2008 ENGINE PERFORMANCE

Pinpoint Tests - Gasoline Engines

DIAGNOSTIC TESTS

PINPOINT TEST A: NO START

WARNING: **Stop this test at the first sign of a fuel leak and repair as required.**

No open flame. No smoking during fuel delivery checks.

Failure to follow these instructions may result in personal injury.

This pinpoint test is intended to diagnose the following:

- spark (as related to electronic engine control)
- powertrain control module (PCM) (12A650)

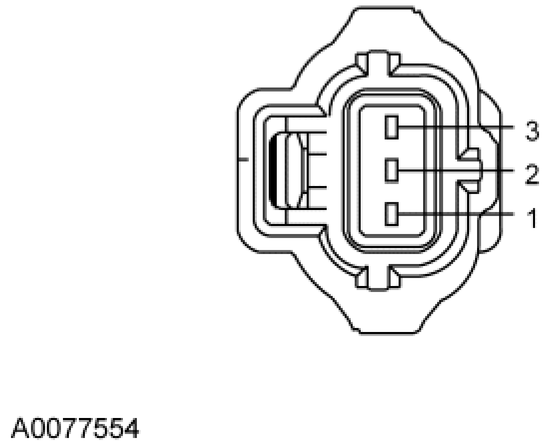

Fig. 1: Throttle Position (TP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

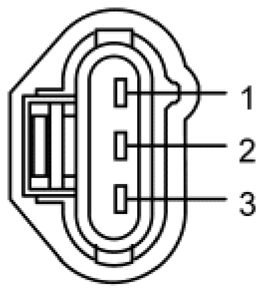

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Fig. 2: Throttle Position (TP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Ranger 2.3L	A	1 3	SIGRTN VREF
All other vehicles	B	3 1	SIGRTN VREF

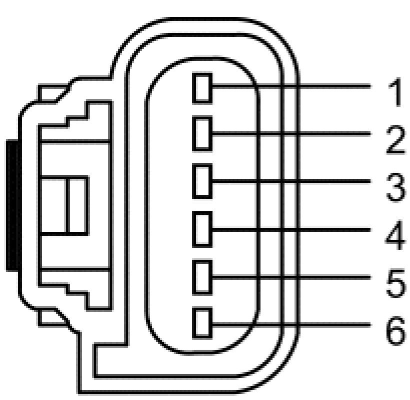

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Fig. 3: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

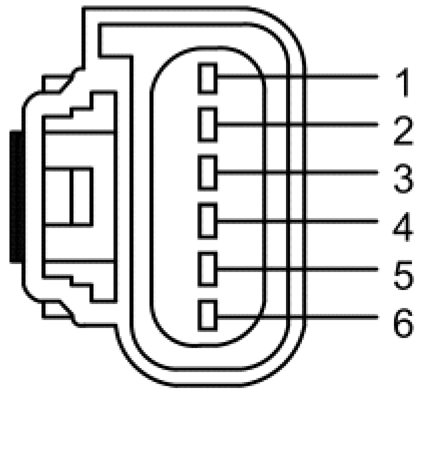

Fig. 4: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - B
Courtesy of FORD MOTOR CO.

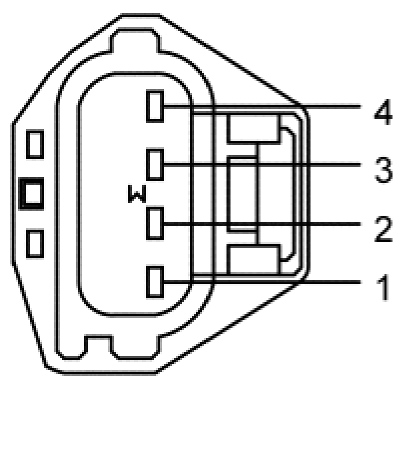

Fig. 5: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus,	A	2 3	ETCRTN ETCREF

Taurus X			
Fusion 2.3L, Milan 2.3L	B	3 5	ETCRTN ETCREF
Fusion 3.0L, Milan 3.0L	B	4 5	ETCRTN ETCREF
All other vehicles	C	3 2	ETCRTN ETCREF

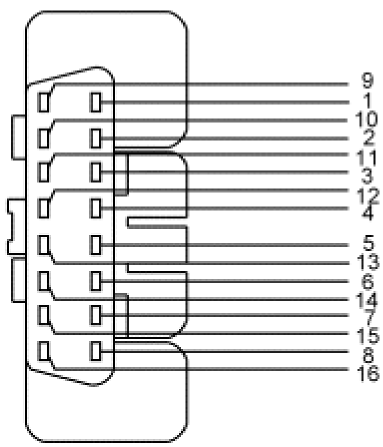

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Fig. 6: Data Link Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
13	FEPS (Flash EEPROM Programming Signal)

A1 ATTEMPT TO CRANK THE ENGINE

NOTE: **Verify the inertia fuel shutoff (IFS) switch is set (button pushed in). Refer to the Owner's Literature for location.**

- **Does the engine crank?**

Yes	No
GO to **A2**.	REFER to the **STARTING SYSTEM - GASOLINE ENGINES -- E-SERIES** and diagnose the engine does not crank symptom.

A2 IDENTIFY THE TYPE OF NO START

NOTE: **The purpose of this test step is to identify intermittent no starts in order to determine the proper repair procedure.**

- **Does the vehicle start?**

Yes	No
The vehicle has an intermittent no start. refer to **PINPOINT TEST Z**.	GO to **A3**.

A3 DETERMINE THE THROTTLE TYPE

- **Is the vehicle equipped with electronic throttle control?**

Yes	No
GO to **A5**.	GO to **A4**.

A4 CHECK THE VREF VOLTAGE TO TP SENSOR

- Key in OFF position.
- TP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) TP Sensor Connector, Harness Side	(-) TP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **A6**.	refer to **PINPOINT TEST C**.

A5 CHECK VREF VOLTAGE TO ETBTPS SENSOR

- Key in OFF position.
- ETBTPS connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ETBTPS Connector, Harness Side	(-) ETBTPS Connector, Harness Side
ETCREF	ETCRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **A6**.	refer to **PINPOINT TEST C**.

A6 CHECK THE FLASH EEPROM PROGRAMMING SIGNAL (FEPS) CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- TP Sensor connector connected.
- ETBTPS connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) DLC, Harness Side	(-) Vehicle Battery
FEPS - Pin 13	Negative terminal

- **Is the voltage less than 9 V?**

Yes	No
GO to **A7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

A7 CHECK THE RPM IN THE PCM

NOTE: **Connect the scan tool to a reliable voltage source that is powered with the key in the START position (such as directly to the vehicle battery). Also verify that the vehicle battery is fully charged.**

NOTE: **Normal engine cranking speed is between 150 RPM and 350 RPM.**

- Access the PCM and monitor the RPM PID.
- Crank the engine while viewing the RPM PID.
- **Is the RPM between 150 RPM - 350 RPM?**

Yes	No
GO to **A8**.	For base engine concerns, REFER to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** - General Information and diagnose difficult starting symptom. For all others, GO to **JD2**.

A8 CHECK FOR CKP AND CMP SYNCHRONIZATION

- Access the PCM and monitor the SYNC PID.
- Crank the engine while viewing the SYNC PID.
- **Does the SYNC PID read YES?**

Yes	No
GO to **A9**.	GO to **JD2**.

A9 CHECK THE PCM DRIVER SIGNAL TO THE COILS

NOTE: Test lamp bulb filament wattages vary widely. The intensity and duration of blinking depends on the test lamp being used.

- Connect a test lamp between B+ and each coil driver circuit at the harness connector.
- Crank the engine.
- **Does the test lamp blink consistently for each coil driver (1 blink per engine revolution)?**

Yes	No
GO to **A10**.	For coil-on-plug (COP) ignition testing, GO to **JB2**. For coil pack ignition testing, GO to **JC2**.

A10 CHECK THE FUEL PRESSURE

WARNING: **The fuel system remains pressurized when the engine is not running. To prevent injury or fire, use caution when working on the fuel system.**

Refer to the fuel system WARNING information at the beginning of Pinpoint Test HC.

Failure to follow these instructions may result in personal injury.

NOTE: While activating the fuel pump on an electronic returnless fuel system a brief pressure spike may occur.

- Key in OFF position.
- Relieve the fuel pressure. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure.
- Connect the fuel pressure gauge to the Schrader valve using the appropriate fuel pressure test hose and adaptor.
- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Activate the fuel pump to obtain maximum fuel pressure.
- **Is the fuel pressure within specification (refer to the fuel pressure chart in Pinpoint Test HC)?**

Yes	No
GO to **A11**.	refer to **PINPOINT TEST HC**.

A11 CHECK THE FUEL PRESSURE LEAKDOWN

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Activate the fuel pump to obtain maximum fuel pressure.
- Exit output test mode.
- Monitor the fuel pressure.
- Verify the fuel pressure remains within 34 kPa (5 psi) of the maximum pressure for 1 minute after turning the pump off.
- **Does fuel pressure remain within 34 kPa (5 psi)?**

Yes	No
GO to **A12**.	refer to **PINPOINT TEST HC**.

A12 CHECK THE FUEL INJECTORS FOR VOLTAGE

NOTE: **A no start condition typically exists only if greater than half of the fuel injectors are without voltage. Check at least 2 fuel injectors, 1 on each bank on V type engines.**

- Key in OFF position.
- Disconnect 2 fuel injectors.
- Key ON, engine OFF.
- Measure the VPWR voltage at each fuel injector harness connector.
- **Is the voltage greater than 10 volts?**

Yes	No
GO to **A13**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

A13 CHECK THE FUEL INJECTORS' ABILITY TO DELIVER FUEL

- Cycle the key several times to charge the fuel system.
- Disable the fuel pump.
- Monitor the fuel pressure gauge while cranking the engine for at least 5 seconds.
- **Is there a pressure drop greater than 34 kPa (5 psi) while cranking the engine?**

Yes	No
The electronic engine control (EEC) system is not	

the cause of the no start. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	GO to **A14**.

A14 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST B: POWERTRAIN CONTROL MODULE (PCM) POWER RELAY

NOTE: The IGN START/RUN and ground circuits, or the B+ and VPWR circuits may be reversed in the harness connector. Refer to the Wiring Diagrams article Electronic Engine Control Cell for schematic and connector information.

This pinpoint test is intended to diagnose the following:

- harness circuits: B+, IGN START/RUN, INJPWRM, ISP-R, PCMRC, VPWR and GND
- PCM power relay (12A646)
- PCM (12A650)

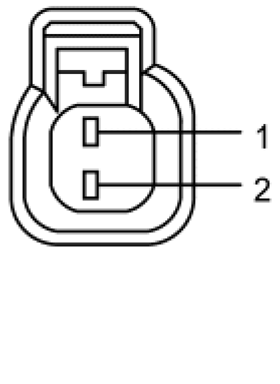

Fig. 7: Injector (INJ) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Fusion 3.0L, Milan 3.0L	A	1	VPWR
All other vehicles	A	2	VPWR

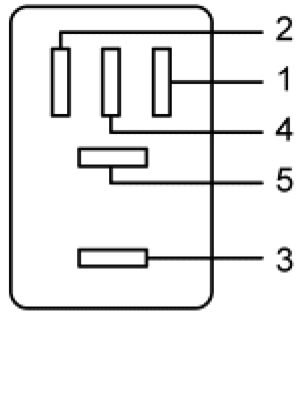

Fig. 8: Powertrain Control Module Power (PCM Power) Relay Connector - A
Courtesy of FORD MOTOR CO.

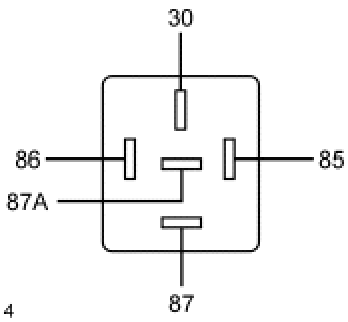

Fig. 9: Powertrain Control Module Power (PCM Power) Relay Connector - B
Courtesy of FORD MOTOR CO.

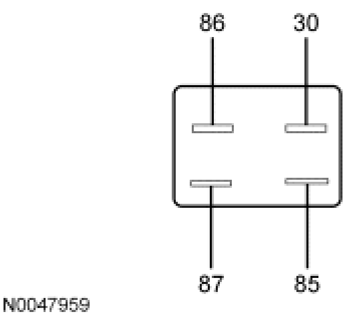

Fig. 10: Powertrain Control Module Power (PCM Power) Relay Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Escape/Mariner, Grand Marquis	A	5 2 1 3	VPWR GND IGN START/RUN B+
Expedition, F-Super Duty, Fusion, Milan, MKZ, Navigator, Sable, Taurus, Taurus X	B	87 86 30, 85	VPWR PCMRC B+
Explorer, Explorer Sport Trac, Mountaineer	B	87 85 30, 86	VPWR PCMRC B+
F-150, Mark LT	A	5 1 2, 3	VPWR PCMRC B+
Focus	A	3 2	VPWR PCMRC

		1, 5	B+
Mustang	C	87 85 30, 86	VPWR PCMRC B+
All other vehicles	B	87 85 86 30	VPWR GND IGN START/RUN B+

Vehicle	Connector	Pin	Circuit
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B33 B51, B52, B53 B7 B8	INJPWRM VPWR ISP-R PCMRC
Escape/Mariner	150 (50-50-50) Pin	B35, B36	VPWR
Expedition, Navigator	140 Pin	B33 B51, B52, B53 B7 B8	INJPWRM VPWR ISP-R PCMRC
Explorer, Explorer Sport Trac, Mountaineer	170 Pin	B35, B36 B46 B37	VPWR ISP-R PCMRC
F-150 4.6L, F-150 5.4L, Mark LT	190 Pin	B51, B52, B53 B17 B40	VPWR ISP-R PCMRC
F-150 4.2L	190 Pin	B33 B51, B52, B53 B17 B40	INJPWRM VPWR ISP-R PCMRC
F-Super Duty	170 Pin	E23 B35, B36 B31 B37	INJPWRM VPWR ISP-R PCMRC
Focus	190 Pin	B21 B67, B68 B42 B38	INJPWRM VPWR ISP-R PCMRC
Fusion, Milan, MKZ	140 Pin	B45 B51, B52 B37 B35	INJPWRM VPWR ISP-R PCMRC
Mustang	170 Pin	E23 B35, B36 B46	INJPWRM VPWR ISP-R

		B37	PCMRC
All other vehicles	170 Pin	B35, B36	VPWR

B1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Is DTC P0685, P0689, or P0690 present?**

Yes	No
For DTCs P0685 or P0690, GO to **B8**. For DTC P0689, GO to **B11**.	GO to **B2**.

B2 CHECK THE B+ AND IGN START/RUN VOLTAGE TO PCM POWER RELAY

- Key in OFF position.
- PCM Power Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Power Relay Connector, Harness Side	(-)
B+	Ground
IGN START/RUN	Ground

- **Are the voltages greater than 10 V?**

Yes	No
For Crown Victoria, Grand Marquis, E-Series, Escape/Mariner, Ranger, and Town Car, GO to **B6**. For all others, GO to **B3**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B3 CHECK THE PCMRC CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM	

Power Relay Connector, Harness Side	(-) PCM Connector, Harness Side
PCMRC	PCMRC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **B4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B4 CHECK THE PCMRC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
PCMRC	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **B5**.

B5 CHECK THE ISP-R VOLTAGE AT THE PCM HARNESS CONNECTOR

- Key in OFF position.
- PCM Power Relay connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ISP-R	Ground

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

Yes	No
GO to **B7**.	REPAIR the open circuit. CLEAR the DTCs.

	REPEAT the self-test.

B6 CHECK THE PCM POWER RELAY GROUND CIRCUIT FOR AN OPEN

- Measure the voltage between:

(+) PCM Power Relay Connector, Harness Side	(-) PCM Power Relay Connector, Harness Side
B+	GND

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

Yes	No
GO to **B7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B7 CHECK FOR AN OPEN VPWR CIRCUIT BETWEEN THE PCM AND POWER RELAY

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Power Relay Connector, Harness Side	(-) PCM Connector, Harness Side
VPWR	VPWR

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new PCM Power relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B8 DTCS P0685 OR P0690: CHECK THE PCMRC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- PCM Power Relay connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	**(-)**
PCMRC	Ground

- **Is the resistance greater than 10K ohms?**

Yes	**No**
GO to **B9**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

B9 CHECK THE ISP-R CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- Measure the voltage between:

(+) PCM Connector, Harness Side	**(-)**
ISP-R	Ground

- **Is any voltage present?**

Yes	**No**
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **B10**.

B10 CHECK THE INJPWRM CIRCUIT FOR AN OPEN IN THE HARNESS

- INJ connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	**(-) INJ Connector, Harness Side**
INJPWRM	VPWR

- **Is the resistance less than 5 ohms?**

Yes	**No**
GO to **B12**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B11 DTC P0689: CHECK THE ISP-R VOLTAGE AT THE PCM HARNESS CONNECTOR

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ISP-R	Ground

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

Yes	No
GO to **B12**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B12 CHECK FOR CORRECT PCM OPERATION

- Key in OFF position.
- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST C: REFERENCE VOLTAGE (VREF)

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- harness circuits: ETCREF, ETCRTN, SIGRTN and VREF
- accelerator pedal position (APP) sensor (9F836)
- air conditioning pressure (ACP) transducer sensor (19D594)
- differential pressure feedback exhaust gas recirculation (EGR) sensor (9J460)
- EGR system module (ESM) (9Y456)
- fuel rail pressure temperature (FRPT) sensor (9G756)
- fuel tank pressure (FTP) sensor (9C052)
- manifold absolute pressure (MAP) sensor (9F479)
- power steering pressure (PSP) sensor (3N824)
- throttle position (TP) sensor (9B989)
- powertrain control module (PCM) (12A650)

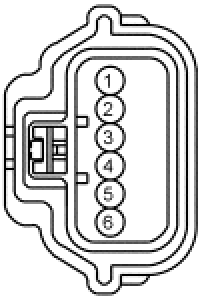

Fig. 11: Accelerator Pedal Position (APP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

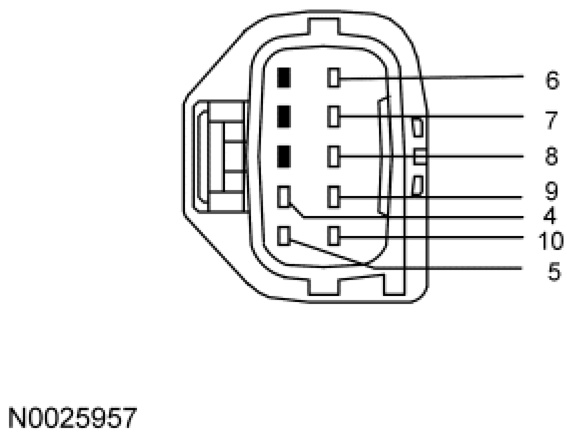

Fig. 12: Accelerator Pedal Position (APP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

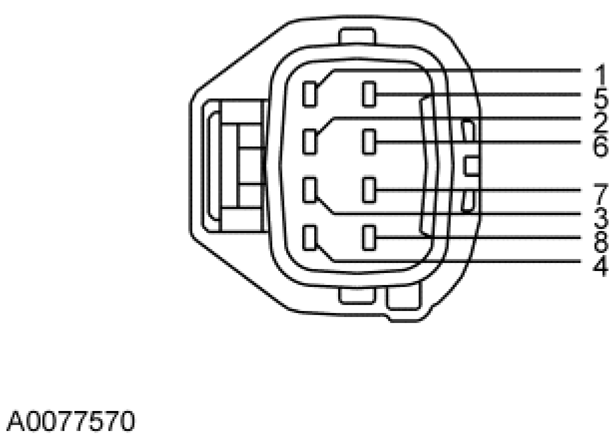

Fig. 13: Accelerator Pedal Position (APP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Focus	A	3, 4 1, 6	ETCRTN ETCREF
Fusion, Milan, MKZ	B	6, 9 10, 8	ETCRTN ETCREF
All other vehicles	C	1, 3 6, 7	ETCRTN ETCREF

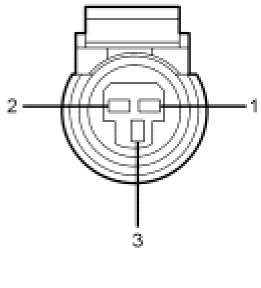

Fig. 14: Air Conditioning Pressure (ACP) Transducer Sensor Connector - A
Courtesy of FORD MOTOR CO.

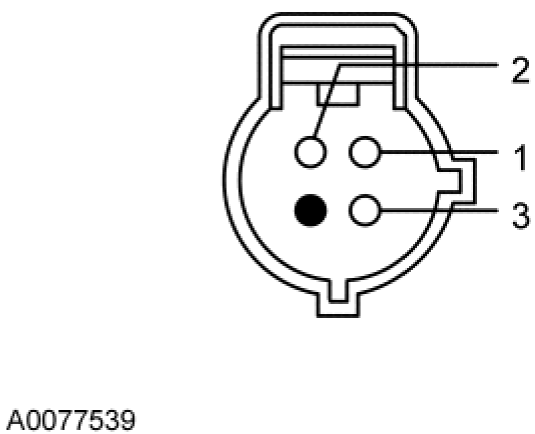

Fig. 15: Barometric Pressure (BARO) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Fusion, Milan, MKX, MKZ	A	1 2	SIGRTN VREF
All other vehicles	B	1 2	SIGRTN VREF

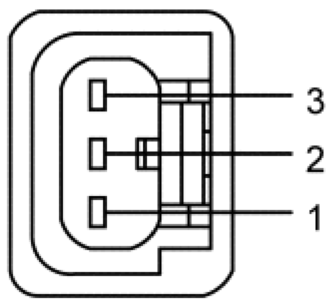

Fig. 16: Differential Pressure Feedback EGR Sensor Connector - A
Courtesy of FORD MOTOR CO.

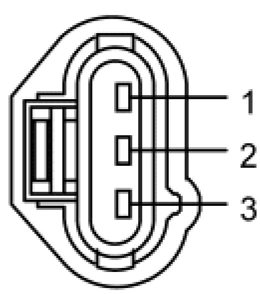

Fig. 17: Differential Pressure Feedback EGR Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Vehicles equipped with a tube mounted differential pressure feedback EGR sensor	A	1 2	VREF SIGRTN
All other vehicles	B	3 2	VREF SIGRTN

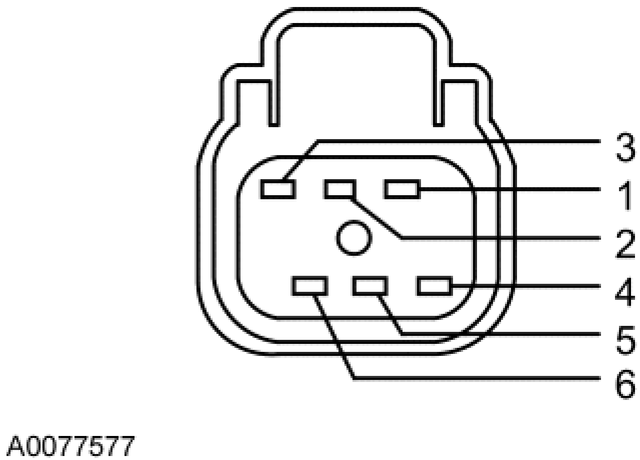

Fig. 18: EGR System Module (ESM) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
6	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

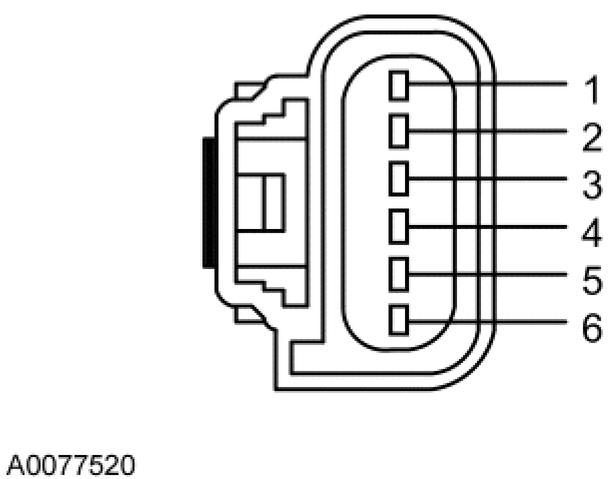

Fig. 19: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

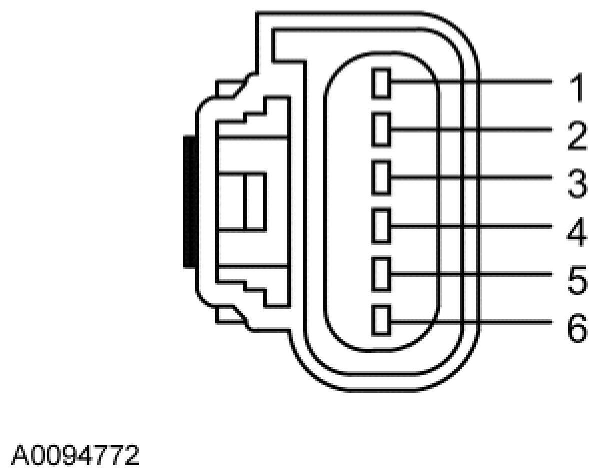

Fig. 20: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - B
Courtesy of FORD MOTOR CO.

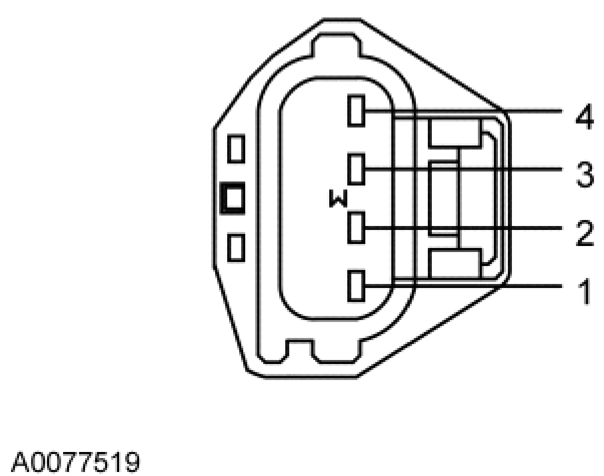

Fig. 21: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus,	A	2 3	ETCRTN ETCREF

Taurus X			
Fusion 2.3L, Milan 2.3L	B	3 5	ETCRTN ETCREF
Fusion 3.0L, Milan 3.0L	B	4 5	ETCRTN ETCREF
All other vehicles	C	3 2	ETCRTN ETCREF

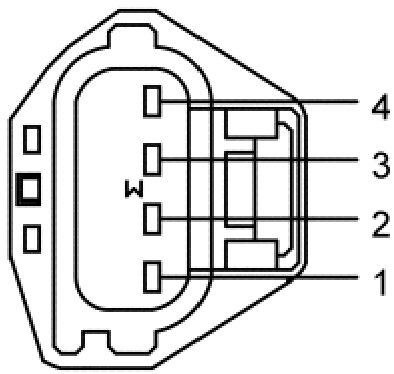

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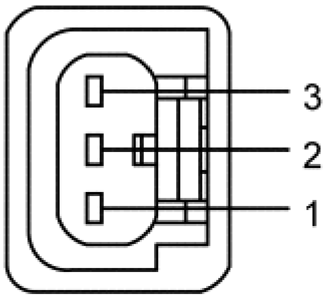
Fig. 22: Fuel Rail Pressure Temperature (FRPT) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	VREF (Reference Voltage)
4	SIGRTN (Signal Return)



A0077573

Fig. 23: Differential Pressure Feedback EGR Sensor Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	VREF (Reference Voltage)
2	SIGRTN (Signal Return)

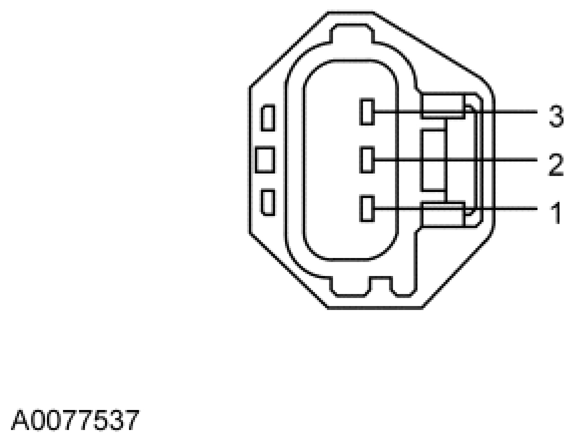


Fig. 24: Manifold Absolute Pressure (MAP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

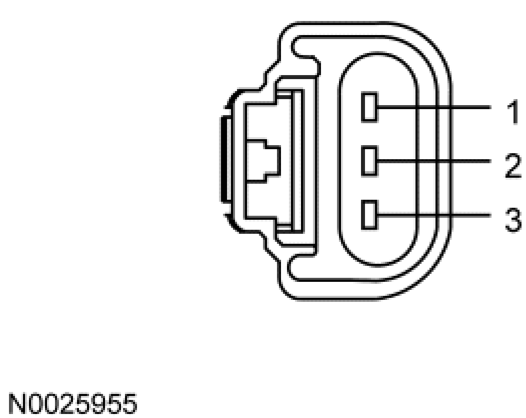


Fig. 25: Manifold Absolute Pressure (MAP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

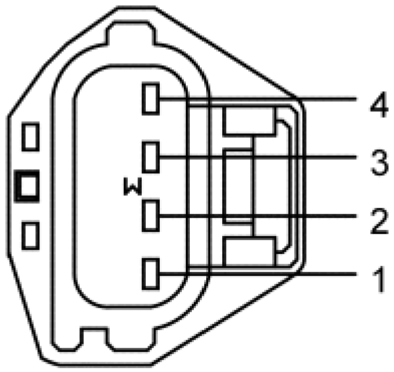


Fig. 26: Manifold Absolute Pressure (MAP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 3.0L	A	3 1	SIGRTN VREF
Fusion 3.0L, Milan 3.0L	B	2 3	SIGRTN VREF
All other vehicles	C	4 2	SIGRTN VREF

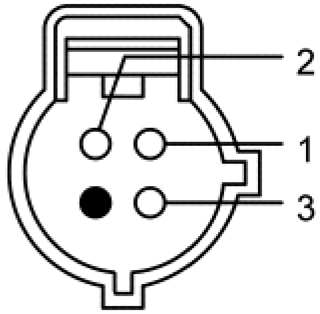


Fig. 27: Barometric Pressure (BARO) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit

2	VREF (Reference Voltage)
1	SIGRTN (Signal Return)

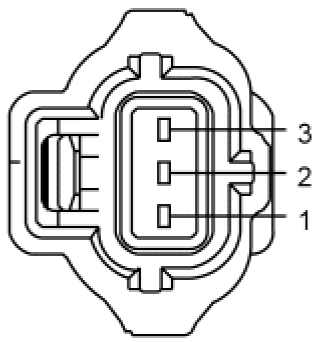


Fig. 28: Throttle Position (TP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

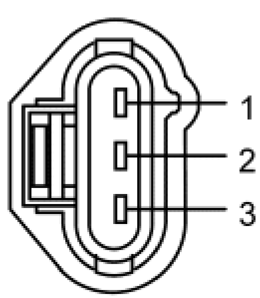


Fig. 29: Throttle Position (TP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Ranger 2.3L	A	3 1	VREF SIGRTN
All other vehicles	B	1 3	VREF SIGRTN

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Mustang, Town Car	170 Pin	B35, B36 B41, E58, T41 B41, B6, E59 B40, E57 B24, B4, E66	VPWR SIGRTN ETCRTN VREF ETCREF
E-Series, F-Super Duty	170 Pin	B35, B36 B41, E58, T41 B18, B6, E59 B40, E57 B16, B4, E66	VPWR SIGRTN ETCRTN VREF ETCREF
Escape/Mariner	150 (50-50-50) Pin	B35, B36 B41, E41, T41 B40, E40	VPWR SIGRTN VREF
Expedition, Navigator	140 Pin	B51, B52, B53 B58, E58 B59, B65, E59 E57 B21, B28, E66	VPWR SIGRTN ETCRTN VREF ETCREF
Explorer, Explorer Sport Trac, Mountaineer	170 Pin	B35, B36 B41, E58, T41 B43, B6, E59 B40, E57 B24, B4, E66	VPWR SIGRTN ETCRTN VREF ETCREF
F-150, Mark LT	190 Pin	B51, B52, B53 B58, E58, T43 B58, B59, E59 B29, E57 B21, B28, E66	VPWR SIGRTN ETCRTN VREF ETCREF
Focus	190 Pin	B67, B68 B58, E64, T40 B44, B60, E60 B52, B66, E63 B45, B61, E59	VPWR SIGRTN ETCRTN VREF ETCREF
Fusion, Milan, MKZ	140 Pin	B51, B52 B58, E58 B59, B60, E59 B33, E57 B21, B28, E66	VPWR SIGRTN ETCRTN VREF ETCREF
Ranger	170 Pin	B35, B36 B41, E58, T41 B40, E57	VPWR SIGRTN VREF
All other vehicles	190 Pin	B51, B52, B53 B58, E58	VPWR SIGRTN

		B59, B65, E59 B29, B64 B21, B28, E66	ETCRTN VREF ETCREF

SENSORS CONNECTED TO VREF/ETCREF

Applications	TP or ETC	APP	Differential Pressure Feedback EGR or ESM	FTP	ACP	PSPT	FRPT	MAP
Crown Victoria/Grand Marquis	ETC	X	X	X	X		X	
Edge/MKX	ETC	X		X	X			
Escape/Mariner - 2.3L	TP			X			X	X
Escape/Mariner - 3.0L	TP		X	X			X	X
E-Series - 4.6L/5.4L	ETC	X	X	X			X	
E-Series - 6.8L	ETC	X		X			X	
Expedition/Navigator	ETC	X		X				
Explorer/Explorer Sport Trac/Mountaineer	ETC	X	X	X			X	
F-150 - 4.2L	ETC	X	X	X			X	
F-150 - 4.6L	ETC	X	X	X		X	X	
F-150 - 5.4L/Mark LT	ETC	X		X		X	X	
F-Super Duty	ETC	X		X			X	
Focus	ETC	X		X		X		X
Fusion/Milan/MKZ	ETC	X		X	X			X
Mustang - 4.0L	ETC	X	X	X	X		X	
Mustang - 4.6L	ETC	X		X			X	
Mustang - 5.4L	ETC	X	X	X			X	
Ranger - 2.3L	TP			X				X
Ranger - 3.0L/4.0L	TP		X	X				
Taurus/Taurus X/Sable	ETC	X		X	X			
Town Car	ETC	X	X	X	X		X	

NOTE:

- **ETCREF and ETCRTN are internally bussed within the PCM and are dedicated circuits for the APP sensor and the electronic throttle body TP sensor only. Refer to the Wiring Diagrams article Electronic Engine Controls Cell for schematic and connector information.**

C1 CHECK THE REFERENCE VOLTAGE TO SIGRTN/ETCRTN

NOTE: **Diagnostic trouble codes (DTCs) P0642 and P0643 are set due to VREF circuit concerns only. When diagnosing DTC P0642 or P0643, follow the path for VREF**

concerns.

- Key in OFF position.
- Disconnect the suspect sensor.
- Key ON, engine OFF.
- For ETCREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-) Suspect Sensor Connector, Harness Side
ETCREF	ETCRTN

- For VREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-) Suspect Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **C19**.	GO to **C2**.

C2 CHECK THE REFERENCE VOLTAGE TO GROUND

- For ETCREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
ETCREF	Ground

- For VREF concerns.
- Measure the voltage between:

(+) Suspect	

Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **C18**.	GO to **C3**.

C3 CHECK THE REFERENCE VOLTAGE WITH ALL SENSORS DISCONNECTED

NOTE: Refer to the Sensors Connected To VREF/ETCREF Chart at the beginning of this pinpoint test and the Wiring Diagrams article Electronic Engine Controls Cell to identify the sensors connected to VREF/ETCREF.

- Key in OFF position.
- Disconnect all of the sensors connected to the VREF/ETCREF circuit.
- Key ON, engine OFF.
- Measure the voltage at the sensor disconnected in C1.
- For ETCREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
ETCREF	Ground

- For VREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For electronic throttle control (ETC) concerns, GO to **C8**.	GO to **C4**.

For all other VREF concerns, GO to **C10**.	

C4 CHECK THE REFERENCE VOLTAGE CIRCUIT FOR AN OPEN

- Key in OFF position.
- Disconnect the PCM.
- For ETCREF concerns.
- Measure the resistance between:

(+) Suspect Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ETCREF	ETCREF

- For VREF concerns.
- Measure the resistance between:

(+) Suspect Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	VREF

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **C5**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

C5 CHECK THE REFERENCE VOLTAGE CIRCUIT FOR A SHORT TO GROUND

- For ETCREF concerns.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ETCREF	ETCRTN

- Measure the resistance between:

(+) PCM	

Connector, Harness Side	(-)
ETCREF	Ground

- For VREF concerns.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
VREF	Ground

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **C6**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

C6 CHECK THE REFERENCE VOLTAGE CIRCUIT FOR A SHORT TO VPWR

- For ETCREF concerns.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ETCREF	VPWR

- For VREF concerns.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	VPWR

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **C7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

C7 CHECK THE REFERENCE VOLTAGE FOR A SHORT TO VOLTAGE

- Key ON, engine OFF.
- For ETCREF concerns.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ETCREF	Ground

- For VREF concerns.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
VREF	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **C20**.

C8 CHECK THE REFERENCE VOLTAGE WITH THE ELECTRONIC THROTTLE CONTROL CONNECTED

NOTE: If this sensor was used for the ETCREF measurement in C3, GO to C9.

- Key in OFF position.
- Connect the electronic throttle body throttle position sensor (ETBTPS).
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector,	(-)

Harness Side	
ETCREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
The concern is intermittent. refer to **PINPOINT TEST Z**.	INSTALL a new ETBTPS. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C9 CHECK THE REFERENCE VOLTAGE WITH THE APP SENSOR CONNECTED

- Key in OFF position.
- Connect the APP sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
ETCREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
The concern is intermittent. refer to **PINPOINT TEST Z**.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C10 CHECK THE REFERENCE VOLTAGE WITH THE TP SENSOR CONNECTED

NOTE: If this sensor was used for the VREF measurement in C3, GO to C11.

- Key in OFF position.
- Connect the TP sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect	

Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to **C11**. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C11 CHECK THE REFERENCE VOLTAGE WITH THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a differential pressure feedback EGR sensor or if this sensor was used for the VREF measurement in C3, GO to C12.**

- Key in OFF position.
- Differential Pressure Feedback EGR Sensor connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to **C12**. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new Differential Pressure Feedback EGR sensor. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C12 CHECK THE REFERENCE VOLTAGE WITH THE ESM CONNECTED

NOTE: **If the vehicle is not equipped with an ESM or if this sensor was used for the VREF measurement in C3, GO to C13.**

- Key in OFF position.
- Connect the ESM.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	**(-)**
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to **C13**. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C13 CHECK THE REFERENCE VOLTAGE WITH THE MAP SENSOR CONNECTED

NOTE: If the vehicle is not equipped with a MAP sensor or if this sensor was used for the VREF measurement in C3, GO to C14.

- Key in OFF position.
- Connect the MAP sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	**(-)**
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to **C14**. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new MAP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C14 CHECK THE REFERENCE VOLTAGE WITH THE FRPT SENSOR CONNECTED

NOTE: If the vehicle is not equipped with a FRPT sensor or if this sensor was used for the VREF measurement in C3, GO to C15.

- Key in OFF position.
- Connect the FRPT sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to **C15**. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new FRPT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C15 CHECK THE REFERENCE VOLTAGE WITH THE FTP SENSOR CONNECTED

NOTE: If the vehicle is not equipped with a FTP sensor or if this sensor was used for the VREF measurement in C3, GO to C16.

- Key in OFF position.
- Connect the FTP sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No

For additional sensors disconnected, GO to **C16**. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C16 CHECK THE REFERENCE VOLTAGE WITH THE ACP TRANSDUCER SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with an ACP transducer sensor or if this sensor was used for the VREF measurement in C3, GO to C17.**

- Key in OFF position.
- Connect the ACP transducer sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to **C17**. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new Air Conditioning Pressure (ACP) Transducer Sensor. CLEAR the DTCs. REPEAT the self-test.

C17 CHECK THE REFERENCE VOLTAGE WITH THE PSP SENSOR CONNECTED

- Key in OFF position.
- Connect the PSP sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
The concern is intermittent. refer to **PINPOINT TEST Z**.	INSTALL a new PSP sensor. CLEAR the DTCs. REPEAT the self-test.

C18 CHECK THE SIGRTN OR ETCRTN CIRCUIT(S) FOR AN OPEN

NOTE: Refer to the Wiring Diagrams article Electronic Engine Controls Cell for specific vehicle application and pin locations.

- Key in OFF position.
- Disconnect the PCM.
- For ETCRTN concerns.
- Measure the resistance between:

(+) Suspect Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ETCRTN	ETCRTN

- For SIGRTN concerns.
- Measure the resistance between:

(+) Suspect Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
SIGRTN	SIGRTN

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **C20**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

C19 CHECK THE SUSPECT SENSOR FOR AN INTERNAL SHORT

- Clear the KOEO, KOER, and continuous DTCs.
- Key in OFF position.
- Connect the suspect sensor.
- Key ON, engine OFF.
- Carry out the PCM self-test.
- **Is the concern still present?**

Yes	No
INSTALL a new sensor for the sensor in question. CLEAR the DTCs. REPEAT the self-test.	The concern is intermittent. refer to **PINPOINT TEST Z**.

C20 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DA: INTAKE AIR TEMPERATURE (IAT) SENSOR

This pinpoint test is intended to diagnose the following:

- integrated mass air flow/intake air temperature (MAF/IAT) sensor (12B579)
- harness circuits: IAT and SIGRTN
- powertrain control module (PCM) (12A650)

Voltage values calculated for VREF equal 5 volts. These values can vary by 15% due to sensor and VREF variations.

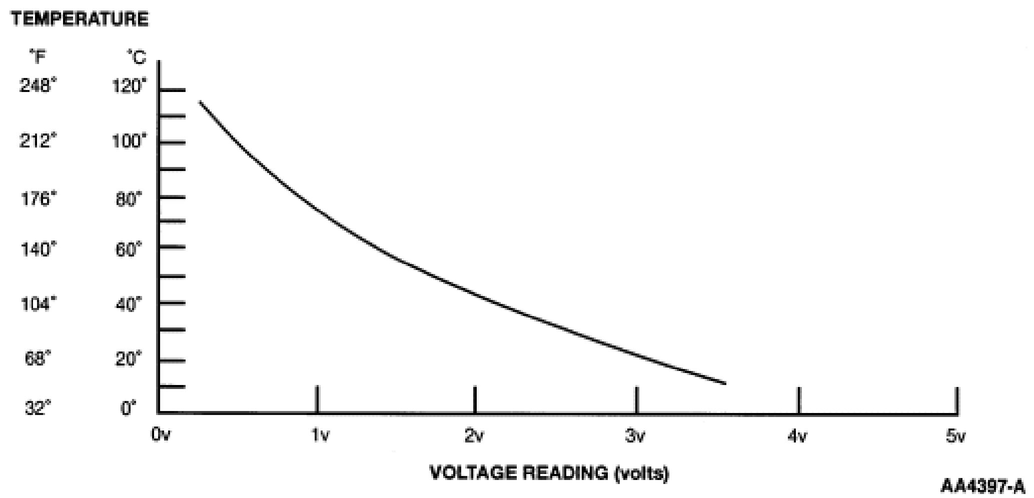


Fig. 30: Temperature Sensor Temperature To Voltage Graph
Courtesy of FORD MOTOR CO.

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
120	248	0.28	1.18
110	230	0.36	1.55
100	212	0.47	2.07
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85
-10	14	4.45	160.31

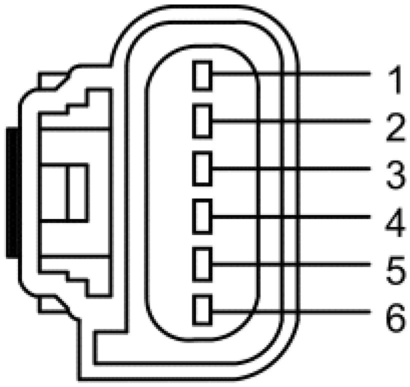


Fig. 31: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	MAF RTN (Mass Air Flow Return)
2	SIGRTN (Signal Return)
1	IAT (Intake Air Temperature)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Town Car	170 Pin	T41 E22	SIGRTN IAT
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B58 B43	SIGRTN IAT
Escape/Mariner 3.0L	150 (50-50-50) Pin	B41 B20	SIGRTN IAT
Escape/Mariner 2.3L	150 (50-50-50) Pin	B41 B39	SIGRTN IAT
Expedition, Fusion, Milan, MKZ, Navigator	140 Pin	B58 B43	SIGRTN IAT
F-150, Mark LT	190 Pin	E58 E22	SIGRTN IAT

Focus	190 Pin	B58 B47	SIGRTN IAT
All other vehicles	170 Pin	E58 E22	SIGRTN IAT

DA1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0111, P0112, P0113, P0114, or P1112 present?**

Yes	No
For DTC P0111, GO to **DA12**. For KOEO and KOER DTC P0112, GO to **DA6**. For KOEO and KOER DTC P0113, GO to **DA2**. For continuous memory DTCs P0112, P0113 or P1112, GO to **DA9**. For DTC P0114, GO to **DA9**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DA2 DTC P0113: CHECK THE IAT SIGNAL CIRCUIT

NOTE: The DTC indicates the sensor signal is greater than the self-test maximum.

- MAF/IAT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MAF/IAT Sensor Connector, Harness Side	(-)
IAT - Pin 1	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **DA3**.	GO to **DA4**.

DA3 CHECK THE IAT SENSOR RESISTANCE

- Key in OFF position.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector,	(-) MAF/IAT Sensor Connector,

Component Side	Component Side
IAT - Pin 1	SIGRTN - Pin 2

- **Is the resistance between 1K - 500K ohms?**

Yes	No
GO to **DA4**.	INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DA4 CHECK THE SIGNAL AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IAT - Pin 1	IAT
SIGRTN - Pin 2	SIGRTN

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

Yes	No
GO to **DA5**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DA5 CHECK THE SIGNAL FOR A SHORT TO VOLTAGE IN HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MAF/IAT Sensor Connector, Harness Side	(-)
IAT - Pin 1	Ground

- **Is the voltage greater than 1 V?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DA14**.

DA6 DTC P0112: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

NOTE: The DTC indicates the sensor signal is less than the self-test minimum.

- MAF/IAT Sensor connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the IAT PID.
- **Is the voltage greater than 4.2 V?**

Yes	No
INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DA7**.

DA7 CHECK THE IAT CIRCUIT FOR A SHORT TO MAF RTN

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
IAT - Pin 1	MAF RTN - Pin 4

- **Is the resistance less than 5 ohms?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DA8**.

DA8 CHECK THE IAT CIRCUIT FOR A SHORT TO GROUND

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
IAT	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) 12 Volt Vehicle Battery
IAT	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DA14**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DA9 SELF-TEST DTCS P0112, P0113, P0114 OR P1112: INTERMITTENT CHECK

- Key ON, engine OFF.
- Access the PCM and monitor the IAT PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector
- **Is there a large change in the voltage reading?**

Yes	No
DISCONNECT and INSPECT the connector. If OK, INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DA10**.

DA10 CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

- Access the PCM and monitor the IAT PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there a large change in the voltage reading?**

Yes	No

ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DA11**.

DA11 CHECK THE PCM AND VEHICLE HARNESS CONNECTORS

- Key in OFF position.
- PCM connector disconnected.
- MAF/IAT Sensor connector disconnected.
- **Are the connectors and terminals OK?**

Yes	No
The concern is not present at this time. DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DA12 DTC P0111: CHECK THE RESISTANCE OF THE IAT SENSOR WITH THE ENGINE OFF

NOTE: **Verify the engine temperature is at ambient temperature before continuing with this test.**

- Key in OFF position.
- IAT Sensor connector disconnected.
- Measure the resistance between:

(+) IAT Sensor Connector, Component Side	(-) IAT Sensor Connector, Component Side
IAT	SIGRTN

- Refer to the chart at the beginning of this test for the resistance specifications.
- **Is the resistance within specification?**

Yes	No
GO to **DA13**.	INSTALL a new IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DA13 DTC P0111: CHECK THE RESISTANCE OF THE IAT SENSOR

NOTE: Verify the engine is at operating temperature before taking the IAT reading.

- IAT Sensor connector connected.
- Run the engine until the engine temperature stabilizes.
- Key in OFF position.
- IAT Sensor connector disconnected.
- Measure the resistance between:

(+) IAT Sensor Connector, Component Side	(-) IAT Sensor Connector, Component Side
IAT	SIGRTN

- Refer to the chart at the beginning of this test for the resistance specifications.
- **Is the resistance within specification?**

Yes	No
The concern is not present at this time. CARRY OUT the OBD drive cycle to determine if fuel, HO2S, catalyst and misfire monitors can be executed. REFER to On Board Diagnostic (OBD) Drive Cycle. REPEAT the PCM self-test if necessary.	INSTALL a new IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DA14 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DC: MASS AIR FLOW (MAF) SENSOR

This pinpoint test is intended to diagnose the following:

- mass air flow (MAF) sensor (12B579)
- harness circuits: MAF SIG, MAF RTN, vehicle power (VPWR), power ground (PWRGND), IAT and SIGRTN
- powertrain control module (PCM) (12A650)

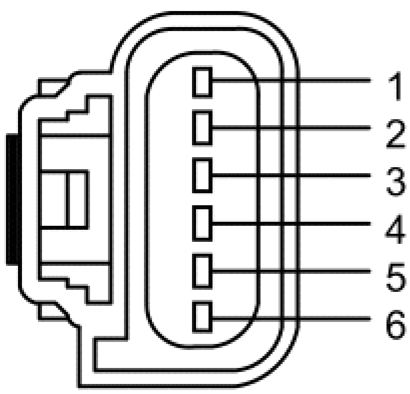


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Fig. 32: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	IAT (Intake Air Temperature)
2	SIGRTN (Signal Return)
4	MAF RTN (Mass Air Flow Return)
3	MAF (Mass Air Flow)
5	PWRGND (Power Ground)
6	VPWR (Vehicle Power)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B41 B42	MAF MAF RTN
Escape/Mariner	150 (50-50-50) Pin	B32	MAF

		B43	MAF RTN
Expedition, Fusion, Milan, MKZ, Navigator	140 Pin	B41 B42	MAF MAF RTN
F-150, Mark LT	190 Pin	E25 E26	MAF MAF RTN
Focus	190 Pin	B40 B41	MAF MAF RTN
All other vehicles	170 Pin	E25 E26	MAF MAF RTN

DC1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0102, P0103, P0104, P1100, or P1101 present?**

Yes	No
For KOER and continuous memory DTC P0102, P0104, GO to **DC5**. For DTC P0103, GO to **DC21**. For KOEO DTC P1101, GO to **DC7**. For KOER and continuous memory DTC P1101, GO to **DC2**. For continuous memory DTC P1100, GO to **DC19**.	For all other symptoms without DTCs, GO to **DC27**.

DC2 DTC P1101: CHECK FOR MAF SENSOR CONTINUOUS MEMORY DTCS

- Retrieve continuous memory DTCs.
- **Is a continuous memory MAF DTC present with the KOER DTC P1101?**

Yes	No
GO to **DC3**.	GO to **DC5**.

DC3 VERIFY CONTINUOUS MEMORY DTC P0102

- **Is a continuous memory DTC P0102 present with the KOER DTC P1101?**

Yes	No
GO to **DC5**.	GO to **DC4**.

DC4 VERIFY CONTINUOUS MEMORY DTC P0103

- **Is a continuous memory DTC P0103 present with the KOER DTC P1101?**

Yes	No
GO to **DC21**.	All other continuous memory DTCs: DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DC5 KOER AND CONTINUOUS MEMORY DTCS P0102, P0104 OR P1101: CHECK THE INTAKE AIR SYSTEM FOR LEAKS, OBSTRUCTIONS, AND DAMAGE

- Key in OFF position.
- Check the air inlet system (air cleaner, housing, duct work) for obstructions or blockage.
- Check for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in the air outlet tube, and worn gaskets between the MAF sensor and the air cleaner assembly. Check the throttle body bore for sludge. Verify the MAF sensor is connected. Repair as necessary.
- **Are there any concerns found during the visual inspection?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DC6**.

DC6 CHECK THE MAF PID

- Access the PCM and monitor the RPM PID.
- Run the engine up to 1,500 RPM for 5 seconds, then bring it back to idle.
- Access the PCM and monitor the MAF PID.
- **Is the voltage less than 0.23 V?**

Yes	No
GO to **DC9**.	GO to **DC7**.

DC7 CHECK THE MAF SIGNAL SENT TO THE PCM

NOTE: **DTC P1101 can be generated by a low charged vehicle battery or the garage exhaust ventilation system. Charge the battery as necessary, then remove the ventilation system and properly vent to the outside atmosphere. Check the air inlet system (air cleaner, housing, duct work) for obstructions or blockage. Repeat the KOEO self-test.**

- Key in OFF position.
- MAF/IAT Sensor connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the MAF PID.

- **Is the voltage less than 0.2 V?**

Yes	No
GO to **DC8**.	GO to **DC9**.

DC8 CHECK THE MAF SIGNAL SENT TO THE PCM

- Key ON, engine running.
- Access the PCM and monitor the MAF PID.
- **Is the voltage between 0.46 - 2.44 V?**

Yes	No
Unable to identify the concern at this time. refer to **PINPOINT TEST Z**.	GO to **DC9**.

DC9 CHECK THE VPWR TO THE MAF SENSOR

- Key in OFF position.
- MAF/IAT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 6	Negative terminal

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

Yes	No
GO to **DC10**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC10 CHECK THE PWRGND CIRCUIT TO THE MAF SENSOR

- Measure the voltage between:

(+) Vehicle Battery	(-) MAF/IAT Sensor Connector, Harness Side

Positive terminal	PWRGND - Pin 5

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

Yes	No
GO to **DC11**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC11 CHECK FOR SHORTS BETWEEN THE CIRCUITS IN THE MAF HARNESS

- Key in OFF position.
- MAF/IAT Sensor connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF - Pin 3	PWRGND - Pin 5
MAF - Pin 3	MAF RTN - Pin 4
MAF - Pin 3	SIGRTN - Pin 2
MAF - Pin 3	IAT - Pin 1

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DC12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DC12 CHECK THE MAF RTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF RTN	MAF RTN - Pin 4

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DC13**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC13 CHECK THE MAF RTN CIRCUIT FOR A SHORT TO PWRGND IN THE HARNESS

- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF RTN - Pin 4	PWRGND - Pin 5

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DC14**.	REPAIR the short circuit to GND. CLEAR the DTCs. REPEAT the self-test.

DC14 CHECK THE MAF CIRCUIT FOR A SHORT TO PWRGND IN THE PCM

- PCM connector connected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF - Pin 3	PWRGND - Pin 5

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DC15**.	GO to **DC31**.

DC15 CHECK THE MAF CIRCUIT VOLTAGE CYCLING INTEGRITY

- Key ON, engine OFF.
- Access the PCM and monitor the MAF PID.

- Connect a 5 amp fused jumper wire between the following:

Point A MAF/IAT Sensor Connector, Harness Side	Point B MAF/IAT Sensor Connector, Harness Side
MAF RTN - Pin 4	PWRGND - Pin 5
MAF - Pin 3	VPWR - Pin 6

- Record the PID reading while both jumpers are installed.
- Remove the VPWR jumper while observing the MAF PID.
- **Does the MAF PID change from greater than 4.50 volts to less than 0.26 volt when the VPWR jumper is removed?**

Yes	No
INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **DC16**.

DC16 CHECK THE MAF CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF	MAF - Pin 3

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DC17**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC17 CHECK THE PWRGND CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) Vehicle Battery
PWRGND - Pin 5	Negative terminal

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DC18**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC18 CHECK THE MAF RTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF RTN	MAF RTN - Pin 4

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DC31**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC19 DTC P1100: CHECK THE MAF CIRCUIT FOR INTERMITTENT VOLTAGE TO THE PCM

- Check for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in the air outlet tube, and worn gaskets between the MAF sensor and the air cleaner assembly. Verify the MAF sensor is connected.
- Key ON, engine running.
- Access the PCM and monitor the MAF PID.
- If idle is not stable, refer to **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** .
- Access the PCM and monitor the RPM PID.

- Run the engine up to 1,500 RPM for 5 seconds, then bring it back to idle.
- Lightly tap on the MAF sensor and wiggle the harness connector to simulate road shock.
- **Does the MAF PID go below 0.23 volt or above 4.6 volts?**

Yes	No
INSPECT the MAF/IAT sensor connector. If OK, INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **DC20**.

DC20 CHECK THE MAF CIRCUIT FOR AN INTERMITTENT OPEN OR SHORTS

- Key ON, engine running.
- Access the PCM and monitor the MAF PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Does the MAF PID go below 0.23 volt or above 4.6 volts?**

Yes	No
REPAIR as necessary. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	Unable to duplicate or identify the concern at this time. CLEAR the DTCs. REPEAT the self-test.

DC21 DTC P0103: CHECK THE MAF SENSOR SCREEN FOR CONTAMINATION

NOTE: DTC P0103 can be generated by foreign material blocking the MAF sensor screen, causing an air flow restriction.

- Check the MAF sensor screen for contamination or blockage.
- Check the air cleaner element and air tubes for proper installation and sealing.
- **Are any concerns present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DC22**.

DC22 DTC P0103: CHECK THE MAF SENSOR SIGNAL HIGH INPUT TO THE PCM

- Key ON, engine OFF.
- Access the PCM and monitor the MAF PID.
- **Is the voltage greater than 2.44 V?**

Yes	No
GO to **DC23**.	GO to **DC25**.

DC23 CHECK THE MAF SENSOR SIGNAL SENT TO THE PCM

- Key in OFF position.
- MAF/IAT Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A MAF/IAT Sensor Connector, Harness Side	Point B MAF/IAT Sensor Connector, Harness Side
MAF RTN - Pin 4	PWRGND - Pin 5

- Key ON, engine OFF.
- Access the PCM and monitor the MAF PID.
- **Is the voltage less than 0.1 V?**

Yes	No
CHECK the MAF/IAT sensor electrical connector for damage, corrosion, and water ingress. If OK, INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **DC24**.

DC24 CHECK THE MAF CIRCUIT FOR A SHORT TO VOLTAGE

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
MAF	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **DC26**.	REPAIR the short circuit to PWR. CLEAR the DTCs. REPEAT the self-test.

DC25 CHECK THE MAF SIGNAL SENT TO THE PCM

- Key ON, engine running.
- Access the PCM and monitor the RPM PID.
- Monitor the MAF signal voltage while increasing the engine RPM from idle to approximately 2,500 RPM, and then back to idle.
- Access the PCM and monitor the MAF PID.
- **Is the voltage between 0.23 - 4.6 V?**

Yes	No
This is an intermittent concern. refer to **PINPOINT TEST Z**.	GO to **DC23**.

DC26 VERIFY THE IDLE CONCERN

- PCM connector connected.
- MAF/IAT Sensor connector connected.
- Key ON, engine running.
- **Is an idle concern present?**

Yes	No
DISREGARD DTC P0103 at this time. The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** to diagnose unique idle concerns.	GO to **DC31**.

DC27 SYMPTOMS WITHOUT DTCS: CHECK THE CONDITIONS RELATED TO THE MAF SENSOR

- Check the air inlet system (air cleaner, housing, duct work) for obstructions or blockage.
- Check for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in the air outlet tube, and worn gaskets between the MAF sensor and the air cleaner assembly. Verify the MAF sensor is connected.
- **Is a concern present?**

Yes	No
REPAIR as necessary. RESET the keep alive	

memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **DC28**.

DC28 DTCS P0171, P0172, P0174, P0175, P2195, P2196, P2197 OR P2198: CHECK THE FUNCTIONALITY OF THE MAF SENSOR

NOTE: A MAF PID value of less than 0.6 volt may indicate an incorrectly installed air cleaner or a leak in the air inlet system.

- Key ON, engine running.
- Allow the engine to stabilize at the correct operating temperature.
- Access the PCM and monitor the MAF PID.
- Check that the MAF PID at idle and NEUTRAL is not greater than 30% of the normal MAF listed in the **REFERENCE VALUES** article, Reference Values or not greater than 1.3 volts.
- **Is the PID value within the expected range?**

Yes	No
GO to **DC30**.	GO to **DC29**.

DC29 CHECK TO ISOLATE THE MAF SENSOR FROM A LEAN DRIVEABILITY OCCURRENCE

NOTE: Due to increasingly stringent emission/OBD requirements, a fuel system DTC on some vehicles can be generated without a noticeable driveability concern with or without the MAF sensor disconnected. Under these conditions, if the MAF PID indicates a MAF sensor concern, install a new MAF sensor. Refer to the ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES .

- Key in OFF position.
- MAF/IAT Sensor connector disconnected.
- Key ON, engine running.
- Drive the vehicle on the road.
- **Is the lean driveability symptom (lack of power, spark knock/detonation, buck/jerk or hesitation/surge on acceleration) gone?**

Yes	No
INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **DC30**.

DC30 VERIFY THE DTC

- **Are any of the following DTCs present:**

  P0171, P0172, P0174, P0175, P2195, P2196, P2197, or P2198?

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** to diagnose performance while driving concerns.

DC31 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DD: FUEL RAIL PRESSURE TEMPERATURE (FRPT) SENSOR

WARNING: **Vehicle fuel systems are pressurized even when the engine is not running. To avoid fire or personal injury, disable the fuel delivery system and relieve fuel system pressure before removing any fuel system component. Refer to the fuel system information at the beginning of pinpoint HC. Failure to follow these instructions may result in personal injury.**

NOTE: With the engine running, the FRP PID value may be 48-70 kPa (7-10 psi) higher than a fuel pressure reading taken with a mechanical gauge.

This pinpoint test is intended to diagnose the following:

- fuel rail pressure temperature (FRPT) sensor (9G756)

- harness circuits: FRP and FRT
- powertrain control module (PCM) (12A650)

FRPT SENSOR VOLTAGE AND PRESSURE SPECIFICATIONS

Voltage	Pressure (kPa)	Pressure (psi)
4.5	482	70
3.9	413	60
3.4	344	50
2.8	275	40
2.2	207	30
1.6	138	20
1.1	69	10
0.5	0	0

FRPT SENSOR TEMPERATURE, VOLTAGE, AND RESISTANCE SPECIFICATIONS

Temperature		Sensor	
°C	°F	Volts	K Ohms
100	212	0.47	2.073
95	203	0.54	2.405
90	194	0.61	2.800
85	185	0.70	3.273
80	176	0.80	3.840
75	167	0.92	4.524
70	158	1.06	5.351
65	149	1.21	6.356
60	140	1.38	7.584
55	131	1.56	9.091
50	122	1.77	10.949
45	113	1.99	13.252
40	104	2.23	16.123
35	95	2.48	19.720
30	86	2.74	24.253
25	77	3.00	30.000
20	68	3.26	37.332
15	59	3.50	46.745
10	50	3.73	58.911
5	41	3.95	74.745
0	32	4.13	95.501

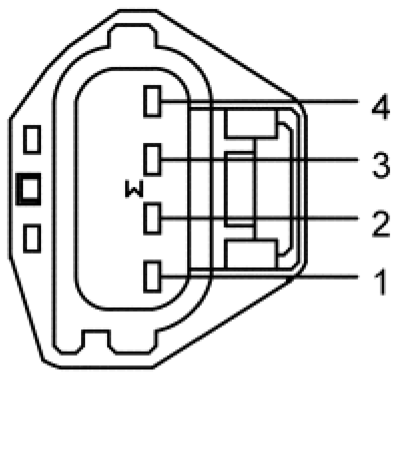

Fig. 33: Fuel Rail Pressure Temperature (FRPT) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
3	FRT (Fuel Rail Temperature)
1	FRP (Fuel Rail Pressure)
4	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	E40 E28 E41 E37	VREF FRT SIGRTN FRP
F-150, Mark LT	190 Pin	E57 E19 E58 E32	VREF FRT SIGRTN FRP
All other vehicles	170 Pin	E57 E19 E58 E32	VREF FRT SIGRTN FRP

DD1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P0180, P0181, P0182, P0183, P0190, P0191, P0192 or P0193 present?**

Yes	No

For DTC P0180, GO to **DD24**. For DTC P0181, GO to **DD26**. For continuous memory DTCs P0182 or P0183, GO to **DD2**. For KOEO and KOER DTCs P0182 or P0183, GO to **DD17**. For continuous memory DTC P0190, GO to **DD3**. For DTC P0191, GO to **DD11**. For continuous memory DTCs P0192 or P0193, GO to **DD16**. For KOEO and KOER DTCs P0192 or P0193, GO to **DD3**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DD2 CHECK THE FRPT AND PCM CONNECTORS FOR DAMAGE

- Key ON, engine OFF.
- Access the PCM and monitor the FRT PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector
  - Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM
- Check the FRPT and PCM connectors for damage and corrosion.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary.	DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DD3 CONTINUOUS MEMORY DTC P0190, KOEO AND KOER DTCS P0192 AND P0193: CHECK THE FRPT SENSOR FOR FUEL LEAKS

NOTE: Repair any fuel pump DTCs prior to this test.

- Key ON, engine running.
- Idle the engine for 2 minutes.
- Inspect the FRPT vacuum hose between the intake manifold and the FRPT sensor for air leaks and correct connection.
- Key in OFF position.
- Remove the vacuum hose from the FRPT.
- Inspect the FRPT and vacuum hose for traces of fuel.

- **Is any fuel present?**

Yes	No
INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DD4**.

DD4 CHECK THE VREF AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Connect the vacuum hose to the FRPT.
- FRPT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FRPT Sensor Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 4

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For DTC P0190, GO to **DD12**. For DTC P0192, GO to **DD5**. For DTC P0193, GO to **DD7**.	refer to **PINPOINT TEST C**.

DD5 INDUCE A HIGH VOLTAGE ON THE FRPT CIRCUIT

- Key in OFF position.
- Connect a 5 amp fused jumper wire between the following:

Point A FRPT Sensor Connector, Harness Side	Point B FRPT Sensor Connector, Harness Side
VREF - Pin 2	FRP - Pin 1

- Key ON, engine OFF.
- Access the PCM and monitor the FRP PID.

- **Is the voltage greater than 4.5 V?**

Yes	No
INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DD6**.

DD6 CHECK THE FRP CIRCUIT FOR A SHORT TO FRT, SIGRTN, AND GND IN THE HARNESS

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRP	SIGRTN
FRP	FRT

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
FRP	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DD28**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DD7 CHECK THE FRP CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
FRP	FRP - Pin 1

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DD8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DD8 CHECK THE FRP CIRCUIT FOR A SHORT TO VREF AND FRT IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRP	VREF
FRP	FRT

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DD9**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DD9 CHECK THE FRP CIRCUIT FOR A SHORT TO VOLTAGE

- Key ON, engine OFF.
- Measure the voltage between:

(+) FRPT Sensor Connector, Harness Side	(-)
FRP - Pin 1	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DD10**.

DD10 INDUCE A LOW VOLTAGE ON THE FRPT CIRCUIT

- Key in OFF position.
- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A FRPT Sensor Connector, Harness Side	Point B FRPT Sensor Connector, Harness Side
FRP - Pin 1	SIGRTN - Pin 4

- Key ON, engine OFF.
- Access the PCM and monitor the FRP PID.
- **Is the voltage less than 0.01 V?**

Yes	No
INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DD28**.

DD11 DTC P0191: CHECK FOR FUEL PUMP DTCS

- Carry out the self-test.
- **Are DTCs P1233, P1234, P1235, P1236, P1237 or P1238 present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DD12**.

DD12 INSPECT ALL THE VACUUM HOSES CONNECTED TO THE INTAKE MANIFOLD FOR LEAKS

- Key in OFF position.
- FRPT Sensor connector connected.
- Key ON, engine running.
- Allow the engine idle to stabilize.
- Inspect all the vacuum hoses connected to the intake manifold for leaks.

- **Are any vacuum hose concerns present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DD13**.

DD13 CHECK THE FRPT CONNECTOR FOR DAMAGE OR CORROSION

- Key in OFF position.
- FRPT Sensor connector disconnected.
- Inspect the sensor, wiring, and connector for damage, corrosion, or water intrusion.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DD14**.

DD14 CHECK THE FRP PID

NOTE: **The fuel pressure is likely to increase after the fuel pressure is relieved with the system closed. The rate and amount of the fuel pressure increase is dependent upon the ambient air and fuel temperatures.**

NOTE: **Prepare to record the FRP PID value within 5 seconds after the engine is shut off and also after the fuel pressure is relieved.**

- FRPT Sensor connector connected.
- Key ON, engine running.
- Allow the engine idle to stabilize.
- Access the PCM and monitor the FRP PID.
- Key in OFF position.
- Key ON, engine OFF.
- Record the FRP PID value within 5 seconds of the key off.
- Relieve the fuel pressure. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure.
- Disable the fuel pump.
- Key ON, engine OFF.
- Record the FRP PID value within 5 seconds of carrying out the fuel system pressure release procedure.
- **Is the difference between the recorded FRP PID values greater than 34 kPa (5 psi)?**

Yes	No

refer to **PINPOINT TEST HC**.	GO to **DD15**.

DD15 COMPARE THE FRP PID TO THE MECHANICAL GAUGE

NOTE: Most mechanical gauges are referenced to atmospheric pressure. The FRPT sensor is referenced to manifold pressure. In order to make a valid comparison, the engine must be off.

NOTE: The vehicle may exhibit a long crank until the fuel system is pressurized.

- Key in OFF position.
- Connect a mechanical fuel pressure gauge.
- Key ON, engine OFF.
- Monitor the mechanical gauge.
- Access the PCM and monitor the FRP PID.
- Compare the FRP PID value to the mechanical gauge.
- Key in OFF position.
- Pressurize the fuel system. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Key ON, engine running.
- Allow the fuel pressure to stabilize.
- Key in OFF position.
- Key ON, engine OFF.
- Compare the FRP PID value to the mechanical gauge.
- **Are the FRP PID values within 34 kPa (5 psi) of the mechanical gauge readings?**

Yes	No
GO to **DD28**.	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DD16 CONTINUOUS MEMORY DTCS P0192 AND P0193: CHECK THE FRPT CIRCUIT FOR AN INTERMITTENT CONCERN

NOTE: Repair any fuel pump DTCs prior to this test.

- Key ON, engine OFF.

- Access the PCM and monitor the FRP PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector
  - Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM
- Check the FRPT connector for damage or corrosion.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

DD17 KOEO AND KOER DTCS P0182 OR P0183: CHECK THE RESISTANCE OF THE FRPT SENSOR

- Key in OFF position.
- FRPT Sensor connector disconnected.
- Measure the resistance between:

(+) FRPT Sensor Connector, Component Side	(-) FRPT Sensor Connector, Component Side
FRT - Pin 3	SIGRTN - Pin 4

- **Is the resistance between 2K - 96K ohms?**

Yes	No
GO to **DD18**.	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DD18 CHECK THE FRPT FOR INTERNAL SHORTS

- Measure the resistance between:

(+) FRPT Sensor	

Connector, Component Side	(-)
FRT - Pin 3	Ground

- Measure the resistance between:

(+) FRPT Sensor Connector, Component Side	(-) FRPT Sensor Connector, Component Side
FRT - Pin 3	FRP - Pin 1
FRT - Pin 3	VREF - Pin 2

- **Are the resistances greater than 10K ohms?**

Yes	No
For DTC P0182, GO to **DD19**. For DTC P0183, GO to **DD21**.	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DD19 CHECK THE FRT CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRT	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
FRT	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DD20**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DD20 FRPT SENSOR: INDUCE A HIGH VOLTAGE ON THE FRT CIRCUIT

- PCM connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the FRT PID.
- **Is the voltage greater than 4.5 V?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	GO to **DD28**.

DD21 CHECK THE FRT AND SIG RTN CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
FRT	FRT - Pin 3
SIGRTN	SIGRTN - Pin 4

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

Yes	No
GO to **DD22**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DD22 CHECK THE FRT SIGNAL FOR A SHORT TO VREF AND FRP

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRT	VREF
FRT	FRP

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DD23**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DD23 FOR THE FRPT SENSOR INDUCE A LOW VOLTAGE ON THE FRT CIRCUIT

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A FRPT Sensor Connector, Harness Side	Point B FRPT Sensor Connector, Harness Side
FRT - Pin 3	SIGRTN - Pin 4

- Key ON, engine OFF.
- Access the PCM and monitor the FRT PID.
- **Is the voltage less than 0.2 V?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	GO to **DD28**.

DD24 DTC P0180: CHECK FOR THE PRESENCE OF DTC P0182 OR P0183

- Key ON, engine OFF.
- Carry out the self-test.
- **Are DTCs P0182 or P0183 present?**

Yes	No
GO to **DD17**.	GO to **DD25**.

DD25 CHECK THE FRT CIRCUIT FOR AN INTERMITTENT CONCERN

- PCM connector connected.
- Access the PCM and monitor the FRT PID.
- Carry out a thorough wiggle test on the FRPT sensor harness.
- **Is the FRT signal stable?**

Yes	No

GO to **DD27**.	ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DD26 KOEO AND KOER DTC P0181: CHECK THE FRT PID

NOTE: Allow vehicle temperatures to stabilize prior to temperature sensor tests.

- Key ON, engine OFF.
- The normal test range is 0°C to 100°C (32°F to 212°F).
- Access the PCM and monitor the FRT PID.
- **Is the voltage between 0.4 - 4.5 V?**

Yes	No
GO to **DD27**.	DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DD27 COMPARE THE PIDS AFTER STABILIZING THE VEHICLE TEMPERATURE

- Access the PCM and monitor the FRT, CHT and ECT PIDs.
- **Are the temperature PIDs nearly equal in value?**

Yes	No
The concern is not present at this time. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

DD28 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DF: VEHICLE SPEED CIRCUIT (VSC) CHECK

WARNING: **Strict observance of posted speed limits and driving conditions is mandatory when proceeding through the following drive cycles.**

Failure to follow these instructions may result in personal injury.

This pinpoint test is intended to diagnose the following:

- harness circuits: VSC
- powertrain control module (PCM) (12A650)

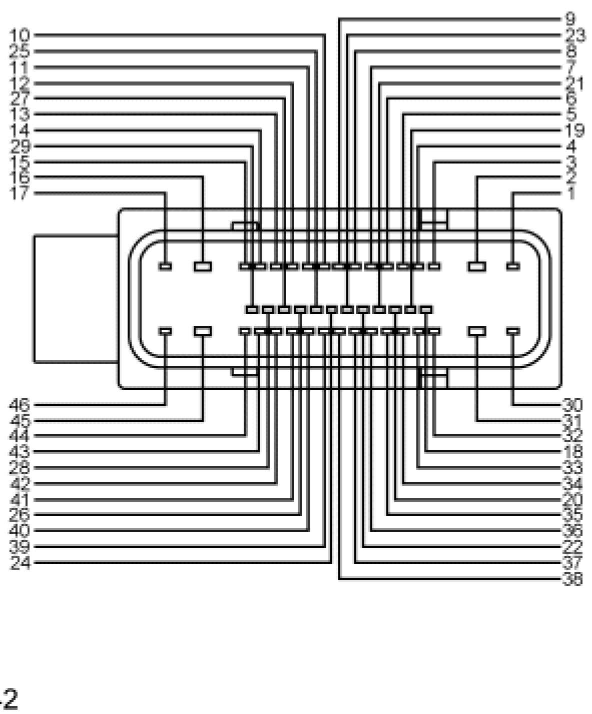

Fig. 34: Anti-lock Brake System (ABS) Module Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
21	VSC (Vehicle Speed Circuit)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Connector	Pin	Circuit
170 Pin	B29	VSC

DF1 DTCS P0500, P0503, P1500, P1501 AND P1502: CHECK THE VEHICLE SPEED CIRCUIT FOR INTERMITTENT CONCERNS

NOTE: The PCM detected an error in the vehicle speed information received from the ABS control module. This test step checks for the recurrence of this vehicle speed error.

- Key ON, engine OFF.
- Clear the DTCs.
- Gradually increase the vehicle speed to 80 km/h (50 mph).
- Coast to an idle and stop the vehicle.
- Key in OFF position.
- Key ON, engine OFF.
- Retrieve the continuous memory DTCs.
- **Are DTCs P0500, P0503, P1500, P1501 or P1502 present?**

Yes	No
The vehicle speed input is incorrect. GO to **DF2**.	The vehicle speed input is correct. The concern that produced the original DTC may be intermittent. GO to **DF5**.

DF2 CHECK THE VSC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Anti-lock Brake System (ABS) Module connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
VSC - Pin B29	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **DF3**.	GO to **DF6**.

DF3 CHECK FOR AN OPEN VSC BETWEEN THE PCM AND THE ABS CONTROL MODULE

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Anti-lock Brake System (ABS) Module Connector, Harness Side
VSC - Pin B29	VSC - Pin 21

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DF4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test. GO to **DF7**.

DF4 CHECK THE VSC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
VSC - Pin B29	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
REFER to the **VEHICLE DYNAMIC SYSTEMS -- E-SERIES** to continue diagnosis of the ABS control module, speed sensors and wheel speed sensor harness circuits. If these components are working properly, GO to **DF8**.	GO to **DF6**.

DF5 VISUAL INSPECTION

NOTE: Refer to the Wiring Diagrams article for harness, module, and connector locations.

- Key in OFF position.
- Visually inspect the VSC circuit harness and connectors at the PCM, ABS, and other VSC user modules for damage, loose connections, loose grounds, or incorrect routing.
- **Does the visual inspection reveal a concern?**

Yes	No

REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. GO to **DF7**.	Unable to duplicate or identify the concern at this time. REFER to the **VEHICLE DYNAMIC SYSTEMS -- E-SERIES** to continue diagnosis of the ABS control module, speed sensors and wheel speed sensor harness circuits.

DF6 VERIFY IF THE VSC IS SHORTED IN THE HARNESS OR ANOTHER MODULE

- Key in OFF position.
- Determine which, if any, modules are connected to the VSC. Refer to the Wiring Diagrams article. If no other modules are connected to the VSC, go to the YES Action To Take.
- One at a time, disconnect the modules associated with the VSC. After disconnecting each module, test again for a short circuit. (Refer to test step that sent you here). Repeat until each associated module is disconnected or the short circuit is eliminated.
- **Does the short circuit remain after all associated modules are disconnected?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test. GO to **DF7**.	REFER to the Workshop article for further diagnosis of the appropriate module. GO to **DF7**.

DF7 VSC REPAIR VERIFICATION DRIVE CYCLE

NOTE: Warm the engine to a normal operating temperature before continuing.

NOTE: Carry out the VSC drive cycle at least 3 times as described below.

- Automatic Transmission Drive Cycle:
  - Place the transmission range selector lever in DRIVE range
  - Accelerate heavily to 56 km/h (35 mph)
  - Coast down to an idle and stop the vehicle
  - Cycle the key OFF and ON
- Manual Transmission Drive Cycle:
  - Accelerate moderately to 64 km/h (40 mph), while shifting from first to second gear
  - Coast down to an idle and stop the vehicle
  - Cycle the key OFF and ON
- Key in OFF position.
- Key ON, engine OFF.
- Retrieve the continuous memory DTCs.
- **Are DTCs P0500, P0503, P1500, P1501 or P1502 present?**

Yes	No
REFER to the **VEHICLE DYNAMIC SYSTEMS -- E-SERIES** to continue diagnosis of the ABS control module, speed sensors and wheel speed sensor harness circuits. If these components are working properly, GO to **DF8**.	The repair has been verified.

DF8 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DG: KNOCK SENSOR (KS)

This pinpoint test is intended to diagnose the following:

- knock sensors KS1, KS2 (12A699)
- harness circuits: KS1+, KS1-, KS2+, and KS2-
- powertrain control module (PCM) (12A650)

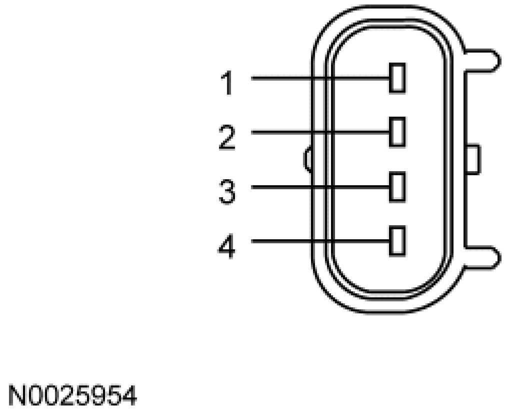

Fig. 35: Knock Sensor 1 (KS1) Connector - A
Courtesy of FORD MOTOR CO.

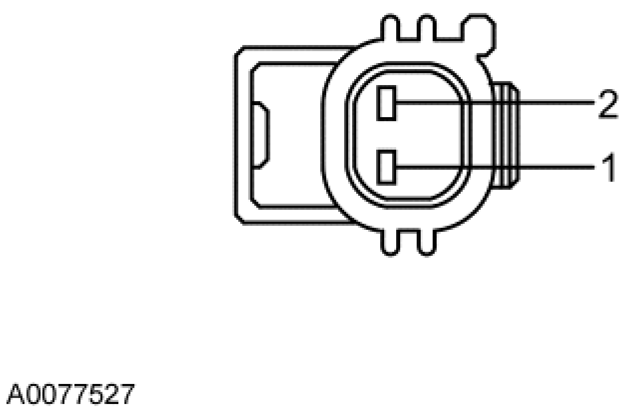

Fig. 36: Knock Sensor 1 (KS1) Connector - A
Courtesy of FORD MOTOR CO.

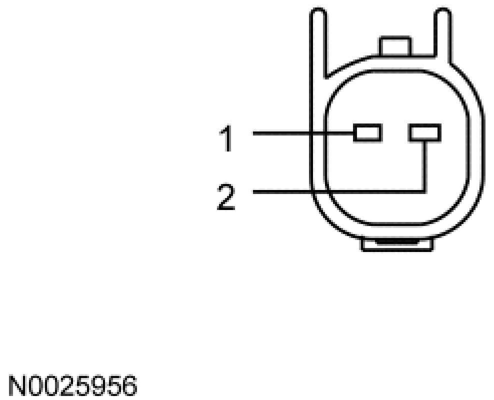

Fig. 37: Knock Sensor 1 (KS1) Connector - C
Courtesy of FORD MOTOR CO.

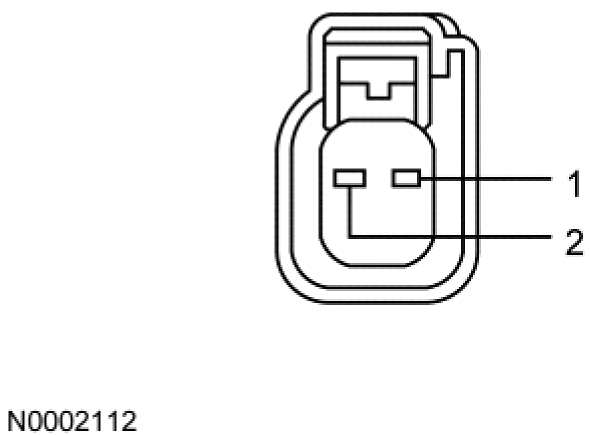

Fig. 38: Knock Sensor 1 (KS1) Connector - D
Courtesy of FORD MOTOR CO.

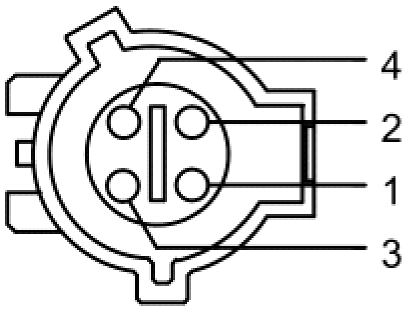

Fig. 39: Knock Sensor 1 (KS1) Connector - E
Courtesy of FORD MOTOR CO.

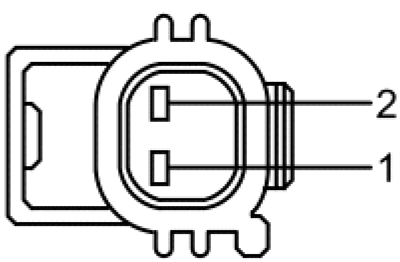

Fig. 40: Knock Sensor 1 (KS1) Connector - F
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, F-Super Duty 6.8L, MKX, Sable, Taurus, Taurus X	A	3 4 1 2	KS2+ KS2- KS1+ KS1-
Escape/Mariner, Fusion 2.3L, Milan 2.3L	B	1 2	KS1+ KS1-

Expedition, Navigator	C	1 2	KS1+ KS1-
F-150 4.2L, Ranger 3.0L	D	1 2	KS1+ KS1-
F-150 5.4L, F-Super Duty 5.4L, Mark LT	C	2 1	KS1+ KS1-
Fusion 3.0L, Milan 3.0L, Ranger 2.3L	B	2 1	KS1+ KS1-
MKZ	A	1 2	KS1+ KS1-
Mountaineer 4.6L	E	1 2	KS1+ KS1-
Mustang 4.6L	E	3 4	KS1+ KS1-
All other vehicles	F	2 1	KS1+ KS1-

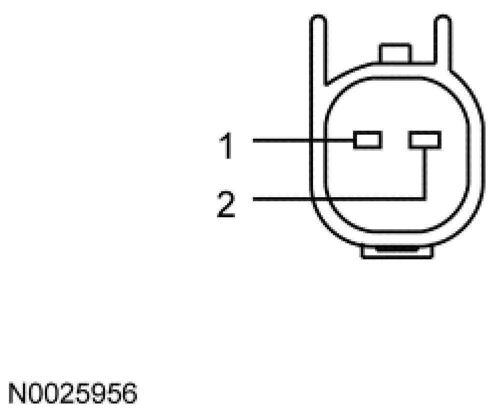

Fig. 41: Knock Sensor 2 (KS2) Connector - A
Courtesy of FORD MOTOR CO.

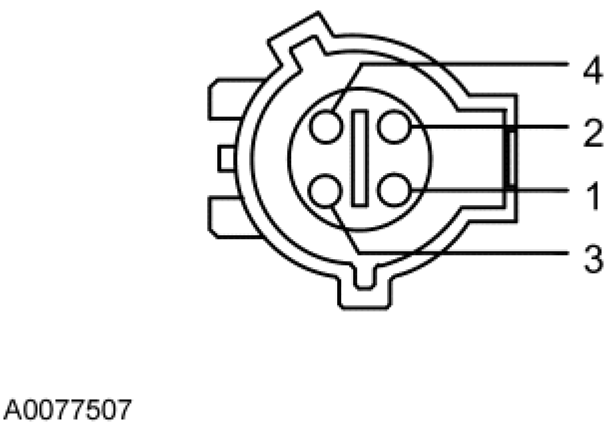

Fig. 42: Knock Sensor 2 (KS2) Connector - B
Courtesy of FORD MOTOR CO.

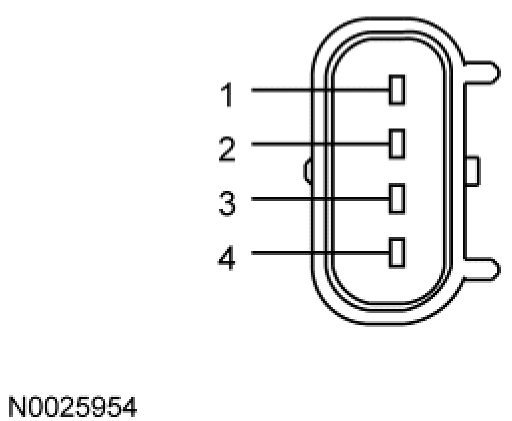

Fig. 43: Knock Sensor 2 (KS2) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition, F-Super Duty 5.4L, Navigator	A	1 2	KS2+ KS2-
F-150, Mark LT	A	2 1	KS2+ KS2-
Mustang	B	1 2	KS2+ KS2-
All other vehicles	C	3 4	KS2+ KS2-

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	E31 E30 E49 E48 B29, B64 B51	KS2+ KS2- KS1+ KS1- VREF VPWR
Escape/Mariner	150 (50-50-50) Pin	E32 E20 E40 B35	KS1+ KS1- VREF VPWR
Expedition, MKZ, Navigator	140 Pin	E31 E30 E49 E48 E57 B51	KS2+ KS2- KS1+ KS1- VREF VPWR
F-150 4.6L, F-150 4.2L	190 Pin	E49 E48 E57 B51	KS1+ KS1- VREF VPWR
F-150 5.4L, Mark LT	190 Pin	E31 E30 E49 E48 E57 B51	KS2+ KS2- KS1+ KS1- VREF VPWR
F-Super Duty, Mustang 4.6L	170 Pin	E31 E30 E49 E48 E57 B35	KS2+ KS2- KS1+ KS1- VREF VPWR
Focus	190 Pin	E46 E47 E63 B67	KS1+ KS1- VREF VPWR
Fusion, Milan	140 Pin	E49 E48 E57 B51	KS1+ KS1- VREF VPWR
All other vehicles	170 Pin	E49 E48 E57	KS1+ KS1- VREF

		B35	VPWR

DG1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P0325, P0326, P0330, or P0331 present?**

Yes	No
For KOER and continuous memory DTCs P0325, P0326, P0330 and P0331, GO to **DG2**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DG2 KOER AND CONTINUOUS MEMORY DTCS P0325, P0326, P0330 AND P0331: CHECK THE INTERNAL RESISTANCE OF THE KS

- KS connector disconnected.
- Measure the resistance between:

(+) KS Connector, Component Side	(-) KS Connector, Component Side
Suspect KS+	Suspect KS-

- **Is the resistance between 4.39M - 5.35M ohms?**

Yes	No
GO to **DG3**.	INSTALL a new KS. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DG3 CHECK THE KS+ CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS+	Suspect KS+

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DG4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DG4 CHECK THE KS- CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS-	Suspect KS-

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DG5**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DG5 CHECK THE KS+ CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) Vehicle Battery
Suspect KS+	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DG6**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DG6 CHECK THE KS- CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) Vehicle Battery
Suspect KS-	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DG7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DG7 CHECK THE KS+ CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS+	VPWR
Suspect KS+	VREF

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DG8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DG8 CHECK THE KS- CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS-	VREF
Suspect KS-	VPWR

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DG9**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DG9 CHECK THE KS+ CIRCUIT FOR INTERMITTENT CONCERNS

NOTE: Carefully wiggle all accessible wiring and connectors associated with the KS circuit.

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS+	Suspect KS+

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DG10**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DG10 CHECK THE KS- CIRCUIT FOR INTERMITTENT CONCERNS

NOTE: Carefully wiggle all accessible wiring and connectors associated with the KS circuit.

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS-	Suspect KS-

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DG11**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DG11 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY**	The system is operating correctly at this time. The concern may have been caused by a loose or

(EEPROM) , Programming the VID Block for a Replacement PCM.	corroded connector.

PINPOINT TEST DH: THROTTLE POSITION (TP) SENSOR

This pinpoint test is intended to diagnose the following:

- TP sensor (9B989)
- binding or sticking throttle linkage
- harness circuits: TP, SIGRTN, VREF, VPWR, and PWRGND
- powertrain control module (PCM) (12A650)

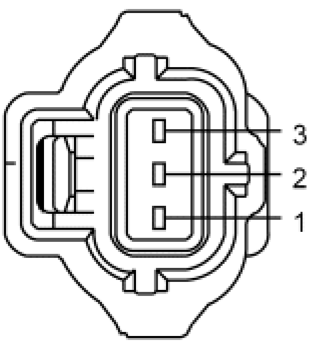

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Fig. 44: Throttle Position (TP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

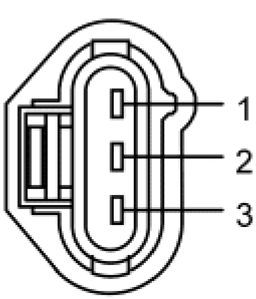

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Fig. 45: Throttle Position (TP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Ranger 2.3L	A	2 1 3	TP SIGRTN VREF
All other vehicles	B	2 3 1	TP SIGRTN VREF

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	E41 B47, B48, B49, B50 B40, E40 B35, B36 E19	SIGRTN PWRGND VREF VPWR TP
Ranger	170 Pin	E58 B47, B48, B49, B50 B40, E57 B35, B36 E61	SIGRTN PWRGND VREF VPWR TP

DH1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0068, P0121, P0122, P0123, P1120, or P1124 present?**

Yes	No
For DTC P0068, GO to **DH18**. For DTC P0121, GO to **DH24**. For KOEO and KOER DTC P0122, GO to **DH14**. For continuous memory DTC P0122, GO to **DH13**. For DTC P0123, GO to **DH9**. For DTC P1120, GO to **DH4**. For DTC P1124, GO to **DH2**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DH2 KOEO AND KOER DTC P1124: CHECK FOR ANY OTHER DTCS

- Key ON, engine OFF.
- Check for KOEO and KOER DTCs.
- **Is DTC P0405 present?**

Yes	No

DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DH3**.

DH3 CHECK FOR A STUCK THROTTLE PLATE OR LINKAGE

- Key in OFF position.
- Visually inspect the throttle linkage and throttle plate for binding or sticking.
- Verify the throttle plate and linkage is at closed throttle position.
- **Does the throttle move freely and return to a closed throttle position?**

Yes	No
The throttle plate and linkage are OK. GO to **DH9**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DH4 DTC P1120: CHECK THE TP CIRCUIT FOR FRAYED WIRES OR CORROSION ON THE CONNECTORS

- Key in OFF position.
- Carry out a visual inspection of the pins on the harness connector at the TP sensor for corrosion.
- Carry out a visual inspection of the harness wires between the TP sensor and the PCM for insulation fraying and corrosion.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DH5**.

DH5 CHECK FOR A STUCK TP SENSOR

- Key ON, engine OFF.
- Slowly move the throttle from the closed throttle position to the wide open throttle position and observe the TP PID.
- Access the PCM and monitor the TP PID.
- **Is the voltage greater than 4.5 V?**

Yes	No
GO to **DH22**.	GO to **DH6**.

DH6 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE TP SENSOR HARNESS CONNECTOR

- TP Sensor connector disconnected.

- Key ON, engine OFF.
- Measure the voltage between:

(+) TP Sensor Connector, Harness Side	(-) TP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **DH7**.	refer to **PINPOINT TEST C**.

DH7 CHECK THE TP CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) TP Sensor Connector, Harness Side
TP	TP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DH8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DH8 CHECK THE TP SENSOR VOLTAGE TO THE PCM

- PCM connector connected.
- TP Sensor connector connected.
- Key ON, engine running.
- Idle the engine for 2 minutes.
- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- Slowly move the throttle from the closed throttle position to the wide open throttle position and observe the TP PID.
- **Is the voltage between 0.17 - 0.49 V?**

Yes	No
INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	If DTC P1120 is still present, GO to **DH22**.

DH9 DTC P0123 OR DTC P1124: INDUCE THE OPPOSITE TP SENSOR VOLTAGE

- TP Sensor connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- **Is the voltage less than 0.17 V?**

Yes	No
GO to **DH10**.	GO to **DH11**.

DH10 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE TP SENSOR VEHICLE HARNESS CONNECTOR

- Key ON, engine OFF.
- Measure the voltage between:

(+) TP Sensor Connector, Harness Side	(-) TP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST C**.

DH11 CHECK THE CIRCUIT FOR A SHORT TO VREF AND VPWR IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side

VPWR	TP
VREF	TP

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DH12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DH12 CHECK FOR AN INTERMITTENT SHORT TO VOLTAGE IN THE TP CIRCUIT

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VPWR	TP
VREF	TP

- Observe the digital multimeter (DMM) for an indication of a concern while shaking, wiggling, and bending the TP circuit between the TP sensor and the PCM.
- **Is a concern present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DH26**.

DH13 CONTINUOUS MEMORY DTC P0122: CHECK THE TP CIRCUIT FOR AN INTERMITTENT CONCERN

- Key ON, engine OFF.
- Clear the PCM DTCs.
- Key ON, engine running.
- Retrieve the continuous memory DTCs.
- **Is DTC P0122 present?**

Yes	No
GO to **DH14**.	refer to **PINPOINT TEST Z**.

DH14 KOEO AND KOER DTC P0122: CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE TP SENSOR VEHICLE HARNESS CONNECTOR

- Key in OFF position.
- TP Sensor connector disconnected.

- Key ON, engine OFF.
- Measure the voltage between:

(+) TP Sensor Connector, Harness Side	(-) TP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **DH15**.	refer to **PINPOINT TEST C**.

DH15 CHECK THE TP CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) TP Sensor Connector, Harness Side
TP	TP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DH16**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DH16 CHECK THE TP CIRCUIT FOR A SHORT TO PWRGND OR SIGRTN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
TP	PWRGND
TP	SIGRTN

- **Are the resistances greater than 10K ohms?**

Yes	No

GO to **DH17**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DH17 INDUCE THE OPPOSITE TP SENSOR VOLTAGE

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A TP Sensor Connector, Harness Side	Point B TP Sensor Connector, Harness Side
VREF	TP

- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- **Is the voltage greater than 4.65 V?**

Yes	No
INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DH26**.

DH18 DTC P0068: CHECK THE RATIONALITY BETWEEN THE TP AND MAF SENSORS

- Attempt to start the engine.
- **Does the engine start?**

Yes	No
GO to **DH19**.	CHECK for major leaks, cracks and openings between the MAF sensor and the throttle body. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. If OK, refer to **PINPOINT TEST A**.

DH19 CHECK THE TP SENSOR FOR MECHANICAL OPERATION

- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- Slowly move the throttle from the closed throttle position to the wide open throttle position and observe the TP PID.
- **Is the voltage between 0.49 - 4.65 V?**

Yes	No
GO to **DH20**.	INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DH20 CHECK THE TP SENSOR SIGNAL HIGH VERSUS THE ENGINE LOAD WHILE DRIVING THE VEHICLE

- Key ON, engine running.
- Access the PCM and monitor the TP PID.
- Access the PCM and monitor the LOAD PID.
- Drive the vehicle, exercising the throttle and TP sensor.
- **Is the TP PID greater than 2.44 volts and the LOAD PID less than 30%?**

Yes	No
LISTEN for air noise around the MAF sensor and throttle body while the engine is running. REPAIR as necessary. If OK, INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DH21**.

DH21 CHECK THE TP SENSOR SIGNAL LOW VERSUS THE ENGINE LOAD WHILE DRIVING THE VEHICLE

- Key ON, engine running.
- Access the PCM and monitor the TP PID.
- Access the PCM and monitor the LOAD PID.
- Drive the vehicle while exercising the throttle and TP sensor near higher gears (preferably overdrive).
- **Is the TP PID less than 0.24 volt and the LOAD PID greater than 55%?**

Yes	No
If continuous memory DTC P0068 is present, INSTALL a new MAF sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DH22 CHECK FOR AN INTERMITTENT TP SIGNAL

- Key ON, engine running.
- Access the PCM and monitor the TP PID.
- Increase the engine speed to 1,500 RPM for 10 seconds.

- Lightly tap on the TP sensor and wiggle the harness connector to simulate road shock.
- **Is the voltage between 0.49 V - 4.65 V?**

Yes	No
GO to **DH23**.	INSPECT the TP sensor connector. REPAIR as necessary. If OK, INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DH23 CHECK THE TP SENSOR HARNESS FOR INTERMITTENT OPENS OR SHORTS

- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- Grasp the vehicle harness closest to the TP sensor connector.
- Shake and bend a small section of the harness all the way to the bulkhead.
- Wiggle, shake, and bend the harness from the bulkhead to the PCM.
- **Is the voltage between 0.49 V - 4.65 V?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DH24 DTC P0121: CHECK FOR OBSTRUCTION OR STICKING CONCERNS

NOTE: **Do not attempt to clean the throttle bore and plate area. Cleaning damages the throttle body assembly.**

NOTE: **Conditions of sticking or obstruction can either be within the cables or throttle body assembly.**

- Disconnect the accelerator cable and speed control cable from the throttle body linkage.
- Rotate the throttle body linkage.
- **Does the throttle body rotate freely without a sticking, binding, or grabbing condition?**

Yes	No
INSPECT the cable(s). REPAIR as necessary. REPEAT the self-test. If DTC P0121 is still present,	INSTALL a new throttle body assembly. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL --**

GO to **DH25**.	**E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DH25 CHECK THE FUNCTIONALITY OF THE THROTTLE POSITION SENSOR

- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- While slowly pressing the accelerator from the closed throttle position to the wide open throttle position, observe the TP PID.
- **Does the TP PID display a smooth reading during accelerator movement?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DH26 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DJ: AIR CONDITIONING EVAPORATOR TEMPERATURE (ACET) SENSOR

This pinpoint test is intended to diagnose the following:

- ACET sensor (19C734)
- harness circuits: ACET and SIGRTN
- powertrain control module (PCM) (12A650)

AIR CONDITIONING EVAPORATOR TEMPERATURE (ACET) SENSOR

°C	°F	Voltage	Resistance (K ohms)
100	212	0.47	2.08
90	194	0.61	2.8
80	176	0.80	3.84
70	158	1.05	5.34
60	140	1.37	7.55
50	122	1.77	10.93
40	104	2.23	16.11
30	86	2.74	24.25
20	68	3.26	37.34
10	50	3.73	58.99
0	32	4.14	95.85
-10	14	4.45	160.31
-20	-4	4.66	276.96

These values can vary by 15% due to sensor and VREF variations. Voltage values calculated for VREF are equal to 5 volts.

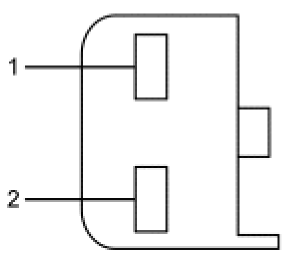

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Fig. 46: Powertrain Control Module (PCM) (12A650)
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	SIGRTN (Signal Return)
2	ACET (Air Conditioning Evaporator Temperature)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Connector	Pin	Circuit
140 Pin	B33, E57 B58, E58 B53	VREF SIGRTN ACET

DJ1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0537, P0538, P1436, or P1437 present?**

Yes	No
For KOEO and KOER DTCs P0538 or P1437, GO to **DJ2**. For KOEO and KOER DTCs P0537 or P1436, GO to **DJ6**. For continuous memory DTCs P0537, P0538, P1436 or P1437, GO to **DJ9**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DJ2 KOEO AND KOER DTCS P0538 OR P1437: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- ACET Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A ACET Sensor Connector, Harness Side	Point B ACET Sensor Connector, Harness Side
ACET - Pin 2	SIGRTN - Pin 1

- Check for self-test DTCs.
- **Are DTCs P0537 or P1436 present?**

Yes	No
INSTALL a new ACET sensor. CLEAR the DTCs. REPEAT the self-test.	GO to **DJ3**.

DJ3 CHECK THE ACET AND SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector disconnected.
- Measure the resistance between:

(+) ACET Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ACET - Pin 2	ACET - Pin B53
SIGRTN - Pin 1	SIGRTN - Pin B58, E58

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

Yes	No
GO to **DJ4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DJ4 CHECK THE ACET CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) ACET Sensor Connector, Harness Side	(-)
ACET - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **DJ5**.	REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

DJ5 CHECK THE ACET CIRCUIT FOR A SHORT TO VREF IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ACET - Pin B53	VREF - Pin E57

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DJ10**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DJ6 KOEO AND KOER DTCS P0537 OR P1436: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- ACET Sensor connector disconnected.
- Carry out the KOEO self-test.
- **Are DTCs P0538 or P1437 present?**

Yes	No
INSTALL a new ACET sensor. CLEAR the DTCs. REPEAT the self-test.	GO to **DJ7**.

DJ7 CHECK THE ACET CIRCUIT(S) FOR A SHORT TO SIGRTN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) ACET Sensor Connector, Harness Side	(-) ACET Sensor Connector, Harness Side
ACET - Pin 2	SIGRTN - Pin 1

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DJ8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DJ8 CHECK THE ACET CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) ACET Sensor Connector, Harness Side	(-)
ACET - Pin 2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DJ10**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DJ9 CONTINUOUS MEMORY DTCS P0537, P0538, P1436 OR P1437: CHECK THE ACET AND SIGRTN CIRCUIT FOR AN INTERMITTENT CONCERN

NOTE: **The voltage should be between 4.5 and 5.5 volts. The voltage reading changes suddenly when a concern is detected. For P0537/P1436, a sudden change could indicate a short to ground. For P0538/P1436, a sudden change could indicate an**

open ACET or SIGRTN circuit.

- ACET Sensor connector disconnected.
- Inspect the connectors for signs of damage, water intrusion, or corrosion.
- Measure the voltage between:

(+) ACET Sensor Connector, Harness Side	(-) ACET Sensor Connector, Harness Side
ACET - Pin 2	SIGRTN - Pin 1

- Key ON, engine OFF.
- While monitoring the voltage reading on the digital multimeter (DMM), wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- Key in OFF position.
- **Is there any change in the voltage reading, or is a concern found?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DJ10 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins.
  - corrosion.
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DK: ACCELERATOR PEDAL POSITION (APP) SENSOR

NOTE: After clearing an APP sensor diagnostic trouble code (DTC) to verify a repair or an intermittent concern, apply the accelerator pedal before carrying out the self-test. Take 10 seconds to carry out a full sweep of the accelerator pedal from fully released to fully applied and back to fully released.

This pinpoint test is intended to diagnose the following:

- accelerator pedal position (APP) sensor (9F836)
- harness circuits: ETCRTN, SIGRTN, ETCREF, APP1, APP2, and APP3
- powertrain control module (PCM) (12A650)

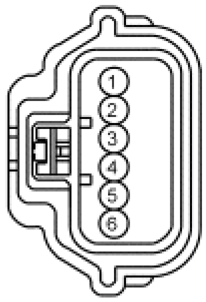

Fig. 47: Accelerator Pedal Position (APP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

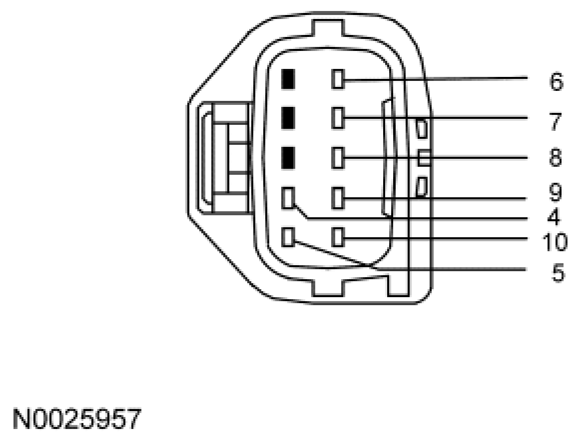

Fig. 48: Accelerator Pedal Position (APP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

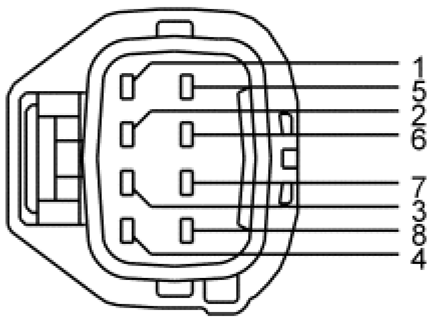

Fig. 49: Accelerator Pedal Position (APP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Focus	A	5 2 3, 4 1, 6	APP2 APP1 ETCRTN ETCREF
Fusion, Milan, MKZ	B	4 5 7 6, 9 10, 8	APP3 APP2 APP1 ETCRTN ETCREF
All other vehicles	C	8 5 2 1, 3 6, 7	APP3 APP2 APP1 ETCRTN ETCREF

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Mustang, Town Car	170 Pin	B41, B6, E59 B24, B4, E66 B35, B36 B28 B17 B5	ETCRTN ETCREF VPWR APP3 APP2 APP1
E-Series, F-Super Duty	170 Pin	B18, B6, E59 B16, B4, E66 B35, B36	ETCRTN ETCREF VPWR

		B28 B17 B5	APP3 APP2 APP1
Expedition, Navigator	140 Pin	B59, B65, E59 B21, B28, E66 B51, B52, B53 B27 B26 B25	ETCRTN ETCREF VPWR APP3 APP2 APP1
Explorer, Explorer Sport Trac, Mountaineer	170 Pin	B43, B6, E59 B24, B4, E66 B35, B36 B28 B17 B5	ETCRTN ETCREF VPWR APP3 APP2 APP1
F-150, Mark LT	190 Pin	B58, B59, E59 B21, B28, E66 B51, B52, B53 B27 B26 B25	ETCRTN ETCREF VPWR APP3 APP2 APP1
Focus	190 Pin	B44, B60, E60 B45, B61, E59 B67, B68 B29 B28	ETCRTN ETCREF VPWR APP2 APP1
Fusion, Milan, MKZ	140 Pin	B59, B60, E59 B21, B28, E66 B51, B52 B27 B26 B25	ETCRTN ETCREF VPWR APP3 APP2 APP1
All other vehicles	190 Pin	B59, B65, E59 B21, B28, E66 B51, B52, B53 B27 B26 B25	ETCRTN ETCREF VPWR APP3 APP2 APP1

DK1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P1575, P2104, P2121, P2122, P2123, P2126, P2127, P2128, P2131, P2132, P2133, or P2138 present?**

Yes	No
	For a lack/loss of power, GO to **DK3**.

For DTC P1575, GO to **DK2**. For all others, GO to **DK4**.	For all others, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DK2 DTC P1575: REPEAT THE KOEO SELF-TEST

NOTE: Make sure the accelerator pedal is not applied during the KOEO self-test.

- Key ON, engine OFF.
- Carry out the KOEO self-test.
- **Are any DTCs present other than P1575?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DK3**.

DK3 CHECK THE ACCELERATOR PEDAL FOR OBSTRUCTION

- Key ON, engine OFF.
- Press the accelerator pedal fully to the floor and release.
- **Does the pedal move freely to the floor and back?**

Yes	No
GO to **DK4**.	ISOLATE and REPAIR the obstruction. CLEAR the DTCs. REPEAT the self-test.

DK4 CHECK THE APP SENSOR SIGNAL VOLTAGE RANGES FOR THE ACCELERATOR PEDAL FULLY APPLIED AND RELEASED POSITIONS

- Access the PCM and monitor the APP1, APP2 and APP3 PIDs.
- Press the accelerator pedal fully to the floor and release.

ACCELERATOR PEDAL FULLY APPLIED VOLTAGE VALUES

Vehicle	APP1	APP2	APP3
E-Series	0.73 - 1.28	3.03 - 4.55	2.59 - 3.89
Expedition, Navigator	0.79 - 2.09	2.75 - 4.33	2.26 - 3.73
Explorer, Explorer Sport Trac, Mountaineer	0.60 - 1.57	3.07 - 4.50	2.57 - 3.89
F-150, Mark	0.60 -	3.07 -	2.57 -

LT	1.57	4.50	3.89
F-Super Duty	0.28 - 0.97	3.45 - 4.71	2.95 - 4.10
Focus	3.69 - 4.60	1.75 - 2.40	-
Fusion, Milan, MKZ	1.20 - 2.50	2.50 - 3.94	2.00 - 3.33
All others	0.48 - 1.76	2.95 - 4.62	2.43 - 4.02

ACCELERATOR PEDAL FULLY RELEASED VOLTAGE VALUES

Vehicle	APP1	APP2	APP3
Focus	0.70 - 0.90	0.30 - 0.50	-
All vehicles	3.43 - 4.69	1.13 - 1.88	0.64 - 1.28

- **Are all APP signals out of range for the pedal fully applied and released positions?**

Yes	No
GO to **DK5**.	For continuous memory DTCs P2121 and P2126 with P2131, GO to **DK24**. For all others, GO to **DK5**.

DK5 CHECK THE VREF VOLTAGE TO APP SENSOR

- Key in OFF position.
- APP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
ETCREF	ETCRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
For E-Series, Explorer, Explorer Sport Trac, F-150, Mark LT, and Mountaineer, GO to **DK6**. For F-Super Duty, GO to **DK7**.	

For Fusion, Milan, and MKZ, GO to **DK10**. For Focus with DTC P2122, P2123, or P2138, GO to **DK12**. For Focus with DTC P2127 or P2128, GO to **DK16**. For all others, GO to **DK11**.	refer to **PINPOINT TEST C**.

DK6 E-SERIES, EXPLORER, EXPLORER SPORT TRAC, F-150, MARK LT, MOUNTAINEER: CHECK THE APP SENSOR FOR THE CORRECT RESISTANCE

NOTE: Make sure the accelerator pedal is fully released when taking the resistance measurements.

- Key in OFF position.
- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Component Side	(-) APP Sensor Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
APP1	ETCREF	550	1,390
APP1	ETCRTN	1,030	2,590
APP1	APP2	2,125	5,335
APP1	APP3	1,930	4,845
APP2	ETCREF	1,785	4,480
APP2	ETCRTN	1,475	3,705
APP2	APP3	2,520	6,330
APP3	ETCREF	1,620	4,070
APP3	ETCRTN	1,135	2,860
ETCREF	ETCRTN	780	1,955
ETCREF	ETCREF	0	10
ETCRTN	ETCRTN	0	10

- **Are all the resistances within specifications?**

Yes	No
For DTCs P2121, P2122 or P2123 alone or in combination, GO to **DK12**. For DTCs P2126, P2127 or P2128 alone or in combination, GO to **DK16**. For DTCs P2131, P2132 or P2133 alone or in combination, GO to **DK20**. For DTC P2104 alone, GO to **DK30**.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal.

For a lack/loss of power, the concern is elsewhere. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction. For all others, GO to **DK24**.	CLEAR the DTCs. REPEAT the self-test.

DK7 F-SUPER DUTY: CHECK THE ACCELERATOR PEDAL CONFIGURATION AND APP SENSOR HOUSING

- Check the configuration of the accelerator pedal and determine the color of the APP sensor housing.
- **Is the vehicle equipped with an adjustable accelerator pedal?**

Yes	No
GO to **DK8**.	For F-Super Duty with a fixed accelerator pedal and a white APP sensor housing, GO to **DK9**. For all others, GO to **DK11**.

DK8 F-SUPER DUTY WITH ADJUSTABLE ACCELERATOR PEDAL: CHECK THE APP SENSOR FOR THE CORRECT RESISTANCE

NOTE: Make sure the accelerator pedal is fully released when taking the resistance measurements.

- Key in OFF position.
- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Component Side	(-) APP Sensor Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
APP1	ETCREF	550	1,390
APP1	ETCRTN	1,030	2,590
APP1	APP2	2,125	5,335
APP1	APP3	1,930	4,845
APP2	ETCREF	1,785	4,480
APP2	ETCRTN	1,475	3,705
APP2	APP3	2,520	6,330
APP3	ETCREF	1,620	4,070
APP3	ETCRTN	1,135	2,860
ETCREF	ETCRTN	780	1,955
ETCREF	ETCREF	0	10
ETCRTN	ETCRTN	0	10

- **Are all the resistances within specifications?**

Yes	No
For DTCs P2121, P2122 or P2123 alone or in combination, GO to **DK12**. For DTCs P2126, P2127 or P2128 alone or in combination, GO to **DK16**. For DTCs P2131, P2132 or P2133 alone or in combination, GO to **DK20**. For DTC P2104 alone, GO to **DK30**. For a lack/loss of power, the concern is elsewhere. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction. For all others, GO to **DK24**.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal. CLEAR the DTCs. REPEAT the self-test.

DK9 F-SUPER DUTY WITH FIXED ACCELERATOR PEDAL AND WHITE APP SENSOR HOUSING: CHECK THE APP SENSOR FOR THE CORRECT RESISTANCE

NOTE: **Make sure the accelerator pedal is fully released when taking the resistance measurements.**

- Key in OFF position.
- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Component Side	(-) APP Sensor Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
APP1	ETCREF	1,080	1,865
APP1	ETCRTN	1,535	2,860
APP1	APP2	2,820	5,225
APP1	APP3	2,775	5,205
APP2	ETCREF	1,995	3,700
APP2	ETCRTN	1,625	3,170
APP2	APP3	3,000	5,835
APP3	ETCREF	1,985	3,735
APP3	ETCRTN	1,440	2,870
ETCREF	ETCRTN	805	1,500
ETCREF	ETCREF	0	10
ETCRTN	ETCRTN	0	10

- **Are all the resistances within specifications?**

Yes	No
For DTCs P2121, P2122 or P2123 alone or in combination, GO to **DK12**. For DTCs P2126, P2127 or P2128 alone or in combination, GO to **DK16**. For DTCs P2131, P2132 or P2133 alone or in combination, GO to **DK20**. For DTC P2104 alone, GO to **DK30**. For a lack/loss of power, the concern is elsewhere. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction. For all others, GO to **DK24**.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal. CLEAR the DTCs. REPEAT the self-test.

DK10 FUSION, MILAN, MKZ: CHECK THE APP SENSOR FOR THE CORRECT RESISTANCE

NOTE: **Make sure the accelerator pedal is fully released when taking the resistance measurements.**

- Key in OFF position.
- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Component Side	(-) APP Sensor Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
APP1	ETCREF	650	1,340
APP1	ETCRTN	1,210	2,470
APP1	APP2	2,430	4,960
APP1	APP3	2,390	4,880
APP2	ETCREF	2,020	4,120
APP2	ETCRTN	1,650	3,380
APP2	APP3	3,000	6,130
APP3	ETCREF	2,010	4,110
APP3	ETCRTN	1,450	2,970
ETCREF	ETCRTN	900	1,840
ETCREF	ETCREF	0	10
ETCRTN	ETCRTN	0	10

- **Are all the resistances within specifications?**

Yes	No

For DTCs P2121, P2122 or P2123 alone or in combination, GO to **DK12**. For DTCs P2126, P2127 or P2128 alone or in combination, GO to **DK16**. For DTCs P2131, P2132 or P2133 alone or in combination, GO to **DK20**. For DTC P2104 alone, GO to **DK30**. For a lack/loss of power, the concern is elsewhere. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction. For all others, GO to **DK24**.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal. CLEAR the DTCs. REPEAT the self-test.

DK11 ALL OTHERS: CHECK THE APP SENSOR FOR THE CORRECT RESISTANCE

NOTE: Make sure the accelerator pedal is fully released when taking the resistance measurements.

- Key in OFF position.
- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Component Side	(-) APP Sensor Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
APP1	ETCREF	600	1,370
APP1	ETCRTN	720	1,660
APP1	APP2	1,300	2,960
APP1	APP3	1,250	2,860
APP2	ETCREF	750	1,720
APP2	ETCRTN	660	1,520
APP2	APP3	1,230	2,810
APP3	ETCREF	710	1,640
APP3	ETCRTN	580	1,340
ETCREF	ETCRTN	200	470
ETCREF	ETCREF	0	10
ETCRTN	ETCRTN	0	10

- **Are all the resistances within specifications?**

Yes	No
For DTCs P2121, P2122 or P2123 alone or in	

combination, GO to **DK12**. For DTCs P2126, P2127 or P2128 alone or in combination, GO to **DK16**. For DTCs P2131, P2132 or P2133 alone or in combination, GO to **DK20**. For DTC P2104 alone, GO to **DK30**. For a lack/loss of power, the concern is elsewhere. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction. For all others, GO to **DK24**.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal. CLEAR the DTCs. REPEAT the self-test.

DK12 CHECK THE APP1 CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- APP Sensor connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APP1	APP1

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DK13**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DK13 CHECK THE APP1 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) Vehicle Battery
APP1	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No

GO to **DK14**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK14 CHECK THE APP1 CIRCUIT FOR A SHORT IN THE HARNESS

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP1	ETCRTN
APP1	ETCREF

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DK15**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK15 CHECK THE APP1 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) APP Sensor Connector, Harness Side	(-) Vehicle Battery
APP1	Negative terminal

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DK24**.

DK16 CHECK THE APP2 CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- APP Sensor connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APP2	APP2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DK17**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DK17 CHECK THE APP2 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
APP2	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DK18**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK18 CHECK THE APP2 CIRCUIT FOR A SHORT IN THE HARNESS

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP2	ETCRTN
APP2	ETCREF

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DK19**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK19 CHECK THE APP2 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
APP2	Negative terminal

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DK25**.

DK20 CHECK THE APP3 CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APP3	APP3

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DK21**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DK21 CHECK THE APP3 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
APP3	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DK22**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK22 CHECK THE APP3 CIRCUIT FOR A SHORT IN THE HARNESS

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP3	ETCRTN
APP3	ETCREF

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DK23**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK23 CHECK THE APP3 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
APP3	Negative terminal

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DK26**.

DK24 CHECK FOR THE APP1 CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

- Key in OFF position.
- PCM connector disconnected.

- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP1	APP2
APP1	APP3
APP1	ETCREF
APP1	ETCRTN

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DK27**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK25 CHECK FOR THE APP2 CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP2	APP1
APP2	APP3
APP2	ETCREF
APP2	ETCRTN

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DK27**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK26 CHECK FOR THE APP3 CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP3	APP1
APP3	APP2
APP3	ETCREF
APP3	ETCRTN

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DK27**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK27 CHECK THE APP SENSOR CIRCUITS FOR AN INTERMITTENT CONCERN

- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APP1	APP1
APP2	APP2
APP3	APP3

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

Yes	No
For Focus, GO to **DK28**. For all others, GO to **DK30**.	ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DK28 CHECK FOR DTCS

- PCM connector connected.
- Key ON, engine OFF.
- Carry out the KOEO self-test.
- **Are DTCs P2122 and P2127 present?**

Yes	No
GO to **DK29**.	GO to **DK30**.

DK29 SIMULATE THE OPPOSITE SIGNAL

- Key in OFF position.
- Connect a 5 amp fused jumper wire between the following:

Point A APP Sensor Connector, Harness Side	Point B APP Sensor Connector, Harness Side
ETCREF	APP1
ETCREF	APP2

- Key ON, engine OFF.
- Access the PCM and monitor the APP1 and APP2 PIDs.
- **Are the voltages greater than 4.5 V?**

Yes	No
INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal. CLEAR the DTCs. REPEAT the self-test.	GO to **DK30**.

DK30 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DL: CYLINDER HEAD TEMPERATURE (CHT) SENSOR

This pinpoint test is intended to diagnose the following:

- cylinder head temperature (CHT) sensor (6G004)
- harness circuits: CHT, VREF, and SIGRTN
- powertrain control module (PCM) (12A650)

On applications that do not use an engine coolant temperature (ECT) sensor, the CHT sensor is used to determine the engine coolant temperature. To cover the entire temperature range of both the CHT and ECT sensors, the PCM has a dual switching resistor circuit on the CHT input. A graph showing the temperature switching from the COLD END line to the HOT END line, with increasing temperature and back with decreasing temperature is included. Note the temperature to voltage overlap zone. Within this zone it is possible to have either a COLD END or HOT END voltage at the same temperature. For example, at 90°C (194°F) the voltage could read either 0.60 volt or 3.71 volts. Refer to the table for the temperature to voltage expected values.

Voltage values calculated for VREF = 5 volts. These values can vary by 15% due to sensor and VREF variations.

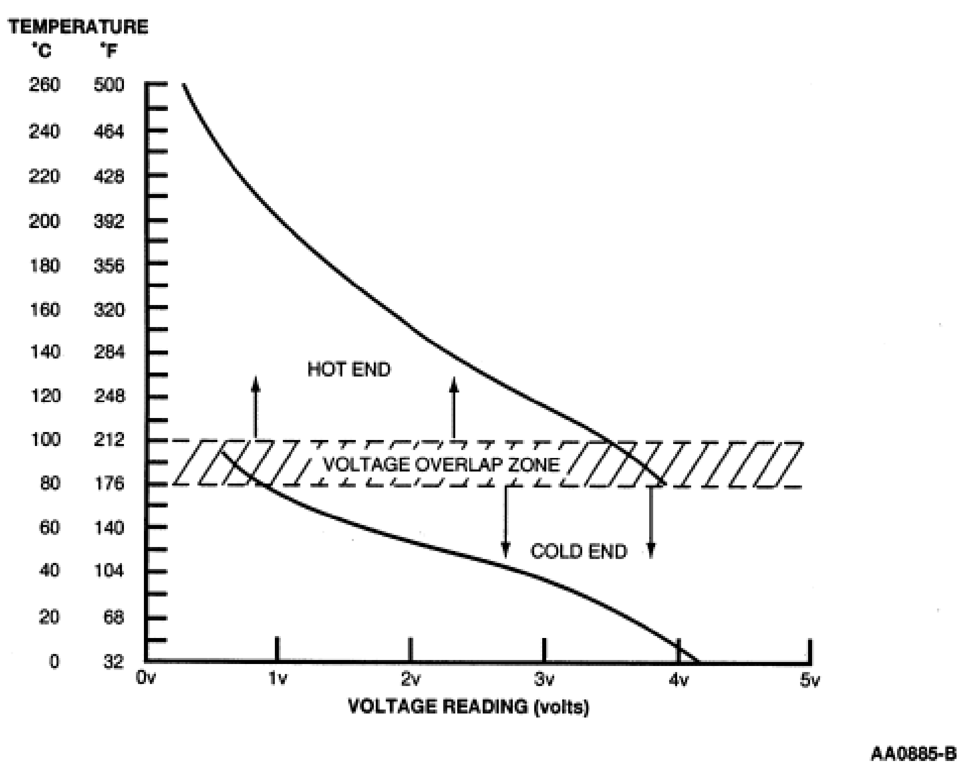

Fig. 50: Cylinder Head Temperature Sensor Voltage Graph
Courtesy of FORD MOTOR CO.

CYLINDER HEAD TEMPERATURE SENSOR EXPECTED VALUES

Temperature		CHT Sensor Values		
°C	°F	Cold End (volts)	Hot End (volts)	Resistance (K ohms)
-40	-40	4.89	-	965.808

-30	-22	4.81	-	513.019
-20	-4	4.67	-	283.664
-10	14	4.45	-	162.584
0	32	4.14	-	96.255
10	50	3.73	-	59.175
20	68	3.26	-	37.387
30	86	2.74	-	24.215
40	104	2.23	-	16.043
50	122	1.76	-	10.85
60	140	1.36	-	7.487
70	158	1.04	-	5.268
80	176	0.79	3.99	3.775
85	185	0.69	3.86	3.215
90	194	0.60	3.71	2.75
95	203	0.53	3.56	2.361
100	212	0.46	3.41	2.034
110	230	-	3.07	1.523
120	248	-	2.74	1.155
130	266	-	2.41	0.8866
140	284	-	2.10	0.6891
150	302	-	1.81	0.5417
160	320	-	1.55	0.4301
170	338	-	1.33	0.3449
180	356	-	1.13	0.2791
190	374	-	0.96	0.2278
200	392	-	0.82	0.1875
210	410	-	0.70	0.155
220	428	-	0.60	0.130
230	446	-	0.51	0.109
240	464	-	0.44	0.092
250	482		0.35	0.078
260	500		0.33	0.067

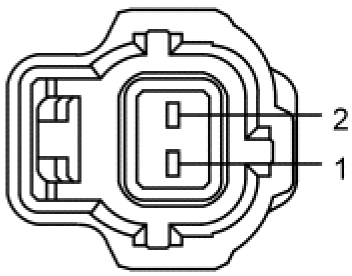

Fig. 51: Cylinder Head Temperature (CHT) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
1	CHT (Cylinder Head Temperature)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B29, B64 E58 E41	VREF SIGRTN CHT
Escape/Mariner	150 (50-50-50) Pin	E40 E41 E33	VREF SIGRTN CHT
Expedition, Fusion, Milan, MKZ, Navigator	140 Pin	E57 E58 E41	VREF SIGRTN CHT
F-150, Mark LT	190 Pin	E57 E58 E41	VREF SIGRTN CHT
Focus	190 Pin	E63 E64 E15	VREF SIGRTN CHT
All other vehicles	170 Pin	E57	VREF

		E58 E41	SIGRTN CHT

DL1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0116, P0119, P0125, P0128, P1116, P1285, P1288, P1289, P128A, P1290, or P1299 present?**

Yes	No
For DTCs P1116 or P1288, GO to **DL2**. For KOEO and KOER DTCs P1289 or P1290, GO to **DL8**. For continuous memory DTCs P0119, P1289, P128A, or P1290, GO to **DL15**. For KOEO or continuous memory DTC P1299, GO to **DL21**. For continuous memory DTCs P0125 or P0128, GO to **DL22**. For continuous memory DTC P0116, GO to **DL24**. For DTC P1285, GO to **DL18**.	For Temperature Warning Indicator Lamp or Gauge (applications with CHT sensor only) symptom, GO to **DL29**. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DL2 SELF-TEST DTCS P1288 OR P1116: CHECK THE COOLING SYSTEM

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

- The DTC indicates the temperature sensor is out of self-test range. The engine is not at normal operating temperature.
- Check the vehicle coolant level.
- **Is the cooling system OK?**

Yes	No
GO to **DL3**.	REFER to the **ENGINE COOLING -- E-SERIES** , for loss of coolant diagnosis. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL3 CHECK IF THE VEHICLE ENGINE STARTS

- Attempt to start the engine.
- **Does the engine start and run normally?**

Yes	No
GO to **DL6**.	GO to **DL4**.

DL4 CHECK THE RESISTANCE OF THE CHT SENSOR WITH THE ENGINE OFF

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to **DL5**.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DL5 CHECK THE CIRCUIT FROM THE MODULE TO THE COMPONENT

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- CHT Sensor connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the CHT PID.
- Using the data collected from the previous step, compare temperature resistance measured at the sensor to the PID temperature voltage measured at the PCM.
- **Does the measured value at the sensor agree with measured PID value at the PCM?**

Yes	No
The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** , for further direction.	GO to **DL12**.

DL6 CHECK THE CHT SENSOR OPERATION

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Carry out the PCM self-test.
- **Are DTCs P1116 or P1288 present?**

Yes	No
GO to **DL7**.	The engine temperature was not stabilized. REPAIR any other DTCs as necessary.

DL7 CHECK THE RESISTANCE OF THE CHT SENSOR

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- The vehicle must be at normal operating temperature.
- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to **DL31**.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DL8 DTCS P1289 OR P1290: ACCESS THE CHT PID AND CHECK THE VOLTAGE

- Key ON, engine OFF.
- Access the PCM and monitor the CHT PID.
- **Is the voltage less than 0.2 V?**

Yes	No

GO to **DL9**.	GO to **DL10**.

DL9 CHECK FOR A GROUNDED CIRCUIT

- CHT Sensor connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the CHT PID.
- **Is the voltage greater than 4.6 V?**

Yes	No
INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DL14**.

DL10 CHECK THE CHT CIRCUIT FOR A SHORT TO VOLTAGE

- CHT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CHT Sensor Connector, Harness Side	(-)
CHT - Pin 1	Ground

- **Is the voltage greater than 5.5 V?**

Yes	No
REPAIR the short circuit to PWR. CHECK the CHT sensor for damage. GO to **DL11**.	GO to **DL11**.

DL11 CHECK THE RESISTANCE OF THE CHT SENSOR WITH THE ENGINE OFF

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to **DL12**.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DL12 CHECK THE SIGNAL AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
CHT - Pin 1	CHT
SIGRTN - Pin 2	SIGRTN

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

Yes	No
GO to **DL13**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DL13 CHECK THE SENSOR SIGNAL FOR A SHORT TO VREF

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
CHT	VREF

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DL31**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DL14 CHECK THE SENSOR SIGNAL FOR A SHORT TO GROUND

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
CHT	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) 12 Volt Vehicle Battery
CHT	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DL31**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DL15 DTCS P0119, P1289, P1290 OR P128A: INTERMITTENT CHECK

- Key ON, engine OFF.
- Access the PCM and monitor the CHT PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector
- **Is there a large change in the voltage reading?**

Yes	No
DISCONNECT and INSPECT the connector. If OK, INSTALL a new CHT sensor. REFER to the	

ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES . CLEAR the DTCs. REPEAT the self-test.	GO to **DL16**.

DL16 CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

- Access the PCM and monitor the CHT PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there a large change in the voltage reading?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DL17**.

DL17 CHECK THE PCM AND VEHICLE HARNESS CONNECTORS

- PCM connector disconnected.
- CHT Sensor connector disconnected.
- **Are the connectors and terminals OK?**

Yes	No
GO to **DL31**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL18 SELF-TEST DTC P1285: EARLY WARNING OF ENGINE OVERHEAT CONDITION

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

NOTE: If the electric cooling fan does not operate, return toDIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS for electric cooling fan DTC. Return toNO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX for symptom diagnosis.

- An engine overheat condition is sensed by the CHT sensor.
- Check the cooling system for:
  - correct coolant level
  - internal or external coolant leaks

  - blockage of the radiator
  - cooling fan operation
- **Is the cooling system OK?**

Yes	No
GO to **DL19**.	REFER to the **ENGINE COOLING -- E-SERIES** , for loss of coolant diagnosis. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL19 CHECK THE OPERATION OF THE CYLINDER HEAD TEMPERATURE SENSOR

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Carry out the self-test.
- **Is DTC P1285 present?**

Yes	No
GO to **DL20**.	An engine overheat temperature was not detected. REPAIR any other DTCs as necessary.

DL20 CHECK THE RESISTANCE OF THE CHT SENSOR

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- The vehicle must be at normal operating temperature.
- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to **DL31**.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** .

	CLEAR the DTCs. REPEAT the self-test.

DL21 SELF-TEST DTC P1299: INDICATES AN ENGINE OVERHEAT CONDITION

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

NOTE: Refer to DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS for possible causes and additional DTC description information.

- Check the engine coolant level.
- **Is the engine coolant fill level correct?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the engine overheating condition. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the loss of coolant. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL22 SELF-TEST DTCS P0125 OR P0128: CHECK THE ENGINE COOLANT LEVEL

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

NOTE: DTC P0125 or P0128 indicates the engine coolant temperature has not achieved the required engine operation temperature level, since start-up within a specified amount of time.

- Check the engine coolant level.
- **Is the engine coolant fill level correct?**

Yes	No
GO to **DL23**.	REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the loss of coolant. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL23 CHECK THE SENSOR OPERATION

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Access the PCM and monitor the CHT PID.
- **Is the temperature greater than 77°C (170.6°F)?**

Yes	No
The test is complete. CLEAR the DTCs. REPEAT the self-test.	REFER to the **ENGINE COOLING -- E-SERIES** to diagnosis engine not reaching normal operating temperature. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL24 DTC P0116: CHECK THE RESISTANCE OF THE CHT SENSOR WITH THE ENGINE OFF

NOTE: **Verify the engine temperature is at ambient room temperature before continuing with this test. A soak period of 6 hours may be required. Refer toDIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS for information concerning P0116.**

- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- Refer to the chart at the beginning of this test for the resistance specifications.
- **Is the resistance within specification?**

Yes	No
GO to **DL25**.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DL25 DTC P0116: CHECK THE RESISTANCE OF THE CHT SENSOR

NOTE: **Verify the engine is at operating temperature before taking the CHT reading.**

- CHT Sensor connector connected.
- Run the engine until the engine temperature stabilizes.
- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- Refer to the chart at the beginning of this test for the resistance specifications.
- **Is the resistance within specification?**

Yes	No
The concern is not present at this time. CARRY OUT the OBD drive cycle to determine if fuel, HO2S, catalyst and misfire monitors can be executed. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . REPEAT the PCM self-test if necessary.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DL26 DTC P0298: ENGINE OIL OVER TEMPERATURE CONDITION

NOTE: **The engine oil temperature protection strategy in the PCM has been activated. This protects the engine against mechanical damage due to overheating. Refer toDIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS for possible causes and additional DTC description information.**

- Check for an overheating condition and base engine concerns.
- **Are there any overheating or base engine concerns?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DL27**.

DL27 CHECK FOR CHT DTCS

- Carry out the self-test.
- **Are DTCs P1285, P1288, P1289 or P1299 present?**

Yes	No
DISREGARD the engine oil temperature (EOT) diagnostic trouble code (DTC) at this time. ADDRESS the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DL28**.

DL28 ROAD TEST THE VEHICLE AND MONITOR FOR ENGINE OVER TEMPERATURE

- Access the freeze frame data (if available) and record the DTC malfunction conditions.
- Access the PCM and monitor the CHT PID.
- Test drive the vehicle and allow the engine to reach normal operating temperature.
- Observe CHT PID.
- **Does the engine overheat?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the overheat symptom. REPAIR as necessary. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time.

DL29 ENGINE TEMPERATURE WARNING INDICATOR LAMP ON OR TEMPERATURE GAUGE INDICATES HOT, BUT ENGINE IS NOT OVERHEATING

NOTE: The PCM self-test must be carried out prior to entering this pinpoint test.

- **Was the PCM self-test carried out prior to entering this pinpoint test?**

Yes	No
GO to **DL30**.	The concern is elsewhere. RETURN to**PINPOINT TEST QT** for further direction.

DL30 ENGINE TEMPERATURE INDICATOR LAMP ON OR TEMPERATURE GAUGE INDICATES HOT WITH NO DTCS

NOTE: The engine temperature warning indicator (gauge or lamp) is a warning system that gives the driver information during an engine overheating condition. The PCM monitors the CHT sensor and determines if fail-safe cooling mode is needed. If fail-safe cooling mode is needed, the PCM sends a controller area network (CAN) message to the instrument cluster to signal an overheating condition. This causes the instrument cluster indicator to illuminate and forces the temperature gauge to the H (hot) zone. DTC P1285 is stored in the PCM.

NOTE: For Engine Temperature Warning Indicator system problems, refer to the INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES .

- PCM connector disconnected.
- Key ON, engine OFF.
- **Does the engine temperature warning indicator lamp turn OFF (prove out) and\or the temperature gauge return to the normal zone with the PCM disconnected?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the overheat symptom. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	REFER to the **INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES** to diagnose the incorrect temperature gauge. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL31 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DM: MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

This pinpoint test is intended to diagnose the following:

- manifold absolute pressure (MAP) sensor (9F479)
- harness circuits: MAP, SIGRTN, VREF
- powertrain control module (PCM) (12A650)

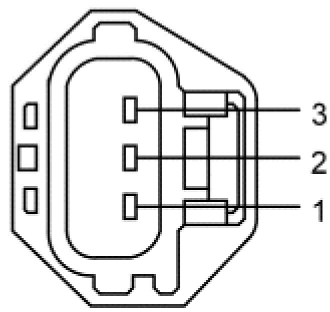

Fig. 52: Manifold Absolute Pressure (MAP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

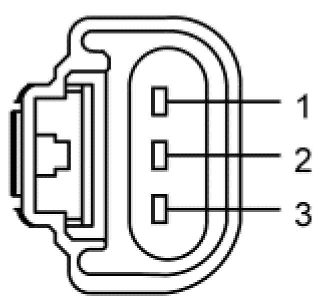

Fig. 53: Manifold Absolute Pressure (MAP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

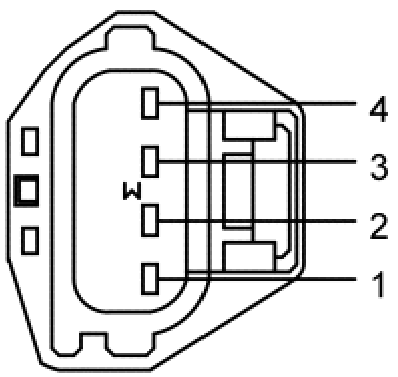

Fig. 54: Manifold Absolute Pressure (MAP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 3.0L	A	2 3 1	MAP SIGRTN VREF
Fusion 3.0L, Milan 3.0L	B	1 2 3	MAP SIGRTN VREF
All other vehicles	C	1 4 2	MAP SIGRTN VREF

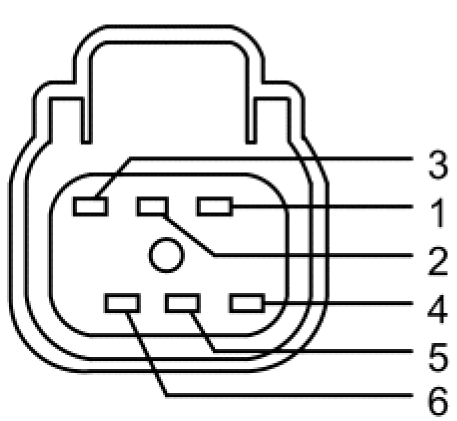

Fig. 55: EGR System Module (ESM) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	VPWR (Vehicle Power)
3	MAP (Manifold Absolute Pressure)
6	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B35, B36 B40, E40 B41, E41, T41 E23	VPWR VREF SIGRTN MAP
F-150	190 Pin	B51, B52, B53 B29, E57 B58, E58, T43 E62	VPWR VREF SIGRTN MAP
Focus	190 Pin	B67, B68 B52, B66, E63 B58, E64, T40 E40	VPWR VREF SIGRTN MAP
Fusion, Milan	140 Pin	B51, B52 B33, E57 B58, E58 E62	VPWR VREF SIGRTN MAP
All other vehicles	170 Pin	B35, B36 B40, E57 B41, E58, T41 E62	VPWR VREF SIGRTN MAP

DM1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0106, P0107, P0108, P0109, P012B, P012C, P012D, or P012E present?**

Yes	No
For vehicles with an EGR system module (ESM), KOEO, KOER DTCs P0107, P0108, P012C, or P012D. GO to **DM2**. For vehicles without an EGR system module (ESM), any DTC P0106, KOEO, KOER DTCs P0107 or P0108, GO to **DM20**. For vehicles with an EGR system module (ESM) continuous memory DTCs P0107, P0108, P012C, P012D or KOEO P0109, or P012E. GO to **DM14**. For vehicles without an EGR system module (ESM)	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

continuous memory DTCs P0107, P0108, or KOEO P0109, GO to **DM26**. For vehicles with an EGR system module (ESM) DTC P0106, or P012B. GO to **DM15**.	

DM2 DTCS P0107 AND P0108: MONITOR THE MAP PID

- Key ON, engine running.
- Carry out the KOER self-test.
- Access the PCM and monitor the MAP PID.
- **Is the voltage between 0.05 - 4.95 V?**

Yes	No
VERIFY the PCM is at the latest calibration level. REPROGRAM if necessary. If the PCM is at the latest calibration level, the concern is not present at this time.	GO to **DM3**.

DM3 VERIFY HARNESS AND CONNECTOR INTEGRITY

- Key in OFF position.
- ESM connector disconnected.
- Carry out a thorough visual inspection of the connector, pins and wires attaching to the pins.
- **Are there any concerns with the wiring or the ESM connection?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DM4**.

DM4 MONITOR THE MAP PID

- ESM connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- **Is the voltage between 0.05 - 4.95 V?**

Yes	No
The concern is not present at this time. CLEAR the DTCs. REPEAT the self-test.	GO to **DM5**.

DM5 DETERMINE THE PRESENT MAP PID VOLTAGE

- Access the PCM and monitor the MAP PID.

- **Is the voltage less than 0.05 V?**

Yes	No
GO to **DM6**.	GO to **DM9**.

DM6 KOEO AND KOER DTC P0107: CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE ESM HARNESS CONNECTOR

- ESM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 6

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to **DM7**.	refer to **PINPOINT TEST C**.

DM7 CHECK THE MAP CIRCUIT FOR A SHORT TO SIGRTN AND GND IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) ESM Connector, Harness Side	(-)
MAP - Pin 3	Ground

- Measure the resistance between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP - Pin 3	SIGRTN - Pin 6

- **Is the resistance greater than 10K ohms?**

Yes	No

GO to **DM8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DM8 INDUCE THE OPPOSITE MAP SENSOR VOLTAGE TO SIMULATE A HIGH CONDITION

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A ESM Connector, Harness Side	Point B ESM Connector, Harness Side
MAP - Pin 3	VREF - Pin 2

- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- **Is the voltage greater than 4.6 V?**

Yes	No
INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DM27**.

DM9 KOEO AND KOER DTC P0108: CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE ESM HARNESS CONNECTOR

- ESM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 6

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to **DM10**.	refer to **PINPOINT TEST C**.

DM10 CHECK THE MAP AND SIGRTN CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP	MAP - Pin 3
SIGRTN	SIGRTN - Pin 6

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

Yes	No
GO to **DM11**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DM11 CHECK THE MAP CIRCUIT FOR A SHORT TO VREF IN THE HARNESS

- Measure the resistance between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP - Pin 3	VREF - Pin 2

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DM12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DM12 CHECK THE MAP CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Measure the resistance between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP - Pin 3	VPWR - Pin 4

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DM13**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DM13 INDUCE THE OPPOSITE MAP SENSOR VOLTAGE TO SIMULATE A LOW CONDITION

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A ESM Connector, Harness Side	Point B ESM Connector, Harness Side
MAP - Pin 3	SIGRTN - Pin 6

- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- **Is the voltage less than 0.1 V?**

Yes	No
INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DM27**.

DM14 DTCS P0107, P0108 AND P0109: CHECK THE MAP CIRCUIT(S) FOR INTERMITTENT CONCERNS

- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- Carry out a thorough wiggle test on the ESM harness.
- Lightly tap on the ESM and wiggle the harness connector to simulate road shock.
- **Does a sudden change in voltage occur while monitoring the PID?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DM15 DTC P0106: MAP RANGE/PERFORMANCE

NOTE: **If MAP DTC(s) P0107, P0108 or P0109 are present, diagnose those DTC(s) first. If any mass air flow (MAF) sensor related DTCs are present, diagnose those DTCs prior to diagnosing MAP DTC P0106. Disregard any DTC(s) generated as a result of this test.**

- Key in OFF position.
- ESM connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A ESM Connector, Harness Side	Point B ESM Connector, Component Side
VREF - Pin 2	VREF - Pin 2
SIGRTN - Pin 6	SIGRTN - Pin 6

- Key ON, engine running.
- Measure the voltage between:

(+) ESM Connector, Component Side	(-) Vehicle Battery
MAP - Pin 3	Negative terminal

- **Is the voltage between 1 - 2 V?**

Yes	No
GO to **DM19**.	GO to **DM16**.

DM16 CHECK THE MAP CIRCUIT FOR AN OPEN IN THE ESM HARNESS

- Key in OFF position.
- Remove the jumper wires.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP	MAP - Pin 3

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DM17**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DM17 CHECK THE MAP CIRCUIT FOR A SHORT IN THE ESM HARNESS

- Measure the resistance between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP - Pin 3	SIGRTN - Pin 6
MAP - Pin 3	VREF - Pin 2
MAP - Pin 3	VPWR - Pin 4

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DM18**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DM18 KOEO AND KOER MAP VOLTAGE

NOTE: The MAP PID should change by at least 1.5 volts from key on engine off to key on engine running.

- Key in OFF position.
- ESM connector connected.
- PCM connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- Record the KOEO MAP voltage.
- Key ON, engine running.
- Access the PCM and monitor the MAP PID.
- Record the KOER MAP voltage.
- **Does the MAP PID value change?**

Yes	No
GO to **DM19**.	CHECK the MAP hose for freezing or obstructions. If OK, INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DM19 COMPARE ACTUAL MAP VOLTAGE TO MAP PID VOLTAGE

- Key in OFF position.
- ESM connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

	Point B ESM

Point A ESM Connector, Harness Side	Connector, Component Side
VREF - Pin 2	VREF - Pin 2
SIGRTN - Pin 6	SIGRTN - Pin 6
MAP - Pin 3	MAP - Pin 3

- Measure the voltage between:

(+) ESM Connector, Harness Side	(-)
MAP - Pin 3	Ground

- Record the actual MAP voltage values at key on engine off, idle, 1,000 and 2,000 RPM.
- Access the PCM and monitor the MAP PID.
- Record the MAP PID voltage values at key on engine off, idle, 1,000 and 2,000 RPM.
- **Does the MAP PID voltage stay within 0.5 volt of the actual MAP voltage?**

Yes	No
The concern is not present at this time. CLEAR the DTCs. REPEAT the self-test.	CARRY OUT a visual inspection. CHECK for loose connections, and damaged or corroded pins. WIGGLE the harness, attempting to RECREATE the concern. CLEAR the DTCs. REPEAT the self-test.

DM20 KOEO AND KOER DTCS P0106, P0107 AND P0108: CHECK THE VOLTAGE BETWEEN VREF AND SIGRTN AT THE MAP SENSOR

- MAP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MAP Sensor Connector, Harness Side	(-) MAP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **DM22**.	GO to **DM21**.

DM21 CHECK FOR VREF VOLTAGE AT THE SENSOR

- Measure the voltage between:

(+) MAP Sensor Connector, Harness Side	(-) Vehicle Battery
VREF	Negative terminal

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
REPAIR the open SIGRTN circuit. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST C**.

DM22 CHECK MAP SIGNAL VOLTAGE AT THE SENSOR

- Measure the voltage between:

(+) MAP Sensor Connector, Harness Side	(-) MAP Sensor Connector, Harness Side
MAP	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **DM24**.	GO to **DM23**.

DM23 CHECK THE MAP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) MAP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
MAP	MAP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DM24**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DM24 CHECK THE MAP CIRCUIT FOR A SHORT TO VOLTAGE OR SIGRTN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
MAP	VREF
MAP	SIGRTN
MAP	VPWR

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DM25**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DM25 INDUCE THE OPPOSITE SIGNAL

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A MAP Sensor Connector, Harness Side	Point B MAP Sensor Connector, Harness Side
MAP	SIGRTN

- Access the PCM and monitor the MAP PID.
- **Is the voltage less than 0.1 V?**

Yes	No
INSTALL a new MAP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** .	GO to **DM27**.

CLEAR the DTCs. REPEAT the self-test.	

DM26 DTCS P0107, P0108 AND P0109: CHECK THE MAP CIRCUIT(S) FOR INTERMITTENT CONCERNS

- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- Carry out a thorough wiggle test on the MAP harness.
- Lightly tap on the MAP and wiggle the harness connector to simulate road shock.
- **Does a sudden change in voltage occur while monitoring the PID?**

Yes	No
GO to **DM20**.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DM27 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DP: OUTPUT SHAFT SPEED (OSS) SENSOR/VEHICLE SPEED SENSOR (VSS)/TRANSFER CASE SPEED SENSOR (TCSS)

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- OSS/VSS/TCSS (7F293/7M101/7H103)
- harness circuits: OSS/VSS, TCSS, and SIGRTN

- powertrain control module (PCM) (12A650)

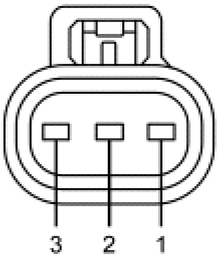

Fig. 56: Output Shaft Sensor/Vehicle Speed Sensor (OSS/VSS) Connector - A
Courtesy of FORD MOTOR CO.

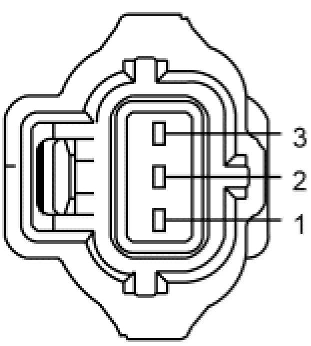

Fig. 57: Output Shaft Sensor/Vehicle Speed Sensor (OSS/VSS) Connector - B
Courtesy of FORD MOTOR CO.

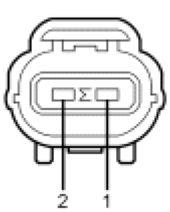

Fig. 58: Output Shaft Sensor/Vehicle Speed Sensor (OSS/VSS) Connector - C
Courtesy of FORD MOTOR CO.

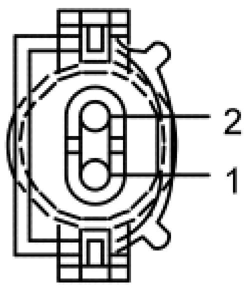

Fig. 59: Output Shaft Sensor/Vehicle Speed Sensor (OSS/VSS) Connector - D
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
F-Super Duty	A	3 2 1	SIGRTN OSS/VSS VPWR
Focus	B	2 1 3	OSS/VSS PWRGND VPWR
Fusion 2.3L, Milan 2.3L	C	2 1	SIGRTN OSS/VSS
Mustang	D	2 1	SIGRTN OSS/VSS
All other vehicles	D	1 2	SIGRTN OSS/VSS

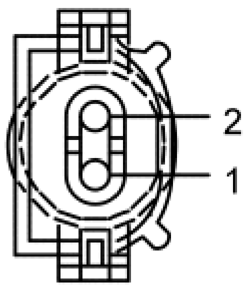

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Fig. 60:
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	TCSS (Transfer Case Speed Sensor)
1	SIGRTN (Signal Return)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B35 B47, B48, B49, B50 B41, E41, T41 T4	VPWR PWRGND SIGRTN OSS/VSS
F-150 4.2L	190 Pin	B51 B67, B68, B69, B70 B58, E58, T43 T14	VPWR PWRGND SIGRTN OSS/VSS
F-Super Duty, Mustang, Ranger	170 Pin	B35 B47, B48, B49, B50 B41, E58, T41 T3	VPWR PWRGND SIGRTN OSS/VSS
Focus	190 Pin	B67 B69, B70 B58, E64, T40 T2	VPWR PWRGND SIGRTN OSS/VSS
Fusion, Milan	140 Pin	B51 B67, B68, B69 B58, E58 B65	VPWR PWRGND SIGRTN OSS/VSS

All other vehicles	190 Pin	B51 T16 B67, B68, B69, B70 B58, E58, T43	VPWR TCSS PWRGND SIGRTN

DP1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

NOTE: For vehicles with automatic transmission and output shaft speed (OSS) sensor DTCs, refer to the DIAGNOSTIC METHODS -- GASOLINE ENGINES .

- **Are DTCs P0500, P0503, P0720, P0721, P0722, P0723, P1500, P1501, P1502 or P1900 present?**

Yes	No
For DTCs P0500, P0503, P1500, P1501 or P1502, with manual shift transfer case, GO to **DP16**. For DTCs P0500, P0720, P0721, P0722, P0723, P1502 or P1900, with a manual transmission or an electronic shift transfer case, GO to **DP2**. For DTCs P0503 or P1500, with a manual transmission or an electronic shift transfer case, GO to **DP13**. For DTC P1501, with a manual transmission or an electronic shift transfer case, GO to **DP12**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DP2 DTCS P0500, P0720, P0721, P0722, P0723, P1502 AND P1900: VERIFY THE DRIVE CYCLE

- Access the PCM and monitor the OSS PID.
- Access the PCM and monitor the VSS PID.
- Drive the vehicle.
- Monitor the PID in all transmission gear ranges while increasing and decreasing the speed.
- **Does the PID reading increase and decrease with engine and vehicle speed?**

Yes	No
GO to **DP3**.	GO to **DP4**.

DP3 VISUAL INSPECTION

- OSS/VSS connector disconnected.
- Inspect the OSS/VSS harness for damage.
- Inspect the OSS/VSS vehicle harness connector for damage and proper seating.
- If possible, carry out a wiggle test.

- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

DP4 VERIFY THE TYPE OF OSS/VSS SENSOR

NOTE: The variable reluctance (VR) sensors have 2-wire connectors, Hall-effect sensors have 3-wire connectors.

- Key in OFF position.
- Inspect for a Hall-effect or a VR type of OSS/VSS sensor.
- **Is this a Hall-effect type OSS/VSS sensor?**

Yes	No
GO to **DP5**.	GO to **DP7**.

DP5 CHECK VOLTAGE TO THE OSS/VSS SENSOR

- Key in OFF position.
- OSS/VSS connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) OSS/VSS Connector, Harness Side	(-) Vehicle Battery
VPWR	Negative terminal

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

Yes	No
GO to **DP6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DP6 CHECK THE VPWR GROUND TO THE OSS/VSS SENSOR

- Key in OFF position.
- Measure the resistance between:

(+) OSS/VSS	

Connector, Harness Side	(-) Vehicle Battery
PWRGND	Negative terminal

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DP7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DP7 CHECK THE OSS/VSS CIRCUIT FOR A SHORT TO VREF AND VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- OSS/VSS connector disconnected.
- Measure the voltage between:

(+) OSS/VSS Connector, Harness Side	(-) Vehicle Battery
OSS/VSS	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to **DP8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DP8 CHECK THE OSS/VSS CIRCUIT(S) FOR AN OPEN IN THE HARNESS

NOTE: Hall-effect sensors are not equipped with a SIGRTN circuit. Disregard the SIGRTN measurement.

- Key in OFF position.
- PCM connector disconnected.
- OSS/VSS connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) OSS/VSS Connector, Harness Side
OSS/VSS	OSS/VSS

SIGRTN	SIGRTN
PWRGND	PWRGND

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

Yes	No
GO to **DP9**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DP9 CHECK THE OSS/VSS CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) OSS/VSS Connector, Harness Side	(-) OSS/VSS Connector, Harness Side
OSS/VSS	PWRGND

- **Is the resistance greater than 10K ohms?**

Yes	No
For Hall-effect sensors, GO to **DP10**. For VR sensors, GO to **DP11**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DP10 CHECK THE OSS/VSS SIGNAL OUTPUT TO THE PCM, HALL-EFFECT TYPE SENSOR

NOTE: The opposite wheel must be held stationary.

- PCM connector disconnected.
- Raise the vehicle to allow for the rotation of the front drive wheels.
- Key ON, engine OFF.
- Transmission gear selector in NEUTRAL.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
OSS/VSS	PWRGND

- The voltage should rise above 5 volts and fall below 1 volt in a regular cycle. Observe several cycles.
- **Does the OSS/VSS output voltage rise and fall as specified?**

Yes	No

GO to **DP22**.	REMOVE the OSS/VSS sensor and inspect the target wheel. REPAIR as necessary. If OK, INSTALL a new OSS/VSS sensor. REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DP11 CHECK THE RESISTANCE OF THE OSS/VSS SENSOR

- Measure the resistance between:

(+) OSS/VSS Connector, Component Side	(-) OSS/VSS Connector, Component Side
OSS/VSS	SIGRTN

- **Is the resistance between 170 - 270 ohms (VSS) or 400 - 1.25K ohms (OSS)?**

Yes	No
GO to **DP22**.	REMOVE the OSS/VSS sensor and inspect the target wheel. REPAIR as necessary. If OK, INSTALL a new OSS/VSS sensor. REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DP12 KOER DTC P1501: CHECK THE VSS PID FOR AN INPUT SIGNAL

- Key ON, engine running.
- Access the PCM and monitor the VSS PID.
- Observe the VSS input to the PCM.
- Increase the engine speed, not greater than 2,000 RPM, several times while observing the VSS PID.
- **Is the reading on the PID less than 5 km/h (3 mph)?**

Yes	No
Unable to duplicate or identify the concern at this time. REFER to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** for possible causes and additional DTC description information. If DTC P1501 still exists, refer to **PINPOINT TEST Z**.	GO to **DP15**.

DP13 DTCS P0503 AND P1500: INSPECT THE VSS AND THE CIRCUIT FOR AN INTERMITTENT

- Visually inspect the VSS and harness circuits for any potential failures.
- Use the following check list for reference:
  - loose wires/connectors
  - pushed out connector pins
  - damaged wiring harness insulation
  - incorrect harness routing
  - incorrect VSS mounting
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DP14**.

DP14 CHECK THE PCM VSS PID FOR AN INPUT SIGNAL

NOTE: For scan tools which have a data record feature, record the data for future playback to help identify any variations.

- Access the PCM and monitor the VSS PID.
- Drive the vehicle at several steady state speeds above and below 50 km/h (30 mph).
- **Are there any indicators of a noisy or intermittent signal with the VSS PID?**

Yes	No
GO to **DP15**.	Unable to duplicate or identify the concern at this time. REPAIR any other DTCs. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.

DP15 CHECK THE VSS HARNESS ROUTING

NOTE: Refer to Pinpoint Test Schematic and Connectors at the beginning of this pinpoint test.

- Check the VSS harness routing:
  - Verify the harness is not routed adjacent to any high current wires such as ignition wires or generator wiring.
  - Verify the VSS harness is shielded and grounded, if applicable.
- Measure the resistance of the VSS harness.
- **Is a concern present?**

Yes	No

REPAIR as necessary.	Unable to duplicate or identify the concern at this time. REFER to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** for possible causes and additional DTC description information. refer to **PINPOINT TEST Z**.

DP16 DTCS P0500, P0503, P1500, P1501 AND P1502: VISUAL INSPECTION OF TCSS

NOTE: The TCSS provides the rotational speed of the output shaft of the transfer case.

The PCM uses this information to control the powertrain behavior and on some applications it is used as the source for the vehicle speed information.

- TCSS connector disconnected.
- Inspect the TCSS vehicle harness connector for damage and proper seating.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DP17**.

DP17 CHECK THE RESISTANCE OF THE TCSS

- Measure the resistance between:

(+) TCSS Connector, Component Side	(-) TCSS Connector, Component Side
SIGRTN - Pin 1	TCSS - Pin 2

- **Is the resistance between 1K - 1.25K ohms?**

Yes	No
GO to **DP18**.	INSTALL a new TCSS. REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DP18 CHECK THE TCSS SENSOR OUTPUT

NOTE: The opposite wheel must be held stationary.

- With the vehicle in NEUTRAL and the parking brake off, position it on a hoist. Refer to the **JACKING AND LIFTING -- E-SERIES** for the locations of the lifting points.
- Raise the vehicle.
- Measure the frequency between:

(+) TCSS Connector, Component Side	(-) TCSS Connector, Component Side
SIGRTN - Pin 1	TCSS - Pin 2

- Monitor the TCSS signal while rotating the driven wheel as fast as possible.
- **Does the frequency reading increase and decrease with the wheel speed?**

Yes	No
GO to **DP19**.	REMOVE the TCSS and inspect the target wheel. REPAIR as necessary. If OK, INSTALL a new TCSS sensor. REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DP19 CHECK THE TCSS CIRCUIT(S) FOR A SHORT TO GROUND AND VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- TCSS connector disconnected.
- Measure the voltage between:

(+) TCSS Connector, Harness Side	(-)
TCSS - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **DP20**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DP20 CHECK THE CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) TCSS Connector, Harness Side
TCSS	TCSS - Pin 2
SIGRTN	SIGRTN - Pin 1

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

Yes	No
GO to **DP21**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DP21 CHECK THE HARNESS FOR A SHORT TO GROUND

- Measure the resistance between:

(+) TCSS Connector, Harness Side	(-) TCSS Connector, Harness Side
SIGRTN - Pin 1	TCSS - Pin 2

- Measure the resistance between:

(+) TCSS Connector, Harness Side	(-)
TCSS - Pin 2	Ground

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DP22**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DP22 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.

- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DR: CAMSHAFT POSITION (CMP) SENSOR

This pinpoint test is intended to diagnose the following:

- camshaft position (CMP) sensor (6B288)
- harness circuits: CMP, CMP2, SIGRTN, VBPWR, VRSRTN, and VRSRTN2
- powertrain control module (PCM) (12A650)

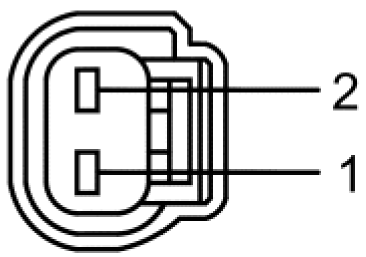

Fig. 61: Camshaft Position (CMP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

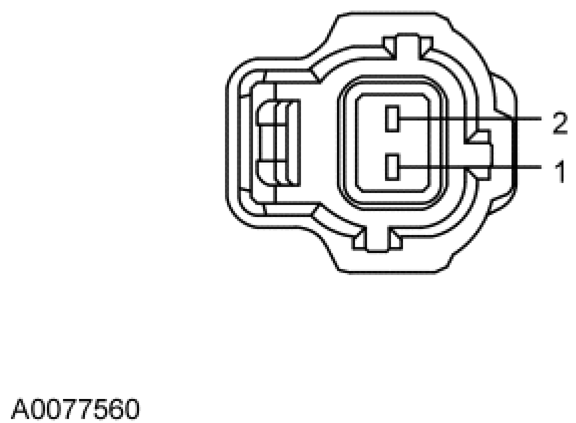

Fig. 62: Camshaft Position (CMP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

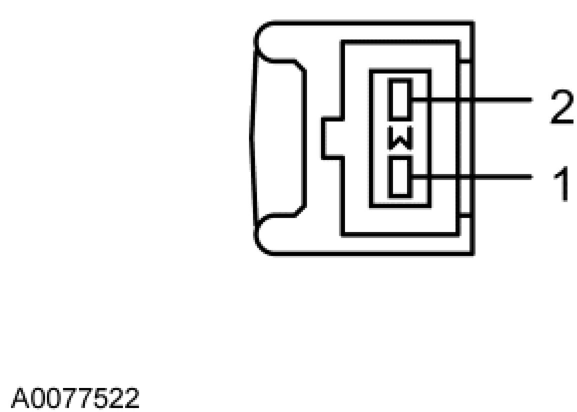

Fig. 63: Camshaft Position (CMP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

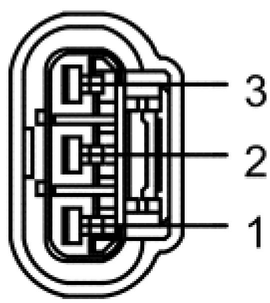

Fig. 64: Camshaft Position (CMP) Sensor Connector - D
Courtesy of FORD MOTOR CO.

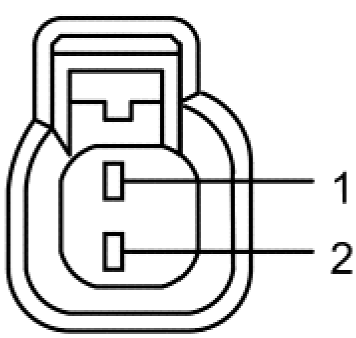

Fig. 65: Camshaft Position (CMP) Sensor Connector - E
Courtesy of FORD MOTOR CO.

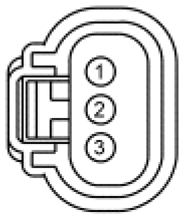

Fig. 66: Camshaft Position (CMP) Sensor Connector - F
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Expedition, F-150 4.6L, F-150 5.4L, Mark LT, MKX, MKZ, Navigator, Sable, Taurus, Taurus X	A	1 2	VRSRTN CMP
Escape/Mariner 2.3L, Ranger 2.3L	B	1 2	SIGRTN CMP
Explorer 4.0L, Explorer Sport Trac 4.0L, Mountaineer 4.0L, Mustang 4.0L, Ranger 4.0L	C	2 1	SIGRTN CMP
Fusion 2.3L, Milan 2.3L	D	1 3 2	VBPWR SIGRTN CMP
Fusion 3.0L, Milan 3.0L	E	2 1	VRSRTN CMP
F-150 4.2L	D	3 1 2	PWRGND VPWR CMP
Focus	F	1	VBPWR

		3 2	SIGRTN CMP
All other vehicles	A	1 2	SIGRTN CMP

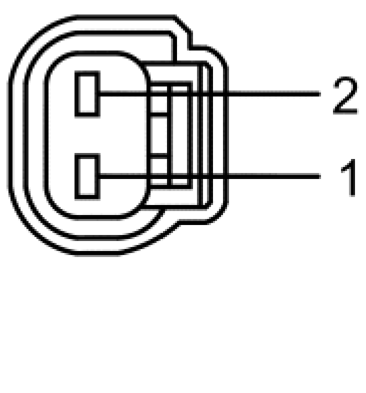

Fig. 67: Camshaft Position 2 (CMP2) Sensor Connector - A
Courtesy of FORD MOTOR CO.

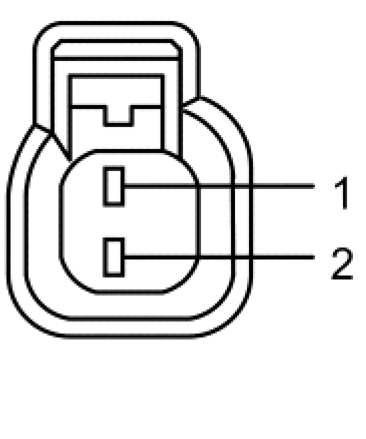

Fig. 68: Camshaft Position 2 (CMP2) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, MKX, MKZ, Sable,	A	1 2	VRSRTN CMP2

Taurus, Taurus X			
Expedition, F-150 5.4L, Mark LT, Navigator	A	1 2	VRSRTN2 CMP2
Fusion 3.0L, Milan 3.0L	B	2 1	VRSRTN CMP2
All other vehicles	A	1 2	SIGRTN CMP2

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	E44 E42 E45	CMP2 VRSRTN CMP
Escape/Mariner	150 (50-50-50) Pin	E41 E25	SIGRTN CMP
Expedition, Navigator	140 Pin	E5 E44 E4 E45	VRSRTN2 CMP2 VRSRTN CMP
Explorer 4.6L, Explorer Sport Trac 4.6L, F-Super Duty 5.4L, Mountaineer 4.6L, Mustang 4.6L	170 Pin	E44 E58 E45	CMP2 SIGRTN CMP
F-150 4.6L	190 Pin	E4 E45	VRSRTN CMP
F-150 4.2L	190 Pin	E45	CMP
F-150 5.4L, Mark LT	190 Pin	E5 E44 E4 E45	VRSRTN2 CMP2 VRSRTN CMP
Focus	190 Pin	E64 E8	SIGRTN CMP
Fusion 3.0L, Milan 3.0L, MKZ	140 Pin	E44 E33 E45	CMP2 VRSRTN CMP
Fusion 2.3L, Milan 2.3L	140 Pin	E58 E45	SIGRTN CMP
All other vehicles	170 Pin	E58	SIGRTN

		E45	CMP

DR1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0340, P0344, P0345, or P0349 present?**

Yes	No
For DTCs P0340, P0344, P0345 or P0349, GO to **DR2**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DR2 CONTINUOUS MEMORY DTCS P0340, P0344, P0345 AND P0349: CHECK IF THE ENGINE STARTS

- Attempt to start the engine.
- **Does the engine start?**

Yes	No
GO to **DR3**.	RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.

DR3 CLEAR AND ATTEMPT TO RETRIEVE THE DTC

NOTE: **If DTCs P0340, P0344, P0345, or P0349 are present, ignition, alternator noise, RFI and CKP concerns should be considered.**

NOTE: **For vehicles with variable camshaft timing (VCT), concerns with the engine oil level, oil filter, oil contamination, or the VCT system may cause camshaft positioning errors.**

- Key ON, engine OFF.
- Clear the PCM DTCs.
- Key ON, engine running.
- Increase engine speed to greater than 1,500 RPM for 10 seconds. Repeat this 3 times.
- Retrieve the continuous memory DTCs.
- **Are DTCs P0340, P0344, P0345 or P0349 present?**

Yes	No
GO to **DR4**.	refer to **PINPOINT TEST Z**.

DR4 CHECK THE GENERATOR FOR EXCESSIVE ELECTRICAL NOISE

NOTE: **If the generator/regulator is electrically noisy, the noise decreases when the B+ connector is disconnected.**

- PCM connector connected.
- CMP Sensor connector connected.
- Key ON, engine running.
- Monitor the generator for an audible electric noise.
- Key in OFF position.
- Generator/regulator B+ connector disconnected.
- Key ON, engine running.
- With the engine running, determine if the generator is still noisy.
- **Does the noise remain constant when the B+ connector is disconnected?**

Yes	No
For continuous memory DTCs P0340 or P0344, GO to **DR5**. For continuous memory DTCs P0345 or P0349, GO to **DR13**.	REFER to the **GENERATOR AND REGULATOR -- E-SERIES** to diagnose the generator is noisy symptom.

DR5 DETERMINE THE CMP SENSOR PHYSICAL TYPE

- Key in OFF position.
- **Is the CMP sensor a synchronizer (gear driven) type?**

Yes	No
GO to **DR6**.	GO to **DR7**.

DR6 VERIFY THE CORRECT INSTALLATION OF THE CMP SENSOR

NOTE: A CMP sensor identifies the cylinder 1 power stroke. A sensor that is improperly installed/indexed can identify the wrong cylinder as 1, produce a tip-in hesitation and generate DTC P0340.

- **Is the CMP sensor installed correctly?**

Yes	No
GO to **DR7**.	INSTALL the CMP sensor correctly. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** for the Camshaft Synchronizer removal and installation procedures. CLEAR the DTCs. REPEAT the self-test.

DR7 DETERMINE THE CMP SENSOR ELECTRONIC TYPE

NOTE: The variable reluctance (VR) sensors have 2-wire connectors, Hall-effect

sensors have 3-wire connectors.

- **Is the CMP sensor a VR type?**

Yes	No
GO to **DR8**.	The CMP sensor is a Hall-effect type. GO to **DR19**.

DR8 CONTINUOUS MEMORY DTCS P0340 AND P0344: CHECK THE CMP SENSOR RESISTANCE

- Key in OFF position.
- CMP Sensor connector disconnected.
- Measure the resistance between:

(+) CMP Sensor Connector, Component Side	(-) CMP Sensor Connector, Component Side
CMP	SIGRTN
CMP	VRSRTN

Vehicle	Minimum Resistance (ohms)	Maximum Resistance (ohms)
Edge, MKX	586	2,033
F-150 4.6L	1,978	5,590
F-150, Mark LT	205	579
MKZ	586	2,033
Taurus, Taurus X, Sable	586	2,033
All others	250	1,000

- **Is the resistance within specification?**

Yes	No
GO to **DR9**.	INSTALL a new CMP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DR9 CHECK THE CMP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CMP Sensor Connector, Harness Side	(-) Vehicle Battery
CMP	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to **DR10**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR10 CHECK THE CMP AND SIGRTN OR VRSRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CMP Sensor Connector, Harness Side
CMP	CMP
SIGRTN	SIGRTN
VRSRTN	VRSRTN

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

Yes	No
GO to **DR11**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DR11 CHECK FOR A SHORT IN THE HARNESS BETWEEN THE PCM AND THE CMP SENSOR

- Measure the resistance between:

(+) CMP Sensor Connector, Harness Side	(-) CMP Sensor Connector, Harness Side

CMP	SIGRTN
CMP	VRSRTN

- Measure the resistance between:

(+) CMP Sensor Connector, Harness Side	**(-) Vehicle Battery**
CMP	Negative terminal
SIGRTN	Negative terminal
VRSRTN	Negative terminal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DR12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR12 CHECK THE CMP SENSOR OUTPUT

- Key in OFF position.
- Generator/regulator B+ connector connected.
- CMP Sensor connector disconnected.
- Key ON, engine running.
- Digital multimeter (DMM) on low voltage AC scale.
- Measure the voltage between:

(+) CMP Sensor Connector, Component Side	**(-) CMP Sensor Connector, Component Side**
CMP	SIGRTN
CMP	VRSRTN

- Run the engine at approximately 2,500 RPM.
- **Is the voltage greater than 0.25 V?**

Yes	No

For Edge, Expedition, Explorer 4.6L, Explorer Sport Trac 4.6L, F-150 5.4L, F-Super Duty 5.4L, Fusion, Mark LT, Milan, MKX, MKZ, Mountaineer 4.6L, Mustang 4.6L, Navigator, Sable, Taurus, and Taurus X, GO to **DR25**. For all others, GO to **DR26**.	INSTALL a new CMP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DR13 CONTINUOUS MEMORY DTCS P0345 AND P0349: CHECK THE CMP2 SENSOR RESISTANCE

- Key in OFF position.
- CMP2 Sensor connector disconnected.
- Measure the resistance between:

(+) CMP2 Sensor Connector, Component Side	(-) CMP2 Sensor Connector, Component Side
CMP2	SIGRTN
CMP2	VRSRTN
CMP2	VRSRTN2

Vehicle	Minimum Resistance (ohms)	Maximum Resistance (ohms)
Edge, MKX	586	2,033
F-150, Mark LT	205	579
MKZ	586	2,033
Taurus, Taurus X, Sable	586	2,033
All others	250	1,000

- **Is the resistance value(s) within specifications?**

Yes	No
GO to **DR14**.	INSTALL a new CMP2 sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DR14 CHECK THE CMP2 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CMP2 Sensor Connector, Harness Side	(-) Vehicle Battery
CMP2	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to **DR15**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR15 CHECK THE CMP2 AND SIGRTN, VRSRTN, OR VRSRTN2 CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CMP2 Sensor Connector, Harness Side
CMP2	CMP2
SIGRTN	SIGRTN
VRSRTN	VRSRTN
VRSRTN2	VRSRTN2

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

Yes	No
GO to **DR16**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DR16 CHECK FOR A SHORT IN THE HARNESS BETWEEN THE PCM AND THE CMP2 SENSOR

- Measure the resistance between:

(+) CMP2 Sensor Connector, Harness Side	(-) CMP2 Sensor Connector, Harness Side
CMP2	SIGRTN
CMP2	VRSRTN
CMP2	VRSRTN2

- Measure the resistance between:

(+) CMP2 Sensor Connector, Harness Side	(-) Vehicle Battery
CMP2	Negative terminal
SIGRTN	Negative terminal
VRSRTN	Negative terminal
VRSRTN2	Negative terminal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DR17**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR17 CHECK FOR A SHORT BETWEEN THE CMP AND THE CMP2 CIRCUITS

- CMP Sensor connector disconnected.
- CMP2 Sensor connector disconnected.
- Measure the resistance between:

(+) PCM	(-) PCM

Connector, Harness Side	Connector, Harness Side
CMP	CMP2

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DR18**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR18 CHECK THE CMP2 SENSOR OUTPUT

- Key in OFF position.
- Generator/regulator B+ connector connected.
- CMP2 Sensor connector disconnected.
- Key ON, engine running.
- DMM on low voltage AC scale.
- Measure the voltage between:

(+) CMP2 Sensor Connector, Component Side	(-) CMP2 Sensor Connector, Component Side
CMP2	SIGRTN
CMP2	VRSRTN
CMP2	VRSRTN2

- Run the engine at approximately 2,500 RPM.
- **Is the voltage greater than 0.25 V?**

Yes	No
For Edge, Expedition, Explorer 4.6L, Explorer Sport Trac 4.6L, F-150 5.4L, F-Super Duty 5.4L, Fusion, Mark LT, Milan, MKX, MKZ,	INSTALL a new CMP2 sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

Mountaineer 4.6L, Mustang 4.6L, Navigator, Sable, Taurus, and Taurus X, GO to **DR25**. For all others, GO to **DR26**.	

DR19 CONTINUOUS MEMORY DTCS P0340 AND P0344: CHECK THE VOLTAGE TO THE CMP SENSOR

- CMP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CMP Sensor Connector, Harness Side	(-) Vehicle Battery
VPWR	Negative terminal
VBPWR	Negative terminal

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

Yes	No
GO to **DR20**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DR20 CHECK THE PWRGND OR SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the voltage between:

(+) Vehicle Battery	(-) CMP Sensor Connector, Harness Side
Positive terminal	PWRGND
Positive terminal	SIGRTN

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

Yes	No
GO to **DR21**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DR21 CHECK THE CMP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CMP Sensor Connector, Harness Side	(-) Vehicle Battery
CMP	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to **DR22**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR22 CHECK FOR AN OPEN CIRCUIT BETWEEN THE PCM AND CMP SENSOR

- Key in OFF position.
- CMP Sensor connector disconnected.
- Measure the resistance between:

(+) CMP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
CMP	CMP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DR23**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DR23 CHECK THE CMP CIRCUIT FOR A SHORT TO PWRGND OR SIGRTN IN THE HARNESS

NOTE: The measurement may be taken at the PCM or CMP connector, whichever is easier to access.

- Measure the resistance between:

(+) CMP Sensor Connector, Harness Side	(-) CMP Sensor Connector, Harness Side
CMP	PWRGND
CMP	SIGRTN

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DR24**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR24 CHECK THE CMP SENSOR FOR CORRECT OPERATION

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A CMP Sensor Connector, Harness Side	Point B CMP Sensor Connector, Component Side
VPWR	VPWR
VBPWR	VBPWR
SIGRTN	SIGRTN
PWRGND	PWRGND

- Key ON, engine running.
- DMM on low voltage DC scale.
- Measure the voltage between:

(+) CMP Sensor Connector, Component Side	(-) Vehicle Battery
CMP	Negative

	terminal

- **Does the voltage switch between LOW (less than 2 volts DC) and HIGH (greater than 8 volts DC)?**

Yes	No
GO to **DR26**.	INSTALL a new CMP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DR25 CHECK THE VARIABLE CAMSHAFT TIMING (VCT) SYSTEM

NOTE: Only diagnose the bank indicated by the DTC.

- Check the VCT system for correct operation.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DR26**.

DR26 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DS: AIR CONDITIONING PRESSURE (ACP) TRANSDUCER SENSOR

This pinpoint test is intended to diagnose the following:

- ACP transducer sensor (19D594)

- harness circuits: ACP, VREF, SIGRTN
- powertrain control module (PCM) (12A650)

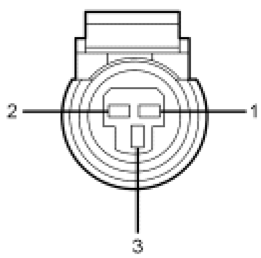

Fig. 69: Air Conditioning Pressure (ACP) Transducer Sensor Connector - A
Courtesy of FORD MOTOR CO.

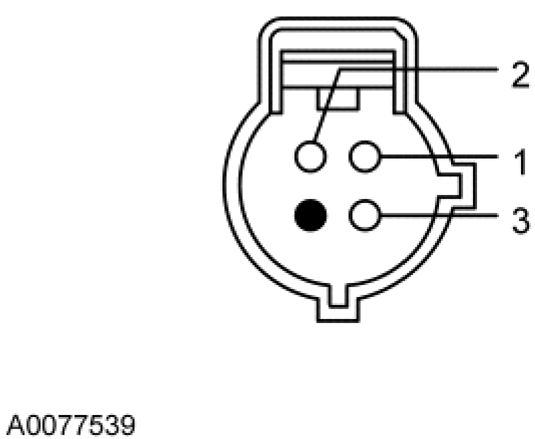

Fig. 70: Barometric Pressure (BARO) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Fusion, Milan, MKX, MKZ	A	3 1 2	ACP SIGRTN VREF
All other vehicles	B	3 1 2	ACP SIGRTN VREF

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Mustang, Town Car	170 Pin	B40, E57 B35 B47 B26	VREF VPWR PWRGND ACP
Expedition, Navigator	140 Pin	E57 B51 B67 B19	VREF VPWR PWRGND ACP
Explorer, Explorer Sport Trac	170 Pin	B40, E57 B35 B47 B18	VREF VPWR PWRGND ACP
F-150	190 Pin	B29, E57 B51 B67 B10	VREF VPWR PWRGND ACP
Focus	190 Pin	B52, B66, E63 B67 B69 B31	VREF VPWR PWRGND ACP
Fusion, Milan, MKZ	140 Pin	B33, E57 B51 B67 B63	VREF VPWR PWRGND ACP
All other vehicles	190 Pin	B29, B64 B51 B67 B37	VREF VPWR PWRGND ACP

DS1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0532, P0533, P1461, P1462, or P1463 present?**

Yes	No
For DTC P0533, P1461, GO to **DS2**. For DTC P0532, P1462, GO to **DS8**. For DTC P1463, GO to **DS17**.	For symptoms without DTCs, GO to **DS19**. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DS2 DTC P0533, P1461: CHECK THE ACP PID

- Key ON, engine OFF.
- Access the PCM and monitor the ACP_PRESS PID.
- **Is the voltage less than 4.9 V?**

Yes	No
The ACP transducer sensor voltage is now below maximum. To determine if an intermittent condition exists, GO to **DS16**.	GO to **DS3**.

DS3 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE ACP TRANSDUCER SENSOR VEHICLE HARNESS CONNECTOR

- Air Conditioning Pressure (ACP) Transducer Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to **DS4**.	refer to **PINPOINT TEST C**.

DS4 CHECK THE ACP CIRCUIT FOR A SHORT TO VREF

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
ACP	VREF

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DS5**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DS5 CHECK THE ACP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-)
ACP	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **DS6**.	REPAIR the short circuit to PWR. CLEAR the DTCs. REPEAT the self-test.

DS6 CHECK FOR AN OPEN ACP CIRCUIT IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ACP	ACP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DS7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DS7 CHECK THE PCM

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	Point B Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
ACP	SIGRTN

- Key ON, engine OFF.
- Access the PCM and monitor the ACP_PRESS PID.
- **Is the voltage less than 4.9 V?**

Yes	No
INSTALL a new Air Conditioning Pressure (ACP) Transducer Sensor. CLEAR the DTCs. REPEAT the self-test.	GO to **DS23**.

DS8 DTC P0532, P1462: CHECK THE ACP PID

- Key ON, engine OFF.
- Access the PCM and monitor the ACP_PRESS PID.
- **Is the voltage greater than 0.15 V?**

Yes	No
The ACP transducer sensor voltage is now above the minimum. To determine if an intermittent condition exists, GO to **DS16**.	GO to **DS9**.

DS9 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE ACP TRANSDUCER SENSOR VEHICLE HARNESS CONNECTOR

- Air Conditioning Pressure (ACP) Transducer Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Air Conditioning	(-) Air Conditioning

Pressure (ACP) Transducer Sensor Connector, Harness Side	Pressure (ACP) Transducer Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to **DS10**.	refer to **PINPOINT TEST C**.

DS10 SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- Key in OFF position.
- Connect a 5 amp fused jumper wire between the following:

Point A Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	Point B Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
VREF	ACP

- Key ON, engine OFF.
- Access the PCM and monitor the ACP_PRESS PID.
- **Is the voltage greater than 4 V?**

Yes	No
INSTALL a new Air Conditioning Pressure (ACP) Transducer Sensor. CLEAR the DTCs. REPEAT the self-test.	GO to **DS11**.

DS11 CHECK THE ACP CIRCUIT FOR A SHORT TO GND

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Air Conditioning Pressure (ACP)	

Transducer Sensor Connector, Harness Side	(-)
ACP	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DS12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DS12 CHECK THE ACP CIRCUIT FOR A SHORT TO SIGRTN

- Measure the resistance between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
ACP	SIGRTN

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DS13**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DS13 CHECK THE ACP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ACP	ACP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DS14**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DS14 CHECK FOR THE A/C CLUTCH TO ENGAGE

- PCM connector connected.
- Air Conditioning Pressure (ACP) Transducer Sensor connector connected.
- Key ON, engine running.
- While listening for the A/C clutch to engage, turn the A/C on. Repeat if necessary.
- **Does the A/C engage when the A/C is turned on?**

Yes	No
GO to **DS23**.	GO to **DS15**.

DS15 VERIFY THE A/C SYSTEM FUNCTION, INCLUDING THE REFRIGERANT CHARGE

- Restore the vehicle.
- Verify the A/C system function, including the refrigerant charge. Refer to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** .
- **Does the A/C system have the correct refrigerant charge and if so does the A/C system function correctly?**

Yes	No
GO to **DS23**.	REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.

DS16 CHECK THE ACP CIRCUIT FOR AN INTERMITTENT CONCERN

NOTE: **A concern is indicated by a sudden change in voltage.**

- Key ON, engine OFF.
- Access the PCM and monitor the ACP PID.
- Observe the ACP PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the ACP, SIGRTN, and VREF wires between the ACP sensor and PCM
  - Lightly tap on the ACP transducer sensor to simulate road shock
- **Is a concern present?**

Yes	No

ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DS17 DTC P1463: VERIFY THE A/C CLUTCH CAN DISENGAGE

- Turn the A/C and defroster OFF.
- Key ON, engine running.
- Verify the A/C clutch can disengage.
- **Is the A/C clutch disengaged?**

Yes	No
GO to **DS18**.	REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is always on symptom.

DS18 CHECK FOR VOLTAGE AND GROUND TO THE A/C CLUTCH USING A NON-POWERED TEST LAMP

NOTE: If voltage and ground to the A/C clutch have already been checked or the A/C clutch can be heard clicking on when the A/C is turned on, go to the question at the end of this test step.

- Key in OFF position.
- A/CCS Switch connector disconnected.
- Connect a jumper wire in the A/C low pressure cycling switch harness connector to complete the circuit.
- A/CC Assembly connector disconnected.
- Connect a non-powered test lamp between the voltage pin and ground pin at the A/C clutch harness connector.
- Key ON, engine running.
- Turn the A/C on, and wait 15 seconds.
- Monitor the test lamp.
- Connect the A/C clutch and A/C cycling switch when done testing.
- **Does the lamp illuminate, or can the A/C clutch be heard clicking on?**

Yes	No
GO to **DS19**.	REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.

DS19 DETERMINE IF A SUFFICIENT A/C PRESSURE CHANGE CAN BE DETECTED BY THE ACP PID

- Key ON, engine running.
- Turn the A/C and defroster OFF.
- Access the PCM and monitor the ACP PID.
- Turn the A/C and defroster OFF.
- Five seconds after A/C clutch engagement, note the voltage. If the clutch does not engage, follow the NO answer instructions.
- **Does the PCM-ACP PID change more than 0.3 volt within 5 seconds of clutch engagement?**

Yes	No
The ACP transducer sensor and the PCM can detect a sufficient change in the A/C pressure. For symptom without DTC P1463, REFER to the **SYMPTOM CHARTS** article, Symptom Charts. For all others, REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.	GO to **DS20**.

DS20 CHECK THE A/C SYSTEM PRESSURE AND PRESSURE CHANGE

- Key in OFF position.
- Install an A/C system manifold gauge set and check the A/C system high pressure reading.
- Turn the A/C and defroster OFF.
- Key ON, engine running.
- Note the A/C high pressure reading.
- While monitoring the A/C system high pressure reading, turn the A/C on. Five seconds after clutch engagement, note the pressure (the pressure should increase).
- A/C and defroster OFF.
- **Does the A/C high pressure reading change more than 207 kPa (30 psi) within 5 seconds of clutch engagement?**

Yes	No
GO to **DS21**.	REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.

DS21 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE ACP TRANSDUCER SENSOR VEHICLE HARNESS CONNECTOR

- Key in OFF position.

- Air Conditioning Pressure (ACP) Transducer Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to **DS22**.	refer to **PINPOINT TEST C**.

DS22 CHECK THE ACP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ACP	ACP

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new Air Conditioning Pressure (ACP) Transducer Sensor. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DS23 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
    - pushed out pins

  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DT: POWER STEERING PRESSURE (PSP) SENSOR

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- PSP sensor (3K215)
- harness circuit(s): PSP, SIGRTN and VREF
- powertrain control module (PCM) (12A650)

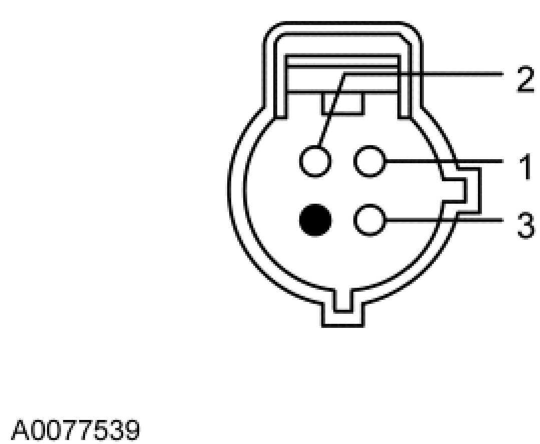

Fig. 71: Barometric Pressure (BARO) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
3	PSP (Power Steering Pressure)

1	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Focus	190 Pin	T29	PSP
All other vehicles	190 Pin	E24	PSP

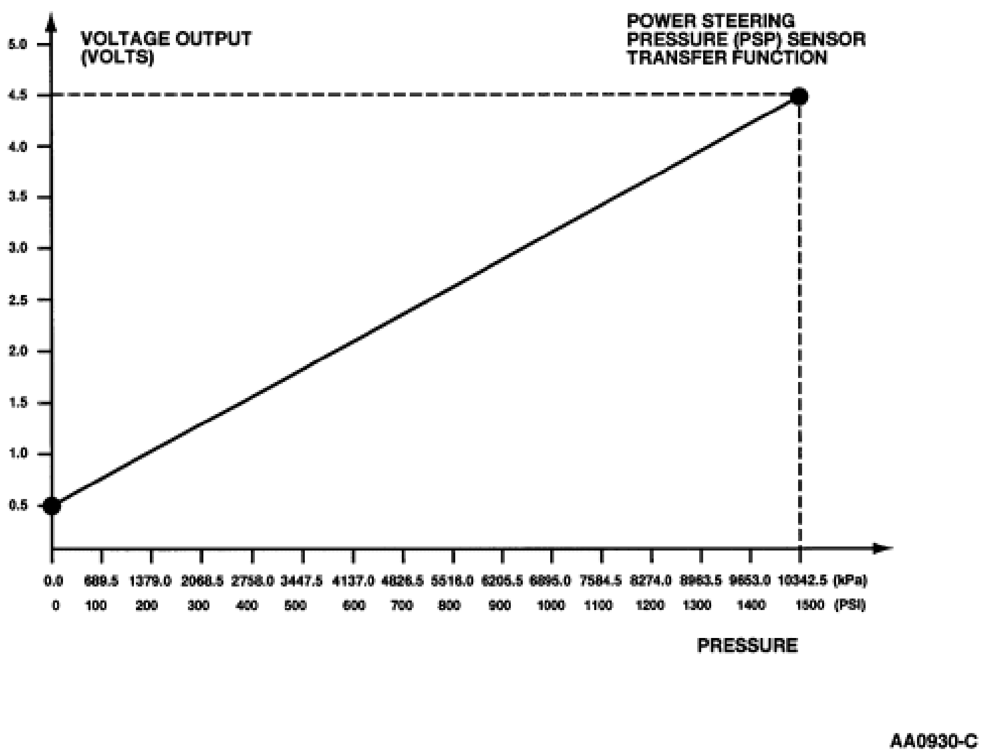

Fig. 72: Power Steering Pressure Sensor Voltage To Pressure Graph
Courtesy of FORD MOTOR CO.

DT1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P0552, P0553, or P1550 present?**

Yes	No
For KOEO and KOER DTCs P0552 or P0553, GO to **DT4**. For continuous memory DTCs P0552 or P0553, GO to **DT8**. For KOEO and KOER DTC P1550, GO to **DT2**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DT2 DTC P1550: MAKE SURE THE STEERING WHEEL IS TURNED

- **Did you turn the steering wheel at least one half turn within 20 seconds of starting the KOER self-test?**

Yes	No
If there are any symptoms with the power steering system (for example, lack of power assist), REFER to the **STEERING SYSTEM - GENERAL INFORMATION -- E-SERIES** to diagnosis the lack of assist or inconsistent assist of steering system. If no symptoms are present with the power steering system, GO to **DT3**.	REPEAT the KOER self-test.

DT3 CHECK THE VOLTAGE BETWEEN VREF AND SIGRTN AT THE PSP SENSOR

- PSP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PSP Sensor Connector, Harness Side	(-) PSP Sensor Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 1

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to **DT4**.	refer to **PINPOINT TEST C**.

DT4 CHECK THE PSP CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PSP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
PSP - Pin 3	PSP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DT5**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DT5 CHECK THE PSP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PSP Sensor Connector, Harness Side	(-)
PSP - Pin 3	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **DT6**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DT6 CHECK THE PSP CIRCUIT FOR A SHORT TO VREF, SIGRTN AND GND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PSP Sensor Connector, Harness Side	(-) PSP Sensor Connector, Harness Side
PSP - Pin 3	VREF - Pin 2
PSP - Pin 3	SIGRTN - Pin 1

- Measure the resistance between:

(+) PSP Sensor Connector, Harness Side	(-)
PSP - Pin 3	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DT7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DT7 CHECK THE SENSOR OPERATION

- Connect a 5 amp fused jumper wire between the following:

Point A PSP Sensor Connector, Harness Side	Point B PSP Sensor Connector, Component Side
VREF - Pin 2	VREF - Pin 2
SIGRTN - Pin 1	SIGRTN - Pin 1
PSP - Pin 3	PSP - Pin 3

- Start engine and allow to idle.
- Measure the voltage between:

(+) PSP Sensor Connector, Component Side	(-)
PSP - Pin 3	Ground

- Observe the voltage while turning the steering wheel at least 1/2 turn right and left.
- **Is the voltage reading between 0.3 and 4.7 volts and does the voltage change when the steering wheel is turned?**

Yes	No
GO to **DT9**.	INSTALL a new PSP sensor. CLEAR the DTCs. REPEAT the self-test.

DT8 CONTINUOUS MEMORY DTCS P0552 OR P0553: CHECK THE POWER STEERING PRESSURE SENSOR CIRCUIT(S) FOR INTERMITTENT CONCERNS

- Key ON, engine OFF.
- Access the PCM and monitor the PSP PID.
- Observe the PSP PID for an indication of a concern while carrying out the following. (a concern is indicated by a sudden change in the voltage):
  - Shake, wiggle, and bend the PSP, VREF, SIGRTN circuit(s).
  - Lightly tap on the power steering pressure sensor to simulate road shock.

- **Is a concern indicated?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DT9 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DU: INTAKE AIR TEMPERATURE 2 (IAT2) SENSOR

This pinpoint test is intended to diagnose the following:

- intake air temperature 2 (IAT2) sensor (12A697)
- harness circuits: IAT2 and SIGRTN
- powertrain control module (PCM) (12A650)

Voltage values calculated for VREF = 5 volts. These values can vary by 15% due to sensor and VREF variations.

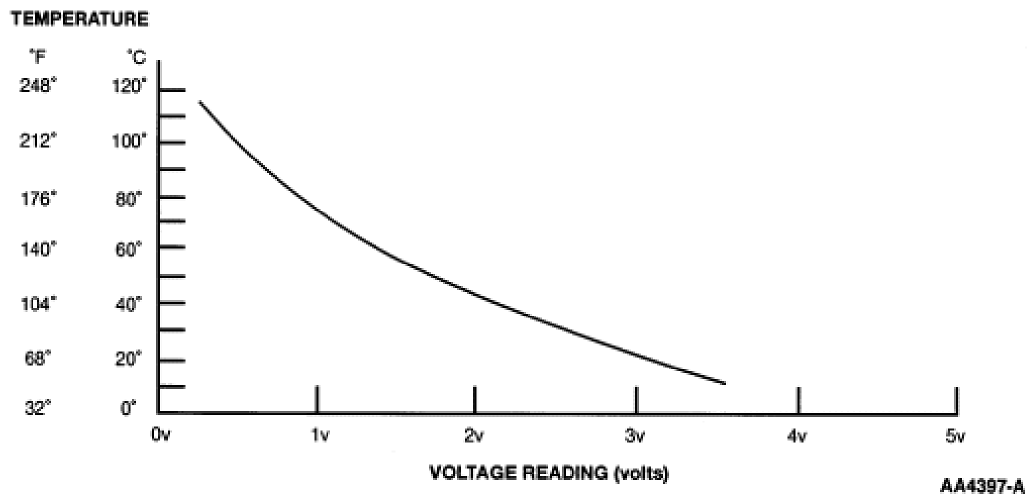

Fig. 73: Temperature Sensor Temperature To Voltage Graph
Courtesy of FORD MOTOR CO.

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
120	248	0.28	1.18
110	230	0.36	1.55
100	212	0.47	2.07
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85
-10	14	4.45	160.31

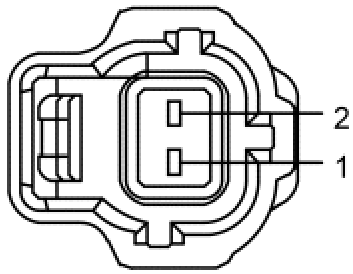

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Fig. 74: Canister Vent (CV) Solenoid Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
1	IAT2 (Intake Air Temperature 2)

Connector	Pin	Circuit
170 Pin	B41, E58, T41 B40, E57 E27	SIGRTN VREF IAT2

DU1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0097, P0098, P0127, P1114, or P1115 present?**

Yes	No
For DTCs P0097 or P1114, GO to **DU4**. For DTCs P0098 or P1115, GO to **DU2**. For DTC P0127, GO to **DU6**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DU2 CHECK FOR AN OPPOSITE SIGNAL TO THE PCM

- The DTC indicates the sensor signal is greater than the self-test maximum.
- IAT2 Sensor connector disconnected.
- Key ON, engine OFF.
- Connect a 5 amp fused jumper wire between the following:

Point A IAT2	Point B IAT2

Sensor Connector, Harness Side	Sensor Connector, Harness Side
IAT2 - Pin 1	SIGRTN - Pin 2

- Access the PCM and monitor the IAT2 PID.
- **Is the voltage less than 0.2 V?**

Yes	No
INSTALL a new IAT2 sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DU3**.

DU3 CHECK THE SENSOR SIGNAL FOR A SHORT TO VREF

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
IAT2 - Pin E27	VREF - Pin B40, E57

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DU10**.	REPAIR the short circuit to VREF. CLEAR the DTCs. REPEAT the self-test.

DU4 DTC P1114: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- The DTC indicates the sensor signal is less than the self-test minimum.
- IAT2 Sensor connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the IAT2 PID.
- **Is the voltage greater than 4.2 V?**

Yes	No
INSTALL a new IAT2 sensor. REFER to the	

ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES . CLEAR the DTCs. REPEAT the self-test.	GO to **DU5**.

DU5 CHECK THE SENSOR SIGNAL FOR A SHORT TO GROUND

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
IAT2 - Pin E27	SIGRTN - Pin B41, E58, T41

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) 12 Volt Vehicle Battery
IAT2 - Pin E27	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DU10**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DU6 DTC P0127: CHECK CHARGE AIR COOLER PUMP (CAC) OPERATION

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- **Does the CAC pump run?**

Yes	No
GO to **DU7**.	DIAGNOSE the charge air cooler (CAC) pump. GO to **KP9**.

DU7 CHECK THE CHARGE AIR COOLER (CAC) SYSTEM

- Check the CAC system for low fluid level, cracked, blocked or misrouted coolant lines, cracked or blocked heat exchanger.

- **Is a concern present?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** , Supercharger Cooling to diagnose a loss of coolant. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DU8**.

DU8 SIMULATE THE HIGH IAT2 SIGNAL TO THE PCM

- Key ON, engine OFF.
- Access the PCM and monitor the IAT2 PID.
- Observe the PID while disconnecting the IAT2 sensor.
- **Is the voltage greater than 4.2 V?**

Yes	No
GO to **DU9**.	GO to **DU10**.

DU9 SIMULATE THE LOW IAT2 SIGNAL TO THE PCM

- Key in OFF position.
- IAT2 Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A IAT2 Sensor Connector, Harness Side	Point B IAT2 Sensor Connector, Harness Side
IAT2 - Pin 1	SIGRTN - Pin 2

- Key ON, engine OFF.
- Access the PCM and monitor the IAT2 PID.
- **Is the voltage less than 0.2 V?**

Yes	No
CONNECT the sensor and GO to the **REFERENCE VALUES** article, Reference Values. COMPARE the IAT2 PID to reference values under different road test conditions. If the sensor is not in range, INSTALL a new IAT2 sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DU10**.

DU10 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DV: THROTTLE BODY ASSEMBLY ELECTRONIC THROTTLE CONTROL (ETC)

WARNING: **Substantial opening and closing torque is applied by this system. To prevent injury, be careful to keep fingers away from throttle mechanism when actuated. Failure to follow these instructions may result in personal injury.**

NOTE: The voltage of the TP2 circuit and PID reaches a limit of approximately 4.5 volts at approximately 45 degrees of throttle angle.

This pinpoint test is intended to diagnose the following:

- electronic throttle body (ETB) (9F991)
- electronic throttle body throttle position sensor (ETBTPS) (9E928)
- harness circuits: ETCRTN, ETCREF, TP1, TP2, TACM+, and TACM-
- powertrain control module (PCM) (12A650)

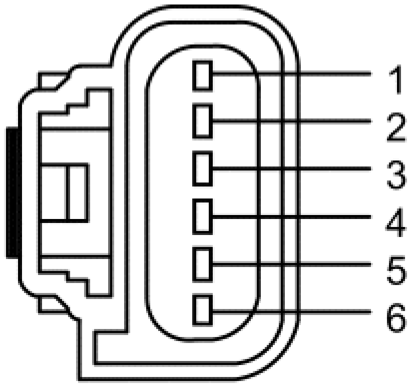

Fig. 75: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

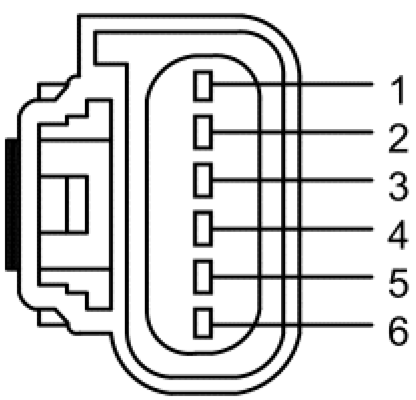

Fig. 76: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - B
Courtesy of FORD MOTOR CO.

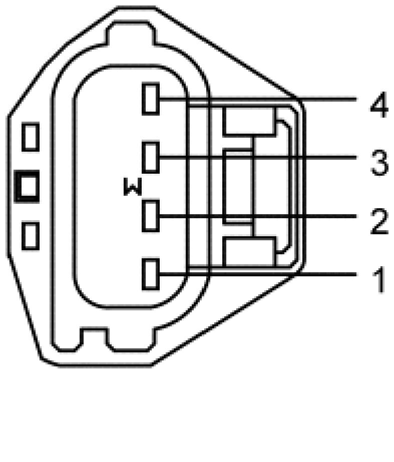

Fig. 77: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus, Taurus X	A	4 1 2 3	TP2 TP1 ETCRTN ETCREF
Fusion 2.3L, Milan 2.3L	B	4 6 3 5	TP2 TP1 ETCRTN ETCREF
Fusion 3.0L, Milan 3.0L	B	6 3 4 5	TP2 TP1 ETCRTN ETCREF
All other vehicles	C	1 4 3 2	TP2 TP1 ETCRTN ETCREF

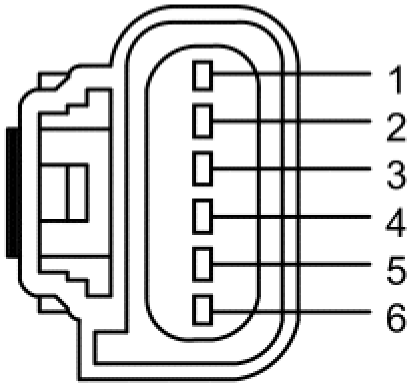

Fig. 78: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

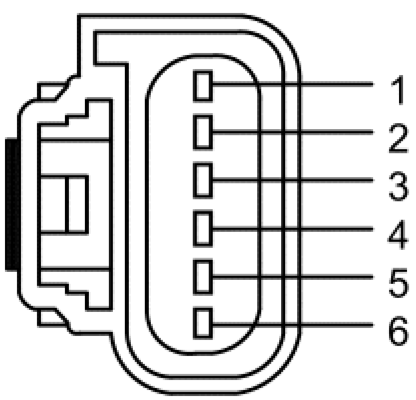

Fig. 79: Electronic Throttle Body Throttle Actuator Control Motor (ETBTACM) Connector - B
Courtesy of FORD MOTOR CO.

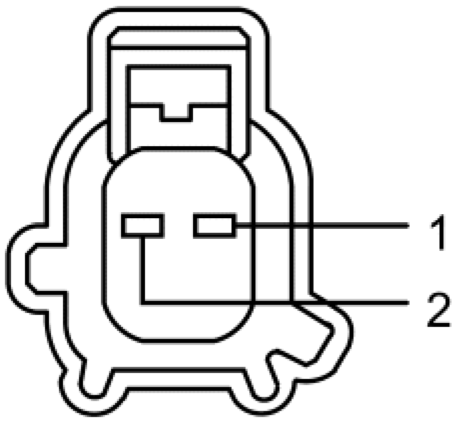

Fig. 80: Electronic Throttle Body Throttle Actuator Control Motor (ETBTACM) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus, Taurus X	A	6 5	TACM- TACM+
Fusion 2.3L, Milan 2.3L	B	2 1	TACM- TACM+
Fusion 3.0L, Milan 3.0L	B	1 2	TACM- TACM+
All other vehicles	C	2 1	TACM- TACM+

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Mustang, Town Car	170 Pin	B24, B4, E66 B41, B6, E59 B35 B47 E51 E34 E60	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2

		E61	TP1
E-Series, F-Super Duty	170 Pin	B16, B4, E66 B18, B6, E59 B35 B47 E51 E34 E60 E61	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1
Expedition, Navigator	140 Pin	B21, B28, E66 B59, B65, E59 B51 B67 E51 E34 E60 E61	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1
Explorer, Explorer Sport Trac, Mountaineer	170 Pin	B24, B4, E66 B43, B6, E59 B35 B47 E51 E34 E60 E61	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1
F-150, Mark LT	190 Pin	B21, B28, E66 B58, B59, E59 B51 B67 E51 E34 E60 E61	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1
Focus	190 Pin	B45, B61, E59 B44, B60, E60 B67 B69 E51 E34 E45 E44	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1
Fusion, Milan, MKZ	140 Pin	B21, B28, E66 B59, B60, E59 B51 B67 E51	ETCREF ETCRTN VPWR PWRGND TACM-

		E34 E60 E61	TACM+ TP2 TP1
All other vehicles	190 Pin	B21, B28, E66 B59, B65, E59 B51 B67 E51 E34 E60 E61	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1

DV1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: Diagnose and repair ETBTPS circuit DTCs before addressing DTC P0068.

- **Are DTCs P0068, P0121, P0122, P0123, P0221, P0222, P0223, P1124, P2100, P2101, P2107, P2111, P2112, or P2135 present?**

Yes	No
For DTC P0068, GO to **DV12**. For DTCs P0121, P0122, P0123, P0221, P0222, P0223, P2111, or P2112, GO to **DV3**. For DTC P1124, GO to **DV2**. For DTC P2100, GO to **DV19**. For DTC P2101, GO to **DV27**. For DTC P2107, GO to **DV18**. For Fusion and Milan with DTC P2135, GO to **DV6**. For all others with DTC P2135, GO to **DV7**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DV2 DTC P1124: REPEAT THE KOEO OR KOER SELF-TEST

NOTE: Make sure the accelerator pedal is not applied during the KOEO and KOER self-tests.

- Key ON, engine OFF.
- Carry out the self-test.
- **Are any DTCs present other than P1124?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DV3**.

DV3 CHECK THE THROTTLE POSITION (TP) OPEN AND CLOSED VOLTAGES

NOTE: **Certain failure mode effects management (FMEM) operating strategies maintain limited vehicle function in the event of a PCM, harness, or component concern and may prevent the throttle plate from opening. If the throttle plate does not open, follow the NO answer.**

- Key ON, engine OFF.
- Access the PCM and monitor the TP1 and TP2 PIDs.
- Press the accelerator pedal to the floor and release.

ELECTRONIC THROTTLE CONTROL THROTTLE POSITION SENSOR SIGNAL VOLTAGES

Accelerator Pedal Position	TP1	TP2
Pedal fully released	3.7 - 4.7	0.3 - 1.9
Pedal fully applied	0.7 - 2.9	4.1 - 4.7

- **Are both PIDs within the chart ranges?**

Yes	No
For DTCs P2111 or P2112, GO to **DV4**. For all others, GO to **DV17**.	GO to **DV4**.

DV4 CHECK FOR OBSTRUCTION OF THE THROTTLE BODY

WARNING: **Substantial opening and closing torque is applied by this system. To prevent injury, be careful to keep fingers away from throttle mechanism when actuated. Failure to follow these instructions may result in personal injury.**

- Key in OFF position.
- Remove the inlet tube from the throttle body.
- Visually inspect for throttle plate obstructions or engine deposits.
- Slowly, push the throttle plate to wide open and release.
- **Does the throttle plate move freely to wide open and back?**

Yes	No
For continuous memory DTCs P0121, P0122, P0123, P0221, P0222, or P0223 alone or together,	

GO to **DV5**. For DTCs P2111, P2112 or continuous memory DTCs P2100, P2101, or P2107 alone or together, GO to **DV19**. For Fusion and Milan with all other DTCs, GO to **DV6**. For all others, GO to **DV7**.	ISOLATE and REPAIR the obstruction. CLEAR the DTCs. REPEAT the self-test.

DV5 CHECK THE VREF VOLTAGE TO TP

- ETBTPS connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ETBTPS Connector, Harness Side	(-) ETBTPS Connector, Harness Side
ETCREF	ETCRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
For Fusion and Milan, GO to **DV6**. For all others, GO to **DV7**.	refer to **PINPOINT TEST C**.

DV6 FUSION, MILAN: CHECK THE RESISTANCE OF THE ETBTPS

NOTE: **Do not move the throttle plate during the resistance measurement. Measure the sensor resistance with the throttle plate at the default position.**

- Key in OFF position.
- ETBTPS connector disconnected.
- For Fusion 2.3L and Milan 2.3L, measure the resistance between:

(+) ETBTPS Connector, Component Side	(-) ETBTPS Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
ETCREF	ETCRTN	2,000	4,000

- For Fusion 3.0L and Milan 3.0L, measure the resistance between:

(+)	(-)		

ETBTPS Connector, Component Side	ETBTPS Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
TP1	ETCREF	380	987
TP1	ETCRTN	665	1,890
TP2	ETCREF	608	1,932
TP2	ETCRTN	390	1,187
ETCREF	ETCRTN	475	1,365

- **Are all the resistances within specifications?**

Yes	No
GO to **DV8**.	INSTALL a new ETB. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** to INSTALL a new throttle body. CLEAR the DTCs. REPEAT the self-test.

DV7 ALL OTHERS: CHECK THE RESISTANCE OF THE ETBTPS

NOTE: Do not move the throttle plate during the resistance measurement. Measure the sensor resistance with the throttle plate at the default position.

- ETBTPS connector disconnected.
- Measure the resistance between:

(+) ETBTPS Connector, Component Side	(-) ETBTPS Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
TP1	ETCREF	700	1,800
TP1	ETCRTN	1,300	2,800
TP2	ETCREF	1,000	2,400
TP2	ETCRTN	500	1,500
ETCREF	ETCRTN	700	2,100

- **Are all the resistances within the specifications?**

Yes	No
	For E-Series 4.6L, Edge,

GO to **DV8**.	F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus, and Taurus X, INSTALL a new ETB. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** to INSTALL a new throttle body. CLEAR the DTCs. REPEAT the self-test. For all others, INSTALL a new ETBTPS. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** to INSTALL a new TP sensor. CLEAR the DTCs. REPEAT the self-test.

DV8 CHECK THE TP1 AND TP2 CIRCUITS FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ETBTPS Connector, Harness Side	(-)
TP1	Ground
TP2	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DV9**.

DV9 CHECK THE TP1 AND TP2 CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) ETBTPS Connector, Harness Side	(-) PCM Connector, Harness Side
TP1	TP1

TP2	TP2

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

Yes	No
GO to **DV10**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DV10 CHECK THE TP1 AND TP2 CIRCUITS FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) ETBTPS Connector, Harness Side	(-) Vehicle Battery
TP1	Negative terminal
TP2	Negative terminal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DV11**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DV11 CHECK THE TP CIRCUITS FOR A SHORT TOGETHER

- Measure the resistance between:

(+) ETBTPS Connector, Harness Side	(-) ETBTPS Connector, Harness Side
TP1	TP2
TP1	ETCREF
TP1	ETCRTN
TP2	ETCREF
TP2	ETCRTN

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DV14**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DV12 DTC P0068: CHECK FOR DTCS

- Carry out the self-test.
- **Are DTCs P0121, P0122, P0123, P0221, P0222, P0223 or P2135 present?**

Yes	No
For DTCs P0121, P0122, P0123, P0221, P0222, and P0223, GO to **DV3**. For Fusion and Milan with DTC P2135, GO to **DV6**. For all others with DTC P2135, GO to **DV7**.	GO to **DV13**.

DV13 CHECK FOR INLET AIR LEAKS

- Check the air inlet system for leaks.
- Listen for air noise around the mass air flow (MAF) sensor and throttle body while the engine is running.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DV14**.

DV14 CHECK FOR A TP2 SIGNAL HIGH VERSUS LOAD WHILE DRIVING THE VEHICLE

- ETBTPS connector connected.
- PCM connector connected.
- Key ON, engine running.
- Access the PCM and monitor the TP2 PID.
- Access the PCM and monitor the LOAD PID.
- Drive the vehicle while exercising the throttle and ETCTP sensor and accessing the PIDS.
- **Is the TP2 PID greater than 2.44 volts and the LOAD PID less than 30%?**

Yes	No
GO to **DC5**.	GO to **DV15**.

DV15 CHECK FOR A TP2 SIGNAL LOW VERSUS LOAD WHILE DRIVING THE VEHICLE

- Key ON, engine running.
- Access the PCM and monitor the TP2 PID.
- Access the PCM and monitor the LOAD PID.
- Drive the vehicle while exercising the throttle and ETCTP sensor and accessing the PIDS.
- **Is the TP2 PID less than 0.24 volt and the LOAD PID greater than 55%?**

Yes	No
GO to **DV16**.	GO to **DV17**.

DV16 CHECK FOR SELF-TEST DTCS

NOTE: After retrieving the continuous memory DTCs, diagnose any non-ETC related DTCs before continuing.

- Key ON, engine OFF.
- Clear the DTCs.
- Drive the vehicle while exercising the throttle.
- Retrieve the continuous memory DTCs.
- **Are any DTCs present?**

Yes	No
For continuous memory DTC P0068, CHECK the MAF sensor and connector for damage and corrosion. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. For E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, Fusion, Milan, MKX, MKZ, Sable, Taurus, and Taurus X with DTC P2135, INSTALL a new ETB. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** to INSTALL a new throttle body. CLEAR the DTCs. REPEAT the self-test. For all others with DTC P2135, INSTALL a new ETBTPS. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** to INSTALL a new TP sensor. CLEAR the DTCs. REPEAT the self-test. For all others, GO to **DV17**.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DV17 CHECK THE TP CIRCUITS FOR AN INTERMITTENT CONCERN

- Access the PCM and monitor the TP1 and TP2 PIDs.
- Wiggle, shake, and bend the harness from the TP to the PCM.
- **Are the voltages between 0.49 - 4.65 V?**

Yes	No
GO to **DV29**.	REPAIR as necessary. If DTC P2100 or P2101 is present, GO to **DV19**.

DV18 DTC P2107: CHECK FOR OTHER SELF-TEST DTCS

NOTE: The DTC P2107 may set when a failure mode effects management (FMEM) action is taken. If the FMEM DTC P2110 is present with other DTCs, diagnose the other DTCs before diagnosing the DTC P2110.

- Key ON, engine OFF.
- Check for self-test DTCs.
- **Are any DTCs present other than P2107 and P2110?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	For DTC P2110, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** and diagnose the DTC. For DTC P2107, GO to **DV23**.

DV19 VISUALLY INSPECT THE ETB

NOTE: Make sure the ETB harness connector is properly connected.

- Key in OFF position.
- Inspect the ETB for damaged housing, harness connector, and harness.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DV20**.

DV20 CHECK THE TACM FOR A SHORT OR OPEN

- ETBTACM connector disconnected.
- Measure the resistance between:

(+) ETBTACM Connector, Component Side	(-) ETBTACM Connector, Component Side
TACM+	TACM-

- **Is the resistance between 1 ohm - 900 ohms?**

Yes	No

GO to **DV21**.	INSTALL a new ETB. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** to INSTALL a new throttle body. CLEAR the DTCs. REPEAT the self-test.

DV21 CHECK THE TACM HARNESS FOR AN OPEN

- PCM connector disconnected.
- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-) PCM Connector, Harness Side
TACM+	TACM+
TACM-	TACM-

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

Yes	No
GO to **DV22**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DV22 CHECK THE TACM+ AND TACM- CIRCUITS FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-)
TACM+	Ground
TACM-	Ground

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DV23**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DV23 CHECK THE HARNESS FOR A SHORT TO GND, PWR, ETCREF, AND ETCRTN

- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-) PCM Connector, Harness Side
TACM+	PWRGND
TACM+	VPWR
TACM+	ETCRTN
TACM+	ETCREF
TACM-	PWRGND
TACM-	ETCRTN
TACM-	VPWR
TACM-	ETCREF

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DV24**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DV24 CHECK FOR TACM HARNESS CIRCUITS SHORTED TOGETHER

- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-) ETBTACM Connector, Harness Side
TACM+	TACM-

- **Is the resistance greater than 10K ohms?**

Yes	No
For DTCs P2111 or P2112, GO to **DV25**. For all others, GO to **DV26**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DV25 CHECK FOR AN INTERMITTENT CONCERN

- ETBTACM connector connected.
- PCM connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the TP1 and TP2 PIDs.
- Wiggle, shake, and bend the harness from the TP to the PCM.
- **Are the voltages between 0.49 - 4.65 V?**

Yes	No
GO to **DV26**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DV26 CHECK FOR SELF-TEST CODES

- ETBTACM connector connected.
- PCM connector connected.
- Key ON, engine OFF.
- Carry out the self-test.
- **Is DTC P2101 present?**

Yes	No
GO to **DV27**.	GO to **DV29**.

DV27 CHECK FOR PROPER TACM+ WIRING IN THE HARNESS CONNECTOR

- Key in OFF position.
- ETBTACM connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-) PCM Connector, Harness Side
TACM+	TACM+

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DV28**.	REPAIR the open circuit. WIRE the TACM harness connector per the TACM and PCM connector diagrams. CLEAR the DTCs. REPEAT the self-test.

DV28 CHECK FOR PROPER TACM- WIRING IN THE HARNESS CONNECTOR

- Measure the resistance between:

(+) ETBTACM Connector,	(-) PCM Connector, Harness Side

Harness Side	
TACM-	TACM-

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DV30**.	GO to **DV29**.

DV29 CHECK THE REPAIR THROUGH PROCEDURE

- Key ON, engine OFF.
- Record and clear the DTCs.
- Cycle the accelerator pedal to the floor and back several times.
- Check for self-test DTCs.
- **Are any ETC system related DTCs present?**

Yes	No
GO to **DV30**.	refer to **PINPOINT TEST Z**.

DV30 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DW: HEATED OXYGEN SENSOR (HO2S)

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

WARNING: **While conducting tests on a hot engine take all safety precautions to prevent skin contact with hot engine components. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- HO2S/O2S (9F472)
- HO2S/O2S (9G444)
- harness circuits: HO2S, HO2S Heater, VPWR, and SIGRTN
- powertrain control module (PCM) (12A650)

The pin numbering for the connector is in reference to the connector lock tab. Not all connector key combinations are shown.

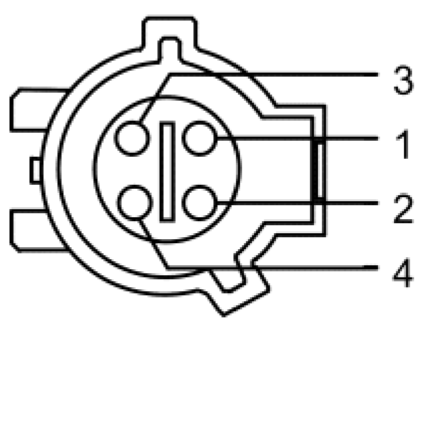

Fig. 81: Heated Oxygen Sensor-Front (HO2S-Front) Connector - A
Courtesy of FORD MOTOR CO.

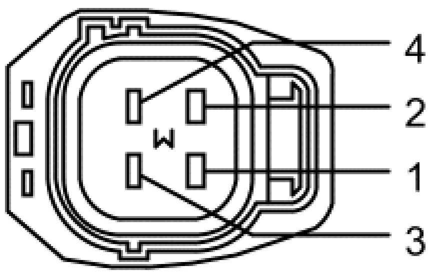

Fig. 82: Heated Oxygen Sensor-Front (HO2S-Front) Connector - B
Courtesy of FORD MOTOR CO.

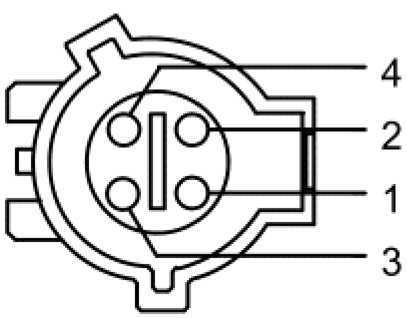

Fig. 83: Heated Oxygen Sensor-Front (HO2S-Front) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria, F-150, Grand Marquis, Mark LT, Mustang, Ranger, Town Car	A	2 4 3 1	VPWR SIGRTN HO2S Signal HO2S Heater
Focus	B	1 3	VPWR SIGRTN

		4 2	HO2S Signal HO2S Heater
All other vehicles	C	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater

The pin numbering for the connector is in reference to the connector lock tab. Not all connector key combinations are shown.

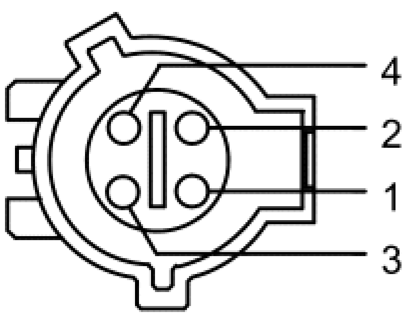

Fig. 84: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - A
Courtesy of FORD MOTOR CO.

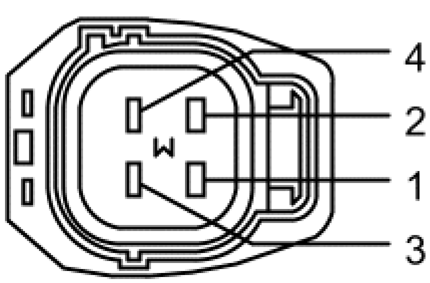

Fig. 85: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - B
Courtesy of FORD MOTOR CO.

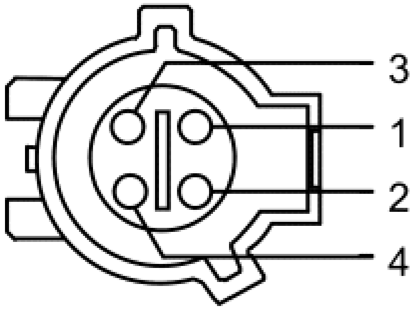

Fig. 86: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner, F-150, Mark LT	A	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater
Focus	B	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater
All other vehicles	C	2 4 3 1	VPWR SIGRTN HO2S Signal HO2S Heater

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series 6.8L, E-Series 5.4L Cutaway or stripped chassis	170 Pin	E28 E69 E29 E70 T24 T47 T25 T48 B14 B38 B35, B36	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 HO2S13 HTR13 VPWR

		B41, E58, T41	SIGRTN
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	E29 E69 E28 E70 E23 E1 E24 E2 B51, B52, B53 B58, E58	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN
Escape/Mariner 3.0L	150 (50-50-50) Pin	E30 E49 E26 E48 T24 T47 T25 T48 B35, B36 B41, E41, T41	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN
Escape/Mariner 2.3L	150 (50-50-50) Pin	E30 E49 T24 T47 B35, B36 B41, E41, T41	HO2S11 HTR11 HO2S12 HTR12 VPWR SIGRTN
Expedition, Navigator	140 Pin	E29 E69 E28 E70 B39 B10 B40 B11 B51, B52, B53 B58, E58	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN
F-150, Mark LT	190 Pin	E29 E69 E28 E70 T22 T1 T21 T12 B51, B52, B53 B58, E58, T43	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN

F-Super Duty 6.8L Narrow frame	170 Pin	E28 E69 E29 E70 B14 B38 B35, B36 B41, E58, T41	HO2S11 HTR11 HO2S21 HTR21 HO2S13 HTR13 VPWR SIGRTN
Focus 2.0L PZEV	190 Pin	E11 E52 T16 T18 T7 T25 B67, B68 B58, E64, T40	HO2S11 HTR11 HO2S12 HTR12 HO2S13 HTR13 VPWR SIGRTN
Focus 2.0L	190 Pin	E11 E52 T16 T18 B67, B68 B58, E64, T40	HO2S11 HTR11 HO2S12 HTR12 VPWR SIGRTN
Fusion 3.0L, Milan 3.0L, MKZ	140 Pin	E28 E69 E29 E70 E3 E23 E4 E24 B51, B52 B58, E58	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN
Fusion 2.3L, Milan 2.3L	140 Pin	E28 E69 E3 E23 B51, B52 B58, E58	HO2S11 HTR11 HO2S12 HTR12 VPWR SIGRTN
Fusion 2.3L PZEV, Milan 2.3L PZEV	140 Pin	E28 E69 E3 E23 E5 E25 B51, B52 B58, E58	HO2S11 HTR11 HO2S12 HTR12 HO2S13 HTR13 VPWR SIGRTN

Ranger 2.3L	170 Pin	E28 E69 T24 T47 B35, B36 B41, E58, T41	HO2S11 HTR11 HO2S12 HTR12 VPWR SIGRTN
All other vehicles	170 Pin	E28 E69 E29 E70 T24 T47 T25 T48 B35, B36 B41, E58, T41	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN

DW1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0040, P0041, P0053, P0054, P0055, P0059, P0060, P0132, P0133, P0135, P0138, P0139, P0141, P0144, P0147, P0152, P0153, P0155, P0158, P0159, P0161, or P1127 present?**

Yes	No
For DTCs P0040 or P0041, GO to **DW2**. For DTCs P0053, P0054, P0055, P0059 or P0060, GO to **DW14**. For DTCs P0132, P0138, P0144, P0152 or P0158, GO to **DW20**. For DTCs P0133 or P0153, GO to **DW3**. For DTCs P0135, P0139, P0141, P0147, P0155, P0159 or P0161, GO to **DW9**. For DTC P1127, GO to **DW19**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DW2 KOER DTCS P0040 AND P0041: CROSSED SENSOR WIRES

- Key in OFF position.
- Check the vehicle repair history.
- Verify the HO2S connectors are connected to the correct engine bank.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DW3 CONTINUOUS MEMORY DTCS P0133 AND P0153: CARRY OUT THE KOER SELF-TEST

- Engine at normal operating temperature.
- Carry out the KOER self-test.
- **Are DTCs P0040, P0041 or P1127 present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DW4**.

DW4 CHECK THE HO2S RESPONSE TEST RESULTS

- Key ON, engine OFF.
- Access the diagnostic monitoring test results for the HO2S11 and HO2S21.
- **Is the indicated value greater than the minimum threshold?**

Yes	No
CLEAR the DTCs. GO to **DW3**.	GO to **DW5**.

DW5 CHECK FOR UNMETERED AIR LEAKS

NOTE: Fuel calculations can be affected by unmetered air leaks.

- Carefully inspect the following areas for potential air leaks:
  - hoses connecting to the mass air flow (MAF) sensor assembly
  - hoses connecting to the throttle body
  - intake manifold gasket leaks
  - PCV system
  - the vacuum lines are disconnected
  - improperly seated engine oil dipstick, tube or oil fill cap
  - exhaust leaks at flanges and gaskets
- **Are any air leaks present?**

Yes	No
REPAIR the source of the air leak. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **DW6**.

DW6 CHECK THE HO2S CIRCUIT CONTINUITY

NOTE: HO2S is displayed as O2S on the scan tool.

- HO2S connector disconnected.
- Check the connector (both halves) for any water contamination.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side
HO2S Signal	VPWR

- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage greater than 1 V?**

Yes	No
INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CHANGE the engine oil and oil filter. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **DW7**.

DW7 CHECK THE HO2S CIRCUIT(S) FOR AN OPEN IN THE HARNESS

NOTE: A vehicle hoist may be required to access the HO2S harness.

- Key in OFF position.
- Remove the jumper wire(s).
- Visually inspect the HO2S harness for exposed wiring, water contamination, corrosion, and proper assembly.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

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

Yes	No
GO to **DW8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DW8 CHECK THE HO2S CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	VPWR

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DW9**.	GO to **DW12**.

DW9 DTCS P0135, P0139, P0141, P0147, P0155, P0159 OR P0161: CHECK FOR A SOURCE OF POTENTIAL HO2S CONTAMINATION

- Investigate the following items as potential sources of HO2S contamination:
  - use of unapproved silicon sealers
  - fuel contaminated by silicon additives
  - excessive oil consumption
  - glycol leaking internally in the engine
  - lead-contaminated fuel
  - short drive cycles in cold weather
  - use of unapproved cleaning agents
- **Is a concern present?**

Yes	No
REPAIR the source of the contamination. CHANGE the engine oil and oil filter. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **DW10**.

DW10 VISUALLY INSPECT THE HO2S HARNESS

- PCM connector connected.
- Visually inspect the HO2S harness for exposed wiring, water contamination, corrosion, and proper assembly.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	For DTCs P0139 or P0159, GO to **DW11**. For all others, GO to **DW12**.

DW11 CHECK THE EXHAUST SYSTEM FOR LEAKS AND MODIFICATIONS

- Check for leaks in the exhaust system.
- Visually inspect the vehicle for aftermarket accessories and performance modifications.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DW25**.

DW12 CHECK THE HO2S AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

NOTE: Verify the harness pins are in the proper location.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

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

Yes	No
GO to **DW13**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DW13 CARRY OUT THE KOEO ON DEMAND SELF-TEST

- Key ON, engine OFF.
- Carry out the KOEO self-test.
- **Are DTCs P0135, P0141, P0147, P0155 or P0161 present?**

Yes	No
GO to **DW14**.	GO to **DW15**.

DW14 DTCS P0053, P0054, P0055, P0059 AND P0060: CHECK FOR VPWR IN THE HARNESS

NOTE: If DTCs P0053, P0054, P0055, P0059, or P0060 are present, test their related circuits individually.

- Key in OFF position.
- HO2S connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HO2S Connector, Harness Side	(-) HO2S Connector, Harness Side
VPWR	SIGRTN

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

Yes	No
GO to **DW15**.	REPAIR the open circuit. CHECK the fuses. CLEAR the DTCs. REPEAT the self-test.

DW15 CHECK THE HO2S HEATER FOR SHORTS IN THE HARNESS

NOTE: If DTCs P0053, P0054, P0055, P0059, or P0060 are present, test their related circuits individually.

- Key in OFF position.
- HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) Vehicle Battery
HO2S Heater	Negative terminal

- Measure the resistance between:

(+) HO2S	(-) HO2S

Connector, Harness Side	Connector, Harness Side
HO2S Heater	VPWR
HO2S Heater	SIGRTN
HO2S Heater	HO2S Signal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DW16**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DW16 CHECK THE HO2S HEATER CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Heater	HO2S Heater

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DW17**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DW17 CHECK THE INTERNAL RESISTANCE OF THE HO2S HEATER

- Measure the resistance between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Heater	VPWR

- **Is the resistance between 3 - 30 ohms?**

Yes	No
GO to **DW18**.	INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER

	to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DW18 CHECK THE HO2S HEATER CIRCUIT FOR AN INTERNAL SHORT TO SIGRTN OR GND

- Measure the resistance between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Heater	SIGRTN

- Measure the resistance between:

(+) HO2S Connector, Component Side	(-) Vehicle Battery
HO2S Heater	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DW25**.	INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DW19 KOER DTC P1127: EXHAUST TEMPERATURE OUT OF RANGE

NOTE: Address all other DTCs before proceeding.

- Key ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the HO2S Heater PID.
- **Is the PID state ON?**

Yes	No

CARRY OUT the KOER self-test.	RUN the engine until the PID indicates ON. CARRY OUT the KOER self-test.

DW20 DTCS P0132, P0138, P0144, P0152 AND P0158: VISUALLY INSPECT THE HO2S HARNESS

NOTE: Disconnect the suspect HO2S harness connector. Only the suspect HO2S needs to be diagnosed.

- Key in OFF position.
- HO2S connector disconnected.
- Visually inspect the HO2S harness.
  - check the connector (both halves) for contamination
  - make sure the connector pins are fully seated
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DW21**.

DW21 CHECK THE HO2S SIGNAL LEVEL TOO HIGH

- HO2S connector connected.
- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage less than 1.1 V?**

Yes	No
GO to **DW22**.	GO to **DW23**.

DW22 CARRY OUT A THOROUGH WIGGLE TEST ON THE HO2S HARNESS

- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and monitor the HO2S Signal PID.
- Carry out a thorough wiggle test on the HO2S harness.
- **Does the voltage change during the wiggle test?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

DW23 CHECK THE HO2S SIGNAL FOR A SHORT TO VPWR INSIDE THE SENSOR

- Key in OFF position.
- HO2S connector disconnected.
- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage less than 1.1 V?**

Yes	No
INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **DW24**.

DW24 CHECK THE HO2S CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HO2S Connector, Harness Side	(-)
HO2S Signal	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DW25**.

DW25 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DX: ENGINE COOLANT TEMPERATURE (ECT) SENSOR

NOTE: Engine coolant temperature must be greater than 10°C (50°F) to pass the KOEO self-test and greater than 82°C (180°F) to pass the KOER self-test. to accomplish this, the engine must be at normal operating temperature.

This pinpoint test is intended to diagnose the following:

- engine coolant temperature (ECT) sensor (12A648)
- harness circuits: ECT and SIGRTN
- powertrain control module (PCM) (12A650)

Voltage values calculated for VREF = 5 volts. These values can vary by 15% due to sensor and VREF variations.

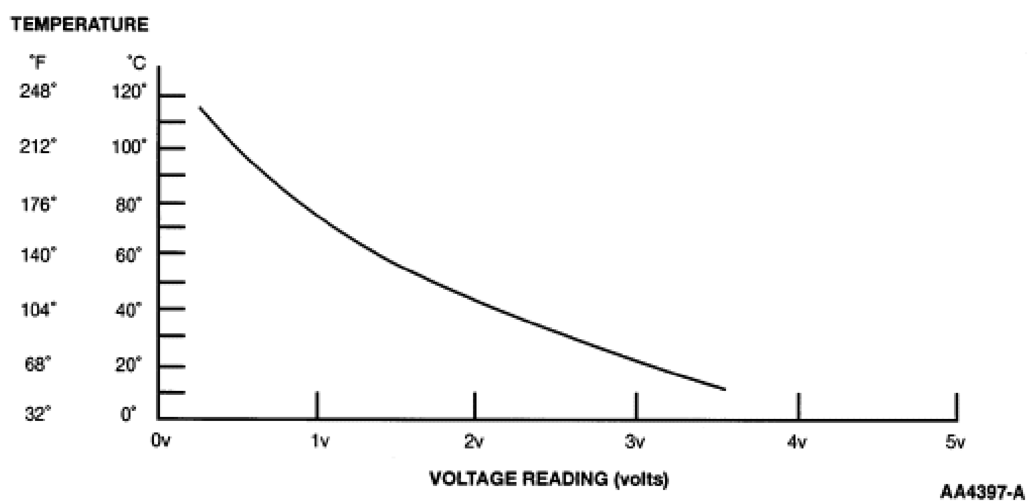

Fig. 87: Temperature Sensor Temperature To Voltage Graph
Courtesy of FORD MOTOR CO.

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
120	248	0.28	1.18
110	230	0.36	1.55

100	212	0.47	2.07
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85
-10	14	4.45	160.31

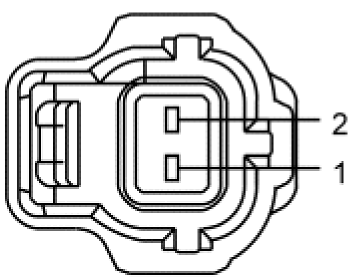

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Fig. 88: Engine Oil Temperature (EOT) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
1	ECT (Engine Coolant Temperature)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	E40 E41 E21	VREF SIGRTN ECT
Fusion, Milan	140 Pin	E57 E58 E18	VREF SIGRTN ECT

All other vehicles	170 Pin	E57 E58 E18	VREF SIGRTN ECT

DX1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0116, P0117, P0118, P0119, P0125, P0128, P0217, P1116, or P1117 present?**

Yes	No
For continuous memory DTC P0116, GO to **DX14**. For KOEO and KOER DTC P0117, GO to **DX12**. For continuous memory DTCs P0117, P0118, P0119, or P1117, GO to **DX16**. For KOEO and KOER DTC P0118, GO to **DX8**. For continuous memory DTCs P0125, or P0128, GO to **DX19**. For DTC P0217, GO to **DX21**. For KOEO and KOER DTC P1116, GO to **DX2**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DX2 DTC P1116: CHECK THE COOLING SYSTEM

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

- The DTC indicates the temperature sensor is out of self-test range. The engine is not at normal operating temperature.
- Check the vehicle coolant level.
- **Is the cooling system OK?**

Yes	No
GO to **DX3**.	REFER to the **ENGINE COOLING -- E-SERIES** , for loss of coolant diagnosis. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DX3 CHECK IF THE VEHICLE ENGINE STARTS

- Attempt to start the engine.
- **Does the engine start and run normally?**

Yes	No

GO to **DX6**.	GO to **DX4**.

DX4 CHECK THE RESISTANCE OF THE ECT SENSOR WITH THE ENGINE OFF

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- Key in OFF position.
- ECT Sensor connector disconnected.
- Measure the resistance between:

(+) ECT Sensor Connector, Component Side	(-) ECT Sensor Connector, Component Side
ECT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to **DX5**.	INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DX5 CHECK THE CIRCUIT FROM THE MODULE TO THE COMPONENT

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- ECT Sensor connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the ECT PID.
- Using the data collected from the previous step, compare temperature resistance measured at the sensor to the PID temperature voltage measured at the PCM.
- **Does the measured value at the sensor agree with the measured PID voltage value at the PCM?**

Yes	No
RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	GO to **DX10**.

DX6 CHECK THE ECT SENSOR OPERATION

- Run the engine until the engine temperature stabilizes.

- Verify the upper radiator hose is hot and the cooling system is pressurized.
- Repeat the KOER self-test.
- **Is DTC P1116 present?**

Yes	No
GO to **DX7**.	The engine temperature was not stabilized. REPAIR any other DTCs as necessary.

DX7 CHECK THE RESISTANCE OF THE ECT SENSOR

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- The vehicle must be at normal operating temperature.
- Key in OFF position.
- ECT Sensor connector disconnected.
- Measure the resistance between:

(+) ECT Sensor Connector, Component Side	(-) ECT Sensor Connector, Component Side
ECT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to **DX25**.	INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DX8 DTC P0118: CHECK THE ECT SIGNAL CIRCUIT

- The DTC indicates the sensor signal is greater than the self-test maximum.
- ECT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ECT Sensor Connector, Harness Side	(-) ECT Sensor Connector, Harness Side

ECT - Pin 1	SIGRTN - Pin 2

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **DX9**.	GO to **DX10**.

DX9 CHECK THE RESISTANCE OF THE ECT SENSOR WITH THE ENGINE OFF

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- Key in OFF position.
- ECT Sensor connector disconnected.
- Measure the resistance between:

(+) ECT Sensor Connector, Component Side	(-) ECT Sensor Connector, Component Side
ECT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to **DX11**.	INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DX10 CHECK THE SIGNAL AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) ECT Sensor Connector, Harness Side
ECT	ECT - Pin 1
SIGRTN	SIGRTN - Pin 2

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

Yes	No
GO to **DX25**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DX11 CHECK THE SENSOR SIGNAL FOR A SHORT TO VREF

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ECT	VREF

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DX25**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DX12 DTC P0117: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- The DTC indicates the sensor signal is less than the self-test minimum.
- Possible causes:
  - grounded circuit in the harness
  - incorrect harness connections
  - damaged sensor
  - damaged PCM
- ECT Sensor connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the ECT PID.
- **Is the voltage greater than 4.2 V?**

Yes	No
INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DX13**.

DX13 CHECK THE SENSOR SIGNAL FOR A SHORT TO GROUND

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ECT	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) 12 Volt Vehicle Battery
ECT	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DX25**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DX14 DTC P0116: CHECK THE RESISTANCE OF THE ECT SENSOR WITH THE ENGINE OFF

NOTE: **Verify the engine temperature is at ambient room temperature before continuing with this test. A soak period of 6 hours may be required. Refer toDIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS for information concerning P0116.**

NOTE: **Refer to the chart at the beginning of this test for the resistance specifications.**

- Key in OFF position.
- ECT Sensor connector disconnected.
- Measure the resistance between:

(+) ECT Sensor Connector, Component Side	(-) ECT Sensor Connector, Component Side
ECT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to **DX15**.	INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DX15 DTC P0116: CHECK THE RESISTANCE OF THE ECT SENSOR

NOTE: **Refer to the chart at the beginning of this test for the resistance specifications.**

NOTE: **Verify the engine is at operating temperature before taking the ECT reading.**

- ECT Sensor connector connected.
- Run the engine until the engine temperature stabilizes.
- Key in OFF position.
- ECT Sensor connector disconnected.
- Measure the resistance between:

(+) ECT Sensor Connector, Component Side	(-) ECT Sensor Connector, Component Side
ECT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
The concern is not present at this time. CARRY OUT the OBD drive cycle to determine if fuel, HO2S, catalyst and misfire monitors can be executed. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DX16 DTCS P0117, P0118, P0119 OR P1117: INTERMITTENT CHECK

- Key ON, engine OFF.
- Access the PCM and monitor the ECT PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector

- **Is there a large change in the voltage reading?**

Yes	No
DISCONNECT and INSPECT the connector. If OK, INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DX17**.

DX17 CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

- Access the PCM and monitor the ECT PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there a large change in the voltage reading?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DX18**.

DX18 CHECK THE PCM AND VEHICLE HARNESS CONNECTORS

- Key in OFF position.
- PCM connector disconnected.
- ECT Sensor connector disconnected.
- **Are the connectors and terminals OK?**

Yes	No
The concern is not present at this time. DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DX19 DTCS P0125 OR P0128: CHECK THE ENGINE COOLANT LEVEL

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

- The DTC indicates the engine coolant temperature has not achieved the required engine operation temperature level, since start-up within a specified amount of time.

- Possible causes:
  - insufficient warm up time
  - leaking or stuck-open thermostat
  - low engine coolant
- Check the engine coolant level.
- **Is the engine coolant fill level correct?**

Yes	No
GO to **DX20**.	REFER to the **ENGINE COOLING -- E-SERIES** , for loss of coolant diagnosis. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DX20 CHECK THE SENSOR OPERATION

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Access the PCM and monitor the ECT PID.
- **Is the temperature greater than 77°C (170.6°F)?**

Yes	No
The test is complete. DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	REFER to the **ENGINE COOLING -- E-SERIES** for cooling system diagnosis. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DX21 DTC P0217: INDICATES AN ENGINE OVERHEAT CONDITION

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

- Check the engine coolant level.
- **Is the engine coolant fill level correct?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the overheating condition. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the loss of coolant. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DX22 DTC P0298: ENGINE OIL OVER TEMPERATURE CONDITION

NOTE: The engine oil temperature protection strategy in the PCM is activated. This protects the engine against mechanical damage due to overheating.

- Check for an overheating condition and base engine concerns.
- **Are there any overheating or base engine concerns?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DX23**.

DX23 CHECK FOR ECT DTCS

- Carry out the self-test.
- **Are DTCs P0117, P0118, P1116 or P1117 present?**

Yes	No
DISREGARD the engine oil temperature (EOT) diagnostic trouble code (DTC) at this time. ADDRESS the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DX24**.

DX24 ROAD TEST THE VEHICLE AND MONITOR FOR ENGINE OVER TEMPERATURE

- Access the freeze frame data (if available) and record the DTC concern conditions.
- Access the PCM and monitor the ECT PID.
- Test drive the vehicle and allow the engine to reach normal operating temperature.
- Observe the ECT PID.
- **Does the engine overheat?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the overheat symptom. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. CLEAR the DTCs. REPEAT the self-test.

DX25 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins

  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DY: ENGINE OIL TEMPERATURE (EOT) SENSOR

This pinpoint test is intended to diagnose the following:

- engine oil temperature (EOT) sensor (12A648)
- harness circuits: EOT and SIGRTN
- powertrain control module (PCM) (12A650)

Engine oil temperature must be greater than 10°C (50°F) to pass the KOEO self-test and greater than 66°C (150°F) to pass the KOER self-test.

Voltage values calculated for VREF = 5 volts. These values can vary by 15% due to sensor and VREF variations.

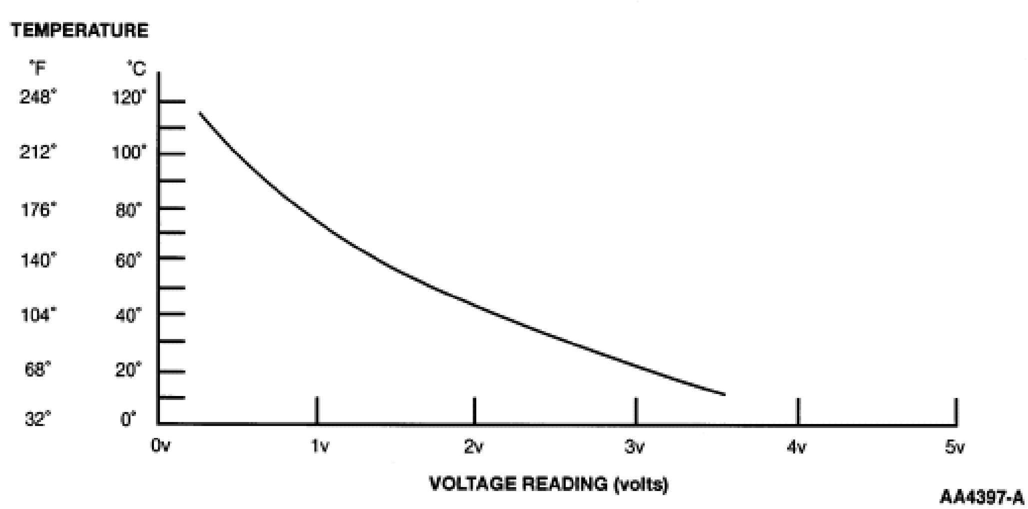

Fig. 89: Temperature Sensor Temperature To Voltage Graph
Courtesy of FORD MOTOR CO.

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
120	248	0.28	1.18
110	230	0.36	1.55
100	212	0.47	2.07
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85
-10	14	4.45	160.31

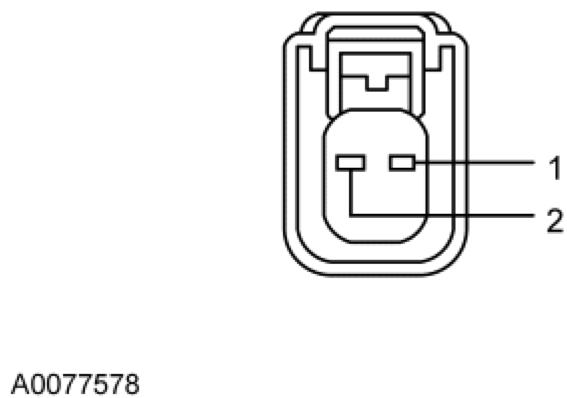

Fig. 90: Engine Oil Temperature (EOT) Sensor Connector - A
Courtesy of FORD MOTOR CO.

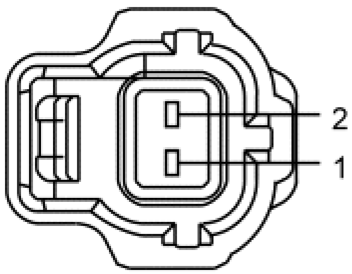

Fig. 91: Engine Oil Temperature (EOT) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Mustang	A	2 1	SIGRTN EOT
All other vehicles	B	2 1	SIGRTN EOT

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Connector	Pin	Circuit
170 Pin	E58 B35 E57 E27	SIGRTN VPWR VREF EOT

DY1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0196, P0197, P0198, P0298, or P1184 present?**

Yes	No
For DTCs P0196 or P1184, GO to **DY2**. For DTCs P0197 or P0198, GO to **DY3**. For continuous memory DTC P0298, GO to **DY14**.	For all others, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DY2 DTCS P0196 OR P1184: CHECK THE EOT SENSOR OPERATION

NOTE: **Before continuing with this pinpoint test, verify the engine oil condition and level are within specification.**

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Carry out the self-test.
- **Are DTCs P0196 or P1184 present?**

Yes	No
GO to **DY3**.	The engine temperature was not stabilized. REPAIR any other DTCs as necessary.

DY3 DTCS P0196, P0197, P0198, P1184 OR P0298: CHECK THE TEMPERATURE SENSOR SIGNAL

- Key ON, engine OFF.
- Access the PCM and monitor the EOT PID.
- **Is the voltage less than 0.3 V?**

Yes	No
GO to **DY4**.	GO to **DY6**.

DY4 SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- Key ON, engine OFF.
- EOT Sensor connector disconnected.
- Access the PCM and monitor the EOT PID.
- **Is the voltage greater than 4.2 V?**

Yes	No
INSTALL a new EOT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DY5**.

DY5 CHECK THE SENSOR SIGNAL FOR A SHORT TO GROUND

- PCM connector disconnected.
- Measure the resistance between:

(+) EOT Sensor Connector, Harness Side	(-) EOT Sensor Connector, Harness Side
EOT	SIGRTN

- Measure the resistance between:

(+) EOT Sensor Connector, Harness Side	(-) Vehicle Battery
EOT	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DY18**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DY6 CHECK FOR HIGH EOT SENSOR VOLTAGE

- Access the PCM and monitor the EOT PID.
- **Is the voltage greater than 4.2 V?**

Yes	No
GO to **DY7**.	GO to **DY11**.

DY7 CHECK THE EOT CIRCUIT VOLTAGE

- EOT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) EOT Sensor Connector, Harness Side	(-) EOT Sensor Connector, Harness Side
EOT	SIGRTN

- **Is the voltage greater than 4.2 V?**

Yes	No
GO to **DY8**.	GO to **DY10**.

DY8 CHECK THE RESISTANCE OF THE EOT SENSOR WITH THE ENGINE OFF

- Key in OFF position.
- EOT Sensor connector disconnected.
- Measure the resistance between:

(+) EOT Sensor Connector, Component Side	(-) EOT Sensor Connector, Component Side
EOT	SIGRTN

- Refer to the chart at the beginning of this test for the resistance specifications.
- **Is the resistance within specification?**

Yes	No
GO to **DY9**.	INSTALL a new EOT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DY9 CHECK THE SENSOR SIGNAL CIRCUIT FOR SHORTS TO PWR

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
EOT - Pin E27	VREF - Pin E57
EOT - Pin E27	VPWR - Pin B35

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DY18**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DY10 CHECK THE SIGNAL AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector,	(-) EOT Sensor

Harness Side	Connector, Harness Side
EOT - Pin E27	EOT
SIGRTN - Pin E58	SIGRTN

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

Yes	No
GO to **DY18**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DY11 INTERMITTENT CHECK

- Key ON, engine OFF.
- Access the PCM and monitor the EOT PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector
- **Is there a large change in the voltage reading?**

Yes	No
DISCONNECT and INSPECT the connector. REPAIR as necessary. If OK, INSTALL a new EOT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **DY12**.

DY12 CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

- Access the PCM and monitor the EOT PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there a large change in the voltage reading?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DY13**.

DY13 CHECK THE RESISTANCE OF THE EOT SENSOR WITH THE ENGINE RUNNING

NOTE: **Refer to the chart at the beginning of this test for the resistance specifications.**

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Measure the resistance between:

(+) EOT Sensor Connector, Component Side	(-) EOT Sensor Connector, Component Side
EOT	SIGRTN

- **Is the resistance within specification for the given engine temperature?**

Yes	No
The concern is not present at this time. refer to **PINPOINT TEST Z**.	INSTALL a new EOT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DY14 DTC P0298: ENGINE OIL OVER TEMPERATURE CONDITION

NOTE: The engine oil temperature protection strategy in the PCM has been activated. This protects the engine against mechanical damage due to overheating.

- Check for an overheating condition and base engine concerns.
- **Are there any overheating or base engine concerns?**

Yes	No
ISOLATE the concern. REPAIR as necessary. REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the overheat symptom. CLEAR the DTCs. REPEAT the self-test.	GO to **DY15**.

DY15 CHECK FOR EOT SENSOR HARDWARE

- The engine oil temperature protection strategy in the PCM can be activated with or without an EOT sensor.
- **Does the vehicle have a EOT sensor?**

Yes	No
GO to **DY3**.	GO to **DY16**.

DY16 IDENTIFY THE CUSTOMER'S DRIVING HABITS

- Identify the customers driving habits.
- Access the freeze frame data (if available) and record the DTC concern conditions.
- **Does the vehicle appear to have been driven in an incorrect transmission gear or at high RPM for an extended period?**

Yes	No
ADVISE the customer that improper transmission gear selection and high RPM for an extended period initializes the engine protection strategy. CLEAR the DTCs. REPEAT the self-test.	GO to **DY17**.

DY17 TYPE OF ENGINE COOLANT SENSOR

NOTE: When an oil temperature sensor is not present, the PCM uses an oil algorithm to infer actual temperature based on input from the engine temperature sensor.

- **Is the vehicle equipped with cylinder head temperature (CHT) sensor?**

Yes	No
GO to **DL26**.	GO to **DX22**.

DY18 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DZ: UNIVERSAL HEATED OXYGEN SENSOR (HO2S)

WARNING: **While conducting tests on a hot engine take all safety precautions to prevent skin contact with hot engine components. Failure to follow these instructions may result in personal injury.**

NOTE: Only diagnose the suspect universal HO2S indicated by the DTC.

This pinpoint test is intended to diagnose the following:

- universal HO2S (9Y460)
- harness circuits: UO2S, UO2SGREF, UO2SHTR, UO2SPC, UO2SPCT, and VPWR
- powertrain control module (PCM) (12A650)

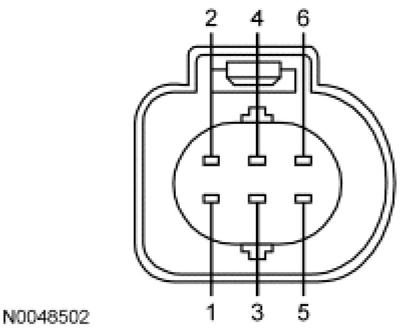

Fig. 92: Universal Heated Oxygen Sensor (HO2S)
Courtesy of FORD MOTOR CO.

Pin	Circuit
5	UO2SPCT (Universal Oxygen Sensor Pumping Current Trim)
1	UO2SPC (Universal Oxygen Sensor Pumping Current)
4	VPWR (Vehicle Power)
2	UO2SGREF (Universal Oxygen Sensor Ground Reference)
6	UO2S (Universal Oxygen Sensor)
3	UO2SHTR (Universal Oxygen Sensor Heater)

Pin	Circuit
E18	UO2S11 (Universal Oxygen Sensor Bank 1, Sensor 1)
E20	UO2S21 (Universal Oxygen Sensor Bank 2, Sensor 1)
E19	UO2SGREF11 (Universal Oxygen Sensor Ground Reference Bank 1, Sensor 1)
E21	UO2SGREF21 (Universal Oxygen Sensor Ground Reference Bank 2, Sensor 1)
E69	UO2SHTR11 (Universal Oxygen Sensor Heater Bank 1, Sensor 1)
E70	UO2SHTR21 (Universal Oxygen Sensor Heater Bank 2, Sensor 1)
E4	UO2SPC11 (Universal Oxygen Sensor Pumping Current Bank 1, Sensor 1)
E6	UO2SPC21 (Universal Oxygen Sensor Pumping Current Bank 2, Sensor 1)

E5	UO2SPCT11 (Universal Oxygen Sensor Pumping Current Trim Bank 1, Sensor 1)
E7	UO2SPCT21 (Universal Oxygen Sensor Pumping Current Trim Bank 2, Sensor 1)

DZ1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0030, P0040, P0050, P0053, P0059, P0130, P0133, P0134, P0135, P0150, P0153, P0154, P0155, P1127, P2096, P2097, P2098, or P2099 present?**

Yes	No
For DTCs P0030 or P0050, GO to **DZ2**. For DTC P0040, GO to **DZ5**. For DTCs P0053, P0059, P0135 or P0155, GO to **DZ6**. For DTCs P0130 or P0150, GO to **DZ11**. For DTCs P0133 or P0153, GO to **DZ15**. For DTCs P0134 or P0154, GO to **DZ18**. For DTC P1127, GO to **DZ19**. For DTCs P2096, P2097, P2098 or P2099, GO to **DZ20**.	For symptoms without DTCs, GO to **DZ23**. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DZ2 DTCS P0030 AND P0050: CHECK FOR MISFIRE CONCERNS AND AFTERMARKET EQUIPMENT

- Key in OFF position.
- Check for the following:
  - misfire concern
  - non-factory or aftermarket equipment that may increase the exhaust temperature
- Universal HO2S connector disconnected.
- Check the universal HO2S connector for damage or corrosion.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DZ3**.

DZ3 CHECK THE UO2SHTR CIRCUIT FOR A SHORT TO VOLTAGE

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Universal HO2S	

Connector, Harness Side	(-)
UO2SHTR - Pin 3	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DZ4**.

DZ4 CHECK THE UO2S, UO2SGREF, UO2SHTR CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2S - Pin 6	UO2S
UO2SGREF - Pin 2	UO2SGREF
UO2SHTR - Pin 3	HO2S Heater

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

Yes	No
INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DZ5 DTC P0040: CROSSED SENSOR WIRES

- Key in OFF position.
- Check the vehicle repair history.
- Verify the connectors are connected to the correct engine bank.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DZ6 DTCS P0053, P0059, P0135 AND P0155: CHECK FOR VPWR IN THE HARNESS

- Key in OFF position.
- Universal HO2S connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Universal HO2S Connector, Harness Side	(-)
VPWR - Pin 4	Ground

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

Yes	No
GO to **DZ7**.	REPAIR the open circuit. CHECK the fuses. CLEAR the DTCs. REPEAT the self-test.

DZ7 CHECK THE UO2SHTR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2SHTR - Pin 3	UO2SHTR

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DZ8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DZ8 CHECK THE UO2SHTR CIRCUIT FOR A SHORT IN THE HARNESS

- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) Vehicle Battery
UO2SHTR - Pin 3	Negative terminal

- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) Universal HO2S Connector, Harness Side
UO2SHTR - Pin 3	UO2S - Pin 6
UO2SHTR - Pin 3	UO2SGREF - Pin 2
UO2SHTR - Pin 3	UO2SPC - Pin 1
UO2SHTR - Pin 3	UO2SPCT - Pin 5
UO2SHTR - Pin 3	VPWR - Pin 4

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DZ9**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DZ9 CHECK THE INTERNAL RESISTANCE OF THE UNIVERSAL HO2S HEATER

- Measure the resistance between:

(+) Universal HO2S Connector, Component Side	(-) Universal HO2S Connector, Component Side
VPWR - Pin 4	UO2SHTR - Pin 3

- **Is the resistance between 1.8 - 9 ohms?**

Yes	No
GO to **DZ10**.	INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ10 CHECK THE UO2SHTR CIRCUIT FOR AN INTERNAL SHORT TO GROUND

- Measure the resistance between:

(+) Universal HO2S Connector, Component Side	(-)
UO2SHTR - Pin 3	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **DZ25**.	INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ11 DTCS P0130 AND P0150: CHECK THE UO2S AND UO2SGREF CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector,	(-) PCM Connector,

Harness Side	Harness Side
UO2S - Pin 6	UO2S
UO2SGREF - Pin 2	UO2SGREF

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

Yes	No
GO to **DZ12**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DZ12 CHECK THE UO2S, UO2SGREF, UO2SPC, AND UO2SPCT CIRCUITS FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-)
UO2S - Pin 6	Ground
UO2SGREF - Pin 2	Ground
UO2SPC - Pin 1	Ground
UO2SPCT - Pin 5	Ground

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **DZ13**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DZ13 CHECK THE UO2S, UO2SGREF, UO2SPC, AND UO2SPCT CIRCUITS FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) Universal HO2S Connector, Harness Side	(-)
UO2S - Pin 6	Ground

UO2SGREF - Pin 2	Ground
UO2SPC - Pin 1	Ground
UO2SPCT - Pin 5	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **DZ14**.

DZ14 CHECK THE UO2SGREF CIRCUIT FOR VOLTAGE

- Key in OFF position.
- PCM connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Universal HO2S Connector, Harness Side	(-)
UO2SGREF - Pin 2	Ground

- **Is the voltage between 2.4 - 2.6 V?**

Yes	No
INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **DZ25**.

DZ15 DTCS P0133 AND P0153: CARRY OUT THE KOER SELF-TEST

- Engine at normal operating temperature.
- Carry out the KOER self-test.
- **Are any DTCs present other than P0133 or P0153?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DZ16**.

DZ16 CHECK FOR A SOURCE OF POTENTIAL CONTAMINATION

- Investigate the following items as potential sources of universal HO2S contamination:
  - use of unapproved silicon sealers
  - fuel contaminated by silicon additives
  - excessive oil consumption
  - glycol leaking internally in the engine
  - lead-contaminated fuel
  - short drive cycles in cold weather
  - use of unapproved cleaning agents
- **Is a concern present?**

Yes	No
REPAIR the source of the contamination. CHANGE the engine oil and oil filter. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **DZ17**.

DZ17 CHECK THE UNIVERSAL HO2S RESPONSE TEST RESULTS

- Key ON, engine OFF.
- Access the diagnostic monitoring test results for the HO2S11 and HO2S21.
- **Is the indicated value greater than the minimum threshold?**

Yes	No
Unable to duplicate or identify the concern at this time. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ18 DTCS P0134 AND P0154: CHECK THE UO2SPC CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2SPC - Pin 1	UO2SPC

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DZ19 KOER DTC P1127: EXHAUST TEMPERATURE OUT OF RANGE

NOTE: Address all other DTCs before proceeding.

- Key ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the HTR11 and HTR21 PIDs.
- **Are the PID states ON?**

Yes	No
CARRY OUT the KOER self-test.	RUN the engine until the PID indicates ON. CARRY OUT the KOER self-test.

DZ20 DTCS P2096, P2097, P2098 AND P2099: VISUALLY INSPECT THE UPSTREAM AND DOWNSTREAM HO2S CONNECTORS

- Key in OFF position.
- HO2S connector disconnected.
- Universal HO2S connector disconnected.
- Check for a loose connection, and damaged or corroded terminals.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DZ21**.

DZ21 CHECK FOR LEAKS IN THE EXHAUST SYSTEM

- Visually inspect the exhaust system for the following:
  - exhaust leaks at flanges and gaskets
  - HO2Ss not tightened to specification
  - physical exhaust system concerns
  - aftermarket exhaust
  - punctures or cracks in the catalytic converter
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DZ22**.

DZ22 CHECK FOR POTENTIAL SENSOR CONTAMINATION CONCERNS

- Investigate the following items as potential sources of universal HO2S contamination:
  - use of unapproved silicon sealers
  - fuel contaminated by silicon additives
  - excessive oil consumption
  - glycol leaking internally in the engine
  - lead-contaminated fuel
  - short drive cycles in cold weather
  - use of unapproved cleaning agents
- **Is a concern present?**

Yes	No
REPAIR the source of the contamination. CHANGE the engine oil and oil filter. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **DZ25**.

DZ23 CHECK THE UO2SPCT CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Universal HO2S connector disconnected.

- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2SPCT - Pin 5	UO2SPCT

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **DZ24**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DZ24 CHECK THE RESISTANCE OF THE CURRENT TRIM RESISTOR IN THE UNIVERSAL HO2S

- Measure the resistance between:

(+) Universal HO2S Connector, Component Side	(-) Universal HO2S Connector, Component Side
UO2SPCT - Pin 5	UO2SPC - Pin 1

- **Is the resistance between 25 - 330 ohms?**

Yes	No
The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** for further direction.	INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ25 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins

- corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST EM: EMISSION COMPLIANCE

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

NOTE: **Canada and some states or metropolitan areas in the United States require periodic emission, or inspection/maintenance (I/M) tests. All Ford products are designed to pass these tests. If a Ford product fails an I/M test, it is probably because 1) the engine or catalyst temperature was not warm and stabilized before the test, or 2) the vehicle had idled excessively before the test.**

If any new emission components are installed, carry out the following steps before repeating the I/M test procedure:

- Reset the keep alive memory (KAM). Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .
- To relearn some basic adaptive learning (trim) values, run the engine at 2,500 RPM for 1 minute and idle the engine for 2 minutes.

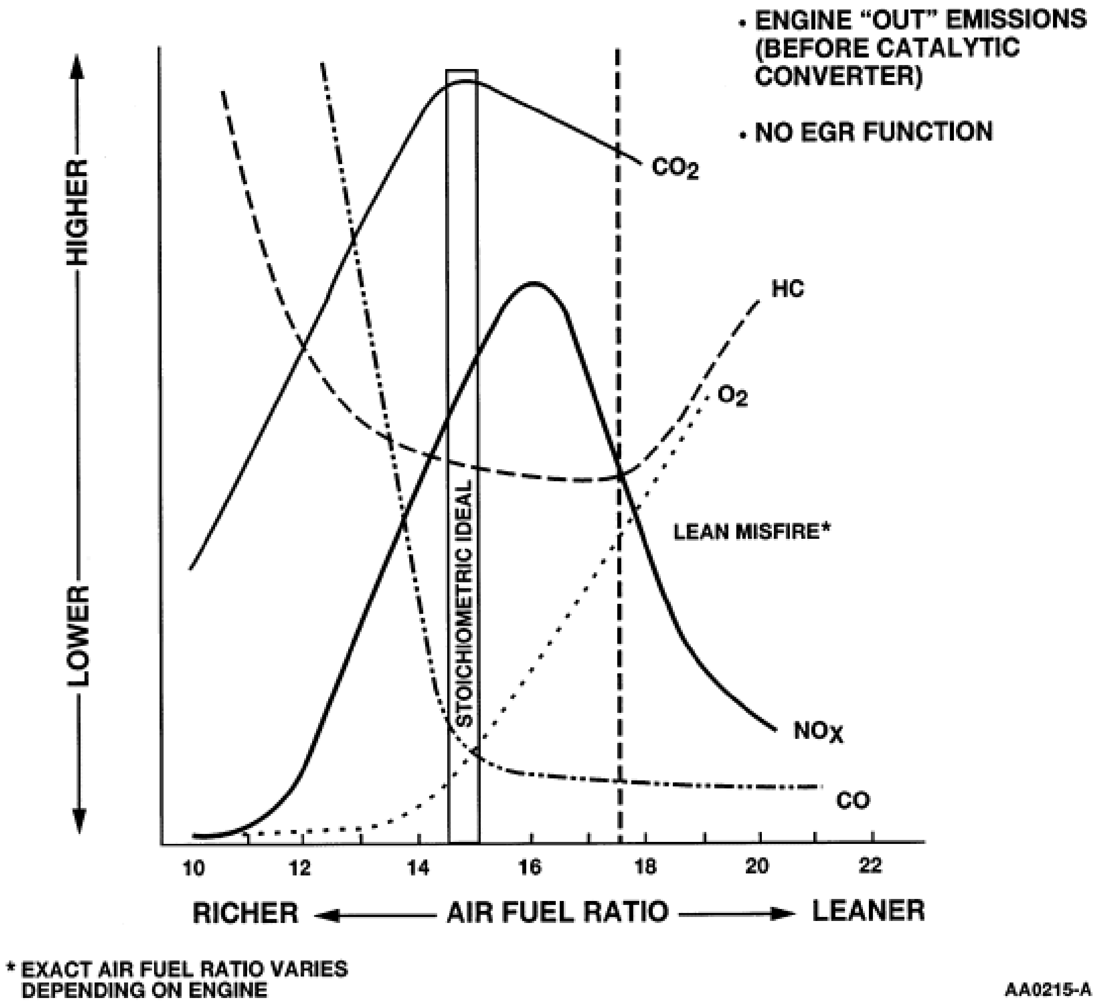

Fig. 93: Exhaust Gas Analysis Chart
Courtesy of FORD MOTOR CO.

Verifying an Excessive Grams Per Mile (GPM) Indication Using a Parts Per Million (PPM) Reading.

For vehicle gas reading(s) that are excessive, compare the actual GPM reading to the gas cut point level needed to pass testing. This gives an indication of how much the PPM reading has to be reduced (if the actual reading is twice the cut point, the baseline reading has to be cut in half or more).

Example:

- The actual HC produced by a vehicle is 1.6 gpm. The cut point for HC in this example is 0.8 gpm. The actual reading is twice the cut point.
- The HC reading obtained for the same vehicle during the baseline drive averages 440 ppm. In order for this vehicle to pass the I/M test, the HC reading from the verification trip must be at least half of the baseline reading, or an average of 220 ppm or less.
- This method only gives a general idea of how much the PPM reading needs to be reduced in order for the vehicle to pass an I/M test that calculates GPM. This test is not exact. Experience still has to be used to

determine if the emission readings are reduced enough for the vehicle to pass the I/M test.

EM1 ANALYZE THE I/M TEST REPORT

- Analyze the I/M test report for data entry errors.
  - model
  - model year
  - correct calibration, if included on the report
  - correct test weight, if included on the report (this number is less than the vehicle's GVW)
- Analyze the I/M test report results.
  - identify high and low gas readings.
  - for reports that include a drive trace, identify during which mode the gas(es) failed. Be aware that if all gases were high early then decreased, the catalyst may have been cool when testing began.
- **Has the I/M test report been analyzed?**

Yes	No
GO to **EM2**.	REPEAT the test step.

EM2 EVAP SYSTEM LEAK OR PURGE FLOW TEST (IF THESE TESTS WERE CARRIED OUT)

- **Does the vehicle fail only an EVAP system leak or purge flow test (if these tests are carried out)?**

Yes	No
This is an EVAP concern only. GO to **EM22**.	GO to **EM3**.

EM3 BASELINE THE VEHICLE

NOTE: Baselining the vehicle exhaust gas readings is important so the baseline readings can be used for comparison after any repair is made.

- Baseline the vehicle using an exhaust gas analyzer. If the vehicle must be driven, be certain any baseline drive used is repeatable. The same drive cycle will be used to verify any repair.
- During the baseline, check for any related symptoms that may be present, such as driveability, transmission shifting or exhaust smoke concerns.
- **Has the vehicle been baselined?**

Yes	No
GO to **EM4**.	REPEAT the test step.

EM4 SYMPTOM CHECKS

- Check if any of the following symptoms are present:

- transmission concerns
- idle concerns
- driveability concerns
- exhaust smoke
- cooling system concerns

- **Are any of the symptoms present?**

Yes	No
CARRY OUT the PCM Quick Test. REFER to the **SYMPTOM CHARTS** article, QT: Step 1: Powertrain Control Module (PCM) Quick Test. REFER to the Exhaust Gas Analysis Chart at the beginning of this pinpoint test. After any repair, GO to **EM26**.	GO to **EM5**.

EM5 PRELIMINARY CHECKS

- Carry out the following checks:
  - vacuum lines for leaks and blockages
  - electrical connections
  - proper scheduled maintenance
  - Ford authorized emission controls and components installed on the vehicle
  - intake air tube and air cleaner concerns such as obstructions, leaks, or a dirty air cleaner element
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to **EM26**.	GO to **EM6**.

EM6 CARRY OUT THE PCM QUICK TEST

- Carry out the PCM Quick Test to access any PCM DTCs. For the procedure information, refer to**PINPOINT TEST QT** .
- **Is a concern present?**

Yes	No
FOLLOW the Quick Test direction. After any repair, GO to **EM26**.	GO to **EM7**.

EM7 CHECK FOR EXCESSIVE CARBON MONOXIDE (CO) LEVELS

- **Does the vehicle have excessive CO levels?**

Yes	No
Excessive CO levels indicate the engine is running rich. GO to **EM10**.	GO to **EM8**.

EM8 CHECK FOR EXCESSIVE HYDROCARBON (HC) LEVELS

- **Does the vehicle have excessive HC levels?**

Yes	No
Excessive HC levels with low to normal CO levels indicate the engine is running lean. GO to **EM16**.	GO to **EM9**.

EM9 CHECK FOR EXCESSIVE OXIDES OF NITROGEN (NOX) LEVELS

- **Does the vehicle have excessive NOx levels?**

Yes	No
GO to **EM20**.	VERIFY the test step results.

EM10 HIGH CO LEVELS: CHECK THE HC LEVELS

- **Does the vehicle have excessive HC levels?**

Yes	No
CHECK for the engine running rich and incomplete combustion. GO to **EM11**.	GO to **EM12**.

EM11 CHECK THE SECONDARY IGNITION SYSTEM

- For ignition coil on plug (COP) equipped vehicles, GO to **JB2** and follow the pinpoint test direction.
- For ignition coil pack equipped vehicles, GO to **JC2** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM12**.

EM12 CHECK THE FUEL DELIVERY SYSTEM FOR CONCERNS SUCH AS HIGH FUEL PRESSURE AND THE ABILITY TO HOLD PRESSURE

- refer to **PINPOINT TEST HC** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM13**.

EM13 CHECK FOR VACUUM LEAKS/OBSTRUCTION IN THE PCV SYSTEM (SUCH AS OIL CAP, PCV VALVE, HOSES, CUT GROMMETS, VALVE COVER BOLT TORQUE/GASKET LEAK)

- GO to **HG2** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM14**.

EM14 CHECK THE EXHAUST SYSTEM

- GO to **HF2** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM15**.

EM15 CHECK THE BASE ENGINE

- Check for base engine concerns. Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** .
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to **EM26**.	GO to **EM27**.

EM16 HIGH HC WITH A NORMAL TO LOW CO LEVEL

- Check the fuel delivery system for concerns. refer to **PINPOINT TEST HC** and follow the pinpoint test direction.

- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM17**.

EM17 CHECK THE SECONDARY IGNITION

- For ignition coil on plug (COP) equipped vehicles, GO to **JB2** and follow the pinpoint test direction.
- For ignition coil pack equipped vehicles, GO to **JC2** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM18**.

EM18 CHECK FOR VACUUM LEAKS/OBSTRUCTION IN THE PCV SYSTEM (SUCH AS OIL CAP, PCV VALVE, HOSES, CUT GROMMETS, VALVE COVER BOLT TORQUE/GASKET LEAK)

- GO to **HG2** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM19**.

EM19 CHECK THE BASE ENGINE

- Check for base engine concerns such as intake manifold leaks, improper compression, or valvetrain or camshaft damage. Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** to carry out the intake manifold vacuum test, compression test, and valve train analysis.
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to **EM26**.	GO to **EM27**.

EM20 HIGH NOX WITH NORMAL TO LOW HC AND CO LEVELS: CHECK THE BASE ENGINE

- Check for base engine concerns such as excessive carbon build up in the combustion chamber. Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** to diagnose the abnormal combustion.
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to **EM26**.	GO to **EM21**.

EM21 ADDITIONAL CHECKS

- Check the following:
  - transmission torque converter clutch operation
  - cooling system concerns such as an aftermarket front fascia covering the intake air or intake air system modifications
  - engine running lean concerns such as vacuum leaks or low fuel pressure
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to **EM26**.	GO to **EM27**.

EM22 EVAP SYSTEM CONCERN: PRELIMINARY CHECKS

- Analyze the I/M test report to determine when the concern is present. Attempt to verify the concern.
- Check the following:
  - fuel filler cap
  - capless fuel tank filler pipe (if equipped)
  - EVAP system lines/hoses for proper connections, damage or blockage
  - fuel vapor storage canister damage
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to **EM25**.	GO to **EM23**.

EM23 CARRY OUT THE PCM QUICK TEST

- Carry out the PCM Quick Test to access any PCM DTCs. For the procedure information, refer to**PINPOINT TEST QT** .

- **Is a concern present?**

Yes	No
FOLLOW the Quick Test direction. After any repair, GO to **EM25**.	GO to **EM24**.

EM24 EVAP SYSTEM CHECK

- Check the EVAP system for leaks. Refer to the **EVAPORATIVE EMISSIONS -- E-SERIES** to carry out the evaporative emission system leak test.
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to **EM25**.	VERIFY the test step results. If all the test steps are OK, refer to **PINPOINT TEST Z**. For additional symptoms, REFER to the **SYMPTOM CHARTS** article. After any repair, GO to **EM25**.

EM25 EVAP SYSTEM REPAIR VERIFICATION

- Confirm the vehicle repair.
- Reset the keep alive memory (KAM). Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . Be aware that this will set DTC P1000 and reset the On-Board System Readiness test.
- To relearn some basic adaptive learning (trim) values, run the engine at 2,500 RPM for 1 minute and idle the engine for 2 minutes.
- Carry out the PCM Quick Test to access any PCM DTCs. For the procedure information, refer to**PINPOINT TEST QT** .
- Carry out the EVAP system leak test and flow check.
- **Does the vehicle pass the EVAP system leak test and flow check?**

Yes	No
SAVE any repair documentation that may be required by local/federal laws. RETURN the vehicle to the customer.	The original concern was not repaired, or another concern exists. GO to **EM1**.

EM26 REPAIR AND VERIFICATION

NOTE: **If the vehicle needs to be driven for the baseline test, it may be necessary to drive the vehicle first up to 8 km (5 miles) to relearn some additional adaptive learning (trim) values. Also, during the baseline make sure to use the same**

drive mode that was used for the original baseline test.

- Confirm the vehicle repair.
- Reset the keep alive memory (KAM). Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . Be aware that this will set DTC P1000 and reset the On-Board System Readiness test.
- To relearn some basic adaptive learning (trim) values, run the engine at 2,500 RPM for 1 minute and idle the engine for 2 minutes.
- Carry out the PCM Quick Test to access any PCM DTCs. For the procedure information, refer to**PINPOINT TEST QT** . Repair any other DTCs.
- Carry out the baseline test using the exhaust gas analyzer.
- For I/M 240 emission testing areas:
    - Refer to the beginning of this pinpoint test for information on verifying an excessive grams per mile indication using a parts per million (PPM) reading.
- All others (original gas concentrations reported in parts per million):
    - Verify the gas levels are within the acceptable range
- **Are all gases within the acceptable range?**

Yes	No
SAVE any repair documentation that may be required by local/federal laws. RETURN the vehicle to the customer.	The gas level is still high, or another gas level is above the acceptable range. GO to **EM1**.

EM27 CATALYST DELTA TEMPERATURE TEST

- Complete all previous testing.
- Run the engine for 2 minutes at 2,500 RPM to heat the exhaust system.
- Key in OFF position.
- Disconnect and ground 1 spark plug wire from each cylinder bank (for coil-on-plug applications, disconnect the coil connector).
- Run the engine at approximately 1,000 RPM.
- Disconnect the IAC valve and maintain 1,000 RPM (if equipped).
- Measure the surface temperature at both the inlet and outlet of each catalytic converter.
- Compare the difference in temperature between the inlet and outlet readings of each catalytic converter.
- **Does each catalytic converter have a difference of more than 28°C (50°F) between its inlet and outlet reading?**

Yes	No
The catalytic converter(s) is operating correctly. CONNECT the spark plug wire(s) and the IAC (if equipped). CLEAR the DTCs.	For catalytic converter(s) that have less than 28°C (50°F) difference, testing indicates the catalytic converter(s) is not working. REPEAT the test to

VERIFY the test step results. If all test steps are OK, refer to **PINPOINT TEST Z**. For additional symptoms, REFER to the **SYMPTOM CHARTS** article. After any repair, GO to **EM26**.	verify the results. If the temperature difference is still less than required, INSTALL a new catalytic converter. After any repair, GO to **EM26**.

PINPOINT TEST FB: POWER TAKE OFF (PTO)

This pinpoint test is intended to diagnose the following:

- PTO switch
- harness circuit: PTO, PTOIL
- powertrain control module (PCM) (12A650)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Connector	Pin	Circuit
170 Pin	B7 B42 B9 B26	PTORPM PTOIL PTOENG PTO

FB1 PTO INDICATOR LAMP

- **Did you come to this pinpoint test for an always on/ never on PTO indicator?**

Yes	No
GO to **FB7**.	GO to **FB2**.

FB2 PTO NOT WORKING CORRECTLY: CHECK THE PTO INDICATOR LAMP OPERATION

NOTE: **The following conditions must be met before the PTO engages:**

- **Engine at normal operating temperature**
- **Accelerator pedal is released**
- **TFT within normal operating temperature**
- **Parking brake is applied**
- **Brake pedal is released**
- **Automatic transmission is in the PARK position**
- **Manual transmission - the clutch pedal is released**

NOTE: This step requires operating the PTO component. Refer to the aftermarket manufacturer for the PTO operating instructions. Follow all safety precautions.

- Key ON, engine running.
- Activate the PTO switch.
- **Does the PTO indicator illuminate?**

Yes	No
GO to the aftermarket PTO mechanical manual.	GO to **FB3**.

FB3 CHECK THE INTEGRITY OF THE PTO SWITCH AND THE PTO SWITCH CIRCUIT

- Access the PCM and monitor the PTO PID.
- Cycle the PTO switch, from off to on to off.
- **Does the PTO PID change state?**

Yes	No
GO to **FB4**.	REPAIR the PTO circuit or switch as necessary. CLEAR the DTCs. REPEAT the self-test.

FB4 CHECK THE PTO LOAD PID STATE IN THE PCM

- Access the PCM and monitor the PTOLOAD PID.
- Cycle the PTO switch,
- **Does the PTO LOAD PID change state?**

Yes	No
GO to **FB5**.	REPAIR the PTO ENG circuit or switch as necessary. CLEAR the DTCs. REPEAT the self-test.

FB5 CHECK THE PTOIR_V PID STATE IN THE PCM

NOTE: The PTOIR_V PID represents an analog input which reflects the user requested engine speed.

- Access the PCM and monitor the PTOIR_V PID.
- Cycle the PTO switch,
- **Does the PTOIR_V PID change state?**

Yes	No
	REPAIR the PTO RPM circuit or switch as

GO to **FB6**.	necessary. CLEAR the DTCs. REPEAT the self-test.

FB6 CHECK THE PTOIL PID STATE IN THE PCM

- Access the PCM and monitor the PTOIL PID.
- Cycle the PTO switch,
- **Does the PTOIL PID change state?**

Yes	No
GO to **FB7**.	VERIFY no DTCs are present. VERIFY the vehicle conditions in step FB2 are correct for PTO operation.

FB7 PTO INDICATOR LAMP ALWAYS OFF OR ON: CHECK THE PTOIL_F PID

- Access the PCM and monitor the PTOIL_F PID.
- **Is a concern present?**

Yes	No
REPAIR the circuit as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to the aftermarket PTO mechanical manual.

PINPOINT TEST FD: BRAKE PEDAL INPUTS

This pinpoint test is intended to diagnose the following:

- brake pedal position (BPP) (13480)
- brake pedal switch (BPS) (9F924), (9C872)
- harness circuits: B+, BPP, BPS
- powertrain control module (PCM) (12A650)

Refer to the Wiring Diagrams article for specific vehicle application and pin locations.

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Town Car	170 Pin	B9	BPS
E-Series, F-Super Duty	170 Pin	E65 B8	BPS BPP
Escape/Mariner	150 (50-50-50) Pin	B8	BPP

Expedition, Fusion, Milan, MKZ, Navigator	140 Pin	B47 B46	BPS BPP
Explorer, Explorer Sport Trac, Mountaineer, Mustang	170 Pin	B9 B8	BPS BPP
Focus	190 Pin	B46 B13	BPS BPP
Ranger	170 Pin	B8	BPP
All other vehicles	190 Pin	B47 B46	BPS BPP

FD1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P0504, P0572, P0573, P0703, P1572, or P1703 present?**

Yes	No
For KOEO or continuous memory DTCs P0504, P0572, P0573, P0703, P1703 and continuous memory DTC P1572, GO to **FD3**. For KOER DTCs P0703, or P1703, GO to **FD2**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

FD2 KOER DTCS P0703 AND P1703: VERIFY THE BRAKE PEDAL WAS APPLIED

- **Was the brake pedal applied and released during the KOER self-test?**

Yes	No
GO to **FD3**.	REPEAT the KOER self-test. APPLY and RELEASE the brake pedal during the KOER test. CLEAR the DTCs. REPEAT the self-test.

FD3 DTCS P0572, P0573, P0703, P1572 AND P1703: CHECK THE OPERATION OF THE STOPLAMP

- Key ON, engine OFF.
- Apply and release the brake pedal and check the stop lamp operation.
- **Do the stoplamp operate correctly?**

Yes	No
For Crown Victoria, Grand Marquis, Sable, Taurus,	REFER to the **EXTERIOR LIGHTING -- E-SERIES** to diagnose the inoperative stoplamp.

Taurus X, and Town Car, GO to **FD4**. For all others, GO to **FD5**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

FD4 CHECK THE BRAKE SWITCH OPERATION

- Key ON, engine OFF.
- Access the PCM and monitor the BPP_BOO PID.
- Apply and release the brake pedal while monitoring the brake position PID.
- **Does the PID cycle ON and OFF?**

Yes	No
GO to **FD6**.	REFER to the **MODULE COMMUNICATIONS NETWORK -- E-SERIES** to diagnose the powertrain control module (PCM) not responding to the scan tool. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

FD5 CHECK FOR BPP CIRCUIT CYCLING

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Apply and release the brake pedal while monitoring the voltage.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
BPP	Ground

- **Is voltage less than 1 volt with the brake pedal released and greater than 10 volts with the brake pedal fully applied?**

Yes	No
For Ranger, GO to **FD7**. For all others, GO to **FD6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

FD6 CHECK FOR BPS CIRCUIT CYCLING

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.

- Apply and release the brake pedal while monitoring the voltage.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
BPS	Ground

- **Is voltage greater than 10 volts with the brake pedal released and less than 1 volt with the brake pedal fully applied?**

Yes	No
GO to **FD7**.	REFER to the **SPEED CONTROL -- E-SERIES** . CARRY OUT the diagnostic steps for DTC P1703 to continue diagnose.

FD7 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST FF: POWER STEERING PRESSURE (PSP) SWITCH

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- power steering pressure (PSP) Switch (3N824)
- harness circuits: PSPSW and SIGRTN

- powertrain control module (PCM) (12A650)

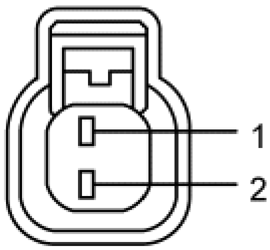

Fig. 94: Positive Crankcase Ventilation Thermal Extension -Harness Side (PCVTE-Harness Side)
Courtesy of FORD MOTOR CO.

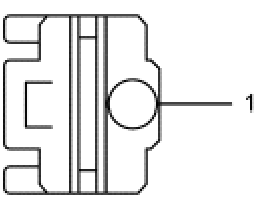

Fig. 95: Power Steering Pressure (PSP) Switch Connector - B
Courtesy of FORD MOTOR CO.

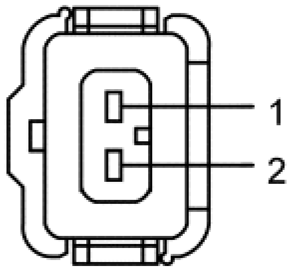

Fig. 96: Power Steering Pressure (PSP) Switch Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Fusion 3.0L, Grand Marquis, Milan 3.0L, Town Car	A	2 1	SIGRTN PSPSW
Edge, Fusion 2.3L, Milan 2.3L, MKX, MKZ	B	1	PSPSW
Ranger	C	2 1	SIGRTN PSPSW
All other vehicles	C	1 2	SIGRTN PSPSW

The PSP and SIGRTN circuits may be reversed in the harness connector. Refer to the Wiring Diagrams article for schematic and connector information.

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, MKX	190 Pin	B17	PSPSW
Explorer, Explorer Sport Trac, Mountaineer	170 Pin	B41 B27	SIGRTN PSPSW

Fusion 3.0L, Milan 3.0L	140 Pin	E58 E65	SIGRTN PSPSW
Fusion 2.3L, Milan 2.3L, MKZ	140 Pin	E65	PSPSW
Ranger	170 Pin	B41 B34	SIGRTN PSPSW
Sable, Taurus, Taurus X	190 Pin	E41 B17	SIGRTN PSPSW
All other vehicles	170 Pin	E58 B34	SIGRTN PSPSW

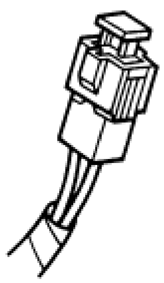

Fig. 97: Shorting Bar For Harness Circuit Without PSP Switch (Typical)
Courtesy of FORD MOTOR CO.

FF1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P1650 or P1651 present?**

Yes	No
For KOEO DTC P1650, GO to **FF3**. For KOER DTC P1650, GO to **FF2**. For continuous memory DTC P1651, GO to **FF7**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

FF2 KOER DTC P1650: CARRY OUT TURNING THE STEERING WHEEL ONE HALF TURN

- **Did you turn the steering wheel at least one half turn within 20 seconds of starting the KOER self-test?**

Yes	No
GO to **FF3**.	CARRY OUT the KOER self-test.

FF3 DTC P1650: CHECK THE PSP PID

- Key ON, engine running.

- Access the PCM and monitor the PSP PID.
- Turn the steering wheel back and forth.
- **Does the PID state change?**

Yes	No
GO to **FF7**.	GO to **FF4**.

FF4 CHECK THE PSP CIRCUITS TO THE PSP SWITCH FOR CYCLING

- Key in OFF position.
- PSP Switch connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the PSP PID.
- For Fusion/Milan 2.3L, Edge/MKX or MKZ,
- Connect a 5 amp fused jumper wire between the following:

Point A PSP Switch Connector, Harness Side	Point B
PSPSW	Ground

- For all others,
- Connect a 5 amp fused jumper wire between the following:

Point A PSP Switch Connector, Harness Side	Point B PSP Switch Connector, Harness Side
PSPSW	SIGRTN

- Remove the jumper wire(s).
- **Does the PID state change?**

Yes	No
INSTALL a new PSP switch. CLEAR the DTCs. REPEAT the self-test.	GO to **FF5**.

FF5 CHECK THE PSP AND SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PSP Switch Connector, Harness Side
PSPSW	PSPSW
SIGRTN	SIGRTN

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

Yes	No
GO to **FF6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

FF6 CHECK THE PSP CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- Measure the resistance between:

(+) PSP Switch Connector, Harness Side	(-)
PSPSW	Ground

- Measure the resistance between:

(+) PSP Switch Connector, Harness Side	(-) PSP Switch Connector, Harness Side
PSPSW	SIGRTN

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **FF8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

FF7 DTC P1651: CHECK THE PSP CIRCUIT(S) FOR INTERMITTENT CONCERNS

NOTE: **Be aware that P1651 could be set if the vehicle is towed with the engine running, or if a power steering hydraulic concern is present.**

- Key ON, engine OFF.

- Access the PCM and monitor the PSP PID.
- Check for open circuits while carrying out the following (a concern is indicated by a sudden change in the PCM-PSP PID):
  - Shake, wiggle, and bend the PSP and SIGRTN circuit(s).
  - Lightly tap on the PSP to simulate road shock
- PSP Switch connector disconnected.
- Check the PSP circuit for a short to ground. Shake, wiggle and bend the PSP circuits.
- **Is a concern present?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	CONNECT the PSP switch. Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

FF8 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST H: FUEL CONTROL

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

WARNING: **While conducting tests on a hot engine take all safety precautions to prevent skin contact with hot engine components. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- HO2S/O2S (9F472)
- HO2S/O2S (9G444)
- fuel injector(s) (9F593)
- harness circuits: HO2S, HO2S Heater, VPWR, and SIGRTN
- vacuum systems
- powertrain control module (PCM) (12A650)

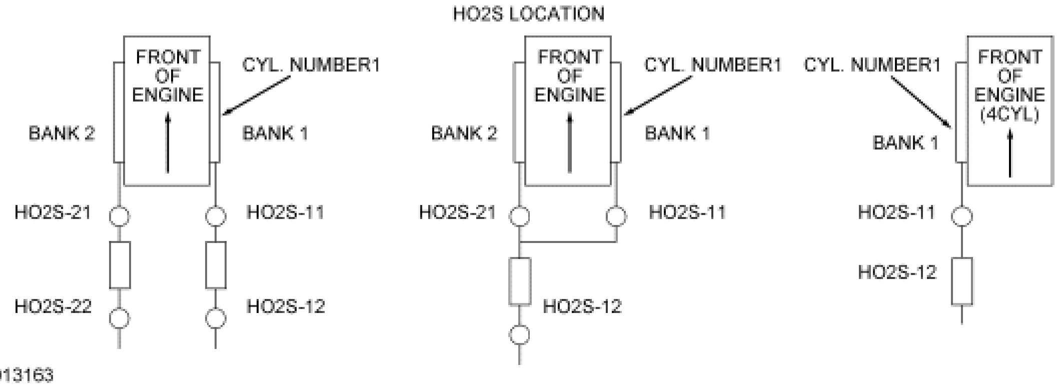

Fig. 98: Identifying HO2S Location (1 Of 2)
Courtesy of FORD MOTOR CO.

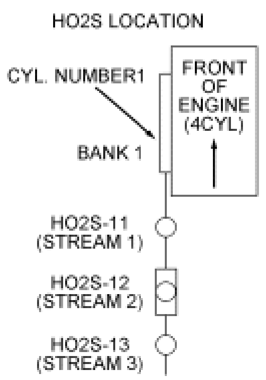

Fig. 99: Identifying HO2S Location (2 Of 2)
Courtesy of FORD MOTOR CO.

The pin numbering for the connector is in reference to the connector lock tab. Not all connector key combinations are shown.

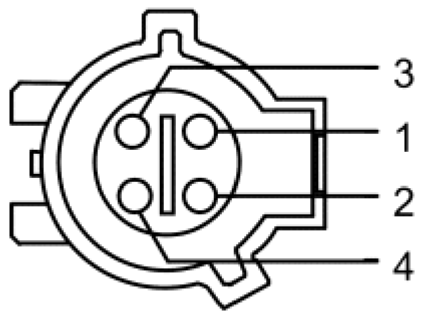

Fig. 100: Heated Oxygen Sensor-Front (HO2S-Front) Connector - A
Courtesy of FORD MOTOR CO.

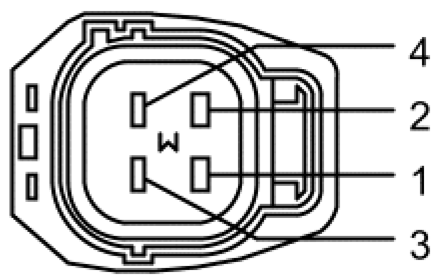

Fig. 101: Heated Oxygen Sensor-Front (HO2S-Front) Connector - B
Courtesy of FORD MOTOR CO.

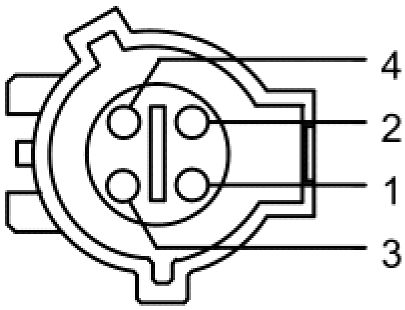

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Fig. 102: Heated Oxygen Sensor-Front (HO2S-Front) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria, F-150, Grand Marquis, Mark LT, Mustang, Ranger, Town Car	A	2 4 3 1	VPWR SIGRTN HO2S Signal HO2S Heater
Focus	B	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater
All other vehicles	C	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater

The pin numbering for the connector is in reference to the connector lock tab. Not all connector key combinations are shown.

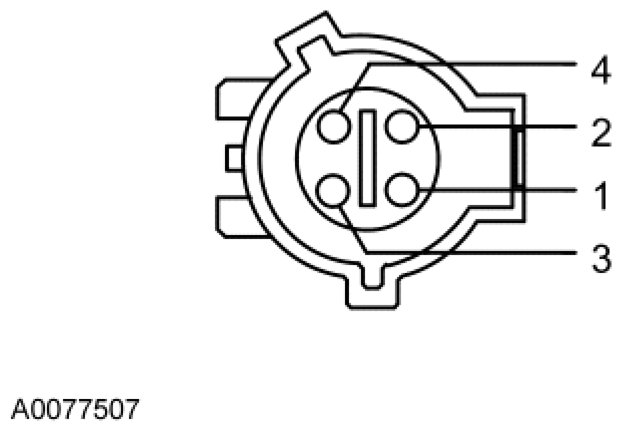

Fig. 103: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - A
Courtesy of FORD MOTOR CO.

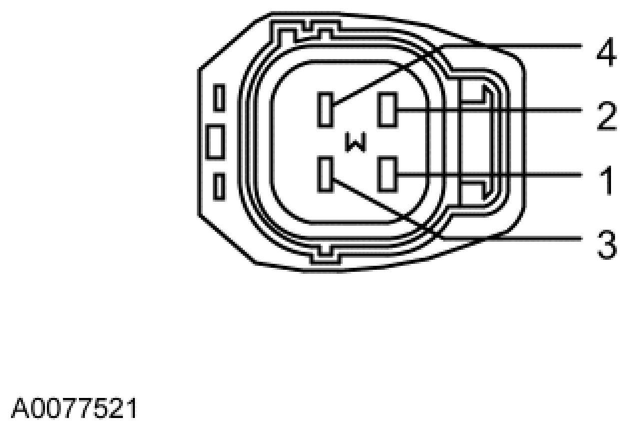

Fig. 104: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - B
Courtesy of FORD MOTOR CO.

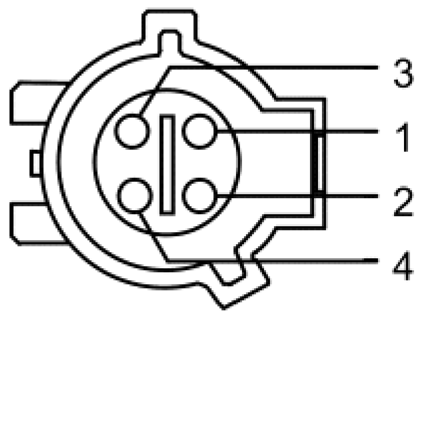

Fig. 105: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner, F-150, Mark LT	A	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater
Focus	B	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater
All other vehicles	C	2 4 3 1	VPWR SIGRTN HO2S Signal HO2S Heater

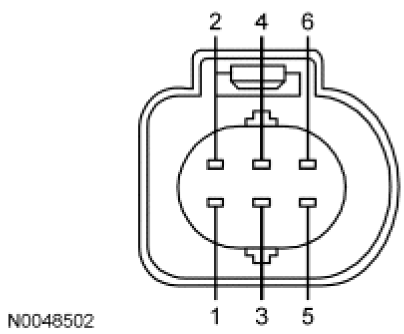

Fig. 106: Universal Oxygen Sensor
Courtesy of FORD MOTOR CO.

Pin	Circuit

1	UO2SPC (Universal Oxygen Sensor Pumping Current)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series 6.8L, E-Series 5.4L Cutaway or stripped chassis	170 Pin	T48 E70 B38 T47 E69 T25 E29 B14 T24 E28 B35 B41, E58, T41	HTR22 HTR21 HTR13 HTR12 HTR11 HO2S22 HO2S21 HO2S13 HO2S12 HO2S11 VPWR SIGRTN
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	E2 E70 E1 E69 E24 E28 E23 E29 B51 B58, E58	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 VPWR SIGRTN
Escape/Mariner 3.0L	150 (50-50-50) Pin	T48 E48 T47 E49 T25 E26 T24 E30 B35 B41, E41, T41	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 VPWR SIGRTN
Escape/Mariner 2.3L	150 (50-50-50) Pin	T47 E49 T24 E30 B35 B41, E41, T41	HTR12 HTR11 HO2S12 HO2S11 VPWR SIGRTN
Expedition, Navigator	140 Pin	B11 E70 B10	HTR22 HTR21 HTR12

		E69 B40 E28 B39 E29 B51 B58, E58	HTR11 HO2S22 HO2S21 HO2S12 HO2S11 VPWR SIGRTN
F-150, Mark LT	190 Pin	T12 E70 T1 E69 T21 E28 T22 E29 B51 B58, E58, T43	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 VPWR SIGRTN
F-Super Duty 6.8L Narrow frame	170 Pin	E70 B38 E69 E29 B14 E28 B35 B41, E58, T41	HTR21 HTR13 HTR11 HO2S21 HO2S13 HO2S11 VPWR SIGRTN
Focus 2.0L PZEV	190 Pin	T25 T18 E52 T7 T16 E11 B67 B58, E64, T40	HTR13 HTR12 HTR11 HO2S13 HO2S12 HO2S11 VPWR SIGRTN
Focus 2.0L	190 Pin	T18 E52 T16 E11 B67 B58, E64, T40	HTR12 HTR11 HO2S12 HO2S11 VPWR SIGRTN
Fusion 3.0L, Milan 3.0L, MKZ	140 Pin	E24 E70 E23 E69 E4 E29 E3 E28	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11

		B51 B58, E58	VPWR SIGRTN
Fusion 2.3L, Milan 2.3L	140 Pin	E23 E69 E3 E28 B51 B58, E58	HTR12 HTR11 HO2S12 HO2S11 VPWR SIGRTN
Fusion 2.3L PZEV, Milan 2.3L PZEV	140 Pin	E25 E23 E69 E5 E3 E28 B51 B58, E58	HTR13 HTR12 HTR11 HO2S13 HO2S12 HO2S11 VPWR SIGRTN
Ranger 2.3L	170 Pin	T47 E69 T24 E28 B35 B41, E58, T41	HTR12 HTR11 HO2S12 HO2S11 VPWR SIGRTN
Sable PZEV, Taurus PZEV, Taurus X PZEV	190 Pin	E6 E4 B51 B58, E58	UO2SPC21 UO2SPC11 VPWR SIGRTN
All other vehicles	170 Pin	T48 E70 T47 E69 T25 E29 T24 E28 B35 B41, E58, T41	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 VPWR SIGRTN

H1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0171, P0172, P0174, P0175, P2195, P2196, P2197, P2198, P2270, P2271, P2272, P2273, P2274, or P2275 present?**

Yes	No
For DTCs P2270, P2271, P2272, P2273, P2274 or P2275, GO to **H32**. For DTCs P0171, P0174, P2195 or P2197, GO to	For all others, GO to**DIAGNOSTIC TROUBLE**

H2. For DTCs P0172, P0175, P2196 or P2198, GO to **H7**.	**CODE (DTC) CHARTS AND DESCRIPTIONS** .

H2 DTCS P0171, P0174, P2195 OR P2197: LEAN SYSTEM DTCS

NOTE: Do not clear the DTCs or reset the keep alive memory (KAM).

- Access the PCM and record the engine coolant temperature (ECT) PID from the freeze frame data. The freeze frame data is used to recreate the concern.
- Retrieve and record the self-test DTCs.
- **Are any DTCs present other than the following: P0171, P0174, P2195 or P2197?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **H3**.

H3 CARRY OUT A VISUAL INSPECTION ON THE INTAKE AIR SYSTEM AND ALL VACUUM HOSES

- Key in OFF position.
- Check the intake air system for leaks, obstructions, and damage.
- Inspect the entire length of all the vacuum hoses for:
  - proper connections
  - damage or cracks
  - damaged or cracked vacuum tees
- Verify the integrity of the positive crankcase ventilation (PCV) system.
- Verify the proper PCV valve part number.
- **Is a concern present?**

Yes	No
GO to **H6**.	GO to **H4**.

H4 CHECK FOR THE PRESENCE OF A VACUUM LEAK

NOTE: Fuel trim values at idle are more sensitive to a vacuum leak. The vacuum leak (unmetered air) represents a larger portion of the total air flow at idle than at part throttle.

NOTE: The barometric pressure (BARO) PID is not a recommended PID to monitor when diagnosing a vacuum leak. Barometric pressure is calculated during high

engine load, when the vacuum leak represents a small portion of the total air flow.

NOTE: **When calculating the total fuel correction in the following steps, if LONGFT1 equals +13% and SHRTFT1 equals +23%, the total fuel correction for bank 1 equals +36%. If LONGFT2 equals +24% and SHRTFT2 equals -3% the total fuel correction for bank 2 equals +21%.**

NOTE: **If the freeze frame ECT PID is available, stabilize the engine at the temperature recorded by the freeze frame ECT PID. If the freeze frame ECT PID is not available, maintain the engine coolant temperature between 82°C - 101°C (180°F - 215°F) and the intake air temperature less than 46°C (115°F).**

- Key ON, engine running.
- Access the PCM and monitor the ECT, CHT and IAT PIDs.
- Access the PCM and monitor the LONGFT1, SHRTFT1, LONGFT2 and SHRTFT2 PIDs.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Mathematically add and record the LONGFT PID value to the SHRTFT PID value for each bank, for a total fuel correction at idle.
- Increase the engine speed to 3,500 RPM for 10 seconds. For vehicles with electronic throttle control (ETC), increase the engine speed to the maximum RPM without activating RPM limiting.

  Record the LONGFT1, SHRTFT1, LONGFT2, and SHRTFT2 PID values.

- Mathematically add and record the LONGFT PID value to the SHRTFT PID value for each bank, for a total fuel correction at 3,500 RPM or the maximum allowable RPM for vehicles with ETC.
- **Is the total fuel correction value difference, between idle and 3,500 RPM or the maximum allowable RPM for vehicles with ETC, less than 15 percent?**

Yes	No
No vacuum leak is present. For DTCs P0171 or P0174, GO to **H16**. For Sable, Taurus, and Taurus X PZEVs with DTCs P2195 or P2197, GO to **H15**. For all other vehicles with DTCs P2195 or P2197, GO to **H9**.	GO to **H5**.

H5 LOCATE THE VACUUM LEAK

NOTE: **Do not clamp or pinch a hard plastic hose. Use a vacuum cap or equivalent to restrict the hose.**

NOTE: **Restricting the EVAP vapor hose while the EVAP emission canister is purging**

may shift the SHRTFT. Carry out a visual inspection as necessary.

NOTE: When monitoring for a decrease in the SHRTFT PIDs in the following steps, if SHRTFT1 equals +15% and the hose is restricted, SHRTFT1 decreases to -7%. The total decrease in the SHRTFT PIDs equals 22%.

- Locate the vacuum tees for the intake air and PCV systems.
- Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs.
- Restrict the vacuum lines one at a time for 30 seconds. If a vacuum leak is present, the SHRTFT PID values decrease as the hose is restricted.
- **Is the decrease in the SHRTFT PIDs greater than 15 percent when one of the vacuum hoses is restricted?**

Yes	No
GO to **H6**.	INSPECT the intake air system for a vacuum leak in the intake manifold or intake gaskets. REPAIR as necessary. For repair verification, GO to **H6**.

H6 VACUUM LEAK REPAIR VERIFICATION

NOTE: If the freeze frame ECT PID is available, stabilize the engine at the temperature recorded by the freeze frame ECT PID. If the freeze frame ECT PID is not available, maintain the engine coolant temperature between 82°C - 101°C (180°F - 215°F) and the intake air temperature less than 46°C (115°F).

- Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Record the SHRTFT1 and SHRTFT2 PID values.
- Key in OFF position.
- Repair the vacuum leak.
- Key ON, engine running.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs.
- Compare the recorded SHRTFT PID values, prior to the vacuum leak repair, to the current SHRTFT PID values.
- **Is the decrease in the SHRTFT PIDs greater than 15 percent?**

Yes	No
RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	A vacuum leak is still present. GO to **H5**.

REPEAT the self-test.	

H7 DTCS P0172, P0175, P2196 OR P2198: RICH SYSTEM DTCS

NOTE: Do not clear the DTCs or reset the keep alive memory (KAM).

- Access the PCM and record the freeze frame data.
- Retrieve and record the self-test DTCs.
- **Are any DTCs present other than the following: P0172, P0175, P2196 or P2198?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **H8**.

H8 INSPECT THE ENTIRE INTAKE AIR SYSTEM FOR DEBRIS, BLOCKAGE OR OTHER DAMAGE

- Check the intake air system for obstructions, restrictions, and damage.
- Check the throttle plate for obstructions or sludge.
- Check the air filter element and housing for blockage.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	For DTCs P0172 or P0175, GO to **H16**. For Sable, Taurus, and Taurus X PZEVs with DTCs P2196 or P2198, GO to **H15**. For all other vehicles with DTCs P2196 or P2198, GO to **H13**.

H9 CHECK THE HO2S AND SIGRTN CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Disconnect the HO2S related to the current DTC.
- PCM connector disconnected.
- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

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

Yes	No
GO to **H10**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

H10 CHECK THE HO2S CIRCUIT FOR A SHORT TO SIGRTN IN THE HARNESS

- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal	SIGRTN

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **H11**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

H11 CHECK THE HO2S CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-)
HO2S Signal	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **H12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

H12 HO2S CIRCUIT TEST (WITH LEAN DTCS)

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side

HO2S Signal	VPWR

- Key ON, engine OFF.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage greater than 1.3 V?**

Yes	No
GO to **H16**.	GO to **H42**.

H13 HO2S CIRCUIT TEST (WITH RICH DTCS)

- Disconnect the HO2S related to the current DTC.
- Key ON, engine OFF.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage less than 0.2 V?**

Yes	No
GO to **H16**.	GO to **H14**.

H14 CHECK THE HO2S CIRCUIT FOR A SHORT TO THE VPWR OR HEATER IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	HO2S Heater
HO2S Signal	VPWR

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **H42**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

H15 CHECK THE UO2SPC CIRCUIT FOR AN OPEN IN THE HARNESS

NOTE: **Only the suspect UO2S needs to be diagnosed.**

- Key in OFF position.

- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2SPC - Pin 1	UO2SPC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **H16**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

H16 CHECK THE FUEL PRESSURE

WARNING: **When checking the fuel system remember that the fuel system may still be pressurized when the engine is switched off. Always follow the instructions related to fuel system pressure relief. All fuel handling safety precautions must be observed. Failure to follow these instructions may result in personal injury.**

NOTE: **For vehicle specific fuel pressure ranges, refer to the Fuel System Specification Chart in pinpoint test HC.**

- Remove the jumper wire(s).
- HO2S connector connected.
- Relieve the fuel pressure. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure.
- Mechanical fuel pressure gauge connected.
- Pressurize the fuel system. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Key ON, engine running.
- Allow the fuel pressure to stabilize.
- Key in OFF position.
- Key ON, engine running.
- Access the PCM and control the FP PID.
- Run the fuel pump to obtain maximum fuel pressure.
- **Is the fuel pressure within range for the vehicle being diagnosed?**

Yes	No
GO to **H17**.	refer to **PINPOINT TEST HC**.

H17 CHECK THE FUEL SYSTEM FOR PRESSURE STABILITY - FAST LEAKDOWN

NOTE: **When the fuel pump is commanded off, the fuel pressure may substantially decrease and then stabilize.**

NOTE: **During output state control, the fuel pump stays commanded on for only about 5 seconds.**

- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and control the FP PID.
- Run the fuel pump to obtain maximum fuel pressure.
- Command the fuel pump off.
- Allow the fuel pressure to stabilize.
- Record the stabilized reading.
- Monitor the fuel pressure for 10 seconds.
- **Does the fuel pressure remain within 34 kPa (5 psi) of the recorded reading after 10 seconds?**

Yes	No
GO to **H19**.	GO to **H18**.

H18 CHECK FOR AN EXTERNAL FUEL LEAK

- Inspect the fuel tank, lines, and filler pipe for a fuel leak.
- **Is a concern present?**

Yes	No
REPAIR as necessary. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. CLEAR the DTCs. REPEAT the self-test.	GO to **H26**.

H19 CHECK THE FUEL SYSTEM FOR PRESSURE STABILITY - SLOW LEAKDOWN

- Continue to monitor the fuel pressure for 1 minute.
- **Does the fuel pressure remain within 34 kPa (5 psi) of the recorded reading (MRFS) or greater than 275 kPa (40 psi) (ERFS) after 1 minute?**

Yes	No
GO to **H20**.	GO to **HC13**.

H20 CHECK THE SEPARATION LEVEL OF THE ETHANOL/WATER MIXTURE AND GASOLINE IN THE FUEL

NOTE: This step requires the use of a locally obtained 200 ml beaker and a 25 ml graduated cylinder.

NOTE: After approximately 3 minutes of standing, the ethanol and water mixes together and settles to the bottom of the 25 ml graduated cylinder. The gasoline rises to the top.

- Fill the 200 ml beaker with 5 ml of clean water.
- Use the pressure relief valve on the mechanical fuel gauge to drain 22 ml of fuel into an approved clean container.
- Pour 20 ml of fuel from the approved clean container into the 25 ml graduated cylinder.
- Add enough water from the 200 ml beaker to the 25 ml graduated cylinder to bring the total volume of liquid to 24 ml.
- Insert a stopper plug in the opening of the 25 ml graduated cylinder.
- Firmly hold the stopper in place and shake the 25 ml graduated cylinder to mix the water and fuel.
- Allow the liquid to stand and separate for approximately 3 minutes.
- Record the separation level from the 25 ml graduated cylinder where the ethanol/water mixture and gasoline meet.
- **Did the ethanol/water mixture and gasoline separate?**

Yes	No
GO to **H21**.	COMPLETE all steps before continuing. The ethanol/water mixture will separate from the gasoline. If the fuel does not appear to separate, then the fuel is either 100% ethanol or a mixture of ethanol and water.

H21 CALCULATE THE PERCENTAGE OF ETHANOL IN THE FUEL

NOTE: Use the illustration as an example for calculating the percentage of ethanol in the following steps. If the separation level is at 14 ml the calculation becomes; 14 minus 4, then multiply by 5 to equal 50. The percentage of ethanol in the fuel is 50%.

- Key in OFF position.
- Take the recorded separation level from the previous step and subtract the amount of water added.
- Multiply the new value by 5. This new value is the percentage of ethanol in the fuel.

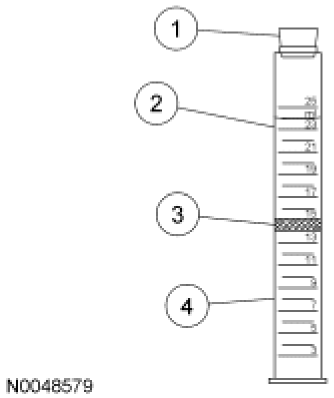

Fig. 107: Calculating Ethanol In Fuel
Courtesy of FORD MOTOR CO.

Item Number	Description
1	Stopper
2	Gasoline
3	Separation Point at 14 ml
4	Ethanol/Water Mixture

- Record the calculated percentage of ethanol in the fuel.
- **Is any ethanol present in the fuel?**

Yes	No
For flex fuel vehicles, GO to **H22**. For all others, GO to **H25**.	GO to **H26**.

H22 COMPARE THE FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

NOTE: **When determining if the FF_INF PID value is within 50% of the calculated percentage of ethanol, if the calculated percentage of ethanol value is 40% then the PID value should be between 0 - 90%. The PID value cannot be less than zero.**

- Key ON, engine OFF.
- Access the PCM and monitor the FF_INF PID.
- Compare the FF_INF PID to the calculated percentage of ethanol.
- **Is the FF_INF PID value within 50% of the calculated percentage of ethanol?**

Yes	No
GO to **H26**.	GO to **H23**.

H23 RESET THE PERCENT ETHANOL PARAMETER IN THE PCM

NOTE: **Certain customer fueling practices such as only fueling with small amounts of fuel or repeatedly switching between gasoline and an ethanol blend greater than E15 may prevent the PCM from learning the correct ethanol content in the fuel.**

- Reset the keep alive memory (KAM). Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .
- Key ON, engine running.
- Access the PCM and monitor the FF_LRND PID.
- Drive the vehicle approximately 11.3 km (7 miles) or until the FF_LRND PID indicates yes.
- **Is the PID state YES?**

Yes	No
GO to **H24**.	GO to **H42**.

H24 COMPARE THE UPDATED FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and monitor the FF_INF PID.
- **Is the FF_INF PID value within 50% of the calculated percentage of ethanol?**

Yes	No
RETURN the vehicle to the customer. ADVISE the customer of the correct fueling practices when using flex fuel. REFER to the Owner's Literature for additional information. ADVISE the customer to continue to use the same fuel for the next 2-3 refuels. This practice helps to verify the PCM is learning the correct percentage of ethanol in the fuel.	A fuel system concern may be present, which prevents the PCM from learning the correct percentage of ethanol in the fuel, GO to **HC13**.

H25 DETERMINE IF THE PERCENTAGE OF ETHANOL IN THE FUEL IS LESS THAN 25%

- Check the recorded calculated percentage of ethanol in the fuel.
- **Is the calculated percentage of ethanol in the fuel less than 25%?**

Yes	No
GO to **H26**.	REPAIR as necessary. ADVISE the customer of the correct fuel type required for this vehicle. REFER to the Owner's Literature for additional information. CLEAR the DTCs. REPEAT the self-test.

H26 FLOW TEST

- Key in OFF position.
- PCM connector connected.
- Flow test the injector using the fuel injector tester.
- **Is the flow rate for each injector within specification?**

Yes	No
For DTCs P0171, P0172, P0174 or P0175, GO to **DC28**. For DTCs P2195 or P2197, GO to **H27**. For DTCs P2196 or P2198, GO to **H28**.	INSTALL a new fuel injector. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

H27 CHECK THE HO2S OUTPUT VOLTAGE

- HO2S connector disconnected.
- Visually inspect the HO2S circuit for exposed wiring, contamination, corrosion and correct assembly. Repair as necessary.
- Measure the voltage between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Signal	SIGRTN

- Increase the engine speed to 2,000 RPM for 3 minutes.
- Carry out the KOER self-test.
- Monitor the signal voltage during the self-test.
- **Is the voltage greater than 0.5 volt at any time during the self-test?**

Yes	No
GO to **H30**.	INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

H28 ATTEMPT TO RETRIEVE DTC P2195 OR P2197

- HO2S connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B Vehicle Battery
HO2S Signal	Negative terminal

- Carry out the KOER self-test.
- **Are DTCs P2195 or P2197 present?**

Yes	No
GO to **H29**.	GO to **H42**.

H29 HO2S VOLTAGE CHECK

- Key in OFF position.
- Remove the jumper wire(s).
- HO2S connector disconnected.
- Key ON, engine running.
- Increase the engine speed to 2,000 RPM for 30 seconds.
- Measure the voltage between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Signal	SIGRTN

- Carry out the KOER self-test.
- Monitor the signal voltage during the self-test.
- **Is the voltage less than 0.4 volt at any time during the self-test?**

Yes	No
GO to **H30**.	INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

H30 CARRY OUT A THOROUGH WIGGLE TEST ON THE HO2S HARNESS

- Key in OFF position.
- HO2S connector connected.
- Key ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the HO2S Signal PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **While monitoring the HO2S PID, does the HO2S stop switching?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **H31**.

H31 TEST DRIVE THE VEHICLE WHILE MONITORING THE HO2S PID FOR SWITCHING

- Access the PCM and monitor the HO2S Signal PID.
- Access the PCM and monitor the FUELSYS PID.
- Start the engine and let idle until the vehicle goes into the closed loop fuel condition.
- Drive the vehicle in a manner consistent with the freeze frame data in an attempt to simulate the original concern.
- **Does the HO2S PID switch?**

Yes	No
GO to **DC28**.	INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

H32 DTCS P2270, P2272, P2271, P2273, P2274 OR P2275: HO2S LACK OF SWITCHES STUCK LEAN OR RICH

NOTE: Address all continuous memory ignition and misfire DTCs before any KOER HO2S DTCs.

- Key in OFF position.
- Visually inspect for:
  - pinched, shorted, and corroded wiring and pins
  - oil or water contamination
  - crossed sensor wires

    - contaminated or damaged sensor
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	For KOER DTCs P2270, P2271, P2272, P2273, P2274 or P2275, GO to **H34**. For continuous memory DTCs P2270, P2271, P2272, P2273, P2274 or P2275, GO to **H33**.

H33 CHECK FOR KOER DTCS

- Key ON, engine OFF.
- Clear the DTCs.
- Key ON, engine running.
- Run the engine at approximately 2,000 RPM. Maintain the engine speed for 3 minutes.
- Retrieve the continuous memory DTCs.
- **Are DTCs P2270, P2271, P2272, P2273, P2274 or P2275 present?**

Yes	No
GO to **H34**.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

H34 CHECK THE HO2S SIGNAL LEVEL TOO HIGH

NOTE: Fuel calculations can be affected by unmetered air leaks.

- Key in OFF position.
- Carefully inspect the following areas for potential air leaks:
    - hoses connecting to the mass air flow (MAF) sensor assembly
    - hoses connecting to the throttle body
    - intake manifold gasket leaks
    - PCV system
    - the vacuum lines are disconnected
    - improperly seated engine oil dipstick, tube or oil fill cap
    - exhaust leaks at flanges and gaskets
- With the vehicle in NEUTRAL, position it on a hoist. Refer to the **JACKING AND LIFTING -- E-SERIES** for the locations of the lifting points.
- Visually inspect for:
    - exhaust leaks at flanges and gaskets
    - HO2S not tightened to specification

- physical exhaust system concerns
- aftermarket exhaust
- punctures or cracks in the catalyst

- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **H35**.

H35 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE HO2S HARNESS

- PCM connector disconnected.
- Disconnect the HO2S harness connector.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
HO2S Signal	Negative terminal

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	SIGRTN
HO2S Signal	VPWR
HO2S Signal	HO2S Heater

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **H36**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

H36 CHECK THE HO2S CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side

HO2S Heater	HO2S Heater
VPWR	VPWR
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

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

Yes	No
GO to **H37**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

H37 CHECK THE HO2S CIRCUIT VOLTAGE

- PCM connector connected.
- HO2S connector connected.
- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage greater than 1.5 V?**

Yes	No
For partial zero emission vehicle (PZEV), GO to **H40**. For all others, GO to **H39**.	GO to **H38**.

H38 CHECK THE HO2S CIRCUIT VOLTAGE

- Key in OFF position.
- PCM connector connected.
- HO2S connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side
HO2S Signal	VPWR

- Key ON, engine OFF.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage greater than 1.5 V?**

Yes	No
INSTALL a new HO2S. REFER to the	

ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **H42**.

H39 CHECK FOR OVER VOLTAGE IN THE PCM

- Key in OFF position.
- HO2S connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HO2S Connector, Harness Side	(-) Vehicle Battery
SIGRTN	Negative terminal
HO2S Signal	Negative terminal

- **Are the voltages less than 1.5 V?**

Yes	No
INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **H42**.

H40 CHECK THE HO2S CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- HO2S connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal	VPWR

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **H41**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

H41 CHECK THE HO2S CIRCUIT VOLTAGE

- PCM connector connected.
- HO2S connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side
HO2S Signal	VPWR

- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage greater than 1.5 V?**

Yes	No
INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **H42**.

H42 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH	

ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM) , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HC: FUEL DELIVERY SYSTEM

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

WARNING: **The fuel system remains under pressure after the engine is off. Relieve pressure before repairing. Highly flammable mixtures are present. To release pressure from the fuel system, carry out the following:**

- **Connect Rotunda fuel pressure gauge 134-R0087 or equivalent.**
- **Gradually open the testing kit valve to relieve the fuel pressure in the vehicle fuel system and drain the fuel into a suitable container or return it to the fuel tank.**
- **To avoid unnecessary fuel spillage and fire hazard, any time fuel lines are disconnected, the ignition switch must be in the OFF position unless fuel pump operation is required for test purposes.**

Failure to follow these instructions may result in personal injury.

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot**

vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

WARNING: **Clean all fuel residue from the engine compartment. If not removed, fuel residue may ignite when the engine is returned to operation. Failure to follow this instruction may result in serious personal injury.**

NOTE: **Replacement fuel injectors may not be the same color as the original injectors in the vehicle. Verify the replacement injector is correct for the application by part number.**

This pinpoint test is intended to diagnose the following:

- chassis components
- engine vacuum
- fuel pressure
- fuel supply line
- fuel supply
- fuel filter (9155)
- fuel injector(s) (9F593)
- fuel pump (9H307)

NOTE: **With the engine running, the FRP PID value may be 48-70 kPa (7-10 psi) higher than a fuel pressure reading taken with a mechanical gauge.**

FUEL SYSTEM SPECIFICATION CHART (KEY ON, ENGINE OFF VALUES)

Application	Fuel System Type	FRP PID Fuel Pressure (kPa)	FRP PID Fuel Pressure (psi)	External Pressure Gauge (kPa)	External Pressure Gauge (psi)
Crown Victoria/Grand Marquis/Town Car	ERFS (1)	240-485	35-70	240-485	35-70
Edge/MKX	MRFS (2)	-	-	331-485	48-70
Escape/Mariner	ERFS (1)	240-485	35-70	240-485	35-70
E-Series	ERFS (1)	240-485	35-70	240-485	35-70
Expedition/Navigator	MRFS (2)	-	-	331-485	48-70
Explorer/Explorer Sport Trac/Mountaineer	ERFS (1)	240-485	35-70	240-485	35-70
F-150, Mark LT	ERFS (1)	240-485	35-70	240-485	35-70
F-Super Duty	ERFS (1)	240-485	35-70	240-485	35-70
Taurus/Taurus X/Sable	MRFS (2)	-	-	331-485	48-70
Focus	MRFS (2)	-	-	331-485	48-70

Fusion/Milan/MKZ	MRFS (2)	-	-	331-485	48-70
Mustang	ERFS (1)	240-485	35-70	240-485	35-70
Ranger	MRFS (2)	-	-	331-485	48-70

Fuel System Type Definitions:

(1) Electronic Returnless Fuel System (ERFS):

This type of fuel delivery system does not return fuel to the fuel tank by means of a return line. This system does not incorporate a mechanical pressure regulator. Pressure is controlled by continuously varying the fuel pump speed through the fuel pump driver module (FPDM). All vehicles equipped with ERFS use a fuel rail pressure temperature (FRPT) sensor.

(2) Mechanical Returnless Fuel System (MRFS):

This type of fuel delivery system does not return fuel to the fuel tank by means of a return line. Fuel pressure is controlled by a mechanical pressure regulator located on the fuel pump module in the fuel tank. Vehicles equipped with MRFS do not use a fuel rail pressure temperature (FRPT) sensor.

WARNING: **If you see or smell gasoline at any time other than during fueling, do not reset the inertia fuel shutoff (IFS) switch. Failure to follow these instructions may result in personal injury.**

- Key in OFF position.
- Check for fuel leaks in the engine compartment.
- If no leak is present, reset the IFS switch by pushing the reset button on the top of the switch. Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch.
- In the closed position, the button can be pressed an additional 1.57 mm (1/16 in) against a spring.
- Key ON, engine OFF.
- Key in OFF position.
- Key ON, engine OFF.
- Key in OFF position.
- Check for leaking fuel.

HC1 DTC P0148 OR SYMPTOMS WITHOUT DTCS: CHECK THE SYSTEM INTEGRITY

- Visually inspect the complete fuel delivery system for damage and leakage.

  Check the following:

  - fuel lines and connections
  - relays
  - fuel tank

  - fuel pump
  - fuel pressure regulator
  - fuel pulse damper
  - fuel rail at injectors
  - damaged connector pins
  - electrical connectors not fully engaged
- Verify the vehicle has followed the maintenance schedule. A new fuel filter should have been installed within the last 48,280 km (30,000 miles).
- Verify the inertia fuel shutoff (IFS) switch is set (button pushed in). Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch.
- Verify the fuse integrity.
- Verify the battery is fully charged.
- Verify clean sufficient fuel.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HC2**.

HC2 CHECK ALL SYSTEM RELATED DEVICES (SENSOR, DAMPER OR REGULATOR) FOR LEAKAGE

- Key in OFF position.
- FP connector connected.
- Remove the vacuum hose on each system device connected to the fuel rail.
- Inspect for the presence of fuel in the vacuum line of each device connected to the fuel rail.
- Key ON, engine running.
- Check for manifold vacuum at each system related component with a vacuum line.
- Key in OFF position.
- **Are all vacuum lines for system related devices indicating no fuel present?**

Yes	No
GO to **HC3**.	If the vacuum line connected to a component indicates that a fuel leak is present, INSTALL a new component. CLEAR the DTCs. REPEAT the self-test.

HC3 CHECK THE FUEL PRESSURE

- Key in OFF position.
- Relieve the fuel pressure. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure.

- Mechanical fuel pressure gauge connected.
- Key ON, engine OFF.
- Pressurize the fuel system. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure to pressurize the fuel system.
- FP connector connected.
- Cycle the key several times to charge the fuel system.
- Compare the fuel pressure reading to the Fuel System Specification Chart.
- **Is the fuel pressure within range?**

Yes	No
GO to **HC6**.	GO to **HC4**.

HC4 CHECK THE FUEL PUMP GROUND CIRCUIT FOR AN OPEN IN THE HARNESS

NOTE: Refer to the Wiring Diagrams article for schematic and connector information.

- FP connector disconnected.
- Measure the voltage between:

(+) Vehicle Battery	(-) FP Connector, Harness Side
Positive terminal	FPGND

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

Yes	No
GO to **HC5**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HC5 CHECK THE FUEL PUMP POWER CIRCUIT FOR AN OPEN IN THE HARNESS

NOTE: During output state control, the fuel pump stays commanded on for only about 5 seconds.

- Verify the inertia fuel shutoff (IFS) switch is set (button pushed in). Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch.
- FP connector disconnected.
- Key ON, engine OFF.
- Access the PCM and control the FP PID.

- Be aware that output state control turns off the FP after a calibrated time. If this happens, command the outputs on again to continue testing.
- Measure the voltage between:

(+) FP Connector, Harness Side	(-) Vehicle Battery
FPPWR	Negative terminal

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

Yes	No
GO to **HC12**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HC6 CHECK THE SEPARATION LEVEL OF THE ETHANOL/WATER MIXTURE AND GASOLINE IN THE FUEL

NOTE: This step requires the use of a locally obtained 200 ml beaker and a 25 ml graduated cylinder.

NOTE: After approximately 3 minutes of standing, the ethanol and water mixes together and settles to the bottom of the 25 ml graduated cylinder. The gasoline rises to the top.

- Fill the 200 ml beaker with 5 ml of clean water.
- Use the pressure relief valve on the mechanical fuel gauge to drain 22 ml of fuel into an approved clean container.
- Pour 20 ml of fuel from the approved clean container into the 25 ml graduated cylinder.
- Add enough water from the 200 ml beaker to the 25 ml graduated cylinder to bring the total volume of liquid to 24 ml.
- Insert a stopper plug in the opening of the 25 ml graduated cylinder.
- Firmly hold the stopper in place and shake the 25 ml graduated cylinder to mix the water and fuel.
- Allow the liquid to stand and separate for approximately 3 minutes.
- Record the separation level from the 25 ml graduated cylinder where the ethanol/water mixture and gasoline meet.
- **Did the ethanol/water mixture and gasoline separate?**

Yes	No
	COMPLETE all steps before continuing. The ethanol/water mixture will separate from the

GO to **HC7**.	gasoline. If the fuel does not appear to separate, then the fuel is either 100% ethanol or a mixture of ethanol and water.

HC7 CALCULATE THE PERCENTAGE OF ETHANOL IN THE FUEL

NOTE: **Use the illustration as an example for calculating the percentage of ethanol in the following steps. If the separation level is at 14 ml the calculation becomes; 14 minus 4, then multiply by 5 to equal 50. The percentage of ethanol in the fuel is 50%.**

- Key in OFF position.
- Take the recorded separation level from the previous step and subtract the amount of water added.
- Multiply the new value by 5. This new value is the percentage of ethanol in the fuel.

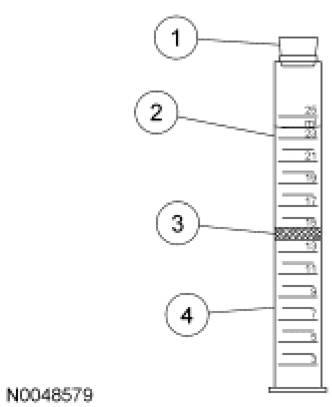

Fig. 108: Calculating Ethanol In Fuel
Courtesy of FORD MOTOR CO.

Item Number	Description
1	Stopper
2	Gasoline
3	Separation Point at 14 ml
4	Ethanol/Water Mixture

- Record the calculated percentage of ethanol in the fuel.
- **Is any ethanol present in the fuel?**

Yes	No
For flex fuel vehicles, GO to **HC8**. For all others, GO to **HC11**.	GO to **HC12**.

HC8 COMPARE THE FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

NOTE: **When determining if the FF_INF PID value is within 50% of the calculated percentage of ethanol, if the calculated percentage of ethanol value is 40% then the PID value should be between 0 - 90%. The PID value cannot be less than zero.**

- Key ON, engine OFF.
- Access the PCM and monitor the FF_INF PID.
- Compare the FF_INF PID to the calculated percentage of ethanol.
- **Is the FF_INF PID value within 50% of the calculated percentage of ethanol?**

Yes	No
GO to **HC12**.	GO to **HC9**.

HC9 RESET THE PERCENT ETHANOL PARAMETER IN THE PCM

NOTE: **Certain customer fueling practices such as only fueling with small amounts of fuel or repeatedly switching between gasoline and an ethanol blend greater than E15 may prevent the PCM from learning the correct ethanol content in the fuel.**

- Reset the keep alive memory (KAM). Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .
- Key ON, engine running.
- Access the PCM and monitor the FF_LRND PID.
- Drive the vehicle approximately 11.3 km (7 miles) or until the FF_LRND PID indicates yes.
- **Is the PID state YES?**

Yes	No
GO to **HC10**.	GO to **HC18**.

HC10 COMPARE THE UPDATED FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and monitor the FF_INF PID.
- **Is the FF_INF PID value within 50% of the calculated percentage of ethanol?**

Yes	No
RETURN the vehicle to the customer. ADVISE the customer of the correct fueling practices when using flex fuel. REFER to the Owner's Literature for	A fuel system concern may be present, which

additional information. ADVISE the customer to continue to use the same fuel for the next 2-3 refuels. This practice helps to verify the PCM is learning the correct percentage of ethanol in the fuel.	prevents the PCM from learning the correct percentage of ethanol in the fuel, GO to **HC12**.

HC11 DETERMINE IF THE PERCENTAGE OF ETHANOL IN THE FUEL IS LESS THAN 25%

- Check the recorded calculated percentage of ethanol in the fuel.
- **Is the calculated percentage of ethanol in the fuel less than 25%?**

Yes	No
GO to **HC12**.	REPAIR as necessary. ADVISE the customer of the correct fuel type required for this vehicle. REFER to the Owner's Literature for additional information. CLEAR the DTCs. REPEAT the self-test.

HC12 CHECK THE FUEL PRESSURE LEAKDOWN

NOTE: When the fuel pump is commanded off, the fuel pressure may substantially decrease and then stabilize.

NOTE: During output state control, the fuel pump stays commanded on for only about 5 seconds.

- Mechanical fuel pressure gauge connected.
- Key ON, engine OFF.
- Access the PCM and control the FP PID.
- Run the fuel pump to obtain maximum fuel pressure.
- Command the fuel pump off.
- Allow the fuel pressure to stabilize.
- Record the stabilized reading.
- Monitor the fuel pressure for 1 minute.
- **Does the fuel pressure remain within 34 kPa (5 psi) of the recorded reading (MRFS) or greater than 275 kPa (40 psi) (ERFS) after 1 minute?**

Yes	No
For ERFS, GO to **HC14**. For MRFS, GO to **HC15**.	GO to **HC13**.

HC13 CHECK THE FUEL INJECTOR FLOW AND LEAKAGE

NOTE: Observe the Warnings, Cautions, and Notes.

- Check the fuel injectors for leakage and flow rate using the injector flow tester or other method such as inspecting the intake manifold for fuel.
- **Are the test results satisfactory?**

Yes	No
For ERFS, GO to **HC14**. For MRFS, GO to **HC15**.	INSTALL a new fuel injector as necessary. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

HC14 COMPARE THE FRP PID TO THE MECHANICAL GAUGE

NOTE: Most mechanical gauges are referenced to atmospheric pressure. The FRPT sensor is referenced to manifold pressure. In order to make a valid comparison, the engine must be off.

NOTE: The vehicle may exhibit a long crank until the fuel system is pressurized.

- Key in OFF position.
- Relieve the fuel pressure. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure.
- Disable the fuel pump.
- Key ON, engine OFF.
- Monitor the mechanical gauge.
- Access the PCM and monitor the FRP PID.
- Compare the FRP PID value to the mechanical gauge.
- Key in OFF position.
- Pressurize the fuel system. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Key ON, engine running.
- Allow the fuel pressure to stabilize.
- Key in OFF position.
- Key ON, engine OFF.
- Compare the FRP PID value to the mechanical gauge.
- **Are the FRP PID values within 34 kPa (5 psi) of the mechanical gauge readings?**

Yes	No
GO to **HC15**.	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of this pinpoint test. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HC15 MONITOR THE FUEL PRESSURE WHILE ROAD TESTING THE VEHICLE

WARNING: **Strict observance of posted speed limits and attention to driving conditions are mandatory when carrying out the road test. Failure to follow these instructions may result in personal injury.**

NOTE: Some concerns may only be present during certain fuel level conditions. Determine the fuel level at the time of the concern. Access the information from the customer information worksheet and the customer.

- Key in OFF position.
- Securely route the mechanical gauge so that the gauge is viewable while road testing the vehicle.
- Key ON, engine running.
- Engine at normal operating temperature.
- Monitor the mechanical gauge.
- From a stop, accelerate to 89 km/h (55 mph) at full throttle. Repeat this 3 times.
- **Is the fuel pressure always greater than 240 kPa (35 psi)?**

Yes	No
For misfire DTC diagnosis, GO to **HD8**. For symptoms without DTCs, the concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** for further direction. For all others, unable to duplicate or identify the concern at this time.	GO to **HC16**.

HC16 CHECK THE FUEL SUPPLY LINE FOR RESTRICTION

NOTE: Observe the Warnings, Cautions, and Notes.

- Key in OFF position.
- Disconnect the fuel supply line at the fuel rail.
- Disconnect the fuel supply line at the fuel pump.
- Check the fuel supply line for restriction.

- Apply 21 to 34 kPa (3 to 5 psi) air pressure to the fuel supply line.
- **Does air flow freely through the line?**

Yes	No
INSTALL a new Fuel Filter assembly. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . GO to **HC17**.	REPAIR the cause of the restriction. CLEAR the DTCs. REPEAT the self-test.

HC17 VERIFY THE REPAIR

WARNING: **Strict observance of posted speed limits and attention to driving conditions are mandatory when carrying out the road test. Failure to follow these instructions may result in personal injury.**

- Key ON, engine running.
- Engine at normal operating temperature.
- Monitor the mechanical gauge.
- From a stop, accelerate to 89 km/h (55 mph) at full throttle. Repeat this 3 times.
- **Is the fuel pressure always greater than 240 kPa (35 psi)?**

Yes	No
The test is complete and no concerns are present.	INSTALL a new FP module. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HC18 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HD: MISFIRE DETECTION MONITOR

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

NOTE: **Mechanical noise caused by the front end accessory drive components, mechanically driven cooling fans, or rough roads at high RPM with light load conditions may produce a nonsymmetrical loss of cylinder acceleration, which may result in a misfire.**

This pinpoint test is intended to diagnose the misfire detection monitor.

Clearing the powertrain control module (PCM) diagnostic trouble codes (DTCs) erases any PCM recorded freeze frame data. Make sure to record any PCM freeze frame information before proceeding. Refer to**FREEZE FRAME DATA** .

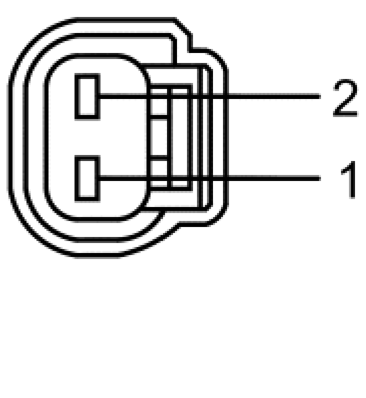

Fig. 109: Camshaft Position (CMP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

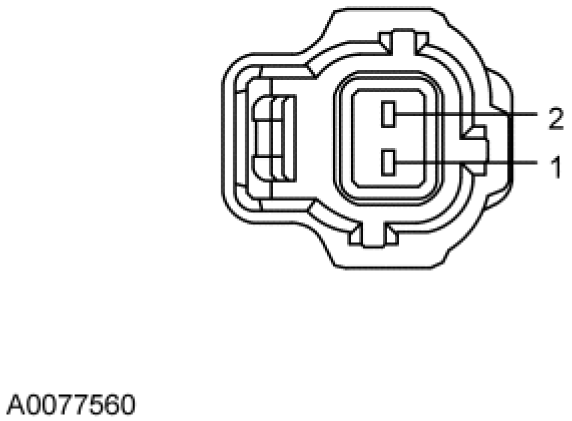

Fig. 110: Camshaft Position (CMP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

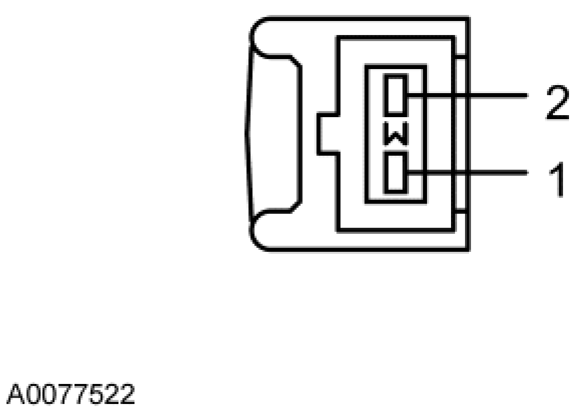

Fig. 111: Camshaft Position (CMP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

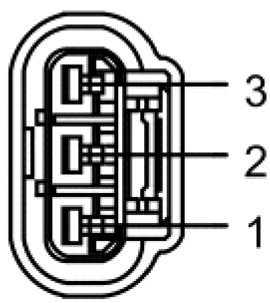

Fig. 112: Camshaft Position (CMP) Sensor Connector - D
Courtesy of FORD MOTOR CO.

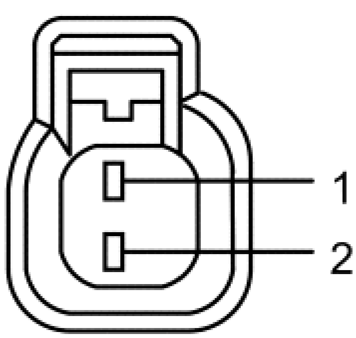

Fig. 113: Camshaft Position (CMP) Sensor Connector - E
Courtesy of FORD MOTOR CO.

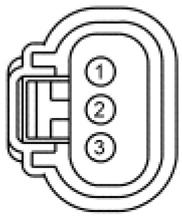

Fig. 114: Camshaft Position (CMP) Sensor Connector - F
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Expedition, F-150 4.6L, F-150 5.4L, Mark LT, MKX, MKZ, Navigator, Sable, Taurus, Taurus X	A	2	CMP
Escape/Mariner 2.3L, Ranger 2.3L	B	1 2	SIGRTN CMP
Explorer 4.0L, Explorer Sport Trac 4.0L, Mountaineer 4.0L, Mustang 4.0L, Ranger 4.0L	C	2 1	SIGRTN CMP
Fusion 2.3L, Milan 2.3L	D	3 2	SIGRTN CMP
Fusion 3.0L, Milan 3.0L	E	1	CMP
F-150 4.2L	D	2 3 1	CMP PWRGND VPWR
Focus	F	3 2	SIGRTN CMP

All other vehicles	A	1 2	SIGRTN CMP

HD1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, P0310, P0315, or P0316 present?**

Yes	No
For DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, P0310 or P0316, GO to **HD2**. For DTC P0315, GO to **HD21**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HD2 DTCS P0300 THROUGH P0310 AND P0316: VIEW THE PCM MISFIRE FREEZE FRAME DATA

NOTE: The misfire freeze frame data may be used to determine the operating conditions when the misfire DTC was set.

- Retrieve and record any available misfire freeze frame data PID values from the PCM.
- Compare recorded freeze frame data PID values to the typical reference values in the **REFERENCE VALUES** article.
- **Are any values out of range?**

Yes	No
REFER to the table in Pinpoint Test Z to find corresponding circuit, and proceed with the intermittent diagnosis. refer to **PINPOINT TEST Z**.	GO to **HD3**.

HD3 CHECK FOR OTHER NON-MISFIRE CONTINUOUS MEMORY DTCS

- Retrieve all continuous memory DTCs.
- **Are there any non-misfire continuous memory DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **HD4**.

HD4 CHECK FOR ANY KOEO SELF-TEST DTCS

- Carry out the KOEO self-test.

- **Are any KOEO DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **HD5**.

HD5 CHECK FOR ANY KOER DTCS

- Carry out the KOER self-test.
- **Are any KOER DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **HD6**.

HD6 CHECK THE IGNITION SYSTEM FOR CONCERNS

- For ignition coil on plug (COP) equipped vehicles, refer to **PINPOINT TEST JB** and follow the pinpoint test direction.
- For ignition coil pack equipped vehicles, refer to **PINPOINT TEST JC** and follow the pinpoint test direction.
- **Is an ignition related concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HD7**.

HD7 CHECK THE FUEL SYSTEM FOR CONCERNS

- refer to **PINPOINT TEST HC** and follow the pinpoint test direction.
- **Is a fuel system related concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HD8**.

HD8 CHECK THE VACUUM SYSTEM

NOTE: Some vacuum leaks can be heard.

- Visually inspect the vacuum hoses for signs of damage or deterioration. A collapsed vacuum hose may cause a blockage to one of the various actuators or sensors. If a blockage is found remove the blockage or install new parts as necessary.
- **Is the vehicle vacuum system OK?**

Yes	No
For vehicles equipped with a differential pressure feedback EGR system, GO to **HD9**. For vehicles equipped with an electric EGR (EEGR) system, GO to **HD10**. For vehicles equipped with an EGR system module (ESM) EGR system, GO to **HD11**. For all others, GO to **HD15**.	REPAIR the vacuum system. CLEAR the DTCs. REPEAT the self-test.

HD9 MONITOR THE DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM RELATED PIDS

- Key ON, engine running.
- Bring the engine to normal operating temperature.
- Access the PCM and monitor the DPFEGR PID.
- Access the PCM and monitor the EGRVR PID.
- Record the PID values with the engine idling.
- Key ON, engine OFF.
- Record the PID values with the engine off.
- Compare the recorded PID values to the typical reference values in the **REFERENCE VALUES** article.
- **Are any values out of range?**

Yes	No
refer to **PINPOINT TEST HE** and diagnose the EGR system.	GO to **HD12**.

HD10 MONITOR THE EEGR SYSTEM RELATED PIDS

- Key ON, engine running.
- Bring the engine to normal operating temperature.
- Access the PCM and monitor the EGRMC1F, EGRMC2F, EGRMC3F and EGRMC4F PIDs.
- Access the PCM and monitor the MAP PID.
- Record the PID values with the engine idling.
- Key ON, engine OFF.
- Record the PID values with the engine off.
- Compare the recorded PID values to the typical reference values in the **REFERENCE VALUES** article.
- **Are any values out of range?**

Yes	No
refer to **PINPOINT TEST KD** and diagnose the EGR system.	GO to **HD13**.

HD11 MONITOR THE ESM SYSTEM RELATED PIDS

- Key ON, engine running.
- Bring the engine to normal operating temperature.
- Access the PCM and monitor the DPFEGR PID.
- Access the PCM and monitor the EGRVR PID.
- Access the PCM and monitor the MAP PID.
- Record the PID values with the engine idling.
- Key ON, engine OFF.
- Record the PID values with the engine off.
- Compare the recorded PID values to the typical reference values in the **REFERENCE VALUES** article.
- **Are any values out of range?**

Yes	No
refer to **PINPOINT TEST HH** and diagnose the EGR system.	GO to **HD14**.

HD12 RECREATE THE MISFIRE SYMPTOM WITH THE DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM DISABLED

NOTE: The PCM may store EGR system related DTCs during this procedure.

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- Key in OFF position.
- EGR Vacuum Regulator Solenoid connector disconnected.
- Access the misfire freeze frame data (if available) and record the operating conditions.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Recreate the misfire symptom using the freeze frame and customer information.
- **Can the symptom be recreated?**

Yes	No
GO to **HD15**.	REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage. REFER to the **ENGINE**

	EMISSION CONTROL -- E-SERIES for more EGR system information. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HD13 RECREATE THE MISFIRE SYMPTOM WITH EEGR SYSTEM DISABLED

NOTE: The PCM may store EGR system related DTCs during this procedure.

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- Key in OFF position.
- EEGR Assembly connector disconnected.
- Access the misfire freeze frame data (if available) and record the operating conditions.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Recreate the misfire symptom using the freeze frame and customer information.
- **Can the symptom be recreated?**

Yes	No
GO to **HD15**.	REMOVE and INSPECT the EEGR for signs of contamination, unusual wear, carbon deposits, binding or other damage. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** for more EGR system information. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HD14 RECREATE THE MISFIRE SYMPTOM WITH THE ESM SYSTEM DISABLED

NOTE: The PCM may store EGR system related DTCs during this procedure.

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- Key in OFF position.
- ESM connector disconnected.
- Access the misfire freeze frame data (if available) and record the operating conditions.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Recreate the misfire symptom using the freeze frame and customer information.
- **Can the symptom be recreated?**

Yes	No
GO to **HD15**.	REMOVE and INSPECT the ESM for signs of contamination, unusual wear, carbon deposits, binding or other damage. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** for more EGR system information. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HD15 CHECK FOR BASE ENGINE CONCERNS

NOTE: The engine temperature may affect the results.

- This step determines if there are any base engine concerns that may have caused the misfire DTC or drive concern.
- Key in OFF position.
- Carry out the following tests in order to evaluate base engine integrity:
  - For vehicles equipped with mechanically driven cooling fans only, rotate the cooling fan by hand. The cooling fan should rotate freely, with no abnormal binding or interference. If binding or interference is present, remove any foreign materials or repair the cooling fan as necessary.
  - Refer to the **ACCESSORY DRIVE -- E-SERIES** and carry out checks in the Visual Inspection Chart.
  - Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** and carry out the Compression Test and Cylinder Leakage Detection.
  - Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** and carry out the Valve Train Analysis.
  - Visually inspect the positive crankcase ventilation (PCV) valve and tube for leaks.
  - Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** and carry out Component Tests.
- **Is a concern present?**

Yes	No
REPAIR as necessary. REFER to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HD19**.

HD16 DTC P1336: IDENTIFY THE CMP SENSOR TYPE

NOTE: The variable reluctance (VR) sensors have 2-wire connectors, Hall-effect sensors have 3-wire connectors.

- Identify which type of CMP sensor the vehicle uses.
- **Does the vehicle use a Hall-effect sensor?**

Yes	No
GO to **HD17**.	GO to **HD18**.

HD17 CHECK THE CMP SENSOR LOW RANGE OUTPUT VOLTAGE

- Key in OFF position.
- CMP Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A CMP Sensor Connector, Harness Side	Point B CMP Sensor Connector, Component Side
VPWR	VPWR
PWRGND	PWRGND

- Key ON, engine running.
- Digital multimeter (DMM) on low voltage DC scale.
- Measure the voltage between:

(+) CMP Sensor Connector, Component Side	(-) 12 Volt Vehicle Battery
CMP	Negative terminal

- **Does the voltage switch between LOW (less than 2 volts DC) and HIGH (greater than 8 volts DC)?**

Yes	No
A Hall-effect CMP sensor that is installed out of synchronization may produce a DTC. To verify the correct CMP sensor installation, REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** , Engine Synchronizer. If the CMP sensor is installed properly, GO to **HD19**.	INSTALL a new CMP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HD18 CHECK THE CMP SENSOR OUTPUT VOLTAGE

- Key in OFF position.
- PCM connector connected.
- CMP Sensor connector disconnected.
- DMM on low voltage AC scale.

- Key ON, engine running.
- Measure the voltage between:

(+) CMP Sensor Connector, Component Side	(-) CMP Sensor Connector, Component Side
CMP	SIGRTN

- Run the engine at approximately 2,500 RPM.
- **Is the voltage greater than 0.25 V?**

Yes	No
GO to **HD19**.	INSTALL a new CMP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HD19 CHECK THE GENERATOR FOR EXCESSIVE ELECTRICAL NOISE

NOTE: If the generator/regulator is electrically noisy, the noise decreases when the B+ connector is disconnected.

- Key ON, engine running.
- Monitor the generator for an audible electric noise.
- Key in OFF position.
- Generator/regulator B+ connector disconnected.
- Key ON, engine running.
- With the engine running, determine if the generator is still noisy.
- **Does the noise remain constant when the B+ connector is disconnected?**

Yes	No
GO to **HD20**.	REFER to the **GENERATOR AND REGULATOR -- E-SERIES** and diagnose the generator is noisy symptom.

HD20 CHECK THE CKP HARNESS FOR INTERMITTENT CONCERNS

NOTE: Chafed CKP wires or other physical damage to the harness may cause an intermittent short in the CKP circuit.

- Key in OFF position.

- Visually check for chafed CKP wires or other physical damage to the CKP harness.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HD21**.

HD21 DTC P0315: CHECK THE PHYSICAL CONDITION OF THE CRANKSHAFT PULSE WHEEL

NOTE: **DTC P0315 is set when the PCM is unable to learn and correct for the mechanical variations in the crankshaft pulse wheel tooth spacing (the allowable correction tolerances are exceeded).**

- Inspect the crankshaft pulse wheel for damaged teeth.
- Inspect the crankshaft pulse wheel for wobble.
- Check for a loose crankshaft pulse wheel.
- Check the CKP sensor for damage.
- **Are the CKP sensor and crankshaft pulse wheel OK?**

Yes	No
If the CKP is installed properly, GO to **HD22**.	REPAIR as necessary. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** and check for correct CKP sensor installation. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . COMPLETE the Misfire and Fuel Monitors drive cycle procedure to learn the profile. Refer to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . To verify the repair RECREATE the original conditions that set the misfire DTC or caused the symptom using the freeze frame data and customer information. MONITOR the cylinder misfire data in Mode 6 - On Board Test Results and VERIFY the misfire count is below 10. REFER to the scan tool manufacturer's article for specific information on the Mode 6 - On Board Test Results.

HD22 CHECK THE DAMPER AND PULLEY ASSEMBLY

NOTE: **For engines that have damper mounted pulse rings, it may be necessary to remove the front cover or other components to observe the crank pulley.**

- Observe the crank pulley for wobble.

- Examine the electronic ignition (EI) pulse ring fastened to the harmonic dampener.
- **Does the crank pulley wobble or is the pulse ring loose or damaged?**

Yes	No
INSTALL a new pulley or damper assembly. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . COMPLETE the Misfire and Fuel Monitors drive cycle procedure to learn the profile. Refer to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . To verify the repair RECREATE the original conditions that set the misfire DTC or caused the symptom using the freeze frame data and customer information. MONITOR the cylinder misfire data in Mode 6 - On Board Test Results and VERIFY the misfire count is below 10. REFER to the scan tool manufacturer's article for specific information on the Mode 6 - On Board Test Results.	GO to **HD23**.

HD23 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HE: EXHAUST GAS RECIRCULATION (EGR) SYSTEMS

This pinpoint test is intended to diagnose the following:

- differential pressure feedback exhaust gas recirculation (EGR) sensor (9J460)

- EGR valve (9D460) (9D475)
- EGR vacuum regulator solenoid (9J459)
- orifice tube assembly (9D477)
- differential pressure feedback EGR sensor pressure hoses
- vacuum lines
- harness circuits: VREF, DPFE, SIGRTN, EVR, VPWR, VREF and PWRGND
- powertrain control module (PCM) (12A650)

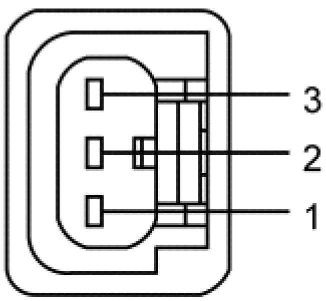

Fig. 115: Differential Pressure Feedback EGR Sensor Connector - A
Courtesy of FORD MOTOR CO.

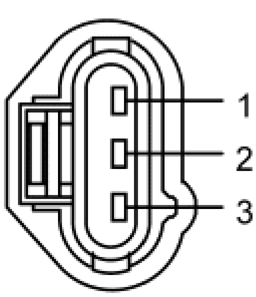

Fig. 116: Differential Pressure Feedback EGR Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Vehicles equipped with a tube mounted differential pressure feedback EGR sensor	A	3 2 1	DPFE SIGRTN VREF
All other vehicles	B	1 2 3	DPFE SIGRTN VREF

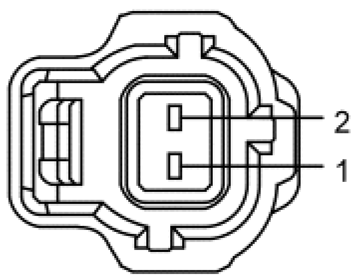

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Fig. 117: Camshaft Position (CMP) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	EVR (EGR Vacuum Regulator)
1	VPWR (Vehicle Power)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B47 E27 E40 E41 E44	PWRGND EVR VREF SIGRTN DPFE
Ranger	170 Pin	B47 E63 E57 E58 E21	PWRGND EVR VREF SIGRTN DPFE

HE1 CHECK FOR DTCS

- **Are DTCs P0401, P0402, P0403, P0405, P0406, P1405, P1406, P1408, or P1409 present?**

Yes	No
For DTCs P0401 and P1408, GO to **HE36**. For DTC P0402, GO to **HE13**. For KOEO and KOER DTCs P0403 and P1409, GO to **HE59**. For continuous memory DTCs P0403 and P1409, GO to **HE64**. For DTC P0405, GO to **HE2**. For DTC P0406, GO to **HE6**. For DTC P1405, GO to **HE27**. For DTC P1406, GO to **HE31**.	For symptoms without DTCs, GO to **HE57**. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HE2 DTC P0405: DETERMINE THE PRESENT DPFEGR PID VOLTAGE

NOTE: **Depending on the application, verify a prior repair has not resulted in the differential pressure feedback EGR sensor being installed backwards or the vacuum hoses being installed on the opposite ports.**

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage less than 0.05 V?**

Yes	No
GO to **HE3**.	An intermittent concern is suspected in the EGR system. GO to **HE12**.

HE3 CHECK THE VREF AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Differential Pressure Feedback EGR Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Differential Pressure Feedback EGR Sensor Connector, Harness Side	(-) Differential Pressure Feedback EGR Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to **HE4**.	refer to **PINPOINT TEST C**.

HE4 CHECK THE DPFE CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
DPFE	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
DPFE	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HE5**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE5 INDUCE THE OPPOSITE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR VOLTAGE

- PCM connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage between 4 - 5.5 V?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before	GO to **HE66**.

starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	

HE6 DTC P0406: DETERMINE THE PRESENT DPFEGR PID VOLTAGE

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage greater than 4 V?**

Yes	No
GO to **HE7**.	An intermittent concern is suspected in the EGR system. GO to **HE12**.

HE7 CHECK THE VREF VOLTAGE TO THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR

- Key in OFF position.
- Differential Pressure Feedback EGR Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Differential Pressure Feedback EGR Sensor Connector, Harness Side	(-) Differential Pressure Feedback EGR Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to **HE8**.	refer to **PINPOINT TEST C**.

HE8 CHECK THE DPFE AND SIGRTN CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	**(-) Differential Pressure Feedback EGR Sensor Connector, Harness Side**
DPFE	DPFE
SIGRTN	SIGRTN

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

Yes	**No**
GO to **HE9**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HE9 CHECK THE DPFE CIRCUIT FOR A SHORT TO VREF

- Measure the resistance between:

(+) PCM Connector, Harness Side	**(-) PCM Connector, Harness Side**
VREF	DPFE

- **Is the resistance greater than 10K ohms?**

Yes	**No**
GO to **HE10**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE10 CHECK THE DPFE CIRCUIT FOR A SHORT TO VOLTAGE

- Key ON, engine OFF.
- Measure the voltage between:

(+) Differential Pressure Feedback EGR Sensor Connector, Harness Side	**(-) Vehicle Battery**
DPFE	Negative terminal

- **Is the voltage less than 0.2 V?**

Yes	No
GO to **HE11**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE11 CHECK THE DPFEGR PID

- Key in OFF position.
- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A Differential Pressure Feedback EGR Sensor Connector, Harness Side	Point B
DPFE	Ground

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the DPFEGR PID greater than 4.5 V with the jumper wire removed and is the DPFEGR PID less than 0.1 V with the jumper wire installed?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. CLEAR the DTCs. REPEAT the self-test.	GO to **HE66**.

HE12 CARRY OUT A THOROUGH WIGGLE TEST ON THE DIFFERENTIAL PRESSURE FEEDBACK EGR HARNESS

- Access the PCM and monitor the DPFEGR PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there any change in the voltage reading, or is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

HE13 DTCS P0402 AND P1405: CHECK FOR SIMULTANEOUS PRESENCE

- **Is DTC P0402 present with DTC P1405?**

Yes	No
GO to **HE28**.	GO to **HE14**.

HE14 DTC P0402: CHECK FOR EGR FLOW AT IDLE WITH THE EGR VACUUM HOSE DISCONNECTED

NOTE: **A pinched or plugged EGR vacuum hose can trap vacuum between the EGR vacuum regulator solenoid and EGR valve, not allowing the EGR valve to close.**

NOTE: **Disregard DTC P1408 if it is generated as a result of carrying out the KOER self-test with the EGR vacuum source hose disconnected.**

- Trace each vacuum hose from the EGR vacuum regulator solenoid and verify each hose is connected correctly.
- Verify the EGR vacuum hose is not pinched or plugged and is routed correctly.
- Disconnect and plug the vacuum hose connected to the EGR valve.
- Carry out the KOER self-test.
- **Does KOER DTC P0402 appear or are you unable to run the KOER self-test due to an engine stall or no start?**

Yes	No
INSPECT the pressure hoses for correct routing, pinching, icing or other blockage. If OK, REMOVE and INSPECT the EGR valve and tube for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. GO to **HE15**.	CONNECT the EGR valve vacuum hose. GO to **HE16**.

HE15 CARRY OUT THE KOER SELF-TEST

- Clear the DTCs.
- Carry out the KOER self-test.
- **Is DTC P0402 present?**

Yes	No
GO to **HE18**.	The test is complete and no concerns are found. CLEAR the DTCs. REPEAT the self-test.

HE16 CHECK FOR EGR FLOW AT IDLE WITH THE EGR VACUUM HOSE CONNECTED

- Key in OFF position.

- Connect the EGR valve vacuum hose.
- Carry out the KOER self-test.
- **Does KOER DTC P0402 appear or are you unable to run the KOER self-test due to an engine stall or no start?**

Yes	No
GO to **HE17**.	INSPECT the pressure hoses for pinching, icing or other blockage. REPAIR as necessary. GO to **HE23**.

HE17 CHECK THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR OUTPUT BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release vacuum.
    - The DPFEGR PID voltage must be between 0.2 and 1.3 volt with the key ON and no vacuum applied.
    - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
    - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	GO to **HE18**.

HE18 CHECK EGR FLOW AT IDLE WITH THE EGR VACUUM REGULATOR HARNESS CONNECTOR OFF

- Differential Pressure Feedback EGR Sensor connector connected.
- Disconnect the vacuum hose at the EGR valve and connect the hose to the vacuum gauge.
- Start the engine.
- EGR Vacuum Regulator Solenoid connector disconnected.
- Observe the vacuum gauge:
  - The EGR valve requires vacuum greater than 5.4 kPa (1.6 in-Hg) to begin to open.
  - If the vacuum reading remains greater than 5.4 kPa (1.6 in-Hg) after the EGR vacuum regulator solenoid is disconnected, a concern may be present in the EGR vacuum regulator solenoid.
- **Does the EGR vacuum remain greater than 5.4 kPa (1.6 in-Hg) at idle after the EGR vacuum regulator is disconnected?**

Yes	No
GO to **HE19**.	GO to **HE20**.

HE19 INSPECT THE EGR VACUUM REGULATOR SOLENOID VENT FOR BLOCKAGE

NOTE: When the EGR valve is closed, the EGR vacuum regulator solenoid vacuum is vented through the solenoid vent to the atmosphere. A plugged EGR vacuum regulator solenoid vent does not allow EGR vacuum to vent to the atmosphere.

- Key in OFF position.
- Remove the EGR vacuum regulator solenoid vent cap.
- Remove the filter and inspect for blockage or icing.
- **Is the EGR vacuum regulator solenoid vent or vent filter plugged or restricted?**

Yes	No
REPAIR the vent, or if not repairable, INSTALL a new EGR vacuum regulator solenoid. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE20 CHECK THE EGR VACUUM REGULATOR SOLENOID COIL RESISTANCE

- Key in OFF position.
- Measure the resistance between:

(+) EGR Vacuum Regulator Solenoid Connector, Component	(-) EGR Vacuum Regulator Solenoid Connector, Component

Side	Side
VPWR - Pin 1	EVR - Pin 2

- **Is the resistance between 26 - 40 ohms?**

Yes	No
GO to **HE21**.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE21 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
EVR	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HE22**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE22 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR SHORT TO VREF

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
EVR	VREF

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HE66**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE23 CHECK THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR OUTPUT BY APPLYING VACUUM

WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
  - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
  - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	GO to **HE24**.

HE24 CHECK THE EGR VALVE OPERATION

NOTE: Typical sensor voltage with no EGR flow is between 0.25 volt and 1.3 volts.

NOTE: A higher voltage at idle may be due to a non-seating or heavily carbon EGR valve pintle.

NOTE: DPFEGR PID voltage must increase as the valve opens and decrease as the valve closes. A slow return voltage is an indication of a binding or slow closing EGR valve.

- Differential Pressure Feedback EGR Sensor connector connected.
- Key ON, engine OFF.

- Access the PCM and monitor the DPFEGR PID.
- Disconnect the vacuum hose at the EGR valve and plug the hose.
- Connect the vacuum pump to the EGR valve.
- Start the engine.
- Observe the DPFEGR PID at idle and compare it to the KOEO voltage.
- Apply just enough vacuum to the EGR valve to open it without stalling the engine.
- Quickly release the vacuum.
- Repeat this 3 times.
- Observe the DPFEGR PID.
- **Does the DPFEGR PID voltage indicate an open, binding or slow closing EGR valve?**

Yes	No
REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HE25**.

HE25 CARRY OUT A THOROUGH WIGGLE TEST ON THE EGR VACUUM REGULATOR HARNESS

NOTE: **An intermittent short to GND in the EGR vacuum regulator circuit causes the vacuum applied to the EGR valve to be higher than normal when the short is present. The vacuum available at the EGR valve at idle is normally below 3.4 kPa (1.6 in-Hg) for the valve to begin to open.**

NOTE: **A concern is indicated by a sudden jump in the vacuum reading during the wiggle test.**

- Key in OFF position.
- Remove the vacuum pump.
- Connect the vacuum gauge to the EGR valve vacuum hose.
- Connect a vacuum gauge to the EGR valve vacuum hose using a vacuum tee.
- Key ON, engine running.
- Observe the vacuum gauge.
    - Lightly tap on the EGR vacuum regulator solenoid.
    - Carry out a thorough wiggle test on the EGR vacuum regulator harness.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	CONNECT the vacuum hose(s). GO to **HE26**.

HE26 INSPECT THE EGR VACUUM REGULATOR SOLENOID AND VACUUM HOSES FOR PLUGGING

- Key in OFF position.
- Remove the EGR vacuum regulator solenoid vent cap.
- Remove the filter and inspect for blockage or icing.
- Inspect the pressure hoses for pinching, icing or other blockage.
- **Is the EGR vacuum regulator solenoid vent or vent filter plugged or restricted?**

Yes	No
REPAIR, or if not repairable, INSTALL a new EGR vacuum regulator solenoid. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

HE27 DTC P1405: INSPECT THE UPSTREAM PRESSURE HOSE CONNECTIONS

- Inspect the upstream hose at the differential pressure feedback EGR sensor and orifice tube assembly for a disconnect or a poor connection.

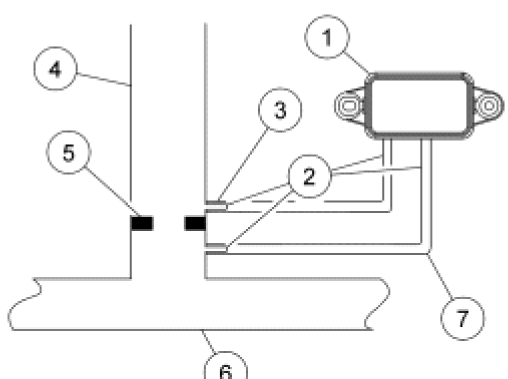

Fig. 118: Typical Differential Pressure Feedback EGR System
Courtesy of FORD MOTOR CO.

TYPICAL DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM

Item Number	Description
1	Differential Pressure Feedback EGR Sensor
2	Pickup Tubes
3	Upstream Pressure Hose
4	To EGR Valve
5	Orifice Tube

	Assembly
6	Exhaust Manifold
7	Downstream Pressure Hose

- **Is vacuum hose off or poorly connected?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HE28**.

HE28 INSPECT THE UPSTREAM PRESSURE HOSE FOR PLUGGING

NOTE: It is essential that only the correct Ford replacement pressure hose be used.

- Visually inspect the upstream pressure hose routing. The hose must not be pinched or have dips in it where water could settle or freeze.
- Remove the upstream pressure hose and carefully inspect for plugging, water, or leaks.
- **Is a concern present?**

Yes	No
REPAIR or INSTALL a new pressure hose as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HE29**.

HE29 CHECK THE ORIFICE TUBE ASSEMBLY AND THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR

- Inspect the upstream connection on the differential pressure feedback EGR sensor for damage or plugging at the sensor.
- Inspect the exhaust manifold side pressure tube at the orifice tube assembly for plugging or damage.
- **Is the differential pressure feedback EGR sensor or orifice tube assembly plugged or damaged?**

Yes	No
REPAIR or INSTALL a new Differential Pressure Feedback EGR sensor or orifice tube assembly as necessary. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402.	GO to **HE30**.

CLEAR the DTCs. REPEAT the self-test.	

HE30 CHECK THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR OUTPUT BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
    - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
    - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
    - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

HE31 DTC P1406: INSPECT THE DOWNSTREAM PRESSURE HOSE CONNECTIONS

NOTE: If the concern is currently present, DTC P1408 appears when running the KOER self-test.

- Verify the EGR valve is securely attached and exhaust gases are not leaking from the sealing surface.
- Inspect the downstream hose at the differential pressure feedback EGR sensor and orifice tube assembly for a disconnect or a poor connection.

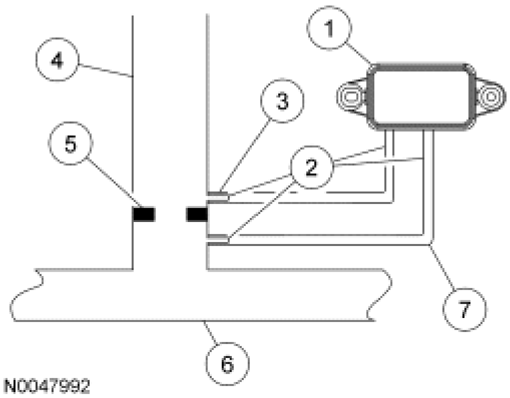

Fig. 119: Typical Differential Pressure Feedback EGR System
Courtesy of FORD MOTOR CO.

TYPICAL DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM

Item Number	Description
1	Differential Pressure Feedback EGR Sensor
2	Pickup Tubes
3	Upstream Pressure Hose
4	To EGR Valve
5	Orifice Tube Assembly
6	Exhaust Manifold
7	Downstream Pressure Hose

- **Is vacuum hose off or poorly connected?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HE32**.

HE32 INSPECT THE DOWNSTREAM PRESSURE HOSE FOR PLUGGING

NOTE: **It is essential that only the correct Ford replacement pressure hose be used.**

- Visually inspect the downstream pressure hose routing.
- Remove the upstream pressure hose and carefully inspect for plugging, water, or leaks.
- **Is a concern present?**

Yes	No

REPAIR or INSTALL a new pressure hose as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HE33**.

HE33 CHECK THE ORIFICE TUBE ASSEMBLY AND THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR

- Inspect the connections at the differential pressure feedback EGR sensor for plugging or damage.
- Inspect the intake manifold side pressure tube at the orifice tube assembly for plugging or damage.
- **Is the differential pressure feedback EGR sensor or orifice tube assembly plugged or damaged?**

Yes	No
REPAIR or INSTALL a new Differential Pressure Feedback EGR sensor or orifice tube assembly as necessary. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	GO to **HE34**.

HE34 CHECK THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR OUTPUT BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
  - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
  - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No

GO to **HE35**.	refer to **PINPOINT TEST Z**.

HE35 CHECK THE DPFE CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Differential Pressure Feedback EGR Sensor Connector, Harness Side
DPFE	DPFE
SIGRTN	SIGRTN
VREF	VREF

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

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.

HE36 DTC P0401: CARRY OUT THE KOER SELF-TEST

- Carry out the KOER self-test.
- **Does DTC P1408 appear?**

Yes	No
GO to **HE37**.	GO to **HE53**.

HE37 KOER AND CONTINUOUS MEMORY DTC P1408: RETRIEVE CONTINUOUS MEMORY DTCS

NOTE: **If any DTC other than P1406 appears, note the DTC and refer to DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS after carrying out this**

pinpoint test.

- Retrieve all continuous memory DTCs.
- **Is DTC 1406 present?**

Yes	No
GO to **HE31**.	GO to **HE38**.

HE38 INSPECT THE DIFFERENTIAL PRESSURE FEEDBACK EGR PRESSURE HOSES

- Inspect the pressure hoses for a reverse connection at the differential pressure feedback EGR sensor or at the orifice tube assembly.
- Inspect the hoses for incorrect routing.
- Inspect both hoses for leaks and blockage.
- Inspect the differential pressure feedback EGR sensor and orifice tube assembly for blockage or damage at the pick-up tubes.

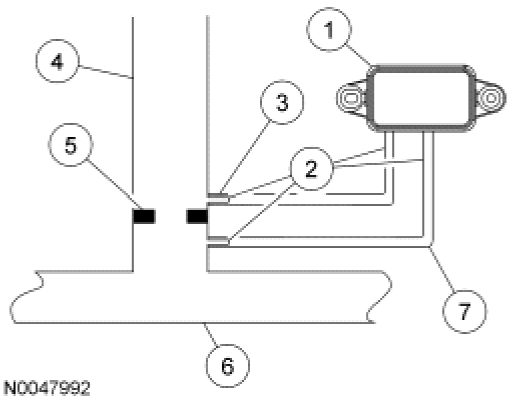

Fig. 120: Typical Differential Pressure Feedback EGR System
Courtesy of FORD MOTOR CO.

TYPICAL DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM

Item Number	Description
1	Differential Pressure Feedback EGR Sensor
2	Pickup Tubes
3	Upstream Pressure Hose
4	To EGR Valve
5	Orifice Tube Assembly
6	Exhaust Manifold
	Downstream Pressure

7	Hose

- **Is a concern present?**

Yes	No
REPAIR or INSTALL a new pressure hose as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HE39**.

HE39 CHECK THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR OUTPUT BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
  - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
  - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	CONNECT all the hoses. GO to **HE40**.

HE40 CHECK THE VREF VOLTAGE TO THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR

- Key in OFF position.
- Differential Pressure Feedback EGR Sensor connector disconnected.

- Key ON, engine OFF.
- Measure the voltage between:

(+) Differential Pressure Feedback EGR Sensor Connector, Harness Side	(-) Differential Pressure Feedback EGR Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to **HE41**.	refer to **PINPOINT TEST C**.

HE41 CHECK THE DPFE CIRCUIT FOR A SHORT TO VREF

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	DPFE

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HE42**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE42 CARRY OUT THE KOER SELF-TEST WHILE MONITORING THE EGR VACUUM

NOTE: **Since the EGR vacuum hose is disconnected, ignore the DTCs during this KOER self-test.**

- PCM connector connected.
- Differential Pressure Feedback EGR Sensor connector connected.
- Disconnect the vacuum hose at the EGR valve and connect the hose to the vacuum gauge.
- Carry out the KOER self-test.

- Monitor the vacuum gauge. Approximately 30 seconds into the test, EGR flow will be requested for a few seconds. Vacuum at this time should increase to greater than 5.4 kPa (1.6 in-Hg) to open the valve.
- **Does the vacuum increase to 10 kPa (3.0 in-Hg) or greater at any time during the KOER self-test?**

Yes	No
GO to **HE43**.	GO to **HE44**.

HE43 CHECK THE EGR VALVE FUNCTION BY APPLYING VACUUM WITH THE HAND PUMP

- Key in OFF position.
- Disconnect the vacuum hose at the EGR valve and plug the hose.
- Connect the vacuum pump to the EGR valve.
- Key ON, engine running.
- Access the PCM and monitor the RPM PID.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds. If the engine wants to stall, increase the engine speed to approximately 1,000 RPM and hold steady.
- Monitor for the following:
  - The EGR valve starts opening at about 5.4 kPa (1.6 in-Hg) vacuum, indicated by an increasing DPFEGR PID voltage.
  - The DPFEGR PID voltage increases until the valve is fully open. The DPFEGR PID voltage must read at least 2.5 volts with full vacuum applied.
  - The DPFEGR PID voltage remains steady with steady vacuum. If voltage drops within a few seconds, the EGR valve or vacuum source may be leaking.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate the EGR valve is operating as described in the test step?**

Yes	No
GO to **HE47**.	GO to **HE44**.

HE44 PHYSICALLY INSPECT ALL VACUUM LINES BETWEEN THE EGR VALVE, EGR VACUUM REGULATOR AND VACUUM SOURCE

- Key in OFF position.
- Inspect all vacuum lines for leaks, kinks, pinches, disconnects, blockage, misrouting or physical damage of any type.
- Inspect the EGR vacuum regulator for cracks or other physical damage.
- **Is a concern present?**

Yes	No

REPAIR as necessary. If the EGR vacuum regulator is damaged, INSTALL a new EGR vacuum regulator. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HE45**.

HE45 PHYSICALLY INSPECT THE EGR VALVE

- Remove and inspect the EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage.
- **Is a concern present?**

Yes	No
REPAIR as necessary. If repair is not possible, INSTALL a new EGR valve. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HE46**.

HE46 CHECK THE ENGINE VACUUM

- EGR vacuum regulator vacuum hoses disconnected.
- Connect a hand held vacuum gauge to the vacuum source.
- Key ON, engine running.
- Engine warm and at idle.
- Observe the vacuum gauge.
- **Is the vacuum gauge steadily reading at least 51 kPa (15 in-Hg)?**

Yes	No
GO to **HE47**.	ISOLATE the base engine concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HE47 CHECK THE VPWR VOLTAGE TO THE EGR VACUUM REGULATOR SOLENOID

- Key in OFF position.
- EGR Vacuum Regulator Solenoid connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) EGR	

Vacuum Regulator Solenoid Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 1	Negative terminal

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

Yes	No
GO to **HE48**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HE48 CHECK THE EGR VACUUM REGULATOR SOLENOID COIL RESISTANCE

- Key in OFF position.
- Measure the resistance between:

(+) EGR Vacuum Regulator Solenoid Connector, Component Side	(-) EGR Vacuum Regulator Solenoid Connector, Component Side
VPWR - Pin 1	EVR - Pin 2

- **Is the resistance between 26 - 40 ohms?**

Yes	No
GO to **HE49**.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE49 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector,	(-) Vehicle Battery

Harness Side	
EVR	Negative terminal

- **Is the voltage greater than 1 V?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **HE50**.

HE50 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) EGR Vacuum Regulator Solenoid Connector, Harness Side
EVR	EVR - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HE51**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HE51 INSPECT THE EGR SYSTEM FOR LEAKS, RESTRICTIONS AND POOR CONNECTIONS

- EGR Vacuum Regulator Solenoid connector connected.
- PCM connector connected.
- Visually inspect the EGR system for signs of intermittent failure.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HE52**.

HE52 CHECK THE EGR VACUUM REGULATOR SOLENOID VACUUM FLOW BY GROUNDING THE EVR CIRCUIT

NOTE: **If the EGR vacuum regulator does not react within 2 seconds, an EGR vacuum**

regulator concern may be present.

- Disconnect the vacuum hose at the EGR valve and connect the hose to the vacuum gauge.
- Key ON, engine running.
- Engine warm and at idle.
- Connect a 5 amp fused jumper wire between the following:

Point A EGR Vacuum Regulator Solenoid Connector, Harness Side	Point B Vehicle Battery
EVR - Pin 2	Negative terminal

- **Does the vacuum gauge indicate 13.5 kPa (4.0 in-Hg) or greater within 2 seconds?**

Yes	No
GO to **HE66**.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE53 INSPECT THE DIFFERENTIAL PRESSURE FEEDBACK EGR PRESSURE HOSES

- Visually inspect the upstream pressure hose routing.
- Visually inspect the downstream pressure hose routing.
- Inspect for a reversed connection at the differential pressure feedback EGR sensor or orifice tube assembly.
- The hose must not be pinched or have dips in it where water could settle or freeze.
- Inspect both hoses for leaks and blockage.
- Inspect the differential pressure feedback EGR sensor and orifice tube assembly for blockage or damage at the pick-up tubes.

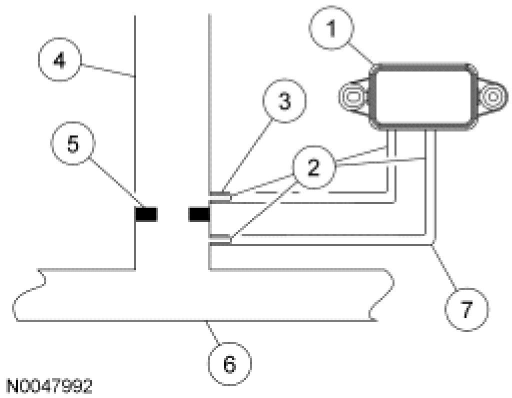

Fig. 121: Typical Differential Pressure Feedback EGR System
Courtesy of FORD MOTOR CO.

TYPICAL DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM

Item Number	Description
1	Differential Pressure Feedback EGR Sensor
2	Pickup Tubes
3	Upstream Pressure Hose
4	To EGR Valve
5	Orifice Tube Assembly
6	Exhaust Manifold
7	Downstream Pressure Hose

- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HE54**.

HE54 CHECK THE EGR VALVE FUNCTION BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.

- Quickly release the vacuum.
  - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
  - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	CONNECT all the hoses. GO to **HE55**.

HE55 CHECK THE EGR VALVE FUNCTION BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the vacuum hose at the EGR valve and plug the hose.
- Connect the vacuum pump to the EGR valve.
- Key ON, engine running.
- Access the PCM and monitor the RPM PID.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds. If the engine wants to stall, increase the engine speed to approximately 1,000 RPM and hold steady.
- Monitor for the following:
  - The EGR valve starts opening at about 5.4 kPa (1.6 in-Hg) vacuum, indicated by an increasing DPFEGR PID voltage.
  - The DPFEGR PID voltage increases until the valve is fully open. The DPFEGR PID voltage must read at least 2.5 volts with full vacuum applied.
  - The DPFEGR PID voltage remains steady with steady vacuum. If voltage drops within a few seconds, the EGR valve or vacuum source may be leaking.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate the EGR valve is operating as described in the test step?**

Yes	No
GO to **HE56**.	REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage. If OK, REMOVE and INSPECT the EGR valve and tube for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HE56 INSPECT THE EGR VACUUM SIGNAL SUPPLY FOR AN INTERMITTENT CONCERN

- Key in OFF position.
- Remove the vacuum hose from the EGR valve and connect to a vacuum gauge.
- Key ON, engine running.
- Connect a 5 amp fused jumper wire between the following:

Point A EGR Vacuum Regulator Solenoid Connector, Harness Side	Point B Vehicle Battery
EVR - Pin 2	Negative terminal

- The solenoid is full ON.
- Vacuum gauge should read above 13.5 kPa (4 in-Hg).
- Observe the vacuum gauge.
- Look for a concern while carrying out the following checks:
  - Lightly tap on the EGR vacuum regulator solenoid.
  - Carry out a thorough wiggle test on the EGR vacuum regulator harness.
  - Inspect the EGR vacuum signal supply for an intermittent concern.
  - Inspect the EGR vacuum regulator solenoid and vacuum hoses for plugging.
  - A concern is indicated by a sudden drop in the vacuum reading.
- **Is a concern indicated?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. Note: In cold climates, the EGR valve may temporarily freeze shut and thaw when the engine warms.

	refer to **PINPOINT TEST Z**.

HE57 EGR DIAGNOSIS BY SYMPTOM: CHECK FOR EGR FLOW WITH THE EGR VACUUM HOSE DISCONNECTED AND PLUGGED

- Carry out the KOER self-test. Repair any other DTCs.
- Possible causes for EGR flow at idle with no related DTCs:
  - EGR valve not fully seating
  - EGR vacuum regulator solenoid vent restricted
  - Damaged EGR vacuum regulator solenoid
- Disconnect and plug the vacuum hose connected to the EGR valve.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Note the voltage.
- Key ON, engine running.
- With the engine at idle, observe the DPFEGR PID voltage. Compare to engine OFF voltage.
- An increase in voltage at idle indicates the differential pressure feedback EGR sensor is sensing EGR flow.
- **Is the DPFEGR PID voltage greater at idle by 0.15 V than with the engine off?**

Yes	No
REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Inspect the EGR vacuum regulator solenoid and vacuum hoses for plugging. INSPECT the EGR vacuum regulator solenoid vent for blockage. GO to **HE58**.

HE58 DETERMINE THE EGR VALVE VACUUM SUPPLY

- **Is a concern present in the EGR valve vacuum supply?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE59 DTCS P0403 AND P1409: CHECK THE EGR VACUUM REGULATOR SOLENOID COIL RESISTANCE

- Key in OFF position.
- EGR Vacuum Regulator Solenoid connector disconnected.
- Measure the resistance between:

(+) EGR Vacuum Regulator Solenoid Connector, Component Side	(-) EGR Vacuum Regulator Solenoid Connector, Component Side
VPWR - Pin 1	EVR - Pin 2

- **Is the resistance between 26 - 40 ohms?**

Yes	No
GO to **HE60**.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE60 CHECK THE VPWR VOLTAGE TO EGR VACUUM REGULATOR SOLENOID

- Key ON, engine OFF.
- Measure the voltage between:

(+) EGR Vacuum Regulator Solenoid Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 1	Negative terminal

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

Yes	No
GO to **HE61**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HE61 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

	(-) EGR

(+) PCM Connector, Harness Side	Vacuum Regulator Solenoid Connector, Harness Side
EVR	EVR - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HE62**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HE62 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
EVR	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to **HE63**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE63 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
EVR	PWRGND

- **Is the resistance greater than 10K ohms?**

Yes	No
	REPAIR the short circuit. CLEAR the DTCs.

GO to **HE66**.	REPEAT the self-test.

HE64 CHECK FOR THE PRESENCE OF KOER DTCS P0403 OR P1409

- Carry out the KOER self-test.
- **Are DTCs P0403 or P1409 present?**

Yes	No
GO to **HE59**.	GO to **HE65**.

HE65 CARRY OUT A THOROUGH WIGGLE TEST ON THE EGR VACUUM REGULATOR HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
EVR	PWRGND

- Lightly tap on the EGR vacuum regulator solenoid. Wiggle the EGR vacuum regulator solenoid connector. Carry out a thorough wiggle test on the harness. A concern is indicated by a voltage drop during the wiggle test.
- **Is the voltage greater than 10 V?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

HE66 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No

INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HF: CATALYST EFFICIENCY MONITOR AND EXHAUST SYSTEMS

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- catalytic converter
- exhaust system

HF1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0420 or P0430 present?**

Yes	No
GO to **HF2**.	For symptoms without DTCs, GO to **HF6**. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HF2 CHECK FOR OTHER DTCS

NOTE: **Internal deterioration of a catalytic converter is usually caused by abnormal engine operation upstream of the catalyst. Events that can produce higher than normal temperatures in the catalyst are particularly suspect. For example, misfiring can cause higher than normal catalyst operating temperatures.**

NOTE: **Make sure the customer has not:**

- **refueled the vehicle with leaded gasoline.**
- **noticed a high vehicle oil consumption. An engine that consumes oil at a high rate deposits high levels of phosphorus on the catalyst and reduces the catalyst efficiency.**

- Check for self-test DTCs.
- **Are any DTCs present other than the following: P0420, P0430?**

Yes	No

GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** for pinpoint test direction and REPAIR the misfire DTCs. CLEAR the DTCs. REPEAT the self-test.	GO to **HF3**.

HF3 CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

NOTE: Check the HO2S electrical connectors to make sure the correct HO2S is connected to the correct electrical connector. The electrical connectors are color coded to make sure the correct connection is made.

If the electrical connection of the rear HO2S are interchanged/crossed, the catalyst efficiency monitor test fails.

- Visually inspect the HO2S harness connectors for any indication of crossed wiring.
- Visually inspect the harness for exposed wiring, corrosion and correct routing.
- Visually inspect the PCM connectors for damaged, or pushed out pins, corrosion and loose wires.
- **Are there any concerns with the wiring or the PCM connection?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. CARRY OUT the catalyst monitor drive cycle to verify the repairs.	GO to **HF4**.

HF4 CHECK THE FUEL PRESSURE

WARNING: **The fuel system remains pressurized when the engine is not running. To prevent injury or fire, use caution when working on the fuel system. Failure to follow these instructions may result in personal injury.**

WARNING: **Before repairing or installing a new component in the fuel system, reduce the possibility of injury or fire by following the warning, caution, and handling directions in pinpoint test HC. refer to PINPOINT TEST HC. Failure to follow these instructions may result in personal injury.**

NOTE: Fuel pressure above specification can produce an abnormally rich air/fuel mixture. This rich air/fuel mixture can cause higher than normal catalyst operating temperatures.

NOTE: On electronic returnless fuel system (ERFS), the fuel pressure can be monitored by the scan tool using the fuel rail pressure (FRP) PID.

- Mechanical returnless fuel systems (MRFS):
    - If applicable, inspect the vacuum hose going to the fuel rail pulse damper for proper installation

and cracks. Repair as necessary.

- Connect a Rotunda fuel pressure gauge or equivalent.
- Access the PCM and monitor the FRP PID.
- Start the engine. Record the fuel pressure.
- Compare the recorded fuel pressure reading to the Fuel System Specification Chart found at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**.
- Key in OFF position.
- **Is the fuel pressure within specifications?**

Yes	No
The fuel pressure is OK. If applicable, REMOVE the fuel pressure gauge. GO to **HF5**.	The fuel pressure is out of specification. GO to **HC3**.

HF5 CHECK FOR LEAKS IN THE EXHAUST SYSTEM

NOTE: If a catalyst is in series with a leaking exhaust system, it can fail the catalyst efficiency monitor test.

- Inspect the exhaust system for leaks, cracks, loose connections, punctures, or non-factory modifications.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. CARRY OUT the catalyst monitor drive cycle to verify the repairs.	GO to **HF10**.

HF6 CHECK FOR RESTRICTIONS IN THE EXHAUST SYSTEM

NOTE: A slight pressure in the exhaust system is normal, but excessive exhaust back pressure seriously affects engine operation.

- Inspect the following for damage or restrictions:
  - front and rear exhaust pipes
  - catalytic converter
  - muffler and tailpipe assembly
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HF7**.

HF7 CHECK FOR EXCESSIVE EXHAUST BACK PRESSURE

- The internal condition of exhaust system and its ability to flow can be checked with an exhaust back pressure tool.
- **Is an exhaust back pressure tester available?**

Yes	No
GO to **HF8**.	GO to **HF9**.

HF8 CHECK FOR EXCESSIVE EXHAUST BACK PRESSURE WITH EXHAUST BACK PRESSURE TOOL

NOTE: Typical exhaust back pressure, when measured near the exhaust manifold and at normal engine operating temperature, should not exceed 20.7 kPa (3 psi) at idle and 55.2 kPa (8 psi) at wide open throttle (WOT) under load.

- Install an exhaust back pressure tester and follow the tool manufacturer installation and testing instructions.
- **Does the exhaust back pressure test indicate a restriction?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. To continue diagnosis of a symptom (lack of power, loss of power, or no start), REFER to the **SYMPTOM CHARTS** article Symptom Charts.	No indication of restrictions or leaks has been detected in the exhaust system. To continue diagnosis of a symptom (lack of power, loss of power, or no start), REFER to the **SYMPTOM CHARTS** article Symptom Charts.

HF9 CHECK MANIFOLD VACUUM FOR AN INDICATION OF EXCESSIVE EXHAUST SYSTEM RESTRICTION

NOTE: When the engine is first started and is idled, the reading may be normal 51-74 kPa (15-22 in-Hg), but as the engine RPM is increased, the back pressure caused by a clogged exhaust system causes the needle to slowly drop to 0 kPa (0 in-Hg). The needle then may slowly rise. Excessive exhaust restriction causes the needle to drop to a low point even if the engine is only idling.

- Attach a vacuum gauge to the intake manifold vacuum source.
- Observe the vacuum gauge while increasing the engine RPM.
- **Does the vacuum gauge indicate an exhaust restriction concern?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. To continue diagnosis of a symptom (lack of power, loss of power, or no start), REFER to the **SYMPTOM CHARTS** article Symptom Charts.	No indication of restrictions or leaks has been detected in the exhaust system. To continue diagnosis of a symptom (lack of power, loss of power, or no start), REFER to the **SYMPTOM CHARTS** article Symptom Charts.

HF10 CARRY OUT THE CATALYST MONITOR DRIVE CYCLE

- Carry out the catalyst monitor drive cycle. Refer to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .
- Retrieve the continuous memory DTCs.
- **Are DTCs P0420 or P0430 present?**

Yes	No
INSTALL a new catalyst between the monitored HO2S sensors, only for the bank referenced, (P0420 Bank 1), (P0430 Bank 2). Do not install a new unmonitored catalyst unless it is repaired as an assembly. REFER to the **EXHAUST SYSTEM -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	The test is complete and no concerns are present.

PINPOINT TEST HG: POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

This pinpoint test is intended to diagnose the following:

- positive crankcase ventilation (PCV) valve (6A666) and related vacuum lines
- electrically heated PCV valve (6A666) and heater circuit, both PCM and non-PCM controlled
- electrically heated PCV tube (9F624) and heater circuit, both PCM and non-PCM controlled
- powertrain control module (PCM) (12A650)
- PCV thermal extension harness (12A580)

NOTE: **For the electrically heated PCV system only, refer to POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM .**

Electrically Heated PCV

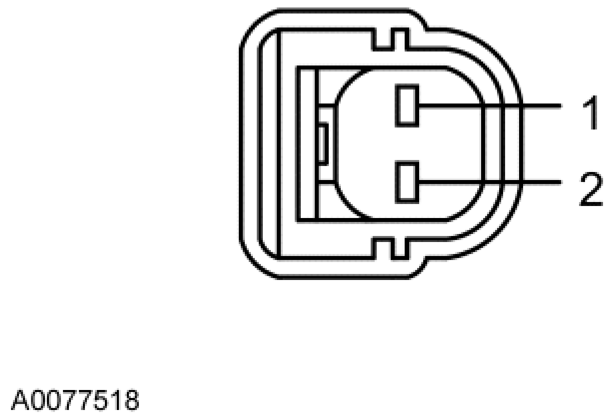

Fig. 122: Positive Crankcase Ventilation Heated Fitting (PCVHF) Connector
Courtesy of FORD MOTOR CO.

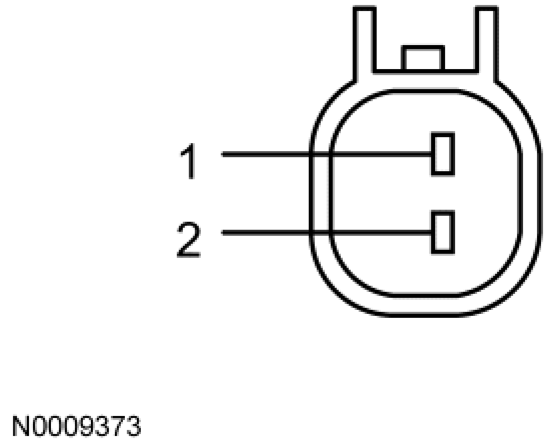

Fig. 123: Positive Crankcase Ventilation (PCV) Connector - B
Courtesy of FORD MOTOR CO.

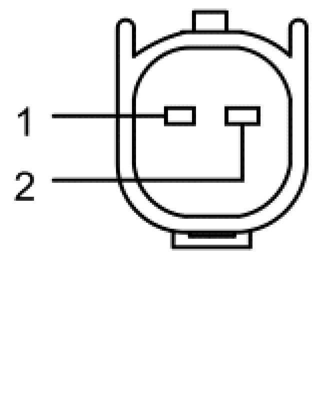

Fig. 124: Positive Crankcase Ventilation (PCV) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria (PCM controlled PCV heater), E-Series 6.8L (PCM controlled PCV heater), E-Series 4.6L (PCM controlled PCV heater), Explorer 4.0L (PCM controlled PCV heater), Explorer Sport Trac 4.0L (PCM controlled PCV heater), F-150 4.2L (PCM controlled PCV heater), F-150 4.6L (PCM controlled PCV heater), Fusion 3.0L (PCM controlled PCV heater), Grand Marquis (PCM controlled PCV heater), Milan 3.0L (PCM controlled PCV heater), Mountaineer 4.0L (PCM controlled PCV heater), Mustang 4.0L (PCM controlled PCV heater), Mustang 5.4L (PCM controlled PCV heater), Town Car (PCM controlled PCV heater)	A	1 2	PCVHC IGN START/RUN
Expedition (Non-PCM controlled heated PCV tube), F-150 5.4L (Non-PCM controlled heated PCV tube), Mark LT (Non-PCM controlled heated PCV tube), Navigator (Non-PCM controlled heated PCV tube)	B	2 1	GND IGN START/RUN
F-Super Duty 5.4L (PCM controlled heated PCV tube)	C	2 1	PCVHC IGN START/RUN

All other vehicles	A	1 2	GND IGN START/RUN

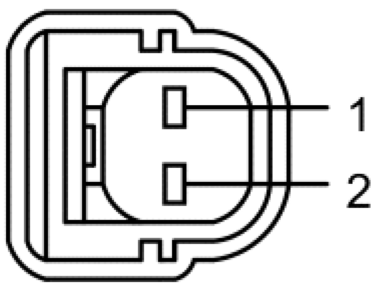

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Fig. 125: Positive Crankcase Ventilation Heated Fitting (PCVHF) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	PCVHF (Positive Crankcase Ventilation Heated Fitting)
2	IGN START/RUN

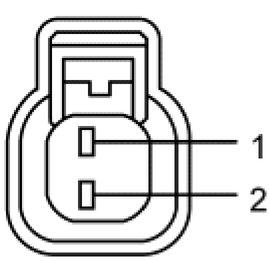

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Fig. 126: Positive Crankcase Ventilation Thermal Extension -Harness Side (PCVTE-Harness Side)
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	GND (Ground)

1	IGN START/RUN

This table is only for vehicles equipped with a PCM controlled PCV heater.

Vehicle	Connector	Pin	Circuit
E-Series, F-Super Duty	170 Pin	E2	PCVHC
F-150	190 Pin	E3	PCVHC
Fusion, Milan	140 Pin	E2	PCVHC
Mustang 5.4L	170 Pin	E67	PCVHC
All other vehicles	170 Pin	E3	PCVHC

HG1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- Check for DTCs P053A, P145E or P1489.
- **Are any of the above listed DTCs present?**

Yes	No
GO to **HG5**.	For all other symptoms without DTCs, GO to **HG2**.

HG2 VISUAL INSPECTION OF THE PCV VALVE

NOTE: If the PCV valve or tube is electrically heated, verify the electrical connection. On some applications the vehicle may be equipped with a thermal harness that only provides electrical continuity when the temperature is less than 5°C (40°F) +/- 4°C (+/- 7°F). Typically this harness is located close to the PCV valve or tube.

NOTE: If the PCV valve is water heated, verify the coolant hose and clip connections.

- Check the PCV valve, hoses and connections for leaks or restrictions.
- Verify the PCV valve maintenance schedule has been followed.
- Verify the proper PCV valve part number.
- Verify the PCV valve is clean.
- Verify the fresh air tube and related hoses are clean and routed correctly.
- **Is a concern present?**

Yes	No
REPAIR as necessary. VERIFY the symptom no longer exists.	For an electrically heated PCV tube, GO to **HG4**. For all others, GO to **HG3**.

HG3 STUCK PCV VALVE CHECK

- Disconnect the PCV valve from the valve cover.
- Shake the PCV valve.
- **Does the PCV valve rattle when shaken?**

Yes	No
REINSTALL the PCV valve. For PCV systems with electrical heating, GO to **HG4**. For PCV systems without electrical heating, GO to **HG12**.	The PCV valve is sticking. INSTALL a new PCV valve. VERIFY the symptom no longer exists.

HG4 CHECK FOR A PCM CONTROLLED PCV HEATER

NOTE: **If a thermal extension harness is present then the PCV is non-PCM controlled. Refer to POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM .**

- Check if the PCV heater is PCM controlled.
- **Is the PCV heater PCM controlled?**

Yes	No
GO to **HG5**.	GO to **HG8**.

HG5 CHECK THE HARNESS VOLTAGE TO THE PCM CONTROLLED PCV HEATER

- Suspect PCV connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCVHF Connector, Harness Side	(-)
IGN START/RUN - Pin 2	Ground

- Measure the voltage between:

(+) PCV Connector, Harness Side	(-)
IGN START/RUN	Ground

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

Yes	No
GO to **HG6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HG6 CHECK THE HARNESS CIRCUIT TO THE PCM CONTROLLED PCV HEATER

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCVHF Connector, Harness Side
PCVHF	PCVHF - Pin 1

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCV Connector, Harness Side
PCVHC	PCVHC

- **Is the resistance greater than 5 ohms?**

Yes	No
GO to **HG7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HG7 CHECK THE RESISTANCE OF THE PCM CONTROLLED PCV VALVE OR TUBE HEATER

- Measure the resistance between:

(+) PCVHF Connector, Component Side	(-) PCVHF Connector, Component Side
IGN START/RUN - Pin 2	PCVHF - Pin 1

- Measure the resistance between:

(+) PCV Connector, Component Side	(-) PCV Connector, Component Side
IGN START/RUN	PCVHC

- **Is the resistance between 10 - 35 ohms?**

Yes	No
GO to **HG13**.	INSTALL a new PCV valve or tube. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HG8 CHECK THE VOLTAGE AND GROUND AT THE HARNESS ELECTRICALLY HEATED PCV VALVE OR TUBE NON-PCM CONTROLLED

- PCV connector disconnected.
- PCVTE-Harness Side connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCVTE-Harness Side, Harness Side	(-) PCVTE-Harness Side, Harness Side
IGN START/RUN - Pin 1	GND - Pin 2

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

Yes	No
For vehicles with a thermal extension harness, GO to **HG10**. For all others, GO to **HG11**.	GO to **HG9**.

HG9 CHECK THE VOLTAGE CIRCUIT

- PCV connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCV Connector,	(-)

Harness Side	
IGN START/RUN	Ground

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

Yes	No
REPAIR the open GND circuit. TEST the system for normal operation.	REPAIR the open PWR circuit TEST the system for normal operation.

HG10 VALVE RESISTANCE CHECK WITHOUT AN EXTENSION HARNESS

NOTE: On some applications the vehicle may be equipped with a thermal harness that only provides electrical continuity when the temperature is less than 5°C (40°F) +/- 4°C (+/- 7°F). Typically this harness is located close to the PCV valve or tube.

- Disconnect the thermal extension harness from the PCV valve.
- Measure the resistance between:

(+) PCV Connector, Component Side	(-) PCV Connector, Component Side
IGN START/RUN	PCVHC

- **Is the resistance between 10 - 35 ohms?**

Yes	No
INSTALL a new thermal extension harness PCV. TEST the system for normal operation.	INSTALL a new PCV.

HG11 CHECK THE RESISTANCE OF THE ELECTRICALLY HEATED PCV VALVE OR TUBE

- Measure the resistance between:

(+) PCV Connector, Component Side	(-) PCV Connector, Component Side
IGN START/RUN	GND

- **Is the resistance between 10 - 35 ohms?**

Yes	No
GO to **HG12**.	INSTALL a new PCV valve or tube. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** .

HG12 PCV SYSTEM CHECK

- Start the engine and warm it until engine temperature is stable.
- Disconnect the closure (fresh air) hose from the remote air cleaner or air outlet tube (the tube connecting the mass air flow sensor and the throttle body).
- Place a stiff piece of paper over the hose end. Wait 1 minute.
- **Does vacuum hold the paper in place?**

Yes	No
The PCV system is OK. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	CHECK for vacuum leaks/obstruction in the PCV system (such as oil cap, PCV valve, hoses, cut grommets, valve cover bolt torque/gasket leak). REFER to the vehicle emissions control information (VECI) label for PCV system components and routing. REPAIR as necessary.

HG13 CHECK IF A CONCERN OR DTC IS STILL PRESENT

- Connect the PCV system.
- Clear the DTCs.
- Carry out the self-test.
- **Is the concern or DTC is still present?**

Yes	No
GO to **HG14**.	Unable to duplicate or identify the concern at this time. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.

HG14 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
    - pushed out pins
    - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HH: EXHAUST GAS RECIRCULATION SYSTEM MODULE (ESM)

This pinpoint test is intended to diagnose the following:

- ESM (9Y456)
- orifice tube assembly (9D477)
- differential pressure feedback exhaust gas recirculation (EGR) sensor pressure hoses
- vacuum lines
- harness circuits: DPFE, SIGRTN, EVR, VPWR and VREF
- powertrain control module (PCM) (12A650)

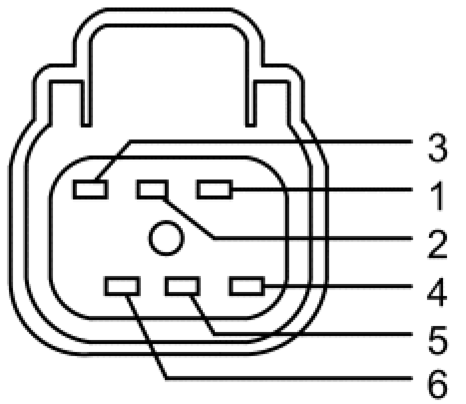

Fig. 127: EGR System Module (ESM) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	EVR (EGR Vacuum Regulator)
4	VPWR (Vehicle Power)
6	SIGRTN (Signal Return)
5	DPFE (Differential Pressure Feedback EGR)
2	VREF (Reference Voltage)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series, F-Super Duty	170 Pin	E63 E58 E57 E58 E21	EVR SIGRTN VREF SIGRTN DPFE
F-150	190 Pin	E63 E58 B29, E57 B58, E58, T43 E21	EVR SIGRTN VREF SIGRTN DPFE
Mustang	170 Pin	E63 E58 B40, E57 B41, E58, T41 E21	EVR SIGRTN VREF SIGRTN DPFE
All other vehicles	170 Pin	E63 E58 E57 B41, E58, T41 E21	EVR SIGRTN VREF SIGRTN DPFE

HH1 CHECK FOR DTCS

- **Are DTCs P0401, P0402, P0403, P0405, P0406, P1408, or P1409 present?**

Yes	No
For DTC P0401, GO to **HH16**. For DTC P0402, GO to **HH12**. For DTCs P0403 and P1409, GO to **HH22**. For DTC P0405, GO to **HH2**. For DTC P0406, GO to **HH5**. For DTC P1408, GO to **HH17**.	For symptoms without DTCs, GO to **HH28**. For all others, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HH2 DTC P0405: DETERMINE THE PRESENT DPFEGR PID VOLTAGE

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage less than 0.05 V?**

Yes	No
GO to **HH3**.	GO to **HH11**.

HH3 INDUCE THE OPPOSITE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR SIGNAL

- Key in OFF position.
- ESM connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage between 4 - 6 V?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HH4**.

HH4 CHECK THE DPFE CIRCUIT FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
DPFE	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
DPFE	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HH29**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HH5 DTC P0406: DETERMINE THE PRESENT DPFEGR PID VOLTAGE

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage greater than 4 V?**

Yes	No
GO to **HH6**.	GO to **HH11**.

HH6 CHECK THE VREF VOLTAGE TO THE ESM

- Key in OFF position.
- ESM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) Vehicle Battery
VREF - Pin 2	Negative terminal

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to **HH7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HH7 CHECK THE DPFE CIRCUIT FOR A SHORT TO VOLTAGE

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) Vehicle Battery
DPFE - Pin 5	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to **HH8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HH8 CHECK THE DPFE CIRCUIT FOR A SHORT TO VREF

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	DPFE

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HH9**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HH9 CHECK THE DPFE AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) ESM Connector, Harness Side
DPFE	DPFE - Pin 5
SIGRTN	SIGRTN - Pin 6

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

Yes	No
GO to **HH10**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HH10 INDUCE THE OPPOSITE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR VOLTAGE

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A ESM Connector, Harness Side	Point B ESM Connector, Harness Side
DPFE - Pin 5	SIGRTN - Pin 6

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage less than 0.1 V?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HH29**.

HH11 CARRY OUT A THOROUGH WIGGLE TEST ON THE ESM HARNESS

- Access the PCM and monitor the DPFEGR PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there any change in the voltage reading, or is a concern found?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

HH12 DTC P0402: CHECK THE VREF VOLTAGE TO THE ESM

NOTE: **Diagnose and repair all circuit concern DTCs before diagnosing range/performance or flow concerns. For circuit concern DTC diagnosis, refer to DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS .**

- Key in OFF position.
- ESM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) Vehicle Battery
VREF - Pin 2	Negative terminal

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **HH13**.	refer to **PINPOINT TEST C**.

HH13 SIMULATE THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR SIGNAL WITH A VACUUM PUMP

- Disconnect the downstream differential pressure feedback EGR sensor port hose at the ESM.
- Verify the hose and port are clear and free of obstructions.

- Connect a vacuum pump to the downstream differential pressure feedback EGR sensor port.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
  - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
  - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HH14**.

HH14 INSPECT THE EGR VACUUM REGULATOR SOLENOID VENT FOR BLOCKAGE

NOTE: **When the EGR valve is closed, the EGR vacuum regulator solenoid vacuum is vented through the solenoid vent to the atmosphere. A plugged EGR vacuum regulator solenoid vent does not allow EGR vacuum to vent to the atmosphere.**

- EGR vacuum regulator vacuum hoses disconnected.
- Connect a hand vacuum pump to the EGR vacuum regulator source port.
- Apply 34 to 51 kPa (10 to 15 in-Hg) vacuum.
- **Does the EGR vacuum regulator solenoid vacuum bleed off?**

Yes	No
GO to **HH15**.	INSTALL a new EGR vacuum regulator solenoid. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HH15 CHECK THE EGR VALVE FOR CARBON BUILD-UP

- Remove the ESM.
- Visually inspect the EGR valve and valve seat for correct seating, carbon build-up and debris.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time.

HH16 DTC P0401: CARRY OUT THE KOER SELF-TEST

NOTE: Diagnose and repair all circuit concern DTCs before diagnosing range/performance or flow concerns.

- Carry out the KOER self-test.
- **Is DTC P1408 present?**

Yes	No
GO to **HH17**.	GO to **HH18**.

HH17 DTC P1408: CHECK THE VREF VOLTAGE TO THE ESM

- Key in OFF position.
- ESM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) Vehicle Battery
VREF - Pin 2	Negative terminal

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to **HH18**.	refer to **PINPOINT TEST C**.

HH18 CHECK THE EGR VACUUM REGULATOR SOLENOID VACUUM

- ESM connector connected.
- Disconnect the EGR vacuum regulator vacuum source hose.
- Connect a vacuum gauge to the EGR vacuum regulator vacuum source hose.
- Key ON, engine running.
- Monitor the vacuum gauge.
- **Is the manifold vacuum greater than 34 kPa (10 in-Hg)?**

Yes	No
GO to **HH19**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HH19 SIMULATE THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR SIGNAL WITH A VACUUM PUMP

- Key in OFF position.
- Disconnect the downstream differential pressure feedback EGR sensor port hose at the ESM.
- Verify the hose and port are clear and free of obstructions.
- Connect a vacuum pump to the downstream differential pressure feedback EGR sensor port.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
  - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
  - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	CONNECT all the hoses. GO to **HH20**.

HH20 CHECK THE EGR VACUUM REGULATOR SOLENOID OPERATION

- Key ON, engine running.
- Engine at normal operating temperature.
- Allow the engine idle to stabilize.
- Access the PCM and monitor the RPM PID.
- Access output state control.
- Increase the EGR vacuum regulator duty cycle while monitoring the RPM PID.
- **Does the RPM decrease or the engine stall as the EGR vacuum regulator duty cycle is increased?**

Yes	No

Unable to duplicate or identify the concern at this time.	GO to **HH21**.

HH21 CHECK FOR THE PRESENCE OF CARBON BUILD-UP IN THE EGR PASSAGE

NOTE: In certain vehicle applications, carbon build-up may occur downstream of the ESM. An inspection is required to make sure the passage in the upper intake manifold plenum chamber behind the ESM is open to allow exhaust gas flow.

- Key in OFF position.
- Remove the ESM. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** .
- Disconnect the air inlet tube from the throttle body.
- Prop open the throttle body.
- Apply regulated shop air to the EGR port at the location where the ESM attaches to the upper intake manifold.
- **Is a restriction concern present?**

Yes	No
CLEAN the EGR port as necessary and INSTALL the ESM. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HH22 DTCS P0403 AND P1409: CHECK THE EGR VACUUM REGULATOR SOLENOID OPERATION

- Key ON, engine running.
- Engine at normal operating temperature.
- Allow the engine idle to stabilize.
- Access the PCM and monitor the RPM PID.
- Access output state control.
- Increase the EGR vacuum regulator duty cycle while monitoring the RPM PID.
- **Does the RPM decrease or the engine stall as the EGR vacuum regulator duty cycle is increased?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	GO to **HH23**.

HH23 CHECK THE VPWR VOLTAGE TO THE EGR VACUUM REGULATOR SOLENOID

- Key in OFF position.
- ESM connector disconnected.

- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 4	Negative terminal

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

Yes	No
GO to **HH24**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HH24 CHECK THE EGR VACUUM REGULATOR SOLENOID COIL RESISTANCE

- Key in OFF position.
- Measure the resistance between:

(+) ESM Connector, Component Side	(-) ESM Connector, Component Side
VPWR - Pin 4	EVR - Pin 1

- **Is the resistance between 26 - 40 ohms?**

Yes	No
GO to **HH25**.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HH25 CHECK THE EVR CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) ESM Connector, Harness Side	(-) PCM Connector, Harness Side
EVR - Pin 1	EVR

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HH26**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HH26 CHECK THE EVR CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
EVR	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to **HH27**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HH27 CHECK THE EVR CIRCUIT FOR A SHORT TO GND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
EVR	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HH29**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HH28 EGR DIAGNOSIS BY SYMPTOM: CHECK FOR EGR FLOW WITH THE EGR VACUUM REGULATOR VACUUM HOSE DISCONNECTED AND PLUGGED

NOTE: **An increase in DPFEGR PID voltage at idle indicates EGR flow.**

- Carry out the KOER self-test. Repair any other DTCs.
- Possible causes for EGR flow at idle with no related DTCs:
  - EGR valve not fully seating
  - EGR vacuum regulator solenoid vent restricted
  - Damaged EGR vacuum regulator solenoid
- Disconnect and plug the EGR vacuum regulator vacuum source hose.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Record the PID voltage.
- Key ON, engine running.
- With the engine at idle, observe the DPFEGR PID voltage. Compare to engine OFF voltage.
- **Is the idle DPFEGR PID voltage greater than 0.15 V when compared to the KOEO DPFEGR PID voltage?**

Yes	No
REMOVE and INSPECT the ESM for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. If no concerns are present, INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	INSPECT the EGR vacuum regulator solenoid vent for blockage. To continue symptom diagnosis, REFER to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHARTS** .

HH29 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HK: VARIABLE CAMSHAFT TIMING (VCT)

This pinpoint test is intended to diagnose the following:

- VCT solenoid (6L713) or (6B297)
- spider assembly right bank (6C260), or left bank (6C261)
- harness circuits: VPWR and VCT
- powertrain control module (PCM) (12A650)

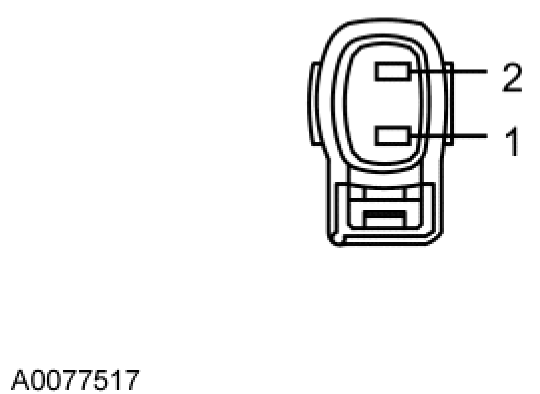

Fig. 128: Variable Camshaft Timing Bank 1 (VCT1) Solenoid Connector - A
Courtesy of FORD MOTOR CO.

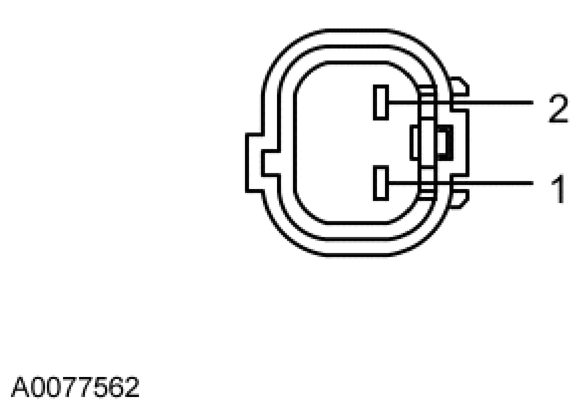

Fig. 129: Variable Camshaft Timing Bank 1 (VCT1) Solenoid Connector - B
Courtesy of FORD MOTOR CO.

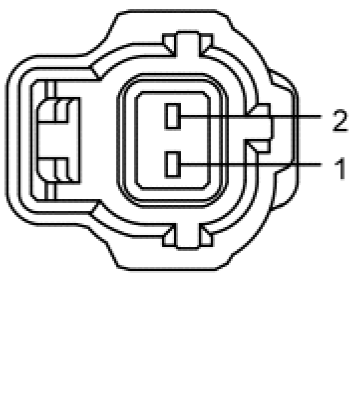

Fig. 130: Variable Camshaft Timing Bank 1 (VCT1) Solenoid Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Fusion 3.0L, Milan 3.0L, MKX, MKZ, Sable, Taurus, Taurus X	A	1 2	VPWR VCT1
Fusion 2.3L, Milan 2.3L	B	2 1	VPWR VCT1
All other vehicles	C	1 2	VPWR VCT1

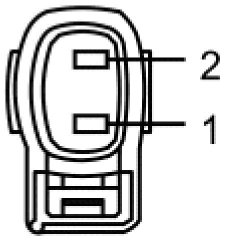

Fig. 131: Variable Camshaft Timing Bank 2 (VCT2) Solenoid Connector - A
Courtesy of FORD MOTOR CO.

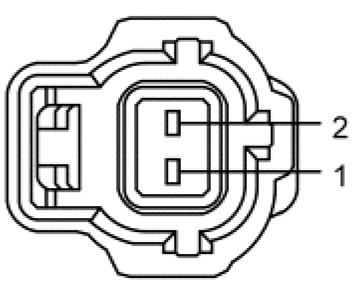

Fig. 132: Variable Camshaft Timing Bank 2 (VCT2) Solenoid Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Fusion 3.0L, Milan 3.0L, MKX, MKZ, Sable, Taurus, Taurus X	A	1 2	VPWR VCT2
All other vehicles	B	1	VPWR

		2	VCT2

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Expedition, Navigator	140 Pin	B51, B52, B53 E68 E67	VPWR VCT2 VCT1
Explorer, Explorer Sport Trac, F-Super Duty, Mountaineer, Mustang	170 Pin	B35, B36 E68 E67	VPWR VCT2 VCT1
Fusion 3.0L, Milan 3.0L, MKZ	140 Pin	B51, B52 E68 E67	VPWR VCT2 VCT1
Fusion 2.3L, Milan 2.3L	140 Pin	B51, B52 E67	VPWR VCT1
All other vehicles	190 Pin	B51, B52, B53 E68 E67	VPWR VCT2 VCT1

HK1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0010, P0011, P0012, P0016, P0018, P0020, P0021, P0022, P052A, P052B, P052C or P052D present?**

Yes	No
For DTCs P0010 or P0020, GO to **HK2**. For DTCs P0011, P0012, P0021, P0022, P052A, P052B, P052C or P052D, GO to **HK17**. For DTCs P0016 and P0018 with or without P0011, P0012, P0021, P0022, P052A, P052B, P052C or P052D, GO to **HK16**.	For symptoms without DTCs, GO to **HK17**. For all others, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HK2 DTCS P0010 OR P0020: CHECK FOR VCT DTCS

NOTE: The engine should be at operating temperature before running the self-test.

- Clear the DTCs.
- Carry out the KOER self-test.
- **Are DTCs P0010 or P0020 present?**

Yes	No

For KOER DTC P0010, GO to **HK4**. For KOER DTC P0020, GO to **HK10**.	GO to **HK3**.

HK3 CARRY OUT A THOROUGH WIGGLE TEST ON THE VCT HARNESS

- Carry out a thorough wiggle test on the VCT harness.
- Carry out the KOER self-test.
- **Are DTCs P0010 or P0020 present?**

Yes	No
For KOER DTC P0010, GO to **HK4**. For KOER DTC P0020, GO to **HK10**.	refer to **PINPOINT TEST Z**.

HK4 CHECK THE VCT1 SOLENOID RESISTANCE

- Key in OFF position.
- VCT1 Solenoid connector disconnected.
- Measure the resistance between:

(+) VCT1 Solenoid Connector, Component Side	(-) VCT1 Solenoid Connector, Component Side
VCT1	VPWR

- **Is the resistance between 5 - 14 ohms?**

Yes	No
GO to **HK5**.	INSTALL a new VCT1 solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HK5 CHECK THE VCT1 SOLENOID FOR INTERNAL SHORTS

- Measure the resistance between:

(+) VCT1 Solenoid Connector, Component Side	(-)
VCT1	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HK6**.	INSTALL a new VCT1 solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HK6 CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) VCT1 Solenoid Connector, Harness Side	(-)
VPWR	Ground

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

Yes	No
GO to **HK7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HK7 CHECK THE VCT1 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) VCT1 Solenoid Connector, Harness Side	(-)
VCT1	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **HK8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HK8 CHECK THE VCT1 CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) VCT1 Solenoid Connector, Harness Side	(-) PCM Connector, Harness Side
VCT1	VCT1

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HK9**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HK9 CHECK THE VCT1 CIRCUIT FOR A SHORT TO GND IN THE HARNESS

- Measure the resistance between:

(+) VCT1 Solenoid Connector, Harness Side	(-)
VCT1	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HK18**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HK10 DTC P0020: CHECK THE VCT2 SOLENOID RESISTANCE

- Key in OFF position.
- VCT2 Solenoid connector disconnected.
- Measure the resistance between:

(+) VCT2 Solenoid Connector, Component Side	(-) VCT2 Solenoid Connector, Component Side

VCT2	VPWR

- **Is the resistance between 5 - 14 ohms?**

Yes	No
GO to **HK11**.	INSTALL a new VCT2 solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HK11 CHECK THE VCT2 SOLENOID FOR INTERNAL SHORTS

- Measure the resistance between:

(+) VCT2 Solenoid Connector, Component Side	(-)
VCT2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HK12**.	INSTALL a new VCT2 solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HK12 CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) VCT2 Solenoid Connector, Harness Side	(-)
VPWR	Ground

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

Yes	No
GO to **HK13**.	REPAIR the open circuit. CLEAR the DTCs.

	REPEAT the self-test.

HK13 CHECK THE VCT2 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) VCT2 Solenoid Connector, Harness Side	(-)
VCT2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **HK14**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HK14 CHECK THE VCT2 CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) VCT2 Solenoid Connector, Harness Side	(-) PCM Connector, Harness Side
VCT2	VCT2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HK15**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HK15 CHECK THE VCT2 CIRCUIT FOR A SHORT TO GND IN THE HARNESS

- Measure the resistance between:

(+) VCT2 Solenoid	

Connector, Harness Side	(-)
VCT2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HK18**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HK16 CONTINUOUS DTCS P0016, P0018 WITH OR WITHOUT P0011, P0012, P0021, P0022, P052A, P052B, P052C, P052D: CHECK THE FUNCTIONALITY OF THE VCT SYSTEM

NOTE: On 4.6L 3V and 5.4L 3V engines, the VCTADV PID indicates a positive value. For all others, the VCTADV PID indicates a negative value.

- Engine at normal operating temperature.
- Clear the DTCs.
- For DTC P0016.
- Access the PCM and monitor the VCTADV PID.
- For DTC P0018.
- Access the PCM and monitor the VCTADV2 PID.
- Run the engine at idle for 1 minute while monitoring the VCTADV (P0016) or VCTADV2 (P0018) PID.
- Retrieve the continuous memory DTCs.
- **Are DTCs P0016 or P0018 present?**

Yes	No
For a VCTADV PID value between -16 and -46 degrees (2.3L, 3.5L), -14 and -36 degrees (3.0L), or 24 and 73 degrees (4.6L 3V, 5.4L 3V), INSTALL a new VCT solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test. For all others, REFER to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** , Timing Drive Components, to verify the engine timing.	Unable to duplicate or identify the concern at this time.

HK17 CONTINUOUS DTCS P0011, P0012, P0021, P0022, P052A, P052B, P052C OR P052D: CHECK THE OPERATION OF THE VCT SYSTEM

NOTE: Some vehicles require higher RPMs and loads to actuate the VCT system than others. The VCTERR PID should be close to 0 whether actuating or not. During

rapid VCT movements, the VCTERR PID may momentarily deviate from 0.

- For DTCs P0011, P0012, P052A or P052B.
- Access the PCM and monitor the VCTADV PID.
- Access the PCM and monitor the VCTADVERR PID.
- For DTCs P0021, P0022, P052C or P052D.
- Access the PCM and monitor the VCTADV2 PID.
- Access the PCM and monitor the VCTADVERR2 PID.
- Drive the vehicle exercising the throttle to induce VCT movement.
- **Does the VCTADV PID indicate VCT movement while the VCTERR PID maintain close to 0?**

Yes	No
Unable to duplicate or identify the concern at this time.	INSTALL a new VCT solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HK18 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HM: SECONDARY AIR INJECTION (AIR) SYSTEM

This pinpoint test is intended to diagnose the following:

- secondary air injection system relay (14B192)
- electric air injection pump (9A486)
- secondary air injection bypass solenoid (9H465)

- harness circuits: B+, VPWR, AIR, AIRM, ground
- powertrain control module (PCM) (12A650)

- secondary air injection diverter valve (9F491)
- vacuum supply
- hoses
- partial restricted exhaust

Refer to the Wiring Diagrams article for schematic and connector information.

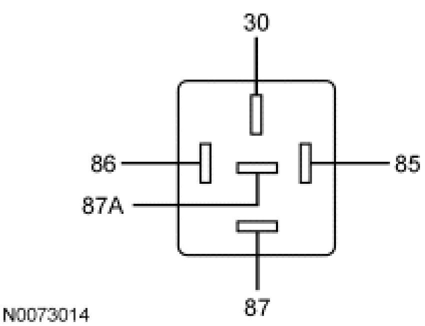

Fig. 133: Powertrain Control Module Power (PCM Power) Relay Connector - B
Courtesy of FORD MOTOR CO.

Pin	Circuit
86	AIR (Secondary Air Injection)
87	AIR_PWR (AIR Pump Power)
30	B+ (Battery Positive Voltage)
85	VPWR (Vehicle Power)

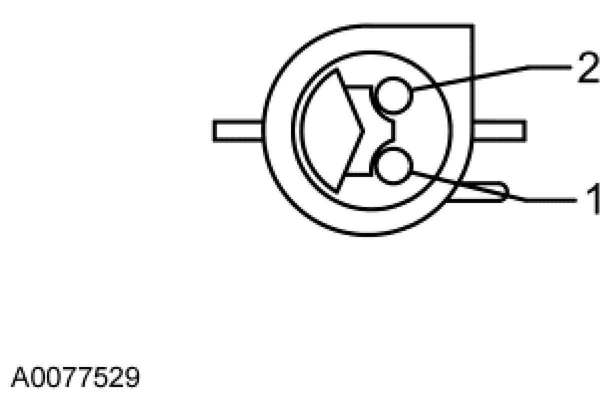

Fig. 134: Secondary Air Pump Connector

Courtesy of FORD MOTOR CO.

Pin	Circuit
2	AIR_PWR (AIR Pump Power)
1	AIR_GND (AIR Pump Ground)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Connector	Pin	Circuit
140 Pin	B58 B66 B67 B33 B51 B50 B1	SIGRTN CASE GND PWRGND VREF VPWR AIRM AIR

HM1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P0410, P0412, P0491, P2257, P2258, or P2448 present?**

Yes	No
GO to **HM2**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HM2 VISUALLY INSPECT THE SECONDARY AIR SYSTEM COMPONENTS AND HOSES

- Visually inspect the secondary AIR system components, connectors and hoses for:
  - damaged hoses
  - obstructions
  - exhaust damage
  - restricted secondary AIR pump inlet
  - water or ice
- **Are the secondary AIR system components and hoses OK?**

Yes	No
GO to **HM3**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HM3 CHECK THE VPWR VOLTAGE TO THE SECONDARY AIR RELAY

- Secondary AIR relay removed.
- Key ON, engine OFF.

- Measure the voltage between:

(+) Secondary AIR Relay Connector, Harness Side	(-)
VPWR - Pin 85	Ground
B+ - Pin 30	Ground

- **Are the voltages greater than 10 V?**

Yes	No
GO to **HM4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HM4 CHECK THE SECONDARY AIR RELAY

- Key in OFF position.
- Carry out the relay component test. Refer to the Wiring Diagrams Cell 149 Component Testing.
- **Does the relay pass the component test?**

Yes	No
GO to **HM5**.	INSTALL a new secondary AIR relay. CLEAR the DTCs. REPEAT the self-test.

HM5 CHECK THE SECONDARY AIR PUMP GROUND CIRCUIT FOR AN OPEN IN THE HARNESS

- Secondary AIR Pump Motor connector disconnected.
- Measure the resistance between:

(+) Secondary Air Pump Connector, Harness Side	(-)
AIR_GND - Pin 1	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HM6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HM6 CHECK THE SECONDARY AIR PUMP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) Secondary AIR Relay Connector, Harness Side	(-) Secondary Air Pump Connector, Harness Side
AIR_PWR - Pin 87	AIR_PWR - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HM7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HM7 CHECK THE SECONDARY AIR CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Secondary AIR Relay Connector, Harness Side
AIR - Pin B1	AIR - Pin 86
AIRM - Pin B50	AIR_PWR - Pin 87

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

Yes	No
GO to **HM8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HM8 CHECK THE SECONDARY AIR MONITOR CIRCUIT AND THE SECONDARY AIR PUMP VOLTAGE CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
AIRM - Pin B50	Ground
AIR - Pin B1	Ground

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **HM9**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HM9 CHECK THE SECONDARY AIR MONITOR CIRCUIT AND THE SECONDARY AIR PUMP VOLTAGE CIRCUIT FOR A SHORT TO VOLTAGE

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
AIRM - Pin B50	Ground
AIR - Pin B1	Ground

- **Is any voltage present?**

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **HM10**.

HM10 MEASURE THE VACUUM AT THE SECONDARY AIR SOLENOID VALVE

CAUTION: Running the secondary AIR pump with OTM longer than 2 minutes may overheat and damage the secondary AIR pump. Refer to{Output Test Mode}.

- Key in OFF position.
- Secondary AIR relay installed.
- Secondary AIR Solenoid connector connected.
- PCM connector connected.
- Key ON, engine OFF.
- Connect a vacuum gauge to the control vacuum outlet at the secondary AIR valve.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Observe the vacuum gauge reading at the secondary AIR valve.
- Command the outputs OFF.
- Exit output test mode.
- **Is vacuum present at the secondary AIR diverter valve?**

Yes	No
GO to **HM11**.	INSTALL a new secondary AIR valve. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HM11 CHECK THE SECONDARY AIR PUMP OPERATION

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Disconnect the inlet hose from the secondary AIR valve.
- Command the outputs ON.
- Place your hand over the secondary AIR valve inlet hose.
- Command the outputs OFF.
- Exit output test mode.
- **Is there any air flow from the secondary AIR inlet valve hose?**

Yes	No
INSTALL a new secondary AIR valve. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	INSTALL a new secondary AIR pump. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST HU: INTAKE AIR SYSTEMS

This pinpoint test is intended to diagnose the following:

- accelerator cable linkage to throttle body (9C799)
- air cleaner assembly (including air cleaner element) (9600)
- air inlet tube (9F843)
- clean air tube hose and resonator (9R504) and (9F593)
- intake manifold runner control (IMRC) housing assembly (9U531), (9U524) and (9J447)
- IMRC actuator assembly (9J559)
- IMRC (9G730)
- intake manifold tuning valve (IMTV) (9L490)
- IMTV electric actuator assembly (9L490)
- speed control cable (9A825)
- throttle body assembly (9E926)
- harness circuits: IMRC, MONITOR, SIGNAL, SIGRTN, PWRGND, and VPWR
- harness circuits: IMTV, MONITOR, SIGNAL, and VPWR
- powertrain control module (PCM) (12A650)

IMRCM VOLTAGE VALUES

VEHICLE	IMRC OFF	IMRC ON
Focus, 2.0L	0	5
F-150 5.4L, Mark LT	5	0
All Others	2.5	0

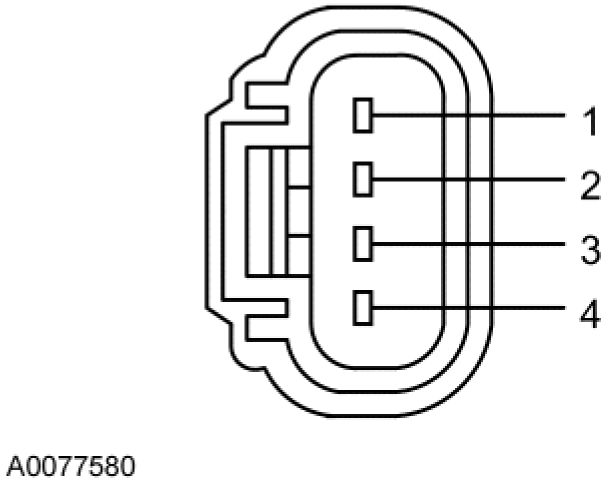

Fig. 135: Intake Manifold Runner Control (IMRC) Actuator Connector - A
Courtesy of FORD MOTOR CO.

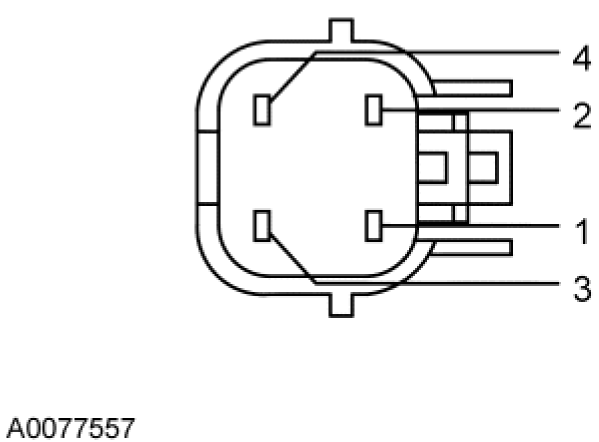

Fig. 136: Intake Manifold Runner Control (IMRC) Actuator Connector - B
Courtesy of FORD MOTOR CO.

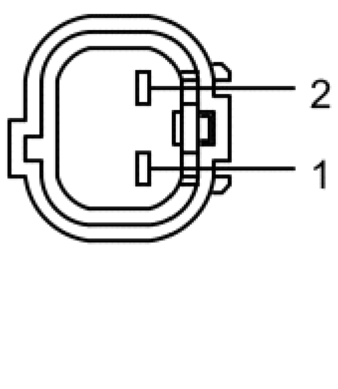

Fig. 137: Intake Manifold Runner Control (IMRC) Actuator Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition 5.4L, F-150 5.4L, F-Super Duty 5.4L, Mark LT 5.4L, Navigator 5.4L	A	4 3 2 1	IMRCM IMRC PWRGND VPWR
Explorer 4.6L, Explorer Sport Trac 4.6L, Mountaineer 4.6L, Mustang 4.6L	A	3 2 1	IMRC PWRGND VPWR
F-150 4.2L	B	4 1 2 3	IMRCM IMRC PWRGND VPWR
Focus	C	2 1	IMRC VPWR
Fusion 2.3L, Milan 2.3L	C	1 2	IMRC VPWR

For most vehicles the IMRCM is integrated into the IMRC connector.

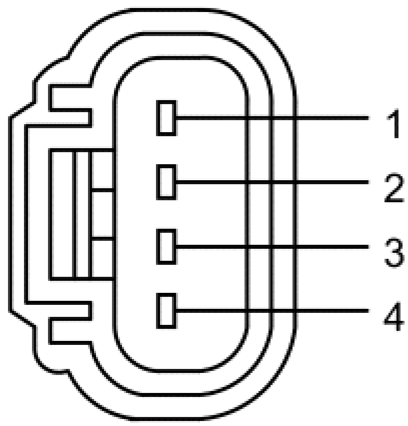

Fig. 138: Intake Manifold Runner Control Monitor (IMRCM) Sensor Connector - A
Courtesy of FORD MOTOR CO.

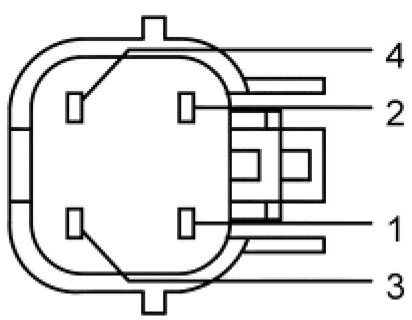

Fig. 139: Intake Manifold Runner Control Monitor (IMRCM) Sensor Connector - B
Courtesy of FORD MOTOR CO.

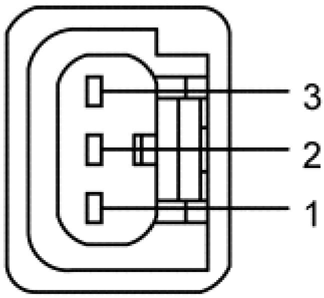

Fig. 140: Intake Manifold Runner Control Monitor (IMRCM) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition 5.4L, F-150 5.4L, F-Super Duty 5.4L, Mark LT 5.4L, Navigator 5.4L	A	2 1 4	PWRGND VPWR IMRCM
F-150 4.2L	B	2 3 4	PWRGND VPWR IMRCM
Focus	C	2 3 1	PWRGND VPWR IMRCM
Fusion 2.3L, Milan 2.3L	C	1	IMRCM

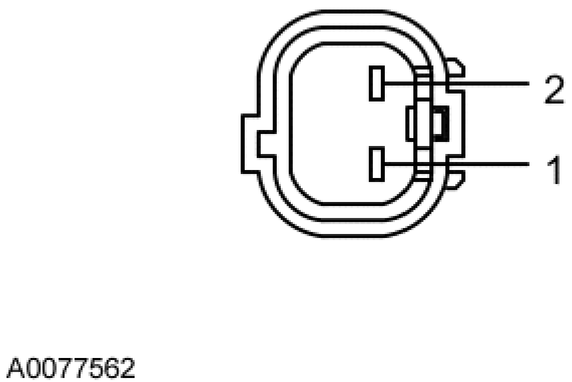

Fig. 141: Intake Manifold Tuning Valve (IMTV) Actuator Connector - A
Courtesy of FORD MOTOR CO.

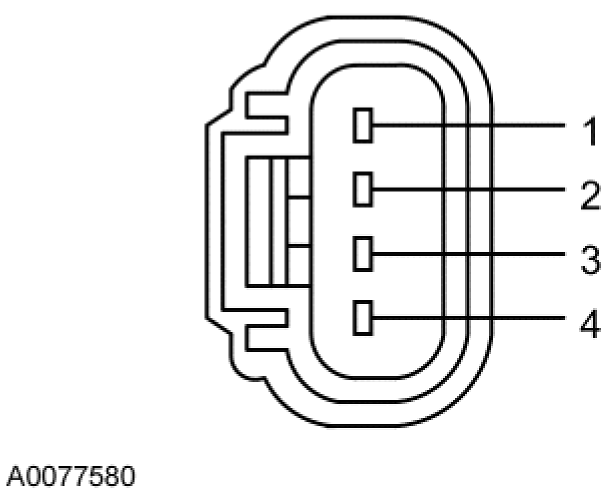

Fig. 142: Intake Manifold Tuning Valve (IMTV) Actuator Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Fusion 2.3L, Milan 2.3L	A	1 2	IMTV VPWR
F-Super Duty 6.8L	B	3 1	IMTV VPWR

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit

Escape/Mariner	150 (50-50-50) Pin	E41 E6 B47	SIGRTN IMTV PWRGND
Expedition, Navigator	140 Pin	E58 B67 E43 E50	SIGRTN PWRGND IMRCM IMRC
F-150, Mark LT	190 Pin	E58 B67 E43 E50	SIGRTN PWRGND IMRCM IMRC
F-Super Duty 5.4L	170 Pin	E58 B47 E43 E50	SIGRTN PWRGND IMRCM IMRC
F-Super Duty 6.8L	170 Pin	E58 E64 B47	SIGRTN IMTV PWRGND
Focus	190 Pin	E64 B69 E25 E22	SIGRTN PWRGND IMRCM IMRC
Fusion, Milan	140 Pin	E58 E64 B67 E43 E50	SIGRTN IMTV PWRGND IMRCM IMRC
All other vehicles	170 Pin	E58 B47 E50	SIGRTN PWRGND IMRC

HU1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0505, P0506, P0660, P0663, P1512, P1513, P1516, P1517, P1518, P1519, P151A, P1520, P1537, P1538, P1549, P2004, P2005, P2006, P2007, P2008, P2014, P2015, P2019, P2020, P2070, or P2071 present?**

Yes	No
For DTCs P0505 or P0506, on vehicles with electronic throttle control (ETC), GO to **HU51**. For DTCs P0505 or P0506, on vehicles without ETC, GO to **HU2**. For DTCs P0660, P0663, P1549, P2070 or P2071, GO to **HU42**.	For vehicles equipped with electronic throttle control (ETC) that have low idle concerns, difficulty

For DTC P151A, Mustang 4.6L, Explorer 4.6L, Explorer Sport Trac 4.6L, and Mountaineer 4.6L. GO to **HU18**. For DTC P151A, all others, GO to **HU17**. For DTCs P1512, P1513, P1516, P1517, P1518, P1519, P1520, P1537, P1538, P2004, P2005, P2006, P2007, P2008, P2014, P2015, P2019 or P2020, GO to **HU15**.	starting, hesitation, loss of RPM, GO to **HU51**. For lack/loss of power, GO to **HU42**. For all other symptoms without DTCs, GO to **HU2**.

HU2 PART THROTTLE SYMPTOM

- **Are any part throttle concerns present?**

Yes	No
GO to **HU7**.	GO to **HU3**.

HU3 CHECK THE BASE IDLE SPEED

NOTE: The vehicle must be at operating temperature and at idle for a minimum of 1 minute.

- Key ON, engine running.
- Determine if the idle speed is incorrect. Refer to the **REFERENCE VALUES** article Typical Reference Value Charts, if necessary.
- Access the PCM and monitor the RPM PID.
- If equipped, read the vehicle tachometer.
- **Is vehicle idle speed correct?**

Yes	No
GO to **HU5**.	GO to **HU4**.

HU4 CHECK THE THROTTLE ARM CONTACTS

- Key in OFF position.
- Check that the throttle arm contacts the return stop.
- **Is the idle speed high?**

Yes	No
GO to **HU9**.	GO to **HU10**.

HU5 CHECK FOR BINDING OR STICKING IN THE THROTTLE SYSTEM

- Gently cycle the throttle from fully closed to fully open and back to fully closed. Check for sticking or binding during rotation.

- **Is a stick and bind condition present?**

Yes	No
GO to **HU6**.	GO to **HU7**.

HU6 ISOLATE THE BINDING AND/OR STICKING CONCERN

NOTE: **Do not attempt to clean the throttle bore and plate area. Cleaning damages the throttle body assembly.**

NOTE: **The sticking or binding condition can either be within the cables or throttle body assembly.**

- Disconnect the accelerator cable and speed control cable from the throttle body linkage.
- Rotate the throttle body linkage.
- **Does the throttle body rotate freely without a sticking, binding or grabbing condition?**

Yes	No
REPAIR the cable(s) causing the concern. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new throttle body assembly. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HU7 CHECK THE FUNCTIONALITY OF THE THROTTLE POSITION (TP) SENSOR

- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- Gently cycle the throttle from fully closed to fully open and back to fully closed.
- **Does the TP PID display a smooth voltage reading?**

Yes	No
GO to **HU8**.	INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HU8 CHECK THE INTAKE AIR SYSTEM FOR LEAKS, OBSTRUCTIONS AND DAMAGE

NOTE: **The Focus air cleaner element is integral to the air cleaner assembly. Inspect the air restriction gauge (if equipped) for a restriction indication.**

- Key in OFF position.
- Remove the air cleaner element. Check the air cleaner for blockage.
- Check for restrictions between the air inlet and the throttle body.
- **Are any restriction concerns present?**

Yes	No
REMOVE the restriction. INSTALL a new air cleaner element. Refer to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	REINSTALL the air cleaner element. GO to **HU9**.

HU9 CHECK THE POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

NOTE: A high idle may indicate an incorrect PCV valve size or a vacuum leak.

- Check that no cracks or leaks are present.
- Remove the PCV valve.
  - Verify a clean PCV valve.
  - Verify the proper PCV valve part number.
- **Are any PCV system concerns present?**

Yes	No
INSTALL a new PCV valve. REPAIR as necessary. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	For high idle, GO to **HU13**. For all others, CONNECT the PCV valve. GO to **HU10**.

HU10 CHECK THE IDLE AIR CONTROL (IAC) VALVE RESPONSE

- Key ON, engine running.
- The vehicle must be at operating temperature and at idle for a minimum of 1 minute.
- IAC connector disconnected.
- **Does the RPM drop or the engine stall?**

Yes	No
GO to **HU12**.	GO to **HU11**.

HU11 CHECK THE IAC VALVE RESPONSE

- **Is the idle speed high?**

Yes	No

GO to **HU13**.	INSTALL a new IAC. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HU12 INSPECT THE THROTTLE BODY PLATE HOLE FOR PLUGGING

NOTE: Only some applications have a throttle plate hole. If not equipped go to the SYMPTOM CHARTS article, Symptom Charts.

- Key in OFF position.
- Remove the resonator from the throttle body assembly.
- Inspect the throttle plate hole for any restrictions.
- **Are any restriction concerns present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** , to diagnose performance while driving concerns.

HU13 CHECK FOR VACUUM LEAKS

- Listen for vacuum leaks.
- Inspect the entire intake air system from the mass air flow (MAF) sensor to the intake manifold for leaks such as:
  - cracked or punctured inlet air tube
  - loose connections on the inlet air tube at the air cleaner housing or throttle body
  - IAC valve assembly or gasket
  - EGR valve gasket leak to intake manifold
  - intake manifold assembly or gasket
  - EGR valve diaphragm or control solenoid
  - vacuum supply connectors and hose
- **Are any leaks present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HU14**.

HU14 CHECK THE THROTTLE BODY FOR EXCESSIVE WEAR

- Key in OFF position.

- Remove the throttle body assembly. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for removal and inspection.
- Check the following:
  - excessive wear or grooving in the throttle bore
  - misaligned or worn throttle plate
  - excessive gap between the throttle bore and plate
- **Are any concerns present?**

Yes	No
INSTALL a new throttle body assembly. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** , to diagnose performance while driving concerns.

HU15 DTCS P1512, P1513, P1516, P1517, P1518, P1519, P1520, P1537, P1538, P2004, P2005, P2006, P2007, P2008, P2014, P2015, P2019 OR P2020: VISUAL INSPECTION

NOTE: **If unable to fully carry out the following inspections, answer NO to the question in this step.**

NOTE: **The IMRC return spring is strong on vacuum systems. Make sure the vacuum system operates correctly and the plates open and close fully. On vacuum operated systems the engine must run for 20 seconds to restore vacuum then return to KOEO for testing.**

Some IMRC electrical systems are driven in both directions by the solenoid and do not use a return spring. They can not be opened manually.

- Visually inspect the linkage for possible causes of binding or obstructions. Check the lever/linkage for movement. There may be some tension in one direction but there should be full travel.
- Manually open and close the IMRC plates at the intake manifold while checking for sticking or binding.
- **Is a mechanical concern present?**

Yes	No
GO to **HU16**.	For Explorer 4.6L, Explorer Sport Trac 4.6L, Mountaineer 4.6L, and Mustang 4.6L, GO to **HU18**. For all others, GO to **HU17**.

HU16 CHECK THE IMRC FOR MECHANICAL OPERATION

NOTE: **The IMRC return spring is strong - approximately 0.34 to 0.45 Nm (3 to 4 in-lb).**

NOTE: **Some electric motor applications do not use a return spring and should move freely when open and closed.**

- Disconnect the IMRC linkage or remove the actuator assembly from the manifold.
- Rotate the IMRC plate lever to fully open and to fully closed, contacting both limits.
- Check for sticking or binding during rotation.
- **Is a mechanical concern present?**

Yes	No
REPAIR as necessary or INSTALL a new IMRC. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	CONNECT the IMRC linkage. For Explorer 4.6L, Explorer Sport Trac 4.6L, Mountaineer 4.6L, and Mustang 4.6L, GO to **HU18**. For all others, GO to **HU17**.

HU17 DTC P151A: CHECK THE FUNCTIONALITY OF THE IMRC

WARNING: **Keep fingers clear of the mechanism. Failure to follow these instructions may result in personal injury.**

NOTE: **The vehicle must be at operating temperature and at idle for a minimum of 1 minute.**

- Key ON, engine running.
- Access the PCM and control the IMRC PID.
- Access the PCM and monitor the IMRC1M PID.
- Command IMRC ON then OFF.

IMRCM VOLTAGE VALUES

VEHICLE	IMRC OFF	IMRC ON
Focus, 2.0L	0	5
F-150 5.4L, Mark LT	5	0
All Others	2.5	0

- **Using the table for reference, do the IMRCM voltage values correctly change while the IMRC is cycled?**

Yes	No
refer to **PINPOINT TEST Z**.	GO to **HU19**.

HU18 CHECK THE FUNCTIONALITY OF BI-DIRECTIONAL IMRC

WARNING: **Keep fingers clear of the mechanism. Failure to follow these instructions may result in personal injury.**

NOTE: **The vehicle must be at operating temperature and at idle for a minimum of 1 minute.**

- Key ON, engine running.
- Access the PCM and control the IMRC PID.
- Access the PCM and monitor the IMRC_F PID.
- Command IMRC ON then OFF.
- **Do the IMRC values correctly change from off to on while the IMRC is cycled and is the IMRCF PID no?**

Yes	No
refer to **PINPOINT TEST Z**.	GO to **HU19**.

HU19 CHECK THE FUNCTIONALITY OF THE IMRC

WARNING: **Keep fingers clear of the mechanism. Failure to follow these instructions may result in personal injury.**

NOTE: **The vehicle must be at operating temperature and at idle for a minimum of 1 minute.**

- Key ON, engine running.
- Physically monitor the IMRC actuator.
- Access the PCM and control the IMRC PID.
- Command the outputs ON.
- **Do the IMRC levers cycle from fully closed and remain fully open while the outputs are on?**

Yes	No
GO to **HU28**.	GO to **HU20**.

HU20 CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.

- IMRC Actuator connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) IMRC Actuator Connector, Harness Side	(-)
VPWR	Ground

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

Yes	No
GO to **HU21**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HU21 CHECK THE GROUND CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the voltage between:

(+) IMRC Actuator Connector, Harness Side	(-) IMRC Actuator Connector, Harness Side
VPWR	PWRGND

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

Yes	No
GO to **HU22**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HU22 VERIFY THE DRIVER CIRCUIT FUNCTION

- Connect a non-powered test lamp between:

(+) IMRC Actuator Connector, Harness Side	(-) IMRC Actuator Connector, Harness Side
VPWR	IMRC

- **Does the test lamp illuminate?**

Yes	No
GO to **HU27**.	GO to **HU23**.

HU23 VERIFY THE DRIVER CIRCUIT FUNCTION WHILE COMMANDING ON IMRC

- Key ON, engine running.
- Access the PCM and control the IMRC PID.
- Connect a non-powered test lamp between:

(+) IMRC Actuator Connector, Harness Side	(-) IMRC Actuator Connector, Harness Side
VPWR	IMRC

- Command the outputs ON.
- **Does the test lamp illuminate?**

Yes	No
GO to **HU26**.	GO to **HU24**.

HU24 CHECK THE IMRC CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) IMRC Actuator Connector, Harness Side	(-) PCM Connector, Harness Side
IMRC	IMRC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HU25**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HU25 CHECK THE IMRC CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) IMRC Actuator Connector, Harness Side	(-)
IMRC	Ground

- **Is the voltage less than 10 V?**

Yes	No
GO to **HU53**.	REPAIR the short circuit to voltage. CLEAR the DTCs. REPEAT the self-test.

HU26 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE IMRC HARNESS

- Key in OFF position.
- PCM connector connected.
- Measure the resistance between:

(+) IMRC Actuator Connector, Harness Side	(-) IMRC Actuator Connector, Harness Side
IMRC	IMRCM
IMRC	PWRGND

- **Are the resistances greater than 10K ohms?**

Yes	No
INSTALL a new IMRC actuator. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HU27**.

HU27 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE IMRC HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) IMRC Actuator Connector, Harness Side	(-) IMRC Actuator Connector, Harness Side
IMRC	IMRCM

IMRC	PWRGND

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **HU53**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.

HU28 CHECK THE IMRCM PID

- Key ON, engine OFF.
- Access the PCM and monitor the IMRC1M PID.
- **Is the IMRCM PID displaying either VREF or approximately 2.5 volts?**

Yes	No
GO to **HU29**.	GO to **HU33**.

HU29 CHECK THE IMRCM CIRCUIT FOR A SHORT TO VPWR

NOTE: The vehicle must be at operating temperature and at idle for a minimum of 1 minute.

- Key ON, engine running.
- Access the PCM and control the IMRC PID.
- Command the outputs ON.
- Access the PCM and monitor the IMRC1M PID.
- **Is the voltage less than 1 V?**

Yes	No
GO to **HU35**.	GO to **HU35**.

HU30 CHECK THE IMRCM CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key ON, engine OFF.
- IMRCM Sensor connector disconnected.
- Measure the voltage between:

(+) IMRCM Sensor Connector, Harness Side	(-)

IMRCM	Ground

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

Yes	No
GO to **HU31**.	GO to **HU32**.

HU31 CHECK THE IMRCM CIRCUIT FOR A SHORT TO VOLTAGE IN THE CONTROL MODULE

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) IMRCM Sensor Connector, Harness Side	(-)
IMRCM	Ground

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

Yes	No
REPAIR the short circuit to voltage. CLEAR the DTCs. REPEAT the self-test.	GO to **HU53**.

HU32 CHECK THE IMRCM CIRCUIT FOR A SHORT TO VPWR

- Key in OFF position.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Component Side	(-) IMRCM Sensor Connector, Component Side
IMRCM	VPWR

- **Is the resistance greater than 10K ohms?**

Yes	No
CHECK for an intermittent concern. refer to **PINPOINT TEST Z**.	INSTALL a new IMRCM sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** as necessary.

	CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.

HU33 CHECK THE IMRCM CIRCUIT FOR A SHORT TO GROUND

- Key ON, engine OFF.
- Access the PCM and monitor the IMRC1M PID.
- IMRCM Sensor connector disconnected.
- **Does voltage change from less than 1 volt to VREF when disconnecting the IMRCM harness connector?**

Yes	No
INSTALL a new IMRCM sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** as necessary. CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.	GO to **HU34**.

HU34 CHECK THE IMRCM CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) IMRCM Sensor Connector, Harness Side
IMRCM	PWRGND

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HU53**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.

HU35 CHECK THE MONITOR CIRCUIT RESPONSE

- IMRCM Sensor connector disconnected.
- Access the PCM and monitor the IMRC1M PID.
- Connect a 5 amp fused jumper wire between the following:

Point A	

IMRCM Sensor Connector, Harness Side	Point B
IMRCM	Ground

- **Does voltage change from less than 1 volt to VREF when disconnecting the IMRCM harness connector?**

Yes	No
GO to **HU36**.	GO to **HU39**.

HU36 CHECK THE PWRGND CIRCUIT FOR CONTINUITY TO CHASSIS GND

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector connected.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) Vehicle Battery
PWRGND	Negative terminal

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HU37**.	GO to **HU38**.

HU37 CHECK THE MONITOR CIRCUIT FOR AN INTERMITTENT OPEN

- PCM connector disconnected.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IMRCM	IMRCM

- Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module.

- **Is the resistance fluctuating while checking the harness?**

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.	INSTALL a new IMRCM sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** as necessary. CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.

HU38 CHECK THE HARNESS PWRGND CIRCUIT FOR CONTINUITY

- PCM connector disconnected.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
PWRGND	PWRGND

- **Is the resistance less than 5 ohms?**

Yes	No
CHECK the circuit for an intermittent concern. refer to **PINPOINT TEST Z**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.

HU39 CHECK THE IMRCM CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector disconnected.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IMRCM	IMRCM

- **Is the resistance less than 5 ohms?**

Yes	No

GO to **HU40**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.

HU40 CHECK THE MONITOR CIRCUIT FOR AN INTERMITTENT OPEN

- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IMRCM	IMRCM

- Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module.
- **Is the resistance fluctuating while checking the harness?**

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test. GO to **HU41**.	GO to **HU53**.

HU41 VERIFY THE REPAIR

- Key ON, engine OFF.
- Clear the PCM DTCs.
- Access the PCM and monitor the IMRC and IMRC_F PIDs.
- Access the PCM and monitor the IMRC1M PID.
- Key ON, engine running.
- Drive the vehicle, obeying all traffic and safety laws.
- Safely carry out 3 acceleration runs from a stop or roll to between 3,000 and 4,000 RPM.
- Watch for any PID change.
- Carry out the PCM self-test.
- **Are any DTCs received?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	The test completed successfully.

HU42 DTCS P0660, P0663, P1549, P2070 OR P2071: VISUAL INSPECTION OF INTAKE MANIFOLD TUNING

VALVE

- Inspect the component for signs of damage.
- Check the harness and connection.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HU43**.

HU43 CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

- IMTV Actuator connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) IMTV Actuator Connector, Harness Side	(-) Vehicle Battery
VPWR	Negative terminal

- **Is the voltage greater than 10.5 V?**

Yes	No
GO to **HU44**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HU44 CHECK THE IMTV CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) IMTV Actuator Connector, Harness Side	(-) PCM Connector, Harness Side
IMTV	IMTV

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HU45**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HU45 CHECK THE IMTV CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
IMTV	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HU46**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HU46 CHECK THE IMTV CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
IMTV	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **HU47**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HU47 CHECK THE IMTV DRIVER CIRCUIT WITH THE PCM CONNECTED

- IMTV Actuator connector disconnected.
- PCM connector connected.
- Key ON, engine OFF.
- Connect a non-powered test lamp between:

(+) IMTV Actuator Connector,	(-) IMTV Actuator Connector,

Harness Side	Harness Side
VPWR	IMTV

- **Does the test lamp illuminate?**

Yes	No
GO to **HU53**.	GO to **HU48**.

HU48 CHECK THE IMTV PCM DRIVER CIRCUIT WHEN COMMANDED ON

- Connect a non-powered test lamp between:

(+) IMTV Actuator Connector, Harness Side	(-) IMTV Actuator Connector, Harness Side
VPWR	IMTV

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Command the outputs OFF.
- Exit output test mode.
- **Does the test lamp illuminate?**

Yes	No
GO to **HU49**.	GO to **HU53**.

HU49 CHECK THE IMTV FOR DAMAGE

- Key in OFF position.
- Remove the IMTV. Refer to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** .
- Visually inspect the shutter for damage.
- Manually rotate the shutter.
- **Is a concern present?**

Yes	No
INSTALL a new IMTV actuator. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **HU50**.

HU50 CHECK THE IMTV FOR FUNCTIONALITY WHEN COMMANDED ON

- IMTV Actuator connector connected.
- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Command the outputs OFF.
- Exit output test mode.
- **Does the IMTV shutter rotate?**

Yes	No
The concern is an intermittent. refer to **PINPOINT TEST Z**.	INSTALL a new IMTV actuator. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** as necessary. CLEAR the DTCs. REPEAT the self-test.

HU51 PRELIMINARY DIAGNOSIS FOR DIAGNOSTIC TROUBLE CODES (DTCS) P0505 OR P0506

- Key ON, engine OFF.
- **Are any DTCs present other than P0505 or P0506?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **HU52**.

HU52 MONITOR THE INTAKE AIR SYSTEM RELATED PIDS

NOTE: **Verify that the vehicle has reached the normal engine coolant operating temperature of 77°C (170°F). Allow the engine to idle an additional 5 minutes.**

NOTE: **The ETC_TRIM PID may not be available on all vehicles.**

- Access the PCM and monitor the ECT PID.
- Access the PCM and monitor the ETC_TRIM PID.
- Access the PCM and monitor the IACTRIM and IACKAM2 PIDs.
- Mathematically add and record the value of the IACTRIM PID to the IACKAM2 PID value, for the total IAC value at idle.
- **Is the ETC_TRIM PID angle equal to 3.5 degrees or is the total IAC value greater than 0.5 lb/min?**

Yes	No
INSTALL a new throttle body assembly. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** to INSTALL a new throttle body. CLEAR the DTCs. REPEAT the self-test.	RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.

HU53 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HV: COOLING FAN CLUTCH

WARNING: **To avoid the possibility of personal injury or damage to the vehicle, do not operate the engine until the fan blade has been first examined for possible cracks and separation. Failure to follow these instructions may result in personal injury or death.**

NOTE: **Before starting this pinpoint test, turn the clutch fan assembly by hand and check for mechanical binding around the fan shroud or surrounding components. If binding is present, correct the problem then continue with the pinpoint test. If no binding is present, start the engine and warm up to normal operating temperature then continue with the pinpoint test.**

This pinpoint test is intended to diagnose the following:

- cooling fan clutch
- harness circuits: fan speed sensor (FSS), FSS PWRGND, FSS VPWR, fan control variable (FCV), and FCV VPWR
- powertrain control module (PCM) (12A650)

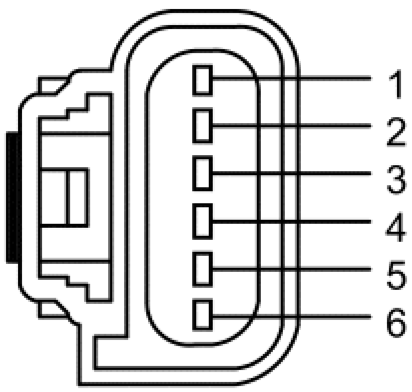

Fig. 143: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	FSS (Fan Speed Sensor)
5	PWRGND (Power Ground)
2	VBPWR (Vehicle Buffered Power)
3	VPWR (Vehicle Power)
6	FCV (Fan Control Variable)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Pin	Circuit
Expedition, Navigator	B51, B52, B53 B45 B67, B68, B69, B70 B20 B48	VPWR FSS PWRGND VBPWR FCV
F-150	B51, B52, B53 E24 B67, B68, B69, B70 B20 B48	VPWR FSS PWRGND VBPWR FCV
All other vehicles	B35, B36 E24 B47, B48, B49, B50 E20 E7	VPWR FSS PWRGND VBPWR FCV

HV1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0480, P0483 or P0528 present?**

Yes	No
For KOEO and KOER DTC P0480, GO to **HV4**. For KOEO and KOER DTCs P0483 or P0528, GO to **HV2**. For continuous memory DTCs P0480 or P0528, GO to **HV10**.	GO to **HV2**.

HV2 CHECK THE COOLING FAN CLUTCH FOR MECHANICAL BINDING

NOTE: The cooling fan clutch uses a viscous coupling. The viscous drag should be smooth during fan rotation. The amount of resistance is dependent upon the final cooling fan operational state before engine shutdown.

- Key in OFF position.
- Manually rotate the cooling fan.
- **Does the cooling fan clutch rotation feel rough or binding?**

Yes	No
INSTALL a new cooling fan clutch. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HV3**.

HV3 CHECK THE COOLING FAN CLUTCH OPERATION

- Key ON, engine running.
- Set the heater controls to OFF.
- Access the PCM and monitor the FANSS PID.
- **Does the FANSS PID indicate any RPM?**

Yes	No
GO to **HV4**.	GO to **HV11**.

HV4 KOEO AND KOER DTC P0480: CHECK THE COOLING FAN CLUTCH ACTUATOR VALVE SOLENOID RESISTANCE

NOTE: If necessary, install terminal adapters on the component side pins to carry out the resistance measurement.

- Key in OFF position.
- Cooling Fan Clutch connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Component Side	(-) Cooling Fan Clutch Connector, Component Side
FCV - Pin 6	VPWR - Pin 3

- **Is the resistance between 6 - 12 ohms?**

Yes	No
GO to **HV5**.	INSTALL a new cooling fan clutch. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HV5 CHECK THE COOLING FAN CLUTCH ACTUATOR VALVE SOLENOID RESISTANCE

- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Component Side	(-)
FCV - Pin 6	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HV6**.	INSTALL a new cooling fan clutch. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HV6 CHECK THE VPWR VOLTAGE TO THE COOLING FAN CLUTCH ACTUATOR VALVE SOLENOID

- Key ON, engine OFF.
- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
VPWR - Pin 3	Ground

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

Yes	No
GO to **HV7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HV7 CHECK THE FCV CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) PCM Connector, Harness Side
FCV - Pin 6	FCV

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HV8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HV8 CHECK THE FCV CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FCV - Pin 6	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HV9**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HV9 CHECK THE FCV CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) Cooling	

Fan Clutch Connector, Harness Side	**(-)**
FCV - Pin 6	Ground

- **Is any voltage present?**

Yes	**No**
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **HV19**.

HV10 CONTINUOUS MEMORY DTCS P0480 OR P0528: INTERMITTENT CHECK

NOTE: **Keep the coil arm of the cooling fan clutch secure while checking the wiring harness. If the coil arm rotates, faulty readings may occur.**

- Key ON, engine OFF.
- Access the PCM and monitor the FANSS PID.
- Access the PCM and monitor the FANVAR_F PID.
- While observing the PID wiggle, shake, and bend small sections of the wiring harness while working from the cooling fan clutch to the PCM.
- Check the cooling fan clutch and the PCM connectors for damage and corrosion.
- **Is a concern present?**

Yes	**No**
ISOLATE the concern and REPAIR as necessary.	DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HV11 KOEO AND KOER DTC P0528: CHECK THE VOLTAGE AND GROUND TO THE FSS SENSOR

- Cooling Fan Clutch connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	**(-) Cooling Fan Clutch Connector, Harness Side**
VBPWR - Pin 2	PWRGND - Pin 5

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

Yes	No
GO to **HV15**.	GO to **HV12**.

HV12 CHECK THE VOLTAGE TO THE FSS SENSOR

- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
VBPWR - Pin 2	Ground

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

Yes	No
GO to **HV14**.	GO to **HV13**.

HV13 CHECK THE VOLTAGE CIRCUIT TO THE FSS SENSOR FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) PCM Connector, Harness Side
VBPWR - Pin 2	VBPWR

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HV19**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HV14 CHECK THE GROUND CIRCUIT TO THE FSS SENSOR FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) PCM Connector, Harness Side
PWRGND - Pin 5	PWRGND

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HV19**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HV15 CHECK THE FSS CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) PCM Connector, Harness Side
FSS - Pin 4	FSS

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HV16**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HV16 CHECK THE FSS CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FSS - Pin 4	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No

GO to **HV17**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HV17 CHECK THE FSS CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FSS - Pin 4	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **HV18**.

HV18 CHECK THE FUNCTIONALITY OF THE FSS CIRCUIT

- Key in OFF position.
- PCM connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FSS - Pin 4	Ground

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

Yes	No
INSTALL a new cooling fan clutch. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HV19**.

HV19 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:

  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HX: EVAPORATIVE EMISSION (EVAP) SYSTEM AND MONITOR

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

WARNING: **Before repairing or installing a new component in the fuel system, reduce the possibility of injury or fire by following the warning, caution, and handling directions in pinpoint test HC. Failure to follow these instructions may result in personal injury.**

NOTE: **Use this pinpoint test only when directed here.**

The use of a soap solution around the fuel filler cap or capless fuel tank filler pipe (if equipped) or the use of the hydrocarbon emission analyzer to determine an evaporative emission system leak is not recommended. The mandatory Rotunda Evaporative Emission System Leak Tester for On Board Diagnostic (OBD) (including the ultrasonic tester) and the Rotunda Vacutec 522 Leak Detector Smoke Machine are the only devices to be used at this time for evaporative emission system leak detection.

When using the smoke machine, the fuel level in the fuel tank must be less than 85% full.

This pinpoint test is intended to diagnose the following:

- canister vent (CV) solenoid (9F945)
- fuel filler cap (9030)
- capless fuel tank filler pipe (9034)
- fuel tank pressure (FTP) sensor (9C052)

- EVAP canister purge (EVAPCP) valve (9C915). Also known as the vapor management valve (VMV).
- EVAP system leaks using the Rotunda Vacutec Leak Detector Smoke Machine.
- harness circuits: B+, CV, EVAPCP, FTP, FTPREF, SIGRTN, VPWR, VREF and CASE GND
- powertrain control module (PCM) (12A650)

For additional information on the EVAP system, refer to**EVAPORATIVE EMISSION (EVAP) SYSTEMS** , or the **EVAPORATIVE EMISSIONS -- E-SERIES** .

For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, KAPWR provides voltage to the CV solenoid instead of VPWR.

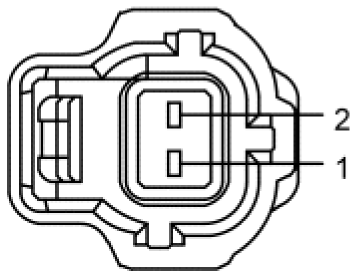

Fig. 144: Canister Vent (CV) Solenoid Connector - A
Courtesy of FORD MOTOR CO.

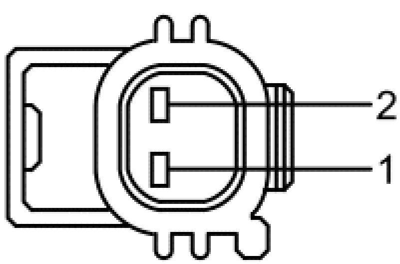

Fig. 145: Canister Vent (CV) Solenoid Connector - B

Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner, Explorer, Explorer Sport Trac, Mountaineer	A	2 1	KAPWR CANV
Mustang	B	2 1	CANV VPWR
All other vehicles	A	1 2	KAPWR CANV

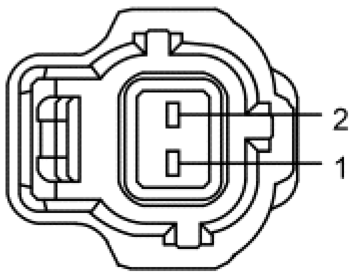

Fig. 146: EVAP Canister Purge (EVAPCP) Valve Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	EVAPCP (EVAP Canister Purge)
1	VPWR (Vehicle Power)

For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, FTPREF provides voltage to the FTP sensor instead of VREF.

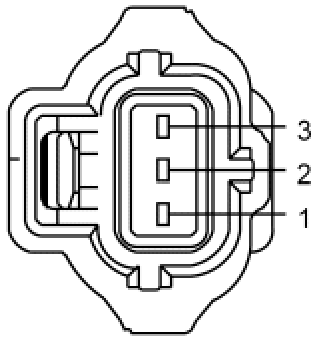

Fig. 147: Fuel Tank Pressure (FTP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

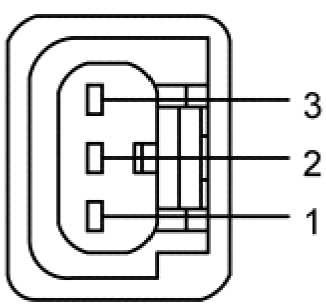

Fig. 148: Fuel Tank Pressure (FTP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series tank design, F-Super Duty tank design	A	3 1 2	FTP FTPREF SIGRTN
Mustang	B	3 2 1	FTP SIGRTN VREF
All other vehicles	B	3 1 2	FTP FTPREF SIGRTN

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series, F-Super Duty	170 Pin	B13 B3 B40 B41 B40 E1	CANV FTP FTPREF SIGRTN VREF EVAPCP
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B61 B44 B29 B58 B29, B64 B50	CANV FTP FTPREF SIGRTN VREF EVAPCP
Escape/Mariner	150 (50-50-50) Pin	B13 B9 B40 B41 B40 B34	CANV FTP FTPREF SIGRTN VREF EVAPCP
Expedition, Navigator	140 Pin	B61 B44 B29 B58 E57 B50	CANV FTP FTPREF SIGRTN VREF EVAPCP
F-150, Mark LT	190 Pin	B61 B44 B65 B58 B29 B50	CANV FTP FTPREF SIGRTN VREF EVAPCP
Focus	190 Pin	B20 B65 B66 B58 B52, B66 B55	CANV FTP FTPREF SIGRTN VREF EVAPCP
Fusion, Milan, MKZ	140 Pin	B61 B44 B29 B58 B33 B4	CANV FTP FTPREF SIGRTN VREF EVAPCP
Mustang	170 Pin	B13	CANV

		B3 B41 B40 E6	FTP SIGRTN VREF EVAPCP
All other vehicles	170 Pin	B13 B3 B40 B41 B40 E6	CANV FTP FTPREF SIGRTN VREF EVAPCP

HX1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0442, P0443, P0446, P0451, P0452, P0453, P0455, P0456, P0457, P0460, P0461, P0462, P0463, P144A, P1450, P1451, or P260F present?**

Yes	No
For DTCs P0442 or P0456, GO to **HX46**. For DTC P0443, GO to **HX2**. For DTCs P0446 or P1451, GO to **HX30**. For DTC P0451, GO to **HX39**. For DTC P0452, GO to **HX18**. For DTC P0453, GO to **HX23**. For DTCs P0455 or P0457, GO to **HX40**. For DTC P0460, GO to **HX38**. For DTCs P0461 through P0463, GO to **HX36**. For DTC P144A, GO to **HX49**. For DTC P1450, GO to **HX8**. For DTC P260F, GO to **HX50**.	For symptoms without DTCs, GO to **HX13**. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HX2 DTC P0443: CHECK THE PCM OUTPUT TO EVAP CANISTER PURGE VALVE

- Key in OFF position.
- EVAPCP Valve connector disconnected.
- Connect a non-powered test lamp between:

(+) EVAPCP Valve Connector, Harness Side	(-) EVAPCP Valve Connector, Harness Side
VPWR - Pin 1	EVAPCP - Pin 2

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .

- Command the outputs ON.
- Command the outputs OFF.
- Exit output test mode.
- **Does the test lamp turn on and off when the output(s) is commanded on and off?**

Yes	No
GO to **HX3**.	GO to **HX4**.

HX3 CHECK THE EVAP CANISTER PURGE VALVE SOLENOID RESISTANCE

- Key in OFF position.
- EVAPCP Valve connector disconnected.
- Measure the resistance between:

(+) EVAPCP Valve Connector, Component Side	(-) EVAPCP Valve Connector, Component Side
EVAPCP - Pin 2	VPWR - Pin 1

- **Is the resistance between 2.5 - 7 ohms?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	INSTALL a new EVAPCP valve. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HX4 CHECK THE VPWR VOLTAGE TO THE EVAP CANISTER PURGE VALVE

- Key ON, engine OFF.
- Measure the voltage between:

(+) EVAPCP Valve Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 1	Negative terminal

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

Yes	No
GO to **HX5**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX5 CHECK THE EVAP CANISTER PURGE VALVE CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) EVAPCP Valve Connector, Harness Side
EVAPCP	EVAPCP - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HX6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX6 CHECK THE EVAP CANISTER PURGE VALVE CIRCUIT FOR A SHORT TO PWRGND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
EVAPCP	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HX7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX7 CHECK THE EVAP CANISTER PURGE VALVE CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) EVAPCP Valve Connector, Harness Side	(-)
EVAPCP - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **HX54**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX8 DTC P1450: CHECK FOR VISUAL CAUSES OF EXCESSIVE FUEL TANK VACUUM

NOTE: **If the CV solenoid and the fuel tank assemblies are not accessible during this step, refer to the EVAPORATIVE EMISSIONS -- E-SERIES and FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES for removal instructions.**

- Check for kinks or bends in the fuel vapor hoses/tubes (EVAPCP outlet tube and EVAP canister tube).
- Visually inspect the EVAP canister inlet port, CV solenoid filter, and canister vent hose assembly for contamination or debris.
- Check the CV solenoid filter for blockage or contamination.
- **Is a concern present?**

Yes	No
REMOVE any contamination or debris around the fuel vapor hose/tubes and CV solenoid assembly. REMOVE kinks or bends in the EVAPCP outlet tube, EVAP canister tube, and canister vent hose assembly. CLEAR the DTCs. For repair verification, CARRY OUT the evaporative emission leak check monitor repair verification drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	GO to **HX9**.

HX9 CHECK THE FTP SENSOR VOLTAGE WITH THE FUEL FILLER CAP REMOVED OR THE CAPLESS FUEL TANK FILLER PIPE OPENED

NOTE: **For vehicles with a capless fuel filler pipe, instead of removing the fuel filler cap, install the supplemental refueling adaptor provided with the vehicle to open the capless fuel tank filler pipe.**

- Remove the fuel filler cap.

- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the voltage between 2.4 - 2.8 V?**

Yes	No
GO to **HX13**.	GO to **HX10**.

HX10 CHECK FOR ANY OTHER DTCS

- Check for other 3-wire sensor DTCs (KOEO, KOER, or continuous memory) present with the DTC P1450.
- **Are any other DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **HX11**.

HX11 CHECK THE VOLTAGE TO THE FTP SENSOR

- Key in OFF position.
- FTP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF	SIGRTN
FTPREF	SIGRTN

- **Are the voltages between 4 - 6 V?**

Yes	No
INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. CLEAR the DTCs. For repair verification, CARRY OUT the evaporative emission leak check monitor repair	GO to **HX12**.

verification drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	

HX12 CHECK THE FTPREF OR VREF AND SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF	VREF
SIGRTN	SIGRTN
FTPREF	FTPREF

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

Yes	No
GO to **HX54**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX13 CHECK IF THE ENGINE IDLES

- Key ON, engine running.
- **Does the engine stall or is it unable to maintain idle?**

Yes	No
GO to **HX14**.	GO to **HX15**.

HX14 CHECK THE EVAP SYSTEM FOR A STUCK OPEN VALVE

- Key in OFF position.
- Disconnect the fuel vapor to intake manifold line at the EVAPCP valve and cap the line at the EVAPCP valve.
- Key ON, engine running.
- **Does the engine stall or is it unable to maintain idle?**

Yes	No
The EVAP system is not the cause of the symptom. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	INSTALL a new EVAPCP valve. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HX15 CHECK FOR BLOCKAGE IN THE FUEL TANK VENT SYSTEM

NOTE: The CV is normally open and venting to the atmosphere.

- Access the PCM and monitor the EVMV PID.
- Access the PCM and monitor the FTP PID.
- Access the PCM and monitor the EVAPCV PID.
- While monitoring the FTP PID, ramp open the EVAPCP valve by incrementally commanding the EVMV PID to a 1,000 mA.
- **Does the FTP sensor voltage drop below 2 volts when the EVAPCP valve is commanded fully open?**

Yes	No
CHECK for blockage in the vapor line to the CV solenoid. CHECK the CV solenoid filter for blockage or contamination. CHECK the carbon canister for blockage. If OK, INSTALL a new CV solenoid. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HX16**.

HX16 CHECK THE EVAP SYSTEM FOR A STUCK OPEN VALVE

- Key ON, engine running.
- Access the PCM and control the EVMV PID.
- Close the EVAPCP by commanding the EVMV PID to 0 mA.
- Access the PCM and control the EVAPCV PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- **Does the FTPV PID decrease, the engine RPM change, or the engine stall, as an indication that the EVAPCP valve is stuck open?**

Yes	No
INSTALL a new EVAPCP valve. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **HX17**.

HX17 EVAP CANISTER PURGE VALVE TEST

- Key ON, engine running.
- Access the PCM and control the EVAPCV PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- Access the PCM and control the EVMV PID.
- While monitoring the FTP PID, ramp open the EVAPCP valve by incrementally commanding the EVMV

PID to a 1,000 mA.

- **Does the FTP PID decrease, the engine RPM change, or the engine stall as an indication that the EVAPCP valve is opening?**

Yes	No
For DTC P1450, unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**. For all others, CHECK the EVAP system for leaks.	CHECK for blockages between the fuel tank, the EVAPCP valve, and the engine intake manifold. CHECK for obstructions in the EVAPCP valve diaphragm and ports. If OK, INSTALL a new EVAPCP valve. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HX18 DTC P0452: CHECK FOR FUEL TANK PRESSURE SENSOR CONNECTOR CONTAMINATION

- Key in OFF position.
- Visually check for liquid fuel contamination of the FTP sensor electrical connector.
- Check for a completely submerged FTP sensor (tank-mounted type only) in the liquid fuel. This can affect the correct FTP voltage reading.
- **Does the FTP sensor and its connector show any signs of fuel contamination?**

Yes	No
REPAIR as necessary. ADJUST the fuel tank overfill. CLEAR the DTCs. REPEAT the self-test.	GO to **HX19**.

HX19 CHECK FOR LOW FTP SENSOR VOLTAGE

NOTE: **The FTP sensor voltage with no pressure/vacuum on the fuel tank is between 2.4 and 2.8 volts.**

- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the voltage less than 0.22 V?**

Yes	No
GO to **HX20**.	The concern that produced the DTC P0452 is intermittent. refer to **PINPOINT TEST Z**.

HX20 CHECK THE OPPOSITE INDUCED HIGH FTP SENSOR SIGNAL

- Key in OFF position.
- FTP Sensor connector disconnected.

- Connect a 5 amp fused jumper wire between the following:

Point A FTP Sensor Connector, Harness Side	Point B FTP Sensor Connector, Harness Side
VREF	FTP

- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the voltage between 4 - 6 V?**

Yes	No
INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. CLEAR the DTCs. REPEAT the self-test.	GO to **HX21**.

HX21 CHECK THE VREF VOLTAGE TO THE FTP SENSOR

- Remove the jumper wire(s).
- Key ON, engine OFF.
- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to **HX22**.	refer to **PINPOINT TEST C**.

HX22 CHECK THE FTP CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM	(-) PCM

Connector, Harness Side	Connector, Harness Side
FTP	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
FTP	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HX54**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX23 DTC P0453: CHECK FOR HIGH FTP SENSOR VOLTAGE

NOTE: The FTP sensor voltage with no pressure/vacuum on the fuel tank is between 2.4 and 2.8 volts.

- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the voltage greater than 4.5 V?**

Yes	No
GO to **HX24**.	The concern that produced the DTC P0453 is intermittent. refer to **PINPOINT TEST Z**.

HX24 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE FTP SENSOR VEHICLE HARNESS CONNECTOR

- Key in OFF position.
- FTP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FTP Sensor Connector,	(-) FTP Sensor Connector,

Harness Side	Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to **HX25**.	refer to **PINPOINT TEST C**.

HX25 CHECK THE FTP CIRCUIT FOR A SHORT TO VOLTAGE

- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) Vehicle Battery
FTP	Negative terminal

- **Is the voltage less than 10 V?**

Yes	No
GO to **HX27**.	GO to **HX26**.

HX26 CHECK THE FTP CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
FTP	Negative terminal

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

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **HX54**.

HX27 CHECK THE FTP CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
FTP	FTP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HX28**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX28 CHECK THE FTP CIRCUIT FOR A SHORT TO VREF

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	FTP

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HX29**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX29 CHECK THE OPPOSITE INDUCED LOW FTP SIGNAL

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A FTP Sensor Connector, Harness Side	Point B FTP Sensor Connector, Harness Side
FTP	SIGRTN

- Key ON, engine OFF.

- Access the PCM and monitor the FTP PID.
- **Is the voltage less than 0.1 V?**

Yes	No
INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. CLEAR the DTCs. REPEAT the self-test.	GO to **HX54**.

HX30 DTCS P0446 OR P1451: CHECK THE PCM OUTPUT TO THE CV SOLENOID

NOTE: **For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, KAPWR provides voltage to the CV solenoid instead of VPWR.**

- Key in OFF position.
- CV Solenoid connector disconnected.
- Connect a non-powered test lamp between:

(+) CV Solenoid Connector, Harness Side	(-) CV Solenoid Connector, Harness Side
VPWR	CANV
KAPWR	CANV

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Command the outputs OFF.
- Exit output test mode.
- **Does the test lamp turn on and off when the output(s) is commanded on and off?**

Yes	No
GO to **HX31**.	GO to **HX32**.

HX31 CHECK THE CV SOLENOID RESISTANCE

NOTE: **For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, KAPWR provides voltage to the CV solenoid instead of VPWR.**

- Key in OFF position.

- Measure the resistance between:

(+) CV Solenoid Connector, Component Side	(-) CV Solenoid Connector, Component Side
KAPWR	CANV
VPWR	CANV

- **Are the resistances between 48 - 65 ohms?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	INSTALL a new CV solenoid. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HX32 CHECK THE VPWR VOLTAGE TO THE CV SOLENOID

NOTE: For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, KAPWR provides voltage to the CV solenoid instead of VPWR.

- Measure the voltage between:

(+) CV Solenoid Connector, Harness Side	(-)
KAPWR	Ground
VPWR	Ground

- **Are the voltages greater than 10 V?**

Yes	No
GO to **HX33**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX33 CHECK THE CANV CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CV Solenoid Connector, Harness Side
CANV	CANV

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **HX34**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX34 CHECK THE CANV CIRCUIT FOR A SHORT TO PWRGND IN THE HARNESS

- Measure the resistance between:

(+) CV Solenoid Connector, Harness Side	(-) Vehicle Battery
CANV	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **HX35**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX35 CHECK THE CANV CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) CV Solenoid Connector, Harness Side	(-)
CANV	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **HX54**.	REPAIR the short circuit. CLEAR the DTCs.

	REPEAT the self-test.

HX36 DTCS P0461, P0462 AND P0463: CHECK THE INSTRUMENT CLUSTER (IC) MODULE FOR DTCS

- Key ON, engine OFF.
- Carry out the IC self-test.
- **Are any DTCs present?**

Yes	No
REFER to the **INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES** to continue diagnosis.	GO to **HX37**.

HX37 CHECK THE FLI PID

- Key ON, engine running.
- Access the PCM and monitor the FLI PID.
- **Does the FLI PID match the fuel gauge?**

Yes	No
GO to **HX38**.	GO to **HX54**.

HX38 DTC P0460: CHECK FOR FUEL TANK FLOAT LEVEL RESPONSE

NOTE: A dual-container (saddle type) fuel tank has 2 fuel level sensors. The FLI PID in the PCM is the average value of both fuel level sensors. Some dual-container tanks may require the fuel level to be greater 3/4 full before the fuel level equalizes.

- Key ON, engine running.
- Access the PCM and monitor the FLI PID.
- Key in OFF position.
- If the fuel level is less than 1/4 (25% on FLI), add approximately 1/4 tank of fuel.
- If the fuel level is greater than 3/4 (75% on FLI), drain approximately 1/4 tank of fuel.
- Key ON, engine running.
- Access the PCM and monitor the FLI PID.
- **Does the FLI PID indicate a movement upward or downward as fuel is either added or drained?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	REFER to the **INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES** to diagnose the incorrect fuel gauge indication

	symptom.

HX39 DTC P0451: CHECK THE FTP SENSOR FOR CORRECT OPERATION

NOTE: **For vehicles with a capless fuel filler pipe, instead of removing the fuel filler cap, install the supplemental refueling adaptor provided with the vehicle to open the capless fuel tank filler pipe.**

- Key in OFF position.
- Remove the fuel filler cap.
- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the pressure between -0.42 and 0.42 kPa (-1.7 and 1.7 in-H2O)?**

Yes	No
CHECK for kinks or bends in the fuel vapor hoses/tubes between the fuel tank and dust separator. CHECK the EVAP canister ports and canister vent hose assembly for contamination or debris. CHECK the dust separator for blockage. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. CLEAR the DTCs. REPEAT the self-test.

HX40 DTCS P0455 OR P0457: CHECK THE FUEL FILLER CAP OF CAPLESS FUEL TANK FILLER PIPE

NOTE: **If the fuel filler cap or capless fuel tank filler pipe is suspected as an EVAP leak source during visual inspection, do not disturb the fuel filler cap or capless fuel tank filler pipe until the repair verification method is complete. If the repair verification method fails, reposition or install a new fuel filler cap and repeat the test. For vehicles with a capless fuel tank filler pipe, install and remove the supplemental refueling adaptor provided with the vehicle to reseal the capless fuel tank filler pipe and repeat the test. This action isolates the fuel filler cap or capless fuel tank filler pipe from the rest of the EVAP system as a potential concern.**

- For vehicles with a fuel filler cap, visually inspect the fuel filler cap without initially disturbing it.
  - Verify the fuel filler cap tether is visible and free to move.
  - Check for missing or loose fuel filler cap.
  - Check the fuel filler cap for damage.
- For vehicles with a capless fuel tank filler pipe, visually inspect the capless fuel tank filler pipe inlet without initially disturbing it.
  - Check the capless fuel tank filler pipe inlet for an obstruction that prevents it from sealing.
  - Check the capless fuel tank filler pipe for damage.

- **Is a concern present?**

Yes	No
For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. REPAIR as necessary. GO to **HX46**.	GO to **HX41**.

HX41 CHECK FOR FLI DTCS

- Key ON, engine OFF.
- Carry out the self-test.
- **Are DTCs P0460, P0461, P0462 or P0463 present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **HX42**.

HX42 CHECK THE OPERATION OF THE FUEL GAUGE

NOTE: A fuel gauge that always indicates a fuel level less than a 1/2 tank or always a full tank, may be caused by a fuel level input (FLI) concern.

- Check operation of the fuel gauge.
- **Is the fuel gauge functioning properly?**

Yes	No
GO to **HX43**.	CHECK the functionality of the FLI circuit. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.

HX43 EVAPORATIVE EMISSION SYSTEM VISUAL INSPECTION

- Key in OFF position.
- Visually inspect for:
  - EVAP system lines/hoses (check for proper connections, damage or blockage)
  - loose fuel vapor hose/tube connections to the EVAP system components
  - blocked vacuum hose between the EVAPCP valve and the engine intake manifold
  - damaged fuel tank or fuel filler pipe
- **Are there any concerns found during the visual inspection?**

Yes	No
REPAIR as necessary. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to **HX46**.	GO to **HX44**.

HX44 CHECK THE FTP SENSOR VOLTAGE WITH THE FUEL FILLER CAP REMOVED OR THE CAPLESS FUEL TANK FILLER PIPE OPENED

NOTE: For vehicles with a capless fuel filler pipe, instead of removing the fuel filler cap, install the supplemental refueling adaptor provided with the vehicle to open the capless fuel tank filler pipe.

- Remove the fuel filler cap.
- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the voltage between 2.4 - 2.8 V?**

Yes	No
GO to **HX45**.	INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. REPEAT the test and VERIFY the results. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to **HX46**.

HX45 EVAP CANISTER PURGE VALVE TEST

- Key in OFF position.
- Install the fuel filler cap or remove the supplemental refueling adaptor.
- Key ON, engine running.
- Access the PCM and monitor the EVAPCV PID.
- Access the PCM and monitor the EVMV PID.
- Access the PCM and monitor the FTP PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- While monitoring the FTP PID, ramp open the EVAPCP valve by incrementally commanding the EVMV PID to a 1,000 mA.
- **Does the FTP PID decrease, the engine RPM change, or the engine stall as an indication that the EVAPCP valve is opening?**

Yes	No
GO to **HX46**.	INSTALL a new EVAPCP valve. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . REPEAT the test and VERIFY the results. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to **HX46**.

HX46 DTCS P0442 OR P0456: HOOK UP THE SMOKE MACHINE (ROTUNDA VACUTEC)

NOTE: **Removing the Schrader valve from the test port permanently damages the valve.**

NOTE: **The smoke and air flow from the smoke machine will not pass through liquid fuel. Liquid fuel may be present in the fuel tank filler pipe.**

NOTE: **Some vehicles are not equipped with an evaporative emission test port. Use a suitable hose adapter in the following diagnostic procedures.**

- Key in OFF position.
- Connect the smoke machine power cables to the vehicle battery. Check to see that the smoke machine power indicator lamp is on, indicating a good battery contact.
- For vehicles not equipped with an evaporative emission test port:
  - Disconnect the fuel vapor to intake manifold line at the EVAPCP valve and cap the line.
  - Connect a suitable hose adapter to the fuel vapor to intake manifold connection at the EVAPCP valve.
- For vehicles equipped with an evaporative emission test port:
  - Locate the evaporative emission test port and remove the green cap. The cap is located on or close to the EVAPCP valve.
  - Install the EVAP test port adapter (provided with the Vacutec Smoke Machine) to the test port.
- **Is the smoke machine hook up complete?**

Yes	No
For leak detection, GO to **HX47**. For leak repair verification, GO to **HX48**.	REFER to the smoke machine operator article for additional instructions and for helpful tips.

HX47 CARRY OUT SMOKE MACHINE PHASE 2 - LEAK DETECTION SMOKE TEST

NOTE: **If the leak is not detected from the top, check the EVAP system for leaks from under the vehicle.**

- **Check the EVAP hoses, EVAPCP valve, CV solenoid, EVAP canister, fuel**

tank, fuel filler pipe, around the fuel tank area, and at the fuel filler cap or capless fuel tank filler pipe inlet.
- **Wiggle the components and connections to simulate road bumps while looking for signs of leaking smoke.**

If the leak is in the fuel tank filler pipe between the check valve and the fuel filler cap or capless fuel tank filler pipe inlet, smoke under pressure may not reach the leak. If leaking smoke is not found, a thorough visual inspection of the fuel tank filler pipe and fuel filler cap or capless fuel tank filler pipe inlet should be done.

- Set the smoke machine to SMOKE.
- Remove the fuel filler cap or install the supplemental refueling adaptor.
- Connect the smoke supply hose nozzle tip into the EVAP service port or suitable hose adapter.
- Key ON, engine OFF.
- Access the PCM and control the EVAPCV PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- For vehicles not equipped with an evaporative emission test port:
  - Start the smoke machine and verify the connection at the EVAPCP valve is correct and not leaking
  - Open the EVAPCP valve by commanding the EVMV PID to 1,000 mA
- Start the smoke machine. If smoke does not exit the fuel tank filler pipe after the system is pressurized, command the EVAPCV PID open to allow air to purge the CV solenoid. Once smoke is seen at the CV solenoid, command the EVAPCV PID close.
  - Install the fuel filler cap or remove the supplemental refueling adaptor once smoke is observed exiting the fuel tank neck area.
  - Continue to smoke the system for 60 seconds to obtain pressure.
  - Press and release the remote starter button in intervals of approximately 15 seconds on and 15 seconds off while checking for exiting smoke.
  - Use the halogen spotlight provided with the smoke machine to follow the EVAP system path and look for smoke exiting at the source of the leak(s).
- **Is the source of the EVAP leak located?**

Yes	No
REPAIR as necessary. CONNECT all the disconnected components. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to **HX48**.	The test passed. CONNECT all the disconnected components. CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to **HX48**.

HX48 CARRY OUT THE SMOKE MACHINE PHASE 1 - LEAK VERIFICATION PRESSURE TEST

- Position the control lever located on the smoke machine to METER.
- Calibrate the smoke machine flow meter using the 0.020 (DTC P0456) or 0.040 (DTC P0442) standard as follows:
  - Insert the air supply hose (transparent hose) nozzle tip into the appropriate EVAP system standard located on the front of the smoke machine.
  - Press the remote starter button on the smoke machine. Observe the position of the flow meter indicator ball.
  - Position the flow meter red pointer flag so that it aligns with the measurement of the indicator ball.
  - Release the button and remove the air supply hose nozzle tip from the EVAP system standard.
- Connect the air supply hose (transparent hose) nozzle tip into the EVAP test port or suitable hose adapter.
- Key ON, engine OFF.
- Access the PCM and control the EVAPCV PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- For vehicles not equipped with an evaporative emission test port, open the EVAPCP valve by commanding the EVMV PID to 1,000 mA.
- Press the remote starter button on the smoke machine. Notice that the ball in the flow meter is all the way at the top. This indicates the system is being pressurized.
- Continue to press the remote starter button until the ball stops descending. Once the ball stops descending, observe if it is above or below the red pointer flag. If the measurement is below the indicator flag, the system has passed the pressure test. If the measurement is above the indicator flag, the EVAP system has an unacceptable leak.
- **Does the EVAP system pass the smoke machine leak verification pressure test?**

Yes	No
The test passed and no concerns are present. CLEAR the DTCs. REPEAT the self-test.	GO to **HX47**.

HX49 DTC P144A: CHECK FOR A BLOCKED FUEL VAPOR TUBE BETWEEN THE FTP SENSOR AND THE FUEL TANK

- Key in OFF position.
- Remove the fuel vapor tube assembly. Refer to the **EVAPORATIVE EMISSIONS -- E-SERIES** .
- Visually inspect the fuel vapor tube for a blockage between the FTP sensor and the connection to the fuel tank or fuel pump module.
- Visually inspect the connection at the fuel tank or fuel pump module for a blockage.
- Attempt to manually remove the blockage.
- **Is the blockage visible and can be removed?**

Yes	No
REMOVE the blockage. INSTALL the Fuel Vapor Tube assembly. REFER to the **EVAPORATIVE**	INSTALL a new Fuel Vapor Tube assembly. REFER to the **EVAPORATIVE EMISSIONS --**

EMISSIONS -- E-SERIES . CLEAR the DTCs. REPEAT the self-test.	**E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HX50 DTC P260F: CHECK FOR THE PRESENCE OF ANY MODULE COMMUNICATION CONCERNS

- Key ON, engine OFF.
- Check for self-test DTCs in all of the vehicle modules.
- **Are any communication concerns or communication DTCs present?**

Yes	No
For communication concerns in the PCM, DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** . For communication concerns in other modules, REFER to the applicable Workshop article part to diagnose the communication DTC.	GO to **HX51**.

HX51 CHECK THE PERFORMANCE OF THE PROCESSOR

- Key in OFF position.
- Disconnect the battery and wait for 1 minute. Refer to the **BATTERY, MOUNTING AND CABLES -- E-SERIES** .
- Connect the battery.
- Key ON, engine running.
- Allow the engine idle to stabilize.
- Access the PCM and monitor the FTP PID.
- **Is the pressure equal to 0 kPa (0 psi)?**

Yes	No
GO to **HX53**.	GO to **HX52**.

HX52 CHECK FOR SELF-TEST DTC P260F

- Idle the engine for 2 minutes.
- Carry out the self-test.
- **Is DTC P260F present?**

Yes	No
GO to **HX53**.	RETURN the vehicle to the customer.

HX53 CHECK THE PCM FOR THE LATEST CALIBRATION

- Program the PCM to the latest calibration.
- Key ON, engine running.
- Idle the engine for 2 minutes.
- Carry out the self-test.
- **Is DTC P260F present?**

Yes	No
GO to **HX54**.	RETURN the vehicle to the customer.

HX54 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HY: GENERATOR/REGULATOR SYSTEM

This pinpoint test is intended to diagnose the following:

- generator/regulator (10346)
- powertrain control module (PCM) (12A650)

HY1 CHECK THE GENERATOR CIRCUITRY AND OPERATION

NOTE: **If the concern is still present after checking the generator circuitry in the workshop article, return to the PC/ED to continue generator diagnosis.**

- Check for any generator related DTCs. Refer to the **GENERATOR AND REGULATOR -- E-SERIES** to diagnose any generator related DTCs.
- **Is the charging system diagnosed and repaired in the GENERATOR AND REGULATOR -- E-SERIES ?**

Yes	No
The system is operating correctly at this time.	GO to **HY2**.

HY2 CHECK THE GENERATOR MONITOR SIGNAL

- Key ON, engine running.
- Access the PCM and monitor the GENMON PID.
- **Is the duty cycle between 5% and 97% and not excessively fluctuating?**

Yes	No
The system is operating correctly at this time.	GO to **HY3**.

HY3 CHECK FOR CORRECT PCM OPERATION

NOTE: When the battery (or PCM) is disconnected and connected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The charging system set point may also vary. The vehicle may need to be driven to relearn its strategy.

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST JB: SECONDARY IGNITION (COP)

NOTE: A malfunctioning ignition system may cause high catalyst temperatures. Check the components next to the catalyst and muffler for heat damage.

This pinpoint test is intended to diagnose the following:

- spark plugs (12405)
- secondary side of the coil

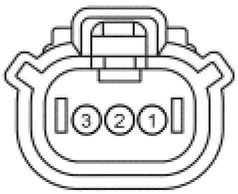

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Fig. 149: Coil On Plug (COP) Connector - A
Courtesy of FORD MOTOR CO.

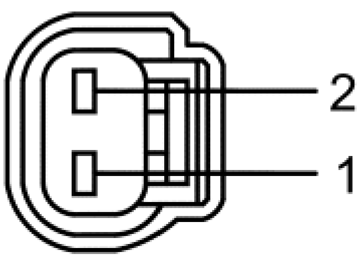

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Fig. 150: Coil On Plug (COP) Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, MKX, MKZ, Taurus, Taurus X, Sable	A	3	IGN START/RUN
Escape/Mariner, Focus, Fusion, Milan, Mustang 5.4L	B	2	IGN START/RUN
All other vehicles	B	1	IGN START/RUN

Vehicle	Firing Order for Coil On Plug Applications

BASE, 4-cylinder applications	1 3 4 2
BASE, 6-cylinder applications	1 4 2 5 3 6
BASE, 8-cylinder applications	1 3 7 2 6 5 4 8
BASE, 10-cylinder applications	1 6 5 10 2 7 3 8 4 9

JB1 CHECK FOR DTCS

- **Are DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, P0310, or P050B present?**

Yes	No
For DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, P0310 or P0316, GO to **JB3**. For DTC P050B, GO to **JB13**.	For symptoms without DTCs, GO to **JB2**. For all other DTCs, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

JB2 VISUAL INSPECTION OF THE IGNITION SYSTEM

- Visually inspect the engine compartment to make sure all coils are properly and securely connected.
- Examine all the wiring harnesses and connectors for damaged, burned, or overheated insulation, and loose or broken conditions.
- Make sure the vehicle battery is in good condition and all of the accessories are turned off.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **JB3**.

JB3 DTC P0301 THROUGH P0310: MISFIRE ON CYLINDERS 1 THROUGH 10

- **Are DTCs P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, or P0310 present?**

Yes	No
For Edge, Escape/Mariner 3.0L, Explorer 4.6L, Explorer Sport Trac 4.6L, F-150 4.6L, F-150 5.4L, Fusion, Milan, MKX, Sable, Taurus, and	GO to **JB6**.

Taurus X, GO to **JB4**. For all others, GO to **JB5**.	

JB4 CHECK SPARK DURATION RELATIVENESS

- Monitor the spark duration PIDs.
- **Are the PIDs relative to each other?**

Yes	No
GO to **JB10**.	INSPECT the coil boot(s) for the missing cylinder (s). INSTALL a new coil boot(s) if necessary. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** , Spark Plugs, and INSPECT the spark plug(s) for the missing cylinder (s). MEASURE the resistance of the spark plug(s). INSTALL a new spark plug(s) if the resistance is lower than 2,000 ohms or higher than 20,000 ohms. If the coil boot(s) and spark plugs are OK, INSTALL a new COP(s) for the missing cylinders. CLEAR the DTCs. REPEAT the self-test.

JB5 CHECK FOR SPARK AT THE CYLINDER(S) INDICATED BY THE DTC(S)

- Key in OFF position.
- Disconnect the ignition coil(s) from the spark plug(s).
- Connect the Air Gap spark tester 303-D037 (D81P-6666-A) or its equivalent to the suspect coil.
- Crank the engine while the accelerator pedal is fully applied.
- Observe the spark tester while cranking the engine.
- **Is a bluish-white spark present?**

Yes	No
GO to **JB8**.	INSPECT the coil boot(s) for the missing cylinder (s). INSTALL a new coil boot(s) if necessary. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** , Spark Plugs, and INSPECT the spark plug(s) for the missing cylinder (s). MEASURE the resistance of the spark plug(s). INSTALL a new spark plug(s) if the resistance is lower than 2,000 ohms or higher than 20,000 ohms. GO to JB7.

JB6 CHECK FOR SPARK AT ALL CYLINDERS

- Key in OFF position.

- Disconnect the ignition coil(s) from the spark plug(s).
- Connect the Air Gap spark tester 303-D037 (D81P-6666-A) or its equivalent to the suspect coil.
- Crank the engine while the accelerator pedal is fully applied.
- Observe the spark tester at each cylinder while cranking the engine.
- **Is a bluish-white spark consistent between all cylinders?**

Yes	No
GO to **JB8**.	INSPECT the coil boot(s) for the missing cylinder (s). INSTALL a new coil boot(s) if necessary. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** , Spark Plugs, and INSPECT the spark plug(s) for the missing cylinder (s). MEASURE the resistance of the spark plug(s). INSTALL a new spark plug(s) if the resistance is lower than 2,000 ohms or higher than 20,000 ohms. RECORD the cylinder(s) with inconsistent spark. GO to **JB7**.

JB7 CHECK THE SECONDARY COIL RESISTANCE FOR THE MISSING CYLINDERS

- Key in OFF position.
- Suspect coil connector disconnected.
- Measure resistance between: Suspect coil connector, IGN START/RUN, component side and ignition coil spring, located in the ignition coil boot.
- **Is the resistance between 5,000 and 6,000 ohms?**

Yes	No
refer to **PINPOINT TEST Z**.	INSTALL a new COP. CLEAR the DTCs. REPEAT the self-test.

JB8 CHECK THE SPARK PLUGS

NOTE: To determine the condition of the spark plugs, refer to the ENGINE - 4.6L AND 5.4L -- E-SERIES and carry out the Spark Plug Inspection.

- Key in OFF position.
- Remove and inspect the plugs for damage, wear, carbon tracking or deposits and proper plug gap.
- **Are the plugs OK?**

Yes	No
GO to **JB9**.	REPAIR the plug(s). ADJUST the gap or INSTALL a new spark plug(s) as necessary. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V)**

	-- E-SERIES . CLEAR the DTCs. REPEAT the self-test.

JB9 CHECK THE SPARK PLUG RESISTANCE

- Measure the spark plug resistance.
- **Is the resistance between 2,000 and 20,000 ohms?**

Yes	No
For Edge, Escape/Mariner 3.0L, Explorer 4.6L, Explorer Sport Trac 4.6L, F-150 4.6L, F-150 5.4L, Fusion, Milan, MKX, Sable, Taurus, and Taurus X, GO to **JB14**. For all others, GO to **JB10**.	INSTALL a new spark plug. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

JB10 TEST DIRECTION FOR SYMPTOM CHARTS

- **Were you directed to this pinpoint test?**

Yes	No
RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	GO to **JB11**.

JB11 TEST DIRECTION FOR PINPOINT TEST HD

- **Were you directed to this pinpoint test from pinpoint test step HD6?**

Yes	No
GO to **HD7**.	GO to **JB12**.

JB12 TEST DIRECTION FOR PINPOINT TEST A

- **Were you directed to this pinpoint test from pinpoint test step A8?**

Yes	No
GO to **A9**.	The concern is intermittent. refer to **PINPOINT TEST Z**.

JB13 DTC P050B: COLD START PERFORMANCE

- **Are any other codes besides P050B present?**

Yes	No
REPAIR all other powertrain related diagnostic trouble codes (DTCs) first.	GO to **JB14**.

JB14 CHECK THE SPARK CAPTURE CIRCUIT

- Access the PCM and monitor the IGNPCM_F PID.
- **Is a concern indicated?**

Yes	No
GO to **JB16**.	GO to **JB15**.

JB15 CHECK THE IGNITION TIMING PID

- Access the PCM and monitor the IGNX_F PIDs.
- **Is a concern indicated?**

Yes	No
Visually inspect the COP harness for damage, exposed wiring, water contamination, corrosion, and correct assembly. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **JB16**.

JB16 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST JC: SECONDARY IGNITION (COIL PACK)

This pinpoint test is intended to diagnose the following:

- spark plugs (12405)
- spark plug wires (12280, 12281)

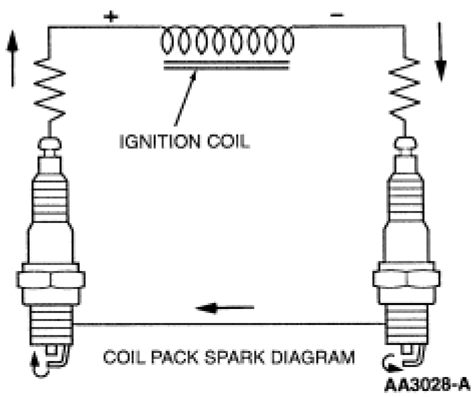

Fig. 151: Coil Pack Spark Diagram
Courtesy of FORD MOTOR CO.

Explorer 4.0L, Explorer Sport Trac 4.0L, F150 4.2L, Mountaineer 4.0L, Mustang 4.0L, Ranger.

JC1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306 or P050B present?**

Yes	No
For DTCs P0301, P0302, P0303, P0304, P0305 or P0306, GO to **JC13**. For DTC P0300, GO to **JC2**. For DTC P050B, GO to **JC18**.	For all other DTCs, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

JC2 VISUAL INSPECTION OF THE IGNITION SYSTEM

- Visually inspect the engine compartment to make sure all coils and spark plug wires are properly and securely connected.
- Examine all wiring harnesses and connectors for damaged, burned or overheated insulation and loose or broken conditions.
- Make sure the vehicle battery is in good condition and all accessories are turned off.
- **Is a concern present?**

Yes	No
REPAIR as necessary.	For a coil pack using an engine analyzer, GO to **JC3**.

CLEAR the DTCs. REPEAT the self-test.	For a coil pack not using an engine analyzer, GO to **JC12**.

JC3 CONNECT THE ENGINE ANALYZER

- Obtain an engine analyzer to diagnose concerns in the secondary side of the ignition system.
- **Is the engine analyzer connected?**

Yes	No
GO to **JC4**.	REPEAT Step JC2.

JC4 CHECK FOR THE IGNITION PATTERN

- Observe the pattern on a scope while cranking the engine.

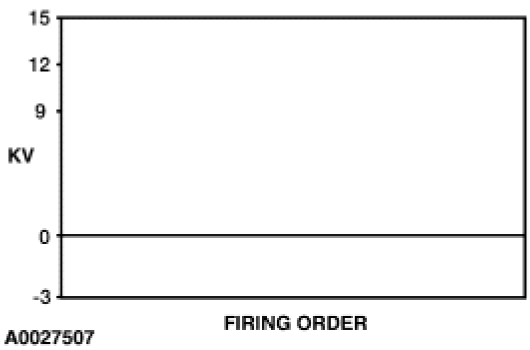

Fig. 152: Ignition Firing Pattern (No Spark)
Courtesy of FORD MOTOR CO.

- **Is the pattern flat, which indicates no spark on all cylinders?**

Yes	No
An IGN/START/RUN circuit concern. CHECK the condition of the related fuses/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the IGN START/RUN circuit for a short to ground. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **JC5**.

JC5 CHECK FOR A NORMAL IGNITION PATTERN

NOTE: Spark plugs may be fired more than once per combustion event. Multi-strike operating mode is RPM dependent.

- Key ON, engine running. If no start, crank the engine.

Fig. 153: Normal Ignition Firing Pattern
Courtesy of FORD MOTOR CO.

- **Are the patterns even and is the average value of spark plug firing voltage between 9 kV and 15 kV (higher during engine crank/no start)?**

Yes	No
refer to **PINPOINT TEST Z**.	GO to **JC6**.

JC6 IGNITION PATTERN EVALUATION

- **Is the ignition pattern normal?**

Yes	No
GO to **JC7**.	GO to **JC8**.

JC7 TEST DIRECTION

- **Were you directed to this pinpoint test from pinpoint test step A8?**

Yes	No
GO to **A9**.	GO to **JC8**.

JC8 CHECK FOR MISSING SPARK PATTERNS

- Observe for missing spark pattern.

Fig. 154: Identifying Missing Spark Pattern
Courtesy of FORD MOTOR CO.

- **Is the spark pattern inconsistent?**

Yes	No
INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire if the resistance is greater than 7,000 ohms per 30.5 cm (1 foot). REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test. GO to **JE2**.	GO to **JC9**.

JC9 CHECK FOR A HIGH SPARK PLUG FIRING VOLTAGE

- Observe for a high spark plug firing voltage.

Fig. 155: Identifying High Spark Plug Firing Voltage
Courtesy of FORD MOTOR CO.

- **Is the average value of the spark plug firing voltage greater than 15 Kv?**

Yes	No
INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark	

plug wires. INSTALL a new spark plug wire if the resistance is greater than 7,000 ohms per 30.5 cm (1 foot). REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **JC10**.

JC10 CHECK FOR LOW SPARK PLUG FIRING VOLTAGE

- Check the spark plug firing voltage average pattern.

Fig. 156: Identifying Low Spark Plug Firing Voltage Pattern
Courtesy of FORD MOTOR CO.

- **Is there consistently low spark plug firing voltage or sloping spark line on one or more cylinders?**

Yes	No
INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire if the resistance is greater than 7,000 ohms per 30.5 cm (1 foot). MEASURE the resistance of the spark plug (s). INSTALL a new spark plug(s) if the resistance is lower than 2,000 or higher than 20,000 ohms. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **JC11**.

JC11 CHECK FOR EVENESS BETWEEN CYLINDERS

- Check the spark plug firing voltage average pattern.

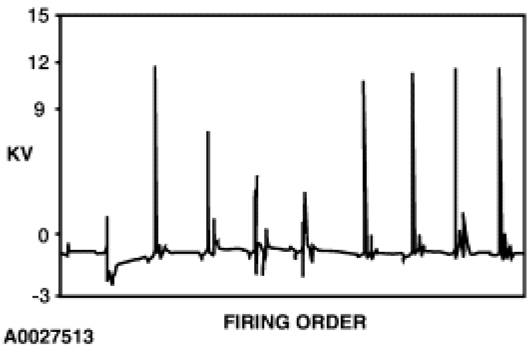

Fig. 157: Identifying Unevenness Between Cylinders Pattern
Courtesy of FORD MOTOR CO.

- **Is the evenness of spark plug firing voltage greater than 6 kV?**

Yes	No
INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire if the resistance is greater than 7,000 ohms per 30.5 cm (1 foot). CHECK for damaged spark plugs or narrow spark plug gaps. MEASURE the resistance of the spark plug(s). INSTALL a new spark plug(s) if the resistance is lower than 2,000 or higher than 20,000 ohms. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

JC12 DTCS P0301 THROUGH P0306: MISFIRE ON CYLINDERS 1 THROUGH 6

- **Are DTCs P0300, P0301, P0302, P0303, P0304, P0305, or P0306 present?**

Yes	No
GO to **JC13**.	GO to **JC14**.

JC13 CHECK FOR SPARK AT THE CYLINDER(S) INDICATED BY THE DTC(S)

- Key in OFF position.
- Disconnect the spark plug wire(s) from the spark plug(s).
- Connect the Air Gap spark tester 303-D037 (D81P-6666-A) or its equivalent to a spark plug wire.
- Crank the engine while the accelerator pedal is fully applied.
- Check for spark while cranking the engine.
- **Is the bluish-white spark present?**

Yes	No

GO to **JC16**.	INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire(s) if the resistance is greater than 7,000 ohms per 30.5 cm (1 foot). REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . If the spark plug wires are OK, GO to **JC15**.

JC14 CHECK FOR SPARK AT ALL CYLINDERS

- Key in OFF position.
- Disconnect the spark plug wire(s) from the spark plug(s).
- Connect the Air Gap spark tester 303-D037 (D81P-6666-A) or its equivalent to a spark plug wire.
- Crank the engine while the accelerator pedal is fully applied.
- Check for spark while cranking the engine.
- **Is the bluish-white spark present?**

Yes	No
GO to **JC16**.	INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire(s), if the resistance is greater than 7,000 ohms per 30.5 cm (1 foot). REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . If the spark plug wires are OK, GO to **JC15**.

JC15 CHECK THE SECONDARY COIL RESISTANCE FOR THE MISSING CYLINDERS

NOTE: **Two adjacent coil towers share a common coil and are called a matched pair. For 6-tower coil pack (6 cylinder) applications, the matched pairs are 1 and 5, 2 and 6, and 3 and 4. For Mustang the matched pairs are 1 and 4, 2 and 5, and 3 and 6. For 4-tower coil pack (4 cylinder) applications, the matched pairs are 1 and 4, and 2 and 3.**

- Key in OFF position.
- Ignition coil pack disconnected.
- Disconnect spark plug wires from the coil pack.
- Measure the resistance of each matched pair.
- **Is the resistance between 9,500 and 15,500 ohms?**

Yes	No

refer to **PINPOINT TEST Z**.	INSTALL a new ignition coil pack. CLEAR the DTCs. REPEAT the self-test.

JC16 CHECK THE SPARK PLUGS

- Key in OFF position.
- Check for damaged spark plugs or narrow spark plug gaps.
- **Are the plugs OK?**

Yes	No
GO to **JC17**.	REPAIR the spark plug(s). ADJUST the gap or INSTALL a new spark plug(s) as necessary. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

JC17 CHECK THE SPARK PLUG RESISTANCE

- Measure the spark plug resistance.
- **Is the resistance between 2,000 and 20,000 ohms?**

Yes	No
refer to **PINPOINT TEST Z**.	INSTALL a new spark plug(s). REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

JC18 DTC P050B: COLD START PERFORMANCE

- **Are any other codes besides P050B present?**

Yes	No
REPAIR all other powertrain related diagnostic trouble codes (DTCs) first.	GO to **JC19**.

JC19 CHECK THE SPARK CAPTURE CIRCUIT

- Access the PCM and monitor the IGNPCM_F PID.
- **Is a concern indicated?**

Yes	No
GO to **JC21**.	GO to **JC20**.

JC20 CHECK THE IGNITION TIMING PID

- Access the PCM and monitor the IGNX_F PIDs.
- **Is a concern indicated?**

Yes	No
Visually inspect the coil pack harness for damage, exposed wiring, water contamination, corrosion, and correct assembly. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **JC21**.

JC21 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST JD: CRANKSHAFT POSITION (CKP) SENSOR

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- crankshaft position (CKP) sensor (6C315)
- harness circuits: CKP(+) and CKP(-)
- powertrain control module (PCM) (12A650)

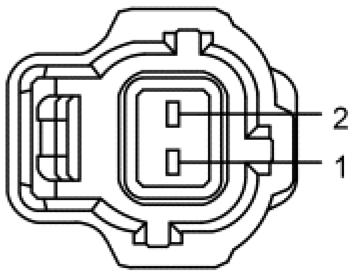

Fig. 158: Crankshaft Position (CKP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

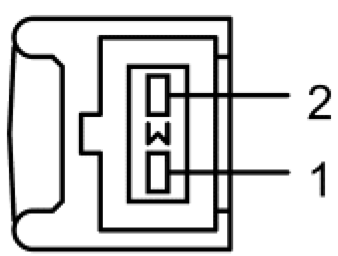

Fig. 159: Crankshaft Position (CKP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

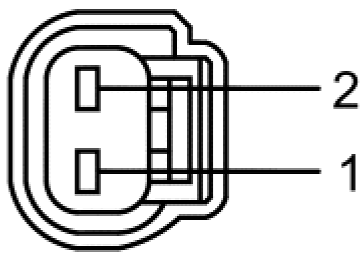

Fig. 160: Crankshaft Position (CKP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Focus, Fusion 2.3L, Milan 2.3L, Ranger 2.3L	A	2 1	CKP- CKP+
Explorer 4.0L, Explorer Sport Trac 4.0L, Mountaineer 4.0L, Mustang 4.0L, Ranger 4.0L	B	2 1	CKP- CKP+
All other vehicles	C	1 2	CKP- CKP+

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, F-150, Mark LT, MKX, Sable, Taurus, Taurus X	190 Pin	E47 E46	CKP+ CKP-
Escape/Mariner	150 (50-50-50) Pin	E34 E45	CKP+ CKP-
Expedition,	140 Pin	E47	CKP+

Fusion, Milan, MKZ, Navigator		E46	CKP-
Focus	190 Pin	E58 E42	CKP+ CKP-
All other vehicles	170 Pin	E47 E46	CKP+ CKP-

JD1 CHECK THE CKP SENSOR SIGNAL SENT TO THE PCM

NOTE: The battery should be fully charged and the starting system should be functioning properly.

- Disable the inertia switch.
- Key ON, engine OFF.
- Access the PCM and monitor the RPM PID.
- Crank the engine.
- **Is the RPM greater than 150 RPM?**

Yes	No
For DTC P1336 with no start, refer to **PINPOINT TEST A**. For DTC P1336, GO to **HD16**. For all others, the CKP, PCM, and harness are working properly. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	GO to **JD2**.

JD2 CHECK THE TIMING COVER, CKP SENSOR AND EXTERNAL TRIGGER WHEEL (OUTSIDE THE TIMING COVER) FOR OBVIOUS PHYSICAL DAMAGE

- Key in OFF position.
- Visually check the timing cover, CKP sensor and external trigger wheel (outside the timing cover) for obvious physical damage.
- **Do any parts appear physically damaged?**

Yes	No
REPAIR as necessary. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to **JD3**.

JD3 CHECK FOR PROPER CKP BIAS VOLTAGES IN THE PCM

- CKP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CKP Sensor Connector, Harness Side	(-) Vehicle Battery
CKP+	Negative terminal
CKP-	Negative terminal

- **Are the voltages between 1 - 3 V?**

Yes	No
GO to **JD4**.	GO to **JD6**.

JD4 CHECK THE CKP SENSOR RESISTANCE

- Key in OFF position.
- Measure the resistance between:

(+) CKP Sensor Connector, Component Side	(-) CKP Sensor Connector, Component Side
CKP+	CKP-

- **Is the resistance between 250 - 1K ohms?**

Yes	No
GO to **JD5**.	INSTALL a new CKP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

JD5 CHECK THE CKP HARNESS SHIELD GROUND

NOTE: **The harness shield protects the CKP signal from electrical noise and is grounded at one end, typically near the PCM.**

NOTE: Carry out the following resistance measurement between the CKP shield and the ground.

- Measure the resistance between:

(+) CKP_SHLD Assembly Connector, Harness Side	(-)
CKP_SHLD	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **JD6**.	REPAIR the open circuit. CHECK for a poor ground connection. CLEAR the DTCs. REPEAT the self-test.

JD6 CHECK FOR SHORT BETWEEN CKP(+) AND CKP(-) IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) CKP Sensor Connector, Harness Side	(-) CKP Sensor Connector, Harness Side
CKP+	CKP-

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **JD7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

JD7 CHECK THE CKP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) CKP Sensor Connector,	(-) PCM Connector, Harness Side

Harness Side	
CKP-	CKP-
CKP+	CKP+

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

Yes	No
GO to **JD8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

JD8 CHECK THE CKP CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) CKP Sensor Connector, Harness Side	(-) Vehicle Battery
CKP+	Negative terminal
CKP-	Negative terminal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **JD9**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

JD9 CHECK THE CKP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
CKP+	Negative terminal
CKP-	Negative terminal

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **JD10**.

JD10 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST JE: INTEGRATED IGNITION COIL PACK A, B, OR C FAILURE

This pinpoint test is intended to diagnose the following:

- ignition coil packs (12029)
- ignition coil harness
- IGN START/RUN circuit to coil packs
- powertrain control module (PCM) (12A650)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

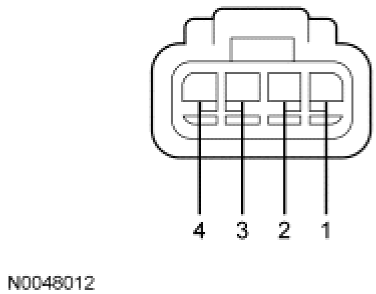

Fig. 161: Coil Pack Assembly Connector - A
Courtesy of FORD MOTOR CO.

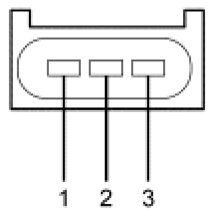

Fig. 162: Coil Pack Assembly Connector - B
Courtesy of FORD MOTOR CO.

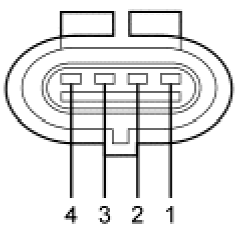

Fig. 163: Coil Pack Assembly Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
F-150	A	2 3 1 4	CD C CD B CD A IGN START/RUN
Ranger 2.3L	B	3 1 2	CD B CD A IGN START/RUN
Ranger 3.0L	A	2 1 3 4	CD C CD B CD A IGN START/RUN
Ranger 4.0L	C	3 4 2 1	CD C CD B CD A IGN START/RUN
All other vehicles	C	3 2 4 1	CD C CD B CD A IGN START/RUN

IGNITION COIL TO CYLINDER CORRELATION

Vehicle	Related DTC	Cylinder Number	Ignition Coil	Coil Driver (CD)	PCM Pin
2.3L Ranger	P0351	1	A	A	E17
	P0352	2	B	B	E12
	P0352	3	B	B	E12
	P0351	4	A	A	E17
3.0L/4.0L Ranger	P0351	1	A	A	E12
	P0353	2	C	C	E16
	P0352	3	B	B	E17
	P0352	4	B	B	E17
	P0351	5	A	A	E12
	P0353	6	C	C	E16
All others	P0351	1	A	A	E17
	P0353	2	C	C	E16
	P0352	3	B	B	E12
	P0352	4	B	B	E12
	P0351	5	A	A	E17
	P0353	6	C	C	E16

JE1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0350, P0351, P0352, or P0353 present?**

Yes	No
GO to **JE2**.	For all other DTCs, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

JE2 DETERMINE WHICH COIL IS NOT FIRING PROPERLY

NOTE: **Electronic ignition engine timing is entirely controlled by the PCM. Electronic ignition timing is NOT adjustable. Do not attempt to check base timing. You will receive false readings.**

- Determine which coil is not firing properly using the information from Pinpoint Test JB or a DTC and the table at the beginning of this pinpoint test.
- Record the suspect cylinder, coil and PCM pin number from the table.
- **Is the suspect cylinder number, coil driver and PCM pin number recorded?**

Yes	No
GO to **JE3**.	To obtain the required information, REPEAT step JE2.

JE3 DTC P0351, P0352, P0353: CHECK IGN START/RUN VOLTAGE TO THE COIL PACK

- Suspect coil connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Coil Pack Assembly Connector, Harness Side	(-)
IGN START/RUN	Ground

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

Yes	No
GO to **JE4**.	The IGN START/RUN has a circuit concern. CHECK the condition of the related fuses/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the IGN START/RUN circuit for a short to ground. REPAIR as necessary. CARRY OUT the misfire monitor drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . CLEAR the DTCs. REPEAT the self-test.

JE4 CHECK THE FUNCTIONALITY OF THE SUSPECT COIL DRIVER (CD) CIRCUIT

- Key in OFF position.
- Connect a test lamp between IGN START/RUN and the suspect CD circuit (determined from the table) at the coil pack harness connector.
- Crank the engine while the accelerator pedal is fully applied.
- Observe the test lamp while cranking the engine.
- **Does the test lamp blink consistently?**

Yes	No
GO to **JE8**.	GO to **JE5**.

JE5 CHECK THE SUSPECT CD CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Coil Pack Assembly Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect coil driver	Suspect coil driver

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **JE6**.	REPAIR the open circuit. CARRY out the misfire monitor drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . CLEAR the DTCs. REPEAT the self-test.

JE6 CHECK THE SUSPECT CD CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
Suspect coil driver	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CARRY out the misfire monitor drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . CLEAR the DTCs. REPEAT the self-test.	GO to **JE7**.

JE7 CHECK THE SUSPECT CD CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM	

Connector, Harness Side	(-)
Suspect coil driver	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **JE9**.	REPAIR the short circuit. CARRY out the misfire monitor drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . CLEAR the DTCs. REPEAT the self-test.

JE8 CHECK THE SUSPECT COIL FOR DAMAGE

- Key in OFF position.
- Remove the spark plug wire from the suspect coil tower (as determined from the table).
- Connect the Air Gap Spark Tester 303-D037 (D81P-6666-A) or equivalent to the suspect spark plug wire.
- Crank the engine while the accelerator pedal is fully applied.
- Observe the spark tester while cranking the engine.
- **Is a bluish-white spark present?**

Yes	No
refer to **PINPOINT TEST Z**.	INSTALL a new coil pack as needed. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CARRY out the misfire monitor drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . CLEAR the DTCs. REPEAT the self-test.

JE9 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH	

ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM) , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST JF: INTEGRATED IGNITION COIL ON PLUG COIL A THROUGH J FAILURE

This pinpoint test is intended to diagnose the following:

- ignition coils (12029)
- ignition coil harness
- ignition coils relay
- powertrain control module (PCM) (12A650)

N0073029

Fig. 164: Coil On Plug (COP) Connector - A
Courtesy of FORD MOTOR CO.

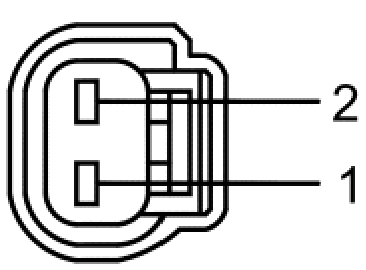

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Fig. 165: Coil On Plug (COP) Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit

Edge, MKX, MKZ, Taurus, Taurus X, Sable	A	1 3	COP IGN START/RUN
Escape/Mariner, Focus, Fusion, Milan, Mustang 5.4L	B	1 2	COP IGN START/RUN
All other vehicles	B	2 1	COP IGN START/RUN

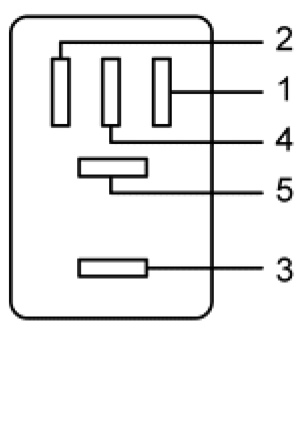

Fig. 166: Powertrain Control Module Power (PCM Power) Relay Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	GND (Ground)
2	IGN START/RUN
5	B+ (Battery Positive Voltage)
3	VPWR (Vehicle Power)

IGNITION COIL TO CYLINDER CORRELATION

Vehicle	Related DTC	Cylinder Number	Ignition Coil	Coil Driver (CD)	PCM Pin
2.3L Escape, 2.3L Mariner	P0351	1	A	A	E1
	P0352	2	B	D	E12
	P0353	3	C	B	E24

	P0354	4	D	C	E35
Focus	P0351	1	A	A	E70
	P0352	2	B	D	E50
	P0353	3	C	B	E66
	P0354	4	D	C	E69
2.3L Fusion, 2.3L Milan	P0351	1	A	A	E17
	P0352	2	B	D	E11
	P0353	3	C	B	E12
	P0354	4	D	C	E16
6-Cylinder Applications	P0351	1	A	A	E17
	P0352	2	B	C	E16
	P0353	3	C	E	E15
	P0354	4	D	B	E12
	P0355	5	E	D	E11
	P0356	6	F	F	E10
3.0L Escape, 3.0L Mariner	P0351	1	A	A	E1
	P0352	2	B	C	E12
	P0353	3	C	E	E24
	P0354	4	D	B	E35
	P0355	5	E	D	E36
	P0356	6	F	F	E22
8-Cylinder Applications	P0351	1	A	A	E17
	P0352	2	B	D	E11
	P0353	3	C	B	E12
	P0354	4	D	G	E14
	P0355	5	E	F	E10
	P0356	6	F	E	E15
	P0357	7	G	C	E16
	P0358	8	H	H	E9
10-Cylinder Applications	P0351	1	A	A	E17
	P0352	2	B	E	E11
	P0353	3	C	G	E12
	P0354	4	D	I	E14
	P0355	5	E	C	E10
	P0356	6	F	B	E15
	P0357	7	G	F	E16
	P0358	8	H	H	E9
	P0359	9	I	J	E13
	P0360	10	J	D	E8

JF1 DETERMINE WHICH COIL IS NOT FIRING PROPERLY

NOTE: Electronic ignition engine timing is entirely controlled by the PCM. Electronic ignition timing is NOT adjustable. Do not attempt to check base timing. You will receive false readings.

- Determine which coil is not firing properly using the information from Pinpoint Test JB or a DTC and the table at the beginning of this pinpoint test.
- Record the suspect cylinder, coil and PCM pin number from the table.
- **Is the suspect cylinder number, coil driver and PCM pin number recorded?**

Yes	No
GO to **JF2**.	REPEAT the test step to obtain the required information.

JF2 CHECK THE FUNCTIONALITY OF THE SUSPECT COIL DRIVER CIRCUIT

NOTE: This step may cause fuel pump related DTCs to set. Disregard any fuel pump related DTCs at this time.

NOTE: Test lamp bulb filament wattages vary widely. The intensity and duration of blinking depends on the test lamp being used.

- Key in OFF position.
- Suspect coil connector disconnected.
- Remove the fuel pump fuse to disable the fuel pump.
- Connect a non-powered test lamp between the IGN START/RUN and suspect coil driver, harness side.
- Observe the test lamp while cranking the engine.
- **Is the test lamp blinking consistently?**

Yes	No
GO to **JF3**.	GO to **JF4**.

JF3 CHECK THE FUNCTIONALITY OF THE SUSPECT COIL

- Key in OFF position.
- Carry out a visual inspection. Closely inspect the coil case and boot for carbon tracking, cracks and torn or improperly installed boots.
- Remove the suspect COP from the spark plug.
- Connect the Air Gap Spark Tester 303-DO37 (D81P-6666-A) or equivalent.
- Suspect coil connector connected.
- Crank the engine.
- Observe the spark tester while cranking the engine.

- **Is a bluish-white spark present?**

Yes	No
refer to **PINPOINT TEST Z**.	INSTALL a new suspect coil. If necessary, INSTALL a new spark plug. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

JF4 CHECK THE IGN START/RUN VOLTAGE TO THE SUSPECT COIL

- Key ON, engine OFF.
- Suspect coil connector disconnected.
- Measure the voltage between:

(+) COP Connector, Harness Side	(-) Vehicle Battery
IGN START/RUN	Negative terminal

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

Yes	No
GO to **JF5**.	For Crown Victoria, Grand Marquis, and Town Car, GO to **JF9**. For all others, REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

JF5 CHECK THE SUSPECT COIL DRIVER CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Suspect coil connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) COP Connector, Harness Side
Suspect coil driver	COP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **JF6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

JF6 CHECK THE SUSPECT COIL DRIVER CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
Suspect coil driver	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to **JF7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

JF7 CHECK THE SUSPECT COIL DRIVER CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
Suspect coil driver	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **JF12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test. If the concern or DTC is still present, GO to **JF8**.

JF8 CHECK THE SUSPECT COIL FOR DAMAGE

- PCM connector connected.
- Connect the Air Gap Spark Tester 303-D037 (D81P-6666-A) or equivalent to the suspect coil.

- Crank the engine while the accelerator pedal is fully applied.
- Observe the spark tester while cranking the engine.
- **Is a bluish-white spark present?**

Yes	No
If necessary, INSTALL a new spark plug. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	INSTALL a new suspect coil. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

JF9 CHECK VPWR CIRCUIT CONTINUITY BETWEEN THE SUSPECT COIL AND IGNITION COILS RELAY

- Key in OFF position.
- Ignition Coils Relay connector disconnected.
- Measure the resistance between:

(+) Ignition Coils Relay Connector, Harness Side	(-) Suspect coil Connector, Harness Side
VPWR - Pin 3	IGN START/RUN

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **JF10**.	REPAIR the open circuit. The open is between the splice and the ignition coils relay. CLEAR the DTCs. REPEAT the self-test.

JF10 CHECK THE B+ AND IGN START/RUN VOLTAGE TO IGNITION COILS RELAY

- Key ON, engine OFF.
- Measure the voltage between:

(+) Ignition Coils Relay Connector, Harness Side	(-)
B+ - Pin 5	Ground
IGN START/RUN - Pin 2	Ground

- **Are the voltages greater than 10 V?**

Yes	No
GO to **JF11**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

JF11 CHECK THE IGNITION COILS RELAY GND CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the voltage between:

(+) Ignition Coils Relay Connector, Harness Side	(-) Ignition Coils Relay Connector, Harness Side
B+ - Pin 5	GND - Pin 1

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

Yes	No
INSTALL a new Ignition Coils relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

JF12 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KA: FUEL PUMP (FP) RELAY

This pinpoint test is intended to diagnose the following:

- fuel pump relay (9345)
- inertia fuel shutoff (IFS) switch (9341)
- harness circuits: B+, VPWR, FP, GND, FPM, and FP PWR
- powertrain control module (PCM) (12A650)

The VPWR and FP circuits may be reversed in the harness connector. Refer to the Wiring Diagrams article for schematic and connector information.

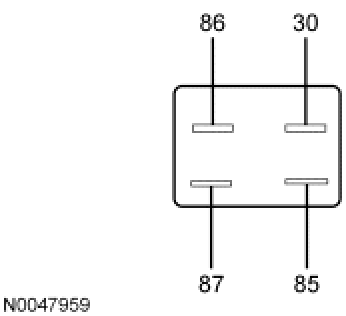

Fig. 167: Powertrain Control Module Power (PCM Power) Relay Connector - A
Courtesy of FORD MOTOR CO.

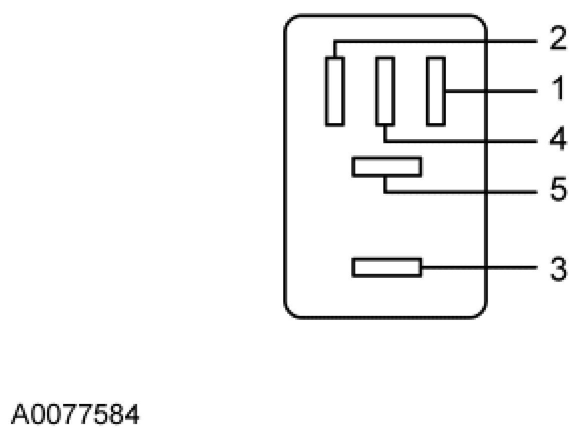

Fig. 168: Powertrain Control Module Power (PCM Power) Relay Connector - B
Courtesy of FORD MOTOR CO.

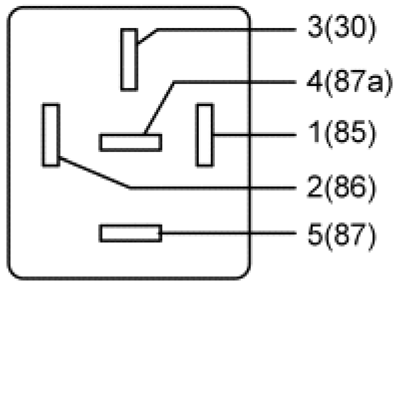

Fig. 169: Powertrain Control Module Power (PCM Power) Relay Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition, Focus, Navigator, Sable, Taurus, Taurus X	A	30 87 85 86	B+ FPPWR FP VPWR
Ranger	B	3 5 1 2	B+ FPPWR FP VPWR
All other vehicles	C	3 5 1 2	B+ FPPWR FP VPWR

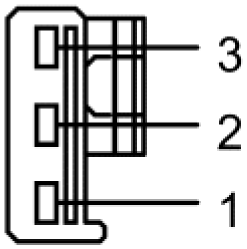

Fig. 170: Inertia Fuel Shutoff (IFS) Switch Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	FPPWR-B (Fuel Pump Power - B)
2	FPPWR-A (Fuel Pump Power - A)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Expedition, Fusion, Milan, MKZ, Navigator	140 Pin	B30 B62	FPM FP
Focus	190 Pin	B32 B19	FPM FP
Ranger	170 Pin	B21 B12	FPM FP
All other vehicles	190 Pin	B30 B62	FPM FP

KA1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0230, P0231, P0232, or P1641 present?**

Yes	No
For KOEO and KOER DTCs P0230 or P1641, GO to **KA2**. For continuous memory DTCs P0230 or P1641, GO	

to **KA32**. For KOEO and KOER DTC P0231, GO to **KA24**. For continuous memory DTC P0231, GO to **KA31**. For KOEO and KOER DTC P0232, GO to **KA12**. For continuous memory DTC P0232, GO to **KA29**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

KA2 KOEO AND KOER DTCS P0230 AND P1641: CHECK FOR THE PRESENCE OF DTC P0685 OR P0690

- Carry out the self-test.
- **Are DTCs P0685 or P0690 present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **KA3**.

KA3 CHECK THE VPWR VOLTAGE TO FUEL PUMP RELAY

- FP Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FP Relay Connector, Harness Side	(-)
VPWR	Ground

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

Yes	No
GO to **KA4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KA4 CHECK THE FUEL PUMP RELAY

- Key in OFF position.
- Carry out the FP relay component test. Refer to the Wiring Diagrams Cell 149 Component Testing.
- **Does the FP relay pass the component test?**

Yes	No
GO to **KA5**.	INSTALL a new FP relay. CLEAR the DTCs. REPEAT the self-test.

KA5 CHECK THE FP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FP Relay Connector, Harness Side	(-)
FP	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KA6**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KA6 CHECK THE FUEL PUMP CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) FP Relay Connector, Harness Side	(-)
FP	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KA7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KA7 CHECK THE FUEL PUMP CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FP Relay Connector, Harness Side	(-) PCM Connector, Harness Side
FP	FP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KA8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KA8 CHECK FOR KOEO DTCS

- Carry out the KOEO self-test.
- **Are DTCs P0231 or P0232 present?**

Yes	No
GO to **KA9**.	GO to **KA34**.

KA9 CHECK THE FP PRIMARY CIRCUIT INSIDE THE PCM

- PCM connector connected.
- FP Relay connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the FP_F PID.
- **Is the PID state YES?**

Yes	No
GO to **KA34**.	GO to **KA10**.

KA10 CHECK THE FUEL PUMP PRIMARY CIRCUIT INSIDE THE PCM WHILE CRANKING THE ENGINE

- Access the PCM and monitor the FP_F PID.
- While observing the PID, crank the engine.
- **Does the PID display indicate a concern during crank?**

Yes	No
GO to **KA34**.	The fuel pump primary circuit is OK in the harness and PCM. GO to **KA11**.

KA11 IS DTC P0231 PRESENT IN THE KOEO SELF-TEST?

- Carry out the KOEO self-test.
- **Is DTC P0231 present?**

Yes	No
GO to **KA24**.	GO to **KA12**.

KA12 KOEO AND KOER DTC P0232: DOES THE ENGINE START?

- **Does the engine start?**

Yes	No
GO to **KA13**.	GO to **KA18**.

KA13 VERIFY THE FUEL PUMP IS OFF

- Key ON, engine OFF.
- Wait for 5 seconds.
- The fuel pump is located above the fuel tank. Listen for the sound of the fuel pump operating which can be heard from outside the vehicle.
- **Is fuel pump off with the key ON?**

Yes	No
GO to **KA15**.	GO to **KA14**.

KA14 CHECK FOR FUEL PUMP RELAY CONTACTS ALWAYS CLOSED

- FP Relay connector disconnected.
- Key ON, engine OFF.
- **Is fuel pump off with the key ON?**

Yes	No
INSTALL a new FP relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the short circuit. The short circuit is between the FPPWR and FPM circuits or in the INJPWRM circuit. CLEAR the DTCs. REPEAT the self-test.

KA15 CHECK THE FPM CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- FP Relay connector disconnected.
- Measure the resistance between:

(+) FP Relay Connector, Harness Side	(-) PCM Connector, Harness Side
FPPWR	FPM

- **Is the resistance less than 5 ohms?**

Yes	No
	REPAIR the open circuit. The concern is between

GO to **KA16**.	the splice and the PCM. CLEAR the DTCs. REPEAT the self-test.

KA16 IS KOEO DTC P0231 PRESENT?

- Carry out the KOEO self-test.
- **Is DTC P0231 present?**

Yes	No
GO to **KA34**.	GO to **KA17**.

KA17 CHECK THE FPM PRIMARY CIRCUIT INSIDE THE PCM

- PCM connector connected.
- FP Relay connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- **Is the PID state OFF?**

Yes	No
The concern is not present at this time. The FPM circuit is OK in the harness and PCM. Disregard DTC P0232 at this time. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	GO to **KA34**.

KA18 CHECK IF THE INERTIA FUEL SHUTOFF (IFS) SWITCH IS TRIPPED

- **Is the IFS switch tripped?**

Yes	No
RESET the IFS switch. CLEAR the DTCs. REPEAT the self-test.	GO to **KA19**.

KA19 CHECK THE INERTIA FUEL SHUTOFF

- IFS Switch connector disconnected.
- Measure the resistance between:

(+) IFS Switch Connector, Component Side	(-) IFS Switch Connector, Component Side
FPPWR-A - Pin	FPPWR-B - Pin

2	1

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KA20**.	INSTALL a new IFS switch. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KA20 CHECK THE FP PWR CIRCUIT FOR AN OPEN IN THE HARNESS

- FP Relay connector disconnected.
- Measure the resistance between:

(+) IFS Switch Connector, Harness Side	(-) FP Relay Connector, Harness Side
FPPWR-A - Pin 2	FPPWR

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KA21**.	REPAIR the open circuit. CHECK for an open circuit between the IFS switch and the FPM splice. REFER to the Wiring Diagrams article for schematic and connector information. CLEAR the DTCs. REPEAT the self-test.

KA21 CHECK THE FUEL PUMP GROUND CIRCUIT FOR AN OPEN IN THE HARNESS

- FP connector disconnected.
- Measure the resistance between:

(+) FP Connector, Harness Side	(-)
FPGND	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
	REPAIR the open circuit. CLEAR the DTCs.

GO to **KA22**.	REPEAT the self-test.

KA22 CHECK THE FP PWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FP Connector, Harness Side	(-) IFS Switch Connector, Harness Side
FPPWR	FPPWR-B - Pin 1

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KA23**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KA23 CHECK THE INTERNAL RESISTANCE OF THE FUEL PUMP

- Measure the resistance between:

(+) FP Connector, Harness Side	(-) FP Connector, Harness Side
FPPWR	FPGND

- **Is the resistance less than 10 ohms?**

Yes	No
The fuel pump circuit is OK in the harness and PCM. Disregard DTC P0232 at this time. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	INSTALL a new FP. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KA24 KOEO AND KOER DTC P0231: IS KOEO DTC P0230 ALSO PRESENT?

- Carry out the KOEO self-test.
- **Is DTC P0230 present?**

Yes	No
GO to **KA3**.	GO to **KA25**.

KA25 DOES THE ENGINE START?

- **Does the engine start?**

Yes	No
GO to **KA15**.	GO to **KA26**.

KA26 CHECK IF THE IFS SWITCH IS TRIPPED

- **Is the IFS switch tripped?**

Yes	No
RESET the IFS switch. CLEAR the DTCs. REPEAT the self-test.	GO to **KA27**.

KA27 CHECK THE B+ CIRCUIT VOLTAGE TO THE FP RELAY

- FP Relay connector disconnected.
- Measure the voltage between:

(+) FP Relay Connector, Harness Side	(-)
B+	Ground

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

Yes	No
GO to **KA28**.	A B+ circuit concern is present. CHECK the condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before installing a new fuse/fuse link. CLEAR the DTCs. REPEAT the self-test.

KA28 CHECK THE FP PWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FP Relay Connector, Harness Side	(-)
FPPWR	Ground

- **Is the resistance less than 10 ohms?**

Yes	No
INSTALL a new FP relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. The open is between the splice and the FP relay. CLEAR the DTCs. REPEAT the self-test.

KA29 CONTINUOUS MEMORY DTC P0232: IS A CONTINUOUS DTC P0230 PRESENT?

- Retrieve the continuous memory DTCs.
- **Is DTC P0230 present?**

Yes	No
GO to **KA33**.	GO to **KA30**.

KA30 CHECK THE FUEL PUMP SECONDARY CIRCUITS FOR A CONCERN

NOTE: Be aware that DTC P0232 could be set if the IFS switch is tripped then reset, or if voltage is supplied to the FP PWR circuit when the PCM expects the fuel pump to be off. The fuel pump prime procedure produces this.

NOTE: The FPM PID turns ON when a concern is present.

- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- Observe the FPM PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FPPWR circuit between the FP RLY and the FP
  - Shake, wiggle, and bend the FP GND
  - Shake, wiggle, and bend the FPM circuit between the PCM and the splice to the FPPWR circuit
  - Shake, wiggle, and bend the INJPWRM circuit between the PCM and the splice to the FPPWR circuit
  - Lightly tap on the FP, IFS, and FP RLY to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KA31 CONTINUOUS MEMORY DTC P0231: CHECK THE HARNESS

- PCM connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A PCM Connector, Harness Side	Point B
FP	Ground

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
FPM	Ground

- The FP turns on and the voltage will be greater than 10 V.
- Check for an indication of a concern while carrying out the following. The voltage changes suddenly when a concern is present.
  - Shake, wiggle, and bend the B+ supply to the FP relay
  - Shake, wiggle, and bend the FP PWR circuit between the FP relay and the FPM splice
  - Lightly tap on the FP relay to simulate road shock
- Key in OFF position.
- Visually inspect the FP relay and its loom connector for damage and corrosion.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KA32 CONTINUOUS MEMORY DTC P0230: CHECK FOR THE PRESENCE OF DTC P0685 OR P0690

- Carry out the self-test.
- **Are DTCs P0685 or P0690 present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **KA33**.

KA33 CHECK THE FP PRIMARY CIRCUITS

NOTE: The PID indicates YES when a concern is present.

- Key ON, engine OFF.
- Wait for 5 seconds.
- Access the PCM and monitor the FP_F PID.
- Observe the FP_F PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FP circuit between the PCM and the FP relay
  - Shake, wiggle, and bend the VPWR circuit between the electronic engine control power relay and the FP relay
  - Lightly tap on the FP relay to simulate road shock
- Key in OFF position.
- Visually inspect the PCM connector and wires as far back as the main loom for damage.
- Visually inspect the FPR connector and wires as far back as the main loom for damage.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KA34 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KB: FUEL PUMP DRIVER MODULE

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- fuel pump driver module (FPDM) (9D370) and (9D372)
- FPDM power supply relay
- inertia fuel shutoff (IFS) switch (9341)
- harness circuits: B+, GND, FPC, FPM, FPM2, FP PWR, FP2PWR, FP RTN, FP2RTN, VPWR Fuel, VPWR Fuel 2, and PWRGND
- powertrain control module (PCM) (12A650)

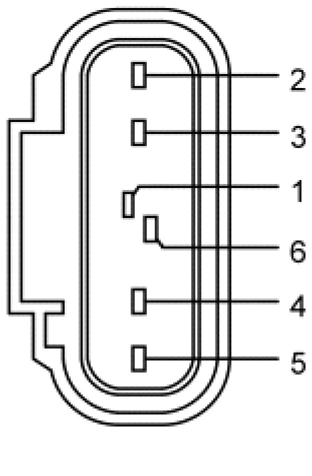

Fig. 171: Fuel Pump Driver Module (FPDM2) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	FPRTN (Fuel Pump Return)
4	FPPWR (Fuel Pump Power)
6	FPC (Fuel Pump Command)
1	FPM (Fuel Pump Monitor)
3	PWRGND (Power Ground)
5	VPWR Fuel

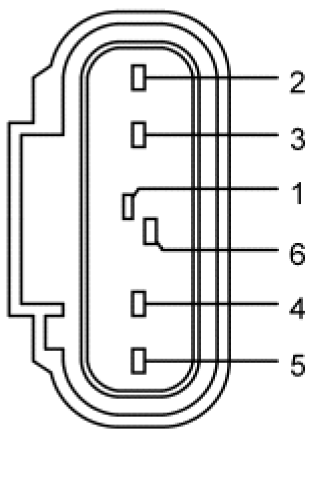

Fig. 172: Fuel Pump Driver Module 2 (FPDM2) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	FP2RTN (Fuel Pump 2 Return)
4	FP2PWR (Fuel Pump 2 Power)
6	FPC (Fuel Pump Command)
1	FPM2 (Fuel Pump Monitor 2 - Rear\Secondary Pump)
3	PWRGND (Power Ground)
5	VPWR Fuel 2

Refer to the Wiring Diagrams article for schematic and connector information. For F-150 and Mark LT, the FPDM PWR relay is integral to the PDJB.

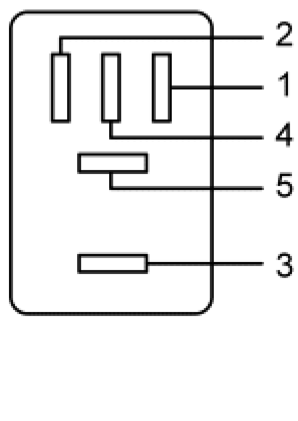

Fig. 173: Powertrain Control Module Power (PCM Power) Relay Connector - A

Courtesy of FORD MOTOR CO.

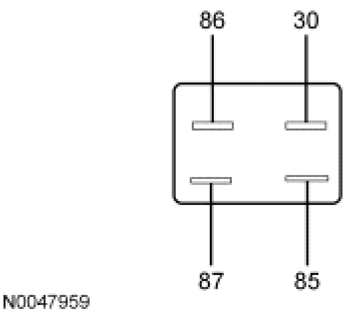

Fig. 174: Fuel Pump Driver Module Power (FPDM PWR) Relay Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Town Car	A	5 1 2 3	VPWR Fuel GND VPWR B+
Escape/Mariner, F-Super Duty	B	87 85 86 30	VPWR Fuel GND VPWR B+
All other vehicles	A	5 2 1 3	VPWR Fuel GND VPWR B+

Refer to the Wiring Diagrams article for schematic and connector information.

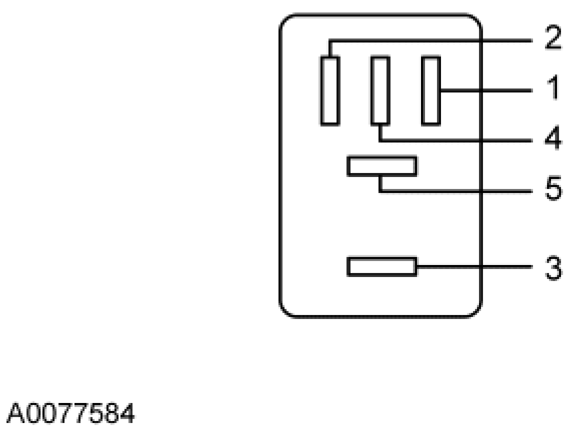

Fig. 175: Powertrain Control Module Power (PCM Power) Relay Connector - A

Courtesy of FORD MOTOR CO.

Pin	Circuit
5	VPWR Fuel 2
2	GND (Ground)
1	VPWR (Vehicle Power)
3	B+ (Battery Positive Voltage)

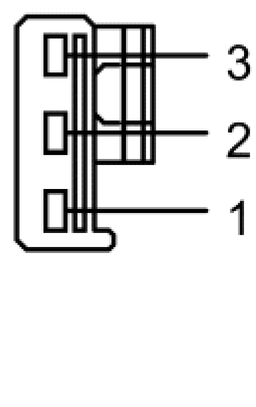

Fig. 176: Inertia Fuel Shutoff (IFS) Switch Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	VPWR Fuel - A
1	VPWR Fuel - B

This applies to applications with an FPDM PWR relay integral to the PDJB.

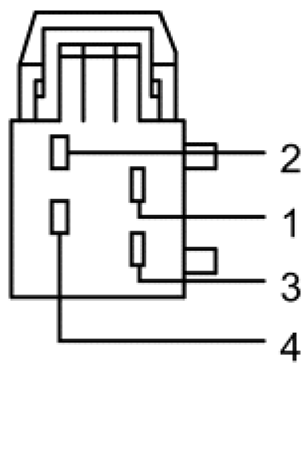

Fig. 177: Power Distribution Junction Box (PDJB) Connector - B
Courtesy of FORD MOTOR CO.

Pin	Circuit
3	VPWR Fuel

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B12 B21	FPC FPM
F-150, Mark LT	190 Pin	B62 B30	FPC FPM
Mustang 5.4L	170 Pin	T18 B12 B21	FPM2 FPC FPM
All other vehicles	170 Pin	B12 B21	FPC FPM

KB1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P1233, P1234, P1235, P1236, P1237, P1238, or P1641 present?**

Yes	No
For DTC P1233, GO to **KB2**. For DTC P1234, GO to **KB38**. For DTCs P1235 or P1641, GO to **KB20**. For DTC P1236, GO to **KB50**. For DTC P1237, GO to **KB26**. For DTC P1238, GO to **KB56**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

KB2 DTC P1233: IS DTC P1233 PRESENT IN THE KOEO SELF-TEST?

NOTE: The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1233 applies to the FPDM mounted on the driver side of the luggage compartment.

- Carry out the KOEO self-test.
- **Is DTC P1233 present?**

Yes	No
GO to **KB3**.	The PCM is now receiving a signal from the FPDM. One possible cause of DTC P1233 is that the IFS switch was tripped, then reset. For a no start (engine cranks), DISREGARD the DTC at this time. RETURN to the **SYMPTOM CHARTS** article Symptom Charts and continue as directed. After repairing the no start, to diagnose the intermittent causes of P1233, GO to **KB19**. For all others, GO to **KB19**.

KB3 DOES THE ENGINE START?

NOTE: The Mustang 5.4L starts with 1 FPDM disabled.

- **Does the engine start?**

Yes	No
For Mustang 5.4L, GO to **KB4**. For all others, to check the FPM circuit, GO to **KB15**.	VERIFY the IFS switch is set (button pressed). If OK, GO to **KB4**.

KB4 CHECK THE VOLTAGE AND GROUND CIRCUITS TO THE FPDM

- FPDM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-) FPDM Connector, Harness Side
VPWR Fuel - Pin 5	PWRGND - Pin 3

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

Yes	No
For Mustang 5.4L, to check the FPM circuit, GO to **KB15**. For all others, INSTALL a new FPDM. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **KB5**.

KB5 CHECK THE VOLTAGE TO THE FPDM

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
VPWR Fuel - Pin 5	Ground

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

Yes	No
REPAIR the open circuit. The FPDM ground circuit is open. CLEAR the DTCs. REPEAT the self-test.	There is no voltage to the FPDM. For F-150, and Mark LT, GO to **KB11**. For all others, GO to **KB6**.

KB6 CHECK THE B+ VOLTAGE TO THE FPDM POWER SUPPLY RELAY

- Key in OFF position.
- FPDM PWR Relay connector disconnected.
- Measure the voltage between:

(+) FPDM PWR Relay Connector, Harness Side	(-)
B+	Ground

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

Yes	No
	A B+ circuit concern is present. CHECK the

GO to **KB7**.	condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before installing a new fuse/fuse link. CLEAR the DTCs. REPEAT the self-test.

KB7 CHECK THE VPWR VOLTAGE TO THE FPDM POWER SUPPLY RELAY

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM PWR Relay Connector, Harness Side	(-)
VPWR	Ground

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

Yes	No
GO to **KB8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB8 CHECK FOR GROUND TO THE FPDM POWER SUPPLY RELAY

- Measure the resistance between:

(+) FPDM PWR Relay Connector, Harness Side	(-)
GND	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KB9**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB9 CHECK THE VPWR FUEL CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FPDM	(-) FPDM

Connector, Harness Side	PWR Relay Connector, Harness Side
VPWR Fuel - Pin 5	VPWR Fuel

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new FPDM relay. CLEAR the DTCs. REPEAT the self-test.	GO to **KB10**.

KB10 ISOLATE THE OPEN IN THE FPDM CIRCUIT

- IFS Switch connector disconnected.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-) IFS Switch Connector, Harness Side
VPWR Fuel - Pin 5	VPWR Fuel - B - Pin 1

- Measure the resistance between:

(+) FPDM PWR Relay Connector, Harness Side	(-) IFS Switch Connector, Harness Side
VPWR Fuel	VPWR Fuel - A - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new IFS switch. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . VERIFY the IFS switch is set (button pressed). CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB11 CHECK THE FUEL PUMP FUSE

NOTE: These steps are for applications with a FPDM PWR relay integral to the PDJB.

- Key in OFF position.
- Check the FPDM power supply relay fuse. Refer to the Wiring Diagrams article for schematic and connector information.
- **Is the fuse OK?**

Yes	No
GO to **KB12**.	INSTALL a new fuse. CHECK the associated circuits for a short to ground before installing the fuse. CLEAR the DTCs. REPEAT the self-test.

KB12 CHECK FOR VOLTAGE TO THE IFS SWITCH

- IFS Switch connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) IFS Switch Connector, Harness Side	(-)
VPWR Fuel - A - Pin 2	Ground

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

Yes	No
GO to **KB14**.	GO to **KB13**.

KB13 CHECK THE VPWR FUEL CIRCUIT FOR AN OPEN BETWEEN THE IFS AND PDJB

- Key in OFF position.
- PDJB connector disconnected. Refer to the Wiring Diagrams article for schematic and connector information.
- Measure the resistance between:

(+) IFS Switch Connector, Harness Side	(-) PDJB Connector, Harness Side
VPWR Fuel - A - Pin 2	VPWR Fuel - Pin 3

- **Is the resistance less than 5 ohms?**

Yes	No
CHECK the fuel pump fuse. REPAIR as necessary. If OK, INSTALL a new FP RLY/PDJB. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB14 CHECK THE IFS FOR AN OPEN

- Key in OFF position.
- Measure the resistance between:

(+) IFS Switch Connector, Component Side	(-) IFS Switch Connector, Component Side
VPWR Fuel - A - Pin 2	VPWR Fuel - B - Pin 1

- **Is the resistance less than 5 ohms?**

Yes	No
REPAIR the open circuit. The VPWR fuel circuit is open. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new IFS switch. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB15 CHECK THE FPM CIRCUIT FOR AN OPEN IN THE HARNESS

- FPDM connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-) PCM Connector, Harness Side
FPM - Pin 1	FPM

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KB16**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB16 CHECK THE FPM CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	**(-)**
FPM - Pin 1	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KB17**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB17 CHECK THE FPM CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	**(-)**
FPM - Pin 1	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KB18**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB18 CHECK FOR FPM OUTPUT FROM THE FPDM

NOTE: It is OK for the voltage to cycle below this range and then return within range.

- FPDM connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	**(-)**
FPM	Ground

- **Is the voltage between 0.02 - 1 V?**

Yes	No
GO to **KB64**.	INSTALL a new FPDM. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB19 CHECK THE CIRCUITS THAT MAY CAUSE AN INTERMITTENT LOSS OF VOLTAGE TO THE FPDM

NOTE: **Be aware that P1233 could be set if the IFS switch is tripped then reset.**

NOTE: **With no concern present, the FPDM sends a 50% duty cycle (all OK) to the PCM on the FPM circuit. Depending on the scan tool type, the FPM PID may display 50%, or a random value that is fluctuating between 85% and 115%.**

- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- Observe the FPM PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the PWRGND circuit to the FPDM
  - Shake, wiggle, and bend the VPWR fuel circuit to the FPDM
  - Shake, wiggle, and bend the FPM circuit between the FPDM and the PCM
  - Shake, wiggle, and bend the B+ and ground circuits to the FPDM power supply relay
  - Lightly tap on the IFS switch to simulate road shock
  - Lightly tap on the FPDM to simulate road shock
  - Lightly tap on the FPDM power supply relay to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KB20 DTC P1235: IS DTC P1235 PRESENT IN THE KOEO SELF-TEST?

NOTE: **The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1235 applies to the FPDM mounted on the driver side of the luggage compartment.**

NOTE: **For ETC applications, check if ETC DTC P2105 is present. An ETC system concern could cause P1235, and should be diagnosed first.**

- Carry out the KOEO self-test.
- **Is DTC P1235 present?**

Yes	No
GO to **KB21**.	GO to **KB25**.

KB21 CHECK THE FPC CIRCUIT FOR AN OPEN IN THE HARNESS

- FPDM connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FPDM Connector, Harness Side
FPC	FPC - Pin 6

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KB22**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB22 CHECK THE FPC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- FPDM2 connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
FPC - Pin 6	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KB23**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB23 CHECK THE FPC CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.

- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-)
FPC - Pin 6	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KB24**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB24 CHECK THE FPC CIRCUIT IN THE FPDM

- FPDM connector connected.
- FPDM2 connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
FPC	Ground

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

Yes	No
GO to **KB64**.	INSTALL a new FPDM. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB25 CHECK THE FPC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORTS

NOTE: **With no concern present, the FPDM sends a 50% duty cycle (all OK) to the PCM on the FPM circuit. Depending on the scan tool type, the FPM PID may display 50%, or a random value that is fluctuating between 85% and 115%.**

- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- Observe the FPM PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FPC circuit between FPDM and the PCM

- Lightly tap on the FPDM to simulate road shock

- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KB26 DTC P1237: IS DTC P1237 PRESENT IN THE KOEO SELF-TEST?

NOTE: The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1237 applies to the FPDM mounted on the driver side of the luggage compartment.

- Carry out the KOEO self-test.
- **Is DTC P1237 present?**

Yes	No
GO to **KB27**.	DTC P1237 is possibly intermittent, GO to **KB33**.

KB27 DOES THE ENGINE START?

NOTE: The Mustang 5.4L starts with 1 FPDM disabled.

- FPDM2 connector disconnected.
- **Does the engine start?**

Yes	No
GO to **KB36**.	GO to **KB28**.

KB28 CHECK THE FPPWR, FPRTN AND INTERNAL FUEL PUMP CIRCUIT RESISTANCE

- Key in OFF position.
- FPDM connector disconnected.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-) FPDM Connector, Harness Side
FPPWR - Pin 4	FPRTN - Pin 2

- **Is the resistance less than 10 ohms?**

Yes	No
GO to **KB29**.	ISOLATE the concern, GO to **KB32**.

KB29 CHECK THE FPRTN CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
FPRTN - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KB30**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB30 CHECK THE FPPWR CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- FP connector disconnected.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-)
FPPWR - Pin 4	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KB31**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB31 CHECK FOR VOLTAGE TO FP

NOTE: During output test mode, the fuel pump stays commanded on for only about 5 seconds.

- FPDM connector connected.
- FP connector disconnected.

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Measure the voltage between:

(+) FP Connector, Harness Side	(-) FP Connector, Harness Side
FPPWR	FPRTN

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

Yes	No
INSTALL a new FP. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	VERIFY the vehicle battery was at a proper charge during the test. VERIFY the pump ON command did not time out before the voltage check was made. REPEAT as necessary. If OK, INSTALL a new FPDM. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB32 ISOLATE THE OPEN CIRCUIT

- FP connector disconnected.
- Measure the resistance between:

(+) FP Connector, Harness Side	(-) FPDM Connector, Harness Side
FPPWR	FPPWR - Pin 4
FPRTN	FPRTN - Pin 2

- Measure the resistance between:

(+) FP Connector, Component Side	(-) FP Connector, Component Side
FPPWR	FPRTN

- **Is the resistance less than 10 ohms?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	REPAIR the open circuit. If the open is internal to the pump, INSTALL a new FP. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB33 VERIFY THE DTC P1237 IS INTERMITTENT

- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- **Is the FPM PID 75% (or varying between 250% and 400%)?**

Yes	No
A concern is present. GO to **KB27**.	CHECK for an intermittent concern, GO to **KB34**.

KB34 CHECK THE FPPWR AND FPRTN CIRCUIT FOR AN INTERMITTENT OPEN OR SHORTS

NOTE: With no concern present, the FPDM sends a 50% duty cycle (all OK) to the PCM on the FPM circuit. Depending on the scan tool type, the FPM PID may display 50%, or a random value that is fluctuating between 85% and 115%.

- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- Observe the FPM PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FPPWR and FPRTN circuits between the FPDM and the FP
  - Lightly tap on the FP and FPDM to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KB35**.

KB35 CHECK THE FPPWR CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

NOTE: The lamp turns on when a concern is present.

- Key in OFF position.
- FPDM connector disconnected.
- Connect a non-powered test lamp between:

(+) FPDM Connector, Harness Side	(-) FPDM Connector, Harness Side
FPPWR - Pin 4	VPWR Fuel - Pin 5

- Key ON, engine OFF.
- Observe the test lamp for an indication of a concern. Shake, wiggle, and bend the FPPWR circuit between the FPDM and the FP.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KB36 CHECK THE FPPWR CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- FPDM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
FPPWR - Pin 4	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KB37**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB37 CHECK THE FPRTN CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- FPDM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-) FPDM Connector, Harness Side
VPWR Fuel -	FPRTN - Pin 2

Pin 5	

- **Is the voltage less than 1 V?**

Yes	No
INSTALL a new FPDM. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB38 DTC P1234: IS DTC P1234 PRESENT IN THE KOEO SELF-TEST?

NOTE: **The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1234 applies to the FPDM2 mounted on the passenger side of the luggage compartment.**

- Carry out the KOEO self-test.
- **Is DTC P1234 present?**

Yes	No
GO to **KB39**.	The PCM is now receiving a signal from FPDM2. One possible cause of DTC P1234 is that the IFS switch was tripped, then reset. GO to **KB49**.

KB39 CHECK THE VOLTAGE AND GROUND CIRCUITS TO THE FPDM2

- FPDM2 connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM2 Connector, Harness Side	(-) FPDM2 Connector, Harness Side
VPWR Fuel 2 - Pin 5	PWRGND - Pin 3

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

Yes	No
To check the FPM2 circuit, GO to **KB45**.	GO to **KB40**.

KB40 CHECK VOLTAGE TO FPDM2

- Measure the voltage between:

(+) FPDM2 Connector, Harness Side	(-)
VPWR Fuel 2 - Pin 5	Ground

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

Yes	No
REPAIR the open circuit. The FPDM2 ground circuit is open. CLEAR the DTCs. REPEAT the self-test.	There is no voltage to the FPDM2. GO to **KB41**.

KB41 CHECK THE B+ VOLTAGE TO THE FPDM2 POWER SUPPLY RELAY

- Key in OFF position.
- FPDM2 PWR Relay connector disconnected.
- Measure the voltage between:

(+) FPDM2 PWR Relay Connector, Harness Side	(-)
B+ - Pin 3	Ground

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

Yes	No
GO to **KB42**.	A B+ circuit concern is present. CHECK the condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before installing a new fuse/fuse link. CLEAR the DTCs. REPEAT the self-test.

KB42 CHECK THE VPWR VOLTAGE TO THE FPDM2 POWER SUPPLY RELAY

- Measure the voltage between:

(+) FPDM2 PWR Relay Connector,	(-)

Harness Side	
VPWR - Pin 1	Ground

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

Yes	No
GO to **KB43**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB43 CHECK FOR GROUND TO THE FPDM2 POWER SUPPLY RELAY

- Key in OFF position.
- Measure the resistance between:

(+) FPDM2 PWR Relay Connector, Harness Side	(-)
GND - Pin 2	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KB44**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB44 CHECK THE VPWR FUEL 2 CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-) FPDM2 PWR Relay Connector, Harness Side
VPWR Fuel 2 - Pin 5	VPWR Fuel 2 - Pin 5

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new FPDM2 PWR relay. CLEAR the DTCs. REPEAT the self-test.	GO to **KB49**.

KB45 CHECK THE FPM2 CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- FPDM2 connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-) PCM Connector, Harness Side
FPM2 - Pin 1	FPM2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KB46**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB46 CHECK THE FPM2 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM2 Connector, Harness Side	(-)
FPM2 - Pin 1	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KB47**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB47 CHECK THE FPM2 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-)
FPM2 - Pin 1	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KB48**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB48 CHECK FOR FPM2 OUTPUT FROM THE FPDM2

NOTE: It is OK for the voltage to cycle below this range and then return within range.

- FPDM2 connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
FPM2	Ground

- **Is the voltage between 0.02 - 1 V?**

Yes	No
GO to **KB64**.	INSTALL a new FPDM2. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB49 CHECK CIRCUITS THAT MAY CAUSE AN INTERMITTENT LOSS OF VOLTAGE SUPPLY TO THE FPDM2

NOTE: Be aware that P1234 could be set if the IFS switch is tripped then reset.

NOTE: With no concern present, the FPDM2 sends a 50% duty cycle (all OK) to the PCM on the FPM2 circuit. Depending on the scan tool type, the FPM2 PID may display 50%, or a random value that is fluctuating between 85% and 115%.

- Key ON, engine OFF.
- Access the PCM and monitor the FPM2 PID.
- Observe the FPM2 PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the PWRGND circuit to the FPDM2
  - Shake, wiggle, and bend the VPWR fuel 2 circuit to the FPDM2
  - Shake, wiggle, and bend the FPM2 circuit between the FPDM2 and the PCM
  - Shake, wiggle, and bend the B+ and ground circuits to the FPDM2 power supply relay
  - Lightly tap on the IFS switch to simulate road shock

- Lightly tap on the FPDM2 to simulate road shock
- Lightly tap on the FPDM2 power supply relay to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KB50 DTC P1236: IS DTC P1236 PRESENT IN THE KOEO SELF-TEST?

- The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1236 applies to the FPDM2 mounted on the passenger side of the luggage compartment.
- Carry out the KOEO self-test.
- **Is DTC P1236 present?**

Yes	No
GO to **KB51**.	GO to **KB55**.

KB51 CHECK THE FPC CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- FPDM2 connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FPDM2 Connector, Harness Side
FPC	FPC - Pin 6

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KB52**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB52 CHECK THE FPC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- FPDM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM2 Connector, Harness Side	(-)
FPC - Pin 6	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KB53**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB53 CHECK THE FPC CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-)
FPC - Pin 6	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KB54**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB54 CHECK THE FPC CIRCUIT IN THE FPDM2

- FPDM2 connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
FPC	Ground

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

Yes	No
GO to **KB64**.	INSTALL a new FPDM2. REFER to the **FUEL SYSTEM - GENERAL INFORMATION -**

	GASOLINE AND DIESEL -- E-SERIES . CLEAR the DTCs. REPEAT the self-test.

KB55 CHECK THE FPC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORTS

NOTE: With no concern present, the FPDM2 sends a 50% duty cycle (all OK) to the PCM on the FPM2 circuit. Depending on the scan tool type, the FPM2 PID may display 50%, or a random value that is fluctuating between 85% and 115%.

- Key ON, engine OFF.
- Access the PCM and monitor the FPM2 PID.
- Observe the FPM2 PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FPC circuit between FPDM2 and the PCM
  - Lightly tap on the FPDM2 to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KB56 DTC P1238: IS DTC P1238 PRESENT IN THE KOEO SELF-TEST?

NOTE: The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1238 applies to the FPDM2 mounted on the passenger side of the luggage compartment.

- Carry out the KOEO self-test.
- **Is DTC P1238 present?**

Yes	No
GO to **KB57**.	CHECK for an intermittent concern, GO to **KB63**.

KB57 CHECK THE FP2PWR, FP2RTN AND INTERNAL FUEL PUMP CIRCUIT RESISTANCE

- Key in OFF position.
- FPDM2 connector disconnected.
- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-) FPDM2 Connector, Harness Side
FP2PWR - Pin 4	FP2RTN - Pin 2

- **Is the resistance less than 10 ohms?**

Yes	No
GO to **KB58**.	ISOLATE the concern, GO to **KB62**.

KB58 CHECK THE FP2PWR AND FP2RTN CIRCUIT(S) FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- FP connector disconnected. Refer to the Wiring Diagrams article for schematic and connector information.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM2 Connector, Harness Side	(-)
FP2PWR - Pin 4	Ground
FP2RTN - Pin 2	Ground

- **Are the voltages less than 1 V?**

Yes	No
GO to **KB59**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB59 CHECK THE FP2PWR AND FP2RTN CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-)
FP2PWR - Pin 4	Ground
FP2RTN - Pin 2	Ground

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **KB60**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB60 CHECK FOR A SHORT BETWEEN THE FP2PWR AND FP2RTN CIRCUITS

- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-) FPDM2 Connector, Harness Side
FP2PWR - Pin 4	FP2RTN - Pin 2

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KB61**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB61 CHECK FOR VOLTAGE TO THE FP

NOTE: During output test mode, the fuel pump stays commanded on for only about 5 seconds.

- FPDM2 connector connected.
- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Measure the voltage between:

(+) FP Connector, Harness Side	(-) FP Connector, Harness Side
FP2PWR	FP2RTN

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

Yes	No
INSTALL a new FP. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	VERIFY the vehicle battery was at a proper charge during the test. VERIFY the pump ON command did not time out before the voltage check was made. REPEAT as necessary. If OK, INSTALL a new FPDM2. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB62 ISOLATE THE OPEN CIRCUIT

- FP connector disconnected. Refer to the Wiring Diagrams article for schematic and connector information.
- Measure the resistance between:

(+) FP Connector, Harness Side	(-) FPDM2 Connector, Harness Side
FP2PWR	FP2PWR - Pin 4
FP2RTN	FP2RTN - Pin 2

- Measure the resistance between:

(+) FP Connector, Component Side	(-) FP Connector, Component Side
FP2PWR	FP2RTN

- **Is the resistance less than 10 ohms?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	REPAIR the open circuit. If the open is internal to the pump, INSTALL a new FP. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB63 CHECK THE FP2PWR AND FP2RTN CIRCUIT FOR AN INTERMITTENT OPEN OR SHORTS

NOTE: With no concern present, the FPDM2 sends a 50% duty cycle (all OK) to the PCM on the FPM2 circuit. Depending on the scan tool type, the FPM2 PID may display 50%, or a random value that is fluctuating between 85% and 115%.

- Key ON, engine OFF.
- Access the PCM and monitor the FPM2 PID.
- Observe the FPM2 PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FP2PWR and FP2RTN circuits between the FPDM2 and the FP
  - Lightly tap on the FP and FPDM2 to simulate road shock
- **Is a concern present?**

Yes	No

ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

KB64 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
    - pushed out pins
    - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KD: ELECTRIC EXHAUST GAS RECIRCULATION (EEGR) SYSTEM

This pinpoint test is intended to diagnose the following:

- EEGR system
- EEGR stepper motor (9D475)
- harness circuits: EGRMC1, EGRMC2, EGRMC3, EGRMC4 and VPWR
- powertrain control module (PCM) (12A650)

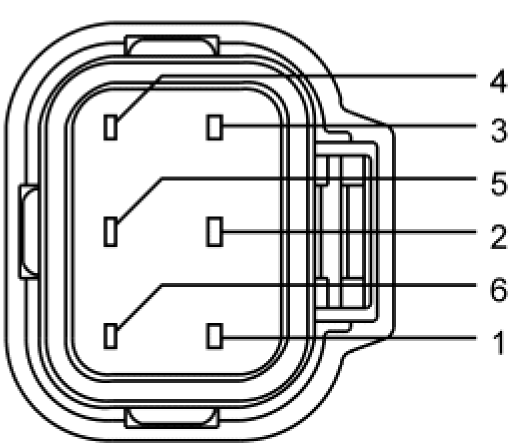

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Fig. 178: Electric Exhaust Gas Recirculation (EEGR) Assembly Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
6	EGRMC4 (EGR Motor Control 4)
4	EGRMC3 (EGR Motor Control 3)
3	EGRMC2 (EGR Motor Control 2)
1	EGRMC1 (EGR Motor Control 1)
5	VPWR (Vehicle Power)
2	VPWR (Vehicle Power)

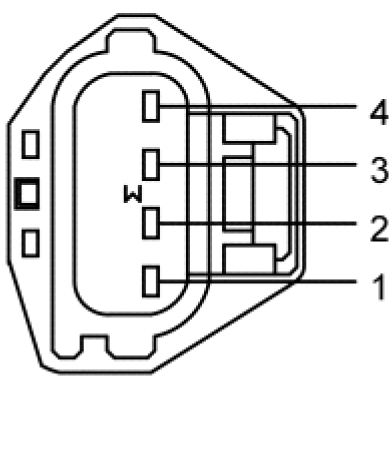

Fig. 179: Manifold Absolute Pressure (MAP) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	MAP (Manifold Absolute Pressure)
4	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B35 E11 E10 E9 E8	VPWR EGRMC4 EGRMC3 EGRMC2 EGRMC1
Focus	190 Pin	B67 E56	VPWR EGRMC4

		E54 E37 E36	EGRMC3 EGRMC2 EGRMC1
Ranger	170 Pin	B35 E56 E39 E13 E8	VPWR EGRMC4 EGRMC3 EGRMC2 EGRMC1
All other vehicles	140 Pin	B51 E9 E8 E7 E6	VPWR EGRMC4 EGRMC3 EGRMC2 EGRMC1

KD1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0400, P0403, or P1408 present?**

Yes	No
For DTCs P0400 and P1408, GO to **KD9**. For DTC P0403, GO to **KD2**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

KD2 DTC P0403: EGR CONTROL CIRCUIT - CHECK THE CONNECTION OF THE EEGR HARNESS CONNECTOR TO THE EEGR

NOTE: **If the DTC is intermittent, wiggle the harness and connectors when taking measurements.**

- Check the connection of the EEGR harness connector to the EEGR.
- **Are the connector contacts clean and correctly seated?**

Yes	No
GO to **KD3**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

KD3 CHECK FOR VPWR AT THE EEGR HARNESS CONNECTOR

- Key ON, engine OFF.
- EEGR Assembly connector disconnected.
- Measure the voltage between:

(+) EEGR Assembly Connector,	(-) Vehicle Battery

Harness Side	
VPWR - Pin 2	Negative terminal
VPWR - Pin 5	Negative terminal

- **Are the voltages greater than 10 V?**

Yes	No
GO to **KD4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KD4 CHECK THE EEGR CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) EEGR Assembly Connector, Harness Side	(-) PCM Connector, Harness Side
EGRMC1 - Pin 1	EGRMC1
EGRMC2 - Pin 3	EGRMC2
EGRMC3 - Pin 4	EGRMC3
EGRMC4 - Pin 6	EGRMC4

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

Yes	No
GO to **KD5**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KD5 CHECK THE EEGR CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) EEGR Assembly Connector,	(-) Vehicle Battery

Harness Side	
EGRMC1 - Pin 1	Negative terminal
EGRMC2 - Pin 3	Negative terminal
EGRMC3 - Pin 4	Negative terminal
EGRMC4 - Pin 6	Negative terminal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **KD6**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KD6 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE EEGR HARNESS

NOTE: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
EGRMC3	EGRMC1
EGRMC3	EGRMC2
EGRMC3	EGRMC4
EGRMC1	EGRMC2
EGRMC1	EGRMC4
EGRMC2	EGRMC4

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to **KD7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KD7 CHECK THE EEGR CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) EEGR Assembly Connector, Harness Side	(-) Vehicle Battery
EGRMC1 - Pin 1	Negative terminal
EGRMC2 - Pin 3	Negative terminal
EGRMC3 - Pin 4	Negative terminal
EGRMC4 - Pin 6	Negative terminal

- **Are the voltages greater than 0.1 V?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **KD8**.

KD8 CHECK THE EEGR COILS FOR AN OPEN

- Key in OFF position.
- Measure the resistance between:

(+) EEGR Assembly Connector, Component Side	(-) EEGR Assembly Connector, Component Side
EGRMC1 - Pin 1	VPWR - Pin 2
EGRMC2 - Pin 3	VPWR - Pin 2
EGRMC3 - Pin 4	VPWR - Pin 5
EGRMC4 - Pin 6	VPWR - Pin 5

- **Are the resistances between 15 - 24 ohms?**

Yes	No
GO to **KD12**.	INSTALL a new EEGR assembly. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** .

	CLEAR the DTCs. REPEAT the self-test.

KD9 DTCS P0400 AND P1408: CHECK FOR STUCK OR STICKY EGR VALVE OPERATION BY COMPARING ACTUAL MAP VOLTAGE TO MAP PID VOLTAGE

NOTE: Repair the following DTCs first, if present: P0102, P0103, P0107, P0108, P1100, P1101.

- Key in OFF position.
- MAP Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A MAP Sensor Connector, Harness Side	Point B MAP Sensor Connector, Component Side
VREF - Pin 2	VREF - Pin 2
SIGRTN - Pin 4	SIGRTN - Pin 4

- Key ON, engine running.
- Measure the voltage between:

(+) MAP Sensor Connector, Component Side	(-) Vehicle Battery
MAP - Pin 1	Negative terminal

- **Is the voltage between 1 - 2 V?**

Yes	No
GO to **KD10**.	CHECK the MAP harness for open and short circuits.

KD10 COMPARE ACTUAL MAP VOLTAGE TO MAP PID VOLTAGE EGR

- Key in OFF position.
- Remove the jumper wires.
- MAP Sensor connected.
- Record the actual MAP voltage values at KOEO, idle, 1,000 and 2,000 RPM.

- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- Note the MAP PID voltage.
- Key ON, engine running.
- Note the MAP PID voltage.
- Increase engine speed to 1,000 RPM.

  Note the MAP PID voltage.

- Increase engine speed to 2,000 RPM.

  Note the MAP PID voltage.

- **Does the MAP PID voltage stay within 0.5 V of the actual MAP voltage?**

Yes	No
The concern is not present at this time. Make sure the MAP sensor is correctly seated and the vacuum source is not blocked.	GO to **KD11**.

KD11 CARRY OUT THE KOER SELF-TEST

- **Is DTC P1408 retrieved again?**

Yes	No
INSTALL a new EEGR assembly. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	REFER to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** .

KD12 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH**	

ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM) , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KE: IDLE AIR CONTROL (IAC) VALVE

This pinpoint test is intended to diagnose the following:

- idle air control (IAC) valve (9F715)
- harness circuits: IAC, PWR and B+ (IAC-RC)
- powertrain control module (PCM) (12A650)

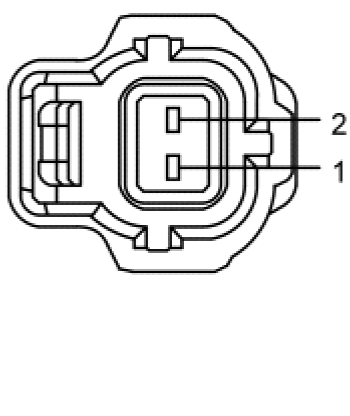

Fig. 180: Idle Air Control (IAC) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	IAC (Idle Air Control)
1	PWR (POWER)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	E39	IAC
Ranger	170 Pin	E33	IAC

KE1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0505, P0506, P0507, P0511, P1504, P1506, or P1507 present?**

Yes	No
For DTCs P0505, P0506, P0511, P1504 or P1507, GO to **KE2**. For DTCs P0507 or P1506, GO to **KE15**.	For all other symptoms without DTCs, GO to **KE2**.

KE2 DTCS P0505, P0506, P0511, P1504 OR P1507: CHECK FOR INLET AIR LEAKS (OR STARTS ONLY AT PART THROTTLE)

- With the engine running at idle (if possible), listen for vacuum leaks.
- Inspect the entire intake air system from the mass air flow (MAF) sensor to the intake manifold for leaks such as:
  - damaged or loose IAC air tubes.
  - cracked or punctured intake air tube.
  - loose intake air tube at the air cleaner housing or throttle body.
  - IAC valve or gasket seal.
  - EGR valve gasket seal.
  - vacuum supply connector and hose.
  - PCV valve, connectors and hoses.
- **Are any leaks present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KE3**.

KE3 CHECK FOR VOLTAGE TO THE IAC SOLENOID

NOTE: If EGR DTC P0402 is output during the self-test, diagnose it first before continuing with this pinpoint test.

- IAC connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) IAC Connector, Harness Side	(-) Vehicle Battery
PWR - Pin 1	Negative terminal

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

Yes	No

GO to **KE4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KE4 CHECK THE RESISTANCE OF THE IAC VALVE

- Key in OFF position.
- IAC connector disconnected.
- Measure the resistance between:

(+) IAC Connector, Component Side	(-) IAC Connector, Component Side
PWR - Pin 1	IAC - Pin 2

- **Is the resistance between 6 ohms - 15 ohms?**

Yes	No
GO to **KE5**.	INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KE5 CHECK THE IAC VALVE FOR AN INTERNAL SHORT TO THE IAC CASE

- Measure the resistance between:

(+) IAC Connector, Component Side	(-) IAC Connector, Component Side
IAC - Pin 2	IAC Case

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KE6**.	INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KE6 CHECK THE IAC CIRCUIT FOR AN OPEN IN THE HARNESS

- IAC connector disconnected.

- PCM connector disconnected.
- Measure the resistance between:

(+) IAC Connector, Harness Side	(-) PCM Connector, Harness Side
IAC - Pin 2	IAC

- **Is the resistance less than 5 ohms?**

Yes	No
For IAC-RC applications, GO to **KE7**. For all others, GO to **KE8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KE7 CHECK IAC-RC FOR VOLTAGE

- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
IAC-RC	Ground

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

Yes	No
GO to **KE8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KE8 CHECK THE IAC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
IAC	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No

GO to **KE9**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KE9 CHECK THE IAC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
IAC	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KE10**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KE10 CHECK FOR A DROP IN IDLE RPM WITH THE IAC DISCONNECTED

- PCM connector connected.
- IAC connector connected.
- Key ON, engine running.
- Bring the engine to normal operating temperature.
- Transmission in PARK or NEUTRAL.
- Disconnect the IAC valve.
- **Does the RPM drop or the engine stall?**

Yes	No
GO to **KE12**.	GO to **KE11**.

KE11 CHECK FOR A STUCK IAC PINTLE

- Key in OFF position.
- Inspect the entire intake air system for debris, blockage or other damage.
- Remove and inspect the IAC valve and check the pintle movement.
- Check the air tubes (if equipped) for blockage or damage.
- Remove and inspect the air cleaner element for excessive dirt.
- **Is the IAC valve OK?**

Yes	No

GO to **KE12**.	INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KE12 VERIFY THE DTC

- **Is DTC P0511 or P1504 present in continuous memory or from the KOER self-test?**

Yes	No
GO to **KE22**.	GO to **KE13**.

KE13 CHECK THE IAC SIGNAL FROM THE PCM

NOTE: **If stalling occurs, place a shim under the hard stop screw to maintain idle conditions.**

NOTE: **With the engine at normal operating temperature, closed throttle and all accessories off, the IAC duty cycle should be between approximately 22% and 65%.**

- PCM connector connected.
- IAC connector connected.
- Key ON, engine running.
- Access the PCM and monitor the RPM PID.
- Access the PCM and monitor the IAC PID.
- Slowly increase the engine speed to 3,000 RPM and return to closed throttle. (Note: If closed throttle RPM is significantly higher than normal, ignore this step).
- **Is the percentage between 22 - 65%?**

Yes	No
GO to **KE14**.	INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KE14 VERIFY THE DTC

- **Is DTC P0506, P0511, P1504 or P1507 present in continuous memory?**

Yes	No
	INSPECT the throttle body for damage. REPAIR as necessary. If OK, INSTALL a new IAC valve.

GO to **KE20**.	REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .

KE15 DTCS P0507 OR P1506: CHECK FOR INLET AIR LEAKS

- Key ON, engine running.
- With the engine running at idle, listen for vacuum leaks.
- Inspect the entire intake air system from the mass air flow (MAF) sensor to the intake manifold for leaks such as:
  - damaged or loose IAC air tubes.
  - cracked or punctured intake air tube.
  - loose intake air tube at the air cleaner housing or throttle body.
  - IAC valve or gasket seal.
  - EGR valve gasket seal.
  - vacuum supply connector and hose.
  - PCV valve, connectors and hoses.
- **Are any leaks present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KE16**.

KE16 CHECK FOR EVAP DTCS

NOTE: EVAP system malfunctions can cause IAC DTCs or idle speed concerns.

- **Are any EVAP DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **KE17**.

KE17 CHECK THE IAC VALVE FOR CORRECT FUNCTION

- Key ON, engine running.
- Bring the engine to normal operating temperature.
- Transmission in PARK or NEUTRAL.

- Disconnect the IAC Valve.
- **Does the RPM drop or the engine stall?**

Yes	No
GO to **KE18**.	INSPECT the throttle body for damage. REPAIR as necessary. If OK, INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . CLEAR the DTCs. REPEAT the self-test.

KE18 CHECK THE IAC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

NOTE: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Key in OFF position.
- Scan tool connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
IAC	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KE19**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KE19 VERIFY THE SYMPTOM

- **Is a fast idle symptom currently present?**

Yes	No
GO to **KE22**.	GO to **KE20**.

KE20 CHECK THE IAC SYSTEM FOR AN INTERMITTENT OPEN OR SHORT

- PCM connector connected.

- Key ON, engine running.
- Access the PCM and monitor the IAC PID.
- Access the PCM and monitor the RPM PID.
- With the engine at normal operating temperature, closed throttle and all accessories off, the IAC duty cycle should be between approximately 22% and 65%.
- Observe the PIDs while carrying out the following at idle:
    - Lightly tap on the and wiggle the harness connector to simulate road shock.
    - Grasp the vehicle harness closest to the IAC valve. Shake and bend a small section of the harness from the IAC to the bulkhead and from the bulkhead to the PCM.
- **Do the IAC or RPM PIDs suddenly change in value, indicating a concern?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KE21**.

KE21 VERIFY THE SYMPTOM

- **Is an idle quality, starting or stalling symptom currently present?**

Yes	No
INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** to diagnose fast idle concerns.

KE22 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
    - pushed out pins
    - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KF: FAN CONTROL (FC) RELAYS

This pinpoint test is intended to diagnose the following:

- LFC, MFC, HFC relays
- harness circuits: HFC, LFC, MFC, VPWR
- powertrain control module (PCM) (12A650)

Although the PCM output circuits are called low, medium and high fan control (FC), cooling fan operation is controlled by a combination of these outputs.

Refer to**ENGINE CONTROL COMPONENTS** .

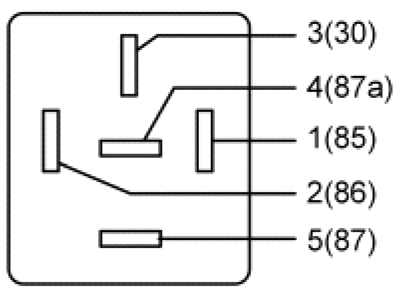

Fig. 181: Low Fan Control (LFC) Relay Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	LFC (Low Fan Control)
1	VPWR (Vehicle Power)

NOTE: The VPWR and LFC circuits may be reversed in the harness connector. Also, the LFC circuit may be wired to 2 separate relays. Refer to the Wiring Diagrams article for additional information.

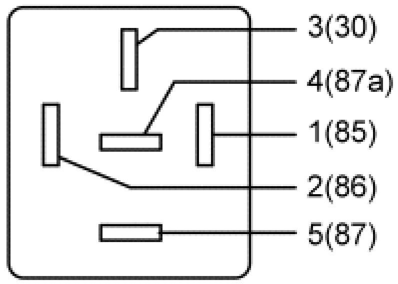

Fig. 182: Medium Fan Control (MFC) Relay Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	MFC (Medium Fan Control)
1	VPWR (Vehicle Power)

NOTE: The VPWR and MFC circuits may be reversed in the harness connector. Also, the MFC circuit may be wired to 2 separate relays. Refer to the Wiring Diagrams article for additional information.

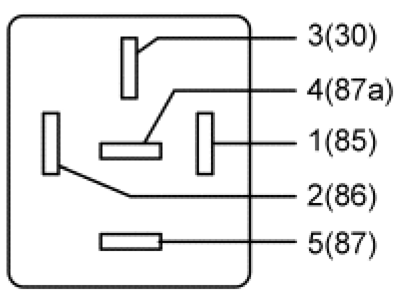

Fig. 183: High Fan Control (HFC) Relay Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	HFC (High Fan Control)

1	VPWR (Vehicle Power)

NOTE: The VPWR and HFC circuits may be reversed in the harness connector. Also, the HFC circuit may be wired to 2 separate relays. Refer to the Wiring Diagrams article for additional information.

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Pin	Circuit
Escape/Mariner 2.3L	B38 B17 B39	HFC MFC LFC
Focus	B18 B34	HFC LFC
Mustang	E4 E7	HFC LFC
Ranger	E7	LFC
All other vehicles	B38 B39	HFC LFC

KF1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0480, P0481, P0482, P1474, P1477 or P1479 present?**

Yes	No
For KOEO and KOER DTCs P0480 or P1474, GO to **KF3**. For continuous memory DTCs P0480 or P1474, GO to **KF36**. For DTCs P0481, P0482, P1477 or P1479, GO to **KF2**.	For fans always on: components, GO to **KF47**. For fans always on: all others, GO to **KF46**. For cooling fan circuits, GO to **KF47**. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

KF2 DTCS P0481, P0482, P1477 OR P1479: CHECK FOR THE PRESENCE OF THESE DTCS

- **Are DTCs P0481, P0482, P1477, or P1479 present? P0481 or P1479.**

Yes	No
For KOEO and KOER DTCs P0481 or P1479, Escape 3.0L, Mariner 3.0L. GO to **KF27**. For continuous memory DTCs P0481 or P1479, Escape 3.0L, Mariner 3.0L. GO to **KF44**. For KOEO and KOER DTCs P0481 or P1479, all others, GO to **KF13**.	For KOEO and KOER DTCs P0482 or P1477, Focus, GO to **KF18**. For continuous memory DTCs P0482 or P1477, Focus, GO to **KF42**. For KOEO and KOER DTCs P0482 or P1477, all others, GO to **KF8**.

For continuous memory DTCs P0481 or P1479, all others, GO to **KF38**.	For continuous memory DTCs P0482 or P1477, all others, GO to **KF40**.

KF3 KOEO AND KOER DTCS P0480 OR P1474: CHECK THE VPWR VOLTAGE TO THE LOW SPEED FC RELAY

- LFC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) LFC Relay Connector, Harness Side	(-)
VPWR - Pin 1	Ground

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

Yes	No
GO to **KF4**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF4 CHECK FOR LFC CIRCUIT CYCLING

- Key ON, engine OFF.
- Connect a non-powered test lamp between:

(+) LFC Relay Connector, Harness Side	(-) LFC Relay Connector, Harness Side
VPWR - Pin 1	LFC - Pin 2

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new LFC relay. CLEAR the DTCs. REPEAT the self-test.	GO to **KF5**.

KF5 CHECK THE LFC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Remove the test lamp.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) LFC Relay Connector, Harness Side	(-)
LFC - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KF6**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF6 CHECK THE LFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) LFC Relay Connector, Harness Side	(-)
LFC - Pin 2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KF7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF7 CHECK THE LFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) LFC Relay Connector, Harness Side	(-) PCM Connector, Harness Side
LFC - Pin 2	LFC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KF59**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF8 KOEO AND KOER DTCS P0482 OR P1477: CHECK THE VPWR VOLTAGE TO THE MEDIUM SPEED FC RELAY

- MFC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MFC Relay Connector, Harness Side	(-)
VPWR - Pin 1	Ground

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

Yes	No
GO to **KF9**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF9 CHECK FOR MFC CIRCUIT CYCLING

- Key ON, engine OFF.
- Connect a non-powered test lamp between:

(+) MFC Relay Connector, Harness Side	(-) MFC Relay Connector, Harness Side
VPWR - Pin 1	MFC - Pin 2

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new MFC relay. CLEAR the DTCs.	GO to **KF10**.

REPEAT the self-test.	

KF10 CHECK THE MFC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Remove the test lamp.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MFC Relay Connector, Harness Side	(-)
MFC - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KF11**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF11 CHECK THE MFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) MFC Relay Connector, Harness Side	(-)
MFC - Pin 2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KF12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF12 CHECK THE MFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) MFC Relay	(-) PCM

Connector, Harness Side	Connector, Harness Side
MFC - Pin 2	MFC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KF59**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF13 KOEO AND KOER DTCS P0481 OR P1479: CHECK THE VPWR VOLTAGE TO THE HIGH SPEED FC RELAY

- HFC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC Relay Connector, Harness Side	(-)
VPWR - Pin 1	Ground

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

Yes	No
GO to **KF14**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF14 CHECK FOR HFC CIRCUIT CYCLING

- Key ON, engine OFF.
- Connect a non-powered test lamp between:

(+) HFC Relay Connector, Harness Side	(-) HFC Relay Connector, Harness Side
VPWR - Pin 1	HFC - Pin 2

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Command the high speed fan ON.

- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new HFC relay. CLEAR the DTCs. REPEAT the self-test.	GO to **KF15**.

KF15 CHECK THE HFC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Remove the test lamp.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC Relay Connector, Harness Side	(-)
HFC - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KF16**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF16 CHECK THE HFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) HFC Relay Connector, Harness Side	(-)
HFC - Pin 2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KF17**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF17 CHECK THE HFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) HFC Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC - Pin 2	HFC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KF59**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF18 KOEO AND KOER DTCS P0482 OR P1477: CHECK THE VPWR VOLTAGE TO THE MFC1 RELAY

NOTE: This application has 2 relays wired to the MFC circuit. This procedure may call out MFC1 and MFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2.

- MFC1 Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MFC1 Relay Connector, Harness Side	(-)
VPWR	Ground

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

Yes	No
GO to **KF19**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF19 CHECK FOR MFC CIRCUIT CYCLING

- Connect a non-powered test lamp between:

(+) MFC1 Relay	(-) MFC1 Relay

Connector, Harness Side	Connector, Harness Side
VPWR	MFC

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new MFC1 relay at the end of diagnostics. Leave the relay disconnected. CLEAR the DTCs. REPEAT the self-test. GO to **KF24**.	Leave the test lamp connected. GO to **KF20**.

KF20 CHECK FOR MFC CIRCUIT CYCLING WITH THE MFC2 RLY DISCONNECTED

- Connect a non-powered test lamp between:

(+) MFC1 Relay Connector, Harness Side	(-) MFC1 Relay Connector, Harness Side
VPWR	MFC

- MFC2 Relay connector disconnected.
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new MFC2 relay. CLEAR the DTCs. REPEAT the self-test.	GO to **KF21**.

KF21 CHECK THE MFC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MFC1 Relay Connector, Harness Side	(-)
MFC	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KF22**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF22 CHECK THE MFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) MFC1 Relay Connector, Harness Side	(-)
MFC	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KF23**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF23 CHECK THE MFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) MFC1 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
MFC	MFC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KF59**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF24 VERIFY THERE IS NOT AN OPEN IN THE CIRCUIT SPECIFIC TO THE MFC2 RELAY

- Access the PCM and monitor the MFC_F PID.
- Command the high speed fan ON.
- Command the outputs OFF.
- Command the low speed fan ON.
- Command the outputs OFF.
- **Does the PID indicate a concern (yes) when either the high or low speed cooling fan output is commanded on and off?**

Yes	No
GO to **KF25**.	INSTALL a new MFC relay. CLEAR the DTCs. REPEAT the self-test.

KF25 CHECK THE VPWR VOLTAGE TO THE MFC2 RELAY

- MFC2 Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MFC2 Relay Connector, Harness Side	(-)
VPWR	Ground

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

Yes	No
GO to **KF26**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF26 CHECK THE MFC CIRCUIT BETWEEN THE MEDIUM SPEED FC RELAY(S)

- Key in OFF position.
- Measure the resistance between:

(+) MFC1 Relay Connector, Harness Side	(-) MFC2 Relay Connector, Harness Side
MFC	MFC

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new MFC relay(s). CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF27 KOEO AND KOER DTCS P0481 OR P1479: CHECK THE VPWR VOLTAGE TO THE HFC1 RELAY

NOTE: **This application has 2 relays wired to the HFC circuit. This procedure may call out HFC1 and HFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2.**

- HFC1 Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC1 Relay Connector, Harness Side	(-)
VPWR	Ground

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

Yes	No
GO to **KF28**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF28 CHECK FOR HFC CIRCUIT CYCLING

- Connect a non-powered test lamp between:

(+) HFC1 Relay Connector, Harness Side	(-) HFC1 Relay Connector, Harness Side
VPWR	HFC

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is**

commanded on and off?

Yes	No
INSTALL a new HFC1 relay at the end of diagnostics. Leave the relay disconnected. CLEAR the DTCs. REPEAT the self-test. GO to **KF33**.	Leave the test lamp connected. GO to **KF29**.

KF29 CHECK FOR HFC CIRCUIT CYCLING WITH THE HFC2 RLY DISCONNECTED

- Connect a non-powered test lamp between:

(+) HFC1 Relay Connector, Harness Side	(-) HFC1 Relay Connector, Harness Side
VPWR	HFC

- HFC2 Relay connector disconnected.
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new HFC2 relay. CLEAR the DTCs. REPEAT the self-test.	GO to **KF30**.

KF30 CHECK THE HFC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC1 Relay Connector, Harness Side	(-)
HFC	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KF31**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF31 CHECK THE HFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) HFC1 Relay Connector, Harness Side	(-)
HFC	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KF32**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF32 CHECK THE HFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) HFC1 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC	HFC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KF59**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF33 VERIFY THERE IS NOT AN OPEN IN THE CIRCUIT SPECIFIC TO THE HFC2 RELAY

- Access the PCM and monitor the HFC_F PID.
- Command the high speed fan ON.
- Command the outputs OFF.
- Command the low speed fan ON.
- Command the outputs OFF.

- **Does the PID indicate a concern (yes) when either the high or low speed cooling fan output is commanded on and off?**

Yes	No
GO to **KF34**.	INSTALL a new HFC1 relay. CLEAR the DTCs. REPEAT the self-test.

KF34 CHECK THE VPWR VOLTAGE TO HFC2 RLY

- HFC2 Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC2 Relay Connector, Harness Side	(-)
VPWR	Ground

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

Yes	No
GO to **KF35**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF35 CHECK THE HFC CIRCUIT BETWEEN THE HIGH SPEED FC RELAY(S)

- Key in OFF position.
- Measure the resistance between:

(+) HFC1 Relay Connector, Harness Side	(-) HFC2 Relay Connector, Harness Side
HFC	HFC

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new HFC relay(s). CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF36 CONTINUOUS MEMORY DTCS P0480 OR P1474: CHECK THE LFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO VOLTAGE

NOTE: If the test lamp does not turn on, command the high speed fan on.

- A/C and defrost off.
- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- LFC Relay connector disconnected.
- Connect a non-powered test lamp between:

(+) LFC Relay Connector, Harness Side	(-) LFC Relay Connector, Harness Side
VPWR - Pin 1	LFC - Pin 2

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is detected.
  - Shake, wiggle, and bend the LFC circuit(s).
  - Shake, wiggle, and bend the VPWR circuit to the LFC relay.
  - Inspect the LFC relay component for signs of damage.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KF37**.

KF37 CHECK THE LFC CIRCUIT FOR AN INTERMITTENT SHORT TO GROUND

- Key ON, engine OFF.
- Command the outputs OFF.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns on when a concern is detected.
  - Shake, wiggle, and bend the LFC circuit
  - Lightly tap on the LFC RLY to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KF38 CONTINUOUS MEMORY DTCS P0481 OR P1479: CHECK THE HFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO VOLTAGE

NOTE: If the test lamp does not turn on, command the low speed fan ON.

- A/C and defrost off.
- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- HFC Relay connector disconnected.
- Connect a non-powered test lamp between:

(+) HFC Relay Connector, Harness Side	(-) HFC Relay Connector, Harness Side
VPWR - Pin 1	HFC - Pin 2

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the high speed fan ON.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is detected.
  - Shake, wiggle, and bend the HFC circuit(s)
  - Shake, wiggle, and bend the VPWR circuit to the HFC relay
  - Lightly tap on the HFC RLY to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KF39**.

KF39 CHECK THE HFC CIRCUIT FOR AN INTERMITTENT SHORT TO GROUND

- Key ON, engine OFF.
- Command the outputs OFF.
- Observe the test lamp for an indication of a concern. Note that the lamp illuminates when a concern is detected. Wiggle, shake, and bend the HFC circuit(s). Shake, wiggle, and bend the PCM on both high speed FC relays.
- **Is a concern present?**

Yes	No
	Unable to duplicate or identify the concern at this

ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	time. refer to **PINPOINT TEST Z**.

KF40 CONTINUOUS MEMORY DTCS P0482 OR P1477: CHECK THE MFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO VOLTAGE

NOTE: If the test lamp does not turn on, command the high speed fan on.

- A/C and defrost off.
- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- MFC Relay connector disconnected.
- Connect a non-powered test lamp between:

(+) MFC Relay Connector, Harness Side	(-) MFC Relay Connector, Harness Side
VPWR - Pin 1	MFC - Pin 2

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is detected.
  - Shake, wiggle, and bend the MFC circuit(s).
  - Shake, wiggle, and bend the VPWR circuit to the MFC relay.
  - Inspect the MFC RLY component for signs of damage.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KF41**.

KF41 CHECK THE MFC CIRCUIT FOR AN INTERMITTENT SHORT TO GROUND

- Key ON, engine OFF.
- Command the outputs OFF.
- Observe the test lamp for an indication of a concern. Note that the lamp illuminates when a concern is detected. Wiggle, shake, and bend the HFC circuit(s). Shake, wiggle, and bend the PCM on both high speed FC relays.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KF42 CONTINUOUS MEMORY DTCS P0482 OR P1477: CHECK THE MFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO VOLTAGE

NOTE: This application has 2 relays wired to the MFC circuit. This procedure may call out MFC1 and MFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2.

NOTE: If the test lamp does not turn on, command the high speed fan ON.

- AC and defroster OFF.
- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- MFC1 Relay connector disconnected.
- Connect a non-powered test lamp between:

(+) MFC1 Relay Connector, Harness Side	(-) MFC1 Relay Connector, Harness Side
VPWR	MFC

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is detected.
  - Shake, wiggle, and bend the MFC circuit between the PCM and both medium speed FC relays
  - Shake, wiggle, and bend the VPWR circuit to both medium speed FC relays
  - Lightly tap on the medium speed FC relay that is still connected to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KF43**.

KF43 CHECK THE MFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key ON, engine OFF.
- Command the outputs OFF.
- Exit output test mode.
- Observe the test lamp for an indication of a concern. Note that the lamp illuminates when a concern is detected. Wiggle, shake, and bend the MFC circuit(s).
- Inspect the medium speed FC relay that is disconnected for intermittent concerns.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

KF44 CONTINUOUS MEMORY DTCS P0481 OR P1479: CHECK THE HFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO VOLTAGE

NOTE: This application has 2 relays wired to the HFC circuit. This procedure may call out HFC1 and HFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2.

NOTE: If the test lamp does not turn on, command the high speed fan ON.

- A/C and defroster OFF.
- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- HFC1 Relay connector disconnected.
- Connect a non-powered test lamp between:

(+) HFC1 Relay Connector, Harness Side	(-) HFC1 Relay Connector, Harness Side
VPWR	HFC

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is detected.
  - Shake, wiggle, and bend the PCM and both high speed FC relays.
  - Shake, wiggle, and bend the VPWR circuit to both high speed FC relays
  - Lightly tap on the high speed FC relay that is still connected to simulate road shock

- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KF45**.

KF45 CHECK THE HFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key ON, engine OFF.
- Command the outputs OFF.
- Exit output test mode.
- Observe the test lamp for an indication of a concern. Note that the lamp illuminates when a concern is detected. Wiggle, shake, and bend the HFC circuit(s) between the PCM and on both high speed FC relays.
- Inspect the high speed FC relay that is disconnected for intermittent concerns.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

KF46 THE COOLING FAN ALWAYS RUNS (NO DTCS): VERIFY THE FAN IS NOT ON BECAUSE OF A/C HIGH PRESSURE SWITCH INPUT TO THE PCM

- Key ON, engine running.
- Access the PCM and monitor the ACP PID.
- **Is the PID state CLOSED?**

Yes	No
The PCM turns the fan on when the medium pressure, normally open contacts of the ACHP switch are closed. GO to **KF57**.	The input is OK. GO to **KF47**.

KF47 COOLING FAN CONCERN (NO DTCS): CHECK THE FAN CONTROL PRIMARY CIRCUITS

NOTE: **Chose the PIDs below as appropriate, according to which circuits the vehicle has.**

- Verify that the A/C is OFF.
- Verify engine temperature is below the temperature where the cooling fan comes on.
- Key ON, engine OFF.
- Access the PCM and monitor the LFC_F, MFC_F and HFC_F PIDs.

- **Does either PID indicate a concern?**

Yes	No
A concern is present in the primary circuit(s). GO to **KF48**.	For all except Ranger, the PCM primary circuit(s) is OK. To check for secondary wiring, REFER to the **ENGINE COOLING -- E-SERIES** , for cooling system diagnosis. For Ranger: GO to **KF50**.

KF48 DOES THE LFCF PID INDICATE A CONCERN?

- **Does the LFCF PID indicate a concern?**

Yes	No
The low fan control (LFC) circuitry has a primary circuit concern. GO to **KF3**.	GO to **KF49**.

KF49 DOES THE MFCF PID INDICATE A CONCERN?

- **Does the MFCF PID indicate a concern?**

Yes	No
The medium fan control (MFC) primary circuitry has a circuit concern. For Focus, GO to **KF18**. For all others, GO to **KF8**.	The high fan control (HFC) primary circuitry has a circuit concern. For Escape 3.0L, and Mariner 3.0L, GO to **KF27**. For all others, GO to **KF13**.

KF50 IS THE SYMPTOM: COOLING FAN ALWAYS RUNS?

- **Is the symptom: cooling fan always runs?**

Yes	No
GO to **KF56**.	GO to **KF51**.

KF51 ELECTRIC COOLING FAN CONCERN (WITH NO DTCS): ELECTRIC COOLING FAN FUNCTIONAL CHECK

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- **Does the fan operate?**

Yes	No
All cooling fan circuit checks are OK. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts to continue diagnosis.	GO to **KF52**.

KF52 FAN INOPERATIVE: COMMAND THE LOW SPEED FAN ON AND CHECK FOR VOLTAGE TO THE CF

- Key in OFF position.
- CF Motor connector disconnected.
- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Measure the voltage between:

(+) CF Motor Connector, Harness Side	(-)
FAN PWR	Ground

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

Yes	No
GO to **KF53**.	GO to **KF54**.

KF53 CHECK THE GROUND CIRCUIT TO THE COOLING FAN

- Key in OFF position.
- Measure the resistance between:

(+) CF Motor Connector, Harness Side	(-)
GND	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new CF motor. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF54 CHECK THE B+ VOLTAGE TO THE FC RELAY

- FC Relay connector disconnected.

- Measure the voltage between:

(+) FC Relay Connector, Harness Side	(-)
B+	Ground

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

Yes	No
GO to **KF55**.	REPAIR the open circuit. There is a B+ circuit concern. CHECK the condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before replacing the fuse/fuse link. CLEAR the DTCs. REPEAT the self-test.

KF55 CHECK THE FAN PWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FC Relay Connector, Harness Side	(-) CF Motor Connector, Harness Side
FAN PWR	FAN PWR

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new FC relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF56 CHECK FOR FC RLY CONTACTS ALWAYS CLOSED

NOTE: Verify the A/C and defrost are off.

- FC Relay connector disconnected.
- Key ON, engine OFF.
- **Does the fan run with the key in the ON position?**

Yes	No
REPAIR the short circuit to PWR. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new FC relay. CLEAR the DTCs. REPEAT the self-test.

KF57 CHECK THE A/CHPSW (MEDIUM PRESSURE, NORMALLY OPEN CONTACTS)

- A/CHPSW connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the ACP PID.
- **Is the PID state CLOSED?**

Yes	No
GO to **KF58**.	CONNECT the A/CHPSW. REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** , to diagnose the A/C system pressure. If OK, INSTALL a new A/CHPSW. CLEAR the DTCs. REPEAT the self-test.

KF58 CHECK THE A/CPSW CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) A/CHPSW Connector, Harness Side	(-)
A/CPSW	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
VERIFY the results of the previous test steps. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts to continue diagnosis.	REPAIR the short circuit to GND. CLEAR the DTCs. REPEAT the self-test.

KF59 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KG: FUEL INJECTOR

This pinpoint test is intended to diagnose the following:

- fuel injector(s) (9F593)
- harness circuits: VPWR and INJ 1 - 10
- powertrain control module (PCM) (12A650)

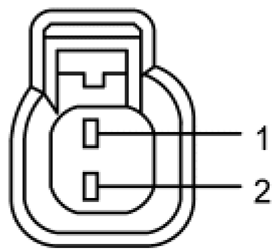

Fig. 184: Injector (INJ) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Fusion 3.0L, Milan 3.0L	A	2 1	INJ VPWR
All other vehicles	A	1 2	INJ VPWR

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series 6.8L, F-Super Duty 6.8L	170 Pin	E52 E35 E53	INJ1 INJ2 INJ3

		E36 E54 E37 E55 E38 E56 E39	INJ4 INJ5 INJ6 INJ7 INJ8 INJ9 INJ10
Edge, F-150 4.2L, MKX, Sable, Taurus, Taurus X	190 Pin	E52 E35 E53 E36 E54 E37	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6
Escape/Mariner 3.0L	150 (50-50-50) Pin	E2 E5 E13 E4 E3 E15	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6
Escape/Mariner 2.3L	150 (50-50-50) Pin	E2 E3 E4 E5	INJ1 INJ2 INJ3 INJ4
Expedition, Navigator	140 Pin	E52 E35 E53 E36 E54 E37 E55 E38	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8
Explorer 4.0L, Explorer Sport Trac 4.0L, Mountaineer 4.0L, Mustang 4.0L, Ranger 4.0L, Ranger 3.0L	170 Pin	E52 E35 E53 E36 E54 E37	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6
F-150 4.6L, F-150 5.4L, Mark LT	190 Pin	E52 E35 E53 E36 E54 E37 E55 E38	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8

Focus	190 Pin	E1 E2 E3 E4	INJ1 INJ2 INJ3 INJ4
Fusion 3.0L, Milan 3.0L, MKZ	140 Pin	E52 E35 E53 E36 E54 E37	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6
Fusion 2.3L, Milan 2.3L	140 Pin	E52 E35 E53 E36	INJ1 INJ2 INJ3 INJ4
Ranger 2.3L	170 Pin	E52 E35 E53 E36	INJ1 INJ2 INJ3 INJ4
All other vehicles	170 Pin	E52 E35 E53 E36 E54 E37 E55 E38	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8

KG1 DTCS P0201 THROUGH P0210 OR SYMPTOMS WITHOUT DTCS: CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

NOTE: **Disconnect the suspect fuel injector harness connector. Only the suspect injector needs to be diagnosed.**

NOTE: **On some vehicles, the injector voltage is only present when the fuel pump relay is energized. Measure the injector voltage within 2 seconds of the key ON.**

- Key in OFF position.
- INJ connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) INJ Connector, Harness Side	(-)
VPWR	Ground

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

Yes	No
GO to **KG2**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KG2 CHECK THE INJ CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) INJ Connector, Harness Side
Suspect INJ	INJ

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KG3**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KG3 CHECK THE INJ CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) INJ Connector, Harness Side	(-)
INJ	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KG4**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KG4 CHECK THE INJ CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) INJ Connector, Harness Side	(-)
INJ	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to **KG5**.

KG5 CHECK THE RESISTANCE OF THE FUEL INJECTOR

- Key in OFF position.
- Measure the resistance between:

(+) INJ Connector, Component Side	(-) INJ Connector, Component Side
VPWR	INJ

- **Is the resistance between 11 - 18 ohms?**

Yes	No
GO to **KG6**.	INSTALL a new fuel injector. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

KG6 CHECK THE FUNCTIONALITY OF THE INJ CIRCUIT

- PCM connector connected.
- Key ON, engine OFF.
- Connect a non-powered test lamp between:

(+) INJ Connector, Harness Side	(-) INJ Connector, Harness Side
VPWR	INJ

- Key ON, engine running.

- **Is the test lamp blinking?**

Yes	No
GO to **KG7**.	GO to **KG8**.

KG7 CARRY OUT A THOROUGH WIGGLE TEST ON THE FUEL INJECTOR HARNESS

- Key in OFF position.
- INJ connector connected.
- Key ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the INJ_F PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the fuel injector to the PCM.
- **Are any injector values fluctuating in and out of range?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KG8 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KJ: SUPERCHARGER BYPASS CONTROL

This pinpoint test is intended to diagnose the following:

- supercharger bypass actuator
- vacuum hoses

KJ1 CHECK FOR DTCS

NOTE: **DTCs P1227 and P1228 are for informational purposes only and are usually accompanied by other DTCs. If concerns are present with the mass air flow (MAF) sensor, the exhaust gas recirculation (EGR) valve, or the manifold absolute pressure (MAP) sensor, DTCs P1227 or P1228 may be set. Diagnose all other DTCs before diagnosing DTCs P1227 or P1228.**

- **Are DTCs P1227, or P1228 present?**

Yes	No
GO to **KJ2**.	For lack/loss of power, GO to **KJ3**. For all other symptoms without DTCs, GO to **KJ2**.

KJ2 DTCS P1227 OR P1228: VERIFY THE DTC

- Record and clear the DTCs.
- Drive the vehicle at normal operating temperature with the engine exceeding 2,000 RPM.
- Check for DTCs.
- **Are any other DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **KJ4**.

KJ3 CHECK THE IAT2 PID

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

- Key ON, engine running.
- Access the PCM and monitor the IAT2 PID.
- **Is the temperature greater than 110°C (230°F)?**

Yes	No

CHECK for low fluid level in the charge air cooler (CAC) system. CHECK for damaged CAC lines. REFER to the **ENGINE COOLING -- E-SERIES** , Supercharger Cooling to diagnose a loss of coolant.	GO to **KJ4**.

KJ4 CHECK THE SUPERCHARGER BYPASS ACTUATOR VACUUM HOSES

NOTE: For vehicle specific vacuum hose routing, refer to the VECI label located in the front of the engine compartment.

- Check for holes, cracks, bends or kinks in the vacuum lines going to the supercharger bypass actuator.
- Check for any disconnected hoses at the supercharger bypass actuator.
- **Are any concerns present?**

Yes	No
REPAIR or INSTALL new vacuum lines as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KJ5**.

KJ5 CHECK THE BYPASS VALVE ACTUATOR

NOTE: Additional DTCs may set as a result of disconnecting the vacuum line in this step.

- Visually inspect the bypass valve actuator for damage.
- Key in OFF position.
- Note the position of the supercharger bypass actuator linkage.
- Key ON, engine running.
- Note the position of the supercharger bypass actuator linkage.
- Disconnect the supercharger bypass actuator upper vacuum hose.
- **Does the supercharger bypass actuator linkage move when the engine is started, and return to the original position when the supercharger bypass actuator vacuum line is disconnected?**

Yes	No
The concern is not present at this time. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** to diagnose lack/loss of power concerns.	INSTALL a new supercharger bypass actuator. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST KM: AIR CONDITIONING CLUTCH (A/CC) RELAY CIRCUIT

WARNING: Crown Victoria Police Interceptor vehicles equipped with fire suppression

system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.

This pinpoint test is intended to diagnose the following:

- A/CC relay
- harness circuits: VPWR, A/CCR, A/CCS
- powertrain control module (PCM) (12A650)

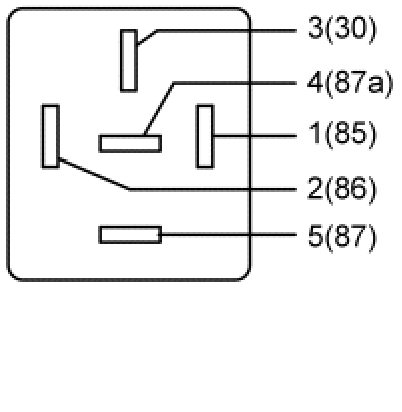

Fig. 185: Air Conditioning Clutch (A/CC) Relay Connector - A
Courtesy of FORD MOTOR CO.

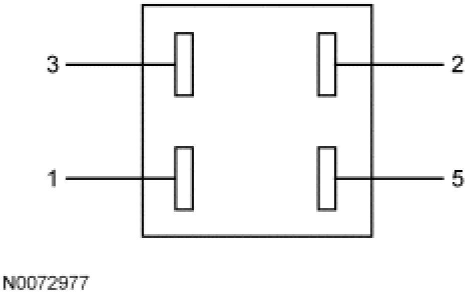

Fig. 186: Air Conditioning Clutch (A/CC) Relay Connector - B
Courtesy of FORD MOTOR CO.

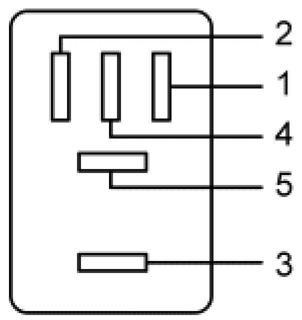

Fig. 187: Air Conditioning Clutch (A/CC) Relay Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition, F-150, Mark LT, Navigator	A	1 2	A/CCR VPWR
Focus	B	2 1	A/CCR VPWR
All other vehicles	C	1 2	A/CCR VPWR

The VPWR and A/CCR circuits may be reversed in the harness connector. Refer to the Wiring Diagrams article for additional information.

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series, F-Super Duty	170 Pin	E3	A/CCR
Edge, F-150, Mark LT, MKX, Sable, Taurus, Taurus X	190 Pin	B18	A/CCR
Escape/Mariner	150 (50-50-50) Pin	B25	A/CCR
Expedition,	140 Pin	B18	A/CCR

Navigator			
Focus	190 Pin	B2	A/CCR
Fusion, Milan, MKZ	140 Pin	B64	A/CCR
All other vehicles	170 Pin	B14	A/CCR

KM1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0534, P0645, P1460, P1464 or P1469 present?**

Yes	No
For KOEO and KOER DTCs P0645 or P1460, GO to **KM2**. For continuous memory DTCs P0645 or P1460, GO to **KM10**. For KOEO and KOER DTC P1464, GO to **KM8**. For continuous memory DTCs P0534 or P1469, GO to **KM12**.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

KM2 KOEO AND KOER DTCS P1460 OR P0645: VERIFY THAT THE ACCS PID IS OFF

NOTE: **Verify the A/C and the defrost are off during KOEO/KOER self-tests. If the vehicle is not equipped with A/C, the A/CCR circuit is not used and DTC P1460/P0645 can be ignored.**

- Key ON, engine running.
- A/C and defroster OFF.
- Access the PCM and monitor the ACCS PID.
- **Is the PID state OFF?**

Yes	No
GO to **KM3**.	REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.

KM3 CHECK THE VPWR VOLTAGE TO THE A/CC RELAY

- Key in OFF position.
- A/CC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) A/CC Relay Connector, Harness Side	(-)
VPWR	Ground

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

Yes	No
GO to **KM4**.	REPAIR the open circuit. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.

KM4 CHECK THE A/CC RELAY

- Key in OFF position.
- Carry out the A/CC relay component test. Refer to the Wiring Diagrams Cell 149 Component Testing.
- **Does the A/CC relay pass the component test?**

Yes	No
GO to **KM5**.	INSTALL a new A/CC relay. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. CLEAR the DTCs. REPEAT the self-test.

KM5 CHECK THE A/CCR (WAC) CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) A/CC Relay Connector, Harness Side	(-)
A/CCR	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KM6**.	REPAIR the short circuit. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch.

	REPEAT the self-test.

KM6 CHECK THE A/CCR (WAC) CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) A/CC Relay Connector, Harness Side	(-)
A/CCR	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KM7**.	REPAIR the short circuit. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.

KM7 CHECK THE A/CCR (WAC) CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) A/CC Relay Connector, Harness Side	(-) PCM Connector, Harness Side
A/CCR	A/CCR

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KM14**.	REPAIR the open circuit. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.

KM8 KOEO AND KOER DTC P1464: VERIFY THE A/C AND DEFROST ARE OFF DURING THE SELF-TEST

- Verify the A/C and defrost are off during the self-test.
- **Are the A/C and defrost off during the self-test?**

Yes	No
GO to **KM9**.	Turn the A/C and defrost off. REPEAT the self-test where DTC P1464 was retrieved.

KM9 CHECK THE ACCS PID

- Key ON, engine OFF.
- A/C and defroster OFF.
- Access the PCM and monitor the ACCS PID.
- **Is the PID state ON?**

Yes	No
The ACCS PID indicates the PCM is being requested to turn the A/C on. REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.	The ACCS PID indicates that the ACCS input to the PCM is low. VERIFY the test step results. Turn off the A/C and defrost. REPEAT the self-test.

KM10 CONTINUOUS MEMORY DTCS P1460 OR P0645: CHECK THE A/CCR (WAC) CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

NOTE: If the vehicle is not equipped with A/C, the A/CCR circuit is not used and the P1460/P0645 can be ignored.

NOTE: The A/C clutch clicks on when a concern is present.

- Key ON, engine OFF.
- Check the A/CCR (WAC) circuit for short to ground while carrying out the following:
  - Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module
  - Lightly tap on the A/CC relay to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.	GO to **KM11**.

KM11 CHECK THE A/CCR (WAC) FOR AN OPEN OR SHORT CIRCUIT TO VOLTAGE

NOTE: The A/C clutch clicks off if a concern is present.

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Check the A/CCR (WAC) circuit for an open or short to voltage while carrying out the following:
  - Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module
  - Lightly tap on the A/CC relay to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KM12 CONTINUOUS MEMORY DTCS P0534 OR P1469: CHECK FOR CAUSES OF FAST A/CCS CYCLING

- Check the following:
  - A/C system pressure
  - A/CCS cycle times

  REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.

- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary.	GO to **KM13**.

KM13 CHECK FOR INTERMITTENT OPEN IN THE A/CCS CIRCUIT

NOTE: The ACCS PID turns off and on quickly when a concern is present, indicating an intermittent open.

- Key ON, engine OFF.
- Access the PCM and monitor the ACCS PID.
- Turn on the A/C switch.
- Check the A/CCR (WAC) circuit for an open or short to voltage while carrying out the following:
  - Wiggle, shake, and bend small sections of the wiring harness while working from the component to

    the module.
    - Lightly tap on the pressure switch (PS) (to simulate road shock).
- Inspect the A/CCS connector.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KM14 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
    - pushed out pins
    - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KN: VARIABLE SPEED ELECTRIC COOLING FAN

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- variable speed electric cooling fan (8T00)
- harness circuits: FCV, B+, GND
- powertrain control module (PCM) (12A650)

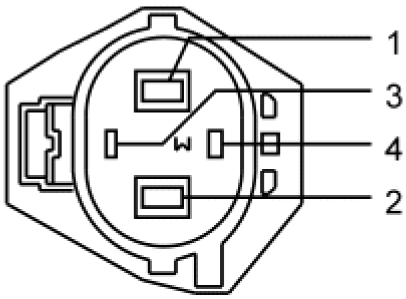

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Fig. 188: Cooling Fan (CF) Motor Connector (1 Of 2)
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	FCV (Fan Control Variable)
2	GND (Ground)
1	B+ (Battery Positive Voltage)

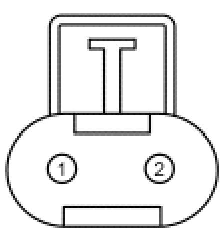

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Fig. 189: Cooling Fan (CF) Motor Connector (2 Of 2)
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	GND (Ground)
2	VPWR (Vehicle Power)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Town Car	170 Pin	E7	FCV

Fusion, Milan, MKZ	140 Pin	B8	FCV
All other vehicles	190 Pin	B48	FCV

KN1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Is DTC P0480 or P0483 present?**

Yes	No
For KOEO and KOER DTC P0480, GO to **KN2**. For continuous memory DTC P0480, GO to **KN9**. For continuous memory DTC P0483, GO to **KN15**.	For electric cooling fan(s) does not operate (low, medium, high or variable speed), GO to **KN11**.

KN2 KOEO AND KOER DTC P0480: CHECK THE B+ AND GND CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- CF Module connector disconnected.
- Rotate the fan by hand. The fan should rotate freely, with no abnormal binding. If binding is present, remove any foreign materials or install a new fan assembly as required.
- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-) CF Module Connector, Harness Side
B+ - Pin 1	GND - Pin 2

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

Yes	No
GO to **KN4**.	GO to **KN3**.

KN3 CHECK THE VOLTAGE TO THE COOLING FAN MODULE USING GROUND AS A REFERENCE

- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-)
B+ - Pin 1	Ground

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

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.	A B+ circuit concern is present. CHECK the condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before installing a new fuse/fuse link.

KN4 CHECK THE FCV CIRCUIT(S)

- Connect the 1.6K ohms resistor between the FCV and B+ circuits at the CF module harness connector (this simulates cooling fan circuitry).
- Key ON, engine OFF.
- Carry out the KOEO self-test.
- **Is DTC P0480 present?**

Yes	No
GO to **KN6**.	For Crown Victoria, Grand Marquis, and Town Car, GO to **KN5**. For all others, INSTALL a new CF module. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KN5 CHECK THE COOLING FAN OPERATION

- CF Motor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A 12 Volt Vehicle Battery	Point B CF Motor Connector, Component Side
Positive terminal	VPWR - Pin 2

- Connect a 5 amp fused jumper wire between the following:

Point A Vehicle Battery	Point B CF Motor Connector, Component Side
Negative	GND - Pin 1

terminal	

- **Does the cooling fan motor operate correctly?**

Yes	No
INSTALL a new CF module. REFER to the **ENGINE COOLING -- E-SERIES** .	INSTALL a new Cooling Fan. REFER to the **ENGINE COOLING -- E-SERIES** .

KN6 CHECK THE FCV CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-)
FCV - Pin 4	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **KN7**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KN7 CHECK THE FCV CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) CF Module Connector, Harness Side	(-)
FCV - Pin 4	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KN8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KN8 CHECK FOR AN OPEN CIRCUIT BETWEEN THE PCM AND COOLING FAN MODULE

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CF Module Connector, Harness Side
FCV	FCV - Pin 4

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KN16**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KN9 CONTINUOUS MEMORY DTC P0480: CHECK THE B+ AND GND CIRCUIT FOR AN INTERMITTENT CONCERN

- Key in OFF position.
- CF Module connector disconnected.
- Rotate the fan by hand. The fan should rotate freely, with no abnormal binding. If binding is present, remove any foreign materials or install a new fan assembly as required.
- Connect a non-powered test lamp between:

(+) CF Module Connector, Harness Side	(-) CF Module Connector, Harness Side
B+ - Pin 1	GND - Pin 2

- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is present.
  - Shake, wiggle, and bend the B+ and GND circuits to the CF
  - Shake, wiggle, and bend the associated fuse
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **KN10**.

KN10 CHECK THE FCV CIRCUIT(S) FOR INTERMITTENT CONCERNS

- Connect the 1.6 K ohms resistor between the FCV and B+ circuits at the CF harness connector (this simulates cooling fan circuitry).

- Measure the voltage between:

(+) CF Module Connector, Harness Side	**(-)**
FCV - Pin 4	Ground

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Observe the digital multimeter (DMM) for an indication of a concern while shaking, wiggling, and bending the FCV circuit between the CF module and the PCM. Note that voltage changes suddenly when a concern is detected.
- Command the outputs OFF.
- Exit output test mode.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

KN11 COOLING FAN MOTOR DOES NOT OPERATE (WITH NO DTCS): COMMAND THE FAN ON TO CHECK OPERATION

- Carry out the KOEO self-test.
- Listen to the fan.
- **Does the fan operate sometime during the KOEO self-test?**

Yes	No
The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** for further direction.	GO to **KN12**.

KN12 CHECK THE B+ AND GND CIRCUITS TO THE COOLING FAN MODULE

- Key in OFF position.
- CF Module connector disconnected.
- Rotate the fan by hand. The fan should rotate freely, with no abnormal binding. If binding is present, remove any foreign materials or install a new fan assembly as required.
- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-) CF Module Connector, Harness Side
B+ - Pin 1	GND - Pin 2

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

Yes	No
For Crown Victoria, Grand Marquis, and Town Car, GO to **KN13**. For all others, INSTALL a new CF module. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to **KN14**.

KN13 CHECK THE COOLING FAN OPERATION

- CF Motor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A 12 Volt Vehicle Battery	Point B CF Motor Connector, Component Side
Positive terminal	VPWR - Pin 2

- Connect a 5 amp fused jumper wire between the following:

Point A Vehicle Battery	Point B CF Motor Connector, Component Side
Negative terminal	GND - Pin 1

- **Does the cooling fan motor operate correctly?**

Yes	No
INSTALL a new CF module. REFER to the **ENGINE COOLING -- E-SERIES** .	INSTALL a new Cooling Fan. REFER to the **ENGINE COOLING -- E-SERIES** .

KN14 CHECK THE VOLTAGE TO THE COOLING FAN MODULE USING GROUND AS A REFERENCE

- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-)
B+ - Pin 1	Ground

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

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.	A B+ circuit concern is present. CHECK the condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before installing a new fuse/fuse link. CLEAR the DTCs. REPEAT the self-test.

KN15 CONTINUOUS MEMORY DTC P0483: CHECK FOR A COOLING FAN MOTOR OBSTRUCTION OR A COOLING FAN MOTOR MECHANICAL FAILURE

- **Is a cooling fan motor obstruction or a cooling fan motor mechanical failure present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	CLEAR the DTCs. REPEAT the self-test.

KN16 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Replacement PCM.	

PINPOINT TEST KP: CHARGE AIR COOLER (CAC) PUMP

This pinpoint test is intended to diagnose the following:

- CAC pump relay (14B192)
- CAC pump (8501)
- harness circuits: CAC, VPWR and GND
- powertrain control module (PCM) (12A650)

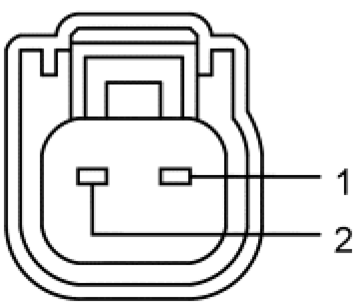

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Fig. 190: Charge Air Cooler (CAC) Pump Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	GND (Ground)
1	PUMPPWR (Pump Power)

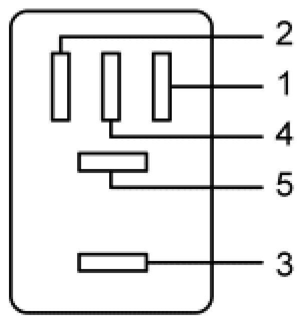

Fig. 191: Powertrain Control Module Power (PCM Power) Relay Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
5	PUMPPWR (Pump Power)
3	B+ (Battery Positive Voltage)
2	CAC (Charge Air Cooler)
1	VPWR (Vehicle Power)

Pin	Circuit
E64	CAC (Charge Air Cooler)

KP1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Is DTC P1229 present?**

Yes	No
For DTC P1229, GO to **KP2**.	For a boost gauge indicates higher than normal boost, GO to **KP9**.

KP2 DTC P1229: CHECK THE VOLTAGE TO THE CAC PUMP RELAY COIL

- Key in OFF position.
- CAC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CAC Relay	

Connector, Harness Side	(-)
VPWR - Pin 1	Ground

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

Yes	No
GO to **KP3**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KP3 CHECK THE CAC PUMP RELAY

- Key in OFF position.
- Remove the relay from the power distribution box.
- Measure the resistance between:

(+) CAC Relay Connector, Component Side	(-) CAC Relay Connector, Component Side
CAC - Pin 2	VPWR - Pin 1

- **Is the resistance between 65 - 100 ohms?**

Yes	No
GO to **KP4**.	INSTALL a new CAC relay. CLEAR the DTCs. REPEAT the self-test.

KP4 CHECK THE CAC PUMP RELAY

- Carry out the CAC pump relay component test. Refer to the Wiring Diagrams Cell 149 Component Testing.
- **Does the CAC pump relay pass the component test?**

Yes	No
GO to **KP5**.	INSTALL a new CAC relay. CLEAR the DTCs. REPEAT the self-test.

KP5 CHECK FOR AN OPEN CIRCUIT BETWEEN THE PCM AND THE CAC RELAY

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CAC Relay Connector, Harness Side
CAC - Pin E64	CAC - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KP6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KP6 CHECK FOR A SHORT TO VOLTAGE BETWEEN THE PCM AND THE CAC RELAY

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
CAC - Pin E64	Negative terminal

- **Is the voltage less than 0.5 V?**

Yes	No
GO to **KP7**.	REPAIR the short circuit to PWR. CLEAR the DTCs. REPEAT the self-test.

KP7 CHECK BETWEEN THE PCM AND THE CAC RELAY FOR A SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
CAC - Pin E64	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **KP8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KP8 CHECK THE SCICP PID

- PCM connector connected.
- Access the PCM and monitor the SCICP PID.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- **Is the SCICP PID on?**

Yes	No
If the CAC reservoir is full, there is no air flow blockage at the CAC radiator, the IAT2 and connecting circuits are not high resistance or open, CAC hoses are not reversed and DTC P1229 is present in KOEO and KOER, GO to **KP15**.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KP9 CHECK THE CAC FOR MECHANICAL OPERATION

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Observe the CAC pump.
- Command the outputs OFF.
- **Does the CAC pump run?**

Yes	No
CHECK for low fluid level in the CAC system. CHECK for cracked or incorrectly routed CAC lines or airflow blockage at the CAC radiator. REPAIR the system as necessary. If the symptom still exists, RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** to diagnose boost gauge indicates higher than normal boost.	GO to **KP10**.

KP10 CHECK THE VOLTAGE AND GROUND CIRCUITS AT THE CAC PUMP

- Charge Air Cooler (CAC) Pump connector disconnected.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Measure the voltage between:

(+) Charge	(-) Charge Air

Air Cooler (CAC) Pump Connector, Harness Side	Cooler (CAC) Pump Connector, Harness Side
PUMPPWR - Pin 1	GND - Pin 2

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

Yes	No
INSTALL a new Charge Air Cooler (CAC) Pump. REFER to the **ENGINE COOLING -- E-SERIES** , Supercharger Cooling. CLEAR the DTCs. REPEAT the self-test.	GO to **KP11**.

KP11 CHECK THE CAC VOLTAGE CIRCUIT TO GND

- Measure the voltage between:

(+) Charge Air Cooler (CAC) Pump Connector, Harness Side	(-) Vehicle Battery
PUMPPWR - Pin 1	Negative terminal

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

Yes	No
GO to **KP12**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KP12 CHECK THE INTEGRITY OF THE CAC PUMP GROUND CONNECTION

- Charge Air Cooler (CAC) Pump connector disconnected.
- Measure the resistance between:

(+) Charge Air Cooler (CAC) Pump Connector, Harness Side	(-) Vehicle Battery
GND - Pin 2	Negative terminal

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **KP13**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KP13 CHECK THE VOLTAGE TO THE CAC PUMP RELAY

- CAC Relay connector disconnected.
- Measure the voltage between:

(+) CAC Relay Connector, Harness Side	(-)
B+ - Pin 3	Ground

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

Yes	No
GO to **KP14**.	REPAIR the open circuit. CHECK the fuses. CLEAR the DTCs. REPEAT the self-test.

KP14 CHECK FOR AN OPEN CAC PUMP CIRCUIT

- Measure the resistance between:

(+) CAC Relay Connector, Harness Side	(-) Charge Air Cooler (CAC) Pump Connector, Harness Side
PUMPPWR - Pin 5	PUMPPWR - Pin 1

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new CAC pump relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KP15 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.

- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. refer to **PINPOINT TEST Z**.

PINPOINT TEST NC: IGNITION ENGINE SPEED INPUT CIRCUIT

This pinpoint test is intended to diagnose the powertrain control module (PCM) (12A650).

NC1 CONTINUOUS MEMORY DTC P0320: ERRATIC IGNITION

- Verify all 2-way radio installations. Carefully follow the manufacturer's installation instructions regarding the routing of the antenna and voltage leads.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **NC2**.

NC2 NO START CONCERN

- **Is the customer complaint no start?**

Yes	No
refer to **PINPOINT TEST A**.	GO to **NC3**.

NC3 INTERMITTENT CONDITION

- **Is this an intermittent condition?**

Yes	No
refer to **PINPOINT TEST Z**.	refer to **PINPOINT TEST JD**.

PINPOINT TEST ND: ENGINE RPM\VEHICLE SPEED LIMITER REACHED

NOTE: Enter this pinpoint test only when directed here.

ND1 DTCS P0219, P0297 OR P1270: EXCESSIVE ENGINE RPM OR VEHICLE SPEED

- P0219 (engine over speed), P0297 (vehicle over speed) or P1270 DTCs indicate the vehicle was operated in a manner which caused the engine or vehicle speed to exceed a calibrated limit.
  - Excessive engine RPM in NEUTRAL or operated in the wrong transmission gear.
  - Excessive wheel slippage (water, ice, mud or snow).
  - Vehicle driven at a high rate of speed.
- **Was the vehicle operating in any of the above conditions?**

Yes	No
The on-board diagnostics (OBD) system is OK. RETURN the vehicle to customer with information about the DTC.	REFER to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** . If there are no other symptoms, RETURN the vehicle to the customer with information about the DTC.

PINPOINT TEST QA: UNABLE TO ACTIVATE SELF-TEST/NETWORK COMMUNICATION ERROR

This pinpoint test is intended to diagnose the following:

- unable to communicate with PCM
- unable to activate the PCM self-test.
- incorrect self-test procedure
- harness circuits: ISP-R, PCMRC, PWRGND and VPWR

VREF INFORMATION TABLE

Application	Engine	Measure the PCM VREF at:
Edge/MKX	All	ETBTPS
Escape/Mariner	All	TP Sensor or FRPT
Expedition/Navigator	All	ETBTPS
Focus	All	ETBTPS
Fusion/Milan/MKZ	All	ETBTPS
Ranger	All	TP Sensor
Taurus/Taurus X/Sable	All	ETBTPS
All Others	All	FRPT

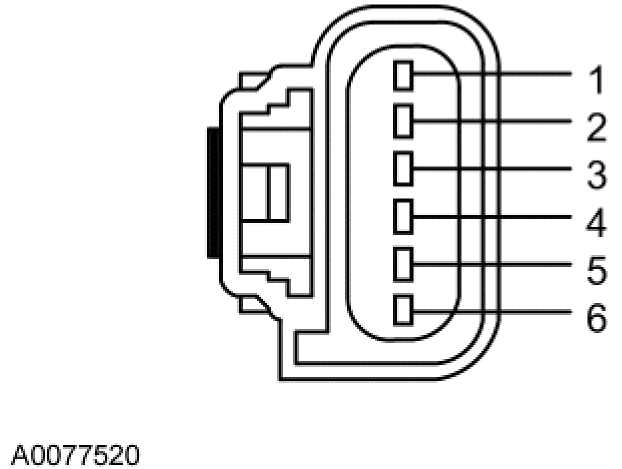

Fig. 192: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

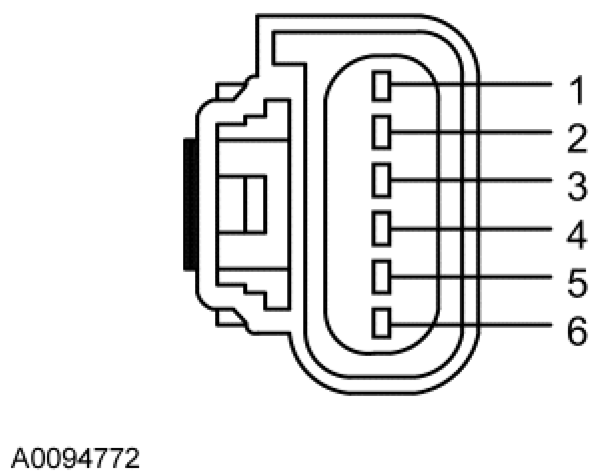

Fig. 193: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - B
Courtesy of FORD MOTOR CO.

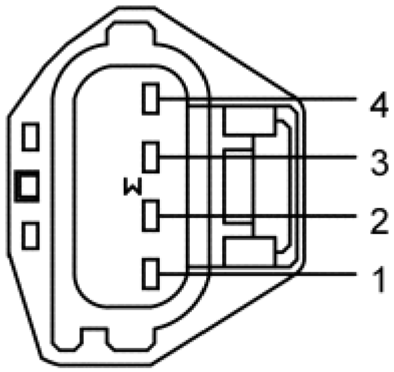

Fig. 194: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus, Taurus X	A	2 3	ETCRTN ETCREF
Fusion 2.3L, Milan 2.3L	B	3 5	ETCRTN ETCREF
Fusion 3.0L, Milan 3.0L	B	4 5	ETCRTN ETCREF
All other vehicles	C	3 2	ETCRTN ETCREF

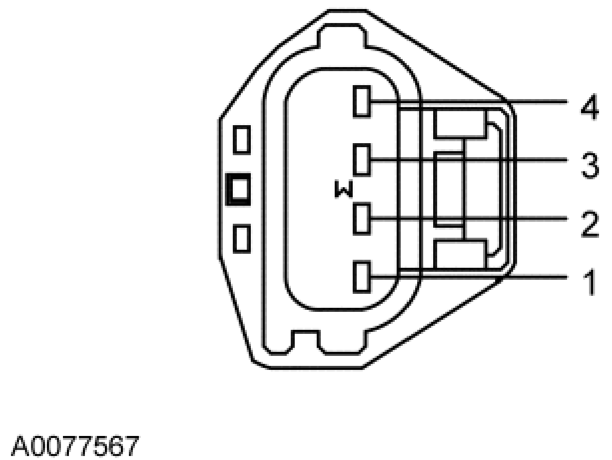

Fig. 195: Fuel Rail Pressure Temperature (FRPT) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

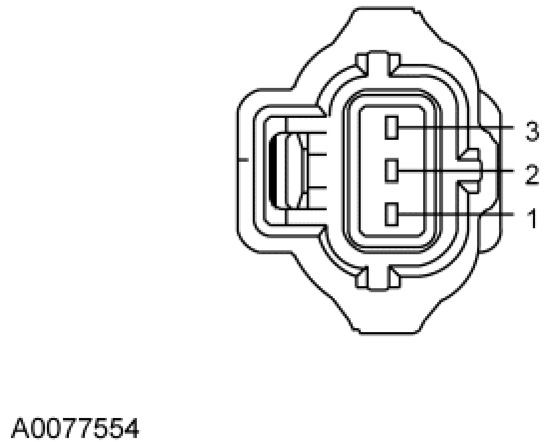

Fig. 196: Throttle Position (TP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

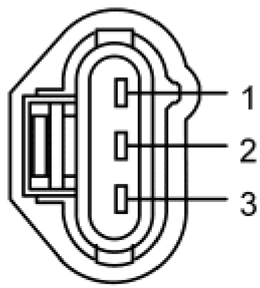

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Fig. 197: Throttle Position (TP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Ranger 2.3L	A	1 3	SIGRTN VREF
All other vehicles	B	3 1	SIGRTN VREF

Vehicle	Connector	Pin	Circuit
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B67, B68, B69, B70 B51, B52, B53 B8 B7	PWRGND VPWR PCMRC ISP-R
Escape/Mariner	150 (50-50-50) Pin	B47, B48, B49, B50 B35, B36	PWRGND VPWR
Expedition, Navigator	140 Pin	B67, B68, B69, B70 B51, B52, B53 B8 B7	PWRGND VPWR PCMRC ISP-R
Explorer, Explorer Sport Trac, Mountaineer, Mustang	170 Pin	B47, B48, B49, B50 B35, B36 B37 B46	PWRGND VPWR PCMRC ISP-R
F-150, Mark LT	190 Pin	B67, B68, B69, B70 B51, B52, B53 B40 B17	PWRGND VPWR PCMRC ISP-R
F-Super Duty	170 Pin	B47, B48, B49, B50	PWRGND

		B35, B36 B37 B31	VPWR PCMRC ISP-R
Focus	190 Pin	B69, B70 B67, B68 B38 B42	PWRGND VPWR PCMRC ISP-R
Fusion, Milan, MKZ	140 Pin	B67, B68, B69 B51, B52 B35 B37	PWRGND VPWR PCMRC ISP-R
All other vehicles	170 Pin	B47, B48, B49, B50 B35, B36	PWRGND VPWR

QA1 CARRY OUT A VEHICLE INSPECTION AND VERIFY THE SELF-TEST PROCEDURE

NOTE: If the self-test or communication concern occurred after a failed or an aborted reprogram, the module may be blank. Attempt to reprogram the module again before continuing with this pinpoint test.

- Visually inspect the following for obvious signs of electrical damage:
  - harness wiring
  - electrical connections
- Verify the correct procedure was used to activate the self-test for the scan tool. Refer to**SCAN TOOL SETUP AND FUNCTIONALITY** .
- **Was the correct self-test procedure used?**

Yes	No
GO to **QA2**.	REFER to**SCAN TOOL SETUP AND FUNCTIONALITY** .

QA2 CARRY OUT THE NETWORK TEST

- Key ON, engine OFF.
- Carry out the network test.
- **Do all modules indicate pass?**

Yes	No
REFER to Symptom Charts, **PINPOINT TEST QT** .	If only PCM indicates fail, GO to **QA3**. For network test or all other modules indicates fail, REFER to the **MODULE COMMUNICATIONS NETWORK -- E-SERIES** to diagnose The Powertrain Control Module (PCM) Does Not Respond To The Scan Tool Or No High Speed

	Controller Area Network (HS-CAN) Communication Symptom.

QA3 CHECK FOR VREF VOLTAGE AT A SENSOR

NOTE: PCM voltage and ground can be determined by measuring VREF voltage at a sensor. Refer to the VREF Information Table at the beginning of this pinpoint test for the vehicle application and the applicable sensor to test.

- Key in OFF position.
- Disconnect the applicable sensor.
- Key ON, engine OFF.
- Measure the voltage between the applicable sensor VREF circuit, harness side and the applicable sensor SIGRTN circuit, harness side.
- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
REFER to the **MODULE COMMUNICATIONS NETWORK -- E-SERIES** to diagnose The Powertrain Control Module (PCM) Does Not Respond To The Scan Tool Or No High Speed Controller Area Network (HS-CAN) Communication Symptom.	For Crown Victoria, Grand Marquis, E-Series, Escape/Mariner, Ranger, and Town Car, GO to **QA6**. For all others, GO to **QA4**.

QA4 CHECK THE ISP-R VOLTAGE AT THE PCM HARNESS CONNECTOR

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ISP-R	Ground

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

Yes	No
GO to **QA5**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

QA5 CHECK THE PCM VPWR CIRCUITS FOR VOLTAGE

- Key in OFF position.
- Disconnect the PCM.
- Connect a 5 amp fused jumper wire between the following:

Point A PCM Connector, Harness Side	Point B
PCMRC	Ground

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
VPWR	Ground

- **Are the voltages greater than 10 V?**

Yes	No
GO to **QA7**.	refer to **PINPOINT TEST B**.

QA6 CHECK THE PCM VPWR CIRCUITS FOR VOLTAGE

- Key in OFF position.
- Disconnect the PCM.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
VPWR	Ground

- **Are the voltages greater than 10 V?**

Yes	No
GO to **QA7**.	refer to **PINPOINT TEST B**.

QA7 CHECK THE PCM GROUND CIRCUITS FOR AN OPEN

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
PWRGND	Ground

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

Yes	No
GO to **QA8**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

QA8 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the network test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST QB: DTCS P0603 OR P1633: KEEP ALIVE POWER (KAPWR)

This pinpoint test is intended to diagnose the following:

- battery terminal condition
- KAPWR wire routing
- harness circuit: KAPWR
- powertrain control module (PCM) (12A650)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, F-150, Mark LT, MKX, Sable, Taurus, Taurus X	190 Pin	B54	KAPWR
Escape/Mariner	150 (50-50-50) Pin	B45	KAPWR
Expedition, Fusion, Milan, MKZ, Navigator	140 Pin	B54	KAPWR
Focus	190 Pin	B62	KAPWR
All other vehicles	170 Pin	B45	KAPWR

QB1 CHECK THE 12-VOLT BATTERY TERMINALS

NOTE: **If the KAPWR is interrupted to the PCM when a breakout box is installed or the battery is disconnected, DTC P0603/P1633 can be generated on the first power-up.**

NOTE: **If DTC P0603 occurred right after or during an unsuccessful reprogramming of the PCM, clear the DTCs and repeat the PCM self-test. If DTC P0603 is retrieved again, continue with this pinpoint test.**

- Inspect the 12-volt battery cables for loose connections and for corrosion.
- **Are the 12-volt battery terminal connections in good condition?**

Yes	No
GO to **QB2**.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

QB2 INSPECT THE ENGINE COMPARTMENT FOR CORRECT WIRE ROUTING

- Inspect the electronic engine control (EEC) system wiring for correct wire routing.
- Check the wiring routing to establish if any of the electrical connectors are being stressed due to poorly routed wiring. If necessary re-route and secure the wiring.
- Visually inspect the wiring and connectors.
- **Is a concern present?**

Yes	No

REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **QB3**.

QB3 CHECK KAPWR TO THE PCM

- Key in OFF position.
- PCM connector disconnected.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) 12 Volt Vehicle Battery
KAPWR	Negative terminal

- While observing the multimeter, grasp the EEC harness and wiggle, shake or bend a small section while working from the battery to the PCM.
- **Is the voltage greater than 10 V?**

Yes	No
GO to **QB4**.	ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

QB4 CHECK FOR A REPEAT OF THE DTC

- PCM connector connected.
- Clear all DTCs that may have been caused by the PCM disconnect.
- Test drive the vehicle and allow the engine to reach normal operating temperature.
- Carry out the PCM self-test.
- **Is DTC P0603 or P1633 present?**

Yes	No
GO to **QB5**.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

QB5 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.

- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST QC: DTC P1000: ON-BOARD DIAGNOSTIC (OBD) SYSTEMS READINESS TEST NOT COMPLETE

NOTE: Diagnostic trouble code (DTC) P1000 indicates that all the OBD monitors have not yet been successfully tested. In some areas, this DTC must be cleared to pass an inspection/maintenance test. The customer should be informed that the law specifies additional city and highway driving must be done to complete the check of the OBD system. This additional driving must occur before the vehicle is tested at the inspection/maintenance station. The amount of driving required varies with individual driving patterns. To complete this requirement in the shortest amount of time, refer toON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE .

It is not necessary to clear DTC P1000 from the powertrain control module (PCM) by driving the vehicle unless it is requested by the customer to pass an inspection/maintenance test.

The only way DTC P1000 can be removed from memory is when all the OBD monitors are successfully completed.

DTC P1000 is set by the PCM under any of the following conditions.

- The vehicle is new from the factory and has not yet completed an OBD drive cycle.
- The battery or PCM is disconnected.
- An OBD monitor concern occurred before completion of an OBD drive cycle.
- The PCM DTCs have been cleared with a scan tool as part of a repair process.
- The PCM has been flashed and the vehicle has not yet completed an OBD drive cycle.
- DTC P1000 may not clear if the vehicle is equipped with a power take off (PTO) and the PTO is engaged or damaged.

QC1 CONTINUOUS MEMORY DTC P1000: CHECK FOR ANY OTHER DTCS

NOTE: Enter this pinpoint test only if DTC P1000 was retrieved from continuous memory. Ignore DTC P1000 in KOEO or KOER memory.

- DTC P1000 indicates all of the OBD monitors have not yet been successfully tested.

- **Are any other DTCs received with P1000?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **QC2**.

QC2 CHECK FOR PTO

- **Is the vehicle equipped with PTO?**

Yes	No
GO to **QC3**.	GO to **QC4**.

QC3 CHECK THE PTO PID

- Key ON, engine running.
- Access the PCM and monitor the PTO PID.
- Cycle the PTO switch/actuator ON and OFF. (Follow the PTO aftermarket instructions).
- **Does the PTO PID cycle ON and OFF?**

Yes	No
GO to **QC4**.	GO to **FB2**.

QC4 REQUEST TO CLEAR DTC P1000

NOTE: An entire OBD drive cycle has not yet been completed to clear DTC P1000 from the PCM.

- **Has the customer requested DTC P1000 be cleared from the PCM memory?**

Yes	No
CARRY OUT an OBD drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	INFORM the customer that if the law in your area requires additional driving in order to clear DTC P1000 from the PCM memory, it must be completed before an inspection/maintenance test.

PINPOINT TEST QD: DTC P1260: PASSIVE ANTI-THEFT SYSTEM

NOTE: The passive anti-theft system (PATS) uses radio frequency identification technology to deter a drive away theft. Passive means that it does not require any activity from the user. The PATS uses a specially encoded ignition key. Each encoded ignition key contains a permanently installed electronic device

called a transponder. Each transponder contains a unique electronic identification code. Each encoded ignition key must be programmed into the vehicle before it can be used to start the engine. DTC P1260 is stored any time the PCM disables the vehicle because of the PATS.

QD1 CHECK FOR PATS DTCS

- Repair all PATS DTCs before P1260. Refer to the **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS) -- E-SERIES** for System Description, Operation and Self-Test.
- **Are all PATS DTCs diagnosed?**

Yes	No
GO to **QD2**.	REFER to the **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS) -- E-SERIES** to diagnose any PATS related DTCs.

QD2 CHECK FOR ANY OTHER POWERTRAIN DTCS

- Repair all powertrain DTCs other than P1260.
- **Are all other powertrain DTCs diagnosed?**

Yes	No
GO to **QD3**.	DISREGARD DTC P1260. DIAGNOSE all other powertrain DTCs. REFER to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

QD3 ATTEMPT TO START THE ENGINE

- Carry out a keep alive memory reset to clear DTC P1260. Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .
- Attempt to start the engine.
- **Does the engine start?**

Yes	No
No system concerns exist at the present time. For intermittent no start or start stalls, CHECK for intermittent PATS concerns. (PATS cannot stall the engine after 1 second of operation). For intermittent stalls while driving, VERIFY scan tool-to-PCM communication during the concern. If a PCM communication error occurs, the possible causes are: loss of PWR or GND to the PCM, damaged PCM PWR relay, or a damaged EEC PWR diode. REPAIR as necessary.	DTC P1260 is not the cause of the No Start. REFER to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** .

CLEAR the DTCs. REPEAT the self-test.	

PINPOINT TEST QE: ELECTRONIC THROTTLE CONTROL (ETC) SYSTEM

NOTE: **Diagnose and repair the following DTCs through DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS and the Workshop article respectively before entering this pinpoint test:**

- **P0715**
- **P0720**
- **P0731-P0735**
- **P0102-P0104**
- **P0321**
- **C1165**
- **U1027**

This pinpoint test is intended to diagnose the informational powertrain control module (PCM) diagnostic trouble codes (DTCs).

The informational DTCs are the result of limited operating strategy (LOS) or failure mode effects management (FMEM) operating strategy that maintains limited vehicle function in the event of a PCM, harness, or component concern.

Circuit DTCs can be accompanied by the informational DTCs, and should be diagnosed first. Informational DTCs without circuit DTCs may or may not indicate the actual concern and should be diagnosed as a symptom.

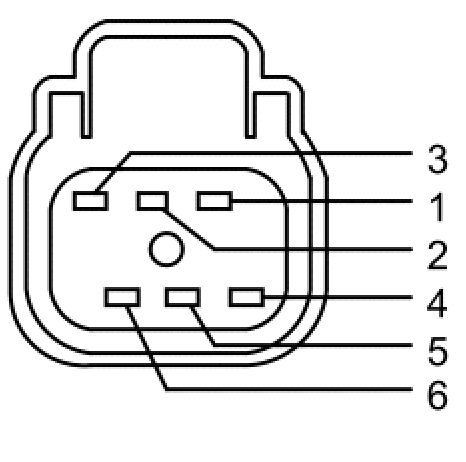

Fig. 198: EGR System Module (ESM) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
6	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

QE1 CHECK FOR DTCS

NOTE: For DTC P061B, make sure the air cleaner and air inlet are correctly seated and properly installed before continuing diagnosis.

- **Are any DTCs present other than the following: P0600, P060A, P060B, P060C, P060D, P061B, P061C, P061D, P061F, P062C, P1674, P2104, P2105, P2110, or U0300?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	For Focus with DTC P0600, GO to **QE2**. For all others with DTC P0600, GO to **QE18**. For DTCs P060A, P060C, P060D, P061D, P1674 or U0300, GO to **QE2**. For DTC P060B, GO to **QE3**. For DTC P061B, GO to **QE13**. For DTC P061C, GO to **QE5**. For DTC P061F, GO to **QE7**. For DTCs P062C, P2104, P2105 or P2110, GO to **QE8**.

QE2 DTCS P060A, P060C, P060D, P061D, P1674 OR U0300: CHECK THE PCM FOR THE LATEST CALIBRATION

- Program the PCM to the latest calibration.
- Key in OFF position.
- Key ON, engine OFF.
- Key in OFF position.
- Key ON, engine running.
- Use the customer information to recreate the concern.
- Carry out the self-test.
- **Are DTCs P060A, P060C, P060D, P061D, P1674 or U0300 present?**

Yes	No
GO to **QE18**.	The concern is not present at this time.

QE3 DTC P060B: CHECK FOR REFERENCE VOLTAGE CONCERNS

- Inspect the PCM harness for damage.
- Verify the correct operation of the sensors using ETCREF, VREF and related circuits. refer to **PINPOINT TEST C** and follow the pinpoint test direction.

- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **QE4**.

QE4 CHECK FOR AN INTERMITTENT CONCERN

- Clear the DTCs.
- Carry out the self-test.
- **Is DTC P060B present?**

Yes	No
GO to **QE18**.	The concern is not present at this time.

QE5 DTC P061C: CHECK THE CKP SENSOR FOR CORRECT OPERATION

- Verify correct operation of the CKP sensor and related circuits. refer to **PINPOINT TEST JD** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **QE6**.

QE6 CHECK THE CMP SENSOR FOR CORRECT OPERATION

- Verify correct operation of the CMP sensor and related circuits. refer to **PINPOINT TEST DR** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **QE7**.

QE7 DTC P061F: VERIFY THE CUSTOMER CONCERN

- Clear the DTCs.
- Use the customer information to recreate the concern.
- Carry out the self-test.
- **Are DTCs P061C or P061F present?**

Yes	No

GO to **QE18**.	The concern is not present at this time.

QE8 DTCS P062C, P2104, P2105 OR P2110: CHECK FOR DTCS IN OTHER VEHICLE MODULES

- Check for self-test DTCs in all of the vehicle modules.
- **Are any DTCs present?**

Yes	No
REFER to the applicable Workshop article part to diagnose the DTC.	GO to **QE9**.

QE9 CHECK FOR THE PRESENCE OF ANY MODULE COMMUNICATION CONCERNS

- Check for self-test DTCs in all of the vehicle modules.
- **Are any communication concerns or communication DTCs present?**

Yes	No
For communication concerns in the PCM, DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** . For communication concerns in other modules, REFER to the applicable Workshop article part to diagnose the communication DTC.	For DTC P062C, GO to **QE16**. For DTC P2104, GO to **QE10**. For DTC P2105, GO to **QE11**. For DTC P2110, GO to **QE15**.

QE10 DTC P2104: CHECK FOR THE PRESENCE OF PCM DTCS

- Clear the PCM DTCs.
- Check for self-test DTCs.
- **Are any DTCs present other than P2104?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	refer to **PINPOINT TEST DK**.

QE11 DTC P2105: CHECK FOR THE PRESENCE OF PCM DTCS

NOTE: P2105 may be set in combination with other DTCs. Diagnose other DTCs first.

- Clear the PCM DTCs.
- Check for self-test DTCs.

- **Are any DTCs present other than P2105?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **QE12**.

QE12 CARRY OUT A VISUAL INSPECTION

- Key in OFF position.
- Visually inspect the following for obvious signs of damage:
  - ETB
  - PCM
- Check the harness for routing, alterations, incorrect shielding, or electrical interference from other systems. Make sure aftermarket wiring is not routed near the PCM.
- Verify aftermarket equipment does not generate radio frequency interference/electromagnetic interference (RFI/EMI).
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **QE18**.

QE13 DTC P061B: CHECK FOR THE PRESENCE OF PCM DTCS

NOTE: An intermittent CKP sensor or harness concern may cause DTC P061B to set. Check for intermittent CKP sensor and harness concerns.

- Clear the PCM DTCs.
- Check for self-test DTCs.
- **Are any DTCs present other than P061B?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	For Crown Victoria, E-Series 4.6L, Explorer 4.0L, Explorer Sport Trac 4.0L, F-150 4.2L, F-150 4.6L, F-Super Duty 6.8L, Grand Marquis, Mountaineer 4.0L,

	Mustang 4.0L, Mustang 5.4L, and Town Car, GO to **QE14**. For all others, CHECK for an intermittent concern with an ETC related harness or sensor. refer to **PINPOINT TEST Z**.

QE14 CHECK THE MAP INPUT FOR AN OFFSET SIGNAL

- Key in OFF position.
- Allow the vehicle to cool down.
- ESM connector disconnected.
- Measure the resistance between:

(+) ESM Connector, Component Side	(-) ESM Connector, Component Side
VREF - Pin 2	SIGRTN - Pin 6

- **Is the resistance greater than 2K ohms?**

Yes	No
For Crown Victoria, Grand Marquis, Explorer 4.0L, Explorer Sport Trac 4.0L, Mountaineer 4.0L, and Town Car, GO to **QE16**. For all others, CHECK for an intermittent concern with an ETC related harness or sensor. refer to **PINPOINT TEST Z**.	INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

QE15 DTC P2110: CHECK FOR THE PRESENCE OF PCM DTCS

NOTE: P2110 sets in combination with other DTCs.

- Clear the PCM DTCs.
- Check for self-test DTCs.
- **Are any DTCs present other than P2110?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO	

to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **QE18**.

QE16 CHECK FOR ABS AND WHEEL SPEED SENSOR CONCERNS

NOTE: Refer to the REFERENCE VALUES article Reference Values for the typical diagnostic reference values.

- ESM connector connected.
- Key ON, engine running.
- Access the PCM and monitor the ISS_SRC, OSS_SRC and TSS PIDs.
- Access the PCM and monitor the VSS PID.
- Access the ABS and monitor the LF_WSPD, LR_WSPD, RF_WSPD and RR_WSPD PIDs.
- Road test the vehicle under various load conditions while comparing the PIDs. Check for signals that are intermittent or do not correspond.
- **Do the PID values correspond with the vehicle operating conditions?**

Yes	No
For Explorer 4.0L, Explorer Sport Trac 4.0L, F-150 5.4L, Mark LT, and Mountaineer 4.0L, GO to **QE17**. For all others, CHECK for an intermittent concern with an ETC related harness or sensor. refer to **PINPOINT TEST Z**.	REFER to the **VEHICLE DYNAMIC SYSTEMS -- E-SERIES** to diagnose any ABS concerns.

QE17 CHECK FOR A TRANSFER CASE MECHANICAL CONCERN

- Stop the vehicle.
- Select 4WD Low.
- **Does the vehicle shift into 4WD Low?**

Yes	No
CHECK for an intermittent concern with an ETC related harness or sensor. refer to **PINPOINT TEST Z**.	REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** , Four Wheel Drive (4WD) Systems to diagnose any transfer case concerns.

QE18 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:

  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST TA: CLUTCH PEDAL POSITION (CPP) SWITCH

This pinpoint test is intended to diagnose the following:

- CPP (11A152/7C534)
- harness circuits: CPP / CPP BT and SIGRTN / GND
- powertrain control module (PCM) (12A650)

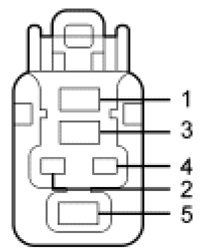

Fig. 199: Clutch Pedal Position (CPP) Switch Connector - A
Courtesy of FORD MOTOR CO.

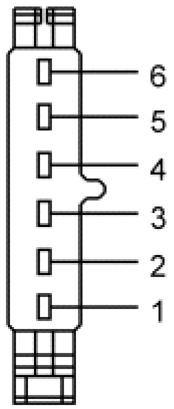

Fig. 200: Clutch Pedal Position (CPP) Switch Connector - B
Courtesy of FORD MOTOR CO.

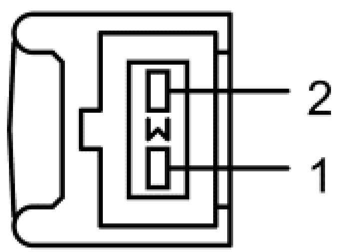

Fig. 201: Clutch Pedal Position (CPP) Switch Connector - C
Courtesy of FORD MOTOR CO.

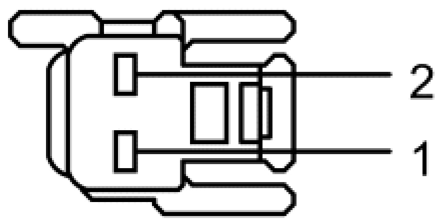

Fig. 202: Clutch Pedal Position (CPP) Switch Connector - D
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	A	2 4	SIGRTN CPP
F-150	B	2 1	GND CPP
Mustang	C	2 1	GND CPP
Ranger	B	5 6	GND CPP
All other vehicles	D	2 1	GND CPP

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B41, E41, T41 T27	SIGRTN CPP
F-150	190 Pin	B39 B58, E58, T43	CPP-BT SIGRTN
F-Super Duty	170 Pin	B34 B41, E58, T41	CPP-BT SIGRTN
Focus	190 Pin	T26 B58, E64, T40	CPP-BT SIGRTN
Fusion, Milan	140 Pin	B18 B58, E58	CPP-BT SIGRTN
All other vehicles	170 Pin	B41, E58, T41 B33	SIGRTN CPP

TA1 DTC P0704, P0830: CHECK THE CPP SWITCH

WARNING: Block all wheels, set the parking brake and firmly apply the service brake to reduce the risk of vehicle movement during this procedure. Failure to follow these instructions may result in serious personal injury.

NOTE: During self-test, the clutch pedal must be down and gearshift lever in NEUTRAL.

- Key ON, engine OFF.
- Access the PCM and monitor the CPP PID.
- **Does the reading cycle when the CPP switch is activated?**

Yes	No
This may be an intermittent circuit concern. INSPECT connectors for signs of damage, water intrusion, corrosion. REPAIR as necessary.	GO to **TA2**.

TA2 CHECK THE SWITCH CIRCUIT RESISTANCE

NOTE: The CPP switch is located near the clutch pedal.

NOTE: Measure the CPP switch resistance with the clutch pedal pressed down.

- Inspect the switches and brackets for damage. Repair as necessary.
- CPP Switch connector disconnected.
- For Focus or Escape,
- Measure the resistance between:

(+) CPP Switch Connector, Component Side	(-) CPP Switch Connector, Component Side
CPP	SIGRTN

- For all others,
- Measure the resistance between:

(+) CPP Switch Connector, Component	(-) CPP Switch Connector, Component

Side	Side
CPP	GND

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **TA3**.	INSTALL a new CPP switch. CLEAR the DTCs. REPEAT the self-test.

TA3 CHECK THE CPP FOR INTERNAL SHORTS

NOTE: Measure the CPP switch resistance with the clutch pedal released.

- For Focus or Escape,
- Measure the resistance between:

(+) CPP Switch Connector, Component Side	(-) CPP Switch Connector, Component Side
CPP	SIGRTN

- For all others,
- Measure the resistance between:

(+) CPP Switch Connector, Component Side	(-) CPP Switch Connector, Component Side
CPP	GND

- **Is the resistance greater than 10K ohms?**

Yes	No
For Focus or Escape, GO to **TA5**. For all others, GO to **TA4**.	INSTALL a new CPP switch. CLEAR the DTCs. REPEAT the self-test.

TA4 CHECK THE CPP AND GROUND CIRCUITS FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) CPP Switch Connector, Harness Side	(-) PCM Connector, Harness Side
CPP	CPP

- Measure the resistance between:

(+) CPP Switch Connector, Harness Side	(-)
GND	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **TA6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

TA5 CHECK THE CPP AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CPP Switch Connector, Harness Side
CPP	CPP
SIGRTN	SIGRTN

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

Yes	No
GO to **TA6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

TA6 CHECK THE CPP CIRCUIT FOR A SHORT TO VOLTAGE

- Key ON, engine OFF.
- Measure the voltage between:

(+) CPP	

Switch Connector, Harness Side	(-)
CPP	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to **TA7**.	REPAIR the short circuit to PWR. CLEAR the DTCs. REPEAT the self-test.

TA7 CHECK THE CPP CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) CPP Switch Connector, Harness Side	(-)
CPP	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **TA8**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

TA8 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Replacement PCM.	

PINPOINT TEST TB: TRANSMISSION CONTROL SWITCH (TCS)/ TRANSMISSION CONTROL INDICATOR LAMP (TCIL)

This pinpoint test is intended to diagnose the following:

- TCS
- TCIL
- harness circuits: TCS and TCIL
- powertrain control module (PCM) (12A650)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series	170 Pin	B43 B27	TCIL TCS
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B16	TCS
Escape/Mariner	150 (50-50-50) Pin	B27	TCS
F-150, Mark LT	190 Pin	B45	TCS
F-Super Duty	170 Pin	B27	TCS
Focus	190 Pin	T30	TCS
Fusion	140 Pin	B16	TCS
All other vehicles	170 Pin	B29	TCS

TB1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Is DTC P1780 present?**

Yes	No
GO to **TB2**.	For TCIL never on, GO to **TB10**. For TCIL always on, GO to **TB8**.

TB2 DTC P1780: CHECK THE TCS FUNCTION

NOTE: Verify the TCS was cycled during self-test.

- Key ON, engine OFF.

- Access the PCM and monitor the TCS PID.
- Apply and release the TCS and then hold it applied for 3 seconds. Release the switch.
- **Does the TCS PID change from ON to OFF and does the PID indicate ON when the switch is applied?**

Yes	No
REPEAT the KOER self-test and cycle the TCS during the test.	GO to **TB3**.

TB3 CHECK THE TCS VOLTAGE

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
TCS	Ground

- Monitor the voltage while applying and releasing the TCS several times.
- **Does the voltage change states?**

Yes	No
GO to **TB12**.	GO to **TB4**.

TB4 CHECK THE TCS CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- TCS connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
TCS	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to **TB5**.	REPAIR the short circuit. CLEAR the DTCs.

	REPEAT the self-test.

TB5 CHECK FOR VOLTAGE TO THE TCS

- Key ON, engine OFF.
- Measure the voltage between:

(+) TCS Connector, Harness Side	(-)
VPWR	Ground

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

Yes	No
GO to **TB6**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

TB6 CHECK THE TCS CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) TCS Connector, Harness Side
TCS	TCS

- **Is the resistance less than 5 ohms?**

Yes	No
GO to **TB7**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

TB7 CHECK THE TCS CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) TCS Connector, Harness Side	(-)
TCS	Ground

- **Is the voltage less than 1 V?**

Yes	No
INSTALL a new TCS. REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

TB8 TCIL ALWAYS ON: CHECK THE TCIL FUNCTION

- Key ON, engine OFF.
- Apply and release the TCS.
- **Does the TCIL change state?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	GO to **TB9**.

TB9 CHECK THE TCIL CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

NOTE: The TCIL turns off when the PCM is disconnected.

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- **Does the TCIL change state?**

Yes	No
GO to **TB12**.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

TB10 TCIL NEVER ON: CHECK FOR KOER P1780

- Carry out the PCM KOER self-test.
- **Is DTC P1780 present?**

Yes	No
REPAIR the DTC. CLEAR the DTCs. REPEAT the self-test. GO to **TB2**.	GO to **TB11**.

TB11 CHECK FOR VOLTAGE TO THE TCIL

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Connect a 5 amp fused jumper wire between the following:

Point A PCM Connector, Harness Side	Point B Vehicle Battery
TCIL	Negative terminal

- **Does the TCIL illuminate?**

Yes	No
GO to **TB12**.	CHECK the indicator bulb and the fuse. If OK, the open is in the wiring between the ignition switch and the TCIL pin at the harness connector. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

TB12 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST Z: INTERMITTENT

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to**

follow these instructions may result in personal injury.

This pinpoint test is intended to diagnose and isolate intermittent concerns for the following:

- all electronic engine control (EEC) subsystems

This chart is used to determine which test to run for the suspect circuit. PIDs corresponding to each circuit are listed. Some circuits do not have an associated PID or the PID may not be available and has to be measured with a digital multimeter (DMM). More specific information on the PID can be found. If the vehicle has a coil pack system with a no start condition, carry out the ignition test.

PCM PIDS/SIGNALS

PCM/TCM PIDS/SIGNALS	Associated Circuit	Test Type
ACCS	A/CCS	input
ACET	ACET	input
ACP	ACPSW	input
AIR	AIR	output
AIRM	AIRM	input
APP1	APPS	input
APP2	APPS	input
APP3	APPS	input
BPP/BOO	BPP	input
BPA	BPS	input
Use DMM	CD A-J (primary)	output
CHT	CHT	input
CKP	CKP	input
CMP	CMP	input
CPP/PNP	CPP	input
DPFEGR	DPFE	input
ECT	ECT	input
EGRMC1	EGRMC1	output
EGRMC2	EGRMC2	output
EGRMC3	EGRMC3	output
EGRMC4	EGRMC4	output
EGRMDSD	EGRMC	output
EVR	EVR	output
EOT	EOT	input
EPC, EPCV	EPC	output
EVAPCV	CV	output
EVAPPDC	VMV	output
EVAPPF	VMV	output
FANDC	VDF	output

FANSS	FANSS	input
FLI	FLI	input
FP	FP	output
FPM	FPM	input
FP M	FPM	input
FRP	FRP	input
FRT	FRT	input
FTP	FTP	input
HFC	HFC	output
HOS11	HEGO	input
HOS12	HEGO	input
HOS13	HEGO	input
IAC	IAC	output
IAT	IAT	input
IAT2	IAT 2	input
IMRC	IMRC	output
IMRC1M	IMRCM	input
IMTV1	IMTV1	output
IMTV2	IMTV2	output
KS1	KS1	input
KS2	KS2	input
LFC	LFC	output
MAF, MAF V	MAF	input
MAP V	MAP	input
O2S11	O2S	input
O2S12	O2S	input
O2S13	O2S	input
OSS	OSS	input
PSP	PSP	input
PSPT	PSP	input
PTO	PTO	input
TACM (+)	TACM (+)	output
TACM (-)	TACM (-)	output
TP1	TP1	input
TP2	TP2	input
TCIL	TCIL	output
TP	TP	input
VCT1	VCT1	output
VCT2	VCT2	output
VPWR	VPWR	input
Use DMM	VREF	output

	VSO	output
VSS	VSS+	input
WAC	WAC	output

Z1 DIRECTION FOR INTERMITTENT DIAGNOSTIC PATH

NOTE: Proceed with this step only if the powertrain control module (PCM) was not previously cleared. Record freeze frame data prior to clearing the PCM DTCs. Clearing the DTCs clears any freeze frame data and eliminates FMEM. This helps to recreate the original conditions that set the DTCs or caused the symptom.

- Key ON, engine OFF.
- Clear the PCM DTCs.
- **Are the PCM DTCs cleared?**

Yes	No
GO to **Z2**.	RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .

Z2 SELECT THE PIDS AND/OR SIGNALS RELATED TO THE SYSTEM

- A list of related PIDs and/or signals are needed for use with the scan tool to monitor the suspect areas. Obtain the customer symptom description. Use the Reference Value Symptom chart and proceed to the Reference Value PID/Signal Measurement chart located at the beginning of Reference Values.
- Highlight each available PID/signal recommended by the charts under the PID/signal selection menu on the scan tool.
- **Are all available PIDs/signals related to the symptom selected?**

Yes	No
GO to **Z3**.	REPEAT the test step. GO to **Z2**.

Z3 DECISION TO VERIFY THE SYMPTOM

NOTE: The path to symptom verification is optional, but is recommended for several reasons. For example: the vehicle is back for a repeat repair, or there is no DTC present.

- **Is a concern symptom detected?**

Yes	No
GO to **Z10**.	GO to **Z4**.

Z4 COLLECT ANY SYMPTOM RELATED DATA TO AID IN VERIFICATION

NOTE: Only MIL codes trigger freeze frame data. Refer to the scan tool instruction article to retrieve the freeze frame information.

- Prepare the freeze frame data for use with information from the Symptom Charts.
- Check for continuous memory DTCs that should have been recorded from an earlier pinpoint test.
- Access the information from the customer information worksheet and the customer if available. Access any other symptom related data available, such as TSBs and OASIS reports.
- **Is all available data recorded?**

Yes	No
GO to **Z5**.	GATHER as much data as possible to aid in isolating the intermittent concern area. REPEAT the test step. GO to **Z4**.

Z5 RECREATE THE SYMPTOM USING ALL AVAILABLE DATA

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- With the scan tool, select and monitor the same PIDs as displayed in freeze frame along with any previously selected PIDs/signals from step Z2. Using the freeze frame data recorded earlier, recreate the conditions described by each freeze frame PID. Pay special attention to ECT, LOAD, RPM and VSS. Also, use any available data from the customer, TSBs, and other sources to aid in producing the correct conditions for recreating the symptom.
- When the symptom occurs, press the trigger to begin recording. Refer to the scan tool instruction article for information on the recorder function.
- **Can the symptom be recreated?**

Yes	No
GO to **Z10**.	GO to **Z6**.

Z6 RECREATE THE SYMPTOM

NOTE: PIDs for output in the Reference Value Charts represent command values only. Circuit measurements with a digital multimeter indicate the actual output status. Therefore, in the case of a concern, the PID and circuit reading on the vehicle may not correspond with each other. PIDs for PCM circuits with a mismatch in the digital multimeter measurement indicate a possible PCM concern.

- The road test is the last attempt to locate the area of concern before physically disturbing vehicle circuits.
- The Intermittent Road Test Procedure is a set of instructions for monitoring PIDs/signals with a scan tool and circuit measurements with a digital multimeter. This is done under 4 different conditions - key

on/engine off, hot idle, 48 km/h (30 mph) and 88 km/h (55 mph). Use the typical diagnostic reference values to compare with the actual vehicle.

- Locate the correct Reference Value Chart.
- Setup the vehicle to measure the circuits with a digital multimeter and a scan tool.
- Connect a scan tool to the DLC.
- Key ON, engine OFF.
- With the scan tool, select and monitor PIDs and measure the circuits shown in the Reference Value Chart.
- Compare the scan tool PIDs and digital multimeter values to the Reference Value Charts.
- **Are any values out of range?**

Yes	No
GO to **Z10**.	GO to **Z7**.

Z7 RECREATE THE SYMPTOM USING THE HOT IDLE ROAD TEST

NOTE: The engine temperature should be at least 87°C (189°F).

- Key ON, engine running.
- Continue to monitor the PIDs and circuits as in the previous step.
- **Are any values out of range?**

Yes	No
GO to **Z10**.	GO to **Z8**.

Z8 RECREATE THE SYMPTOM DURING AN 48 KM/H (30 MPH) ROAD TEST

- Drive the vehicle on a preplanned route.
- Continue to monitor the PIDs and circuits as in the previous step.
- **Are any values out of range?**

Yes	No
GO to **Z10**.	GO to **Z9**.

Z9 RECREATE THE SYMPTOM DURING AN 88 KM/H (55 MPH) ROAD TEST

- Continue to drive the vehicle on the preplanned route.
- Continue to monitor the PIDs and circuits as in the previous step.
- **Are any values out of range?**

Yes	No
	It is now necessary to physically disturb the selected

GO to **Z10**.	vehicle circuits in an attempt to recreate the intermittent concern. GO to **Z10**.

Z10 SELECT THE CIRCUITS FROM THE PCM PIDS/SIGNALS CHART

NOTE: From the same chart, be sure to select and proceed with the appropriate test type.

NOTE: The Input Test step should be used on sensing inputs such as temperature, position or oxygen.

NOTE: The Output Test step should be used on output devices such as relays, coils or solenoids.

- Remain in the PID/Signal selection menu with the scan tool.
- Highlight only the PIDs/signals from step Z2.
- Proceed to the PCM PIDS/SIGNALS chart located at the beginning of this test.
- Match the selected PIDs/signals to the corresponding circuit in the chart. There may be more than one circuit to test. If a PID/signal recording was made with the scan tool, it may be helpful to replay it at this time. Refer to the scan tool instruction article for additional information.
- **Has a test been chosen?**

Yes	No
For the input test step, GO to **Z11**. For the output test step, GO to **Z15**.	To diagnose other driveability symptoms, REFER to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** .

Z11 KOEO INPUT TEST PROCEDURE FOR THE PCM SENSORS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

- Using the circuits chosen from the PCM PIDS/SIGNALS Chart, select only the recommended PIDs/signals to monitor with the scan tool. If a PID is not available for the circuit, use a digital multimeter to check the value.
- Proceed to the area of the suspect wiring or component concern.
- Key ON, engine OFF.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM while tapping on the component.

- Monitor while wiggling the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Are there abrupt changes in the PID values that do not compare with the values?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to **Z12**.

Z12 KOER INPUT TEST PROCEDURE FOR THE PCM SENSORS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

- Key ON, engine running.
- Continue to monitor the PIDs and circuits as in the previous step.
- Proceed to the area of the suspect wiring or component concern.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM while tapping on the component.
- Monitor while wiggling the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Are any values fluctuating in and out of range?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to **Z13**.

Z13 KOEO WATER SOAK TEST PROCEDURE FOR THE PCM SENSORS, EXCLUDING HIGH VOLTAGE CIRCUITS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

- Key ON, engine OFF.
- Continue to monitor the PIDs and circuits as in the previous step.
- Proceed to the area of the suspect wiring or component concern.
- If the input is a switch type-component, turn it on manually.

- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Monitor while spraying the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Are any values fluctuating in and out of range?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to **Z14**.

Z14 KOER WATER SOAK TEST PROCEDURE FOR THE PCM SENSORS, EXCLUDING HIGH VOLTAGE CIRCUITS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

- Key ON, engine running.
- Continue to monitor the PIDs and circuits as in the previous step.
- Proceed to the area of the suspect wiring or component concern.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Monitor while spraying the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Are any values fluctuating in and out of range?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to **Z15**.

Z15 KOER WIGGLE TEST PROCEDURE FOR THE PCM SENSORS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

NOTE: **Remember that PIDs selected from the PCM PIDS/SIGNALS Chart display commanded values only. A digital multimeter measurement is needed to display the actual values. Be sure to compare them. Look for fluctuations to occur**

during any part of the following test. The output state test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators.

- Using the circuits chosen from the PCM PIDS/SIGNALS Chart, select only the recommended PIDs/signals to monitor with the scan tool. If a PID is not available for the circuit, use a DMM to check the value.
- Key ON, engine OFF.
- With the scan tool, turn on selected outputs using output state control. Refer to the scan tool instruction article.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PID or DMM while tapping on the component.
- Monitor while wiggling the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the Reference Value Charts?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to **Z16**.

Z16 KOER OUTPUT TEST PROCEDURE FOR THE PCM ACTUATORS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

NOTE: **Remember that PIDs selected from the PCM PIDS/SIGNALS Chart display commanded values only. A digital multimeter measurement is needed to display the actual values. Be sure to compare them. Look for fluctuations to occur during any part of the following test. The output state test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators.**

- Key ON, engine running.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PIDs with the scan tool and note the values. Compare the scan tool values with values from a digital multimeter with the engine at idle. Look for fluctuations in the values while tapping on the suspect component.
- If a coil for a coil on plug application is suspect, turn off the key. Gain access to the coil and measure continuity from the spark plug terminal to the signal terminal while tapping the coil. A large fluctuation in

resistance indicates an intermittent open or short.

- Monitor while wiggling the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Is there a scan tool to DMM value mismatch or an idle fluctuation?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to **Z17**.

Z17 KOEO WATER SOAK TEST PROCEDURE FOR THE PCM ACTUATORS, EXCLUDING HIGH VOLTAGE CIRCUITS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

NOTE: **Remember that PIDs selected from the PCM PIDS/SIGNALS Chart display commanded values only. A digital multimeter measurement is needed to display the actual values. Be sure to compare them. Look for fluctuations to occur during any part of the following test. The output state test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators.**

- Key ON, engine OFF.
- With the scan tool, turn on selected outputs using output state control. Refer to the scan tool instruction article.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the Reference Value Charts?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to **Z18**.

Z18 KOER WATER SOAK TEST PROCEDURE FOR THE PCM ACTUATORS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

- Key ON, engine running.
- Using the circuits chosen from the PCM PIDS/SIGNALS Chart, select only the recommended PIDs/signals to monitor with the scan tool. If a PID is not available for the circuit, use a DMM to check the value.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Monitor while spraying the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the Reference Value Charts?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to **Z19**.

Z19 INSPECT FOR INTERMITTENT MECHANICAL CONCERNS

NOTE: **It is possible for an intermittent mechanical concern to cause a good PCM system to react abnormally.**

- An inspection of DTC related mechanical systems should have been carried out in an earlier part. If not, visually inspect at this time.
- Look for possible vacuum lines, wires, cables, linkage or hoses that may become kinked, shorted or restricted during normal engine operation.
- This may include engine/transmission gear changes, acceleration and deceleration, rough roads and various engine RPM and torque related conditions.
- **Is a mechanical concern detected?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	It is necessary to seek additional help. REFER to the Professional Technician Society (PTS) web site, the OASIS system or the Technical Hotline. A vehicle data recorder (VDR) or similar recorder may also be useful.