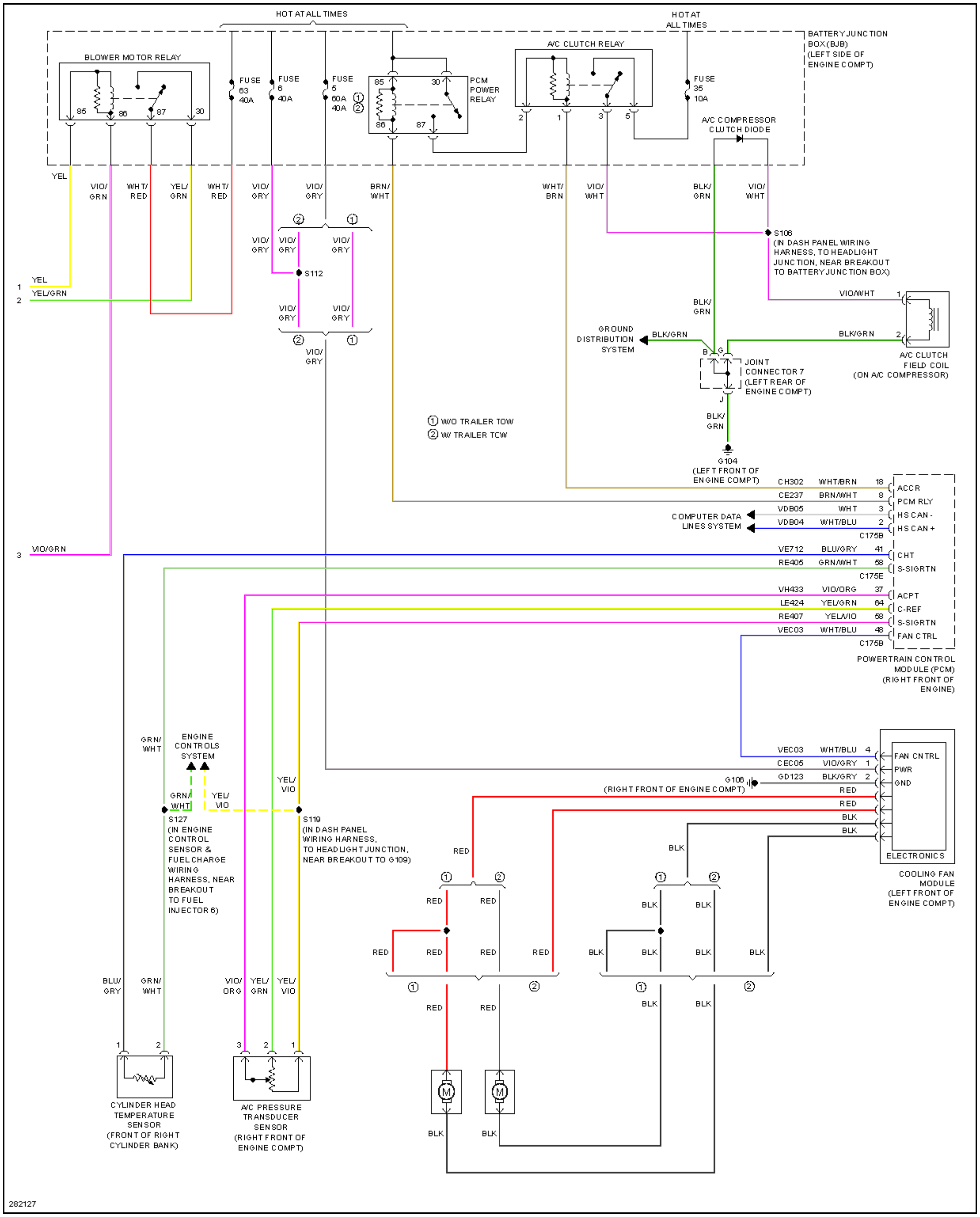


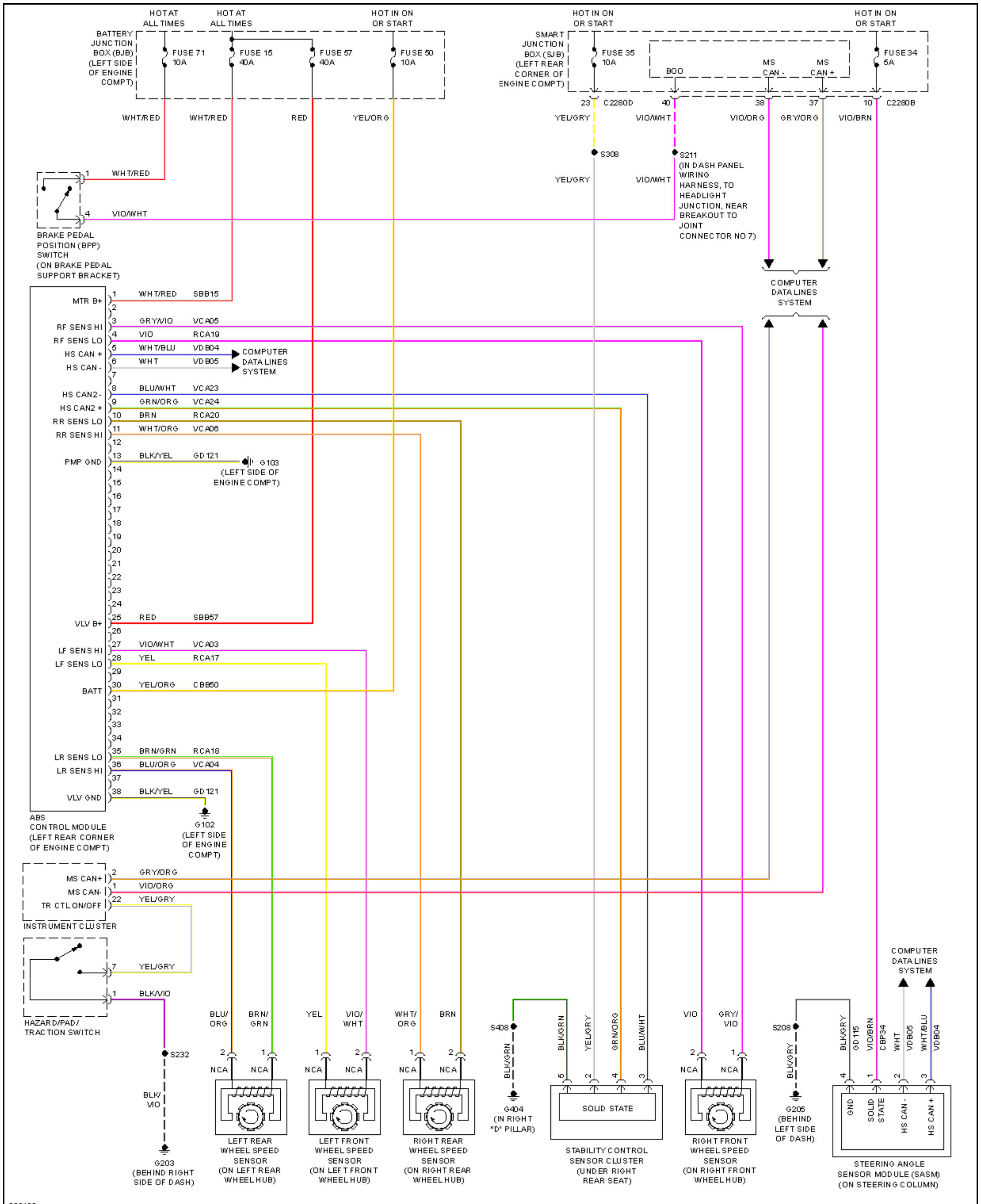
Fig. 4: Manual A/C Circuit (1 of 2)



HOT AT ALL TIMES
HOT AT ALL TIMES
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
BLOWER MOTOR RELAY
FUSE 63 40A
FUSE 6 40A
FUSE 5 60A 1 40A 2
PCM POWER RELAY
A/C CLUTCH RELAY
FUSE 35 10A
A/C COMPRESSOR CLUTCH DIODE
S106 (IN DASH PANEL WIRING HARNESS, TO HEADLIGHT JUNCTION, NEAR BREAKOUT TO BATTERY JUNCTION BOX)
S112
A/C CLUTCH FIELD COIL (ON A/C COMPRESSOR)
GROUND DISTRIBUTION SYSTEM
JOINT CONNECTOR 7 (LEFT REAR OF ENGINE COMPT)
G104 (LEFT FRONT OF ENGINE COMPT)
1 W/O TRAILER TOW
2 W/ TRAILER TOW
COMPUTER DATA LINES SYSTEM
ACCR
PCM RLY
HS CAN -
HS CAN +
CHT
S-SIGRTN
ACPT
C-REF
S-SIGRTN
FAN CTRL
C175B
C175E
POWERTRAIN CONTROL MODULE (PCM) (RIGHT FRONT OF ENGINE)
CH302 WHT/BRN 18
CE237 BRN/WHT 8
VDB05 WHT 3
VDB04 WHT/BLU 2
VE712 BLU/GRY 41
RE405 GRN/WHT 58
VH433 VIO/ORG 37
LE424 YEL/GRN 64
RE407 YEL/VIO 58
VEC03 WHT/BLU 48
ENGINE CONTROLS SYSTEM
S127 (IN ENGINE CONTROL SENSOR & FUEL CHARGE WIRING HARNESS, NEAR BREAKOUT TO FUEL INJECTOR 6)
S119 (IN DASH PANEL WIRING HARNESS, TO HEADLIGHT JUNCTION, NEAR BREAKOUT TO G109)
VEC03 WHT/BLU 4
CEC05 VIO/GRY 1
GD123 BLK/GRY 2
G106 (RIGHT FRONT OF ENGINE COMPT)
FAN CNTRL
PWR
GND
ELECTRONICS
COOLING FAN MODULE (LEFT FRONT OF ENGINE COMPT)
CYLINDER HEAD TEMPERATURE SENSOR (FRONT OF RIGHT CYLINDER BANK)
A/C PRESSURE TRANSDUCER SENSOR (RIGHT FRONT OF ENGINE COMPT)
282127

Fig. 5: Manual A/C Circuit (2 of 2)

ANTI-LOCK BRAKES



HOT AT ALL TIMES
HOT AT ALL TIMES
HOT IN ON OR START
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
FUSE 71 10A
FUSE 15 40A
FUSE 57 40A
FUSE 50 10A
WHT/RED
WHT/RED
RED
YEL/ORG
HOT IN ON OR START
HOT IN ON OR START
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
FUSE 35 10A
BOO
MS CAN -
MS CAN +
FUSE 34 5A
C2280D
C2280B
YEL/GRY
VIO/WHT
VIO/ORG
GRY/ORG
VIO/BRN
S308
S211 (IN DASH PANEL WIRING HARNESS, TO HEADLIGHT JUNCTION, NEAR BREAKOUT TO JOINT CONNECTOR NO 7)
BRAKE PEDAL POSITION (BPP) SWITCH (ON BRAKE PEDAL SUPPORT BRACKET)
COMPUTER DATA LINES SYSTEM
MTR B+
RF SENS HI
RF SENS LO
HS CAN +
HS CAN -
HS CAN2 -
HS CAN2 +
RR SENS LO
RR SENS HI
PMP GND
VLV B+
LF SENS HI
LF SENS LO
BATT
LR SENS LO
LR SENS HI
VLV GND
WHT/RED SBB15
GRY/VIO VCA05
VIO RCA19
WHT/BLU VDB04
WHT VDB05
BLU/WHT VCA23
GRN/ORG VCA24
BRN RCA20
WHT/ORG VCA06
BLK/YEL GD121
RED SBB57
VIO/WHT VCA03
YEL RCA17
YEL/ORG CBB50
BRN/GRN RCA18
BLU/ORG VCA04
BLK/YEL GD121
G103 (LEFT SIDE OF ENGINE COMPT)
ABS CONTROL MODULE (LEFT REAR CORNER OF ENGINE COMPT)
G102 (LEFT SIDE OF ENGINE COMPT)
MS CAN+
MS CAN-
TR CTL ON/OFF
GRY/ORG
VIO/ORG
YEL/GRY
INSTRUMENT CLUSTER
YEL/GRY
BLK/VIO
HAZARD/PAD/ TRACTION SWITCH
S232
BLK/ VIO
G203 (BEHIND RIGHT SIDE OF DASH)
BLU/ ORG
BRN/ GRN
YEL
VIO/ WHT
WHT/ ORG
BRN
NCA
LEFT REAR WHEEL SPEED SENSOR (ON LEFT REAR WHEEL HUB)
LEFT FRONT WHEEL SPEED SENSOR (ON LEFT FRONT WHEEL HUB)
RIGHT REAR WHEEL SPEED SENSOR (ON RIGHT REAR WHEEL HUB)
S408
BLK/GRN
G404 (IN RIGHT "D" PILLAR)
BLK/GRN
YEL/GRY
GRN/ORG
BLU/WHT
SOLID STATE
STABILITY CONTROL SENSOR CLUSTER (UNDER RIGHT REAR SEAT)
VIO
GRY/ VIO
RIGHT FRONT WHEEL SPEED SENSOR (ON RIGHT FRONT WHEEL HUB)
S208
BLK/GRY
G205 (BEHIND LEFT SIDE OF DASH)
COMPUTER DATA LINES SYSTEM
BLK/GRY GD115
VIO/BRN CBP34
WHT VDB05
WHT/BLU VDB04
GND
SOLID STATE
HS CAN -
HS CAN +
STEERING ANGLE SENSOR MODULE (SASM) (ON STEERING COLUMN)
282189

Fig. 6: Anti-lock Brakes Circuit

ANTI-THEFT

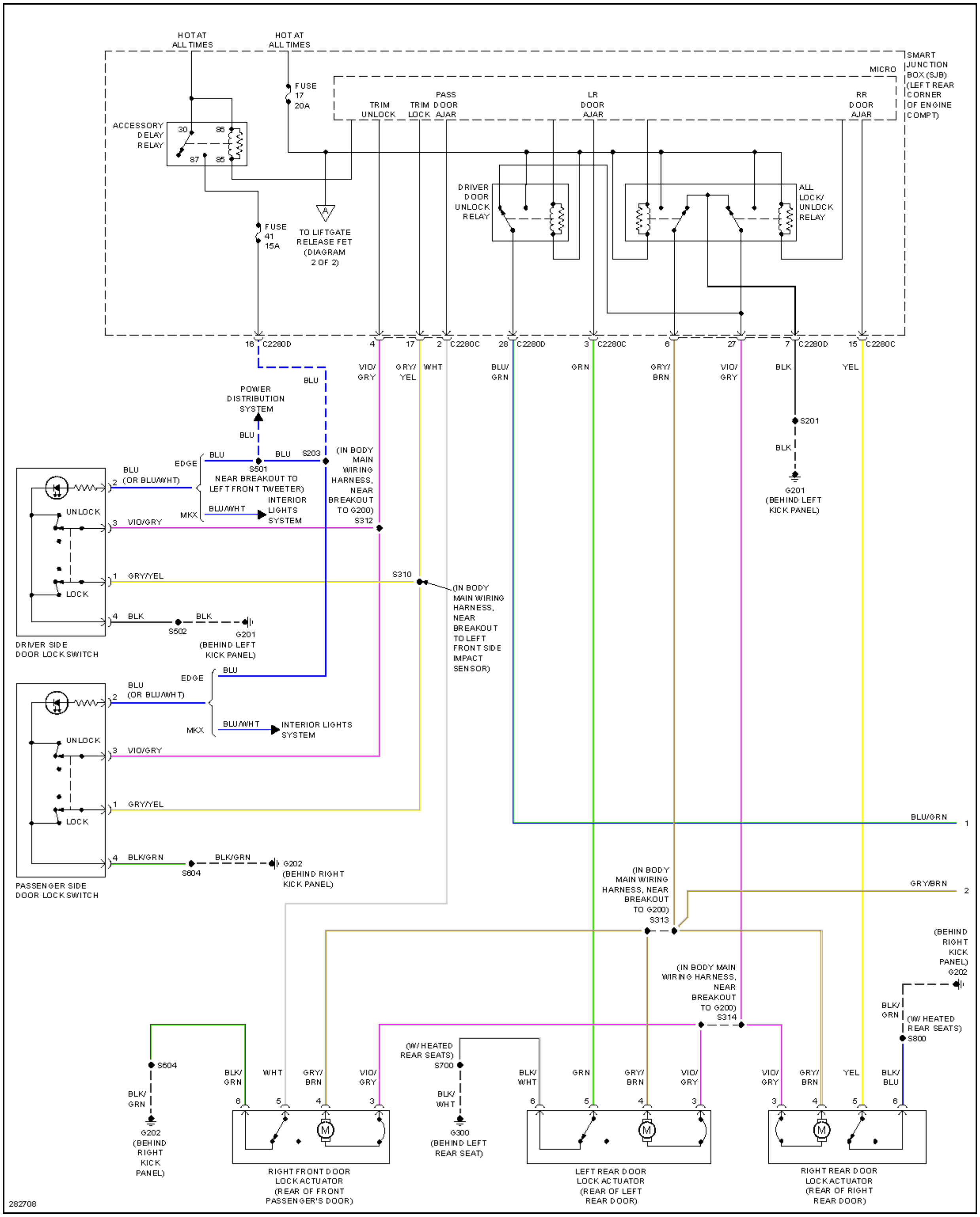
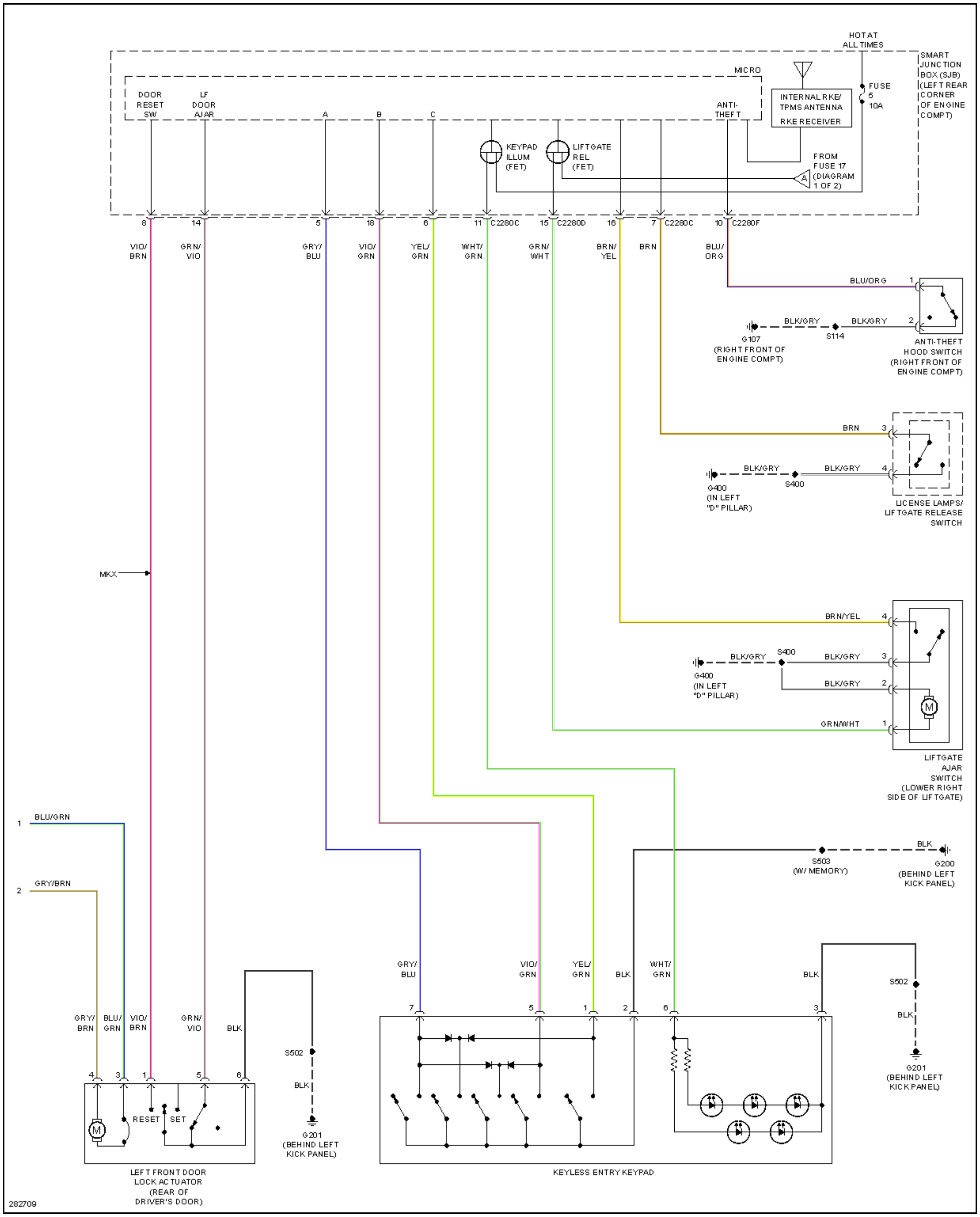

HOT AT ALL TIMES
HOT AT ALL TIMES
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
MICRO
FUSE 17 20A
TRIM UNLOCK
TRIM LOCK
PASS DOOR AJAR
LR DOOR AJAR
RR DOOR AJAR
ACCESSORY DELAY RELAY
30 86 87 85
FUSE 41 15A
TO LIFTGATE RELEASE FET (DIAGRAM 2 OF 2)
DRIVER DOOR UNLOCK RELAY
ALL LOCK/ UNLOCK RELAY
16 C2280D
4
17
2 C2280C
28 C2280D
3 C2280C
6
27
7 C2280D
15 C2280C
BLU
VIO/ GRY
GRY/ YEL
WHT
BLU/ GRN
GRN
GRY/ BRN
VIO/ GRY
BLK
YEL
POWER DISTRIBUTION SYSTEM
S201
BLK
G201 (BEHIND LEFT KICK PANEL)
EDGE
BLU
BLU
S203
S501 NEAR BREAKOUT TO LEFT FRONT TWEETER)
(IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO G200)
S312
MKX
BLU/WHT
INTERIOR LIGHTS SYSTEM
BLU (OR BLU/WHT)
UNLOCK
VIO/GRY
GRY/YEL
S310
(IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO LEFT FRONT SIDE IMPACT SENSOR)
LOCK
BLK
BLK
S502
G201 (BEHIND LEFT KICK PANEL)
DRIVER SIDE DOOR LOCK SWITCH
EDGE
BLU
BLU (OR BLU/WHT)
MKX
BLU/WHT
INTERIOR LIGHTS SYSTEM
UNLOCK
VIO/GRY
GRY/YEL
LOCK
BLK/GRN
BLK/GRN
S604
G202 (BEHIND RIGHT KICK PANEL)
PASSENGER SIDE DOOR LOCK SWITCH
BLU/GRN 1
(IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO G200) S313
GRY/BRN 2
(BEHIND RIGHT KICK PANEL) G202
(IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO G200) S314
BLK/ GRN
(W/ HEATED REAR SEATS) S800
S604
BLK/ GRN
G202 (BEHIND RIGHT KICK PANEL)
BLK/ GRN
WHT
GRY/ BRN
VIO/ GRY
(W/ HEATED REAR SEATS) S700
BLK/ WHT
G300 (BEHIND LEFT REAR SEAT)
BLK/ WHT
GRN
GRY/ BRN
VIO/ GRY
VIO/ GRY
GRY/ BRN
YEL
BLK/ BLU
RIGHT FRONT DOOR LOCK ACTUATOR (REAR OF FRONT PASSENGER'S DOOR)
LEFT REAR DOOR LOCK ACTUATOR (REAR OF LEFT REAR DOOR)
RIGHT REAR DOOR LOCK ACTUATOR (REAR OF RIGHT REAR DOOR)
282708

Fig. 7: Forced Entry Circuit (1 of 2)



HOT AT ALL TIMES
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
MICRO
FUSE 5 10A
INTERNAL RKE/ TPMS ANTENNA
RKE RECEIVER
DOOR RESET SW
LF DOOR AJAR
A
B
C
ANTI-THEFT
KEYPAD ILLUM (FET)
LIFTGATE REL (FET)
FROM FUSE 17 (DIAGRAM 1 OF 2)
C2280C
C2280D
C2280F
VIO/ BRN
GRN/ VIO
GRY/ BLU
VIO/ GRN
YEL/ GRN
WHT/ GRN
GRN/ WHT
BRN/ YEL
BRN
BLU/ ORG
BLU/ORG
BLK/GRY
G107 (RIGHT FRONT OF ENGINE COMPT)
S114
ANTI-THEFT HOOD SWITCH (RIGHT FRONT OF ENGINE COMPT)
G400 (IN LEFT "D" PILLAR)
S400
LICENSE LAMPS/ LIFTGATE RELEASE SWITCH
BRN/YEL
GRN/WHT
LIFTGATE AJAR SWITCH (LOWER RIGHT SIDE OF LIFTGATE)
MKX
BLU/GRN
GRY/BRN
BLK
S503 (W/ MEMORY)
G200 (BEHIND LEFT KICK PANEL)
S502
G201 (BEHIND LEFT KICK PANEL)
RESET
SET
LEFT FRONT DOOR LOCK ACTUATOR (REAR OF DRIVER'S DOOR)
KEYLESS ENTRY KEYPAD
282709

Fig. 8: Forced Entry Circuit (2 of 2)

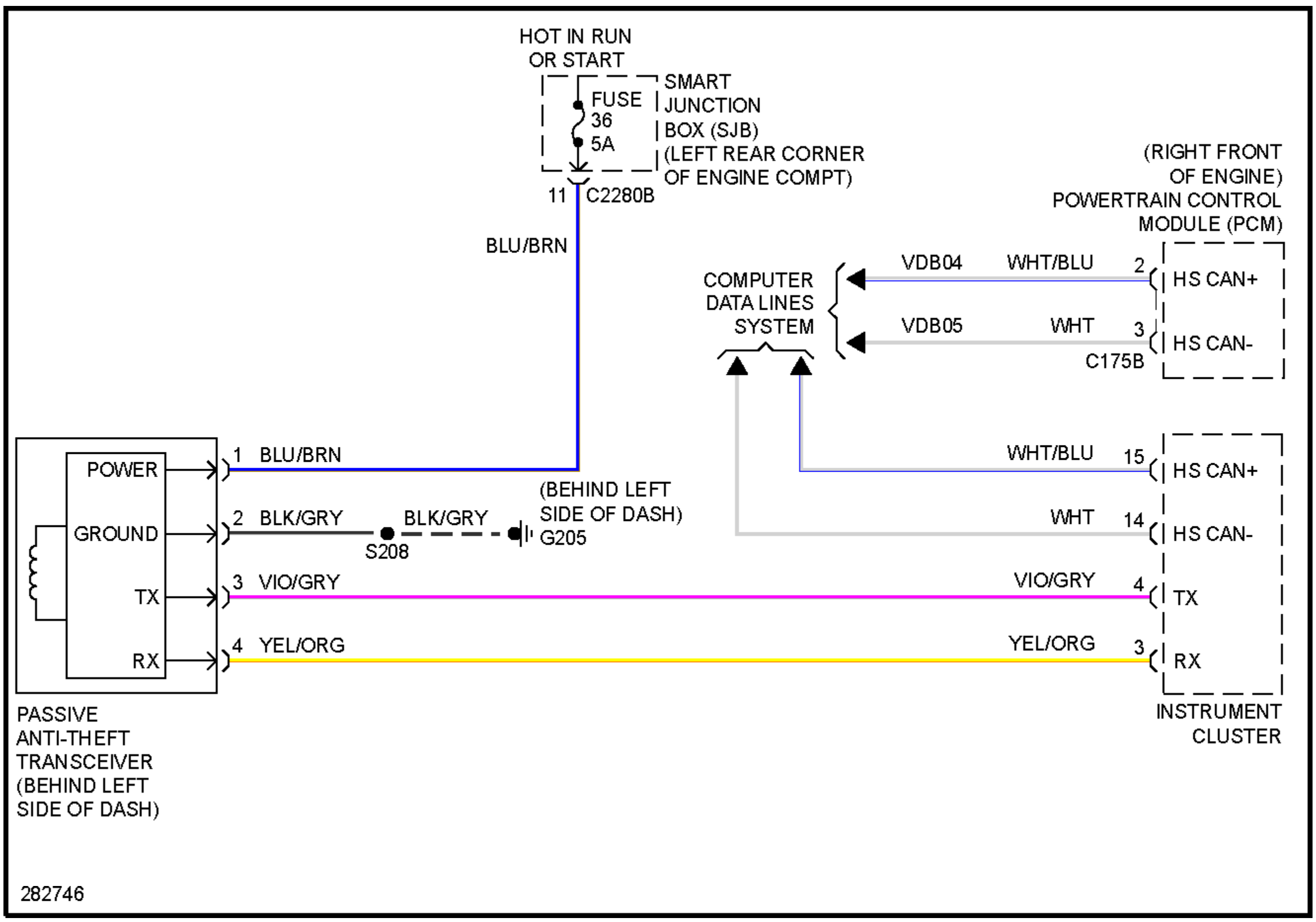
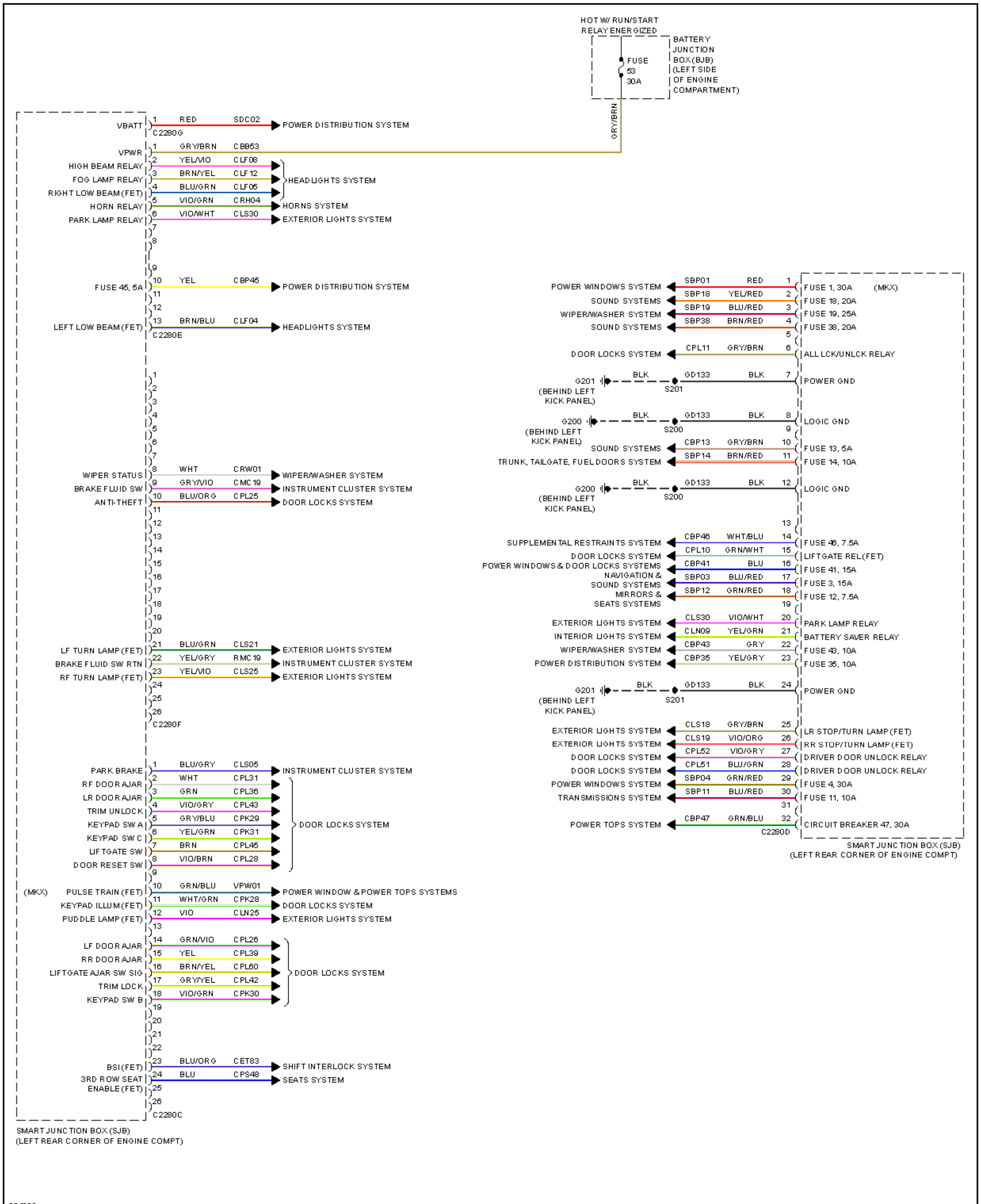

HOT IN RUN
OR START
FUSE
36
5A
SMART
JUNCTION
BOX (SJB)
(LEFT REAR CORNER
OF ENGINE COMPT)
11
C2280B
BLU/BRN
(RIGHT FRONT
OF ENGINE)
POWERTRAIN CONTROL
MODULE (PCM)
COMPUTER
DATA LINES
SYSTEM
VDB04
WHT/BLU
2
HS CAN+
VDB05
WHT
3
HS CAN-
C175B
POWER
1
BLU/BRN
WHT/BLU
15
HS CAN+
(BEHIND LEFT
SIDE OF DASH)
G205
GROUND
2
BLK/GRY
BLK/GRY
S208
WHT
14
HS CAN-
TX
3
VIO/GRY
VIO/GRY
4
TX
RX
4
YEL/ORG
YEL/ORG
3
RX
PASSIVE
ANTI-THEFT
TRANSCEIVER
(BEHIND LEFT
SIDE OF DASH)
INSTRUMENT
CLUSTER
282746

Fig. 9: Passive Anti-theft Circuit

BODY CONTROL MODULES



HOT W/ RUN/START RELAY ENERGIZED
FUSE 53 30A
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPARTMENT)
GRY/BRN
VBATT 1 RED SDC02 POWER DISTRIBUTION SYSTEM
C2280G
VPWR 1 GRY/BRN CBB53
HIGH BEAM RELAY 2 YEL/VIO CLF08
FOG LAMP RELAY 3 BRN/YEL CLF12
RIGHT LOW BEAM (FET) 4 BLU/GRN CLF05
HEADLIGHTS SYSTEM
HORN RELAY 5 VIO/GRN CRH04 HORNS SYSTEM
PARK LAMP RELAY 6 VIO/WHT CLS30 EXTERIOR LIGHTS SYSTEM
FUSE 45, 5A 10 YEL CBP45 POWER DISTRIBUTION SYSTEM
LEFT LOW BEAM (FET) 13 BRN/BLU CLF04 HEADLIGHTS SYSTEM
C2280E
WIPER STATUS 8 WHT CRW01 WIPER/WASHER SYSTEM
BRAKE FLUID SW 9 GRY/VIO CMC19 INSTRUMENT CLUSTER SYSTEM
ANTI-THEFT 10 BLU/ORG CPL25 DOOR LOCKS SYSTEM
LF TURN LAMP (FET) 21 BLU/GRN CLS21 EXTERIOR LIGHTS SYSTEM
BRAKE FLUID SW RTN 22 YEL/GRY RMC19 INSTRUMENT CLUSTER SYSTEM
RF TURN LAMP (FET) 23 YEL/VIO CLS25 EXTERIOR LIGHTS SYSTEM
C2280F
PARK BRAKE 1 BLU/GRY CLS05 INSTRUMENT CLUSTER SYSTEM
RF DOOR AJAR 2 WHT CPL31
LR DOOR AJAR 3 GRN CPL36
TRIM UNLOCK 4 VIO/GRY CPL43
KEYPAD SW A 5 GRY/BLU CPK29
KEYPAD SW C 6 YEL/GRN CPK31
LIFTGATE AJAR SW 7 BRN CPL45
DOOR RESET SW 8 VIO/BRN CPL28
DOOR LOCKS SYSTEM
(MKX) PULSE TRAIN (FET) 10 GRN/BLU VPW01 POWER WINDOW & POWER TOPS SYSTEMS
KEYPAD ILLUM (FET) 11 WHT/GRN CPK28 DOOR LOCKS SYSTEM
PUDDLE LAMP (FET) 12 VIO CLN25 EXTERIOR LIGHTS SYSTEM
LF DOOR AJAR 14 GRN/VIO CPL26
RR DOOR AJAR 15 YEL CPL39
LIFTGATE AJAR SW SIG 16 BRN/YEL CPL60
TRIM LOCK 17 GRY/YEL CPL42
KEYPAD SW B 18 VIO/GRN CPK30
DOOR LOCKS SYSTEM
BSI (FET) 23 BLU/ORG CET83 SHIFT INTERLOCK SYSTEM
3RD ROW SEAT ENABLE (FET) 24 BLU CPS48 SEATS SYSTEM
C2280C
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
POWER WINDOWS SYSTEM SBP01 RED 1 FUSE 1, 30A (MKX)
SOUND SYSTEMS SBP18 YEL/RED 2 FUSE 18, 20A
WIPER/WASHER SYSTEM SBP19 BLU/RED 3 FUSE 19, 25A
SOUND SYSTEMS SBP38 BRN/RED 4 FUSE 38, 20A
DOOR LOCKS SYSTEM CPL11 GRY/BRN 6 ALL LCK/UNLCK RELAY
G201 (BEHIND LEFT KICK PANEL) BLK S201 GD133 BLK 7 POWER GND
G200 (BEHIND LEFT KICK PANEL) BLK S200 GD133 BLK 8 LOGIC GND
SOUND SYSTEMS CBP13 GRY/BRN 10 FUSE 13, 5A
TRUNK, TAILGATE, FUEL DOORS SYSTEM SBP14 BRN/RED 11 FUSE 14, 10A
G200 (BEHIND LEFT KICK PANEL) BLK S200 GD133 BLK 12 LOGIC GND
SUPPLEMENTAL RESTRAINTS SYSTEM CBP46 WHT/BLU 14 FUSE 46, 7.5A
DOOR LOCKS SYSTEM CPL10 GRN/WHT 15 LIFTGATE REL (FET)
POWER WINDOWS & DOOR LOCKS SYSTEMS CBP41 BLU 16 FUSE 41, 15A
NAVIGATION & SOUND SYSTEMS SBP03 BLU/RED 17 FUSE 3, 15A
MIRRORS & SEATS SYSTEMS SBP12 GRN/RED 18 FUSE 12, 7.5A
EXTERIOR LIGHTS SYSTEM CLS30 VIO/WHT 20 PARK LAMP RELAY
INTERIOR LIGHTS SYSTEM CLN09 YEL/GRN 21 BATTERY SAVER RELAY
WIPER/WASHER SYSTEM CBP43 GRY 22 FUSE 43, 10A
POWER DISTRIBUTION SYSTEM CBP35 YEL/GRY 23 FUSE 35, 10A
G201 (BEHIND LEFT KICK PANEL) BLK S201 GD133 BLK 24 POWER GND
EXTERIOR LIGHTS SYSTEM CLS18 GRY/BRN 25 LR STOP/TURN LAMP (FET)
EXTERIOR LIGHTS SYSTEM CLS19 VIO/ORG 26 RR STOP/TURN LAMP (FET)
DOOR LOCKS SYSTEM CPL52 VIO/GRY 27 DRIVER DOOR UNLOCK RELAY
DOOR LOCKS SYSTEM CPL51 BLU/GRN 28 DRIVER DOOR UNLOCK RELAY
POWER WINDOWS SYSTEM SBP04 GRN/RED 29 FUSE 4, 30A
TRANSMISSIONS SYSTEM SBP11 BLU/RED 30 FUSE 11, 10A
POWER TOPS SYSTEM CBP47 GRN/BLU 32 CIRCUIT BREAKER 47, 30A
C2280D
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
284099

Fig. 10: Body Control Modules Circuit (1 of 2)

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

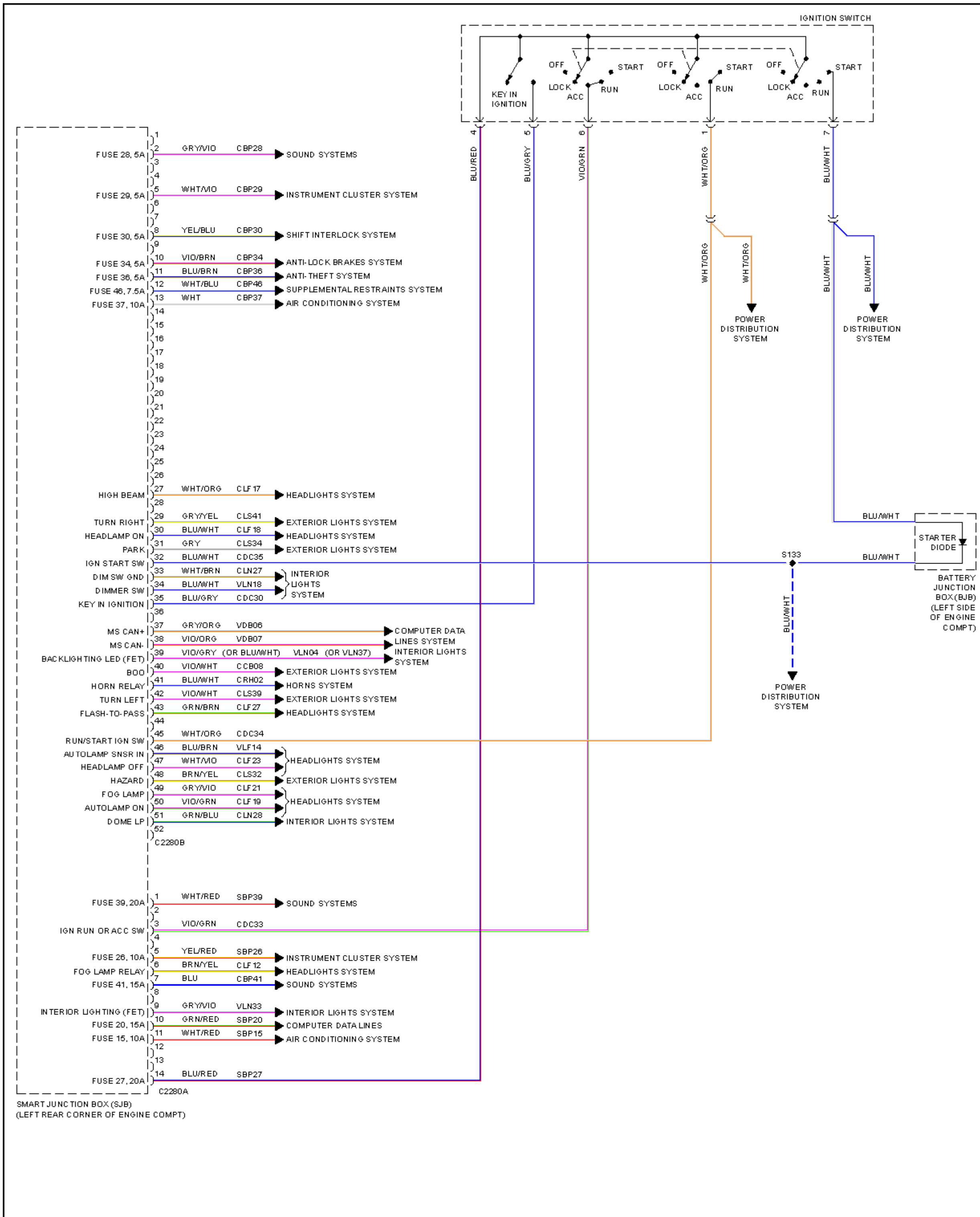
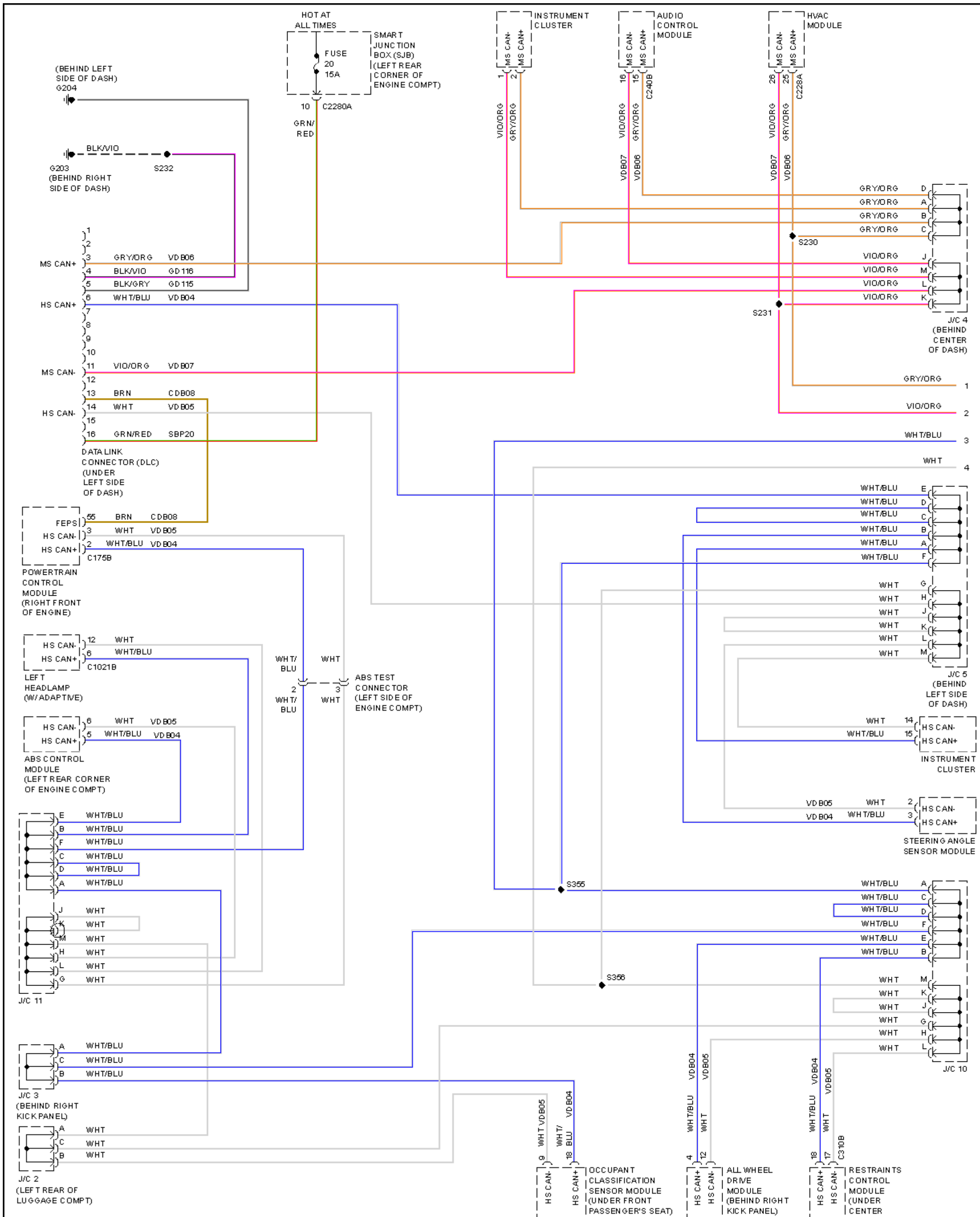


Fig. 11: Body Control Modules Circuit (2 of 2)

COMPUTER DATA LINES



HOT AT ALL TIMES
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
FUSE 20 15A
10 C2280A
GRN/ RED
INSTRUMENT CLUSTER
MS CAN-
MS CAN+
AUDIO CONTROL MODULE
C240B
HVAC MODULE
C228A
VIO/ORG
GRY/ORG
VDB07
VDB06
(BEHIND LEFT SIDE OF DASH) G204
BLK/VIO
G203 (BEHIND RIGHT SIDE OF DASH)
S232
S230
S231
J/C 4 (BEHIND CENTER OF DASH)
MS CAN+
HS CAN+
MS CAN-
HS CAN-
GRY/ORG VDB06
BLK/VIO GD116
BLK/GRY GD115
WHT/BLU VDB04
VIO/ORG VDB07
BRN CDB08
WHT VDB05
GRN/RED SBP20
DATA LINK CONNECTOR (DLC) (UNDER LEFT SIDE OF DASH)
FEPS
POWERTRAIN CONTROL MODULE (RIGHT FRONT OF ENGINE)
C175B
LEFT HEADLAMP (W/ ADAPTIVE)
C1021B
ABS TEST CONNECTOR (LEFT SIDE OF ENGINE COMPT)
ABS CONTROL MODULE (LEFT REAR CORNER OF ENGINE COMPT)
J/C 5 (BEHIND LEFT SIDE OF DASH)
INSTRUMENT CLUSTER
STEERING ANGLE SENSOR MODULE
J/C 11
S355
S356
J/C 10
J/C 3 (BEHIND RIGHT KICK PANEL)
J/C 2 (LEFT REAR OF LUGGAGE COMPT)
OCCUPANT CLASSIFICATION SENSOR MODULE (UNDER FRONT PASSENGER'S SEAT)
ALL WHEEL DRIVE MODULE (BEHIND RIGHT KICK PANEL)
RESTRAINTS CONTROL MODULE (UNDER CENTER CONSOLE)
C310B
283959

Fig. 12: Computer Data Lines Circuit (1 of 2)

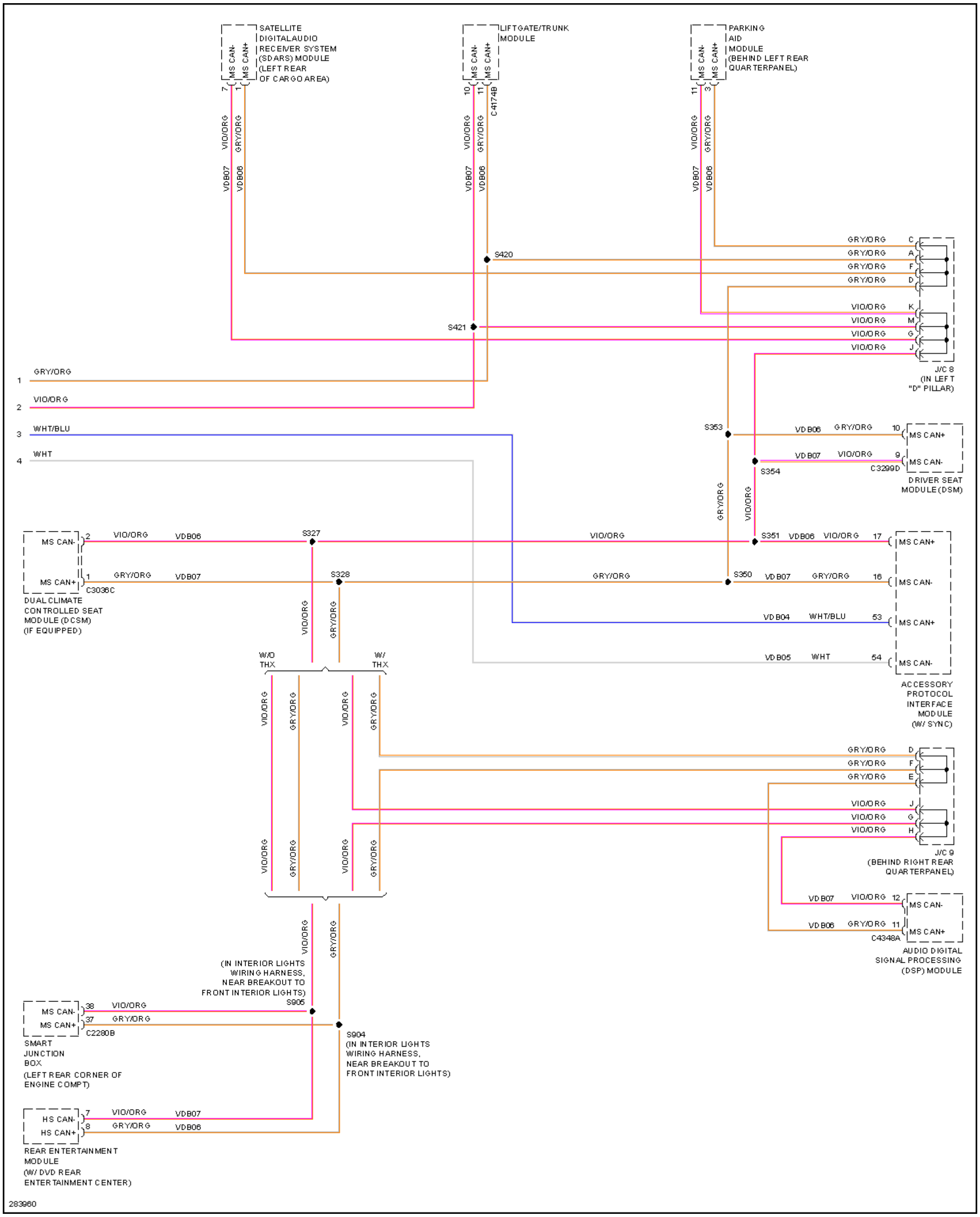

SATELLITE DIGITAL AUDIO RECEIVER SYSTEM (SDARS) MODULE (LEFT REAR OF CARGO AREA)
LIFTGATE/TRUNK MODULE
PARKING AID MODULE (BEHIND LEFT REAR QUARTER PANEL)
MS CAN-
MS CAN+
C4174B
S420
S421
GRY/ORG
VIO/ORG
WHT/BLU
WHT
VDB06
VDB07
VDB04
VDB05
J/C 8 (IN LEFT "D" PILLAR)
S353
S354
C3299D
DRIVER SEAT MODULE (DSM)
DUAL CLIMATE CONTROLLED SEAT MODULE (DCSM) (IF EQUIPPED)
C3036C
S327
S328
S351
S350
ACCESSORY PROTOCOL INTERFACE MODULE (W/ SYNC)
W/O THX
W/ THX
J/C 9 (BEHIND RIGHT REAR QUARTER PANEL)
C4348A
AUDIO DIGITAL SIGNAL PROCESSING (DSP) MODULE
(IN INTERIOR LIGHTS WIRING HARNESS, NEAR BREAKOUT TO FRONT INTERIOR LIGHTS)
S905
S904
SMART JUNCTION BOX (LEFT REAR CORNER OF ENGINE COMPT)
C2280B
HS CAN-
HS CAN+
REAR ENTERTAINMENT MODULE (W/ DVD REAR ENTERTAINMENT CENTER)
283960

Fig. 13: Computer Data Lines Circuit (2 of 2)

COOLING FAN

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

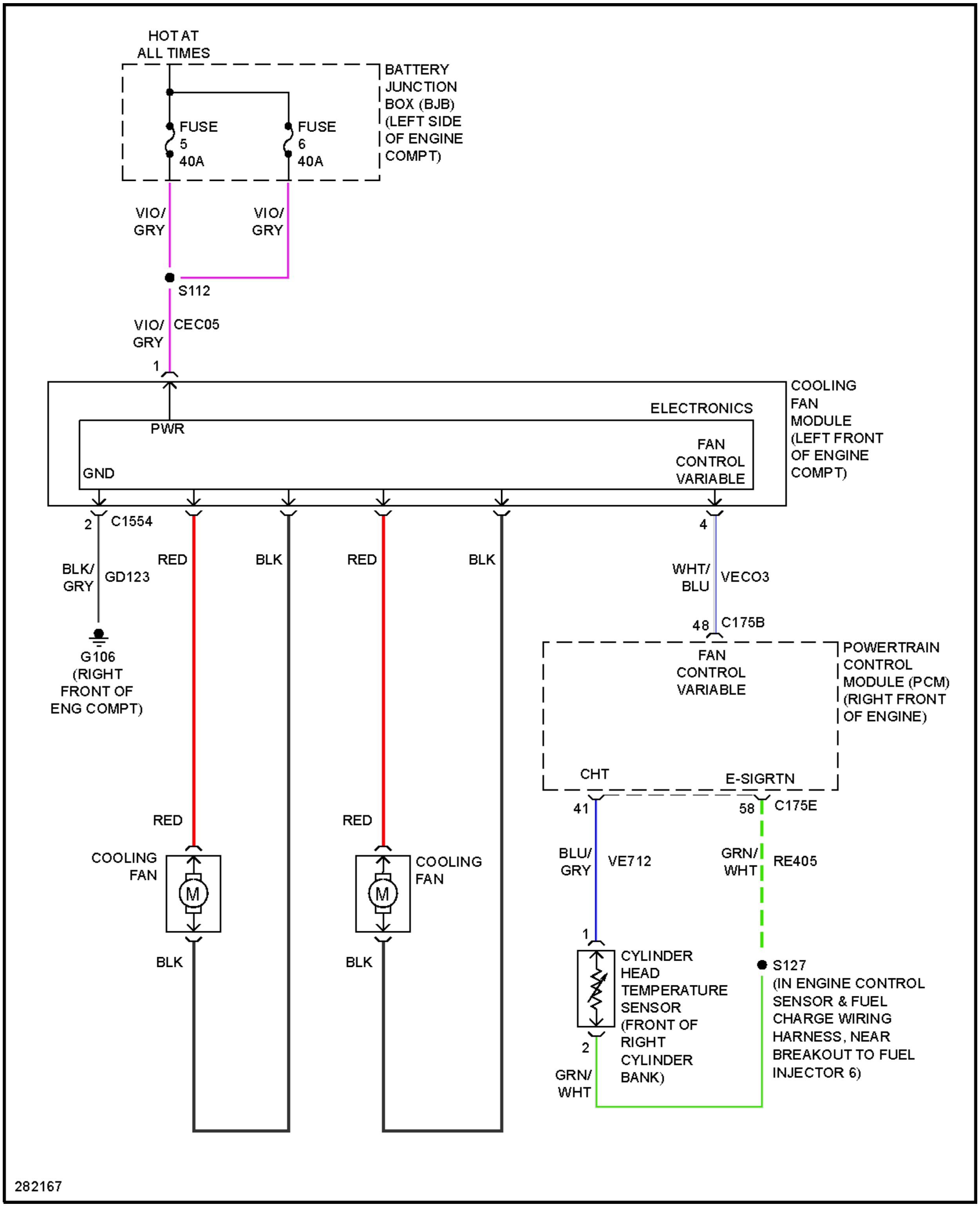


Fig. 14: Cooling Fan Circuit, W/ Trailer Tow

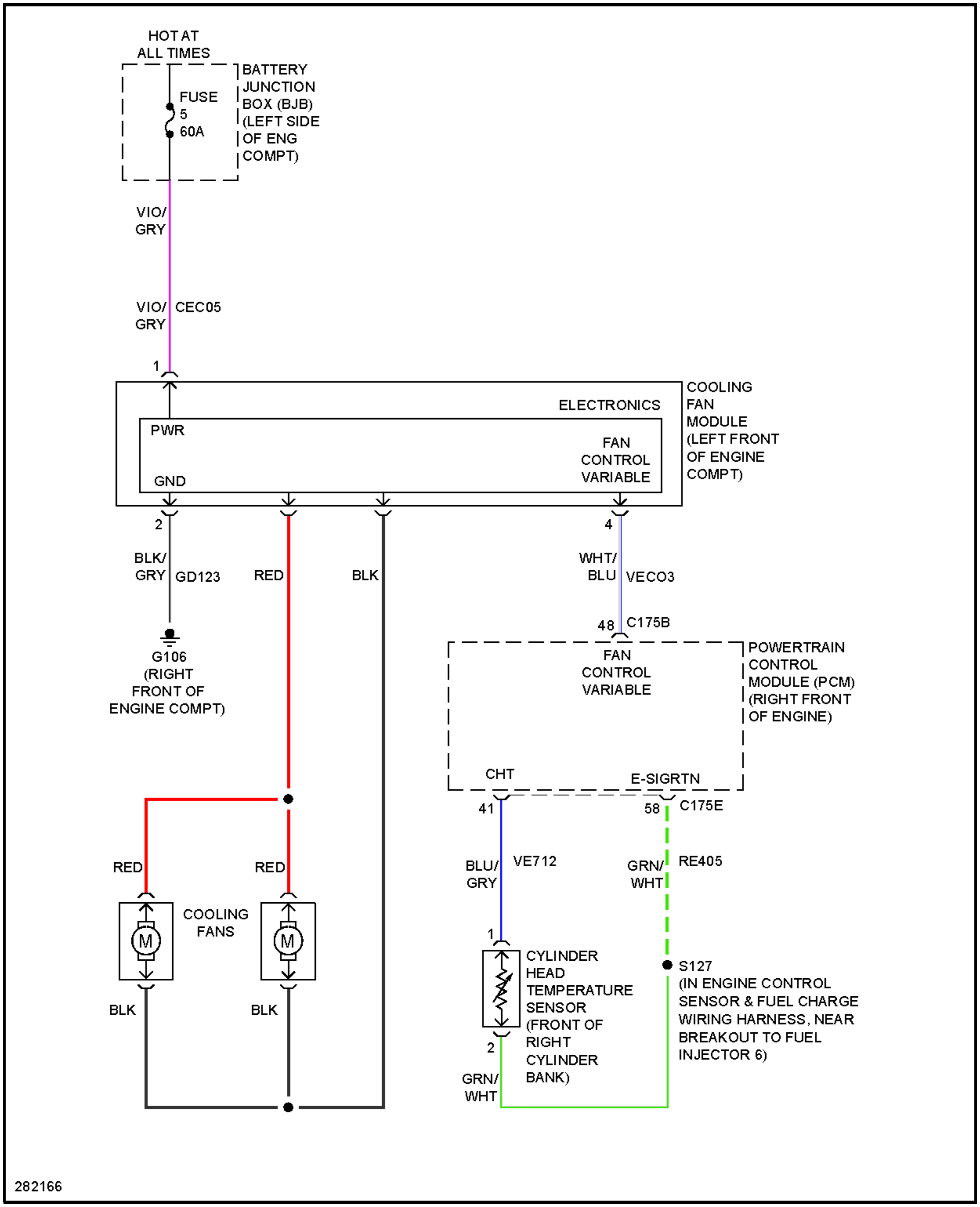
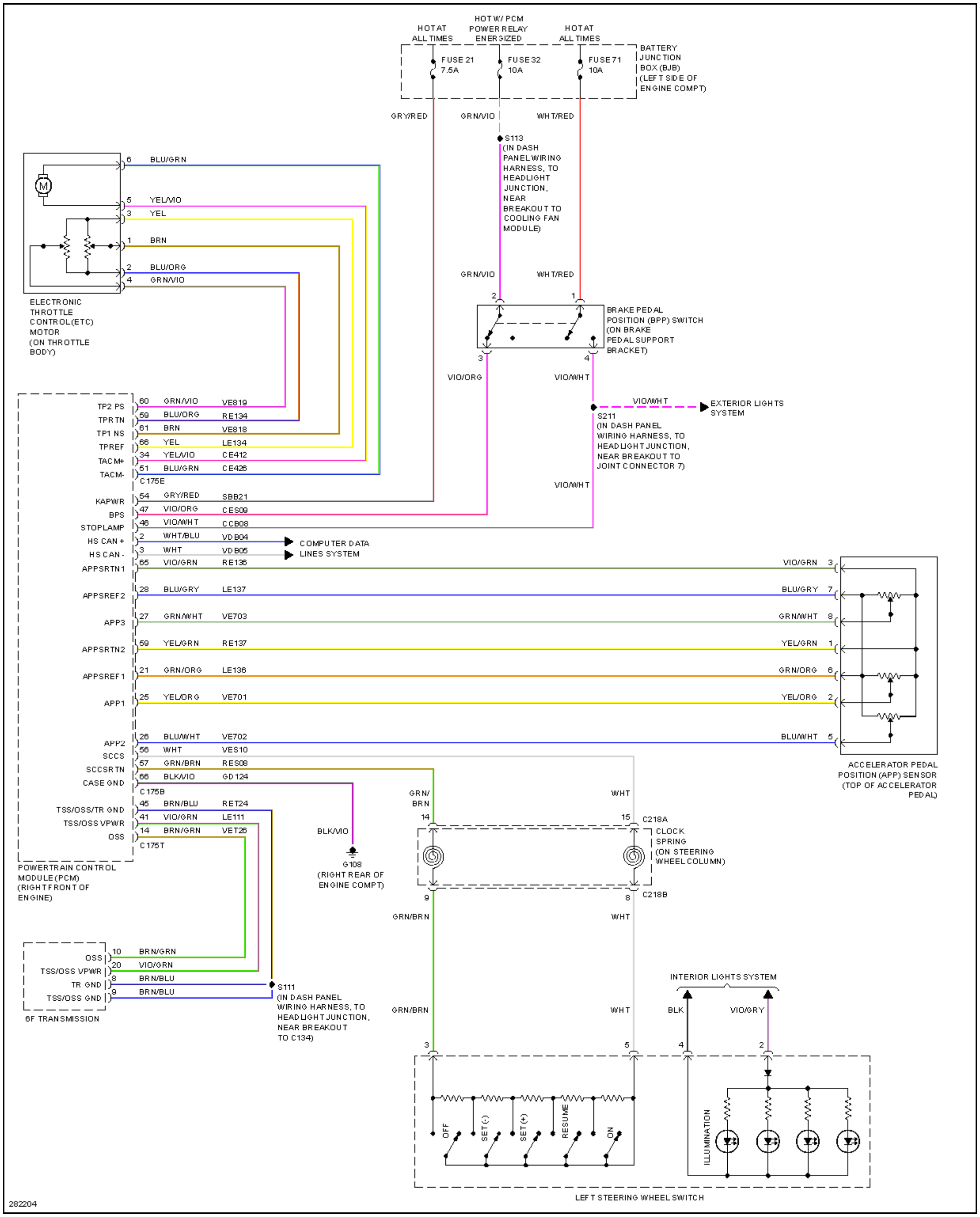

HOT AT
ALL TIMES
BATTERY
JUNCTION
BOX (BJB)
(LEFT SIDE
OF ENG
COMPT)
FUSE
5
60A
VIO/
GRY
VIO/
GRY
CEC05
1
COOLING
FAN
MODULE
(LEFT FRONT
OF ENGINE
COMPT)
ELECTRONICS
PWR
FAN
CONTROL
VARIABLE
GND
2
BLK/
GRY
GD123
RED
BLK
4
WHT/
BLU
VECO3
48
C175B
G106
(RIGHT
FRONT OF
ENGINE COMPT)
POWERTRAIN
CONTROL
MODULE (PCM)
(RIGHT FRONT
OF ENGINE)
FAN
CONTROL
VARIABLE
CHT
E-SIGRTN
41
58
C175E
RED
RED
BLU/
GRY
VE712
GRN/
WHT
RE405
COOLING
FANS
M
M
1
CYLINDER
HEAD
TEMPERATURE
SENSOR
(FRONT OF
RIGHT
CYLINDER
BANK)
2
S127
(IN ENGINE CONTROL
SENSOR & FUEL CHARGE
WIRING HARNESS, NEAR
BREAKOUT TO FUEL
INJECTOR 6)
BLK
BLK
GRN/
WHT
282166

Fig. 15: Cooling Fan Circuit, W/O Trailer Tow

CRUISE CONTROL



HOT AT ALL TIMES
HOT W/ PCM POWER RELAY ENERGIZED
HOT AT ALL TIMES
FUSE 21 7.5A
FUSE 32 10A
FUSE 71 10A
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
S113 (IN DASH PANEL WIRING HARNESS, TO HEADLIGHT JUNCTION, NEAR BREAKOUT TO COOLING FAN MODULE)
ELECTRONIC THROTTLE CONTROL (ETC) MOTOR (ON THROTTLE BODY)
BRAKE PEDAL POSITION (BPP) SWITCH (ON BRAKE PEDAL SUPPORT BRACKET)
S211 (IN DASH PANEL WIRING HARNESS, TO HEADLIGHT JUNCTION, NEAR BREAKOUT TO JOINT CONNECTOR 7)
EXTERIOR LIGHTS SYSTEM
TP2 PS
TPRTN
TP1 NS
TPREF
TACM+
TACM-
C175E
KAPWR
BPS
STOPLAMP
HS CAN +
HS CAN -
COMPUTER DATA LINES SYSTEM
APPSRTN1
APPSREF2
APP3
APPSRTN2
APPSREF1
APP1
APP2
SCCS
SCCSRTN
CASE GND
C175B
TSS/OSS/TR GND
TSS/OSS VPWR
OSS
C175T
POWERTRAIN CONTROL MODULE (PCM) (RIGHT FRONT OF ENGINE)
ACCELERATOR PEDAL POSITION (APP) SENSOR (TOP OF ACCELERATOR PEDAL)
G108 (RIGHT REAR OF ENGINE COMPT)
C218A
CLOCK SPRING (ON STEERING WHEEL COLUMN)
C218B
6F TRANSMISSION
S111 (IN DASH PANEL WIRING HARNESS, TO HEADLIGHT JUNCTION, NEAR BREAKOUT TO C134)
INTERIOR LIGHTS SYSTEM
OFF
SET (-)
SET (+)
RESUME
ON
ILLUMINATION
LEFT STEERING WHEEL SWITCH
282204

Fig. 16: Cruise Control Circuit

DEFOGGERS

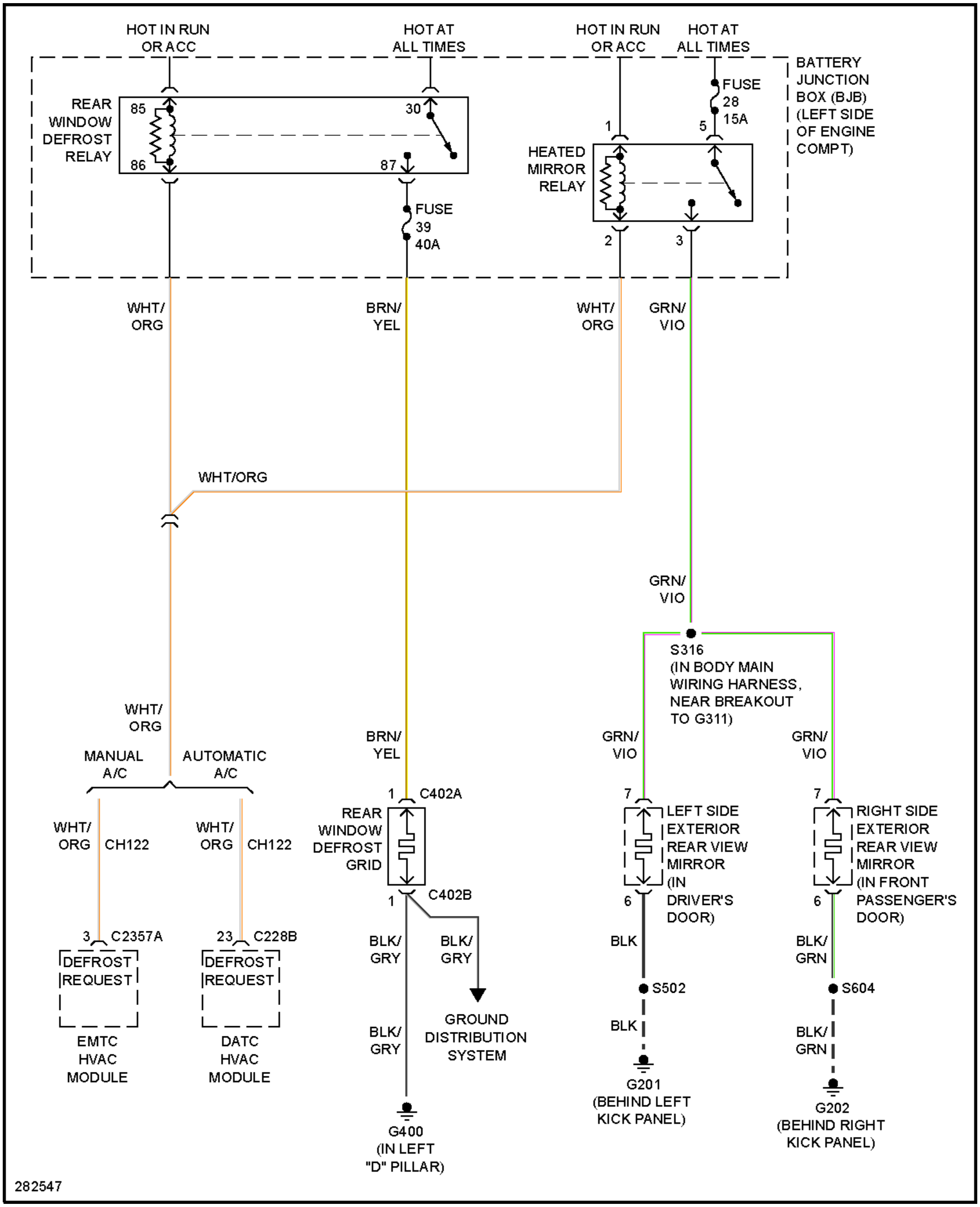

HOT IN RUN OR ACC
HOT AT ALL TIMES
HOT IN RUN OR ACC
HOT AT ALL TIMES
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
REAR WINDOW DEFROST RELAY
85
86
30
87
FUSE 39 40A
FUSE 28 15A
HEATED MIRROR RELAY
1
2
3
5
WHT/ORG
BRN/YEL
WHT/ORG
GRN/VIO
WHT/ORG
GRN/VIO
S316 (IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO G311)
WHT/ORG
MANUAL A/C
AUTOMATIC A/C
BRN/YEL
GRN/VIO
GRN/VIO
WHT/ORG
CH122
WHT/ORG
CH122
1
C402A
REAR WINDOW DEFROST GRID
1
C402B
7
LEFT SIDE EXTERIOR REAR VIEW MIRROR (IN DRIVER'S DOOR)
6
7
RIGHT SIDE EXTERIOR REAR VIEW MIRROR (IN FRONT PASSENGER'S DOOR)
6
3
C2357A
DEFROST REQUEST
EMTC HVAC MODULE
23
C228B
DEFROST REQUEST
DATC HVAC MODULE
BLK/GRY
BLK/GRY
GROUND DISTRIBUTION SYSTEM
BLK/GRY
G400 (IN LEFT "D" PILLAR)
BLK
S502
BLK
G201 (BEHIND LEFT KICK PANEL)
BLK/GRN
S604
BLK/GRN
G202 (BEHIND RIGHT KICK PANEL)
282547

Fig. 17: Defoggers Circuit

ENGINE PERFORMANCE

3.5L

2008 Ford Edge SE

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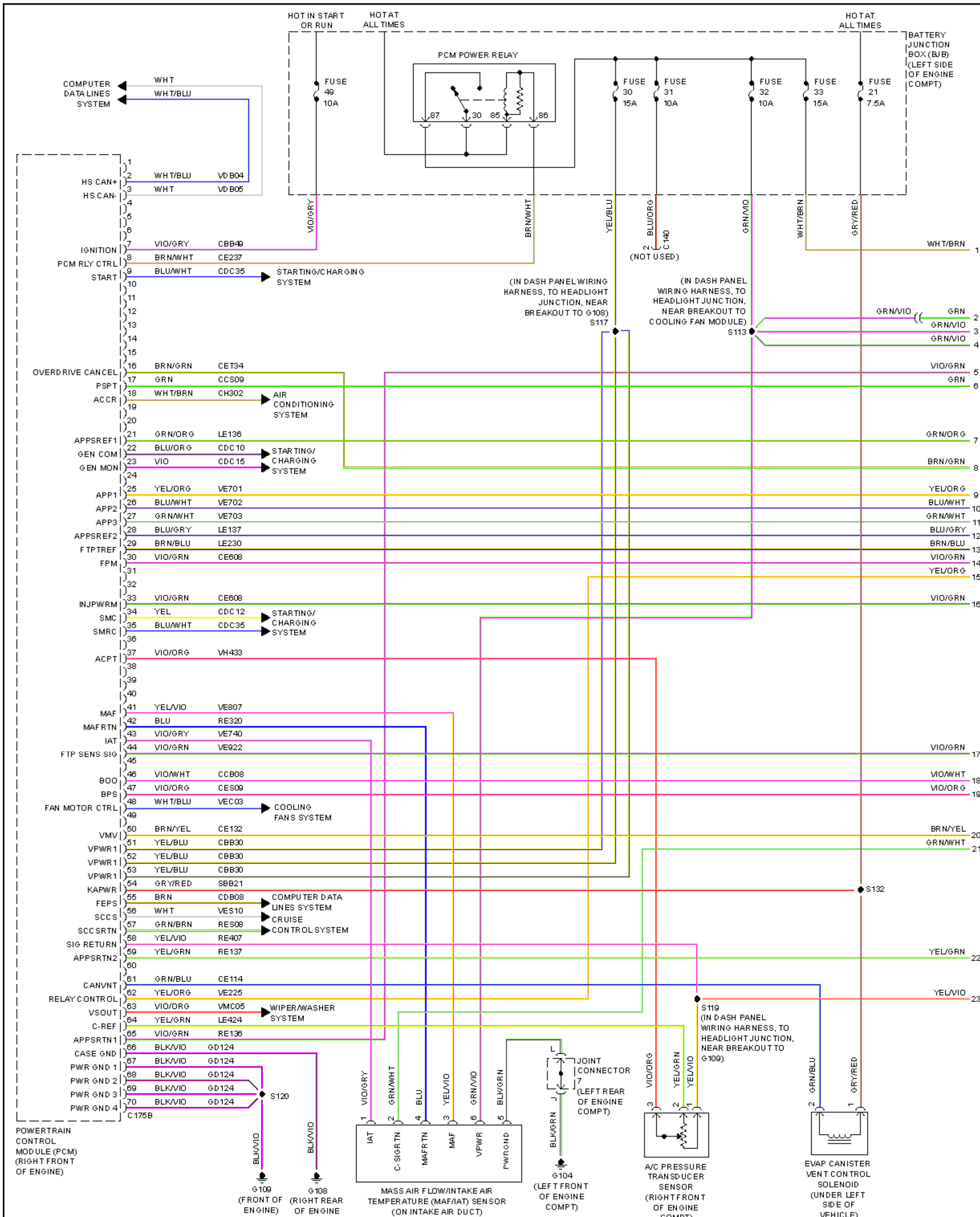


Fig. 18: 3.5L, Engine Performance Circuit (1 of 5)

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

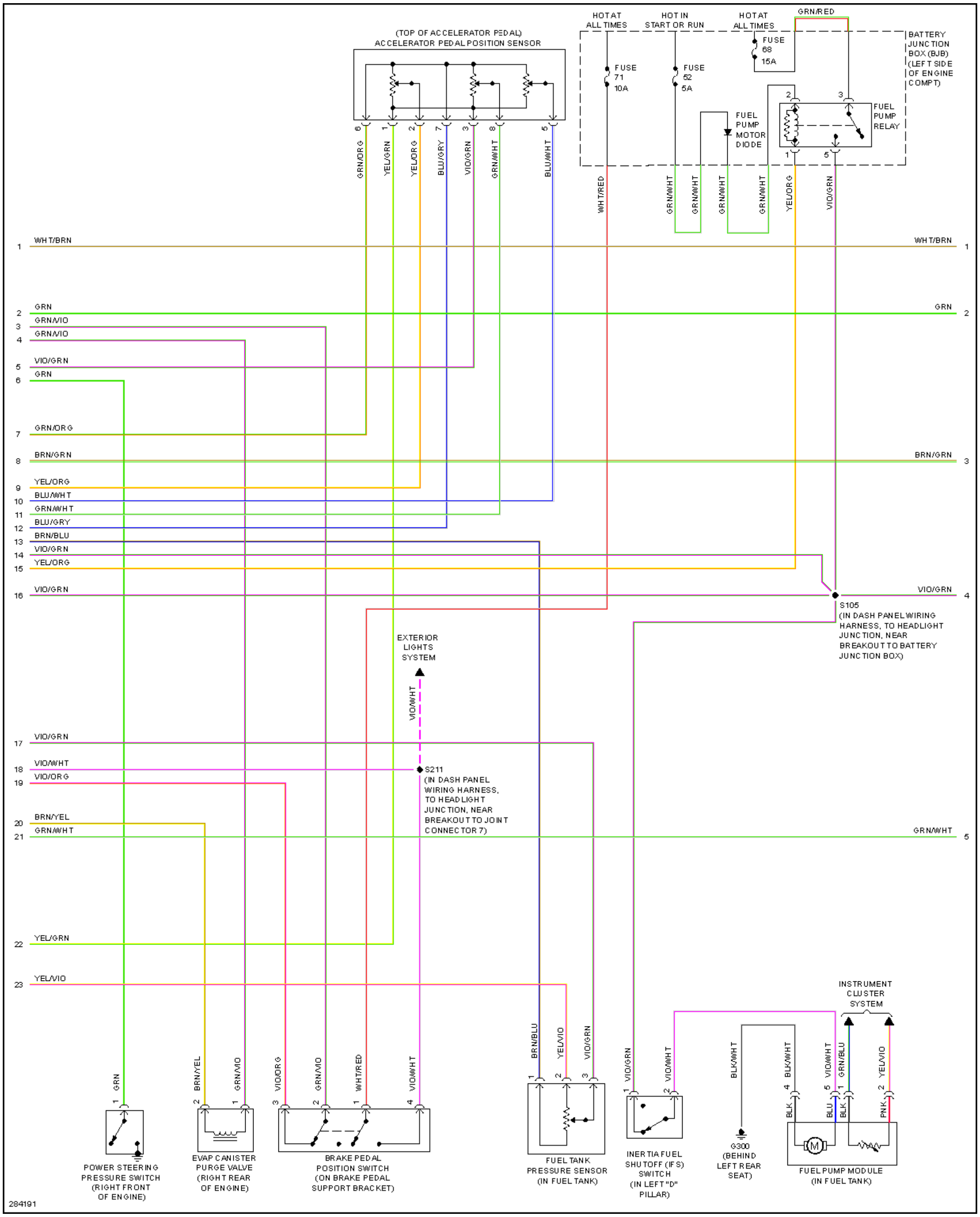


Fig. 19: 3.5L, Engine Performance Circuit (2 of 5)

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

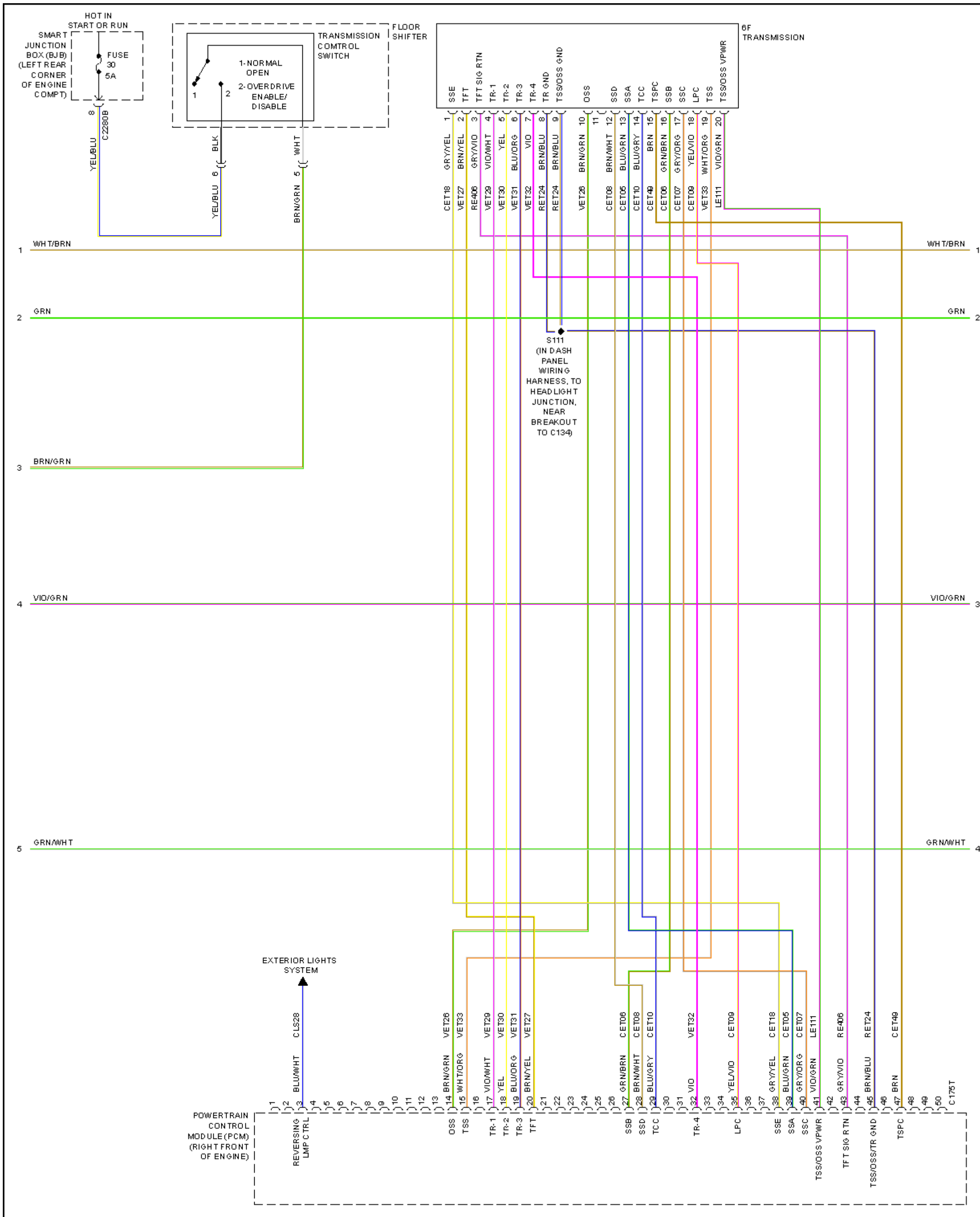
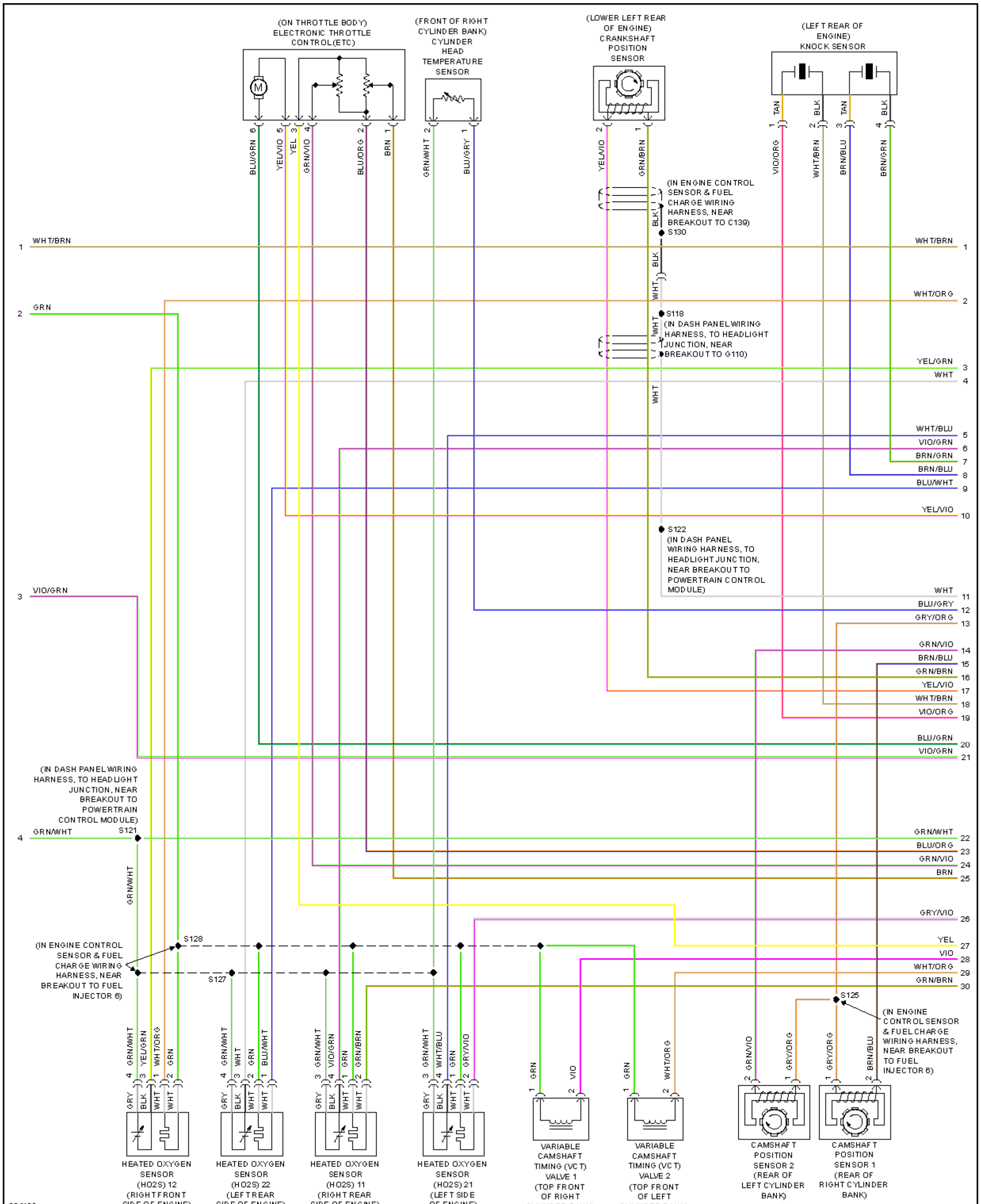
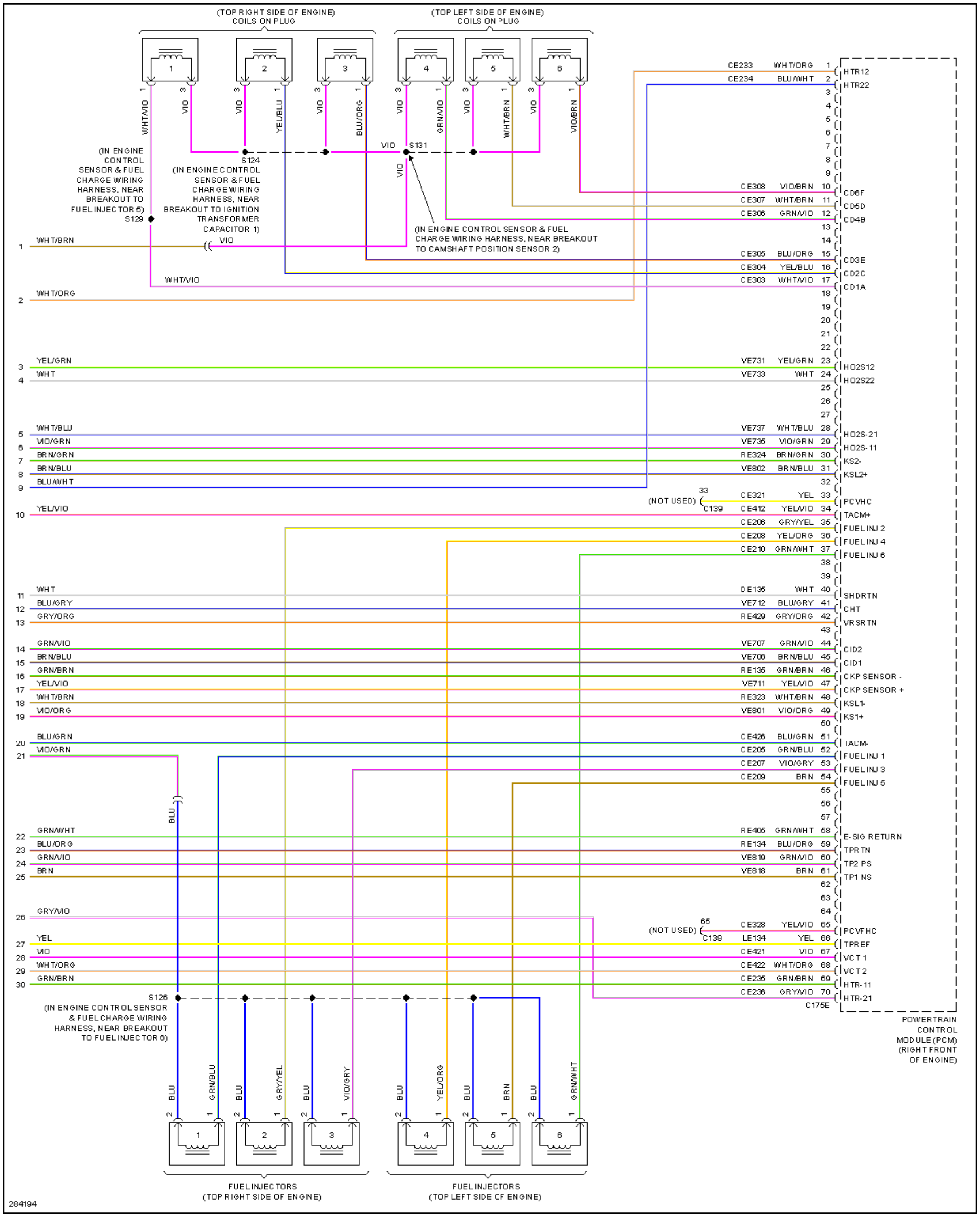


Fig. 20: 3.5L, Engine Performance Circuit (3 of 5)



(ON THROTTLE BODY) ELECTRONIC THROTTLE CONTROL(ETC)
(FRONT OF RIGHT CYLINDER BANK) CYLINDER HEAD TEMPERATURE SENSOR
(LOWER LEFT REAR OF ENGINE) CRANKSHAFT POSITION SENSOR
(LEFT REAR OF ENGINE) KNOCK SENSOR
(IN ENGINE CONTROL SENSOR & FUEL CHARGE WIRING HARNESS, NEAR BREAKOUT TO C139)
S130
S118
(IN DASH PANEL WIRING HARNESS, TO HEADLIGHT JUNCTION, NEAR BREAKOUT TO G110)
S122
(IN DASH PANEL WIRING HARNESS, TO HEADLIGHT JUNCTION, NEAR BREAKOUT TO POWERTRAIN CONTROL MODULE)
(IN DASH PANEL WIRING HARNESS, TO HEADLIGHT JUNCTION, NEAR BREAKOUT TO POWERTRAIN CONTROL MODULE)
S121
S128
S127
(IN ENGINE CONTROL SENSOR & FUEL CHARGE WIRING HARNESS, NEAR BREAKOUT TO FUEL INJECTOR 6)
S125
(IN ENGINE CONTROL SENSOR & FUEL CHARGE WIRING HARNESS, NEAR BREAKOUT TO FUEL INJECTOR 6)
1 WHT/BRN
2 GRN
3 VIO/GRN
4 GRN/WHT
WHT/BRN 1
WHT/ORG 2
YEL/GRN 3
WHT 4
WHT/BLU 5
VIO/GRN 6
BRN/GRN 7
BRN/BLU 8
BLU/WHT 9
YEL/VIO 10
WHT 11
BLU/GRY 12
GRY/ORG 13
GRN/VIO 14
BRN/BLU 15
GRN/BRN 16
YEL/VIO 17
WHT/BRN 18
VIO/ORG 19
BLU/GRN 20
VIO/GRN 21
GRN/WHT 22
BLU/ORG 23
GRN/VIO 24
BRN 25
GRY/VIO 26
YEL 27
VIO 28
WHT/ORG 29
GRN/BRN 30
HEATED OXYGEN SENSOR (HO2S) 12 (RIGHT FRONT SIDE OF ENGINE)
HEATED OXYGEN SENSOR (HO2S) 22 (LEFT REAR SIDE OF ENGINE)
HEATED OXYGEN SENSOR (HO2S) 11 (RIGHT REAR SIDE OF ENGINE)
HEATED OXYGEN SENSOR (HO2S) 21 (LEFT SIDE OF ENGINE)
VARIABLE CAMSHAFT TIMING (VCT) VALVE 1 (TOP FRONT OF RIGHT CYLINDER BANK)
VARIABLE CAMSHAFT TIMING (VCT) VALVE 2 (TOP FRONT OF LEFT CYLINDER BANK)
CAMSHAFT POSITION SENSOR 2 (REAR OF LEFT CYLINDER BANK)
CAMSHAFT POSITION SENSOR 1 (REAR OF RIGHT CYLINDER BANK)
284193

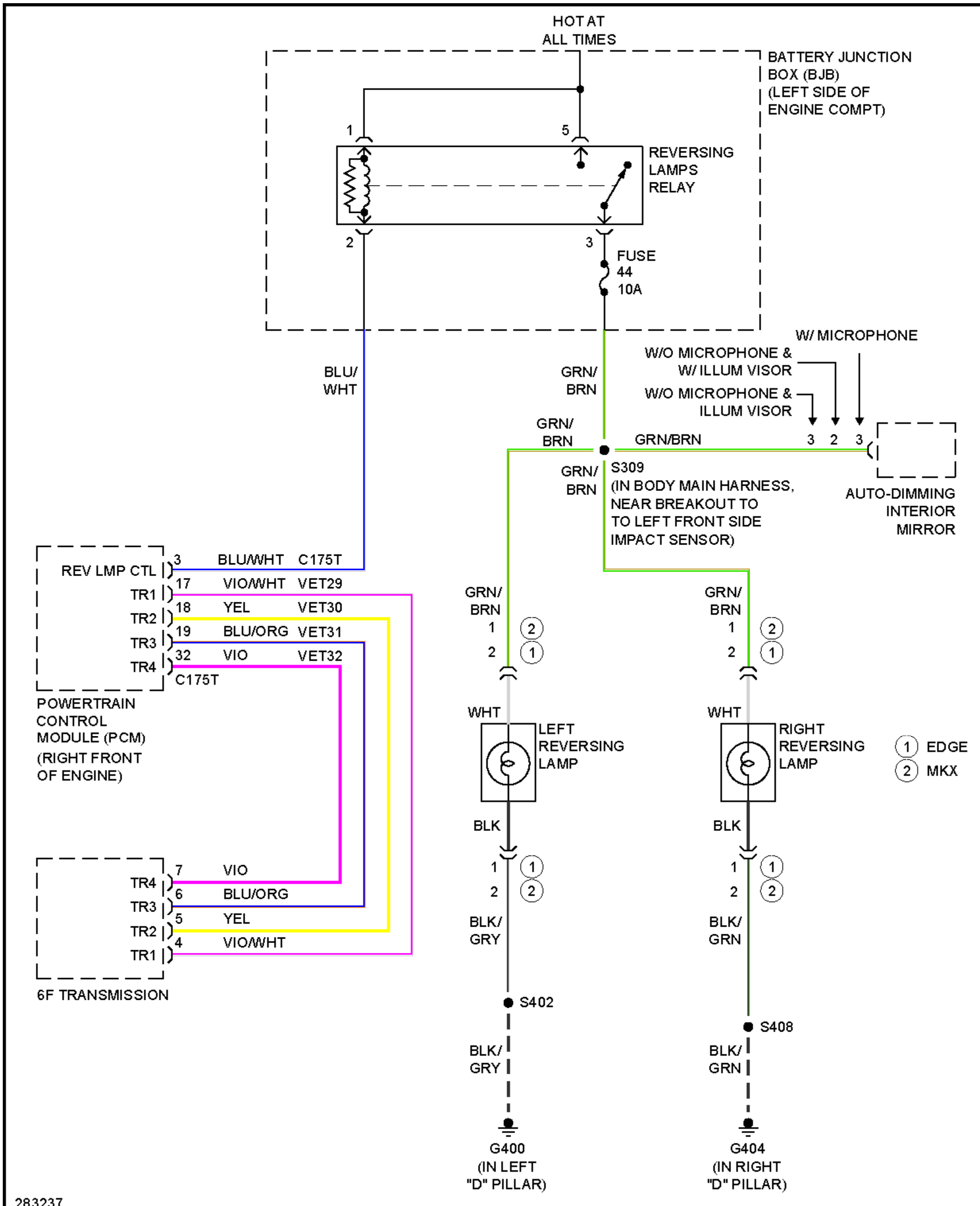
Fig. 21: 3.5L, Engine Performance Circuit (4 of 5)



(TOP RIGHT SIDE OF ENGINE) COILS ON PLUG
(TOP LEFT SIDE OF ENGINE) COILS ON PLUG
(IN ENGINE CONTROL SENSOR & FUEL CHARGE WIRING HARNESS, NEAR BREAKOUT TO FUEL INJECTOR 5) S129
S124 (IN ENGINE CONTROL SENSOR & FUEL CHARGE WIRING HARNESS, NEAR BREAKOUT TO IGNITION TRANSFORMER CAPACITOR 1)
S131
(IN ENGINE CONTROL SENSOR & FUEL CHARGE WIRING HARNESS, NEAR BREAKOUT TO CAMSHAFT POSITION SENSOR 2)
(NOT USED) C139
S126 (IN ENGINE CONTROL SENSOR & FUEL CHARGE WIRING HARNESS, NEAR BREAKOUT TO FUEL INJECTOR 6)
C175E
POWERTRAIN CONTROL MODULE (PCM) (RIGHT FRONT OF ENGINE)
FUEL INJECTORS (TOP RIGHT SIDE OF ENGINE)
FUEL INJECTORS (TOP LEFT SIDE OF ENGINE)
CE233 WHT/ORG 1 HTR12
CE234 BLU/WHT 2 HTR22
CE308 VIO/BRN 10 CD6F
CE307 WHT/BRN 11 CD5D
CE306 GRN/VIO 12 CD4B
CE305 BLU/ORG 15 CD3E
CE304 YEL/BLU 16 CD2C
CE303 WHT/VIO 17 CD1A
VE731 YEL/GRN 23 HO2S12
VE733 WHT 24 HO2S22
VE737 WHT/BLU 28 HO2S-21
VE735 VIO/GRN 29 HO2S-11
RE324 BRN/GRN 30 KS2-
VE802 BRN/BLU 31 KSL2+
CE321 YEL 33 PCVHC
CE412 YEL/VIO 34 TACM+
CE206 GRY/YEL 35 FUEL INJ 2
CE208 YEL/ORG 36 FUEL INJ 4
CE210 GRN/WHT 37 FUEL INJ 6
DE135 WHT 40 SHDRTN
VE712 BLU/GRY 41 CHT
RE429 GRY/ORG 42 VRSRTN
VE707 GRN/VIO 44 CID2
VE706 BRN/BLU 45 CID1
RE135 GRN/BRN 46 CKP SENSOR -
VE711 YEL/VIO 47 CKP SENSOR +
RE323 WHT/BRN 48 KSL1-
VE801 VIO/ORG 49 KS1+
CE426 BLU/GRN 51 TACM-
CE205 GRN/BLU 52 FUEL INJ 1
CE207 VIO/GRY 53 FUEL INJ 3
CE209 BRN 54 FUEL INJ 5
RE405 GRN/WHT 58 E-SIG RETURN
RE134 BLU/ORG 59 TPRTN
VE819 GRN/VIO 60 TP2 PS
VE818 BRN 61 TP1 NS
CE328 YEL/VIO 65 PCVFHC
LE134 YEL 66 TPREF
CE421 VIO 67 VCT 1
CE422 WHT/ORG 68 VCT 2
CE235 GRN/BRN 69 HTR-11
CE236 GRY/VIO 70 HTR-21
1 WHT/BRN
2 WHT/ORG
3 YEL/GRN
4 WHT
5 WHT/BLU
6 VIO/GRN
7 BRN/GRN
8 BRN/BLU
9 BLU/WHT
10 YEL/VIO
11 WHT
12 BLU/GRY
13 GRY/ORG
14 GRN/VIO
15 BRN/BLU
16 GRN/BRN
17 YEL/VIO
18 WHT/BRN
19 VIO/ORG
20 BLU/GRN
21 VIO/GRN
22 GRN/WHT
23 BLU/ORG
24 GRN/VIO
25 BRN
26 GRY/VIO
27 YEL
28 VIO
29 WHT/ORG
30 GRN/BRN
284194

Fig. 22: 3.5L, Engine Performance Circuit (5 of 5)

EXTERIOR LIGHTS



HOT AT ALL TIMES
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
1
5
REVERSING LAMPS RELAY
2
3
FUSE 44 10A
BLU/ WHT
GRN/ BRN
W/ MICROPHONE
W/O MICROPHONE & W/ ILLUM VISOR
W/O MICROPHONE & ILLUM VISOR
GRN/ BRN
GRN/BRN
3 2 3
AUTO-DIMMING INTERIOR MIRROR
GRN/ BRN
S309 (IN BODY MAIN HARNESS, NEAR BREAKOUT TO TO LEFT FRONT SIDE IMPACT SENSOR)
REV LMP CTL
3 BLU/WHT C175T
TR1
17 VIO/WHT VET29
TR2
18 YEL VET30
TR3
19 BLU/ORG VET31
TR4
32 VIO VET32
C175T
POWERTRAIN CONTROL MODULE (PCM) (RIGHT FRONT OF ENGINE)
GRN/ BRN
1 2
2 1
WHT
LEFT REVERSING LAMP
BLK
1 1
2 2
BLK/ GRY
S402
BLK/ GRY
G400 (IN LEFT "D" PILLAR)
GRN/ BRN
1 2
2 1
WHT
RIGHT REVERSING LAMP
BLK
1 1
2 2
BLK/ GRN
S408
BLK/ GRN
G404 (IN RIGHT "D" PILLAR)
1 EDGE
2 MKX
TR4 7 VIO
TR3 6 BLU/ORG
TR2 5 YEL
TR1 4 VIO/WHT
6F TRANSMISSION
283237

Fig. 23: Backup Lamps Circuit

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

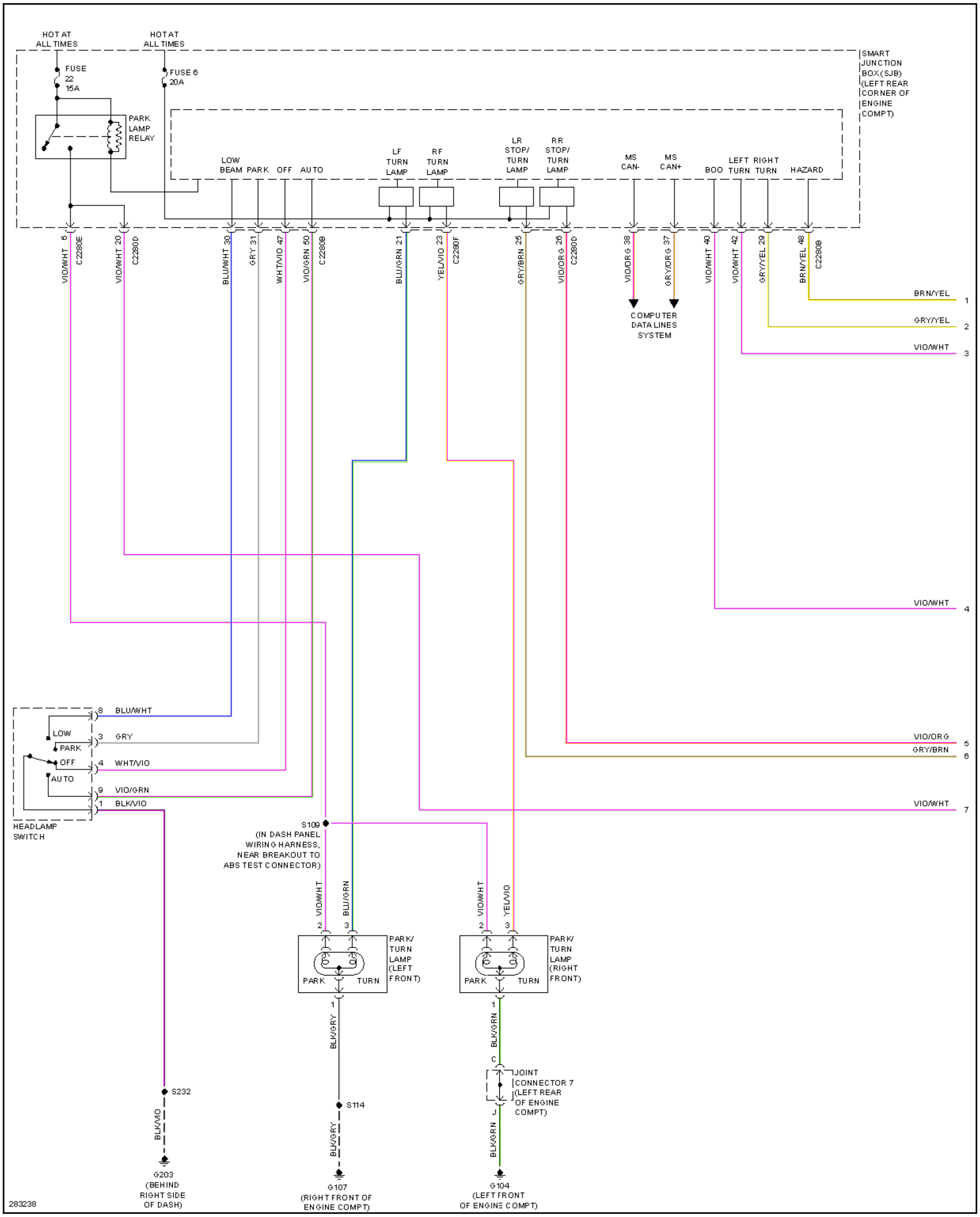
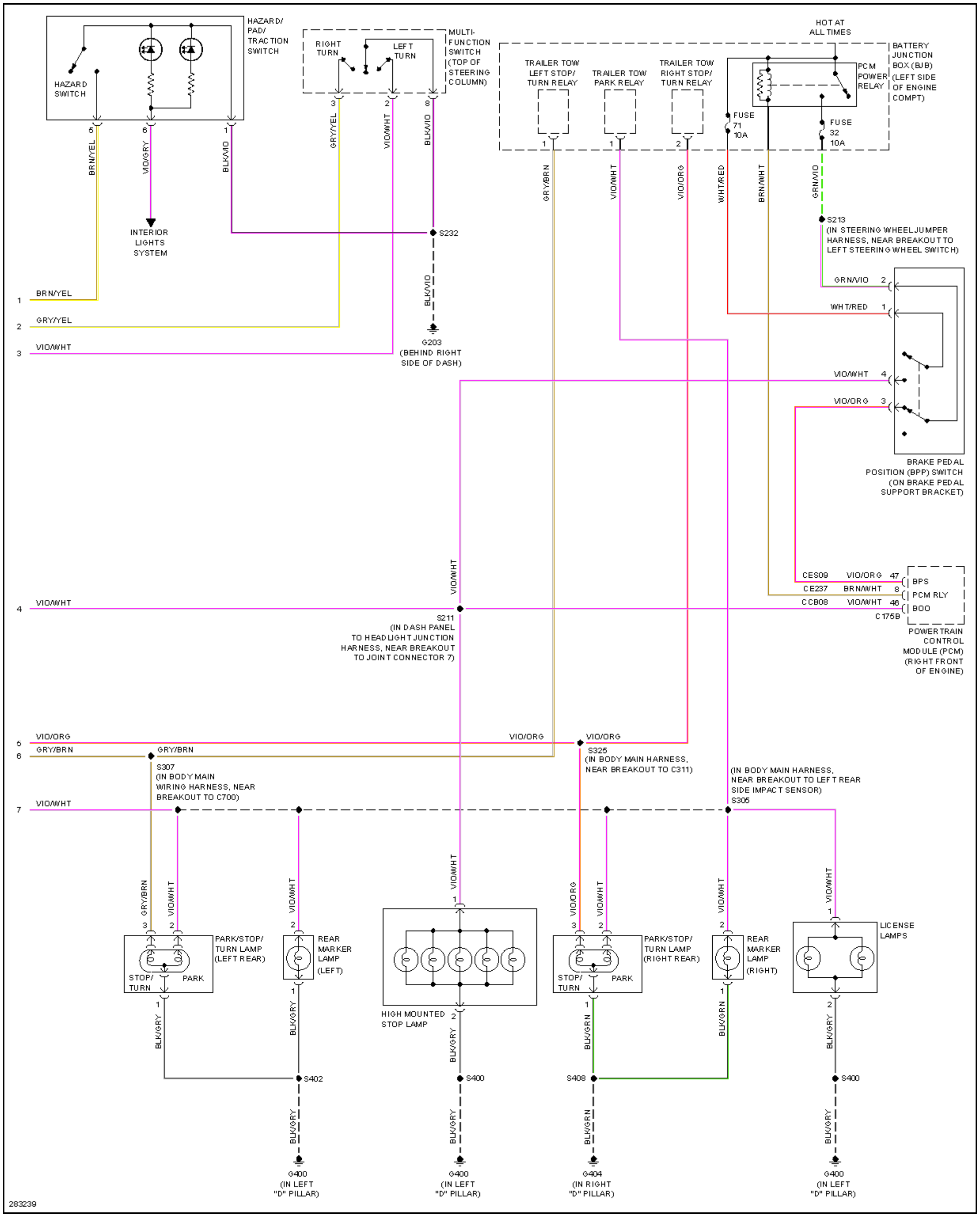


Fig. 24: Exterior Lamps Circuit (1 of 2)



HAZARD/ PAD/ TRACTION SWITCH
HAZARD SWITCH
MULTI-FUNCTION SWITCH (TOP OF STEERING COLUMN)
RIGHT TURN
LEFT TURN
HOT AT ALL TIMES
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
TRAILER TOW LEFT STOP/ TURN RELAY
TRAILER TOW PARK RELAY
TRAILER TOW RIGHT STOP/ TURN RELAY
PCM POWER RELAY
FUSE 71 10A
FUSE 32 10A
INTERIOR LIGHTS SYSTEM
S232
G203 (BEHIND RIGHT SIDE OF DASH)
S213 (IN STEERING WHEEL JUMPER HARNESS, NEAR BREAKOUT TO LEFT STEERING WHEEL SWITCH)
BRAKE PEDAL POSITION (BPP) SWITCH (ON BRAKE PEDAL SUPPORT BRACKET)
CES09 VIO/ORG 47 BPS
CE237 BRN/WHT 8 PCM RLY
CCB08 VIO/WHT 46 BOO
C175B
POWERTRAIN CONTROL MODULE (PCM) (RIGHT FRONT OF ENGINE)
S211 (IN DASH PANEL TO HEADLIGHT JUNCTION HARNESS, NEAR BREAKOUT TO JOINT CONNECTOR 7)
S325 (IN BODY MAIN HARNESS, NEAR BREAKOUT TO C311)
S307 (IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO C700)
(IN BODY MAIN HARNESS, NEAR BREAKOUT TO LEFT REAR SIDE IMPACT SENSOR) S305
PARK/STOP/ TURN LAMP (LEFT REAR)
STOP/ TURN
PARK
REAR MARKER LAMP (LEFT)
HIGH MOUNTED STOP LAMP
PARK/STOP/ TURN LAMP (RIGHT REAR)
REAR MARKER LAMP (RIGHT)
LICENSE LAMPS
S402
S400
S408
G400 (IN LEFT "D" PILLAR)
G400 (IN LEFT "D" PILLAR)
G404 (IN RIGHT "D" PILLAR)
G400 (IN LEFT "D" PILLAR)
283239

Fig. 25: Exterior Lamps Circuit (2 of 2)

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

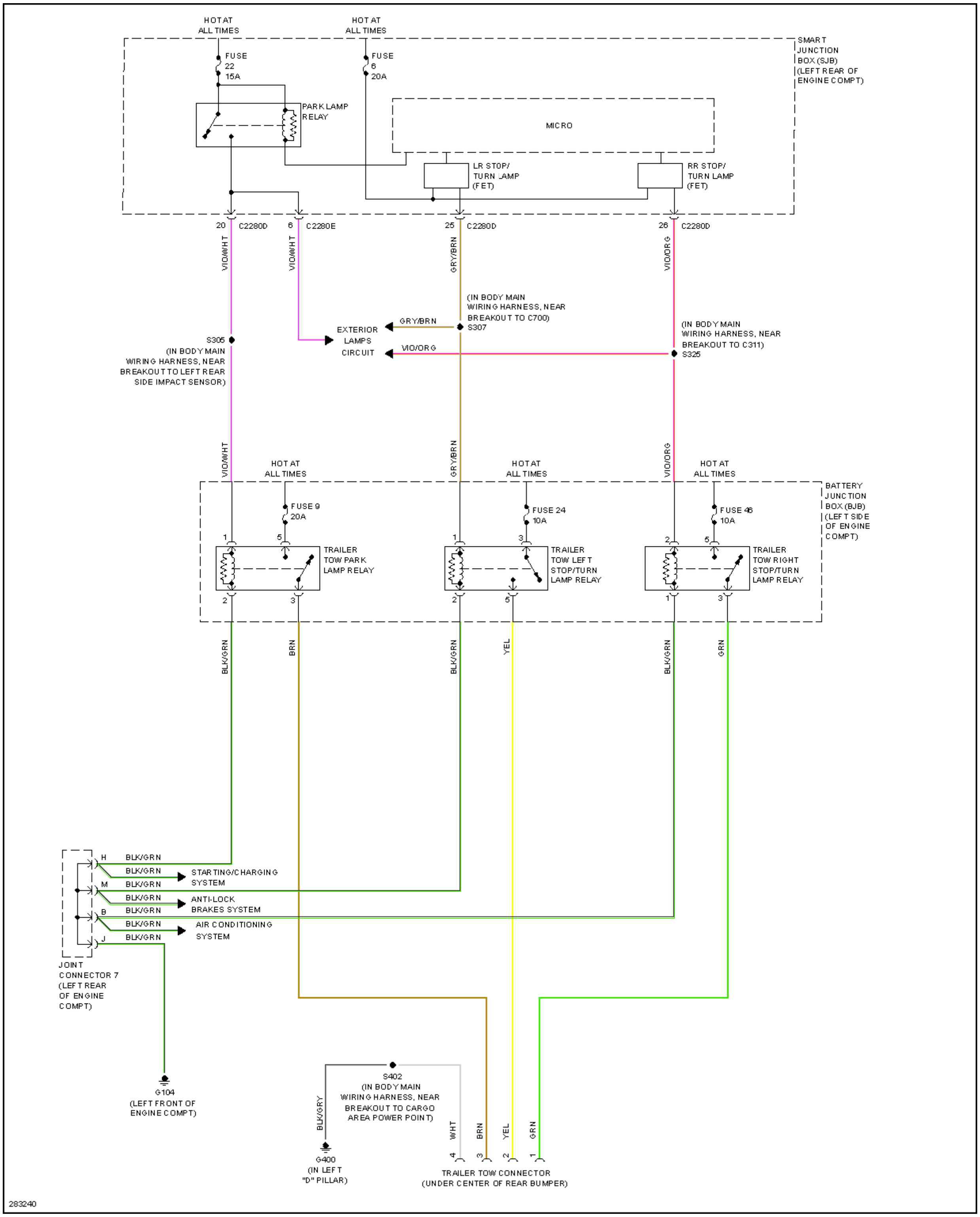
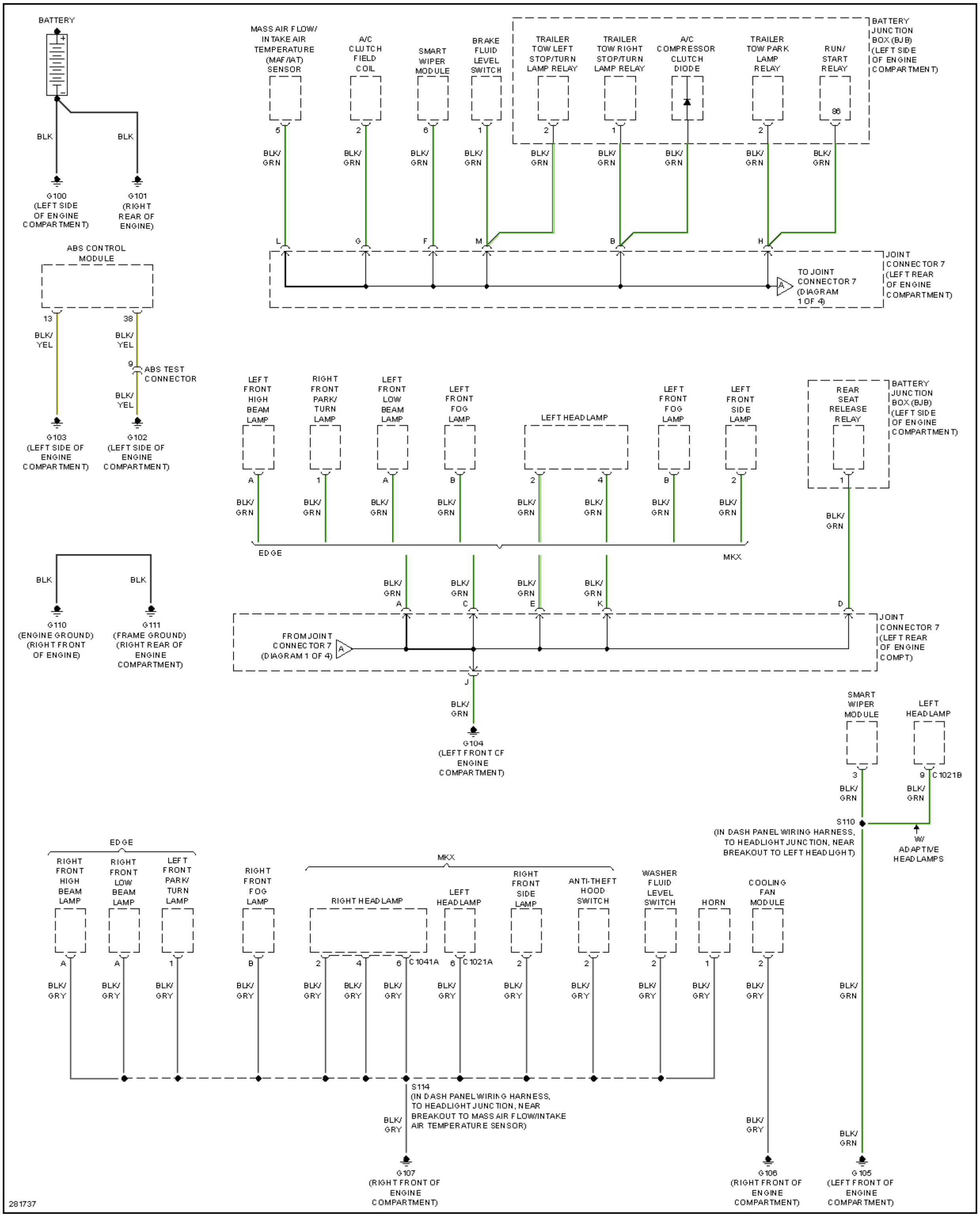


Fig. 26: Trailer Adapter Circuit

GROUND DISTRIBUTION



BATTERY
BLK
BLK
G100 (LEFT SIDE OF ENGINE COMPARTMENT)
G101 (RIGHT REAR OF ENGINE)
MASS AIR FLOW/ INTAKE AIR TEMPERATURE (MAF/IAT) SENSOR
A/C CLUTCH FIELD COIL
SMART WIPER MODULE
BRAKE FLUID LEVEL SWITCH
TRAILER TOW LEFT STOP/TURN LAMP RELAY
TRAILER TOW RIGHT STOP/TURN LAMP RELAY
A/C COMPRESSOR CLUTCH DIODE
TRAILER TOW PARK LAMP RELAY
RUN/ START RELAY
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPARTMENT)
BLK/ GRN
JOINT CONNECTOR 7 (LEFT REAR OF ENGINE COMPARTMENT)
TO JOINT CONNECTOR 7 (DIAGRAM 1 OF 4)
ABS CONTROL MODULE
BLK/ YEL
ABS TEST CONNECTOR
G103 (LEFT SIDE OF ENGINE COMPARTMENT)
G102 (LEFT SIDE OF ENGINE COMPARTMENT)
LEFT FRONT HIGH BEAM LAMP
RIGHT FRONT PARK/ TURN LAMP
LEFT FRONT LOW BEAM LAMP
LEFT FRONT FOG LAMP
LEFT HEADLAMP
LEFT FRONT FOG LAMP
LEFT FRONT SIDE LAMP
REAR SEAT RELEASE RELAY
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPARTMENT)
EDGE
MKX
G110 (ENGINE GROUND) (RIGHT FRONT OF ENGINE)
G111 (FRAME GROUND) (RIGHT REAR OF ENGINE COMPARTMENT)
FROM JOINT CONNECTOR 7 (DIAGRAM 1 OF 4)
JOINT CONNECTOR 7 (LEFT REAR OF ENGINE COMPT)
G104 (LEFT FRONT OF ENGINE COMPARTMENT)
SMART WIPER MODULE
LEFT HEADLAMP
C1021B
S110 (IN DASH PANEL WIRING HARNESS, TO HEADLIGHT JUNCTION, NEAR BREAKOUT TO LEFT HEADLIGHT)
W/ ADAPTIVE HEADLAMPS
RIGHT FRONT HIGH BEAM LAMP
RIGHT FRONT LOW BEAM LAMP
LEFT FRONT PARK/ TURN LAMP
RIGHT FRONT FOG LAMP
RIGHT HEADLAMP
LEFT HEADLAMP
RIGHT FRONT SIDE LAMP
ANTI-THEFT HOOD SWITCH
WASHER FLUID LEVEL SWITCH
HORN
COOLING FAN MODULE
C1041A
C1021A
BLK/ GRY
S114 (IN DASH PANEL WIRING HARNESS, TO HEADLIGHT JUNCTION, NEAR BREAKOUT TO MASS AIR FLOW/INTAKE AIR TEMPERATURE SENSOR)
G107 (RIGHT FRONT OF ENGINE COMPARTMENT)
G106 (RIGHT FRONT OF ENGINE COMPARTMENT)
G105 (LEFT FRONT OF ENGINE COMPARTMENT)
281737

Fig. 27: Ground Distribution Circuit (1 of 4)

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

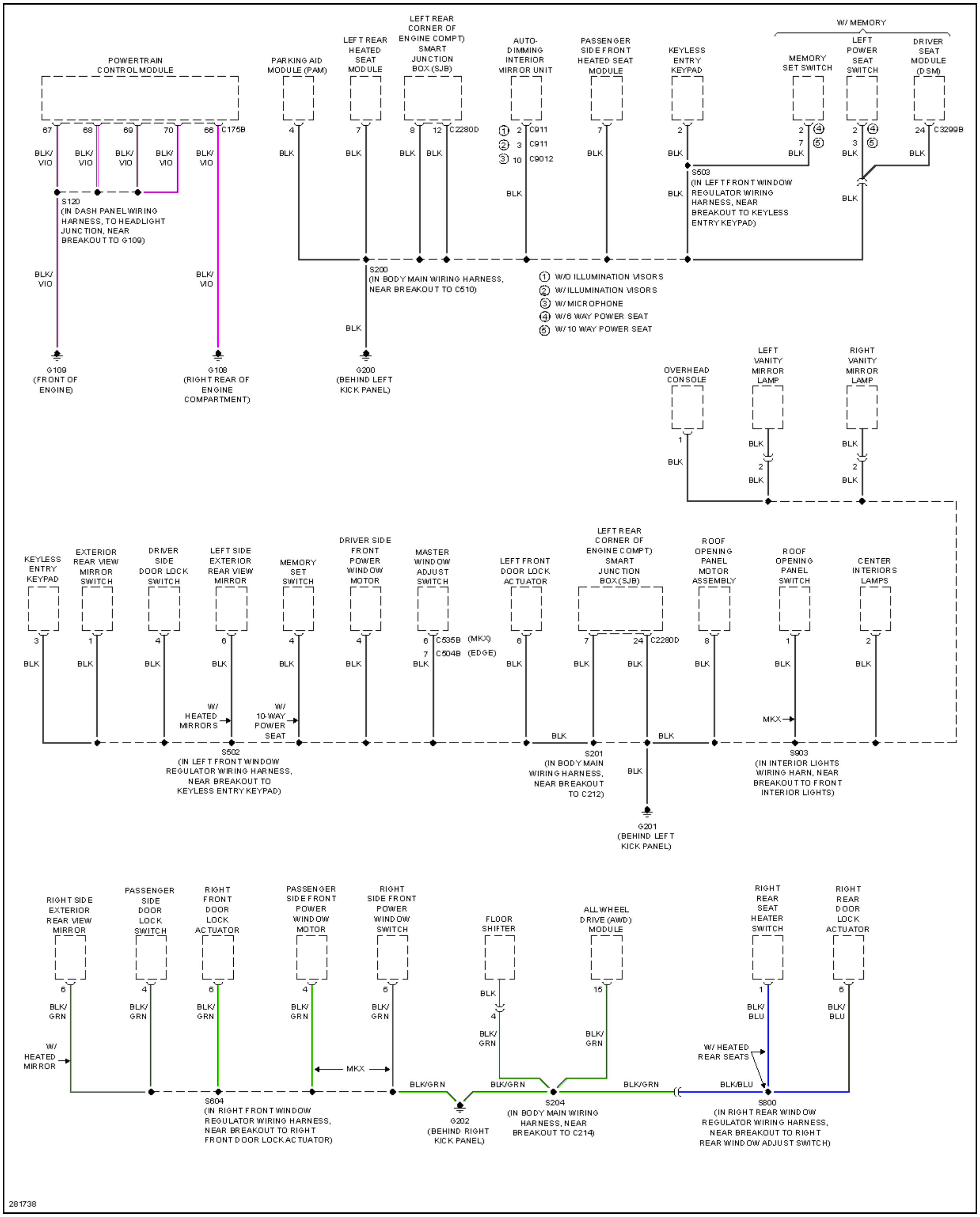


Fig. 28: Ground Distribution Circuit (2 of 4)

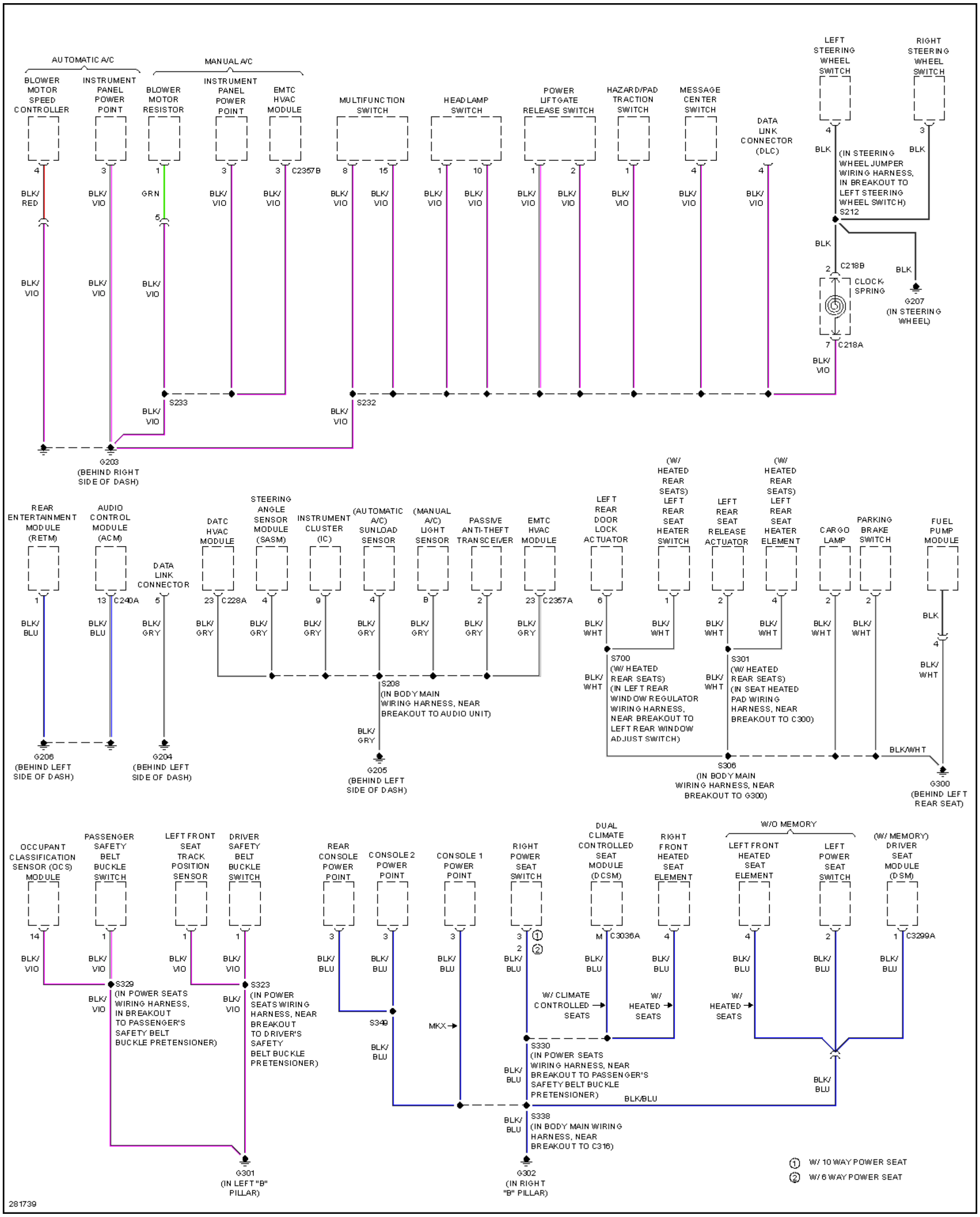
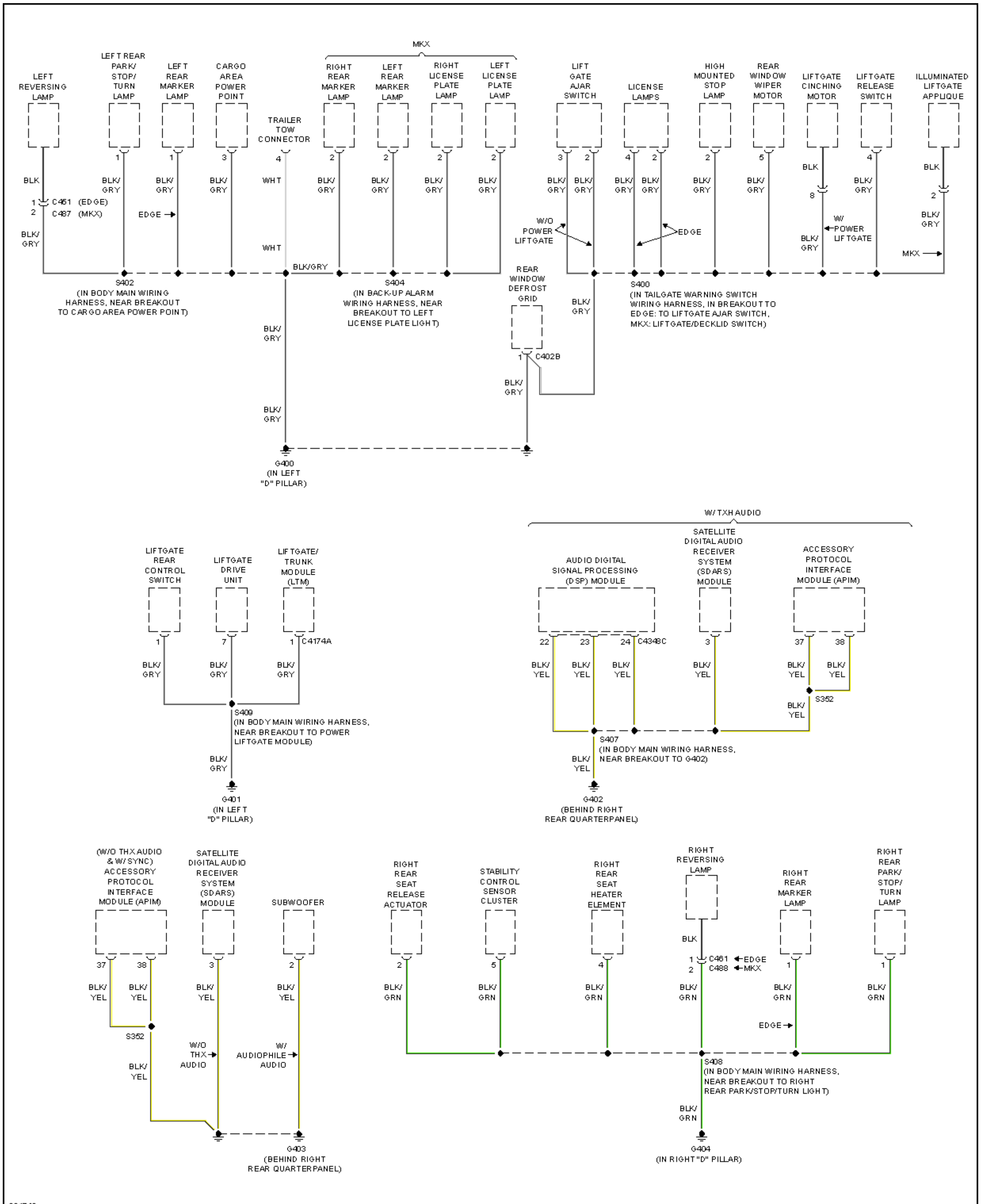

AUTOMATIC A/C
MANUAL A/C
BLOWER MOTOR SPEED CONTROLLER
INSTRUMENT PANEL POWER POINT
BLOWER MOTOR RESISTOR
EMTC HVAC MODULE
MULTIFUNCTION SWITCH
HEADLAMP SWITCH
POWER LIFTGATE RELEASE SWITCH
HAZARD/PAD TRACTION SWITCH
MESSAGE CENTER SWITCH
DATA LINK CONNECTOR (DLC)
LEFT STEERING WHEEL SWITCH
RIGHT STEERING WHEEL SWITCH
(IN STEERING WHEEL JUMPER WIRING HARNESS, IN BREAKOUT TO LEFT STEERING WHEEL SWITCH)
S212
C218B
CLOCK SPRING
C218A
G207 (IN STEERING WHEEL)
C2357B
S233
S232
G203 (BEHIND RIGHT SIDE OF DASH)
REAR ENTERTAINMENT MODULE (RETM)
AUDIO CONTROL MODULE (ACM)
DATA LINK CONNECTOR
DATC HVAC MODULE
STEERING ANGLE SENSOR MODULE (SASM)
INSTRUMENT CLUSTER (IC)
(AUTOMATIC A/C) SUNLOAD SENSOR
(MANUAL A/C) LIGHT SENSOR
PASSIVE ANTI-THEFT TRANSCEIVER
EMTC HVAC MODULE
LEFT REAR DOOR LOCK ACTUATOR
(W/ HEATED REAR SEATS) LEFT REAR SEAT HEATER SWITCH
LEFT REAR SEAT RELEASE ACTUATOR
(W/ HEATED REAR SEATS) LEFT REAR SEAT HEATER ELEMENT
CARGO LAMP
PARKING BRAKE SWITCH
FUEL PUMP MODULE
C240A
C228A
C2357A
S208 (IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO AUDIO UNIT)
G206 (BEHIND LEFT SIDE OF DASH)
G204 (BEHIND LEFT SIDE OF DASH)
G205 (BEHIND LEFT SIDE OF DASH)
S700 (W/ HEATED REAR SEATS) (IN LEFT REAR WINDOW REGULATOR WIRING HARNESS, NEAR BREAKOUT TO LEFT REAR WINDOW ADJUST SWITCH)
S301 (W/ HEATED REAR SEATS) (IN SEAT HEATED PAD WIRING HARNESS, NEAR BREAKOUT TO C300)
S306 (IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO G300)
G300 (BEHIND LEFT REAR SEAT)
OCCUPANT CLASSIFICATION SENSOR (OCS) MODULE
PASSENGER SAFETY BELT BUCKLE SWITCH
LEFT FRONT SEAT TRACK POSITION SENSOR
DRIVER SAFETY BELT BUCKLE SWITCH
REAR CONSOLE POWER POINT
CONSOLE 2 POWER POINT
CONSOLE 1 POWER POINT
RIGHT POWER SEAT SWITCH
DUAL CLIMATE CONTROLLED SEAT MODULE (DCSM)
RIGHT FRONT HEATED SEAT ELEMENT
W/O MEMORY
LEFT FRONT HEATED SEAT ELEMENT
LEFT POWER SEAT SWITCH
(W/ MEMORY) DRIVER SEAT MODULE (DSM)
C3036A
C3299A
S329 (IN POWER SEATS WIRING HARNESS, IN BREAKOUT TO PASSENGER'S SAFETY BELT BUCKLE PRETENSIONER)
S323 (IN POWER SEATS WIRING HARNESS, NEAR BREAKOUT TO DRIVER'S SAFETY BELT BUCKLE PRETENSIONER)
S349
MKX
W/ CLIMATE CONTROLLED SEATS
W/ HEATED SEATS
S330 (IN POWER SEATS WIRING HARNESS, NEAR BREAKOUT TO PASSENGER'S SAFETY BELT BUCKLE PRETENSIONER)
S338 (IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO C316)
G301 (IN LEFT "B" PILLAR)
G302 (IN RIGHT "B" PILLAR)
1 W/ 10 WAY POWER SEAT
2 W/ 6 WAY POWER SEAT
281739

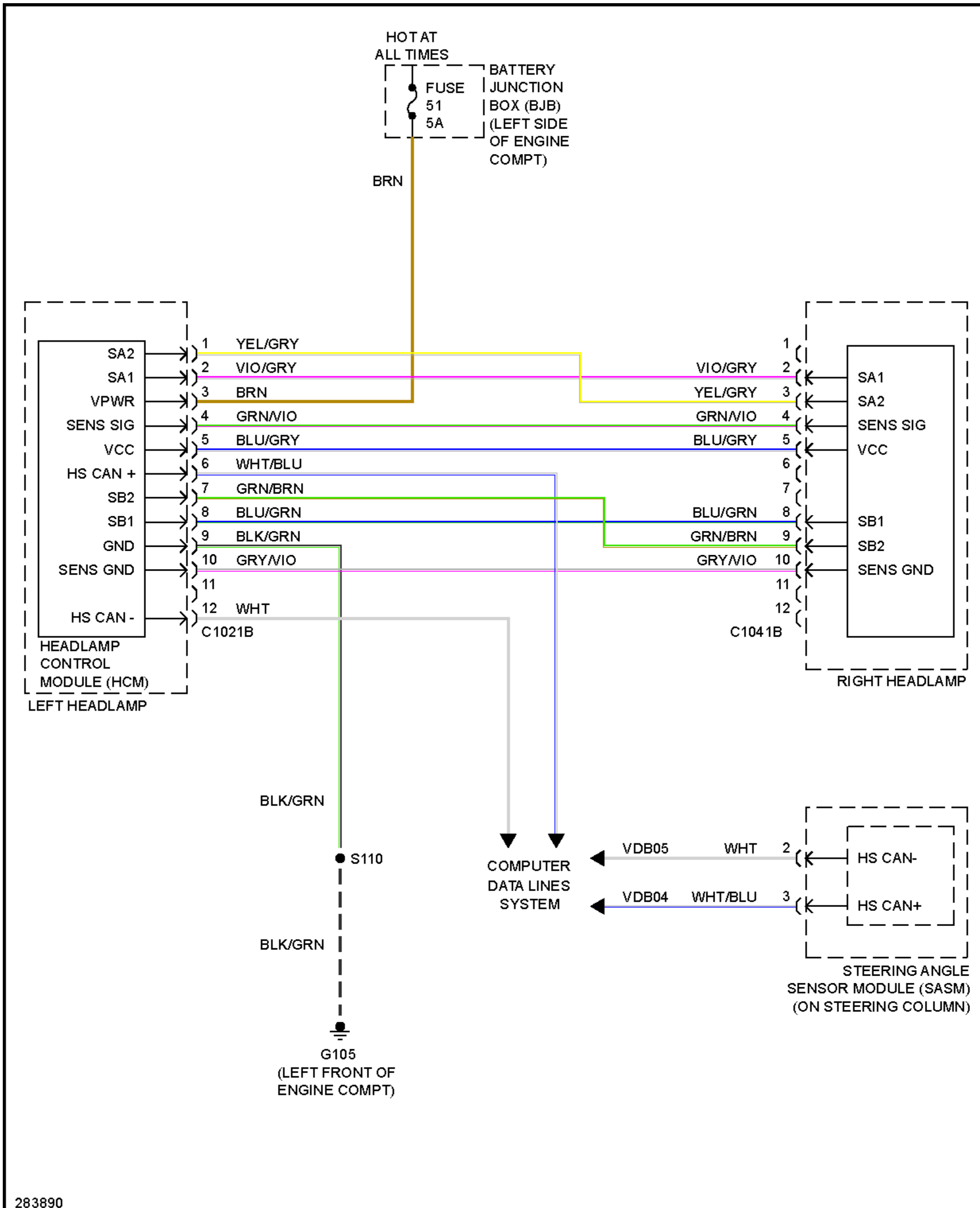
Fig. 29: Ground Distribution Circuit (3 of 4)



LEFT REVERSING LAMP
LEFT REAR PARK/STOP/TURN LAMP
LEFT REAR MARKER LAMP
CARGO AREA POWER POINT
TRAILER TOW CONNECTOR
MKX
RIGHT REAR MARKER LAMP
LEFT REAR MARKER LAMP
RIGHT LICENSE PLATE LAMP
LEFT LICENSE PLATE LAMP
LIFT GATE AJAR SWITCH
LICENSE LAMPS
HIGH MOUNTED STOP LAMP
REAR WINDOW WIPER MOTOR
LIFTGATE CINCHING MOTOR
LIFTGATE RELEASE SWITCH
ILLUMINATED LIFTGATE APPLIQUE
C451 (EDGE)
C487 (MKX)
EDGE
W/O POWER LIFTGATE
W/ POWER LIFTGATE
S402
(IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO CARGO AREA POWER POINT)
S404
(IN BACK-UP ALARM WIRING HARNESS, NEAR BREAKOUT TO LEFT LICENSE PLATE LIGHT)
REAR WINDOW DEFROST GRID
C402B
S400
(IN TAILGATE WARNING SWITCH WIRING HARNESS, IN BREAKOUT TO EDGE: TO LIFTGATE AJAR SWITCH, MKX: LIFTGATE/DECKLID SWITCH)
G400
(IN LEFT "D" PILLAR)
W/ TXH AUDIO
LIFTGATE REAR CONTROL SWITCH
LIFTGATE DRIVE UNIT
LIFTGATE/TRUNK MODULE (LTM)
C4174A
S409
(IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO POWER LIFTGATE MODULE)
G401
(IN LEFT "D" PILLAR)
AUDIO DIGITAL SIGNAL PROCESSING (DSP) MODULE
SATELLITE DIGITAL AUDIO RECEIVER SYSTEM (SDARS) MODULE
ACCESSORY PROTOCOL INTERFACE MODULE (APIM)
C4348C
S352
S407
(IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO G402)
G402
(BEHIND RIGHT REAR QUARTERPANEL)
(W/O THX AUDIO & W/ SYNC) ACCESSORY PROTOCOL INTERFACE MODULE (APIM)
SATELLITE DIGITAL AUDIO RECEIVER SYSTEM (SDARS) MODULE
SUBWOOFER
W/O THX AUDIO
W/ AUDIOPHILE AUDIO
G403
(BEHIND RIGHT REAR QUARTERPANEL)
RIGHT REAR SEAT RELEASE ACTUATOR
STABILITY CONTROL SENSOR CLUSTER
RIGHT REAR SEAT HEATER ELEMENT
RIGHT REVERSING LAMP
RIGHT REAR MARKER LAMP
RIGHT REAR PARK/STOP/TURN LAMP
C461 EDGE
C488 MKX
S408
(IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO RIGHT REAR PARK/STOP/TURN LIGHT)
G404
(IN RIGHT "D" PILLAR)
BLK
BLK/GRY
WHT
BLK/YEL
BLK/GRN
281740

Fig. 30: Ground Distribution Circuit (4 of 4)

HEADLIGHTS



HOT AT
ALL TIMES
FUSE
51
5A
BATTERY
JUNCTION
BOX (BJB)
(LEFT SIDE
OF ENGINE
COMPT)
BRN
SA2
SA1
VPWR
SENS SIG
VCC
HS CAN +
SB2
SB1
GND
SENS GND
HS CAN -
1 YEL/GRY
2 VIO/GRY
3 BRN
4 GRN/VIO
5 BLU/GRY
6 WHT/BLU
7 GRN/BRN
8 BLU/GRN
9 BLK/GRN
10 GRY/VIO
11
12 WHT
C1021B
HEADLAMP
CONTROL
MODULE (HCM)
LEFT HEADLAMP
VIO/GRY 2
YEL/GRY 3
GRN/VIO 4
BLU/GRY 5
BLU/GRN 8
GRN/BRN 9
GRY/VIO 10
C1041B
SA1
SA2
SENS SIG
VCC
SB1
SB2
SENS GND
RIGHT HEADLAMP
BLK/GRN
S110
BLK/GRN
G105
(LEFT FRONT OF
ENGINE COMPT)
COMPUTER
DATA LINES
SYSTEM
VDB05 WHT 2
VDB04 WHT/BLU 3
HS CAN-
HS CAN+
STEERING ANGLE
SENSOR MODULE (SASM)
(ON STEERING COLUMN)
283890

Fig. 31: Adaptive Front Lighting Circuit

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

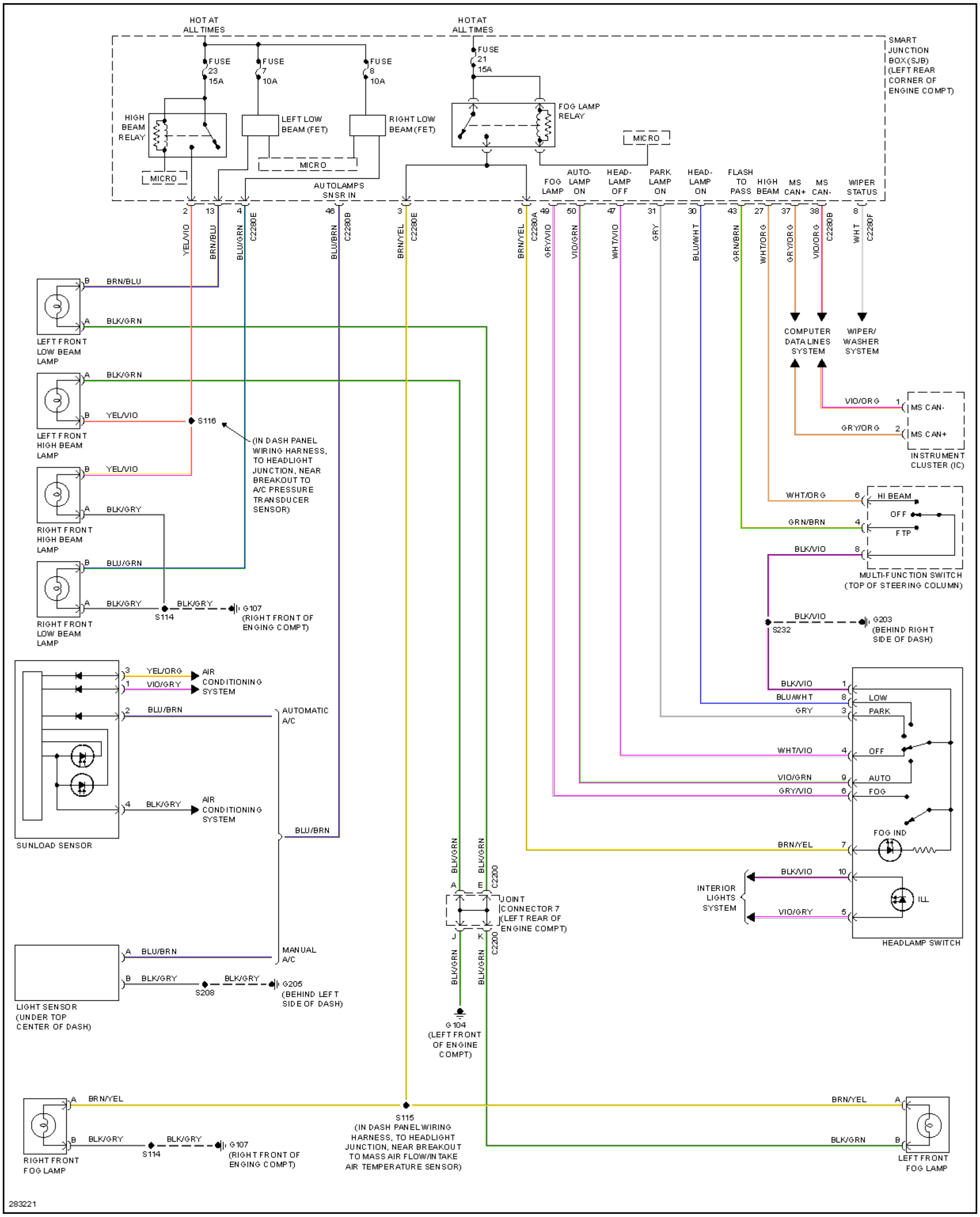
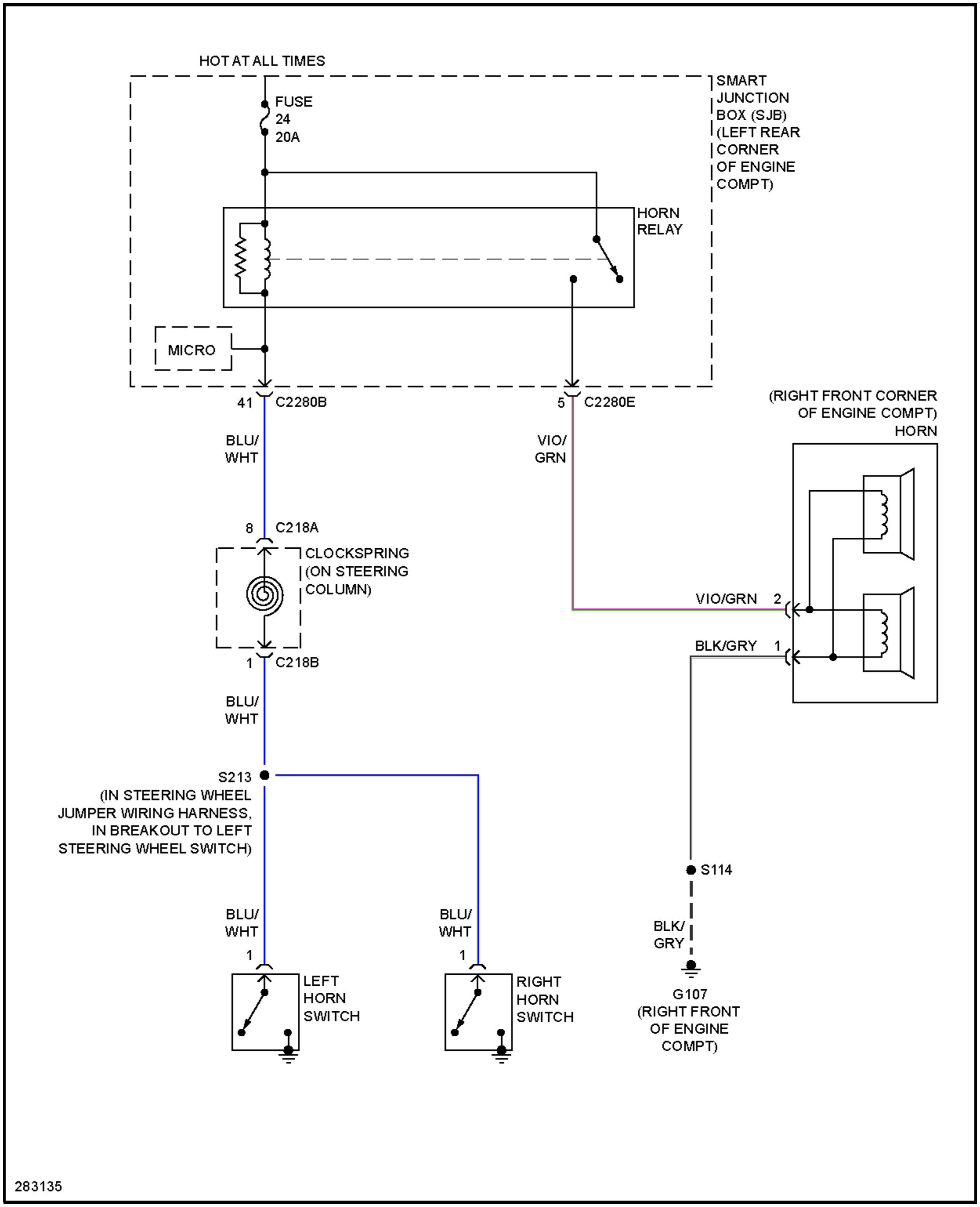


Fig. 32: Headlamps Circuit

HORN



HOT AT ALL TIMES
FUSE
24
20A
SMART
JUNCTION
BOX (SJB)
(LEFT REAR
CORNER
OF ENGINE
COMPT)
HORN
RELAY
MICRO
41
C2280B
5
C2280E
BLU/
WHT
VIO/
GRN
(RIGHT FRONT CORNER
OF ENGINE COMPT)
HORN
8
C218A
CLOCKSPRING
(ON STEERING
COLUMN)
VIO/GRN
2
BLK/GRY
1
1
C218B
BLU/
WHT
S213
(IN STEERING WHEEL
JUMPER WIRING HARNESS,
IN BREAKOUT TO LEFT
STEERING WHEEL SWITCH)
S114
BLU/
WHT
BLU/
WHT
BLK/
GRY
1
1
LEFT
HORN
SWITCH
RIGHT
HORN
SWITCH
G107
(RIGHT FRONT
OF ENGINE
COMPT)
283135

Fig. 33: Horn Circuit

INSTRUMENT CLUSTER

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

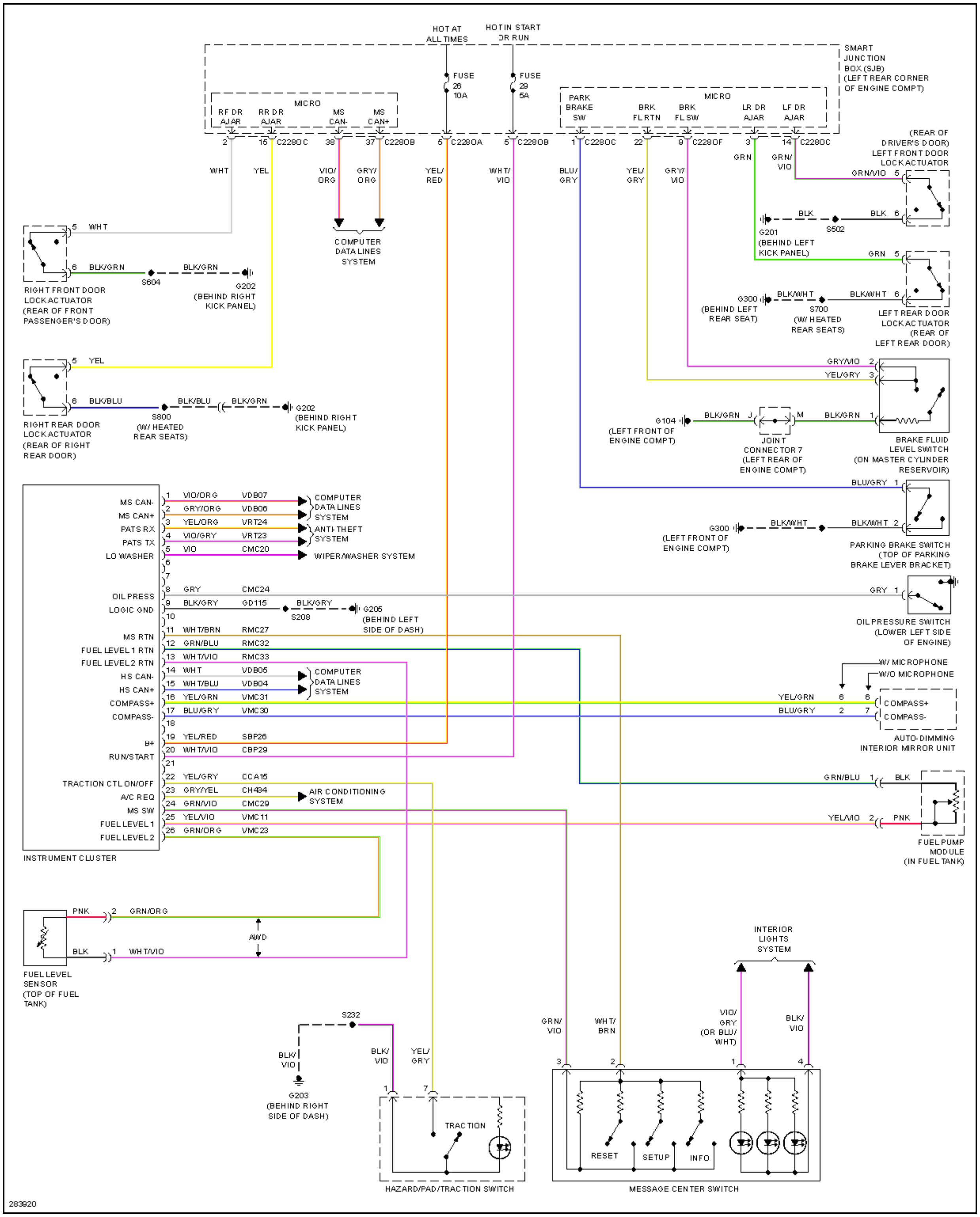


Fig. 34: Instrument Cluster Circuit

INTERIOR LIGHTS

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

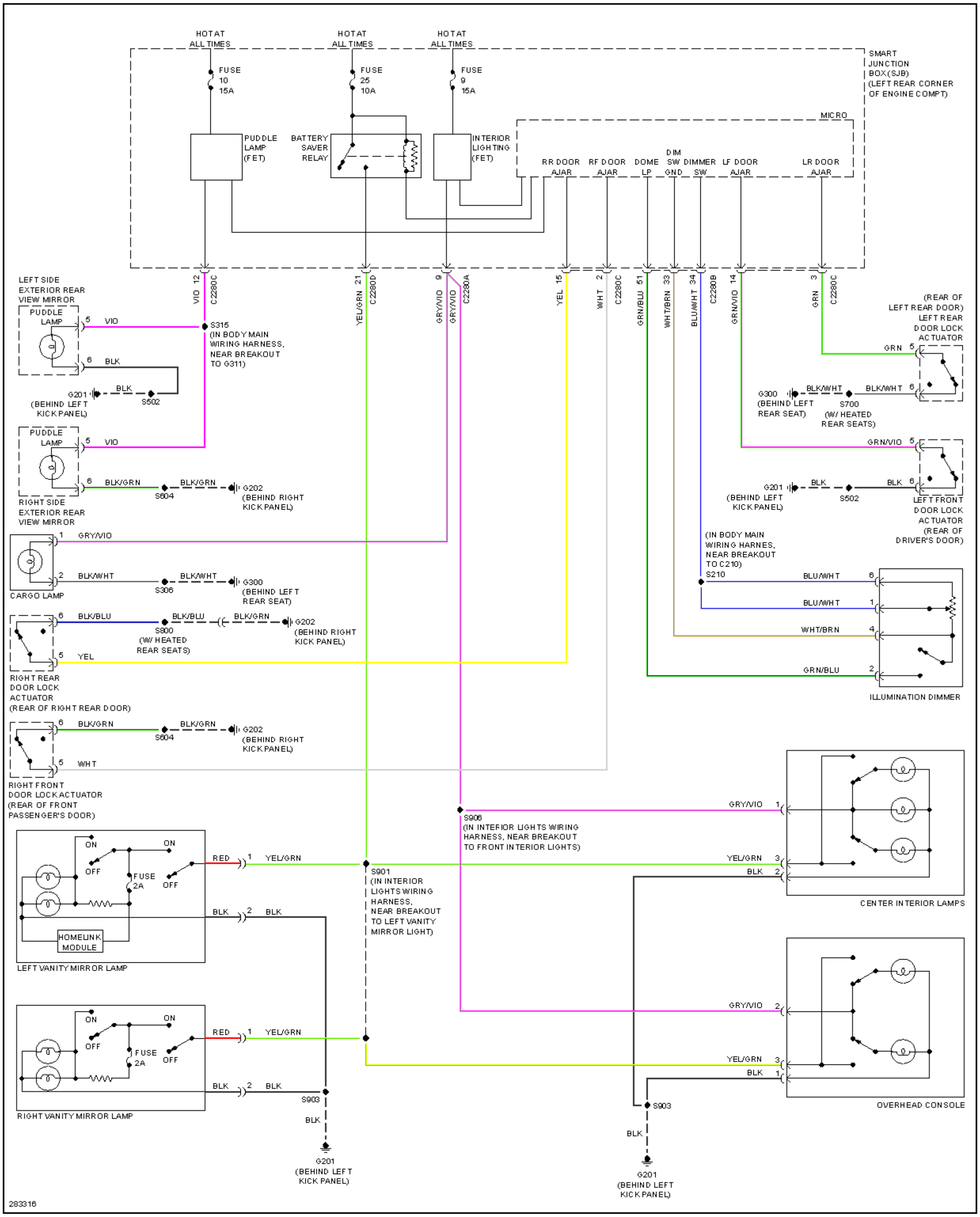
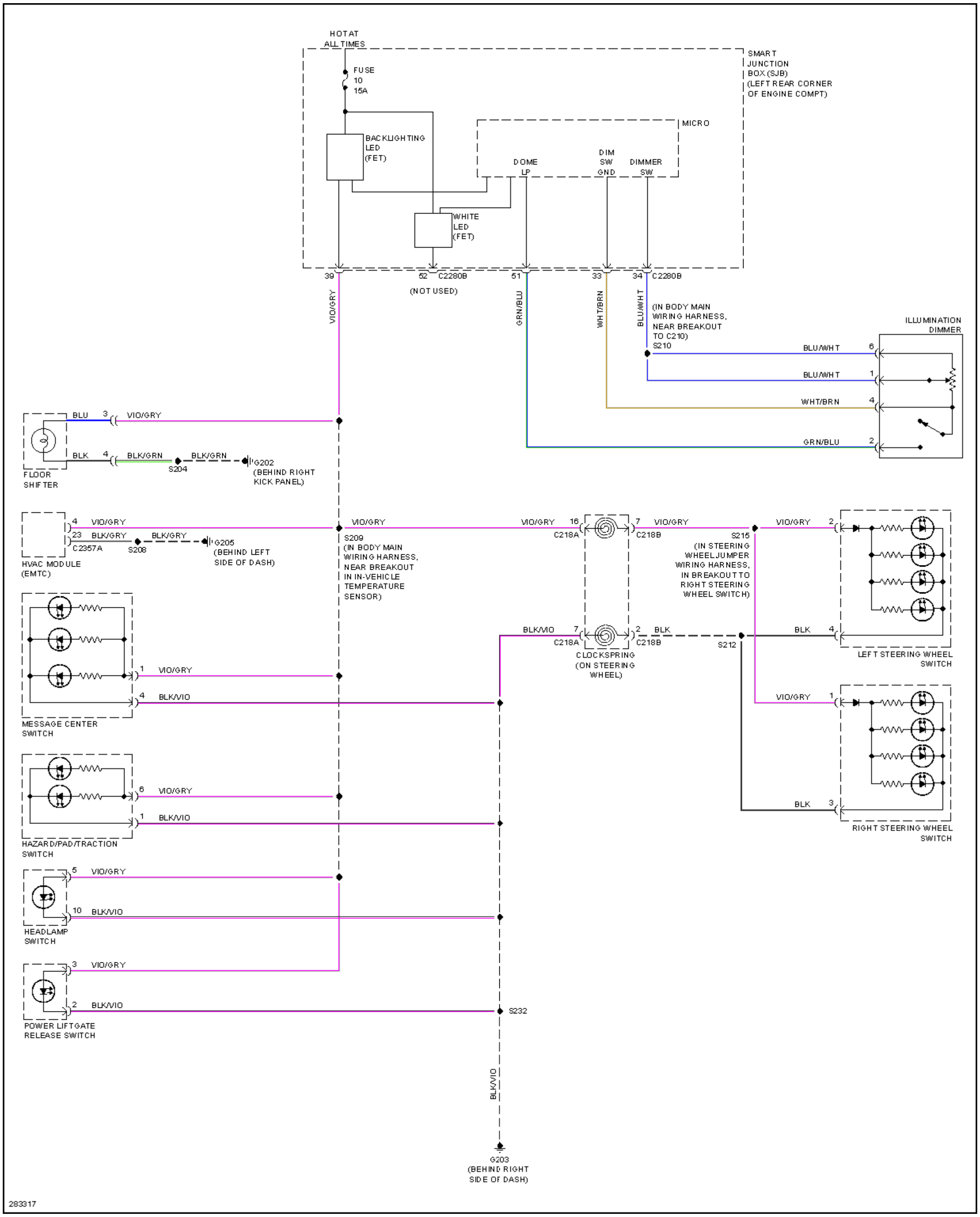


Fig. 35: Courtesy Lamps Circuit



HOT AT ALL TIMES
FUSE 10 15A
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
MICRO
BACKLIGHTING LED (FET)
WHITE LED (FET)
DOME LP
DIM SW GND
DIMMER SW
C2280B
(NOT USED)
VIO/GRY
GRN/BLU
WHT/BRN
BLU/WHT
(IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO C210)
S210
ILLUMINATION DIMMER
FLOOR SHIFTER
BLU
BLK
BLK/GRN
S204
G202 (BEHIND RIGHT KICK PANEL)
HVAC MODULE (EMTC)
BLK/GRY
C2357A
S208
G205 (BEHIND LEFT SIDE OF DASH)
S209 (IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT IN IN-VEHICLE TEMPERATURE SENSOR)
C218A
C218B
S215 (IN STEERING WHEEL JUMPER WIRING HARNESS, IN BREAKOUT TO RIGHT STEERING WHEEL SWITCH)
CLOCKSPRING (ON STEERING WHEEL)
BLK/VIO
S212
LEFT STEERING WHEEL SWITCH
RIGHT STEERING WHEEL SWITCH
MESSAGE CENTER SWITCH
HAZARD/PAD/TRACTION SWITCH
HEADLAMP SWITCH
POWER LIFTGATE RELEASE SWITCH
S232
G203 (BEHIND RIGHT SIDE OF DASH)
283317

Fig. 36: Instrument Illumination Circuit

MEMORY SYSTEMS

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

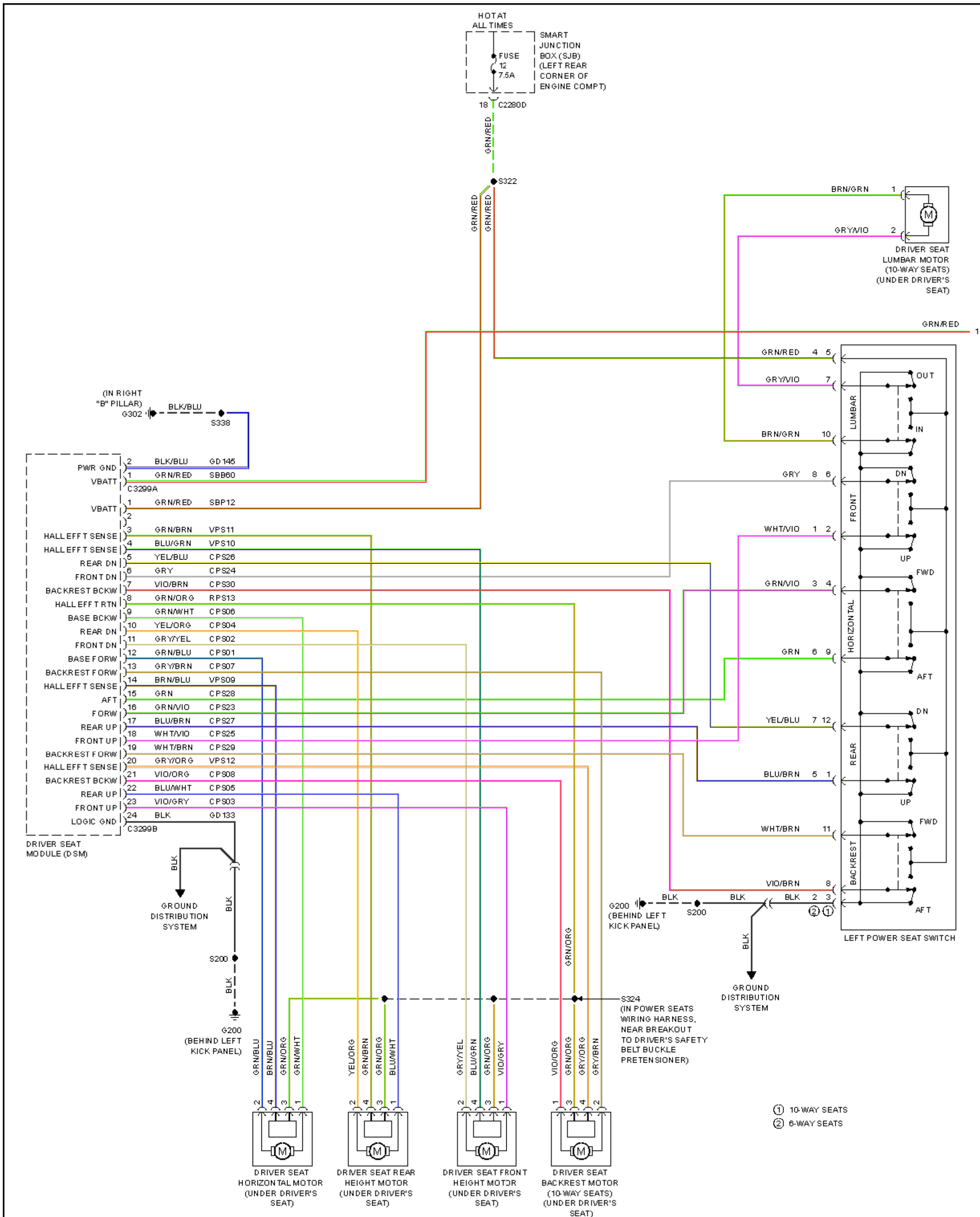


Fig. 37: Driver"s Memory Seat Circuit (1 of 2)

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

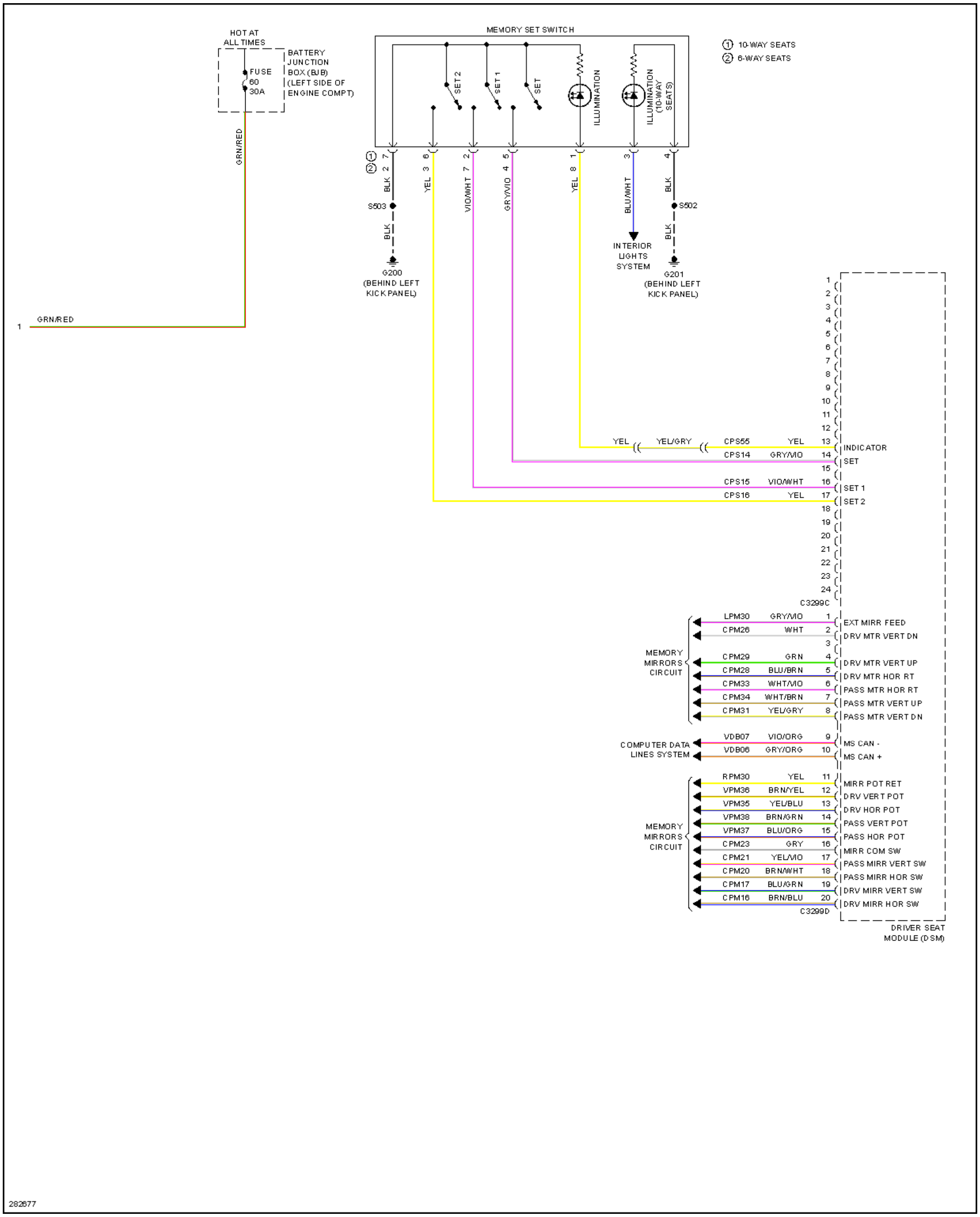


Fig. 38: Driver"s Memory Seat Circuit (2 of 2)

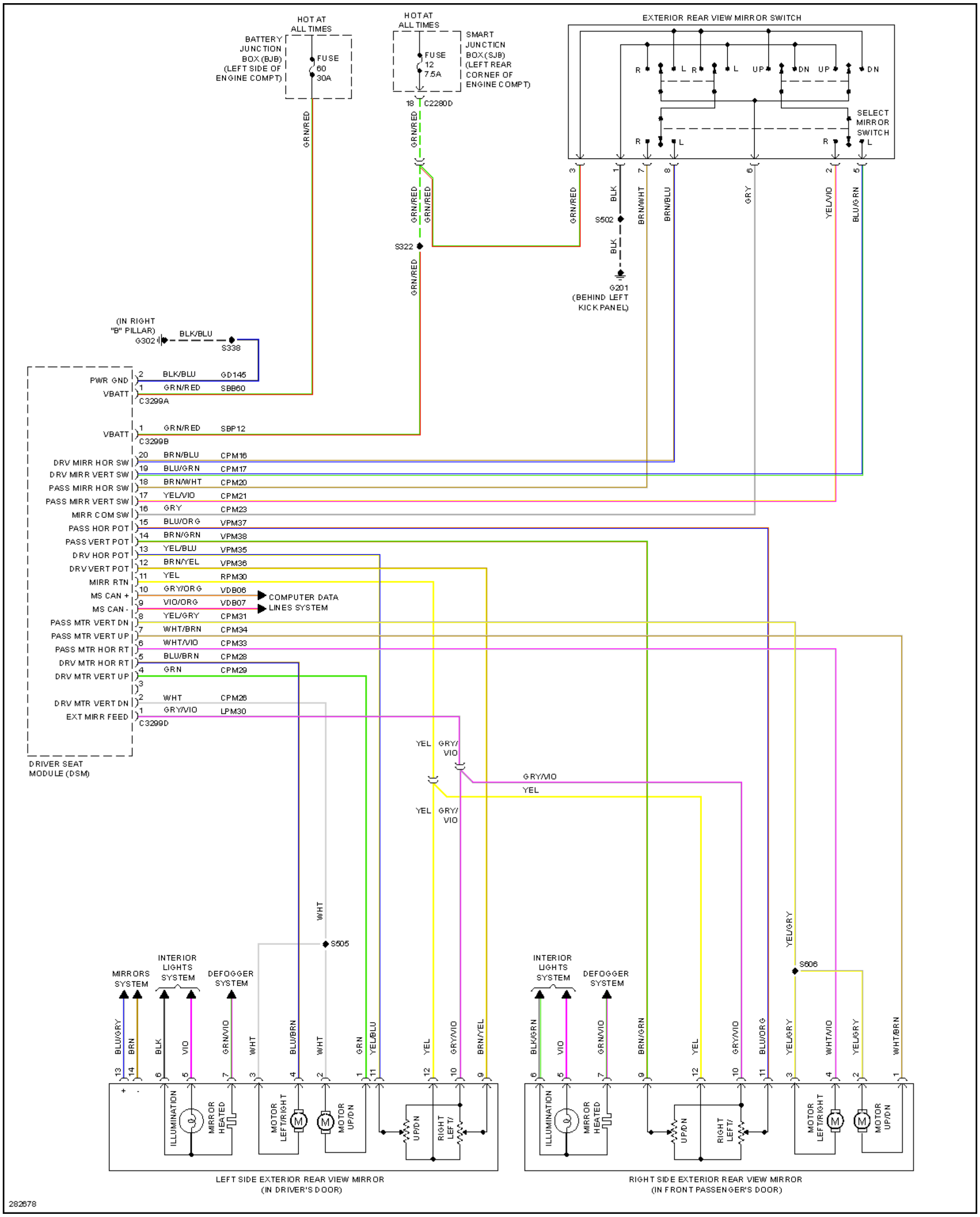

HOT AT ALL TIMES
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
FUSE 60 30A
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
FUSE 12 7.5A
C2280D
EXTERIOR REAR VIEW MIRROR SWITCH
SELECT MIRROR SWITCH
S322
S502
G201 (BEHIND LEFT KICK PANEL)
(IN RIGHT "B" PILLAR) G302
S338
PWR GND
VBATT
C3299A
C3299B
DRV MIRR HOR SW
DRV MIRR VERT SW
PASS MIRR HOR SW
PASS MIRR VERT SW
MIRR COM SW
PASS HOR POT
PASS VERT POT
DRV HOR POT
DRV VERT POT
MIRR RTN
MS CAN +
MS CAN -
PASS MTR VERT DN
PASS MTR VERT UP
PASS MTR HOR RT
DRV MTR HOR RT
DRV MTR VERT UP
DRV MTR VERT DN
EXT MIRR FEED
C3299D
COMPUTER DATA LINES SYSTEM
DRIVER SEAT MODULE (DSM)
S505
S606
MIRRORS SYSTEM
INTERIOR LIGHTS SYSTEM
DEFOGGER SYSTEM
ILLUMINATION
MIRROR HEATED
MOTOR LEFT/RIGHT
MOTOR UP/DN
UP/DN
RIGHT LEFT/
LEFT SIDE EXTERIOR REAR VIEW MIRROR (IN DRIVER'S DOOR)
RIGHT SIDE EXTERIOR REAR VIEW MIRROR (IN FRONT PASSENGER'S DOOR)
282678

Fig. 39: Memory Mirrors Circuit

NAVIGATION

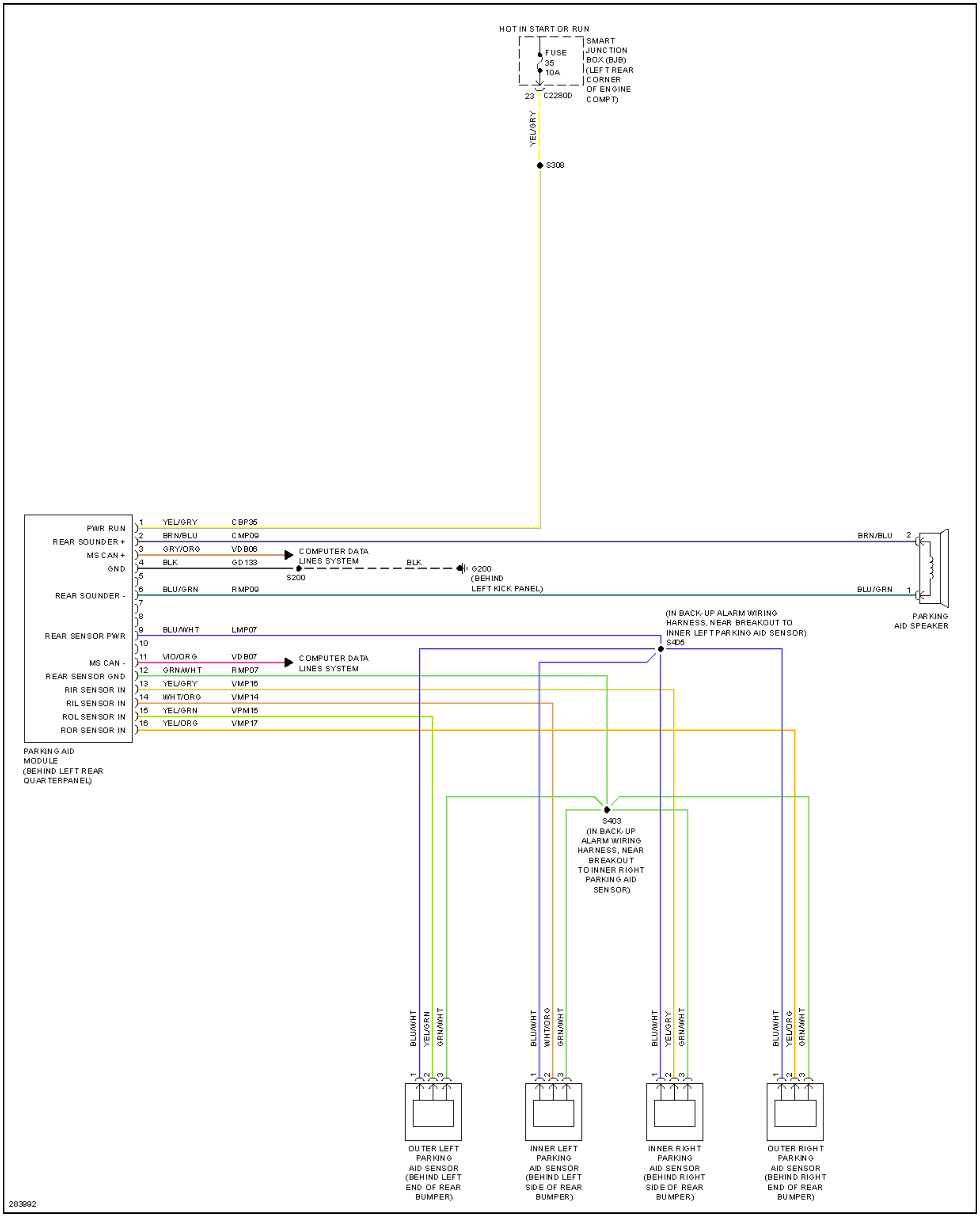
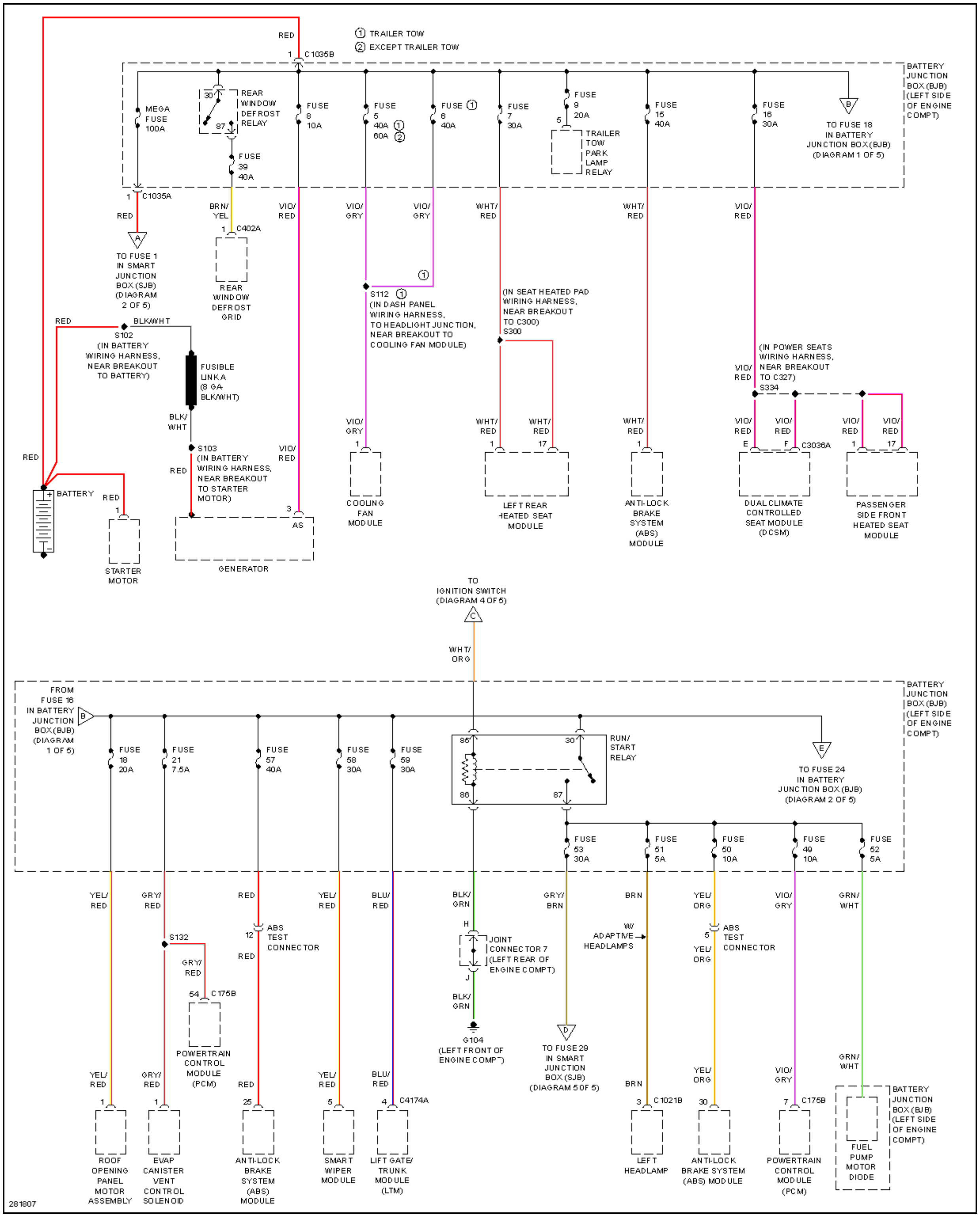

HOT IN START OR RUN
FUSE 35 10A
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
23 C2280D
YEL/GRY
S308
PWR RUN
REAR SOUNDER +
MS CAN +
GND
REAR SOUNDER -
REAR SENSOR PWR
MS CAN -
REAR SENSOR GND
RIR SENSOR IN
RIL SENSOR IN
ROL SENSOR IN
ROR SENSOR IN
1 YEL/GRY CBP35
2 BRN/BLU CMP09
3 GRY/ORG VDB06
4 BLK GD133
6 BLU/GRN RMP09
9 BLU/WHT LMP07
11 VIO/ORG VDB07
12 GRN/WHT RMP07
13 YEL/GRY VMP16
14 WHT/ORG VMP14
15 YEL/GRN VPM15
16 YEL/ORG VMP17
COMPUTER DATA LINES SYSTEM
BLK
S200
G200 (BEHIND LEFT KICK PANEL)
BRN/BLU 2
BLU/GRN 1
PARKING AID SPEAKER
PARKING AID MODULE (BEHIND LEFT REAR QUARTERPANEL)
(IN BACK-UP ALARM WIRING HARNESS, NEAR BREAKOUT TO INNER LEFT PARKING AID SENSOR)
S405
S403
(IN BACK-UP ALARM WIRING HARNESS, NEAR BREAKOUT TO INNER RIGHT PARKING AID SENSOR)
BLU/WHT YEL/GRN GRN/WHT
BLU/WHT WHT/ORG GRN/WHT
BLU/WHT YEL/GRY GRN/WHT
BLU/WHT YEL/ORG GRN/WHT
OUTER LEFT PARKING AID SENSOR (BEHIND LEFT END OF REAR BUMPER)
INNER LEFT PARKING AID SENSOR (BEHIND LEFT SIDE OF REAR BUMPER)
INNER RIGHT PARKING AID SENSOR (BEHIND RIGHT SIDE OF REAR BUMPER)
OUTER RIGHT PARKING AID SENSOR (BEHIND RIGHT END OF REAR BUMPER)
283992

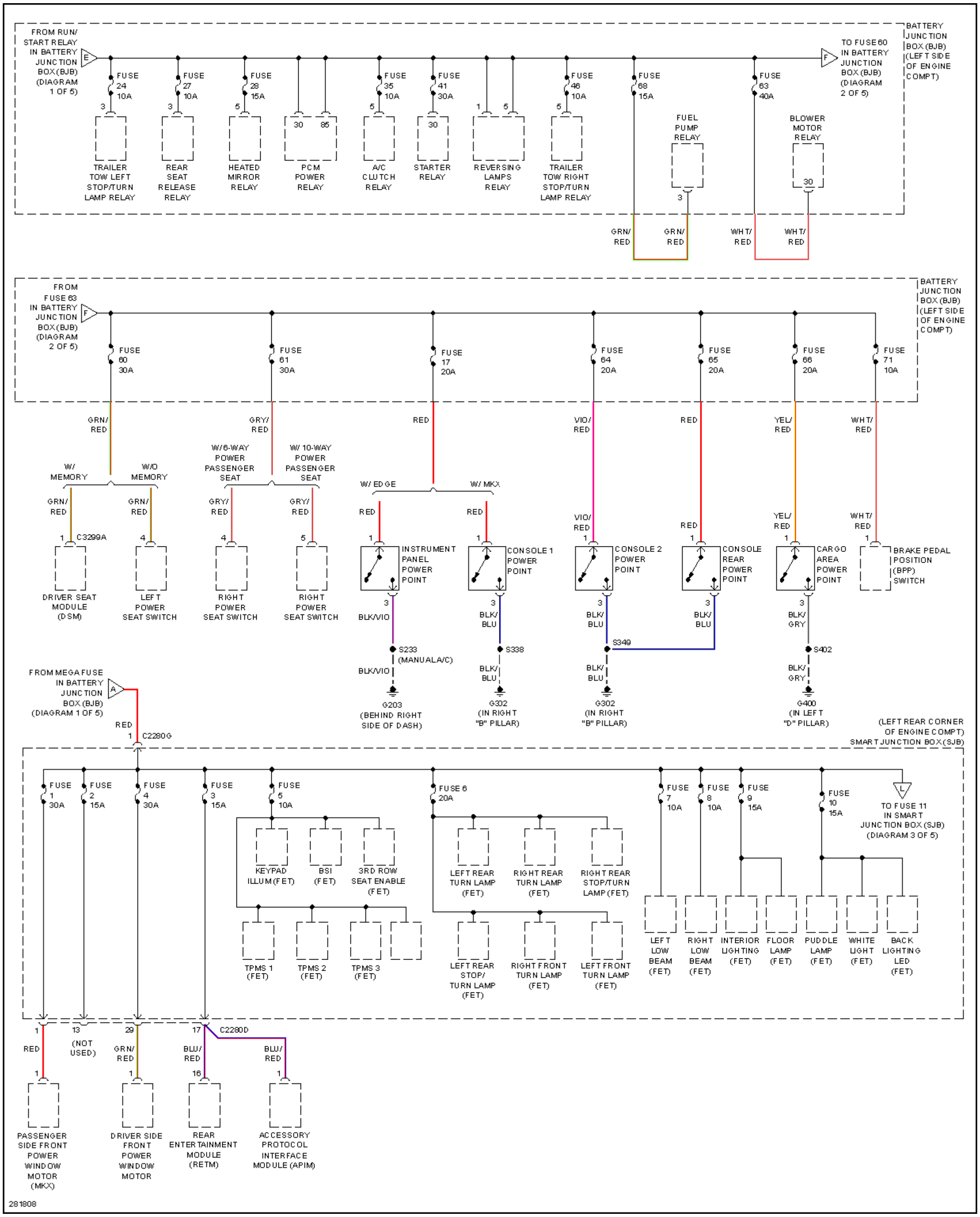
Fig. 40: Parking Assistant Circuit

POWER DISTRIBUTION



TRAILER TOW
EXCEPT TRAILER TOW
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
MEGA FUSE 100A
REAR WINDOW DEFROST RELAY
FUSE 39 40A
FUSE 8 10A
FUSE 5 40A 60A
FUSE 6 40A
FUSE 7 30A
FUSE 9 20A
TRAILER TOW PARK LAMP RELAY
FUSE 15 40A
FUSE 16 30A
TO FUSE 18 IN BATTERY JUNCTION BOX (BJB) (DIAGRAM 1 OF 5)
TO FUSE 1 IN SMART JUNCTION BOX (SJB) (DIAGRAM 2 OF 5)
REAR WINDOW DEFROST GRID
S102 (IN BATTERY WIRING HARNESS, NEAR BREAKOUT TO BATTERY)
FUSIBLE LINK A (8 GA BLK/WHT)
S103 (IN BATTERY WIRING HARNESS, NEAR BREAKOUT TO STARTER MOTOR)
BATTERY
STARTER MOTOR
GENERATOR
S112 (IN DASH PANEL WIRING HARNESS, TO HEADLIGHT JUNCTION, NEAR BREAKOUT TO COOLING FAN MODULE)
COOLING FAN MODULE
(IN SEAT HEATED PAD WIRING HARNESS, NEAR BREAKOUT TO C300) S300
LEFT REAR HEATED SEAT MODULE
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE
(IN POWER SEATS WIRING HARNESS, NEAR BREAKOUT TO C327) S334
DUAL CLIMATE CONTROLLED SEAT MODULE (DCSM)
PASSENGER SIDE FRONT HEATED SEAT MODULE
TO IGNITION SWITCH (DIAGRAM 4 OF 5)
FROM FUSE 16 IN BATTERY JUNCTION BOX (BJB) (DIAGRAM 1 OF 5)
FUSE 18 20A
FUSE 21 7.5A
FUSE 57 40A
FUSE 58 30A
FUSE 59 30A
RUN/START RELAY
TO FUSE 24 IN BATTERY JUNCTION BOX (BJB) (DIAGRAM 2 OF 5)
FUSE 53 30A
FUSE 51 5A
FUSE 50 10A
FUSE 49 10A
FUSE 52 5A
ABS TEST CONNECTOR
JOINT CONNECTOR 7 (LEFT REAR OF ENGINE COMPT)
W/ ADAPTIVE HEADLAMPS
G104 (LEFT FRONT OF ENGINE COMPT)
TO FUSE 29 IN SMART JUNCTION BOX (SJB) (DIAGRAM 5 OF 5)
POWERTRAIN CONTROL MODULE (PCM)
ROOF OPENING PANEL MOTOR ASSEMBLY
EVAP CANISTER VENT CONTROL SOLENOID
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE
SMART WIPER MODULE
LIFT GATE/TRUNK MODULE (LTM)
LEFT HEADLAMP
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE
POWERTRAIN CONTROL MODULE (PCM)
FUEL PUMP MOTOR DIODE
281807

Fig. 41: Power Distribution Circuit (1 of 5)



FROM RUN/START RELAY IN BATTERY JUNCTION BOX (BJB) (DIAGRAM 1 OF 5)
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
TO FUSE 60 IN BATTERY JUNCTION BOX (BJB) (DIAGRAM 2 OF 5)
FUSE 24 10A
FUSE 27 10A
FUSE 28 15A
FUSE 35 10A
FUSE 41 30A
FUSE 46 10A
FUSE 68 15A
FUSE 63 40A
TRAILER TOW LEFT STOP/TURN LAMP RELAY
REAR SEAT RELEASE RELAY
HEATED MIRROR RELAY
PCM POWER RELAY
A/C CLUTCH RELAY
STARTER RELAY
REVERSING LAMPS RELAY
TRAILER TOW RIGHT STOP/TURN LAMP RELAY
FUEL PUMP RELAY
BLOWER MOTOR RELAY
GRN/RED
WHT/RED
FROM FUSE 63 IN BATTERY JUNCTION BOX (BJB) (DIAGRAM 2 OF 5)
FUSE 60 30A
FUSE 61 30A
FUSE 17 20A
FUSE 64 20A
FUSE 65 20A
FUSE 66 20A
FUSE 71 10A
W/ MEMORY
W/O MEMORY
W/ 6-WAY POWER PASSENGER SEAT
W/ 10-WAY POWER PASSENGER SEAT
W/ EDGE
W/ MKX
C3299A
DRIVER SEAT MODULE (DSM)
LEFT POWER SEAT SWITCH
RIGHT POWER SEAT SWITCH
RIGHT POWER SEAT SWITCH
INSTRUMENT PANEL POWER POINT
CONSOLE 1 POWER POINT
CONSOLE 2 POWER POINT
CONSOLE REAR POWER POINT
CARGO AREA POWER POINT
BRAKE PEDAL POSITION (BPP) SWITCH
BLK/VIO
BLK/BLU
BLK/GRY
S233 (MANUAL A/C)
S338
S349
S402
G203 (BEHIND RIGHT SIDE OF DASH)
G302 (IN RIGHT "B" PILLAR)
G302 (IN RIGHT "B" PILLAR)
G400 (IN LEFT "D" PILLAR)
FROM MEGA FUSE IN BATTERY JUNCTION BOX (BJB) (DIAGRAM 1 OF 5)
C2280G
(LEFT REAR CORNER OF ENGINE COMPT) SMART JUNCTION BOX (SJB)
FUSE 1 30A
FUSE 2 15A
FUSE 4 30A
FUSE 3 15A
FUSE 5 10A
FUSE 6 20A
FUSE 7 10A
FUSE 8 10A
FUSE 9 15A
FUSE 10 15A
TO FUSE 11 IN SMART JUNCTION BOX (SJB) (DIAGRAM 3 OF 5)
KEYPAD ILLUM (FET)
BSI (FET)
3RD ROW SEAT ENABLE (FET)
TPMS 1 (FET)
TPMS 2 (FET)
TPMS 3 (FET)
LEFT REAR TURN LAMP (FET)
RIGHT REAR TURN LAMP (FET)
RIGHT REAR STOP/TURN LAMP (FET)
LEFT REAR STOP/TURN LAMP (FET)
RIGHT FRONT TURN LAMP (FET)
LEFT FRONT TURN LAMP (FET)
LEFT LOW BEAM (FET)
RIGHT LOW BEAM (FET)
INTERIOR LIGHTING (FET)
FLOOR LAMP (FET)
PUDDLE LAMP (FET)
WHITE LIGHT (FET)
BACK LIGHTING LED (FET)
C2280D
(NOT USED)
GRN/RED
BLU/RED
PASSENGER SIDE FRONT POWER WINDOW MOTOR (MKX)
DRIVER SIDE FRONT POWER WINDOW MOTOR
REAR ENTERTAINMENT MODULE (RETM)
ACCESSORY PROTOCOL INTERFACE MODULE (APIM)
281808

Fig. 42: Power Distribution Circuit (2 of 5)

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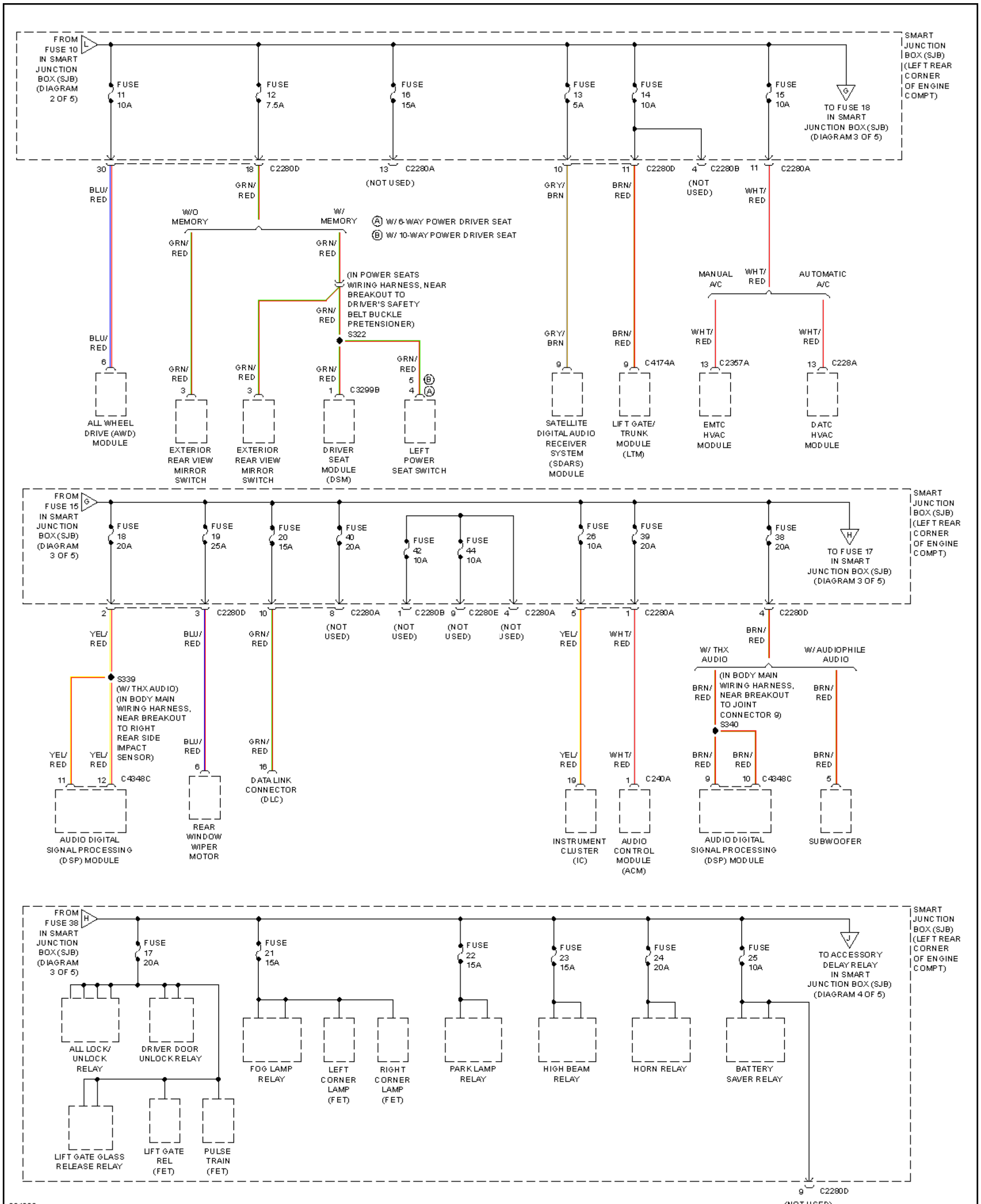


Fig. 43: Power Distribution Circuit (3 of 5)

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

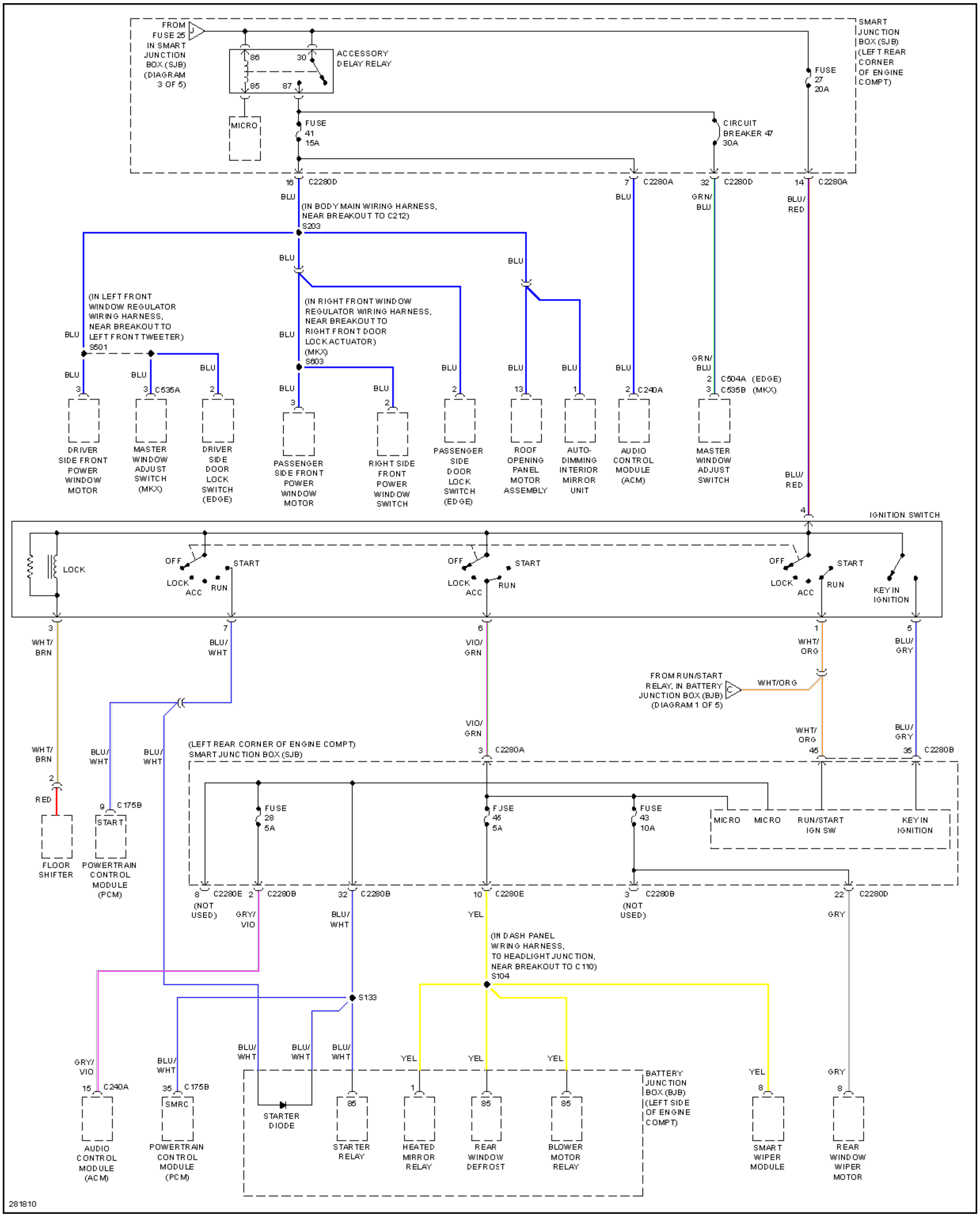
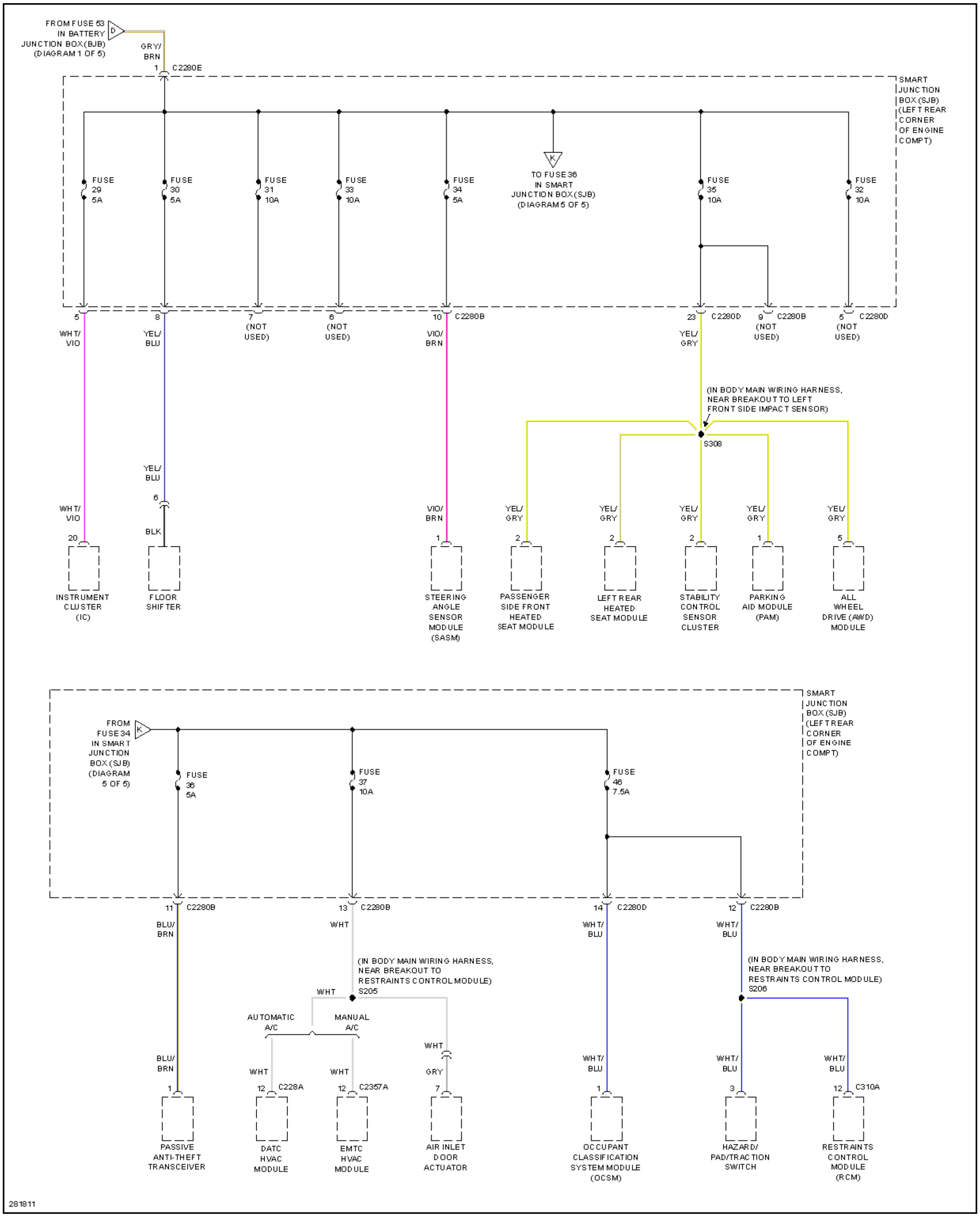


Fig. 44: Power Distribution Circuit (4 of 5)



FROM FUSE 53 IN BATTERY JUNCTION BOX (BJB) (DIAGRAM 1 OF 5)
GRY/ BRN
1 C2280E
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
FUSE 29 5A
FUSE 30 5A
FUSE 31 10A
FUSE 33 10A
FUSE 34 5A
TO FUSE 36 IN SMART JUNCTION BOX (SJB) (DIAGRAM 5 OF 5)
FUSE 35 10A
FUSE 32 10A
5
8
7 (NOT USED)
6 (NOT USED)
10 C2280B
23 C2280D
9 C2280B (NOT USED)
5 C2280D (NOT USED)
WHT/ VIO
YEL/ BLU
VIO/ BRN
YEL/ GRY
(IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO LEFT FRONT SIDE IMPACT SENSOR)
S308
BLK
INSTRUMENT CLUSTER (IC)
FLOOR SHIFTER
STEERING ANGLE SENSOR MODULE (SASM)
PASSENGER SIDE FRONT HEATED SEAT MODULE
LEFT REAR HEATED SEAT MODULE
STABILITY CONTROL SENSOR CLUSTER
PARKING AID MODULE (PAM)
ALL WHEEL DRIVE (AWD) MODULE
FROM FUSE 34 IN SMART JUNCTION BOX (SJB) (DIAGRAM 5 OF 5)
FUSE 36 5A
FUSE 37 10A
FUSE 46 7.5A
11 C2280B
13 C2280B
14 C2280D
12 C2280B
BLU/ BRN
WHT
WHT/ BLU
(IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO RESTRAINTS CONTROL MODULE) S205
(IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO RESTRAINTS CONTROL MODULE) S206
AUTOMATIC A/C
MANUAL A/C
GRY
12 C228A
12 C2357A
12 C310A
PASSIVE ANTI-THEFT TRANSCEIVER
DATC HVAC MODULE
EMTC HVAC MODULE
AIR INLET DOOR ACTUATOR
OCCUPANT CLASSIFICATION SYSTEM MODULE (OCSM)
HAZARD/ PAD/TRACTION SWITCH
RESTRAINTS CONTROL MODULE (RCM)
281811

Fig. 45: Power Distribution Circuit (5 of 5)

POWER DOOR LOCKS

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

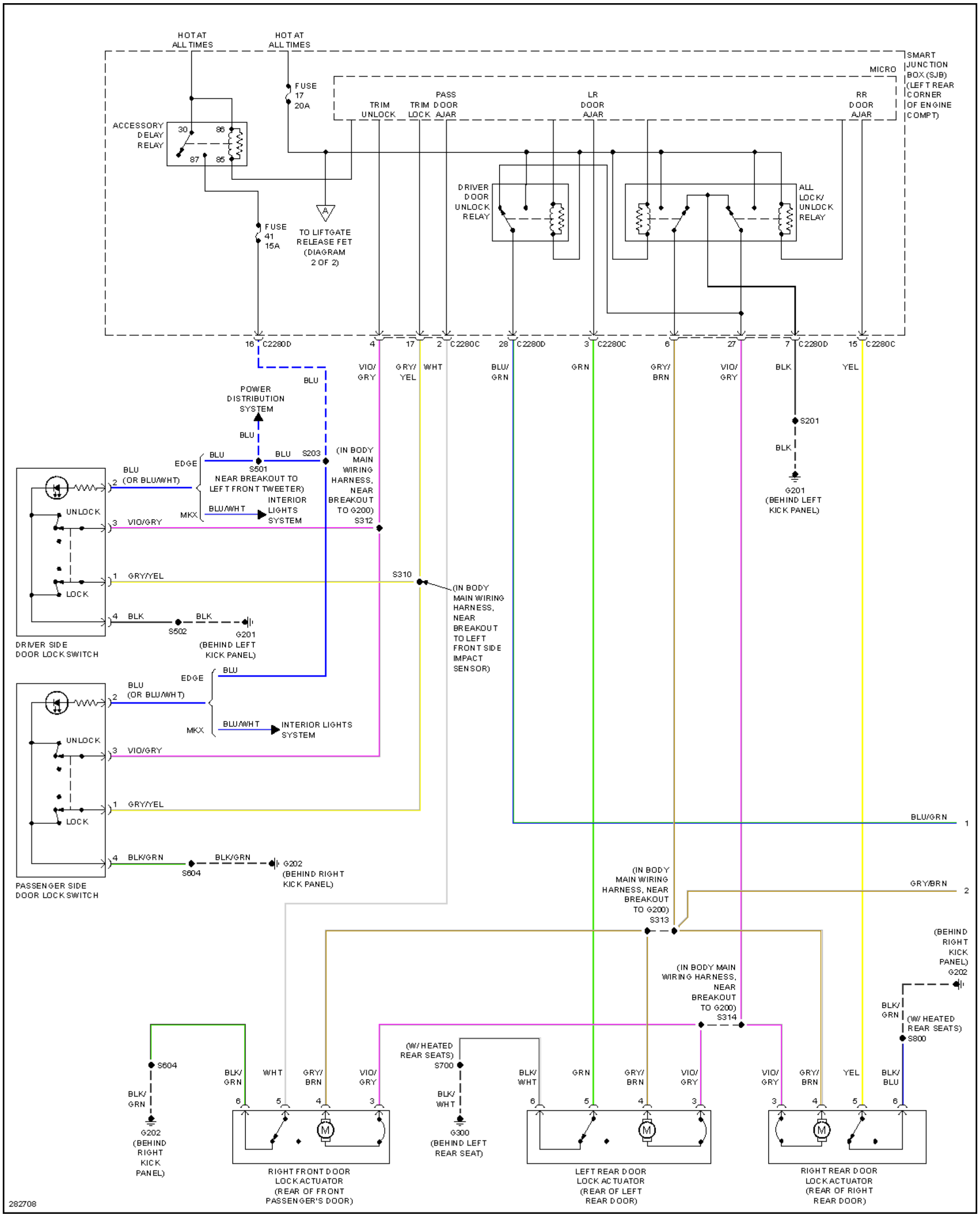


Fig. 46: Power Door Locks Circuit (1 of 2)

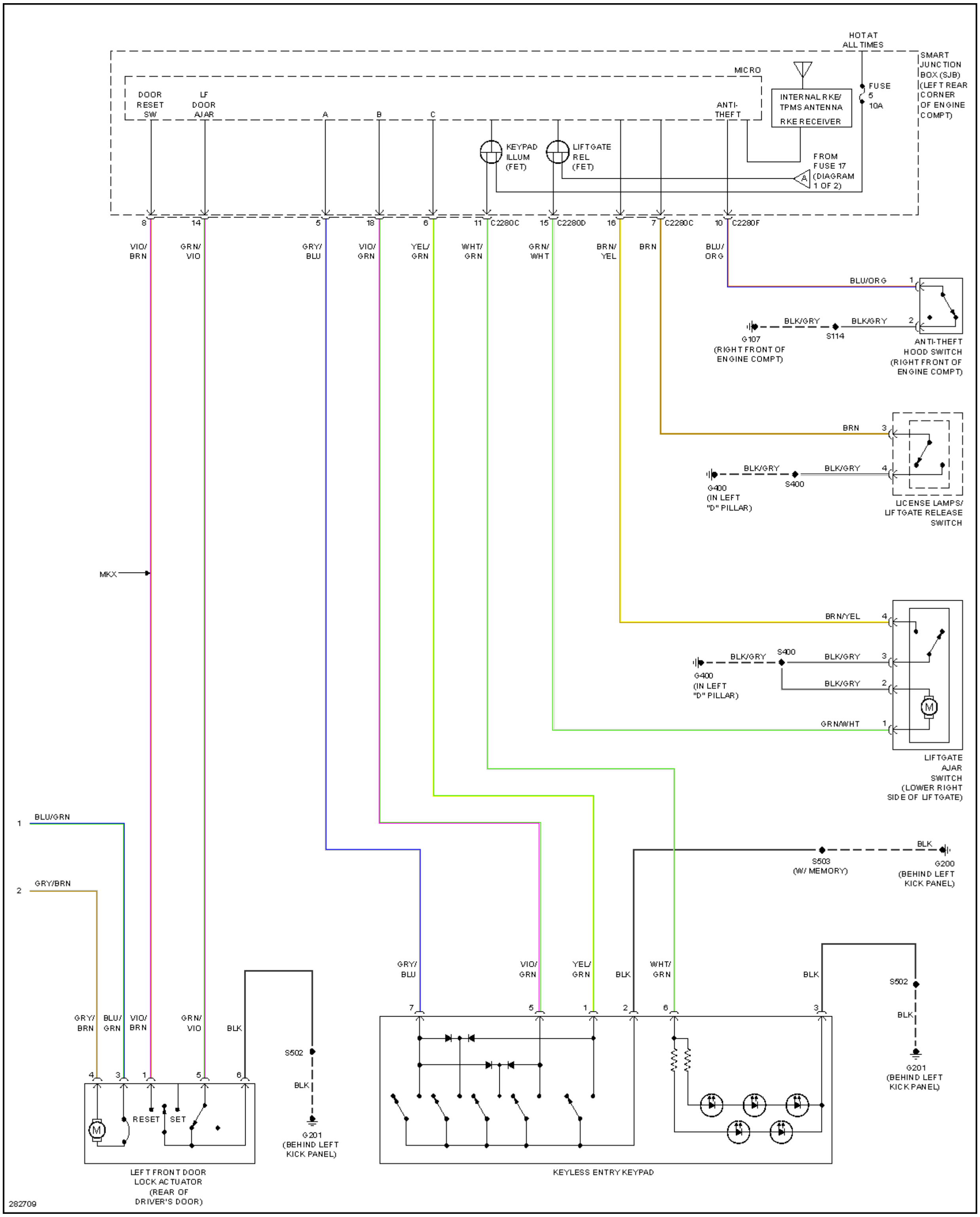

HOT AT ALL TIMES
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
MICRO
FUSE 5 10A
INTERNAL RKE/ TPMS ANTENNA
RKE RECEIVER
DOOR RESET SW
LF DOOR AJAR
A
B
C
ANTI-THEFT
KEYPAD ILLUM (FET)
LIFTGATE REL (FET)
FROM FUSE 17 (DIAGRAM 1 OF 2)
C2280C
C2280D
C2280C
C2280F
VIO/ BRN
GRN/ VIO
GRY/ BLU
VIO/ GRN
YEL/ GRN
WHT/ GRN
GRN/ WHT
BRN/ YEL
BRN
BLU/ ORG
BLU/ORG
BLK/GRY
G107 (RIGHT FRONT OF ENGINE COMPT)
S114
ANTI-THEFT HOOD SWITCH (RIGHT FRONT OF ENGINE COMPT)
G400 (IN LEFT "D" PILLAR)
S400
LICENSE LAMPS/ LIFTGATE RELEASE SWITCH
MKX
BRN/YEL
GRN/WHT
LIFTGATE AJAR SWITCH (LOWER RIGHT SIDE OF LIFTGATE)
BLU/GRN
GRY/BRN
BLK
S503 (W/ MEMORY)
G200 (BEHIND LEFT KICK PANEL)
S502
G201 (BEHIND LEFT KICK PANEL)
RESET
SET
LEFT FRONT DOOR LOCK ACTUATOR (REAR OF DRIVER'S DOOR)
KEYLESS ENTRY KEYPAD
282709

Fig. 47: Power Door Locks Circuit (2 of 2)

POWER MIRRORS

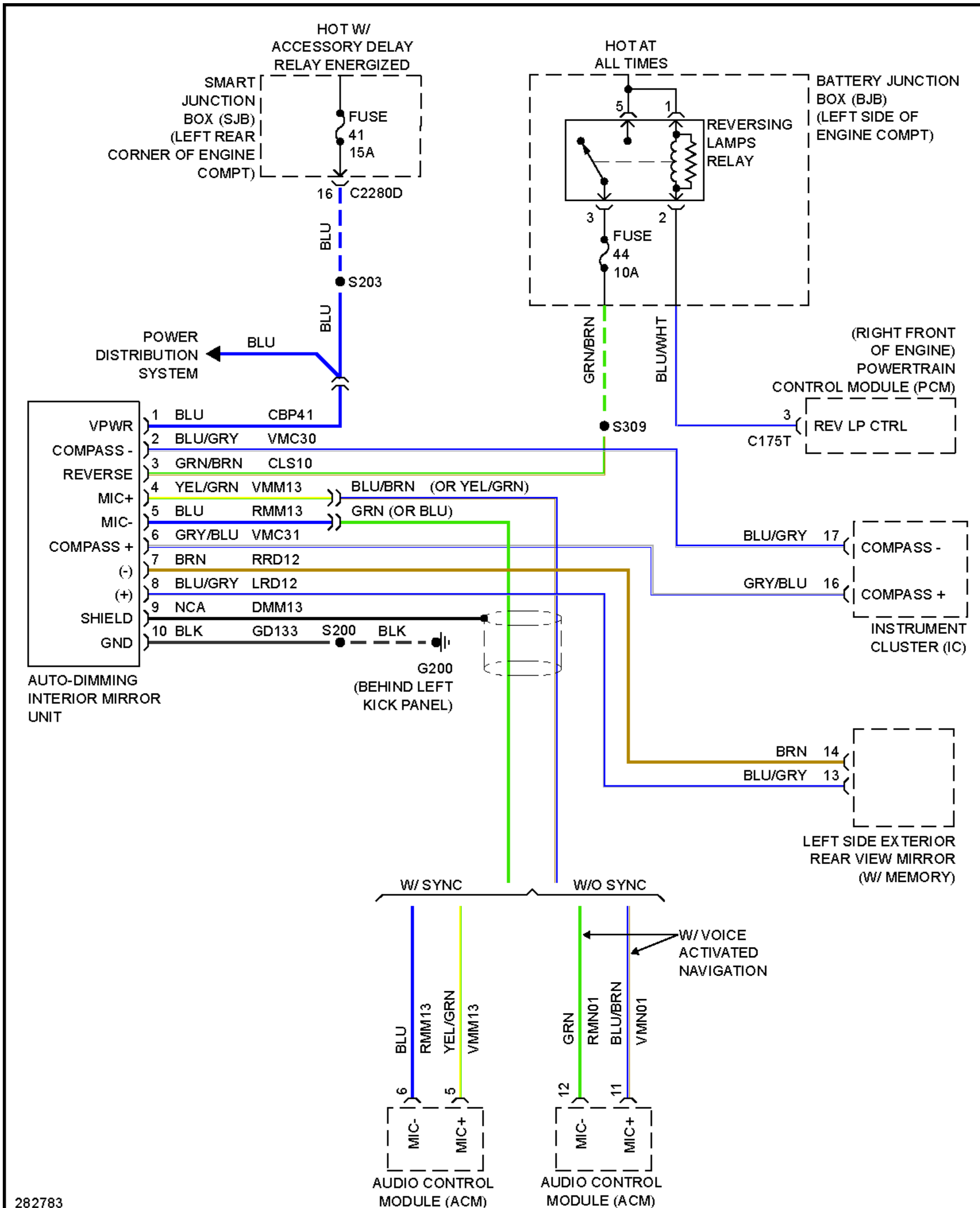

HOT W/ ACCESSORY DELAY RELAY ENERGIZED
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
FUSE 41 15A
16 C2280D
BLU
S203
BLU
POWER DISTRIBUTION SYSTEM
BLU
HOT AT ALL TIMES
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
5
1
REVERSING LAMPS RELAY
3
2
FUSE 44 10A
GRN/BRN
BLU/WHT
S309
(RIGHT FRONT OF ENGINE) POWERTRAIN CONTROL MODULE (PCM)
3
C175T
REV LP CTRL
VPWR
COMPASS -
REVERSE
MIC+
MIC-
COMPASS +
(-)
(+)
SHIELD
GND
1 BLU CBP41
2 BLU/GRY VMC30
3 GRN/BRN CLS10
4 YEL/GRN VMM13
5 BLU RMM13
6 GRY/BLU VMC31
7 BRN RRD12
8 BLU/GRY LRD12
9 NCA DMM13
10 BLK GD133
S200 BLK
BLU/BRN (OR YEL/GRN)
GRN (OR BLU)
G200 (BEHIND LEFT KICK PANEL)
AUTO-DIMMING INTERIOR MIRROR UNIT
BLU/GRY 17
COMPASS -
GRY/BLU 16
COMPASS +
INSTRUMENT CLUSTER (IC)
BRN 14
BLU/GRY 13
LEFT SIDE EXTERIOR REAR VIEW MIRROR (W/ MEMORY)
W/ SYNC
W/O SYNC
W/ VOICE ACTIVATED NAVIGATION
BLU RMM13
YEL/GRN VMM13
GRN RMN01
BLU/BRN VMN01
6
5
12
11
MIC-
MIC+
MIC-
MIC+
AUDIO CONTROL MODULE (ACM)
AUDIO CONTROL MODULE (ACM)
282783

Fig. 48: Electrochromic Mirror Circuit, W/ Microphone

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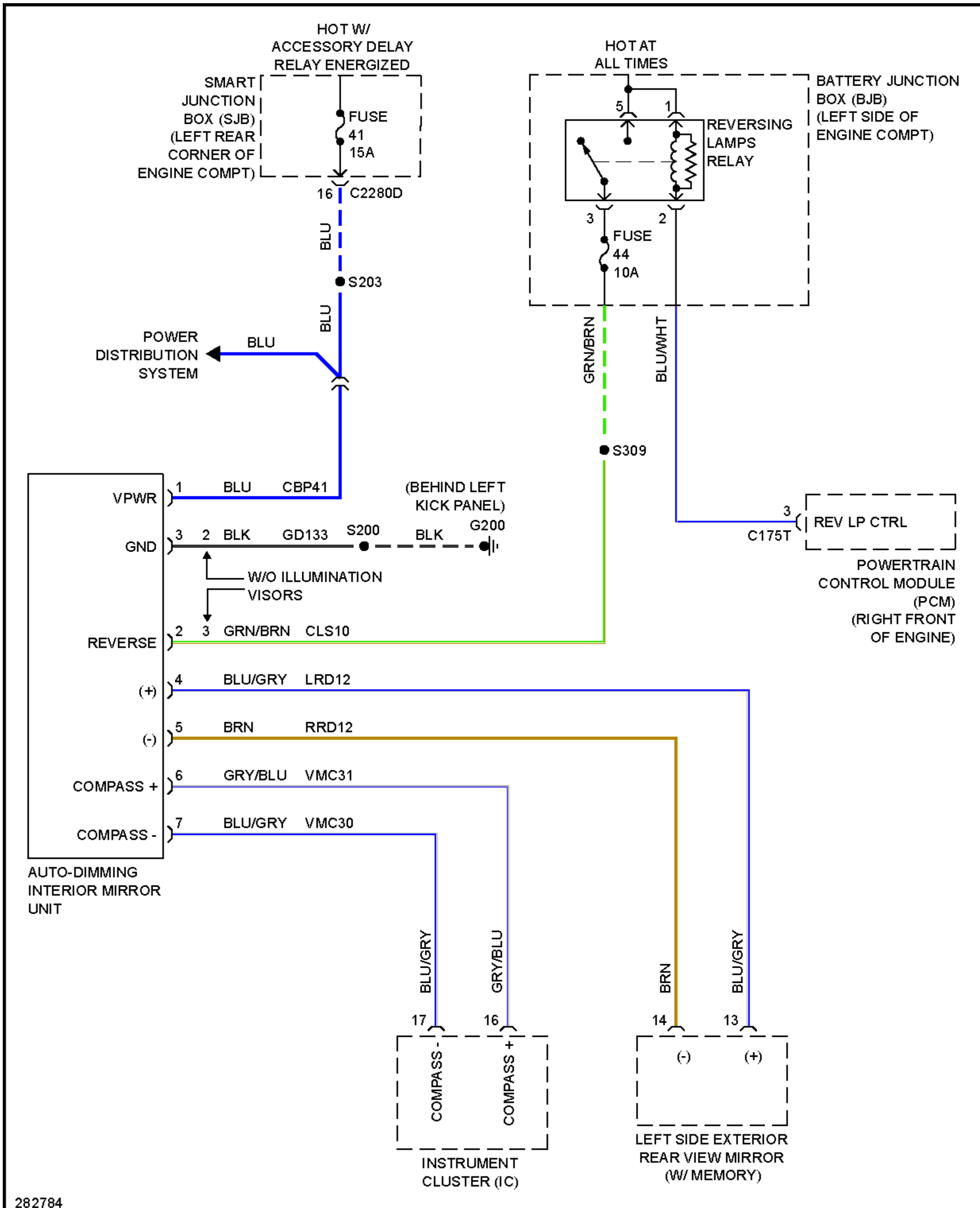
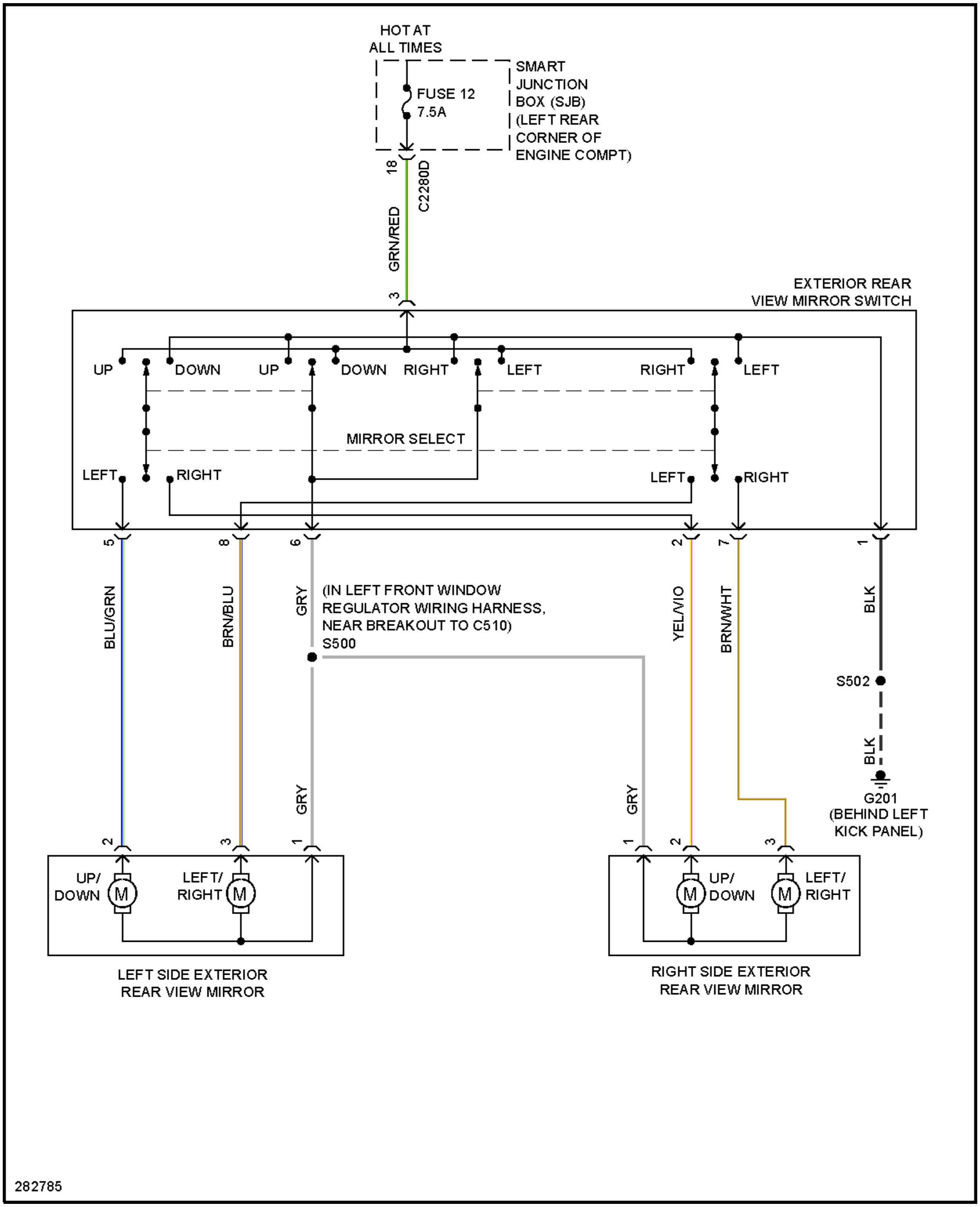


Fig. 49: Electrochromic Mirror Circuit, W/O Microphone



HOT AT ALL TIMES
FUSE 12 7.5A
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
18
C2280D
GRN/RED
3
EXTERIOR REAR VIEW MIRROR SWITCH
UP
DOWN
UP
DOWN
RIGHT
LEFT
RIGHT
LEFT
MIRROR SELECT
LEFT
RIGHT
LEFT
RIGHT
5
8
6
2
7
1
BLU/GRN
BRN/BLU
GRY
(IN LEFT FRONT WINDOW REGULATOR WIRING HARNESS, NEAR BREAKOUT TO C510)
S500
YEL/VIO
BRN/WHT
BLK
S502
BLK
G201 (BEHIND LEFT KICK PANEL)
GRY
GRY
2
3
1
1
2
3
UP/ DOWN
M
LEFT/ RIGHT
M
M
UP/ DOWN
M
LEFT/ RIGHT
LEFT SIDE EXTERIOR REAR VIEW MIRROR
RIGHT SIDE EXTERIOR REAR VIEW MIRROR
282785

Fig. 50: Power Mirrors Circuit

POWER SEATS

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

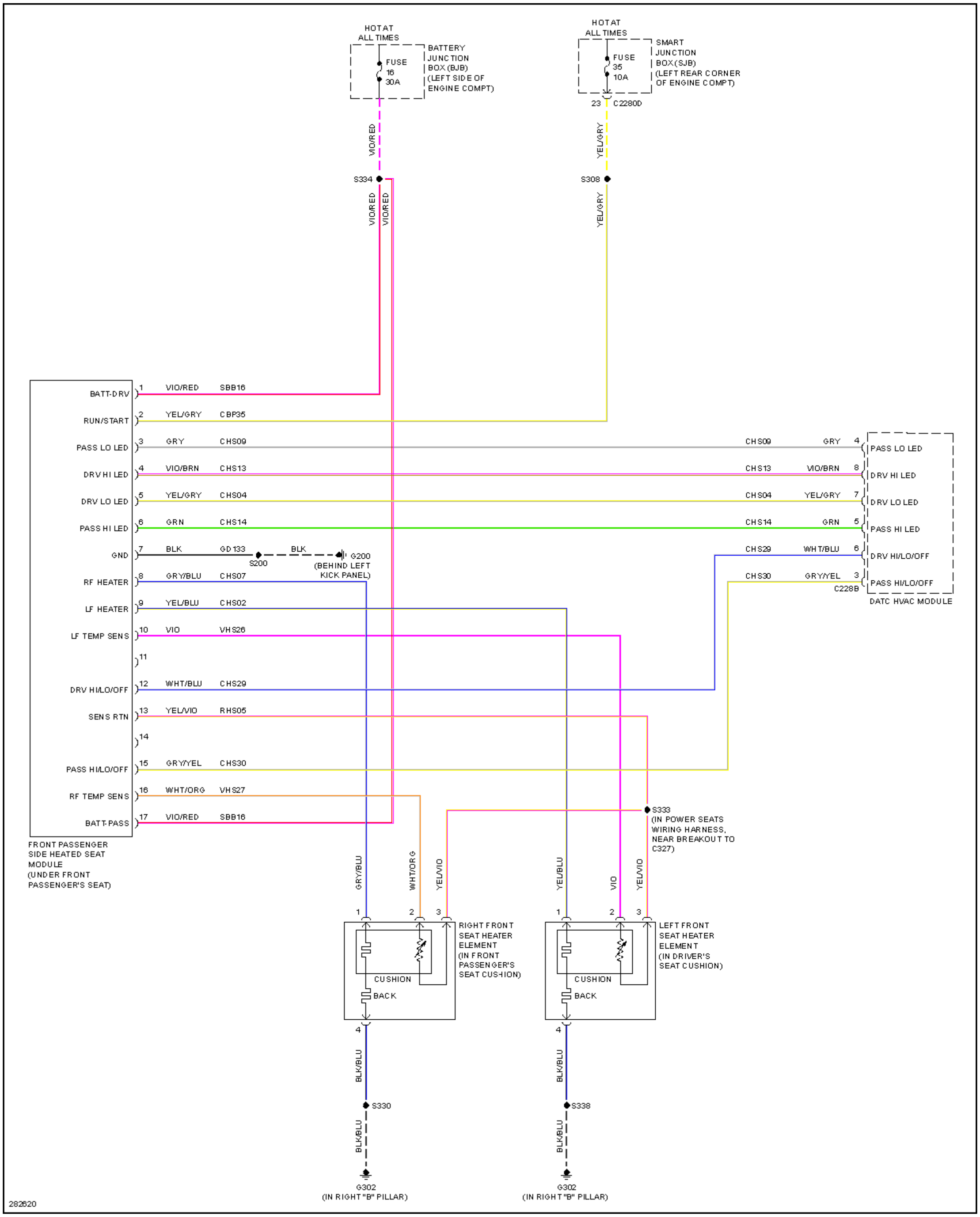


Fig. 51: Heated Seats Circuit

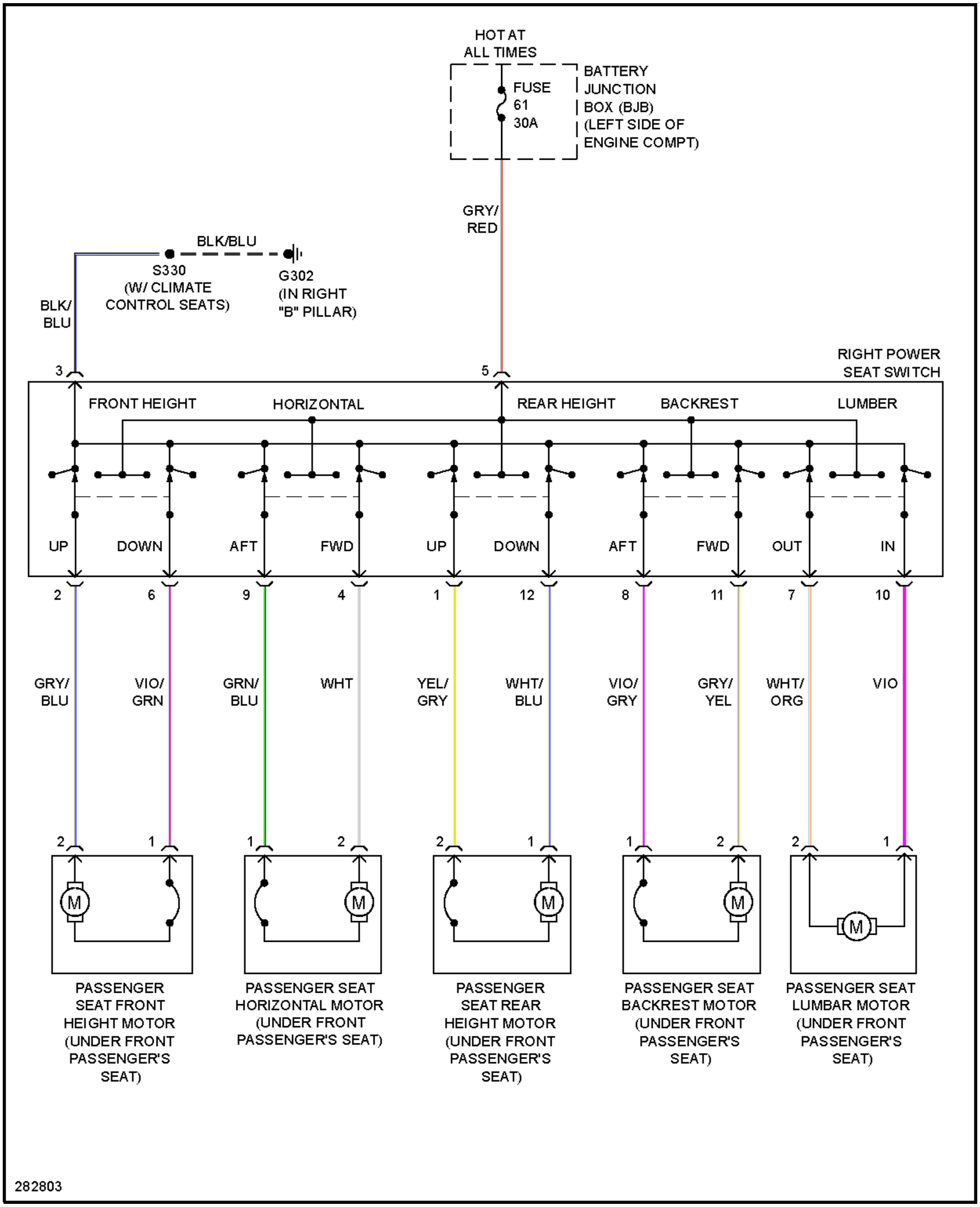
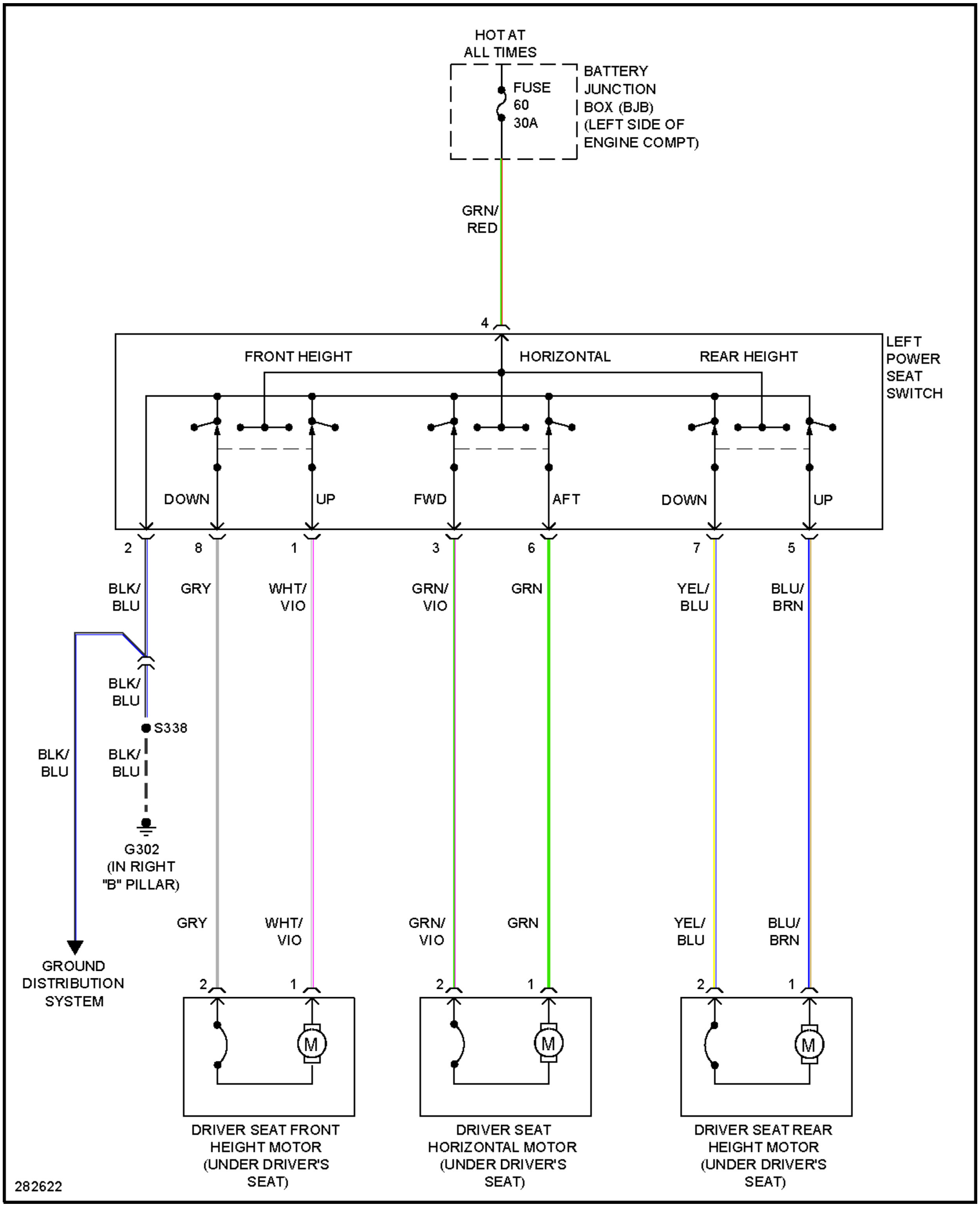

HOT AT ALL TIMES
FUSE 61 30A
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
GRY/ RED
BLK/BLU
S330 (W/ CLIMATE CONTROL SEATS)
G302 (IN RIGHT "B" PILLAR)
BLK/ BLU
RIGHT POWER SEAT SWITCH
FRONT HEIGHT
HORIZONTAL
REAR HEIGHT
BACKREST
LUMBER
UP
DOWN
AFT
FWD
UP
DOWN
AFT
FWD
OUT
IN
GRY/ BLU
VIO/ GRN
GRN/ BLU
WHT
YEL/ GRY
WHT/ BLU
VIO/ GRY
GRY/ YEL
WHT/ ORG
VIO
PASSENGER SEAT FRONT HEIGHT MOTOR (UNDER FRONT PASSENGER'S SEAT)
PASSENGER SEAT HORIZONTAL MOTOR (UNDER FRONT PASSENGER'S SEAT)
PASSENGER SEAT REAR HEIGHT MOTOR (UNDER FRONT PASSENGER'S SEAT)
PASSENGER SEAT BACKREST MOTOR (UNDER FRONT PASSENGER'S SEAT)
PASSENGER SEAT LUMBAR MOTOR (UNDER FRONT PASSENGER'S SEAT)
282803

Fig. 52: Power Seats Circuit, 10-Way Passenger Seat



HOT AT
ALL TIMES
FUSE
60
30A
BATTERY
JUNCTION
BOX (BJB)
(LEFT SIDE OF
ENGINE COMPT)
GRN/
RED
4
FRONT HEIGHT
HORIZONTAL
REAR HEIGHT
LEFT
POWER
SEAT
SWITCH
DOWN
UP
FWD
AFT
DOWN
UP
2
8
1
3
6
7
5
BLK/
BLU
GRY
WHT/
VIO
GRN/
VIO
GRN
YEL/
BLU
BLU/
BRN
BLK/
BLU
S338
BLK/
BLU
BLK/
BLU
G302
(IN RIGHT
"B" PILLAR)
GRY
WHT/
VIO
GRN/
VIO
GRN
YEL/
BLU
BLU/
BRN
GROUND
DISTRIBUTION
SYSTEM
2
1
2
1
2
1
M
M
M
DRIVER SEAT FRONT
HEIGHT MOTOR
(UNDER DRIVER'S
SEAT)
DRIVER SEAT
HORIZONTAL MOTOR
(UNDER DRIVER'S
SEAT)
DRIVER SEAT REAR
HEIGHT MOTOR
(UNDER DRIVER'S
SEAT)
282622

Fig. 53: Power Seats Circuit, 6-Way Driver Seat

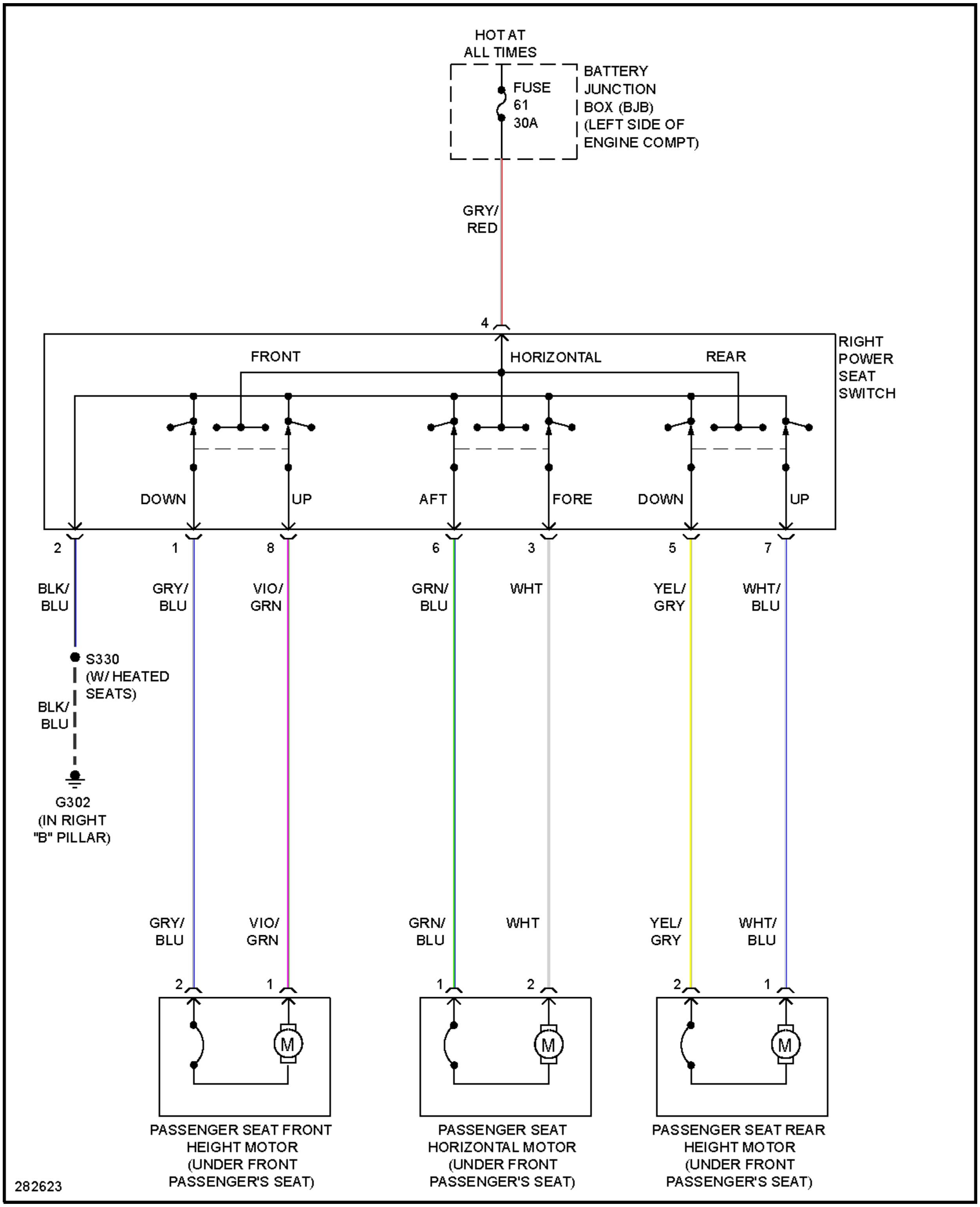
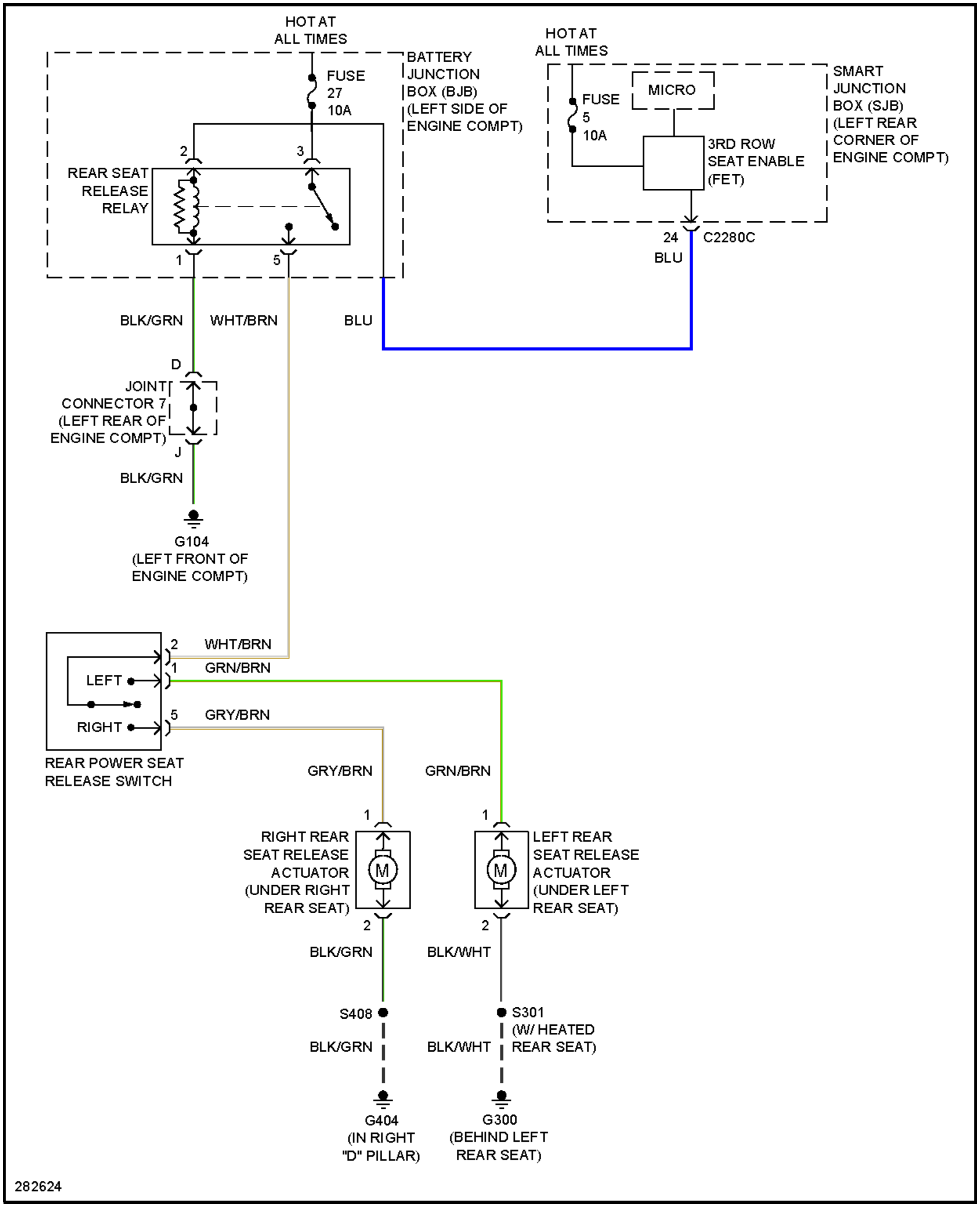

HOT AT
ALL TIMES
FUSE
61
30A
BATTERY
JUNCTION
BOX (BJB)
(LEFT SIDE OF
ENGINE COMPT)
GRY/
RED
4
FRONT
HORIZONTAL
REAR
RIGHT
POWER
SEAT
SWITCH
DOWN
UP
AFT
FORE
DOWN
UP
2
1
8
6
3
5
7
BLK/
BLU
GRY/
BLU
VIO/
GRN
GRN/
BLU
WHT
YEL/
GRY
WHT/
BLU
S330
(W/ HEATED
SEATS)
BLK/
BLU
G302
(IN RIGHT
"B" PILLAR)
GRY/
BLU
VIO/
GRN
GRN/
BLU
WHT
YEL/
GRY
WHT/
BLU
2
1
1
2
2
1
M
M
M
PASSENGER SEAT FRONT
HEIGHT MOTOR
(UNDER FRONT
PASSENGER'S SEAT)
PASSENGER SEAT
HORIZONTAL MOTOR
(UNDER FRONT
PASSENGER'S SEAT)
PASSENGER SEAT REAR
HEIGHT MOTOR
(UNDER FRONT
PASSENGER'S SEAT)
282623

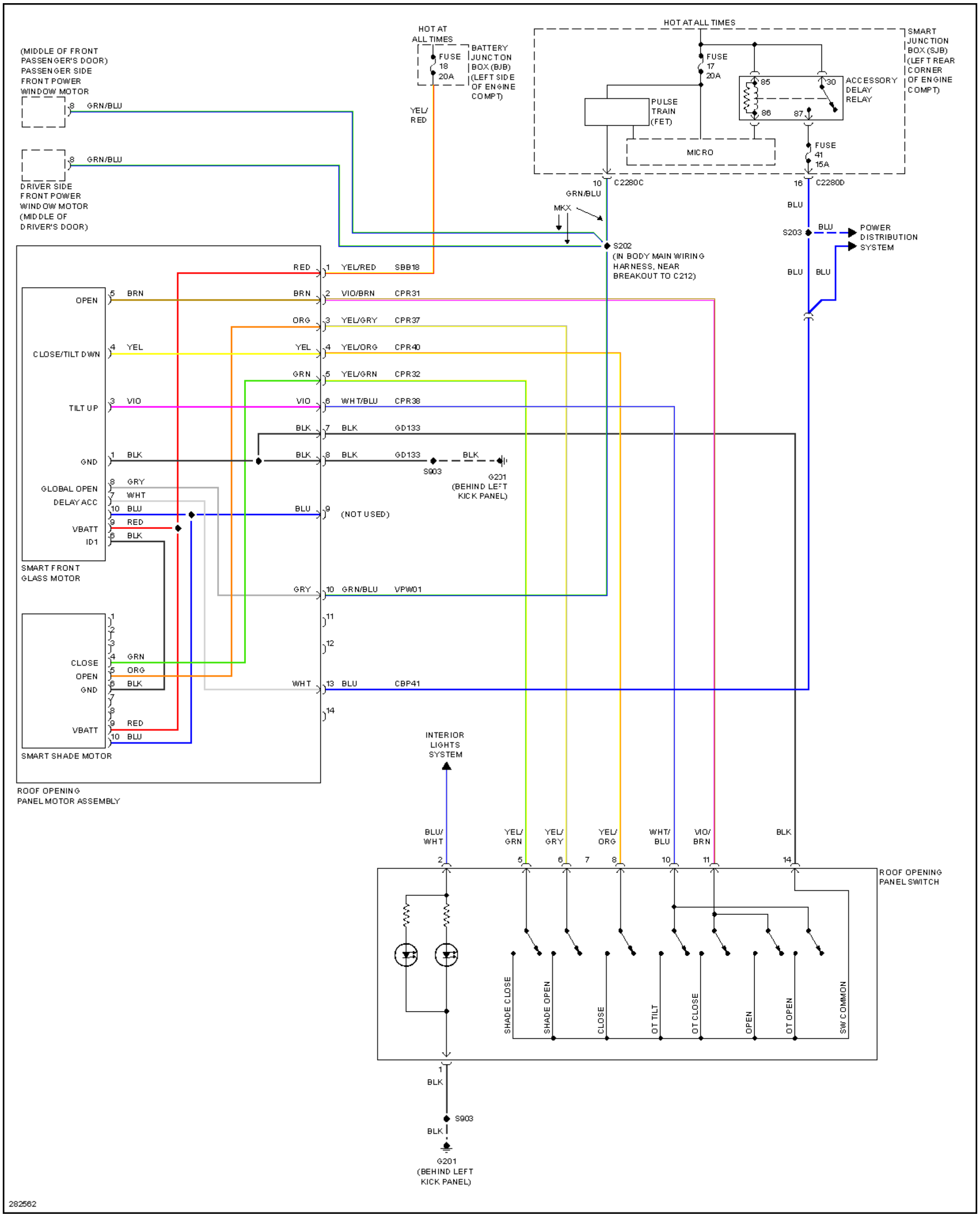
Fig. 54: Power Seats Circuit, 6-Way passenger Seat



HOT AT ALL TIMES
FUSE 27 10A
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
HOT AT ALL TIMES
FUSE 5 10A
MICRO
3RD ROW SEAT ENABLE (FET)
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
2
3
REAR SEAT RELEASE RELAY
1
5
24
C2280C
BLU
BLK/GRN
WHT/BRN
BLU
D
JOINT CONNECTOR 7 (LEFT REAR OF ENGINE COMPT)
J
BLK/GRN
G104 (LEFT FRONT OF ENGINE COMPT)
2
WHT/BRN
1
GRN/BRN
LEFT
5
GRY/BRN
RIGHT
REAR POWER SEAT RELEASE SWITCH
GRY/BRN
GRN/BRN
1
RIGHT REAR SEAT RELEASE ACTUATOR (UNDER RIGHT REAR SEAT)
M
2
1
LEFT REAR SEAT RELEASE ACTUATOR (UNDER LEFT REAR SEAT)
M
2
BLK/GRN
BLK/WHT
S408
S301 (W/ HEATED REAR SEAT)
BLK/GRN
BLK/WHT
G404 (IN RIGHT "D" PILLAR)
G300 (BEHIND LEFT REAR SEAT)
282624

Fig. 55: Second Row Seat Release Circuit

POWER TOP/SUNROOF



HOT AT ALL TIMES
FUSE 18 20A
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
HOT AT ALL TIMES
FUSE 17 20A
PULSE TRAIN (FET)
MICRO
ACCESSORY DELAY RELAY
FUSE 41 15A
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
C2280C
C2280D
(MIDDLE OF FRONT PASSENGER'S DOOR) PASSENGER SIDE FRONT POWER WINDOW MOTOR
DRIVER SIDE FRONT POWER WINDOW MOTOR (MIDDLE OF DRIVER'S DOOR)
GRN/BLU
YEL/RED
MKX
S202 (IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO C212)
S203
POWER DISTRIBUTION SYSTEM
BLU
OPEN
CLOSE/TILT DWN
TILT UP
GND
GLOBAL OPEN
DELAY ACC
VBATT
ID1
SMART FRONT GLASS MOTOR
CLOSE
OPEN
GND
VBATT
SMART SHADE MOTOR
ROOF OPENING PANEL MOTOR ASSEMBLY
SBB18
CPR31
CPR37
CPR40
CPR32
CPR38
GD133
VPW01
CBP41
(NOT USED)
S903
G201 (BEHIND LEFT KICK PANEL)
INTERIOR LIGHTS SYSTEM
BLU/WHT
YEL/GRN
YEL/GRY
YEL/ORG
WHT/BLU
VIO/BRN
BLK
ROOF OPENING PANEL SWITCH
SHADE CLOSE
SHADE OPEN
CLOSE
OT TILT
OT CLOSE
OPEN
OT OPEN
SW COMMON
282562

Fig. 56: Power Top/Sunroof Circuit

POWER WINDOWS

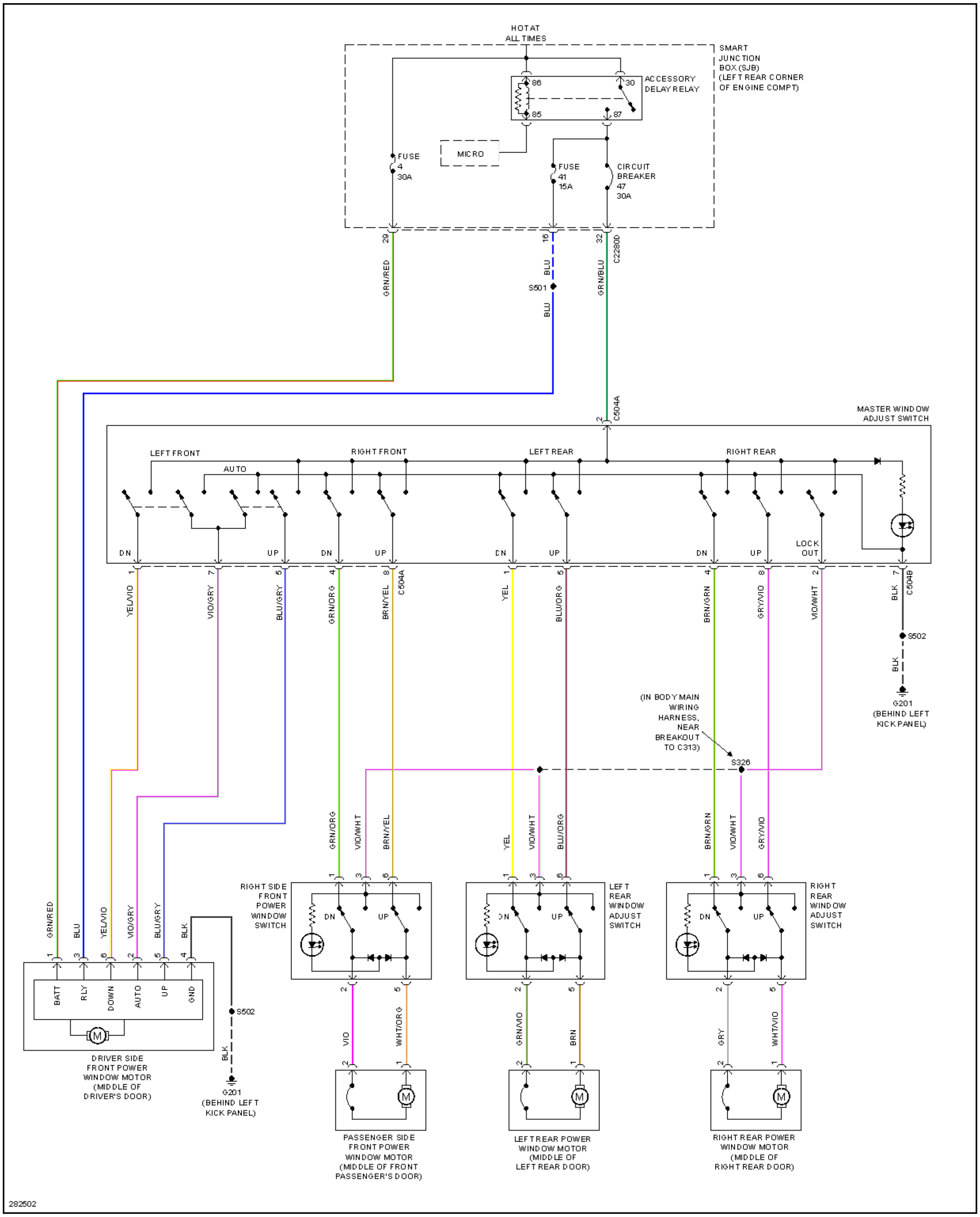

HOT AT ALL TIMES
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
ACCESSORY DELAY RELAY
86
30
85
87
MICRO
FUSE 4 30A
FUSE 41 15A
CIRCUIT BREAKER 47 30A
C2280D
GRN/RED
BLU
S501
GRN/BLU
C504A
MASTER WINDOW ADJUST SWITCH
LEFT FRONT
AUTO
RIGHT FRONT
LEFT REAR
RIGHT REAR
DN
UP
LOCK OUT
C504B
YEL/VIO
VIO/GRY
BLU/GRY
GRN/ORG
BRN/YEL
YEL
BLU/ORG
BRN/GRN
GRY/VIO
VIO/WHT
BLK
S502
G201 (BEHIND LEFT KICK PANEL)
(IN BODY MAIN WIRING HARNESS, NEAR BREAKOUT TO C313)
S326
RIGHT SIDE FRONT POWER WINDOW SWITCH
LEFT REAR WINDOW ADJUST SWITCH
RIGHT REAR WINDOW ADJUST SWITCH
BATT
RLY
DOWN
AUTO
UP
GND
DRIVER SIDE FRONT POWER WINDOW MOTOR (MIDDLE OF DRIVER'S DOOR)
VIO
WHT/ORG
GRN/VIO
BRN
GRY
WHT/VIO
PASSENGER SIDE FRONT POWER WINDOW MOTOR (MIDDLE OF FRONT PASSENGER'S DOOR)
LEFT REAR POWER WINDOW MOTOR (MIDDLE OF LEFT REAR DOOR)
RIGHT REAR POWER WINDOW MOTOR (MIDDLE OF RIGHT REAR DOOR)
282502

Fig. 57: Power Windows Circuit

RADIO

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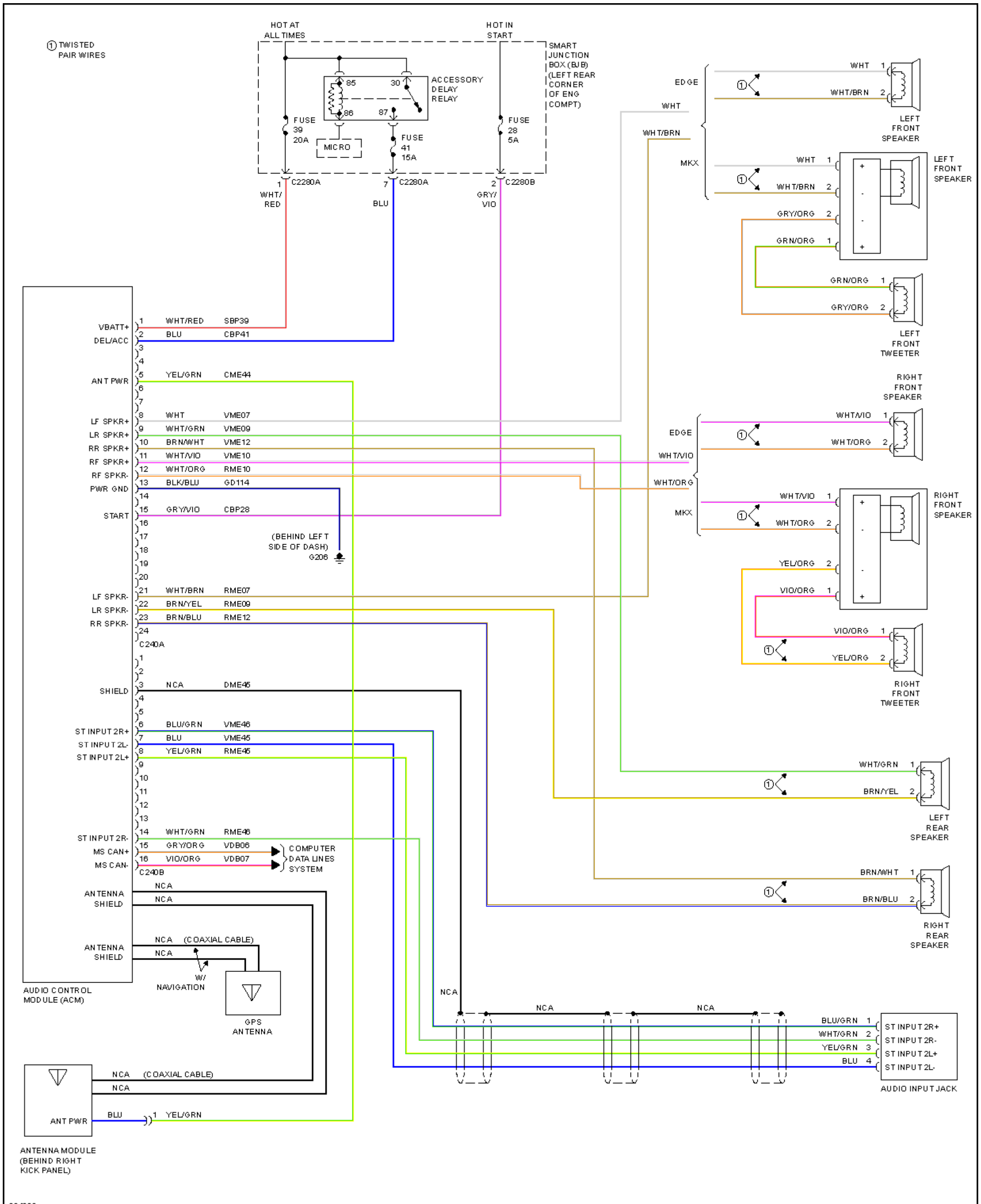


Fig. 58: Base Radio Circuit

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

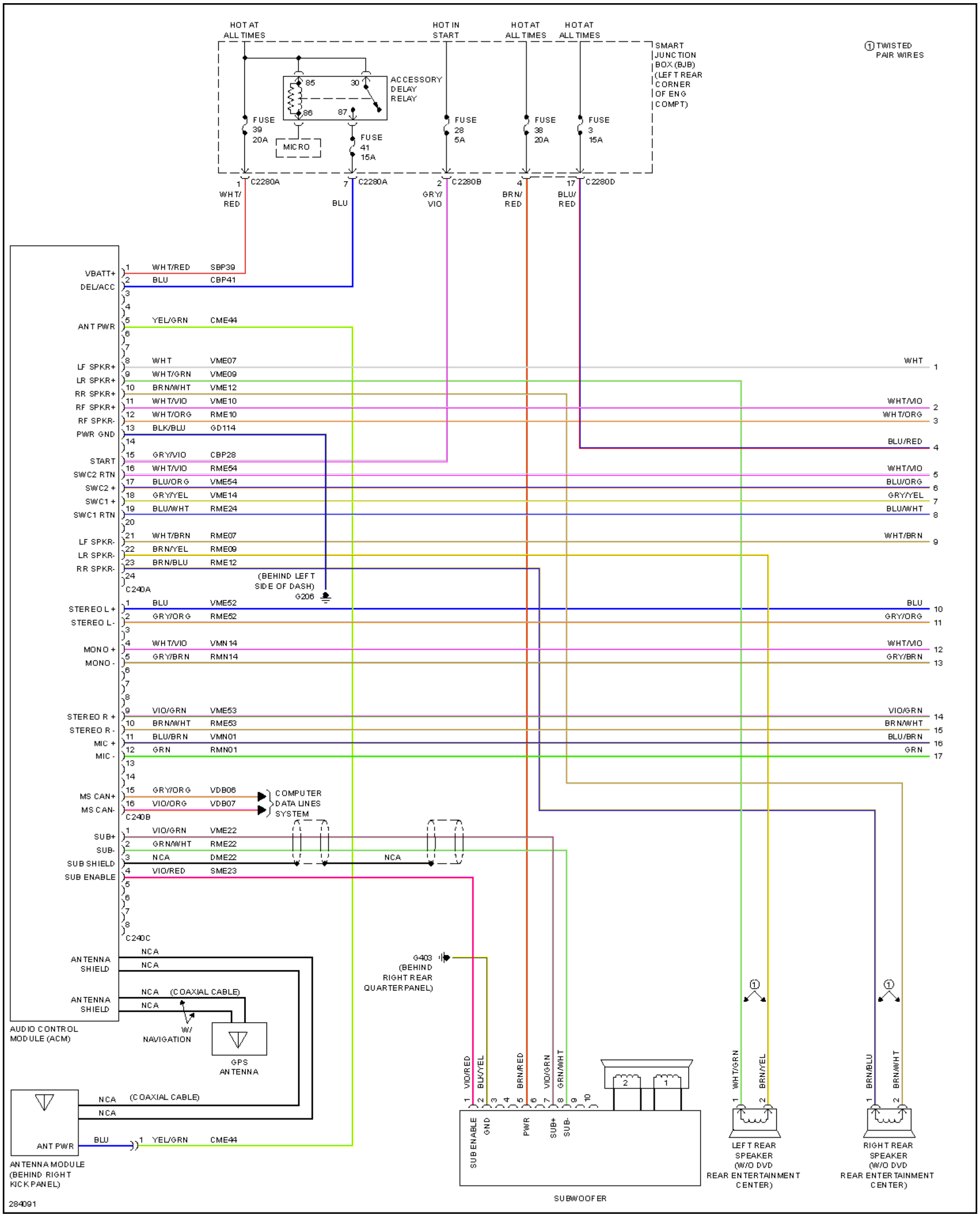


Fig. 59: Premium Radio Circuit, W/ SYNC (1 of 3)

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

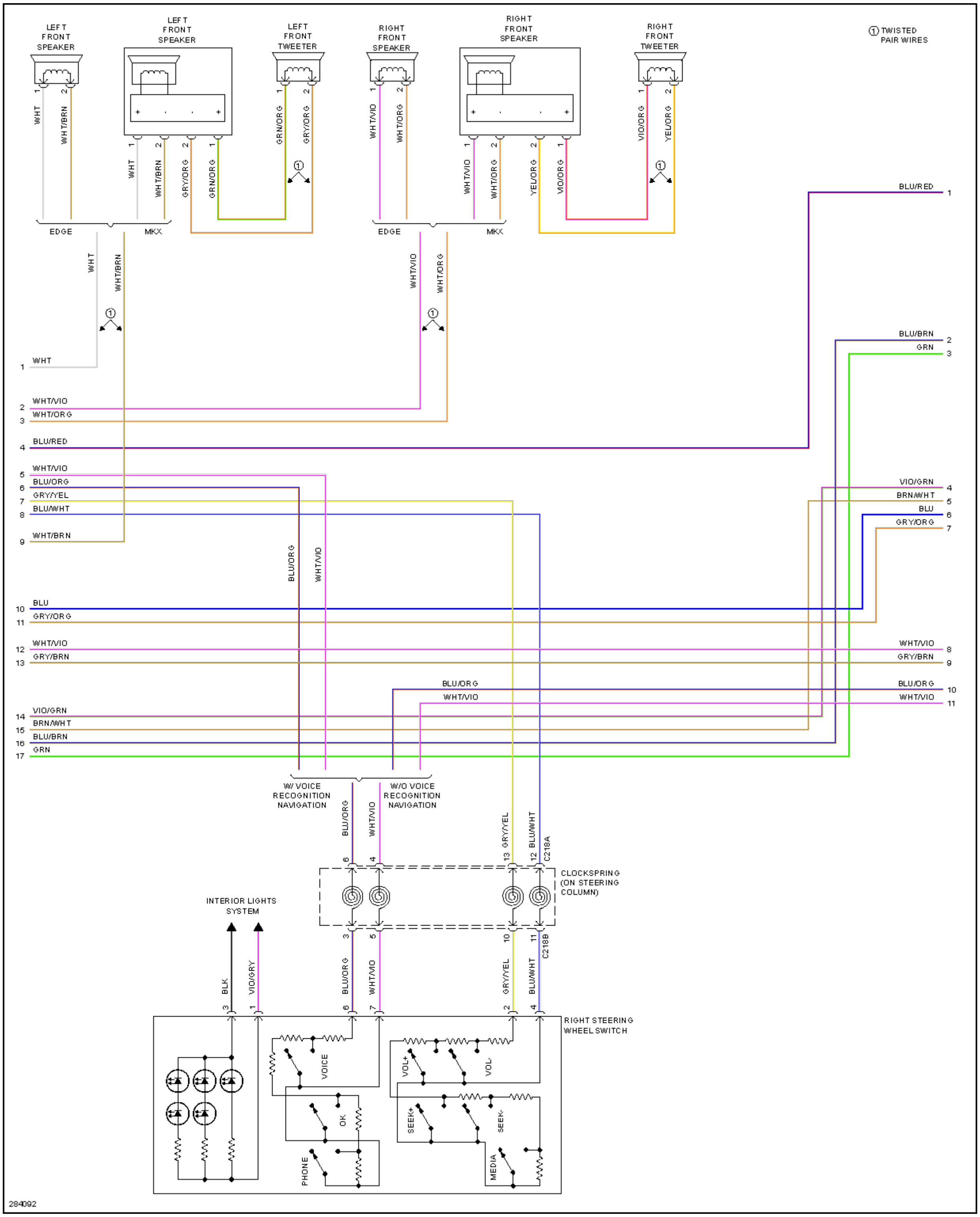


Fig. 60: Premium Radio Circuit, W/ SYNC (2 of 3)

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

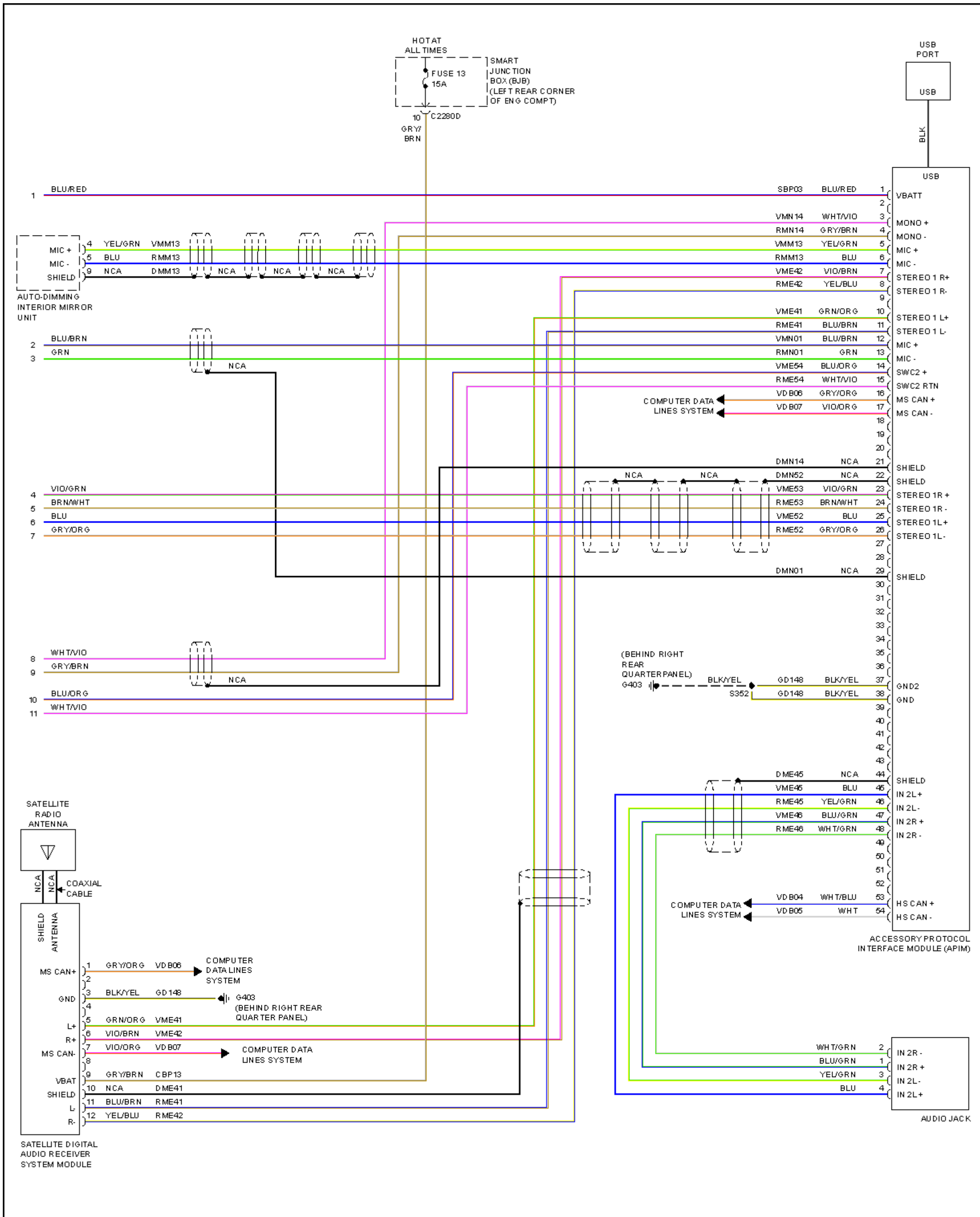


Fig. 61: Premium Radio Circuit, W/ SYNC (3 of 3)

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

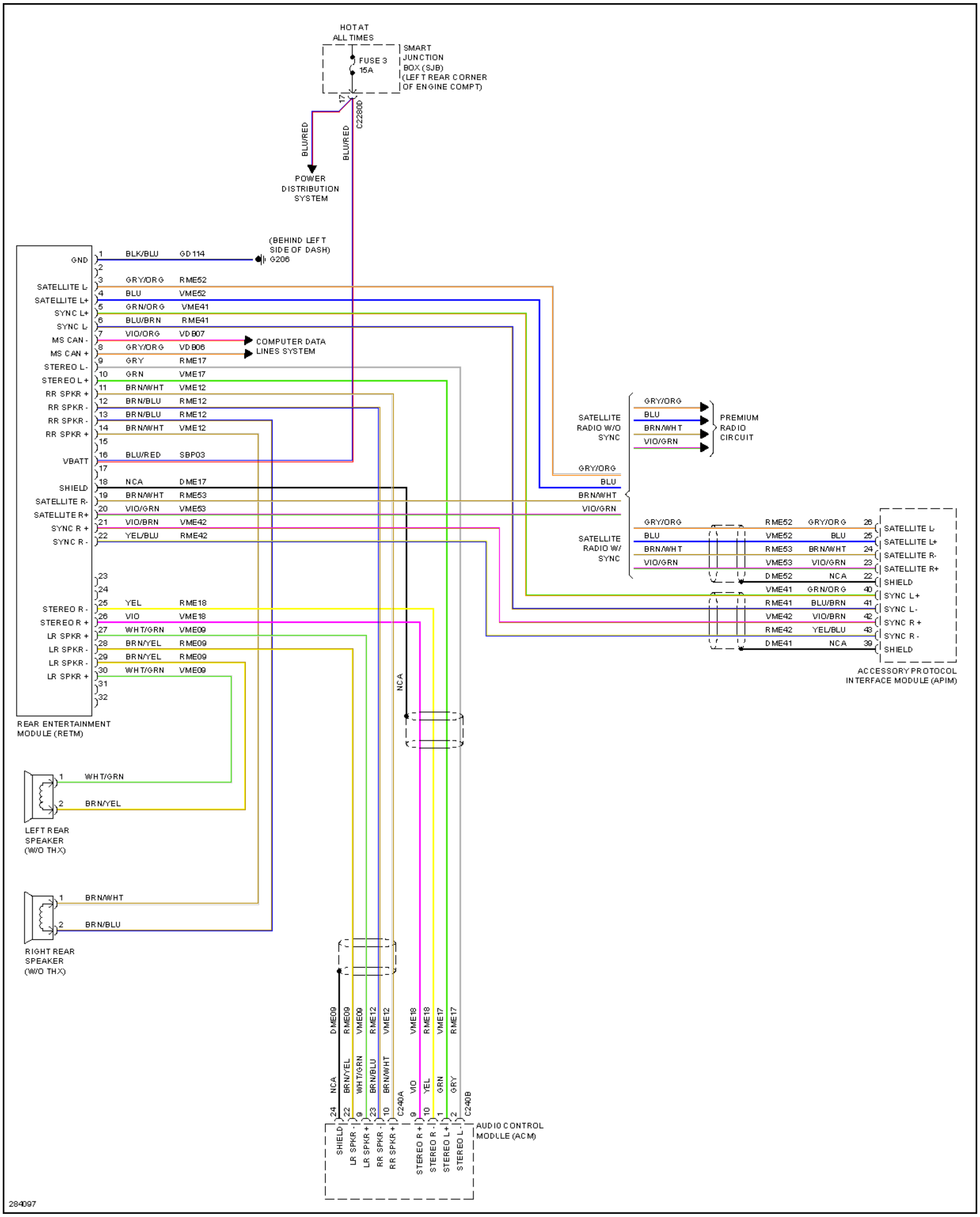


Fig. 62: Rear Entertainment Radio Circuit

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

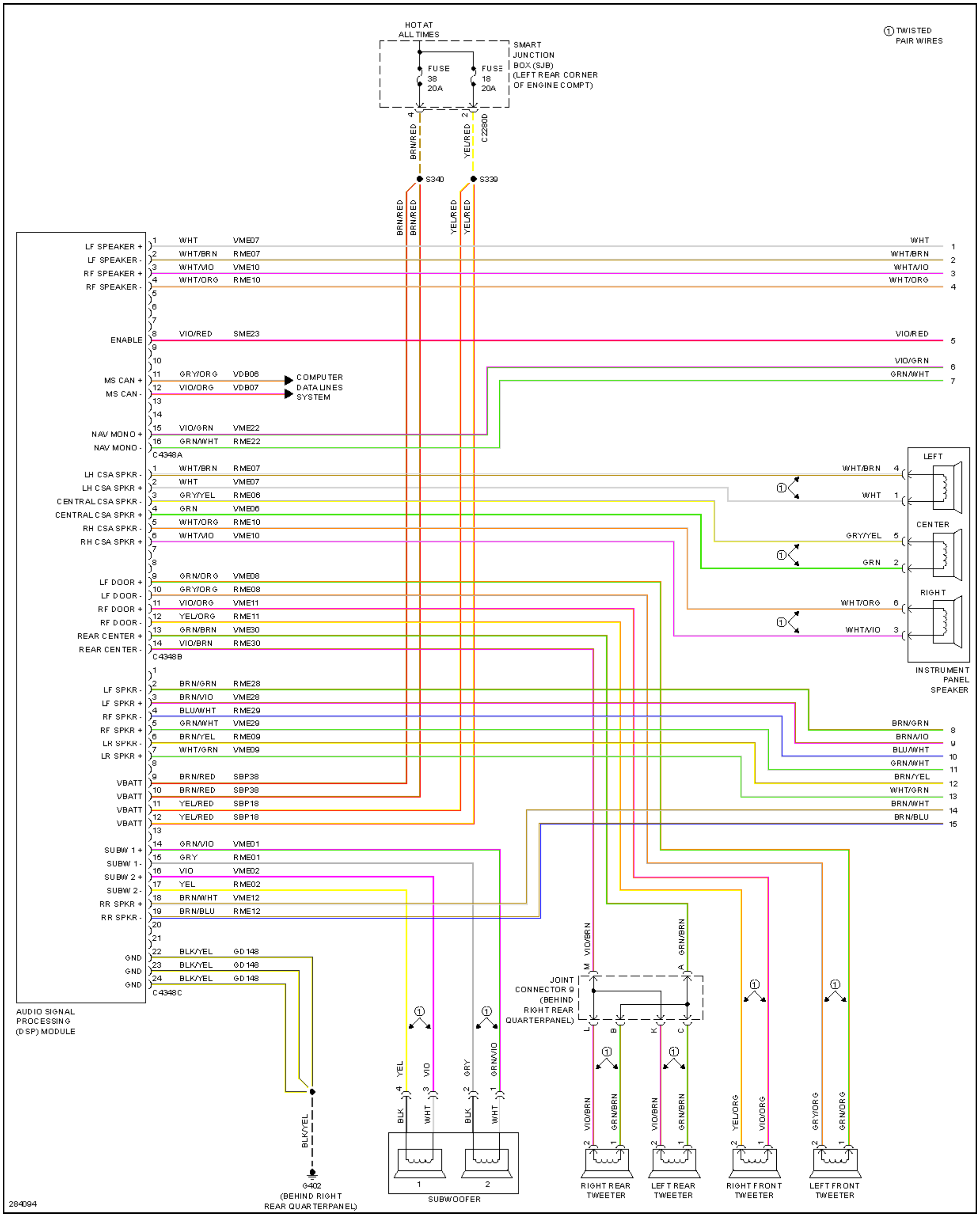


Fig. 63: THX Audio Radio Circuit (1 of 3)

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

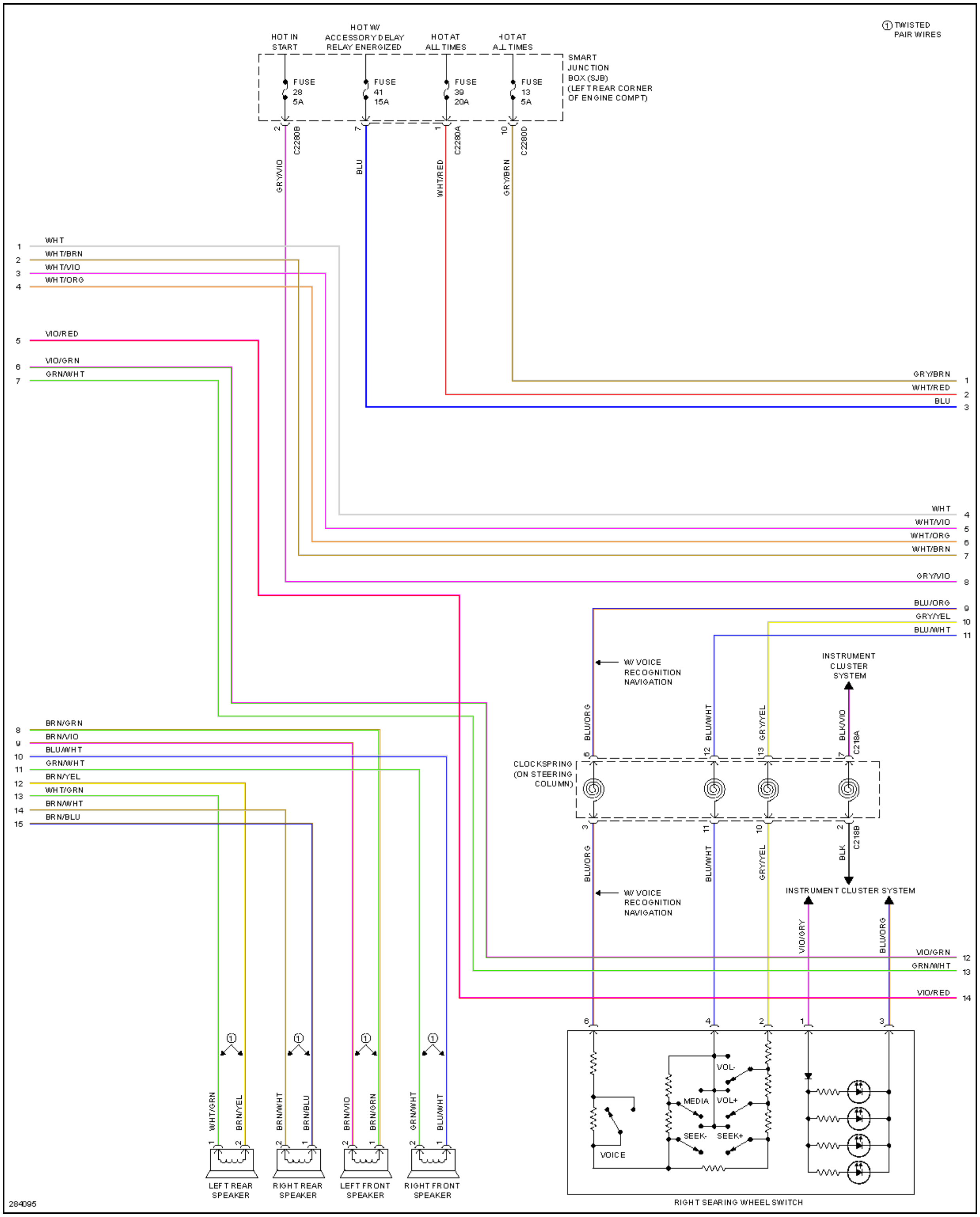


Fig. 64: THX Audio Radio Circuit (2 of 3)

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

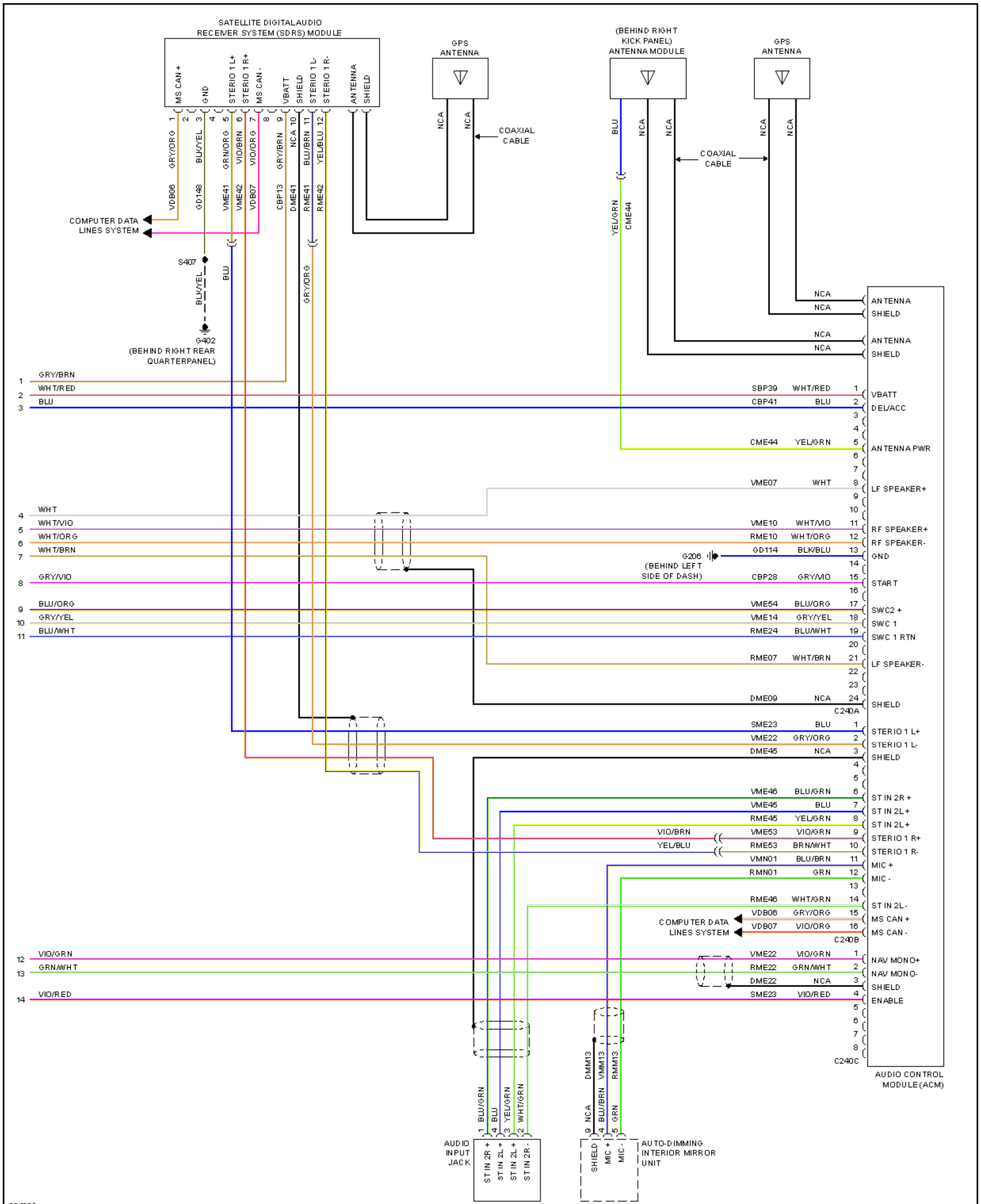


Fig. 65: THX Audio Radio Circuit (3 of 3)

SHIFT INTERLOCK

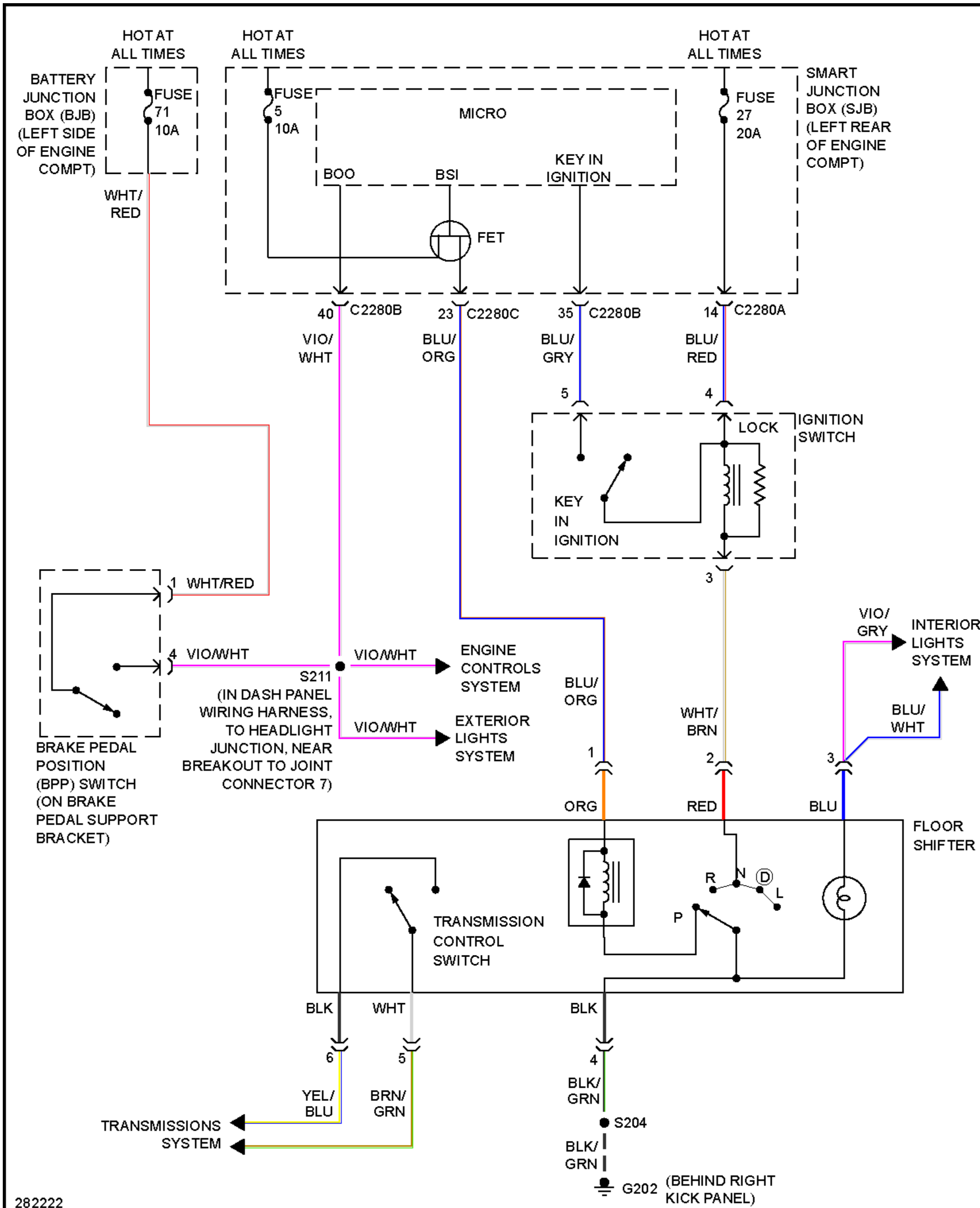

HOT AT ALL TIMES
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
FUSE 71 10A
WHT/ RED
HOT AT ALL TIMES
FUSE 5 10A
MICRO
BOO
BSI
KEY IN IGNITION
FET
HOT AT ALL TIMES
FUSE 27 20A
SMART JUNCTION BOX (SJB) (LEFT REAR OF ENGINE COMPT)
40 C2280B
23 C2280C
35 C2280B
14 C2280A
VIO/ WHT
BLU/ ORG
BLU/ GRY
BLU/ RED
5
4
LOCK
IGNITION SWITCH
KEY IN IGNITION
3
1 WHT/RED
4 VIO/WHT
S211 (IN DASH PANEL WIRING HARNESS, TO HEADLIGHT JUNCTION, NEAR BREAKOUT TO JOINT CONNECTOR 7)
VIO/WHT
ENGINE CONTROLS SYSTEM
VIO/WHT
EXTERIOR LIGHTS SYSTEM
BRAKE PEDAL POSITION (BPP) SWITCH (ON BRAKE PEDAL SUPPORT BRACKET)
BLU/ ORG
WHT/ BRN
VIO/ GRY
INTERIOR LIGHTS SYSTEM
BLU/ WHT
1
2
3
ORG
RED
BLU
FLOOR SHIFTER
TRANSMISSION CONTROL SWITCH
R
N
D
L
P
BLK
WHT
BLK
6
5
4
YEL/ BLU
BRN/ GRN
TRANSMISSIONS SYSTEM
BLK/ GRN
S204
BLK/ GRN
G202 (BEHIND RIGHT KICK PANEL)
282222

Fig. 66: Shift Interlock Circuit

STARTING/CHARGING

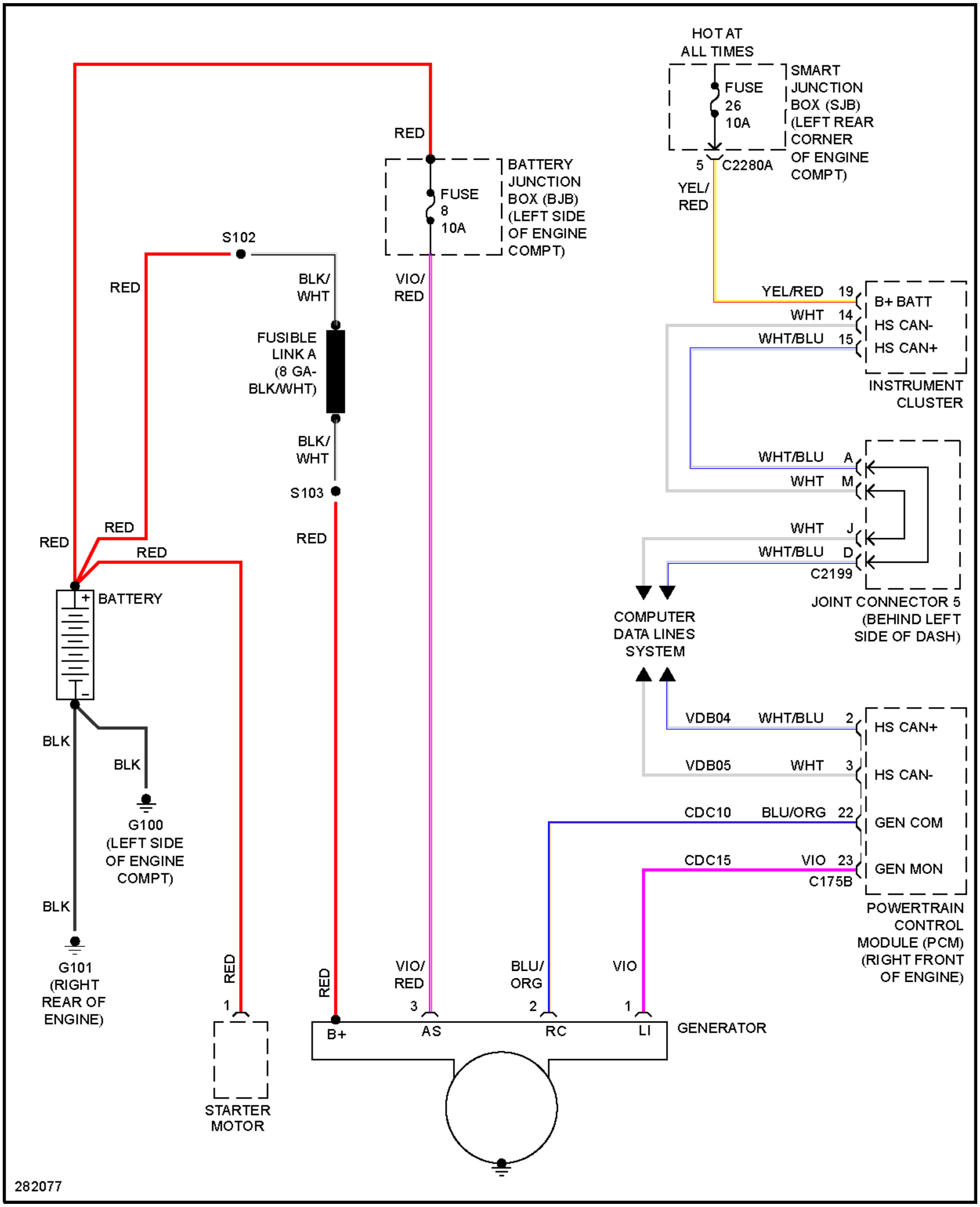
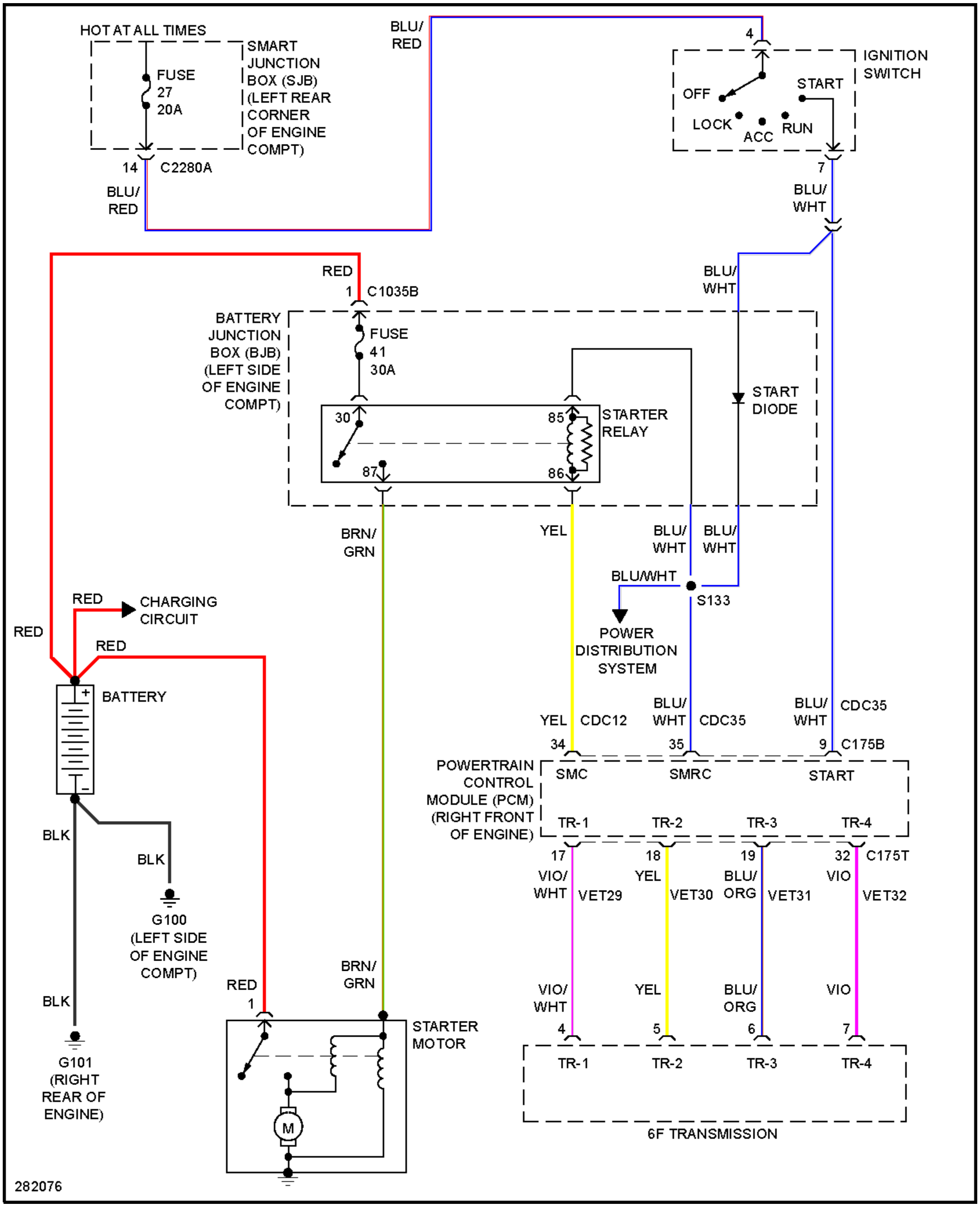

HOT AT ALL TIMES
FUSE 26 10A
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
5 C2280A
YEL/RED
RED
FUSE 8 10A
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
S102
RED
BLK/WHT
VIO/RED
FUSIBLE LINK A (8 GA-BLK/WHT)
BLK/WHT
S103
RED
RED
RED
RED
BATTERY
BLK
BLK
G100 (LEFT SIDE OF ENGINE COMPT)
BLK
G101 (RIGHT REAR OF ENGINE)
RED
1
STARTER MOTOR
YEL/RED 19
WHT 14
WHT/BLU 15
B+ BATT
HS CAN-
HS CAN+
INSTRUMENT CLUSTER
WHT/BLU A
WHT M
WHT J
WHT/BLU D
C2199
JOINT CONNECTOR 5 (BEHIND LEFT SIDE OF DASH)
COMPUTER DATA LINES SYSTEM
VDB04 WHT/BLU 2
HS CAN+
VDB05 WHT 3
HS CAN-
CDC10 BLU/ORG 22
GEN COM
CDC15 VIO 23
GEN MON
C175B
POWERTRAIN CONTROL MODULE (PCM) (RIGHT FRONT OF ENGINE)
RED
VIO/RED
BLU/ORG
VIO
3
2
1
B+
AS
RC
LI
GENERATOR
282077

Fig. 67: Charging Circuit



HOT AT ALL TIMES
FUSE 27 20A
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
14 C2280A
BLU/ RED
BLU/ RED
4
IGNITION SWITCH
OFF
START
LOCK
ACC
RUN
7
BLU/ WHT
BLU/ WHT
RED
1 C1035B
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
FUSE 41 30A
30
85
STARTER RELAY
87
86
START DIODE
BRN/ GRN
YEL
BLU/ WHT
BLU/ WHT
BLU/WHT
S133
POWER DISTRIBUTION SYSTEM
RED
CHARGING CIRCUIT
RED
RED
BATTERY
YEL CDC12
BLU/ WHT CDC35
BLU/ WHT CDC35
34
35
9 C175B
POWERTRAIN CONTROL MODULE (PCM) (RIGHT FRONT OF ENGINE)
SMC
SMRC
START
TR-1
TR-2
TR-3
TR-4
17
18
19
32 C175T
VIO/ WHT VET29
YEL VET30
BLU/ ORG VET31
VIO VET32
BLK
BLK
G100 (LEFT SIDE OF ENGINE COMPT)
BLK
G101 (RIGHT REAR OF ENGINE)
RED
1
BRN/ GRN
STARTER MOTOR
M
VIO/ WHT
YEL
BLU/ ORG
VIO
4
5
6
7
TR-1
TR-2
TR-3
TR-4
6F TRANSMISSION
282076

Fig. 68: Starting Circuit

SUPPLEMENTAL RESTRAINTS

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

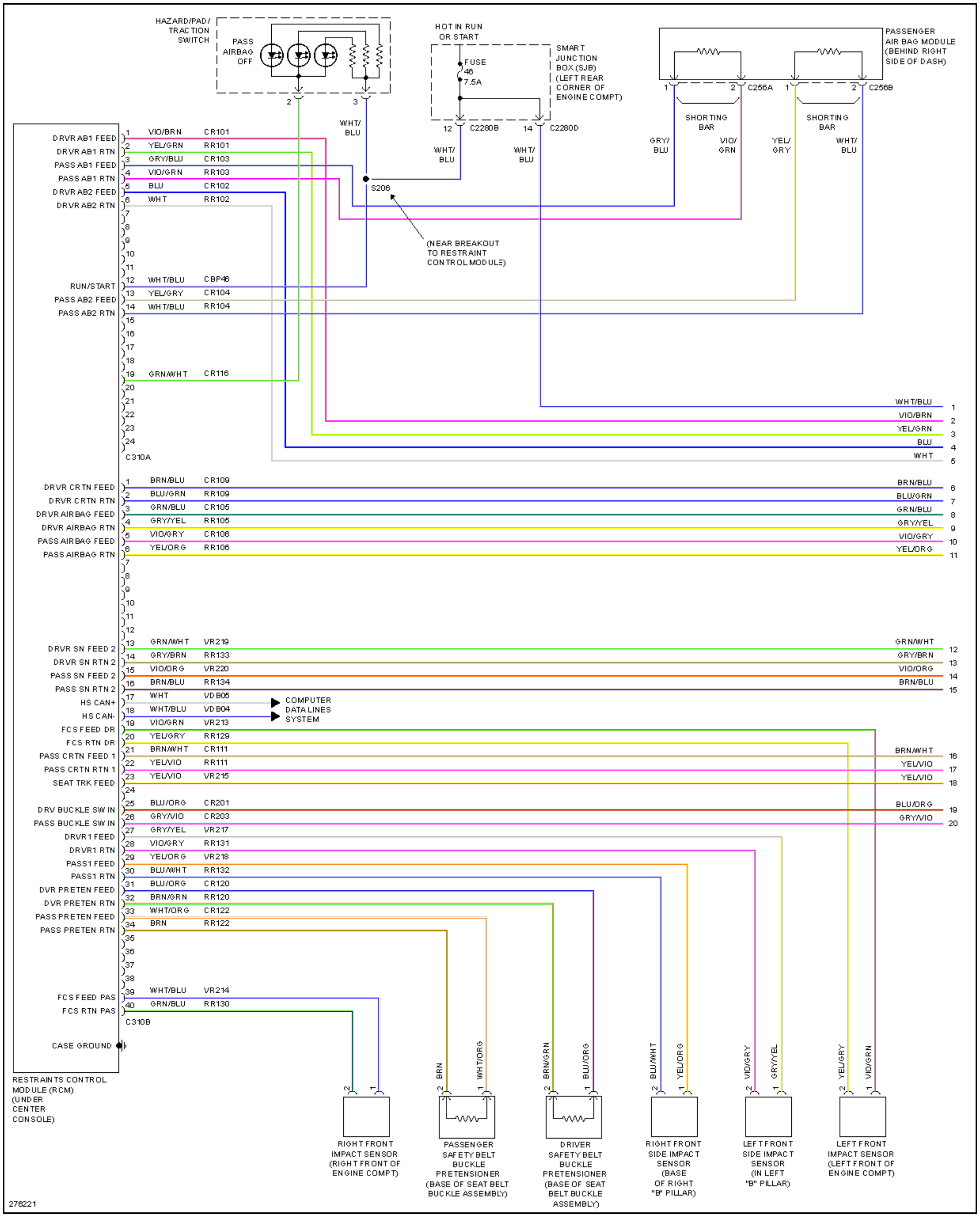
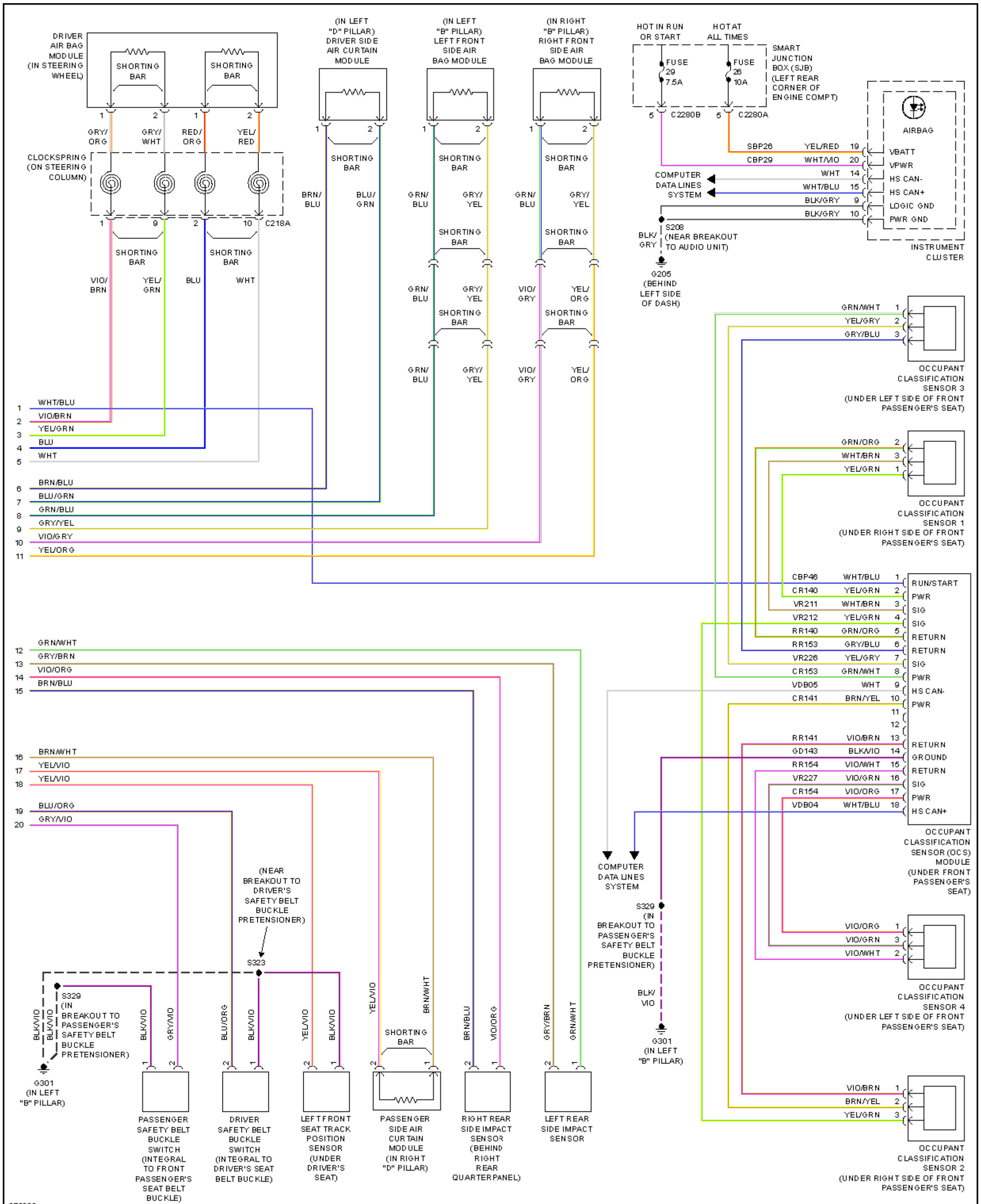


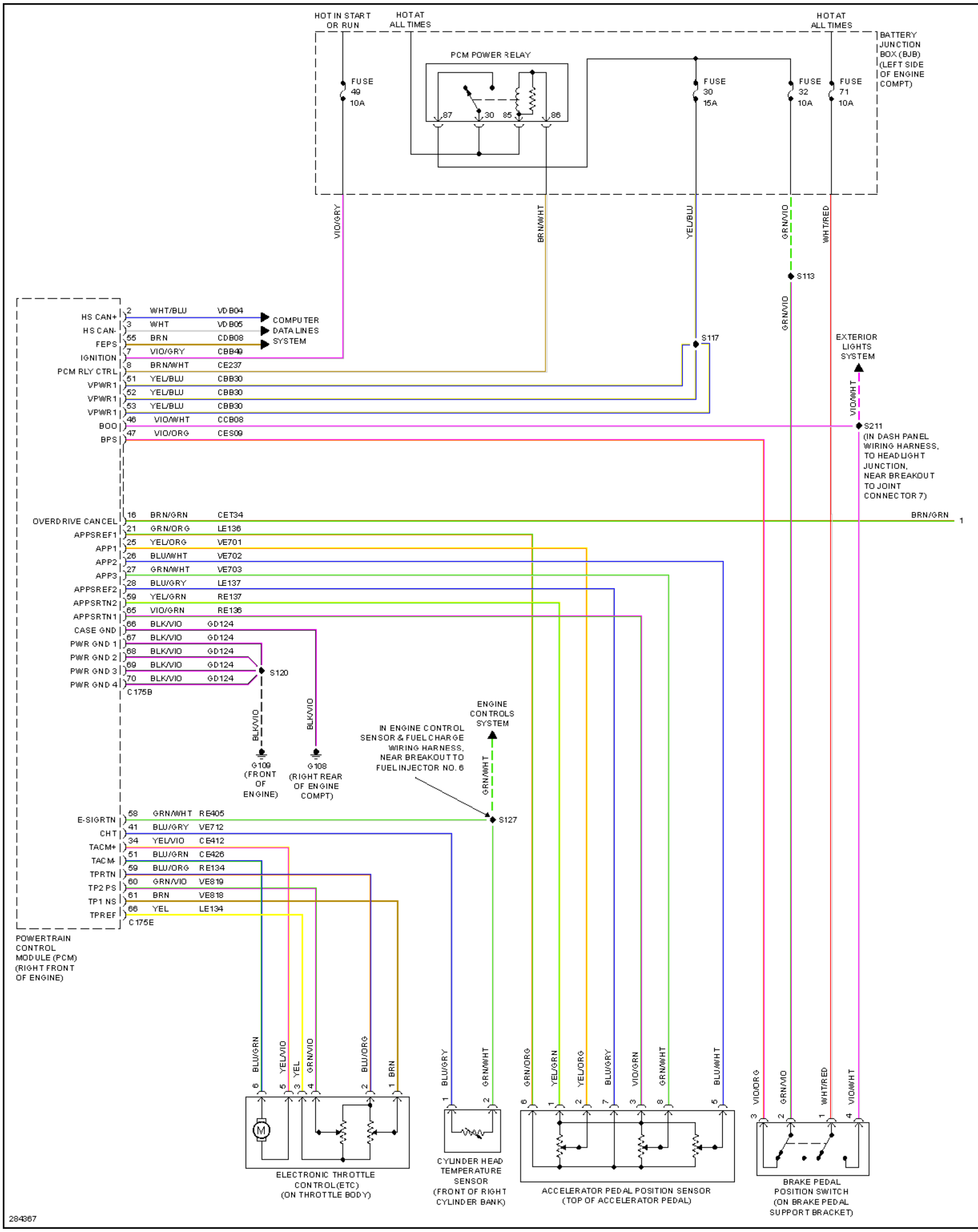
Fig. 69: Supplemental Restraints Circuit (1 of 2)



DRIVER AIR BAG MODULE (IN STEERING WHEEL)
SHORTING BAR
CLOCKSPRING (ON STEERING COLUMN)
C218A
(IN LEFT "D" PILLAR) DRIVER SIDE AIR CURTAIN MODULE
(IN LEFT "B" PILLAR) LEFT FRONT SIDE AIR BAG MODULE
(IN RIGHT "B" PILLAR) RIGHT FRONT SIDE AIR BAG MODULE
HOT IN RUN OR START
HOT AT ALL TIMES
FUSE 29 7.5A
FUSE 26 10A
C2280B
C2280A
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
AIRBAG
VBATT
VPWR
HS CAN-
HS CAN+
LOGIC GND
PWR GND
INSTRUMENT CLUSTER
COMPUTER DATA LINES SYSTEM
S208 (NEAR BREAKOUT TO AUDIO UNIT)
G205 (BEHIND LEFT SIDE OF DASH)
OCCUPANT CLASSIFICATION SENSOR 3 (UNDER LEFT SIDE OF FRONT PASSENGER'S SEAT)
OCCUPANT CLASSIFICATION SENSOR 1 (UNDER RIGHT SIDE OF FRONT PASSENGER'S SEAT)
RUN/START
PWR
SIG
RETURN
HS CAN-
GROUND
HS CAN+
OCCUPANT CLASSIFICATION SENSOR (OCS) MODULE (UNDER FRONT PASSENGER'S SEAT)
OCCUPANT CLASSIFICATION SENSOR 4 (UNDER LEFT SIDE OF FRONT PASSENGER'S SEAT)
OCCUPANT CLASSIFICATION SENSOR 2 (UNDER RIGHT SIDE OF FRONT PASSENGER'S SEAT)
S329 (IN BREAKOUT TO PASSENGER'S SAFETY BELT BUCKLE PRETENSIONER)
G301 (IN LEFT "B" PILLAR)
(NEAR BREAKOUT TO DRIVER'S SAFETY BELT BUCKLE PRETENSIONER)
S323
PASSENGER SAFETY BELT BUCKLE SWITCH (INTEGRAL TO FRONT PASSENGER'S SEAT BELT BUCKLE)
DRIVER SAFETY BELT BUCKLE SWITCH (INTEGRAL TO DRIVER'S SEAT BELT BUCKLE)
LEFT FRONT SEAT TRACK POSITION SENSOR (UNDER DRIVER'S SEAT)
PASSENGER SIDE AIR CURTAIN MODULE (IN RIGHT "D" PILLAR)
RIGHT REAR SIDE IMPACT SENSOR (BEHIND RIGHT REAR QUARTER PANEL)
LEFT REAR SIDE IMPACT SENSOR
276222

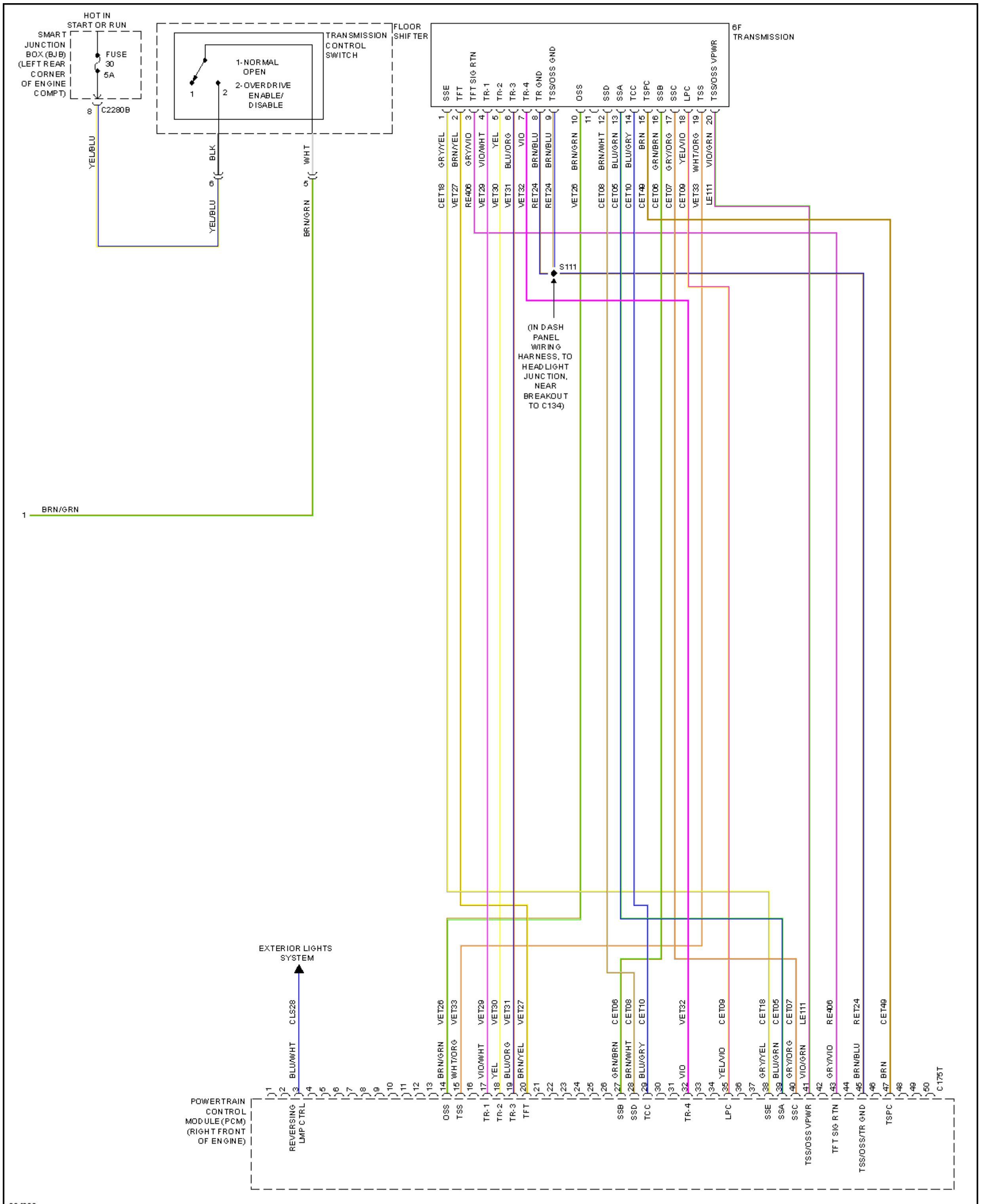
Fig. 70: Supplemental Restraints Circuit (2 of 2)

TRANSMISSION



HOT IN START OR RUN
HOT AT ALL TIMES
HOT AT ALL TIMES
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
PCM POWER RELAY
87
30
85
86
FUSE 49 10A
FUSE 30 15A
FUSE 32 10A
FUSE 71 10A
VIO/GRY
BRN/WHT
YEL/BLU
GRN/VIO
WHT/RED
S113
S117
EXTERIOR LIGHTS SYSTEM
VIO/WHT
S211
(IN DASH PANEL WIRING HARNESS, TO HEADLIGHT JUNCTION, NEAR BREAKOUT TO JOINT CONNECTOR 7)
COMPUTER DATA LINES SYSTEM
HS CAN+ 2 WHT/BLU VDB04
HS CAN- 3 WHT VDB05
FEPS 55 BRN CDB08
IGNITION 7 VIO/GRY CBB49
PCM RLY CTRL 8 BRN/WHT CE237
VPWR1 51 YEL/BLU CBB30
VPWR1 52 YEL/BLU CBB30
VPWR1 53 YEL/BLU CBB30
BOO 46 VIO/WHT CCB08
BPS 47 VIO/ORG CES09
OVERDRIVE CANCEL 16 BRN/GRN CET34
BRN/GRN 1
APPSREF1 21 GRN/ORG LE136
APP1 25 YEL/ORG VE701
APP2 26 BLU/WHT VE702
APP3 27 GRN/WHT VE703
APPSREF2 28 BLU/GRY LE137
APPSRTN2 59 YEL/GRN RE137
APPSRTN1 65 VIO/GRN RE136
CASE GND 66 BLK/VIO GD124
PWR GND 1 67 BLK/VIO GD124
PWR GND 2 68 BLK/VIO GD124
PWR GND 3 69 BLK/VIO GD124
PWR GND 4 70 BLK/VIO GD124
C175B
S120
BLK/VIO
BLK/VIO
G109 (FRONT OF ENGINE)
G108 (RIGHT REAR OF ENGINE COMPT)
ENGINE CONTROLS SYSTEM
IN ENGINE CONTROL SENSOR & FUEL CHARGE WIRING HARNESS, NEAR BREAKOUT TO FUEL INJECTOR NO. 6
GRN/WHT
S127
E-SIGRTN 58 GRN/WHT RE405
CHT 41 BLU/GRY VE712
TACM+ 34 YEL/VIO CE412
TACM- 51 BLU/GRN CE426
TPRTN 59 BLU/ORG RE134
TP2 PS 60 GRN/VIO VE819
TP1 NS 61 BRN VE818
TPREF 66 YEL LE134
C175E
POWERTRAIN CONTROL MODULE (PCM) (RIGHT FRONT OF ENGINE)
BLU/GRN 6
YEL/VIO 5
YEL 3
GRN/VIO 4
BLU/ORG 2
BRN 1
M
ELECTRONIC THROTTLE CONTROL (ETC) (ON THROTTLE BODY)
BLU/GRY 1
GRN/WHT 2
CYLINDER HEAD TEMPERATURE SENSOR (FRONT OF RIGHT CYLINDER BANK)
GRN/ORG 6
YEL/GRN 1
YEL/ORG 2
BLU/GRY 7
VIO/GRN 3
GRN/WHT 8
BLU/WHT 5
ACCELERATOR PEDAL POSITION SENSOR (TOP OF ACCELERATOR PEDAL)
VIO/ORG 3
GRN/VIO 2
WHT/RED 1
VIO/WHT 4
BRAKE PEDAL POSITION SWITCH (ON BRAKE PEDAL SUPPORT BRACKET)
284367

Fig. 71: A/T Circuit (1 of 2)



HOT IN START OR RUN
SMART JUNCTION BOX (BJB) (LEFT REAR CORNER OF ENGINE COMPT)
FUSE 30 5A
C2280B
TRANSMISSION CONTROL SWITCH
1-NORMAL OPEN
2-OVERDRIVE ENABLE/ DISABLE
FLOOR SHIFTER
6F TRANSMISSION
S111
(IN DASH PANEL WIRING HARNESS, TO HEADLIGHT JUNCTION, NEAR BREAKOUT TO C134)
EXTERIOR LIGHTS SYSTEM
POWERTRAIN CONTROL MODULE (PCM) (RIGHT FRONT OF ENGINE)
REVERSING LMP CTRL
C175T
284368

Fig. 72: A/T Circuit (2 of 2)

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

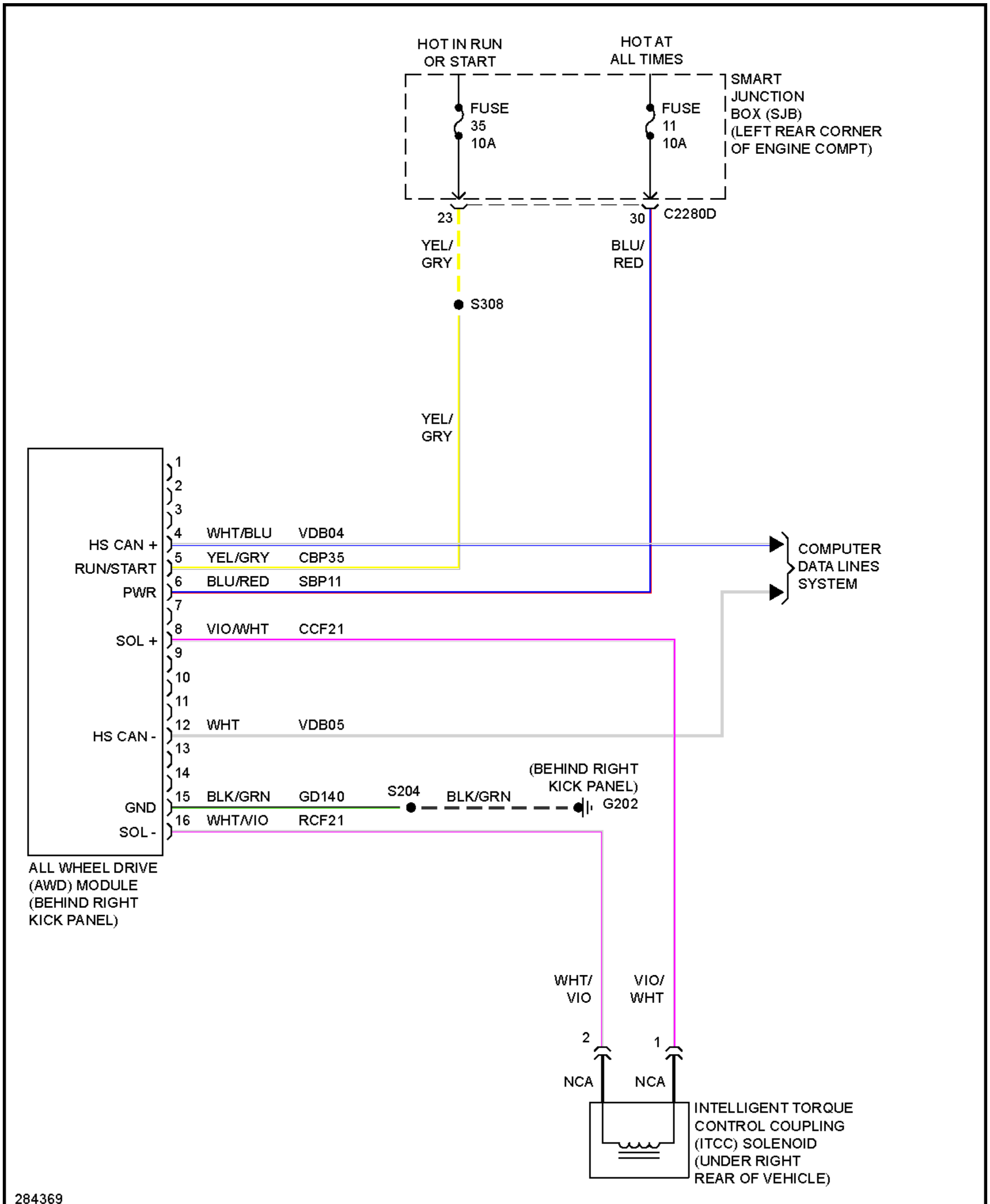
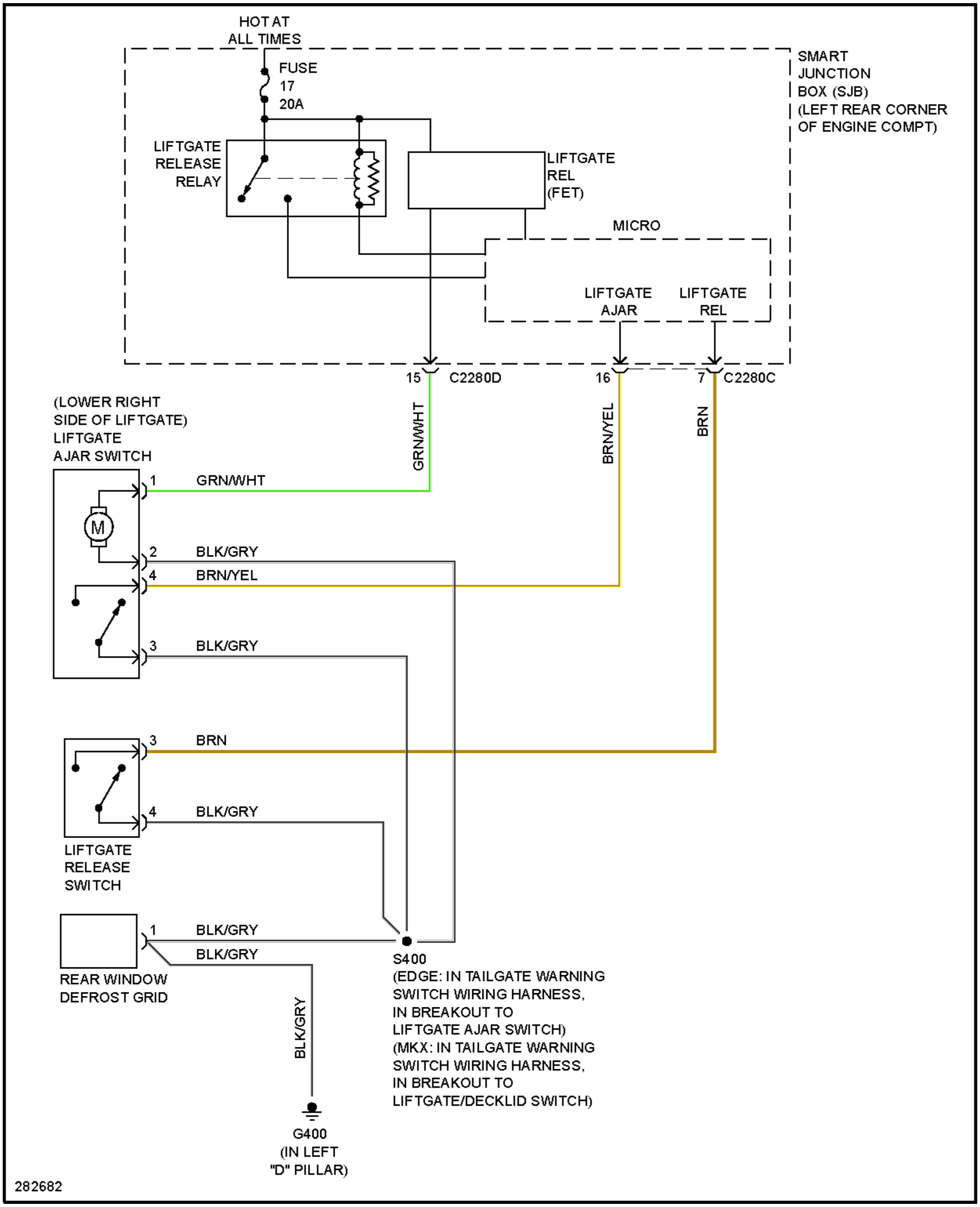


Fig. 73: AWD Circuit

TRUNK, TAILGATE, FUEL DOOR



HOT AT
ALL TIMES
FUSE
17
20A
SMART
JUNCTION
BOX (SJB)
(LEFT REAR CORNER
OF ENGINE COMPT)
LIFTGATE
RELEASE
RELAY
LIFTGATE
REL
(FET)
MICRO
LIFTGATE
AJAR
LIFTGATE
REL
15
C2280D
16
7
C2280C
(LOWER RIGHT
SIDE OF LIFTGATE)
LIFTGATE
AJAR SWITCH
GRN/WHT
BRN/YEL
BRN
1
GRN/WHT
M
2
BLK/GRY
4
BRN/YEL
3
BLK/GRY
3
BRN
4
BLK/GRY
LIFTGATE
RELEASE
SWITCH
1
BLK/GRY
BLK/GRY
REAR WINDOW
DEFROST GRID
BLK/GRY
S400
(EDGE: IN TAILGATE WARNING
SWITCH WIRING HARNESS,
IN BREAKOUT TO
LIFTGATE AJAR SWITCH)
(MKX: IN TAILGATE WARNING
SWITCH WIRING HARNESS,
IN BREAKOUT TO
LIFTGATE/DECKLID SWITCH)
G400
(IN LEFT
"D" PILLAR)
282682

Fig. 74: Liftgate Release Circuit

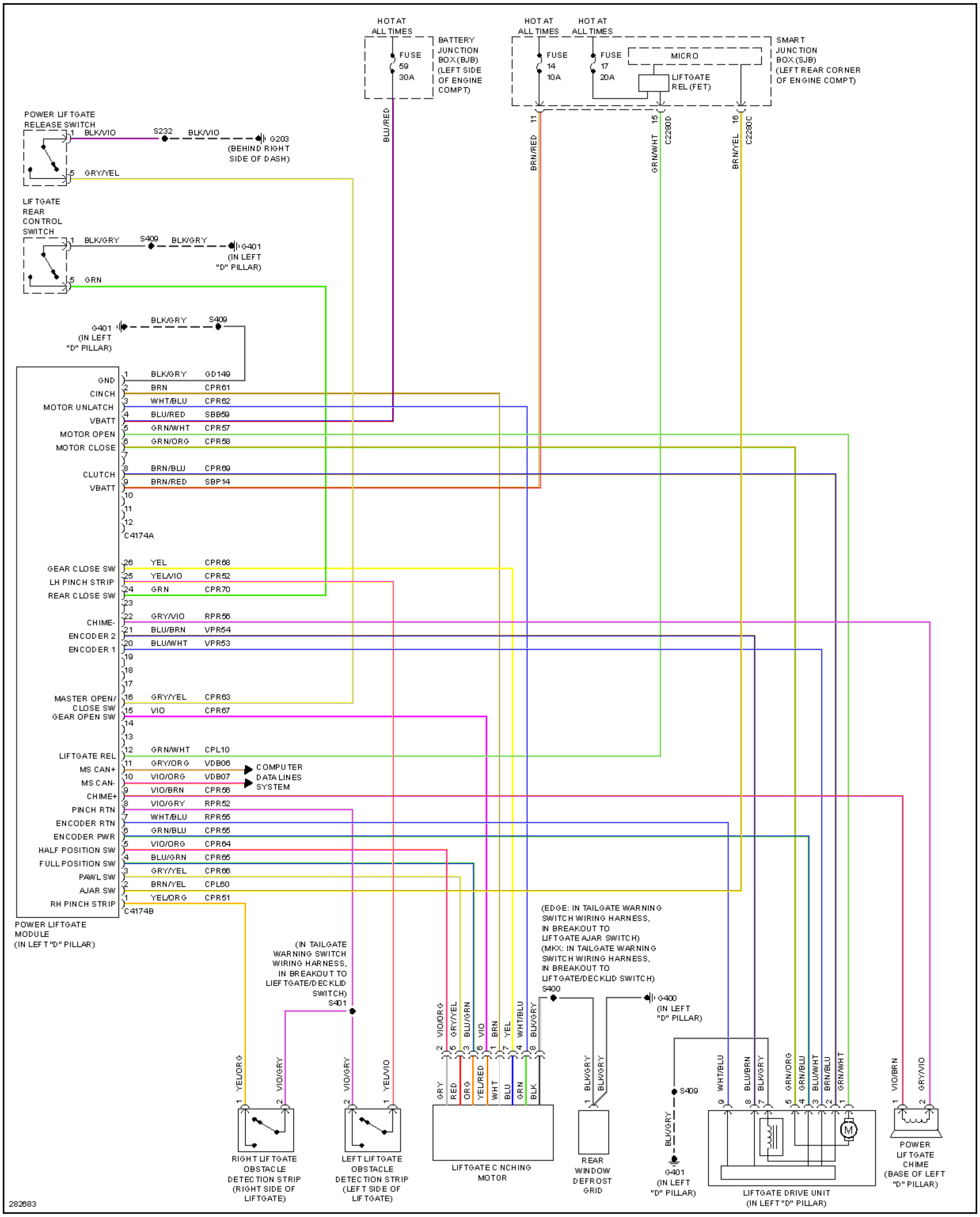

HOT AT ALL TIMES
FUSE 59 30A
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPT)
HOT AT ALL TIMES
HOT AT ALL TIMES
FUSE 14 10A
FUSE 17 20A
MICRO
LIFTGATE REL (FET)
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
POWER LIFTGATE RELEASE SWITCH
BLK/VIO
S232
G203 (BEHIND RIGHT SIDE OF DASH)
GRY/YEL
BLU/RED
BRN/RED
GRN/WHT
BRN/YEL
C2280D
C2280C
LIFTGATE REAR CONTROL SWITCH
BLK/GRY
S409
G401 (IN LEFT "D" PILLAR)
GRN
GND 1 BLK/GRY GD149
CINCH 2 BRN CPR61
MOTOR UNLATCH 3 WHT/BLU CPR62
VBATT 4 BLU/RED SBB59
MOTOR OPEN 5 GRN/WHT CPR57
MOTOR CLOSE 6 GRN/ORG CPR58
CLUTCH 8 BRN/BLU CPR69
VBATT 9 BRN/RED SBP14
C4174A
GEAR CLOSE SW 26 YEL CPR68
LH PINCH STRIP 25 YEL/VIO CPR52
REAR CLOSE SW 24 GRN CPR70
CHIME- 22 GRY/VIO RPR56
ENCODER 2 21 BLU/BRN VPR54
ENCODER 1 20 BLU/WHT VPR53
MASTER OPEN/CLOSE SW 16 GRY/YEL CPR63
GEAR OPEN SW 15 VIO CPR67
LIFTGATE REL 12 GRN/WHT CPL10
MS CAN+ 11 GRY/ORG VDB06
MS CAN- 10 VIO/ORG VDB07
COMPUTER DATA LINES SYSTEM
CHIME+ 9 VIO/BRN CPR56
PINCH RTN 8 VIO/GRY RPR52
ENCODER RTN 7 WHT/BLU RPR55
ENCODER PWR 6 GRN/BLU CPR55
HALF POSITION SW 5 VIO/ORG CPR64
FULL POSITION SW 4 BLU/GRN CPR65
PAWL SW 3 GRY/YEL CPR66
AJAR SW 2 BRN/YEL CPL60
RH PINCH STRIP 1 YEL/ORG CPR51
C4174B
POWER LIFTGATE MODULE (IN LEFT "D" PILLAR)
(EDGE: IN TAILGATE WARNING SWITCH WIRING HARNESS, IN BREAKOUT TO LIFTGATE AJAR SWITCH) (MKX: IN TAILGATE WARNING SWITCH WIRING HARNESS, IN BREAKOUT TO LIFTGATE/DECKLID SWITCH)
S400
G400 (IN LEFT "D" PILLAR)
(IN TAILGATE WARNING SWITCH WIRING HARNESS, IN BREAKOUT TO LIEFTGATE/DECKLID SWITCH)
S401
YEL/ORG
VIO/GRY
YEL/VIO
RIGHT LIFTGATE OBSTACLE DETECTION STRIP (RIGHT SIDE OF LIFTGATE)
LEFT LIFTGATE OBSTACLE DETECTION STRIP (LEFT SIDE OF LIFTGATE)
VIO/ORG GRY/YEL BLU/GRN VIO BRN YEL WHT/BLU BLK/GRY
GRY RED ORG YEL/RED WHT BLU GRN BLK
LIFTGATE CINCHING MOTOR
REAR WINDOW DEFROST GRID
S409
G401 (IN LEFT "D" PILLAR)
WHT/BLU BLU/BRN BLK/GRY GRN/ORG GRN/BLU BLU/WHT BRN/BLU GRN/WHT
LIFTGATE DRIVE UNIT (IN LEFT "D" PILLAR)
VIO/BRN GRY/VIO
POWER LIFTGATE CHIME (BASE OF LEFT "D" PILLAR)
282683

Fig. 75: Power Liftgate Circuit

WARNING SYSTEMS

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

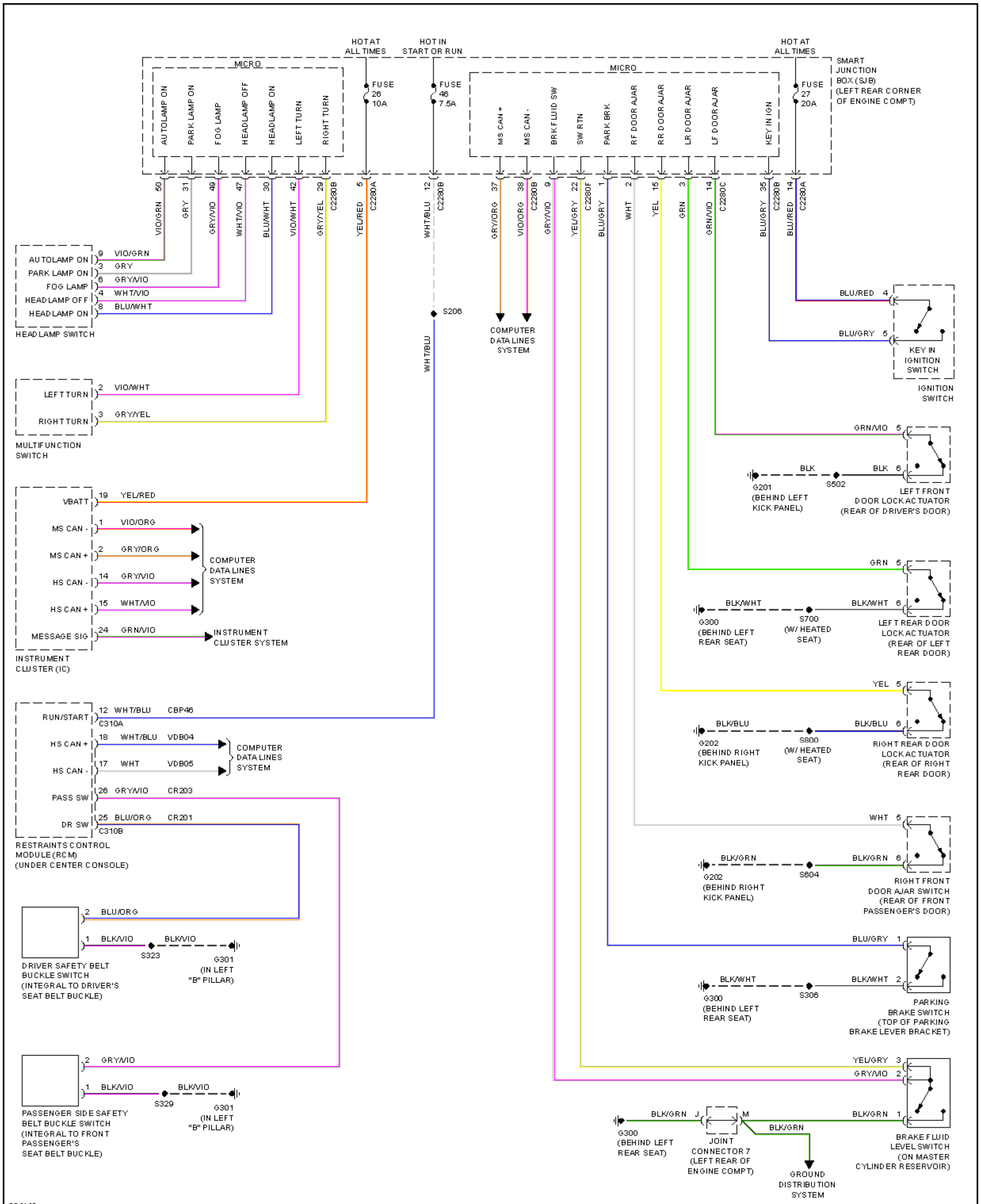
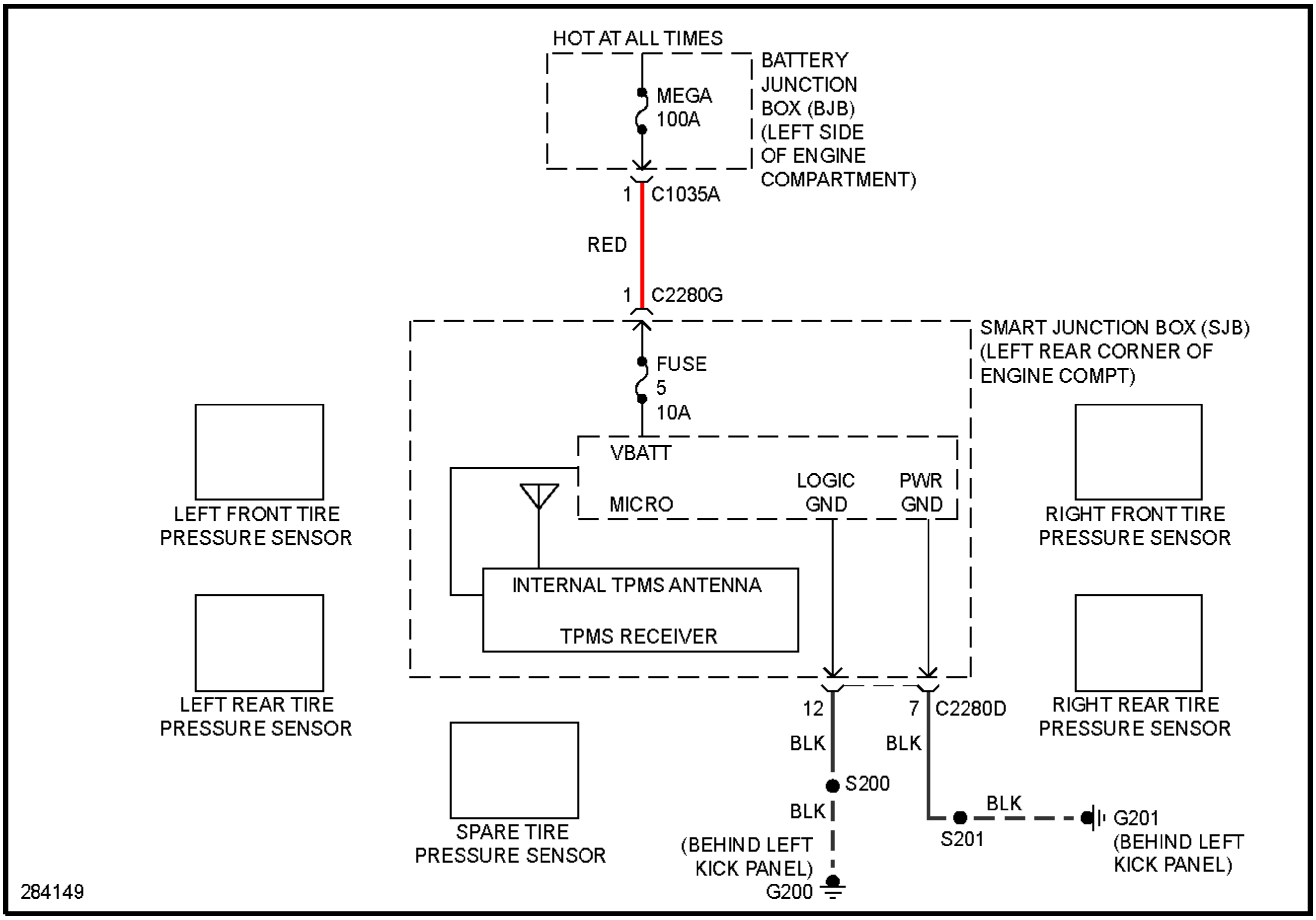


Fig. 76: Chime Circuit



HOT AT ALL TIMES
MEGA
100A
BATTERY JUNCTION BOX (BJB) (LEFT SIDE OF ENGINE COMPARTMENT)
1
C1035A
RED
1
C2280G
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
FUSE
5
10A
VBATT
MICRO
LOGIC GND
PWR GND
INTERNAL TPMS ANTENNA
TPMS RECEIVER
LEFT FRONT TIRE PRESSURE SENSOR
LEFT REAR TIRE PRESSURE SENSOR
SPARE TIRE PRESSURE SENSOR
RIGHT FRONT TIRE PRESSURE SENSOR
RIGHT REAR TIRE PRESSURE SENSOR
12
7
C2280D
BLK
BLK
S200
BLK
(BEHIND LEFT KICK PANEL)
G200
BLK
S201
G201
(BEHIND LEFT KICK PANEL)
284149

Fig. 77: Tire Pressure Monitoring Circuit

WIPER/WASHER

2008 Ford Edge SE

2008 SYSTEM WIRING DIAGRAMS Ford - Edge

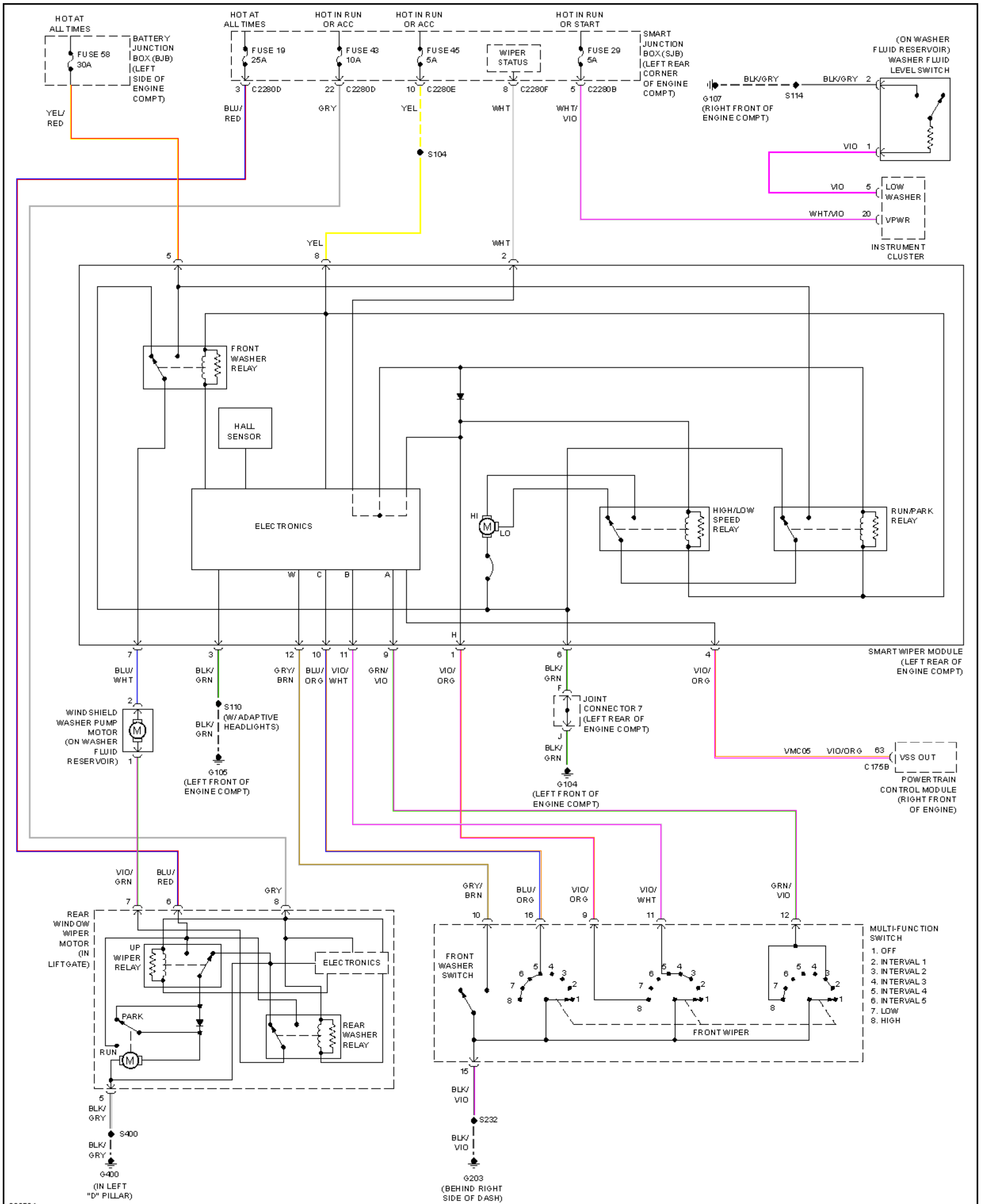
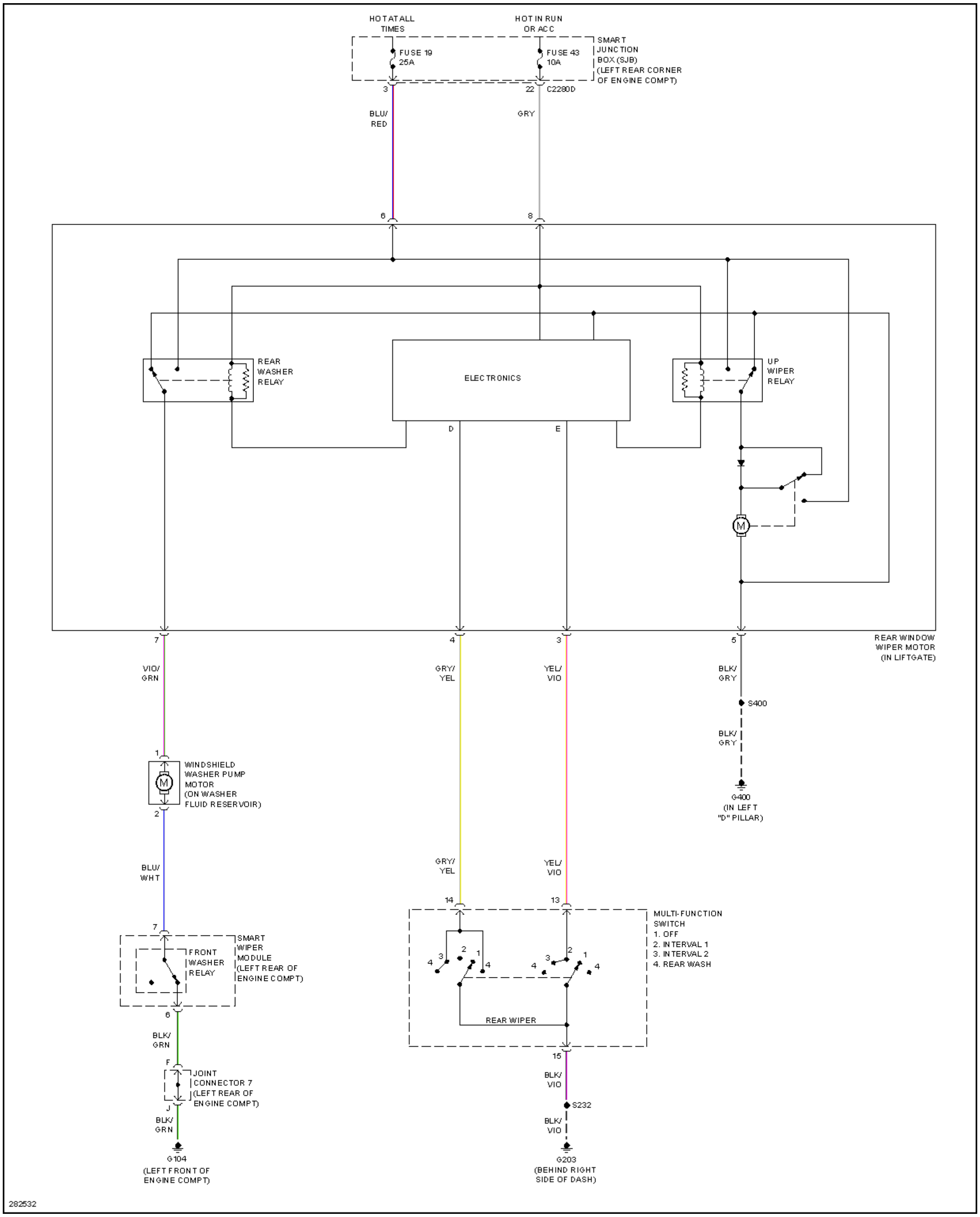


Fig. 78: Front Wiper/Washer Circuit



HOT AT ALL TIMES
HOT IN RUN OR ACC
FUSE 19 25A
FUSE 43 10A
SMART JUNCTION BOX (SJB) (LEFT REAR CORNER OF ENGINE COMPT)
C2280D
BLU/ RED
GRY
REAR WASHER RELAY
ELECTRONICS
UP WIPER RELAY
REAR WINDOW WIPER MOTOR (IN LIFTGATE)
VIO/ GRN
GRY/ YEL
YEL/ VIO
BLK/ GRY
S400
G400 (IN LEFT "D" PILLAR)
WINDSHIELD WASHER PUMP MOTOR (ON WASHER FLUID RESERVOIR)
BLU/ WHT
SMART WIPER MODULE (LEFT REAR OF ENGINE COMPT)
FRONT WASHER RELAY
BLK/ GRN
JOINT CONNECTOR 7 (LEFT REAR OF ENGINE COMPT)
G104 (LEFT FRONT OF ENGINE COMPT)
MULTI-FUNCTION SWITCH
1. OFF
2. INTERVAL 1
3. INTERVAL 2
4. REAR WASH
REAR WIPER
BLK/ VIO
S232
G203 (BEHIND RIGHT SIDE OF DASH)
282532

Fig. 79: Rear Washer/Wiper Circuit